ESTCP

FINAL REPORT

Ex Situ Soil Washing to Remove PFAS Adsorbed to Soils from Source Zones

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This Final Report presents the results of the Environmental Security Technology Certification Program (ESTCP) demonstration conducted at Eielson Air Force Base (AFB) in Fairbanks, Alaska: Ex situ soil washing to remove PFAS adsorbed to soils from source zones. The objective of the project was to demonstrate and validate soil washing as a cost-effective mass removal technology that can be applied to treat soil in source zones impacted by per- and polyfluoroalkyl substances (PFAS).

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FINAL REPORT
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TABLE OF CONTENTS

Page

ABSTRACT VIII
EXECUTIVE SUMMARY ES-1
1.0 INTRODUCTION 1
1.1 BACKGROUND 1
1.2 OBJECTIVE OF THE DEMONSTRATION 1
1.3 REGULATORY AND TECHNOLOGY DRIVERS 1
2.0 TECHNOLOGY 4
2.1 TECHNOLOGY DESCRIPTION 4
2.2 TECHNOLOGY DEVELOPMENT 6
2.3 ADVANTAGES AND LIMITATIONS OF THE TECHNOLOGY 6
3.0 PERFORMANCE OBJECTIVES 8
4.0 SITE DESCRIPTION 11
4.1 SITE LOCATION AND HISTORY 11
4.2 SITE GEOLOGY/HYDROGEOLOGY 12
4.3 PREVIOUS PFAS INVESTIGATIONS 12
4.4 PFAS-CONTAMINATED STOCKPILES 13
5.0 TEST DESIGN 15
5.1 CONCEPTUAL EXPERIMENTAL DESIGN 15
5.2 BENCH-SCALE TREATABILITY STUDY 15
5.3 DESIGN, LAYOUT, AND PROCESS FLOW OF PILOT SYSTEM 17
5.4 FIELD TESTING 21
5.4.1 Mobilization 21
5.4.2 Excavation 21
5.4.3 Treatment 21
5.5 SAMPLING METHODS 23
5.5.1 Batch and ISM Soil Sampling 23
5.5.2 Water Sampling 24
5.5.3 Analysis 24
6.0 PERFORMANCE ASSESSMENT 25
6.1 BENCH-SCALE TREATABILITY TRIAL RESULTS 25
6.2 FIELD DEMONSTRATION RESULTS 27
6.2.1 Treatment Performance 27
6.2.2 PFAS Removal 30
6.2.3 Leachability 31

TABLE OF CONTENTS (Continued)

Page

6.2.4 Variability 31
6.2.5 Non-Target PFAS 32
6.2.6 Water 33
6.2.7 PAH Results 34
6.2.8 Soil Reuse 35
6.3 PERFORMANCE ASSESSMENT MATRIX 35
7.0 COST ASSESSMENT 37
8.0 IMPLEMENTATION ISSUES & FUTURE CONSIDERATIONS 39
8.1 IMPLEMENTATION ISSUES 39
8.2 LESSONS LEARNED 39
8.3 CONSIDERATIONS FOR IMPLEMENTING SOIL WASHING AT PFAS SOURCES 39
9.0 REFERENCES 45
APPENDIX A STANDARD OPERATING PROCEDURES A-1
APPENDIX B LABORATORY TREATABILITY MEMO B-1
APPENDIX C FIELD DEMONSTRATION LABORATORY REPORTS AND SUMMARY TABLES C-1
APPENDIX D USEPA SOIL WASHING GUIDANCE DOCUMENT D-1

LIST OF FIGURES

Page

Figure 1. Site Location 11
Figure 2. Soil Washing Treatability Test Design. 16
Figure 3. Eielson AFB Pilot Process Soil Washing Modules. 17
Figure 4. Soil Washing Process Commissioning 18
Figure 5. Soil Washing Process Flow of Pilot Plant 19
Figure 6. Eielson Pilot-Scale Soil Washing Process Elements and Equipment. 20
Figure 7. Asphalt Observed in Gravel Fraction of EIE385-4 35
Figure 8. Soil Washing Configurations 41

LIST OF TABLES

Page

Table 1. Performance Objectives 9
Table 2. Regional PFAS Screening Levels 10
Table 3. Summary of Stockpile Grain Size 14
Table 4. Stockpile PFAS Characterization Summary 14
Table 5. Soil Volumes 22
Table 6. Stockpiles EIE377-1 and EIE379-2 Bench-Scale Treatability Results 25
Table 7. Stockpile EIE393-1 Bench-Scale Treatability Results 25
Table 8. EIE377-1 and EIE379-2 Bench-Scale Treatability PFAS Removal Efficiencies 26
Table 9. EIE393-1 Bench-Scale Treatability PFAS Removal Efficiencies 27
Table 10. ISM Soil PFAS Results 27
Table 11. ISM Leachate PFAS Results 28
Table 12. ISM Arithmetic Mean Results 28
Table 13. ISM Arithmetic Mean PFAS Removal Efficiencies 29
Table 14. Untreated Soil PFOS Concentration Comparison 30
Table 15. Batch, ISM, and ISM 95% UCL PFOS Results 32
Table 16. Non-target PFAS Analysis Results 33
Table 17. Untreated and Treated Water Results (ng/L) 34
Table 18. EIE385-4 PAH Results (µg/kg) 34
Table 19. Soil Washing Cost Scenarios (per ton) Compared to Landfilling and Thermal Desorption 38

ACRONYMS AND ABBREVIATIONS

AAC	Alaska Administrative Code
ADEC	Alaska Department of Environmental Conservation
AFCEC	Air Force Civil Engineering Center
AFB	Air Force Base
AFFF	aqueous film-forming foam
AOF	adsorbable organofluorine
ART	Alternative Remedial Technologies, Inc.
ASLP	Australian standard leaching procedure
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CET	CleanEarth Technologies, Inc.
CH2M	CH2M Hill
DoD	U.S. Department of Defense
EOF	extractable organofluorine
ESTCP	Environmental Security Technology Certification Program
GAC	granular activated carbon
HAL	Health Advisory Level
ISM	Incremental Sampling Methodology
ITRC	Interstate Technology Regulatory Council
IXR	ion exchange resin
kVA	kilovolt ampere
LOD	limit of detection
µg/kg	microgram per kilogram
µgF/kg	microgram as fluorine per kilogram
µg/L	microgram per liter
MCL	Maximum Contaminant Level
mg/kg	milligram per kilogram
ng/L	nanograms per liter
N-MeFOSA	heptadecafluor-N-methyloctane sulfonamide
OSD	Office of the Secretary of Defense
PA/SI	preliminary assessment/site investigation
PAH	polycyclic aromatic hydrocarbon

pCi/g	picoCuries per gram
PFAS	per- and polyfluoroalkylated substances
PFBS	perfluorobutane sulfonic acid
PFC	perfluorinated compound
PFOA	perfluorooctanoic acid
PFOS	perfluorooctanesulfonic acid
PFHxS	perfluorohexane sulfonate
QSM	Quality Systems Manual
RBSL	Risk-Based Screening Level
RCRA	Resource Conservation and Recovery Act
RE	removal efficiency
RI	remedial investigation
SOP	Standard Operating Procedure
SPLP	synthetic precipitation leaching procedure
TOC	total organic carbon
TOP	total oxidizable precursor
UCL	upper confidence limit
USACE	U.S. Army Corps of Engineers
USAF	U.S. Air Force
USEPA	United States Environmental Protection Agency
VOC	volatile organic compound

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ABSTRACT

This Final Report presents the results of the Environmental Security Technology Certification Program (ESTCP) demonstration conducted at Eielson Air Force Base (AFB) in Fairbanks, Alaska: Ex situ soil washing to remove PFAS adsorbed to soils from source zones. The objective of the project was to demonstrate and validate soil washing as a cost-effective mass removal technology that can be applied to treat soil in source zones impacted by per- and polyfluoroalkyl substances (PFAS).

The approach focused on the treatment of coarse soil fractions (sand and gravel) and separation of fines (silt/clay) for potential treatment by other means such as landfilling, thermal desorption, or stabilization. The goal was to optimize the treatment process to minimize wastes requiring more expensive treatment so that the cost would compete with landfilling in the continental US. The treatment process was designed and optimized at the bench scale and demonstrated at the field scale by conducting a treatment trial at the Eielson AFB using a mobile soil washing plant. Approximately 180 tons of PFAS-contaminated soil was treated from three stockpiles; untreated perfluorooctane sulfonate (PFOS) concentrations ranged from 4.5 micrograms per kilogram (µg/kg) to 560 µg/kg.

The technology was validated by measuring PFAS mass removal efficiencies based on soil concentrations of PFAS compounds measured via Department of Defense (DoD) Quality Systems Manual (QSM) 5.3 Table B-14 and PFAS leachate concentrations as measured by synthetic precipitation leaching procedure (SPLP) testing. PFAS concentrations in treated soils were compared to Alaska Department of Environmental Conservation screening levels for soil migrating to groundwater criteria for perfluorooctanoic acid (PFOA), PFOS, and perfluorobutane sulfonate (PFBS). PFAS concentrations in soil leachate were compared to United States Environmental Protection Agency (USEPA) groundwater screening criteria for PFOA, PFOS, and PFBS. The results of the treatability testing and pilot tests confirmed that coarse-grained sand and gravel were successfully treated to meet performance goals, and the fines were segregated for alternative treatment.

The benefit of the volume reduction approach is that more cost-effective means can be applied to treat most of the impacted soil volume while limiting expensive residuals disposal or more expensive means of treatment such as incineration or thermal desorption. Treated soils can be beneficially re-used on site, and fines could also be stabilized to meet leaching-based standards, as an alternative to off-site disposal or treatment. This flexible approach allows tailoring of the combined remedial strategy to meet clients' objectives and risk tolerance though a sustainable, least-cost remedial approach.

EXECUTIVE SUMMARY

INTRODUCTION

This Final Report (Report) summarizes the implementation and results of the Environmental Security Technology Certification Program (ESTCP) Project ER20-B2-5258 (Project), which validates the field application of ex-situ soil washing using a mobile pilot system to remove per- and polyfluoroalkyl substances (PFAS) adsorbed to soils from source zones at the Department of Defense's (DoD's) Eielson Air Force Base (AFB), Alaska (the Site). The project was conducted by Arcadis U.S., Inc. (Arcadis) and CleanEarth Technologies Inc. (CET).

The objective of the Project was to demonstrate and validate soil washing as a cost-effective mass removal and volume reduction technology that can be applied to treat PFAS-contaminated soil in source zones.

The current state of very low PFAS soil and groundwater standards, combined with recalcitrance of the carbon-fluorine bond and the likelihood of hazardous substance designation under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), creates an exceptional challenge for practitioners and stakeholders when evaluating options for PFAS-impacted soil treatment. Soil treatment options are limited and expensive for PFAS-impacted soils. Current treatment options include excavation and landfill disposal, destructive technologies such as incineration and thermal desorption, and stabilization methods designed to limit leaching.

Landfilling is becoming more expensive as regulations and restrictions limit disposal options. Incineration has long been considered the gold standard for PFAS-containing waste destruction; however, recent public concern about incomplete treatment of off-gas emissions has led to a U.S. DoD moratorium on incineration of PFAS-containing wastes. Adsorption and stabilization can be effective for managing PFAS-impacted soil (McDonough et al. 2021), but it does not remove PFAS from soil, meaning that ongoing long-term management and monitoring are required. Soil washing could fill the gap in the market as a cost-effective mass removal and volume reduction technology that could be used to treat large volumes of PFAS-contaminated soil.

TECHNOLOGY

Soil washing is a "catch-all" phrase that describes a range of physical/chemical techniques for soil remediation that involve processing soil through physical and chemical separation equipment connected in parallel or in series. Historically, soil washing processes have taken on one of three general forms:

1) Size separation processes that segregate the coarse-grained soil particles from the fine-grained to reduce the volume of contaminated soil;
2) Size separation and density separation processes that both concentrate the contaminant in the fine-grained soil and remove it by density separation from the coarser soil fractions; and
3) Size and/or density separation combined with a chemically amended process water.

Soil washing has been used on a commercial scale in Europe since the mid-1980s through fixed facilities (Nunno and Hyman 1988), and in North America, a mobile soil washing system was tested for the United States Environmental Protection Agency (USEPA) in the 1980s (Scholz and Milanowski 1984; Griffiths 1995). Soil washing has been used to treat cyanide, petroleum hydrocarbons, polycyclic aromatic hydrocarbons, and metals, but the treatment of PFAS-impacted soil using soil washing is a relatively new application.

Despite the limited pilot-scale trials on PFAS-impacted soils, the chemical properties of PFAS make it a good candidate contaminant for treatment by soil washing. In a soil washing process, the high aqueous solubility of PFAS, along with the ability to control the pH of the process water, segregate the fine-grained fraction of the soil from the coarse-grained, and target the separation of organic compounds or other soil minerals from the bulk soil offer the ability to reduce the volume of contaminated soil requiring further treatment or disposal. The coarse-grained soil can be treated to achieve single-digit parts per billion cleanup goals; if fine-grained soil concentrations exceed remediation standards, they can be managed using secondary treatment including incineration, thermal desorption, stabilization and adsorption, or specialized landfilling.

PERFORMANCE OBJECTIVES

The overall objective of the trial was to demonstrate the effective removal of PFAS adsorbed to coarse-grained soils through soil washing. **Table ES-1** outlines the performance objectives of the field-scale demonstration. Regional screening levels for the Project discussed in **Table ES-1** are adopted from Alaska Department of Environmental Conservation (ADEC; 2016), ADEC 2019, and Office of the Secretary of Defense (OSD; 2021), which are presented in **Table ES-2**. 2022 USEPA and OSD screening levels were not used, as they were issued after the field demonstration was completed.

Table ES-1. Performance Objectives

Performance Objective	Data Requirements	Success Criteria
1. Bench-scale testing to demonstrate site suitability and optimize treatment process and a field-scale trial to demonstrate performance	Particle size distribution, physico-chemical soil parameters, total concentration and leachable concentration of individual PFAS in soil, co-contaminants and total organic carbon (TOC).	i) >99% removal of PFOS, perfluorooctanoic acid (PFOA), and perfluorobutane sulfonate (PFBS) and >99% removal of sum of 24 PFAS on the USEPA Method 537/DoD QSM analyte list ii) Post-treatment soil concentrations and leachate concentrations < regional screening levels iii) Post-treatment water concentrations < USEPA Health Advisory Level (HAL)
2. Cost optimization and reduction of lifecycle costs	Treatment cost estimate in $180 to $210 USD/ton for different soil types	40 to 50% cost reduction relative to thermal treatment

Table ES-2. Regional PFAS Screening Levels

Screening Levels	PFOS	PFOA	PFOS + PFOA	PFBS
Soil migrating to groundwater (ADEC 2016)	3 µg/kg	1.7 µg/kg	-	-
Groundwater (ADEC 2019)/USEPA HAL	-	-	70 ng/L	-
Groundwater (OSD 2021, USEPA 2021)	40 ng/L	40 ng/L	-	600 ng/L

Notes:
µg/kg – micrograms per kilogram
ng/L – nanograms per liter

Although the Project has no performance criteria for non-target PFAS, the presence and removal efficiency of non-target PFAS in soil and process water were evaluated through extractable organofluorine (EOF) analysis and adsorbable organofluorine (AOF).

SITE DESCRIPTION

PFOS/PFOA-contaminated soil generated from construction projects at Eielson AFB was stockpiled at a centralized location on base (Landfill #3) to allow the construction projects to proceed as scheduled. Currently, there are approximately 150,000 cubic yards of PFOS/PFOA-contaminated soil stockpiled on or near Landfill #3. These stockpiled soils consist predominantly of coarse-grained soil (gravel and sand). Fine-grained soil accounted for 6 to 33 percent of soil in each of the stockpiles; less than 10 percent of the total volume exhibited a fines content above 20 percent.

TEST DESIGN

The technology was tested at the bench scale, and the process was optimized based on initial results to achieve the performance criteria. The most successful treatment elements were carried forward to optimize the final design of the pilot-scale system, which was tested in the field at Eielson AFB. Soil tested during the bench-scale treatability testing and field demonstration contained both the average and highest concentration range of PFAS at Eielson AFB to evaluate the capabilities of the technology at Eielson AFB as well as the wider DoD portfolio.

Bench-Scale Treatability Testing

Testing was conducted on samples from three stockpiles at Eielson AFB: EIE393-1, EIE377-1, and EIE379-2. EIE393-1 was representative of soil from an aqueous film-forming foam (AFFF) source zone, and EIE377-1 and EIE379-2 were representative of construction stockpiles. The objectives of the bench-scale treatability trial were to evaluate the processes required to treat the soils and verify that the soil washing process could reduce PFAS concentrations in the coarse-grained soil to concentrations below ADEC screening levels and meet USEPA groundwater screening levels for leachate.

The design for the test consisted of three main stages; 1) size separation; 2) attrition scrubbing; and 3) advanced physical processing and chemical extraction. One sample was collected from each of the process streams generated from the process (gravel, sand, fines). Three rounds of testing were required to meet the treatment objectives. Round 1 evaluated different process conditions such as basic chemistry of the wash solution, temperature, retention time, liquid to solid ratios, and agitation. Round 2 included the most successful conditions from Round 1 and a chemical extraction step. Round 3 included the most successful conditions from the two previous rounds and a physical optimization step. During the bench-scale treatability testing, the organics were successfully treated without segregation from the fines. The pilot process therefore did not segregate the organic compounds.

Design, Layout, and Process Flow of Pilot System

A modular 1- to 10-ton per hour pilot-scale soil washing system was designed to duplicate the unit treatment processes and sequence of treatment evaluated at the bench scale. The system consisted of two soil modules and a water treatment circuit. Each soil treatment module was built within a rectangular frame measuring 40 feet long by 8 feet wide and certified for shipment by road, rail, and ocean to create flexibility for mobilization to remote project sites. The process area footprint consisted of a 40-foot by 100-foot bermed, lined area that allowed space for equipment setup and stockpiling of untreated and treated soil.

Field Testing

The pilot-scale process was shipped to Eielson AFB, with equipment arriving between August 13 to 20, 2021.Commissioning (consisting of site preparation, liner installation, placement of equipment, and connection of piping and electrical) were completed by August 24, 2021. The system was powered by a 185 kVA generator, and the system was filled with water from a lake at Eielson AFB (Mullins Pit), which was verified to be PFAS-free.

In total, 180 tons of soil were excavated and treated for the demonstration from three stockpiles. Stockpile EIE393-1 was representative of AFFF source-zone soil, and EIE382-5 and EIE385-4 were representative of construction stockpiles. Only the Round 1 treatment process was tested in the field. The Round 2 and Round 3 processes could not be evaluated due to the onset of freezing conditions in September 2021.

Soil samples were collected before and after treatment using two methods to validate the technology: batch sampling to evaluate the consistency in performance of each batch and the Incremental Sampling Methodology (ISM) to evaluate mean treatment performance for each of the three stockpiles. One batch sample was collected for every batch (20 tons) of soil treated for each stockpile. One ISM sample was collected for each process stream and consisted of 30 increments (50 grams per increment), and each ISM sample was collected in triplicate. An untreated and treated water sample of the process water was also collected during the processing of each of the three stockpiles.

Soil and process water samples were sent to Pace Analytical in West Columbus, South Carolina for analysis of 25 target PFAS compounds via the USEPA Method 537 (modified)/US DoD (DoD, 2019) QSM 5.3 (2019) (Table B-15) plus heptadecafluoro-N-methyloctanesulphonamide (N-MeFOSA; list of 25 PFAS). Bench-scale treatability samples were analyzed for leaching via the Australian Standard Leaching Procedure (ASLP) by method AS 4439.3. Field demonstration samples were analyzed for leaching via the SPLP method SW-846 Test Method 1312.

PERFORMANCE ASSESSMENT

Results from the bench-scale treatability testing are presented in **Table ES-3.** Concentrations of PFBS and PFOA were initially low in untreated samples and often treated to concentrations below detection limits, meeting all performance goals at the end of the treatability process. PFOS was the driver for meeting performance goals, and discussion will focus on PFOS results.

For EIE377-1 and EIE379-2, the soil performance goals were achieved using the Round 1 process in coarse-grained soil in the bench-scale testing. For EIE393-1, the soil concentration performance goals were achieved after using the Round 3 processes. The bench-scale treatability trial indicated that, during the field demonstration, soil with lower PFAS concentrations could be successfully treated using the simpler Round 1 process conditions including basic water chemistry, size separation, and agitation. However, soil with higher PFAS concentrations would require chemical extraction and physical optimization steps included in the Round 2 and 3 processes.

Table ES-3. Bench-Scale Treatability Testing Results

Stockpile	Treatment Round	Soil Fraction	PFOS		Sum PFAS	
			Soil	Leachate	Soil	Leachate
			µg/kg	ng/L	µg/kg	ng/L
EIE377-1 Construction Soil	Round 1	Untreated	15	450	20.24	687.5
		Gravel	0.32 J	<0.95	0.32 J	<DL
		Sand	0.50 J	<1	0.5J	<DL
		Fines	5.4	47	5.4	151.3
EIE379-2 Construction Soil	Round 1	Untreated	59	3300	62.85	4045.9
		Gravel	<0.19	29	<DL	147.8
		Sand	0.42 J	2.2 J	0.42 J	64
		Fines	9.6	7.8	11.9	116.7
EIE393-1 AFFF Source Soil	Round 1	Untreated	2,700	32,000	3,155	39,795
		Rock	88	200	97	270
		Gravel	27	620	32	803
		Sand	150	900	170	1,005
		Fines	2,400	530	2,822	1,123
	Round 2	Rock/Gravel	8.8	120	9.4	194
		Sand	12	75	14	181
	Round 3	Rock/Gravel/Sand	0.34 J	36 J	0.34 J	36 J
Performance Goals			**3**	**40**	**--**	**--**

Notes:
<DL = No compounds were detected above the detection limit so Sum of PFAS could not be calculated
J= estimated result, less than limit of quantitation and greater than detection limit
Bold values exceeded the performance goals.
Sum of PFAS = sum of 24 PFAS compounds on Table B-15, QSM 5.3 plus N-MeFOSA

Table ES-4 presents the results from the field demonstration from ISM sampling for the three stockpiles. The soil performance goals were achieved for EIE382-5 and EIE385-4 using the Round 1 treatment process verified in the bench-scale treatability trial. Mean coarse-grained soil PFOS concentrations in these stockpiles ranged from below the detection limit to 0.9 µg/kg.

Soil performance goals were also achieved in the fine-grained fraction for EIE382-5. This result highlights the potential for soil washing to achieve soil performance goals without requiring secondary treatment of the fines if untreated concentrations are relatively low. In Stockpile EIE393-1, the soil performance goals were not achieved, but this was expected because the Round 2 and 3 processes, which were required to achieve higher levels of PFAS removal at the bench scale, could not be completed due to freezing conditions. Based on the comparable performance of the Round 1 process at the bench and pilot scales, we expect that the pilot treatment unit or full-scale treatment would perform to meet soil performance goals. Optimization of performance parameters in the full scale and confirmation of treatment performance related to Round 2 and 3 processes would be part of any future full-scale remediation effort in this regard.

Table ES-4. ISM Arithmetic Mean PFAS Results

Stockpile	Soil Fraction	PFBS		PFOA		PFOS		Sum PFAS	
		Soil µg/kg	Leachate ng/L	Soil µg/kg	Leachate ng/L	Soil µg/kg	Leachate ng/L	Soil µg/kg	Leachate ng/L
EIE382-5	Untreated	<0.19	<10	0.2	10.0	4.5	193	6	316
	Gravel	<0.23	<10	<0.23	<10	<0.23	<10	0.3	<DL
	Sand	<0.23	<10	<0.23	<10	0.2	<10	0.2	50
	Fines	<0.24	<10	<0.24	<10	1.7	56	2	109
EIE385-4	Untreated	0.2	12	0.8	36	8	430	16	825
	Gravel	<0.20	<10	<0.20	<10	0.2	<10	0.2	17
	Sand	<0.20	<10	<0.20	<10	0.9	13	1.3	66
	Fines	<0.21	<10	0.2	16	9	243	12	345
EIE393-1	Untreated	1.4	49	6.0	243	560	22000	675	25833
	Gravel	<0.20	<10	0.4	19	30	1500	35	1796
	Sand	<0.20	<10	0.4	32	31	840	38	1103
	Fines	0.7	12	2.2	88	330	12667	409	14780
Performance Goal		**1900**	**40**	**1.7**	**40**	**3**	**40**	**--**	**--**

Notes:

<DL = No compounds were detected above the detection limit so Sum of PFAS could not be calculated

Bold values exceeded the performance goals.

Sum of PFAS = sum of 24 PFAS compounds on Table B-15, QSM 5.3 plus N-MeFOSA

Concentrations of PFBS and PFOA were treated to concentrations below detection limits for the coarse fractions of EIE382-5 and EIE385-4, and this was sufficient to achieve soil concentration performance goals. In coarse fractions, PFOS removal ranged from 88.6 to 98.1 percent, and removal for the sum of 25 PFAS was generally higher (ranging from 91.7 to 99 percent), which indicated that the soil washing process was effective at removing other target PFAS. The goal of >99 percent PFOS removal was not achieved in the stockpiles; however, soil concentrations for PFOS in coarse-grained fractions of EIE382-5 and EIE385-4 achieved the performance goal, which was the primary driver for evaluating treatment performance. These results confirmed that the simple treatment process employed for these stockpiles was sufficient to achieve soil concentration targets, but Round 2 and Round 3 processes would be required to achieve >99 percent removal and achieve performance goals for EIE393-1.

PFAS leachate results correlated to the soil PFAS results for the untreated and treated soil fractions, commonly showing approximately one order of magnitude higher soil concentrations for PFOS compared to the leachate concentrations. Leachability was reduced in all coarse-grained fractions after treatment with similar levels of PFAS removal from the soil. The leachate concentration performance goals were achieved for EIE382-5 and EIE385-4, but not for EIE393-1.

Batch results indicated that treatment performance was consistent during the demonstration, and treatment variability was low. Batch samples reported concentrations similar to those of ISM samples, and all batch samples for the coarse soil fractions of EIE382-5 and EIE385-4 achieved the performance objectives, consistent with ISM results.

Untreated water results confirmed that PFAS adsorbed to soil was transferred to the aqueous phase. On average, more than 99.99 percent PFAS removal was achieved in treated water samples, indicating that PFAS was successfully adsorbed to granular activated carbon (GAC) and ion exchange resin (IXR).

COST ASSESSMENT

The goal of the Environmental Security Technology Certification Program (ESTCP) project was to demonstrate that soil washing could be implemented at costs similar to landfilling in the lower 48 states, or approximately $200 to $400 per ton, including residuals management. The cost drivers for soil washing include:

1) Soil characteristics – grain size composition and fraction of fines, PFAS concentrations in soil, co-contaminants, and organic content;
2) Regulatory requirements – performance goals for PFAS in soil and leachate;
3) Logistics related to residuals management – proximity to landfills, incinerators, and thermal desorption facilities; and,
4) Stakeholder objectives regarding disposition of residuals – whether landfilling or destructive treatment are required, or if stabilization and on-site management are acceptable.

These factors make it difficult to provide more than a general cost range without site-specific treatability testing results. As the demonstration site's remote location in Fairbanks, Alaska impacts the logistics and costs of the testing, particularly for residuals treatment and disposal, we frame the cost of soil washing based on drivers and scenarios to illustrate the potential savings related to the volume reduction approach below. Under this approach, the costs include treatment of the coarse fraction (gravel and sand) to meet regulatory limits via soil washing and treatment/disposal of the residuals (fines and organics).

Based on the treatability results, a relatively simple process (relying on water and aggressive attrition scrubbing) can be applied to meet performance goals in sand and gravel when total PFAS concentrations are low. For higher concentrations indicative of AFFF sources, advanced treatment using additives, surfactants, and other physical optimization steps would be required. This would increase the complexity of treatment, potentially reducing throughput of full-scale treatment, and ultimately increase the cost. An increased proportion of fines and organic compounds would require additional process equipment to segregate and dewater the residuals. Finally, endpoint objectives can range from a fraction of a µg/kg to tens of µg/kg for PFOA and PFOS and can be a major cost driver.

These factors combine to a range of soil washing costs between approximately $100 to $200 per ton, excluding residuals treatment.

Table ES-5 presents scenarios of low-cost ($100/ton), medium-cost ($150/ton), and high-cost ($200) soil washing alternatives combined with options for residual management as a function of percentage of fines/organics in the soil. For the purposes of this analysis, we assume that the volume of soil requiring treatment would be at least 25,000 cubic yards, such that there would be economies of scale tipping the balance toward equipment mobilization versus transportation of soils to centralized disposal or treatment facilities. The assumption for the low-cost scenario for residuals would be landfilling at $200/ton; medium- and high-cost scenarios would use thermal desorption at $300/ton. The combined costs per ton resulting under these scenarios are summarized in **Table ES-5**, applying unit costs for soil washing to the entire volume for treatment of the coarse fraction and separation of fines for treatment and unit costs for landfilling and thermal desorption to the fines fraction.

Table ES-5. Soil Washing Cost Scenarios (per ton) Compared to Landfilling and Thermal Desorption

	Soil Composition					
	Fines:	**5%**	**10%**	**20%**	**30%**	**50%**
Scenario	**Coarse:**	**95%**	**90%**	**80%**	**70%**	**50%**
Low-Cost		**$110**	**$120**	**$140**	**$160**	$200
Medium-Cost		**$165**	**$180**	**$210**	**$240**	$300
High-Cost		**$215**	**$230**	**$260**	**$290**	$350

Notes:
Bold values are less than cost of landfilling at $200/ton (low-cost scenario) or thermal desorption at $300/ton (medium- and high-cost scenarios)
Low-Cost: treatment of coarse soil using soil washing ($100/ton) and landfilling of fines ($200/ton)
Medium-Cost: treatment of coarse soil using soil washing ($150/ton and thermal desorption of fines ($300/ton)
High-Cost: treatment of coarse soil using soil washing ($200/ton) and thermal desorption of fines ($300/ton)

By design, the low-cost scenario would be compared to landfilling at $200/ton, and the medium- and high-cost scenarios would be compared to thermal desorption at $300/ton. Here we considered fines percentages up to 50 percent as a practical limit. At 10 percent fines, the cost savings as a percentage range between 40 percent for the low-cost scenario and 23 percent for the high-cost scenario. Even at 30 percent fines, the savings range between 20 and 13 percent, indicating that the volume reduction approach inherent in soil washing offers cost advantages. While best value is obtained when the soils have limited fines/organics content, stakeholders that are risk-averse or seek to maximize sustainability could do so with this combined treatment approach. By minimizing the residual wastes that require expensive, high-energy destructive technologies, or by implementing thermal desorption to eliminate landfilling, individual stakeholders can achieve these goals based on their priorities and sensitivity to incremental cost.

IMPLEMENTATION ISSUES

Due to manufacturing delays, the field demonstration did not start until August 2021 and freezing conditions in September 2021 meant that the Round 2 and Round 3 treatment processes could not be conducted on Stockpile EIE393-1.

Considerations for Implementing Soil Washing at PFAS Sources

The chemical properties of PFAS make it a good candidate contaminant for treatment via volume reduction by soil washing. The volume reduction approach has demonstrated treatment of the sand and gravel soil fractions down to the low part per billion levels; however, as soil cleanup goals become more stringent, it is anticipated that more advanced soil washing processes will be needed to consistently treat the coarse-grained soil fractions to a PFAS concentration less than 1 part per billion. In anticipation of these new cleanup goals, continued research is required to demonstrate that optimization of the physical separation approach combined with chemical treatment can achieve these levels in the coarse-grained soil as well as a portion of the fine-grained soil fraction.

When evaluating soil washing as a treatment alternative, one should consider a systematic approach to feasibility assessment and predesign studies. The USEPA has published several step-by-step guides outlining a systematic approach to designing and implementing treatability studies (USEPA 1991; USEPA 1992) along with guidance on planning-level process feasibility evaluations specific to physical separation for volume reduction for a range of contaminants (USEPA 1999). Section 8.3 outlines steps that should be taken specifically for implementing soil washing at PFAS sources.

1.0 INTRODUCTION

1.1 BACKGROUND

This Final Report (Report) summarizes the implementation and results of the Environmental Security Technology Certification Program (ESTCP) Project ER20-B2-5258 (the Project), which validates the field application of ex-situ soil washing using a mobile pilot system to remove per- and polyfluoroalkyl substances (PFAS) adsorbed to soils from source zones at the Department of Defense's (DoD's) Eielson Air Force Base (AFB), Alaska (the Site). The project was conducted by Arcadis U.S., Inc. (Arcadis) and CleanEarth Technologies Inc. (CET).

This Report provides an overview of the technical approach, summarizes the associated performance objectives, provides a brief DoD site description and preliminary site assessment, and discusses the results of the field demonstration to evaluate PFAS removal using the soil washing technology. The report closes with a summary of the key lessons learned from the demonstration, recommendations for future research, and recommendations for use of the mobile lab at other DoD PFAS sites.

1.2 OBJECTIVE OF THE DEMONSTRATION

The objective of the Project was to demonstrate and validate soil washing as a cost-effective mass removal and volume reduction technology that can be applied to treat PFAS-contaminated soil in source zones. Consistent with the objectives of the Defense Environmental Restoration Program, the Project seeks to protect DoD's groundwater resources by preventing the vertical migration of PFAS from soil into groundwater.

Ex-situ soil washing was demonstrated at field scale by conducting a treatment trial at the Eielson AFB using a mobile-scale soil washing plant. The technology was validated using the United States Environmental Protection Agency (USEPA) Method 537/DoD Quality System Manual (QSM) 5.3 for the DoD target analyte list plus heptadecafluor-N-methyloctane sulfonamide (N-MeFOSA).

Incorporation of lessons learned from a recent Australian soil washing trial and bench-scale treatability trials were critical to the success of the Project and aided in the optimization of the treatment processes to ensure that the system could achieve United States (U.S.) remediation standards. Success was measured by the PFAS mass removal efficiencies achieved, reliability and scalability of the treatment process, ability to achieve the Alaskan regional soil and groundwater protection standards, and treatment cost per ton of soil. This successful demonstration of the ex-situ soil washing system can enable the commercialization and application of the technology at multiple sites, provide a cost-effective alternative to destruction technologies, and facilitate the beneficial reuse of treated soils.

1.3 REGULATORY AND TECHNOLOGY DRIVERS

Regulations for PFAS have been evolving since the USEPA promulgated lifetime health advisory levels (HALs) for perfluorooctanesulfonic acid (PFOS) and perfluorooctanoic acid (PFOA) in 2016.

In February 2019, the USEPA issued its PFAS action plan, which included initiation of steps to evaluate the need for a maximum contaminant level (MCL) for PFOS and PFOA, beginning the steps to propose designating PFOS and PFOA as hazardous substances, developing cleanup recommendations for PFOS and PFOA, and developing toxicity values or oral reference doses for GenX chemicals and perfluorobutane sulfonic acid (PFBS; USEPA 2019a). The USEPA issued interim recommendations to address groundwater impacted with PFOA and PFOS in December 2019 (USEPA 2019b) that recommended groundwater screening levels of 40 nanograms per liter (ng/L) for PFOS and PFOA and using the lifetime HALs of 70 ng/L (combined or individually) for preliminary remediation goals for groundwater used as drinking water.

The Office of the Secretary of Defense (OSD) issued policy for screening values of PFOS, PFOA, and PFBS in October 2019 that established screening values for these PFAS compounds in soil and groundwater. The groundwater screening levels were 40 ng/L for PFOA and PFOS and 40 micrograms per liter (µg/L) for PFBS. The soil screening levels for direct contact were 0.13 milligram per kilogram (mg/kg) for PFOA and PFOS and 0.19 mg/kg for PFBS (OSD 2019; USEPA 2021).

In June 2022, the USEPA issued new HALs for PFOS (0.02 ng/L) and PFOA (0.004 ng/L), as well as issuing a HAL for PFBS (2,000 ng/L) and GenX (10 ng/L). In May 2022, the USEPA also issued new Risk-Based Screening Levels (RBSLs) for Resident Soil (target cancer risk of 1E-06 and target hazard quotient of 0.1) for PFOS (0.013 µg/kg), PFOA (0.019 µg/kg), perfluorohexane sulfonate (PFHxS; 0.13 µg/kg), and PFNA (0.019 µg/kg). The RBSL for Resident Soil for PFBS (1.9 µg/kg) was issued in November 2021. These screening levels were issued after the completion of the field demonstration for this Project and were not used as performance criteria in this demonstration. The new RBSLs will impacts future soil washing applications, as they will require higher levels of PFAS removal.

Although federal MCLs and hazardous substance designations are still under consideration, the DoD has initiated preliminary assessments/site inspections (PA/SIs) to assess the occurrence of PFOS and PFOA at its installations throughout the U.S. and remedial investigations (RIs) to evaluate potential threats to off-site drinking water receptors. These evaluations are now generating investigation-derived wastes and identifying aqueous film-forming foam (AFFF) sources that will require treatment.

Soil treatment options are limited and expensive for PFAS-impacted soils. Current soil treatment options include excavation and landfill disposal, destructive technologies (such as incineration and thermal desorption), and stabilization methods designed to limit leaching. Landfilling is becoming more expensive as regulations and restrictions limit disposal to specialized Resource Conservation and Recovery Act (RCRA) Subtitle D landfills with leachate collection and treatment systems, RCRA Subtitle C landfills, and zero-net-leachate landfills in arid environments. Disposal costs have increased in anticipation of hazardous substance designation of PFOS and PFOA under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), but also because transportation costs are significant due to the geography of these specialized landfills. Transportation and disposal costs in the continental U.S. are on the order of $200 per ton but can increase to more than $400 per ton depending on the location and PFAS concentration of the waste.

While there are no national standards, our experience is that the threshold for the most expensive landfill disposal is at PFAS concentrations of approximately 1 mg/kg. Landfill disposal options could be more costly in the future after federal regulations contemplating hazardous substance designation are enacted.

Incineration has long been considered the gold standard for PFAS-containing waste destruction because the high temperatures (650 to more than 1,650 degrees centigrade) effectively desorb PFAS compounds from the soil and are thought to treat the PFAS under appropriate residence time and temperature. Recent public concern about incomplete treatment of off-gas emissions has led to a DoD moratorium on incineration of PFAS-containing wastes until the USEPA establishes emissions criteria and certifies technology providers (National Defense Authorization Act, §.1605, 117th Congress 2021). The USEPA indicated that additional research is needed to address fluorinated products of incomplete combustion (USEPA 2020). Incineration costs typically start at $350 per ton but can be much higher due to transportation costs associated with centralized fixed treatment facilities. Thermal desorption processes are advancing PFAS-containing soil treatment through optimization of the desorption process to reduce energy requirements and off-gas emissions treatment methods using thermal oxidizers with sufficient residence time and temperature to destroy PFAS compounds.

Emerging approaches include smoldering combustion to desorb and treat PFAS (Duchesne et al. 2020) or thermal desorption and treatment of PFAS-laden vapors through condensation and treatment in the liquid state (Stallings 2022). Thermal desorption has the advantage that the equipment can be set up for on-site treatment, creating a cost offset for large-scale treatment projects, where the mobilization would be much less costly than transportation of large volumes of soil. Commercial costs for thermal desorption are evolving with more experience and technology providers; however, the energy requirements to heat the entire volume of soil to 350 to 400 degrees centigrade for desorption will result in costs on the order of $300 per ton for large volumes and substantially higher for small volumes. Thermal desorption processes that use thermal oxidation treatment will also require air permits, which are also difficult to obtain given the evolving regulatory climate.

Adsorption and stabilization have been demonstrated to be effective tools for managing PFAS-impacted soil (McDonough et al. 2021). The general approach is to chemically "fix" the PFAS through amendments that bind them and reduce their mobility or create a low-permeability monolith that limits leaching. This approach could be used for on-site treatment or pre-treatment for off-site disposal. However, further studies are needed to evaluate the longevity of this approach. Soil stabilization has the advantage that the mobilization of equipment and addition of amendments can be applied to smaller volumes more cost-effectively than thermal desorption. Because adsorption and stabilization do not remove PFAS from soil, ongoing long-term management and monitoring are required. Commercial costs for stabilization are not widely available and depend on the soil characteristics, PFAS concentrations, and long-term management and monitoring requirements. Capital costs for mixing and amendments will likely range between $150 to more than $300 per ton, depending on the soil characteristics and PFAS concentrations.

2.0 TECHNOLOGY

2.1 TECHNOLOGY DESCRIPTION

Soil washing does not refer to a singular process or approach. It is a "catch-all" phrase that describes a range of physical/chemical techniques for soil remediation that involve processing soil through physical and chemical separation equipment connected in parallel or in series. While most of the equipment being used in soil washing circuits is commercially available through mining or aggregate equipment suppliers, the soil washing processes that have been applied at contaminated sites all differ in the equipment used, the sequence in which the equipment is applied, and in the use of chemical amendments to enhance contaminant recovery.

Historically, soil washing processes have taken on one of three general forms:

1) Size separation processes that segregate the coarse-grained soil particles from the fine-grained to reduce the volume of contaminated soil. This approach is used on sites where the contaminant concentrates in the fine-grained fraction of the soil, and the fine-grained fraction is a small percentage of the bulk soil.

2) Size separation and density separation process that both concentrate the contaminant in the fine-grained soil and remove it by density separation from the coarser soil fractions. This approach is effective where there is a significant density difference between the contaminant and host soil, especially for sites impacted by lead bullets or sites contaminated with elemental mercury.

3) Size and/or density separation combined with a chemically amended process water. The chemical amendments enhance the solubilization or desorption of the contaminant into the aqueous phase and can be used to treat both the coarse-grained and fine-grained soil fractions. Chemical amendments to enhance removal efficiency are contaminant-specific but typically include acids, bases, alcohols, surfactants, and chelating agents.

Soil washing has been used on a commercial scale in Europe since the mid-1980s (Nunno and Hyman 1988). Fixed facilities located in the Netherlands and Germany have treated a range of contaminants including cyanide, petroleum hydrocarbons, polycyclic aromatic hydrocarbons, and metals. The processes differed, but in general were designed to reduce the volume of contaminated soil by combining physical separation of the coarse-grained from the fine-grained soil fraction with the treatment of the separated coarser-grained soil fractions using chemically amended process water.

In North America one of the first tests of a soil washing system was conducted by the USEPA. The "Mobile Soil Washing System" was developed in the early 1980s (Scholz and Milanowski 1984; Griffiths 1995) to demonstrate treatment through scrubbing combined with a chemically amended process water. The system consisted of a wet trommel with scrubber and screening sections to separate the +2mm soil fraction, with the -2mm soil fraction undergoing additional treatment by contact with chemically amended process water in a series of counter current reactors.

In the late 1980s, the USEPA developed the "Mobile Volume Reduction Unit," which was designed as a small-scale mobile research system that could process soils at a throughput rate of 100 pounds per hour (USEPA 1993). The process reduced the volume of contaminated soil requiring disposal through the separation of the coarse-grained fraction from the contaminant laden fine-grained fraction. The system consisted of a heated screw feeder, wet trommel, wet screens, clarifier, and water treatment. The process had a flexible design and could be run as a water-only process at neutral pH and ambient temperature or could be operated with the addition of surfactants and adjustment of pH and temperature to further reduce the contaminant concentrations in the coarse-grained soils.

During the 1990s, a few commercial vendors demonstrated soil washing in the U.S. BESCORP/ COGINIS processed more than 20,000 tons of metal-contaminated soil at the Twin Cities Army Ammunition Plant in New Brighton, Minnesota (Fristad 1995; USEPA 1999). The process combined mechanical screening with gravity separation to treat the coarse-grained soil and acid leaching to treat the fines. The process consisted of a trommel screening out the +6.35 mm fraction with the oversize handpicked for munitions and cartridges. The -6.35 mm soil was processed through a hydraulic classifier to separate the sand from the fines. The sand stream was further processed by gravity separation via spirals and jigs to remove metal fragments before transferring to a counter current reactor for leaching. The separated fines were sent to a series of leaching clarifiers with the soil fractions dewatered, recombined, and neutralized.

In a similar application, ContraCon Northwest and BESCORP were contracted to perform a pilot-scale demonstration of soil washing at a small arms range in Fort Polk, Louisiana. The demonstration was designed to evaluate the treatment of the lead-contaminated soil using physical separation combined with acid leaching (Sams et al. 1998). The two processes used similar equipment and processes (soil feed conveyors, classification/attrition scrubbing, gravity separation of lead from the sand fraction by jigs and leaching of the lead from the fine-grained soil in leach tanks). As part of the demonstration, each vendor was assigned a different acid to evaluate the effect of using a strong (hydrochloric) or weak (acetic) acid as the chemical amendment added to the leaching circuit.

RMI Environmental Services and Alternative Remedial Technologies, Inc. (ART) completed a pilot-scale demonstration on 64 tons of uranium-contaminated soil at the RMI Titanium Company Extrusion Plant in Ashtabula, Ohio. The pilot-scale chemical leaching system was operated in early 1997 and consisted of a heated batch reactor, mechanical screens, and dewatering equipment (USEPA 1999). The leaching circuit contacted a sodium bicarbonate solution in the heated batch reactor for 1 to 2 hours at 30 percent solids content (USEPA 1999). Following processing, both the coarse- and fine-grained soils met the treatment standard of 30 picoCuries per gram (pCi/g).

ART also completed a full-scale soil washing project at the King of Prussia Technical Corporation site in Winslow Township, New Jersey. A 25-ton-per-hour soil washing process was constructed on site and operated from June to October 1993. The process equipment consisted of wet screening, attrition cells, hydrocyclones, a lamella clarifier, and a belt press. The system was operated as a volume reduction process producing a treated coarse-grained soil and a contaminant-enriched fine-grained soil that was shipped off site for disposal.

The treatment of PFAS-impacted soil using soil washing is a relatively new application with a limited number of trials beyond the laboratory scale. In addition to the project described in this paper, another pilot-scale soil washing project has been completed by Ventia at the Royal Australian Air Force Base in Edinburgh, Australia. More than 2,000 tons of PFAS-contaminated soil from the source zone of the Fire Fighting Training Area were processed during the pilot test using a soil washing system that incorporated treatment elements of soil size separation and density separation of organic compounds (Grimison et al. 2020).

Despite the limited pilot-scale trials on PFAS-impacted soils, the chemical properties of PFAS make it a good candidate contaminant for treatment by soil washing. Organic matter content, mineralogy, fine-grained soil percentage, and pH are all soil properties that interact with the chemical characteristics of PFAS to influence their retention on a given soil (Liu et al. 2020). In a soil washing process, the high aqueous solubility of PFAS along with ability to control the pH of the process water, segregate the fine-grained fraction of the soil from the coarse-grained, and target the separation of organic compounds or other soil minerals from the bulk soil offer the ability to reduce the volume of contaminated soil requiring further treatment or disposal. If treated fines concentrations exceed remediation standards, they can be managed using secondary treatment including incineration, thermal desorption, stabilization and adsorption, or specialized landfilling.

In some sense, we have come full circle back to the late 1980s, where the focus was on volume reduction when remediating difficult-to-treat contaminants. The promise for PFAS-impacted soil washing treatment is that future optimization of fines and organic treatment will minimize the volumes requiring secondary treatment, resulting in more cost-effective and sustainable solutions.

2.2 TECHNOLOGY DEVELOPMENT

CET collaborated with Ventia, an Australian-based remediation company, to conduct a pilot-scale PFAS soil washing trial for Defense Australia. This included the design and construction of a fixed soil washing facility and the treatment of more than 2,000 tons of PFAS contaminated soil at Edinburgh Air Force Base, South Australia. CET and Arcadis built on lessons learned in the Australian field trial to optimize the treatment process and design a mobile soil washing plant capable of achieving U.S. remediation standards. The treatment design is based on results from the bench-scale treatability trial conducted on soil from Eielson AFB.

2.3 ADVANTAGES AND LIMITATIONS OF THE TECHNOLOGY

Soil washing is a volume reduction approach that treats coarse-grained soil and segregates fine-grained soil for secondary management. The benefit of the volume reduction approach is that more cost-effective means can be applied to treat most of the impacted soil volume while limiting expensive residuals disposal or more expensive means of treatment such as incineration or thermal desorption. Treated soils can be beneficially reused on site, and fines could also be stabilized to meet leaching-based standards as an alternative to off-site disposal or treatment. This flexible approach allows tailoring of the combined remedy strategy to meet clients' objectives and risk tolerance through a sustainable, least-cost remedial approach.

The mobile soil washing system can be transported to remote sites directly to the impacted soil. It does not need to be connected to local power or water supplies. The system used for this Project was powered by a generator, and process water was added to the system from the nearby Mullins Pit waterbody using a water tank. The mobile and volume reduction approach brings sustainability benefits in comparison to off-site disposal and treatment technologies by reducing the number of trucks on the road and energy consumption.

The modular design of the soil washing process means that different elements can be scaled up to increase treatment throughput. The system used in this Project was designed to treat up to 12 tons per hour; however, the data obtained from the pilot test is sufficient to scale up the process to a larger footprint with a 50-tons-per-hour process. This allows flexibility for clients where variable treatment timeframes are desired. Where capacities greater than 50 tons per hour are required, multiple 50-ton-per-hour processes could be mobilized.

As a volume reduction technology, soil washing is most effective for soil with a higher percentage of coarse-grained soil compared to fines. Historically, soil washing has been considered appropriate for soil with ≤ 40 percent fines content. The cost analysis in Section 7 confirms that best value is obtained for soil washing when the soils have limited fines/organics content; however, soil washing's volume reduction approach can still be cost-competitive and bring sustainability benefits in comparison to landfilling for soil with up to 50 percent fines.

Soil washing has potential to treat fine-grained soil with low initial PFAS concentrations; however, PFAS removal performance is lower and less consistent compared to coarse-grained soil. Despite lower levels of PFAS removal in the fine-grained fraction, the recombination of coarse- and fine-grained soil after treatment may be suitable if the recombined concentration of soil does not exceed the cleanup criteria. This could be conducted through mass balance calculations of the individual soil fractions before recombination and validation testing the soil after it has been recombined. In addition to reducing the volume of waste requiring off-site disposal or additional treatment, this approach would result in treated soil with geotechnical properties closer to those of the original untreated soil.

3.0 PERFORMANCE OBJECTIVES

The overall objective of the trial was to demonstrate the effective removal of PFAS adsorbed to coarse-grained soils through soil washing. The Project seeks to demonstrate and validate a PFAS soil washing technology at the field scale by:

1) Completing treatability testing and a pilot-scale field trial;
2) Evaluating treatment performance in the presence of common co-contaminants; and
3) Determining the site-specific cost and performance requirements of the technology.

Table 1 outlines the performance objectives of the field-scale demonstration and identifies whether they were achieved. Regional screening levels for the Project discussed in **Table 1** are adopted from Alaska Department of Environmental Conservation (ADEC; 2016), ADEC 2019, and OSD 2021, which are presented in **Table 2**. Although USEPA and OSD 2022 screening levels were not used (as they were issued after the field demonstration was completed), we will discuss the implications on soil washing in Section 8.3.

Table 1. Performance Objectives

Performance Objective	Data Requirements	Success Criteria	Success Criteria Achieved?
1. Bench-scale testing to demonstrate site suitability and optimize treatment process	Particle size distribution, physico-chemical soil parameters, total and leachable concentrations of individual PFAS in soil, co-contaminants, and total organic carbon (TOC).	i) >99% removal of PFOS, PFOA, and PFBS and >99% removal of sum of 24 PFAS on the USEPA Method 537/DoD QSM analyte list.	i) Yes: >99% removal achieved for Stockpile EIE393-1 after Round 3 treatment process. <99% removal not achieved for EIE377-1 and EIE379-2; however, concentrations were < regional screening levels or below detection limits.
		ii) Post-treatment soil concentrations and leachate concentrations < regional screening levels.	ii) Yes: Post-treatment soil concentrations and leachate concentrations < Alaskan regional screening levels
		iii) Post-treatment water concentrations < USEPA HAL	iii) Yes: Post-treatment water concentrations < USEPA HAL
2. Field-scale trial to demonstrate performance	Particle size distribution, physico-chemical soil parameters, total concentration and leachable concentration of individual PFASs in soil, co-contaminants, and TOC	i) >99% removal of PFOS, PFOA, and other PFAS on the USEPA Method 537/DoD QSM analyte list.	i) Partially: Only the Round 1 treatment process was conducted. Round 2 and 3 treatment steps could not be conducted due to onset of freezing temperatures that brought a premature end to the soil processing phase. In the bench-scale testing, Round 2 and Round 3 were required to achieve removal efficiencies of >99%. Concentrations of PFOA treated to below detection limits in two stockpiles. 89 to 98% removal of PFOS was achieved in the three stockpiles. 94 to 99% removal of sum of 25 PFAS was achieved in the three stockpiles.
		ii) Post-treatment soil concentrations and leachate concentrations < regional screening levels.	ii) Partially: Soil criteria achieved for coarse soil in EIE382-5 and EIE385-4, but not for EIE393-1. Criteria also achieved for fines in EIE382-5.
		iii) Post-treatment water concentrations < USEPA HAL	iii) Yes: Post-treatment water concentrations <USEPA HAL
3. Cost optimization and reduction of lifecycle costs	Treatment cost estimate in $180 to $210 USD/ton for different soil types	40 to 50% cost reduction relative to thermal treatment	Yes: Based on current costs for landfilling ($200 to $400/ton) and thermal desorption ($300+/ton). Up to 60% cost savings for soil washing compared to thermal desorption for soil with 10% fines and up to 40% cost savings compared to landfilling in lower 48 states.

Table 2. Regional PFAS Screening Levels

Screening Levels	PFOS	PFOA	PFOS + PFOA	PFBS
Soil migrating to groundwater (ADEC 2016)	3 µg/kg	1.7 µg/kg	-	-
Groundwater (ADEC 2019)/USEPA HAL	-	-	70 ng/L	-
Groundwater (OSD 2021, USEPA 2021)	40 ng/L	40 ng/L	-	600 ng/L

Note:
µg/kg – micrograms per kilogram

Bench-scale testing to demonstrate site suitability and optimize the treatment process was completed and documented in the Laboratory Treatability Memo (Arcadis and CET 2021).

Although the Project has no performance criteria for non-target PFAS, the presence and removal efficiency of non-target PFAS in soil and process water was evaluated through extractable organofluorine (EOF) and adsorbable organofluorine (AOF) analysis.

4.0 SITE DESCRIPTION

4.1 SITE LOCATION AND HISTORY

Eielson AFB lies approximately 120 miles south of the Arctic Circle, 23 miles southeast of Fairbanks, and 9 miles southeast of the City of North Pole (**Figure 1**). Eielson AFB is in the Tanana River Valley along the northern bank of the river on a low, relatively flat floodplain terrace approximately 2 miles from the active river channel. Eielson AFB is an active military installation that has been used for military operations since its establishment in 1944. The mission of Eielson AFB is to train and equip personnel for close air support of ground troops in an arctic environment. Eielson AFB operations include industrial areas, aircraft maintenance and operations, an active runway and associated facilities, administrative offices, and residential and recreational facilities. Eielson AFB provides housing for resident military personnel and their dependents, as well as employment and services for civilians from the surrounding area. The base occupies 19,700 acres, most of which is forest, wetlands, lakes, and ponds beyond the approximately 3,650 acres that have been improved or partially improved and are used for the bulk of base activities (AECOM 2013).

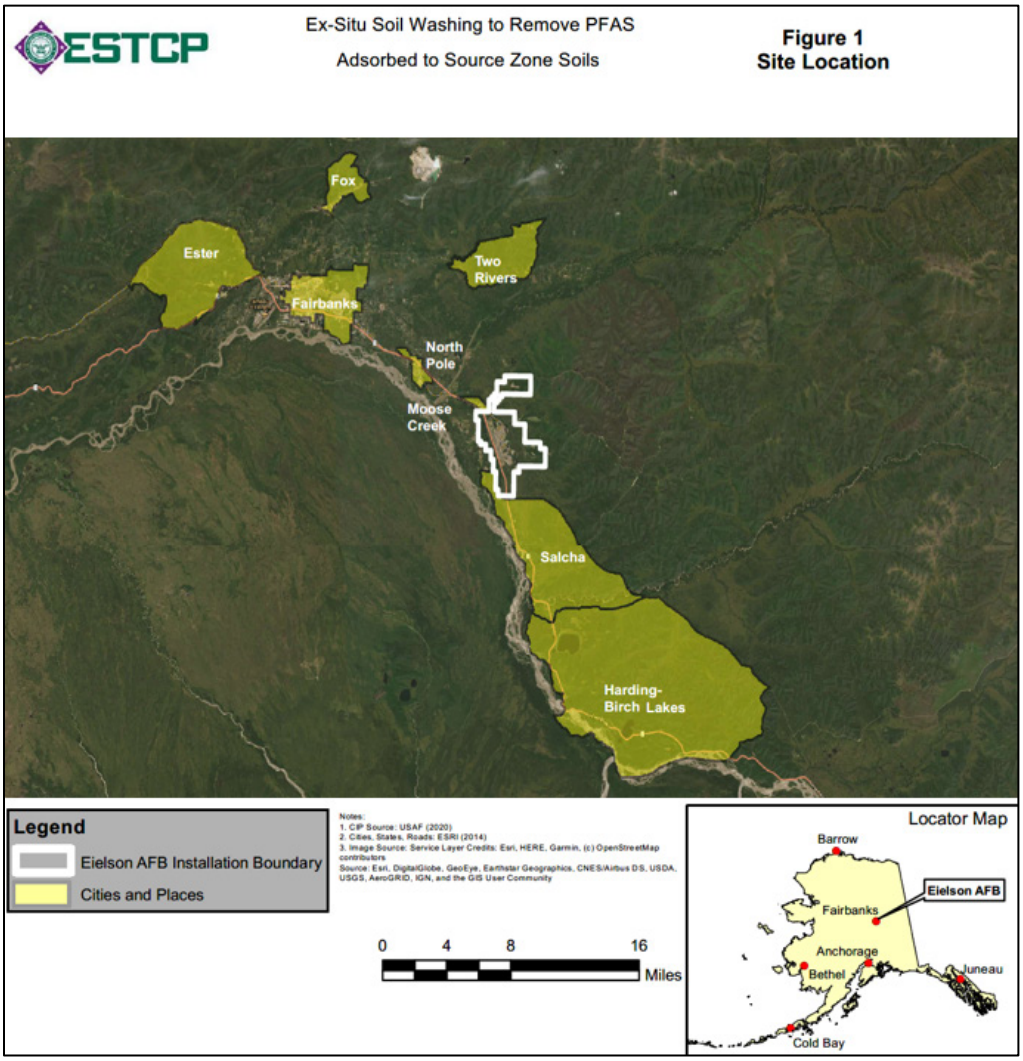


Figure 1. Site Location

4.2 SITE GEOLOGY/HYDROGEOLOGY

In the Eielson AFB area, the low hills and lower slopes consist primarily of Quaternary loess sediments with shallow or outcropping bedrock where sediments are thin or not present. Some of these sediments have been reworked and redistributed downslope. The valley floor consists primarily of alluvium. Sedimentary deposits overlie the Birch Creek Schist in much of the area surrounding Eielson AFB.

Eielson AFB is in an abandoned river-channel belt, and the subsurface underlying most of the base consists of braided river deposits. These deposits are complex in structure but similar in lithology. In the developed portion of Eielson AFB, fill material (generally described as silty sand and gravelly sand) was used during construction. This material was quarried nearby and is lithologically similar to natural soil, although the sedimentary structures would have been obliterated. Only the upper part of the floodplain sediments has been explored, in some areas at depths less than 30 feet. These sediments consist primarily of gravelly sand and sandy gravel (AECOM 2013).

Groundwater depth levels vary seasonally, rising during snowmelt and declining in winter. Generally, groundwater is encountered at depths of 10 feet or less below ground surface, and seasonal fluctuation ranges from 1.5 to 2 feet. The aquifer is more than 250 feet thick, extends to the underlying bedrock, and has a regional hydraulic gradient of approximately 5 feet per mile flowing to the north-northwest. Along the flight line, the hydraulic gradient varies; over a 3,750-foot distance, a decline in head of 4 feet has been observed, yielding a gradient of 0.0011 foot per foot. Using this hydraulic gradient with a hydraulic conductivity of 240 feet per day (derived from a transmissivity of 800,000 gallons per day per foot [Cederstrom 1963] and a 450-foot aquifer thickness) and a porosity of 0.3, groundwater would flow approximately 320 feet per year. However, it is likely that the groundwater velocity is highly variable (AECOM 2013).

4.3 PREVIOUS PFAS INVESTIGATIONS

PFAS-specific environmental investigations have been ongoing at Eielson AFB since 2014. Specifically, PFOA and PFOS have been investigated in multiple media on and off base. Previous PFAS investigations have evaluated several potential source areas, which include fire treatment areas, hangars, fire stations, emergency responses potentially involving the use of AFFF, AFFF spray test areas, AFFF spills, and drinking water wells.

A list of previous PFAS investigations is provided below:

- A PA was conducted to identify locations where perfluorinated compounds (PFCs) may have been released and to assess possible migration pathways and receptors of potential contamination (CH2M Hill, Inc. [CH2M] 2015).
- Between 2015 and 2016, groundwater investigations were conducted at four areas to evaluate for the presence and distribution of PFOA/PFOS in groundwater, surface water, and/or private drinking water in the northern and western base areas and off base in the community of Moose Creek (United States Air Force [USAF] 2017).
- In 2016, SIs were conducted at 15 of the sites identified during the 2015 PA to assess for the presence or absence of PFOA and PFOS in multi-media (CH2M 2018).

- In 2016, a soil investigation was conducted before the expansion of the wastewater treatment plant located adjacent to Garrison Slough Pond (Bristol Site Contractors, LLC [Bristol] 2018).
- In 2016, five AFFF releases occurred at Polaris Lake, at the Combat Alert Center (Building 1300), and at the Haz Waste Facility (Building 4378), and soil samples were collected to evaluate PFAS contamination (ADEC 2020a, 2020b, 2020c).
- In 2019, an RI/Remedial Action was conducted to collect data for an RI, a Human Health Risk Assessment, and Screening-Level Ecological Risk Assessment/Baseline Ecological Risk Assessment (Jacobs Engineering Group, Inc. [Jacobs] 2020)
- In 2019, three groundwater samples were collected from the EIE338 site and analyzed for PFOS and PFOA (U.S. Army Corp of Engineers [USACE] 2019).
- In 2019 and 2010, an Expanded PFOA and PFOS SI for Eielson AFB and Moose Creek was initiated (Sundance 2020a, 2020b).
- In 2021, Arcadis and BEM Systems, Inc. commenced a PFAS RI at Eielson AFB, which is still ongoing.

4.4 PFAS-CONTAMINATED STOCKPILES

In 2016, the ADEC promulgated soil and groundwater cleanup levels for PFOS and PFOA. Widespread PFOS and PFOA contamination was subsequently identified at most of the proposed F-35 Beddown Program construction sites at Eielson AFB. With regulatory approval, PFOS/PFOA-contaminated soil was stockpiled at a centralized location on base (Landfill #3) to allow the construction projects to proceed as scheduled. Currently, there are approximately 50 stockpiles or 150,000 cubic yards of PFOS/PFOA-contaminated soil generated from 14 different F-35 construction projects and stockpiled on or near Landfill #3. Some stockpiles are also impacted with chlorinated volatile organic compounds (VOCs); polycyclic aromatic hydrocarbons (PAHs), pesticides; and petroleum, oil, and lubricants.

From November 2019 to December 2020, a F35 PFAS Stockpile Characterization Assessment was conducted on behalf of the USAF Eielson AFB, Alaska (USAF 2021). Stockpiles were sampled for PFOA and PFOS content, TOC, and geotechnical parameters including grain size gradation. The stockpiles selected for the field demonstration were representative of the 150,000 cubic yards of contaminated soil.

The 150,000 cubic yards of stockpiled soil consist predominantly of coarse-grained soil (gravel and sand). Fine-grained soil accounted for 6 to 33 percent of soil in each of the stockpiles, and less than 10 percent of the total 150,000 cubic yards of stockpiled soil exhibited a fines content above 20 percent. The 95% upper confidence limit (UCL) calculations from the USAF Eielson AFB (2021) Stockpile Characterization Report provide untreated PFAS concentrations for each stockpile. PFOA concentrations in the stockpiles are generally in the single digit µg/kg range, whereas PFOS concentrations are typically higher, ranging from single digits to just more than 100 µg/kg. Less than 10 percent of the total stockpiled volume contains concentrations of PFOA and PFOS above 100 µg/kg. The notable exception is stockpile 393-1, which contains a PFOS/PFOA combined concentration of 1,500 µg/kg to 2,700 µg/kg; however, the stockpile volume is approximately 11 cubic yards.

Table 3 and **Table 4** present the available geotechnical and PFAS data for the stockpiles treated in the bench-scale treatability testing and the field demonstration. Stockpiles were selected based on availability (some stockpiles were earmarked for other remedial activities), proximity to the proposed treatment area and ease of access, PFAS concentrations, and the proportion of coarse- and fine-grained soil. Stockpiles EIE377-1 and EIE379-2 were selected for the bench scale, and EIE382-5 and EIE385-4 were selected for the field demonstration because they are considered representative of construction soils, which account for the majority of the current PFAS contaminated stockpiled soil at Eielson AFB with 95% UCL PFOS concentrations ranging from 29 µg/kg to 111 µg/kg. Stockpile EIE393-1 was selected for the bench trial and field demonstration because it is considered representative of soil from PFAS source zones. Testing these stockpiles will demonstrate the ability of the soil washing processes to treat construction soils and PFAS source zone soils at Eielson AFB and across the DoD portfolio.

Table 3. Summary of Stockpile Grain Size

Stockpile	Gravel (%)	Sand (%)	Fines (%)
EIE377-1	37 [a]	35 [a]	28 [a]
EIE379-2	32 [a]	40 [a]	28 [a]
EIE382-5	32 [a] -40 [b]	40 [b]-42 [a]	21 [b]-26 [a]
EIE385-4	24 [b]-43 [a]	34 [a] -40 [b]	23 [a] -36 [b]
EIE393-1	1 [b]-53 [a]	34 [a] -39 [b]	8 [a]-65 [b]

Notes:
[a]Soil characteristics obtained from Table 6 of USAF (2021).
[b]Soil characteristics from particle size analysis sampling conducted during the pilot demonstration.

Table 4. Stockpile PFAS Characterization Summary

Stockpile Identification	Volume (cubic yards)	Stockpile Height (feet)	Stockpile PFAS Results (µg/kg)			
			PFOA		PFOS	
			Primary Result	Max 95% UCL	Primary Result	Max 95% UCL
EIE377-1	2,725	NA	0.38 to 1.2	1.91	9.75 to 44.8	66.82
EIE379-2	1,369	NA	0.29 to 0.52	0.57	27.7 to 59.2	66.62
EIE382-5	3,761	20.6	ND to 0.182	ND to 0.43	6.47 to 50	111.14
EIE385-4	90	NA	0.8	<LOD	20.0	29.0
EIE393-1	11.3	9	Triplicate	5.54	Triplicate	1,590.49

Notes:
Primary result = range of concentrations from primary samples. Number of samples collected dependent on stockpile volume.
Triplicate = USAF (2021) does not provide a primary result and says sample was collected in triplicate.
NA = Not applicable. No data provided in USAL (2021) ND = non detect LOD = Limit of Detection

5.0 TEST DESIGN

5.1 CONCEPTUAL EXPERIMENTAL DESIGN

The experimental design consisted of testing the technology at the bench scale and optimizing treatment processes based on initial results. The most successful treatment elements were carried forward to optimize the final design of the pilot-scale system, which was tested in the field at Eielson AFB. Soil tested during the bench-scale treatability testing and field demonstration contained both the average and highest concentration ranges of PFAS at Eielson AFB. Soil with a range of PFAS concentrations was used to evaluate the capabilities of the technology at Eielson AFB as well as the wider DoD portfolio.

5.2 BENCH-SCALE TREATABILITY STUDY

The treatability study methods and results were reported in the Laboratory Treatability Memo (Arcadis and CET 2021) which is provided in **Appendix B**.

Three 20-liter samples of PFAS-contaminated soil were obtained from three stockpiles at Eielson AFB: EIE393-1, EIE377-1, and EIE379-2. The bench-scale treatability study was completed at CET Laboratory in Halifax, Nova Scotia. The objectives of the treatability trial were to evaluate the processes required to treat the soils and verify that the soil washing process could reduce PFAS concentrations in the coarse-grained fraction of the soil to concentrations below ADEC screening levels and meet USEPA groundwater screening levels for leachate.

Figure 2 shows the series of treatment stages that comprise the experimental design of the treatability test. The design for the test consisted of three main stages: 1) size separation; 2) attrition scrubbing; and 3) advanced physical processing and chemical extraction. Both dry and wet screening were conducted using an 18-inch round vibratory screener. Three separate fractions were created using 2.5, 4, and 200 Tyler mesh screens placed in sequence. Three rounds of testing were required to meet the treatment objectives. Round 1 evaluated different process conditions such as basic chemistry of the wash solution, temperature, retention time, liquid-to-solid ratios, and agitation. Round 2 included the most successful conditions from Round 1 and a chemical extraction step. Round 3 included the most successful conditions from the two previous rounds and a physical optimization step.

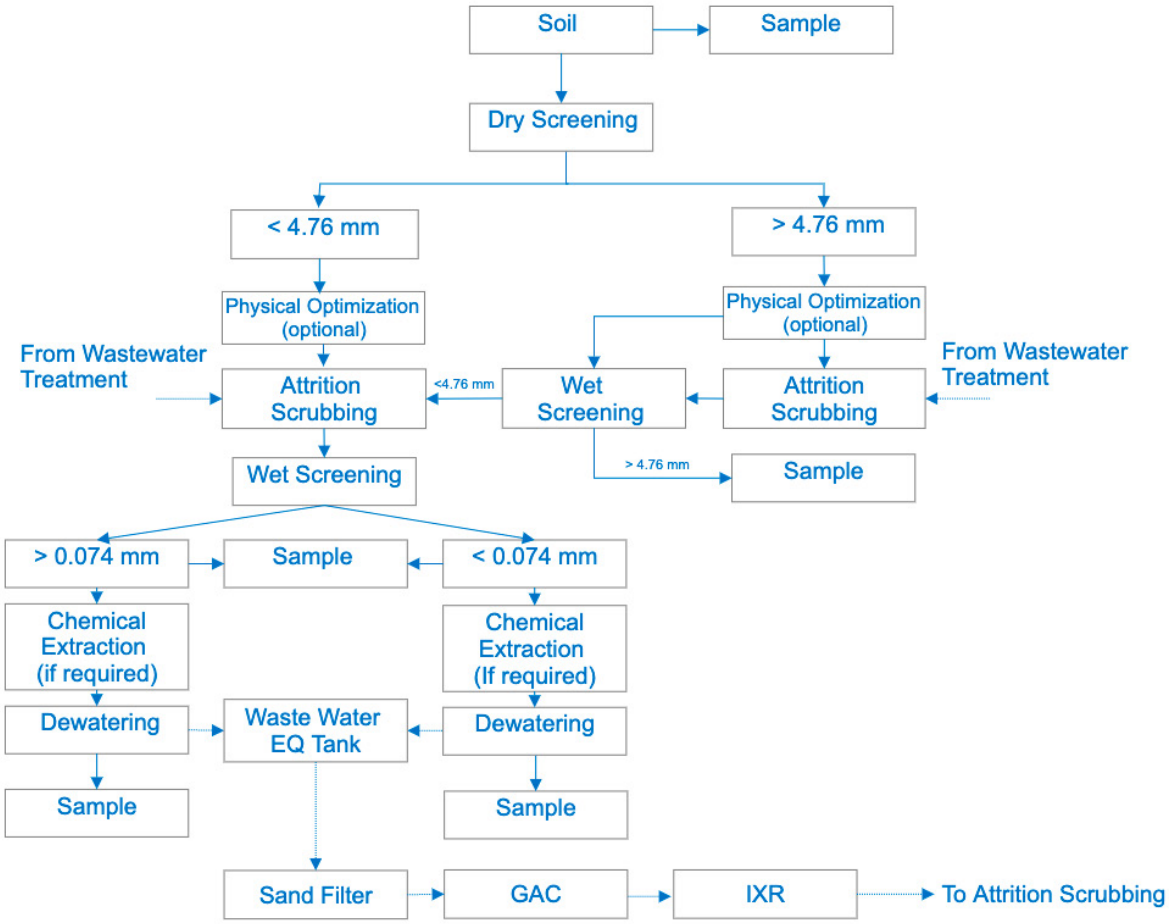


Figure 2. Soil Washing Treatability Test Design.

Process flow from the bench-scale treatability test illustrates the treatment elements, sample collection points, and water treatment circuit.

Attrition scrubbing of the plus and minus 4.76 mm fractions of the soil sample were placed in a Denver attrition mill and processed in a 5:1 liquid/solid slurry. At the end of the attrition scrubbing, the slurry from each run was passed through the SWECO screen to separate into the final soil fractions of +4.76 mm (gravel), -4.76 mm + 0.074 mm (sand), and -0.074mm (fines).

If the remedial objectives were not achieved through the screening and attrition scrubbing stages, chemical extraction was applied to the samples. Proprietary extraction solutions were tested on the different soil fractions using a modified Phipps and Bird six-paddle stirrer with a variable speed mixer. Approximately 200 ml samples of the soil were reacted with the extracting solution at a 5:1 (v:v) ratio of solution to soil for 30 minutes at the specified mixing intensity. Upon completion of the extraction period, the coarser soil fractions are allowed to settle, decanted, and screened on a 200-mesh screen. The finer-grained soil fractions are mixed with a conventional polymer to create a flocculated slurry, allowed to settle for 10 minutes, and decanted before final dewatering using a laboratory-scale filter press. Soil samples were collected at the points indicated on **Figure 2**.

Process water produced during the bench-scale soil washing test was treated through a laboratory-scale wastewater treatment process illustrated on **Figure 2**. The PFAS-impacted process water was pumped through a series of 5-centimeter columns consisting of 0.35- to 0.45-mm filter sand, 8x30 mesh granular activated carbon (GAC), and a strong base anionic ion exchange resin. Empty bed contact times for each of the columns were 3, 15, and 5 minutes, respectively.

Based on the results of the three rounds of treatment trials, the success criteria outlined in **Table 1** were achieved, and this resulted in the team's agreement to proceed (Go) to the formal field demonstration phase of the Project. Results from these three rounds informed the final treatment design of the soil washing plant, which allowed soil to be treated using a range of processes optimized to site-specific characteristics of soil.

5.3 DESIGN, LAYOUT, AND PROCESS FLOW OF PILOT SYSTEM

The complete modular pilot-scale soil washing process consisted of two soil modules and a water treatment circuit. Each soil treatment module was built within a rectangular frame measuring 40 feet long by 8 feet wide and certified for shipment by road, rail, and ocean to create flexibility for mobilization to remote project sites. The process area footprint consisted of a 40-foot by 100-foot bermed lined area that allowed space for equipment setup and stockpiling of untreated and treated soil. **Figure 3** shows the different modules and **Figure 4** shows different stages of the process commissioning and setup.

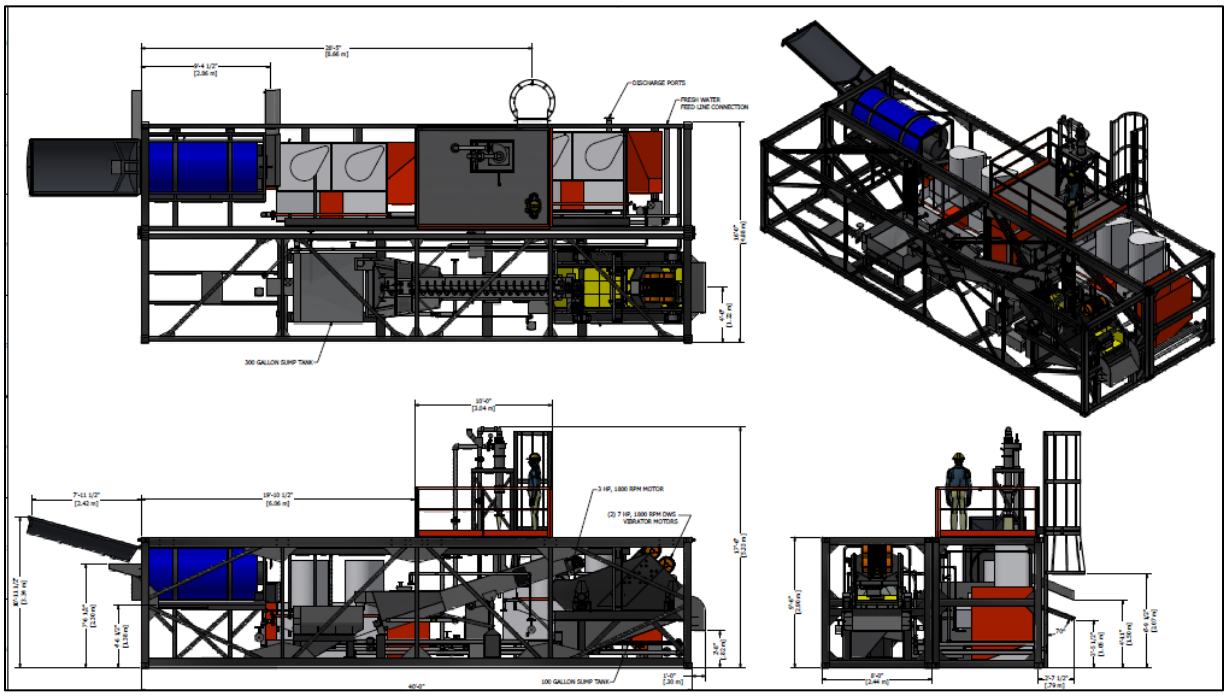


Figure 3. Eielson AFB Pilot Process Soil Washing Modules.



Figure 4. Soil Washing Process Commissioning

(1) Bermed liner being placed. (2) Equipment was transported to site using trucks. (3) and (4) Soil modules were lifted off trucks and placed onto the liner.

The modular pilot process was designed to allow the tuning of key process variables such as soil throughput, retention time, liquid to solid ratios, incorporation of the chemical extraction equipment, and the optional physical optimization equipment. The intent was to evaluate the different processing conditions from the treatability testing versus soil type and contaminant concentration to create a dataset that would support design of a full-scale soil washing process.

Figure 5 and **Figure 6** present the process flow and the pilot-scale process as assembled at Eielson, respectively. The flow of soil through the system begins by feeding soil into the oversize feed screen labelled as (1). This is a wet grizzly screen that can remove rock in the size range of 2 to 8 inches. The screen is equipped with spray bars that apply a spray of the process wash water. The oversized material (boulders, sticks, steel, plastic) is retained and discharged from the screen, while the bulk of the soil passes into a second screening section (2) that splits the feed into +4.76 mm and –4.76 mm particle sizes. The oversized material is retained on the screen and can be stockpiled directly (3). The attritted +4.76 mm material is dewatered and stockpiled (4). Both stockpiles are segregated and can be further processed through the optional physical processing equipment if required. This step could not be conducted during the demonstration due to timing constraints.

The undersized material from screen (2) flows as a slurry (5) into two aerated mixing tanks (6 and 8) to allow for desorption of the PFAS to the aqueous phase and contact with the process water in a turbulent mixing environment. The slurry in the aerated mix tank (6) is pumped though a dewatering cyclone (7) to separate the fine-grained soil from the sand range. The dewatered sand is transferred to the aerated mix tank (8) and pumped into a hydraulic classifier (9), where the sand is dewatered (10) before stockpiling (11).

The fine-grained soil, separated at various points of the process, is conveyed to a thickener (12), where the partially dewatered fines are sent to dewatering (13). The dewatered fines are stockpiled (14), while the filtrate from this process and the overflow from the thickener are pumped to the water treatment process (15) to remove the PFAS from the process water before the water is recycled to the various points in the process.

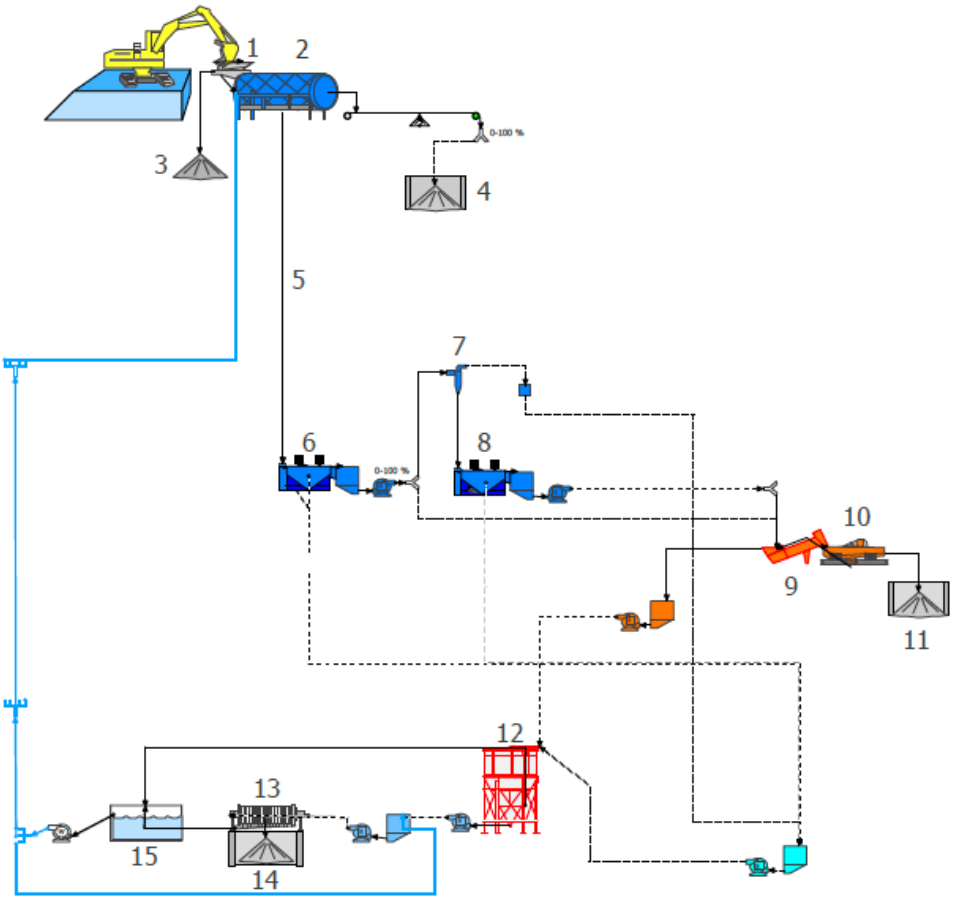


Figure 5. Soil Washing Process Flow of Pilot Plant

Figure 5 illustrates the flow of soil, process water, and slurry through the treatment elements of the pilot-scale soil washing system. The photo of the soil washing process at Eielson AFB illustrates the equipment layout in **Figure 6**.

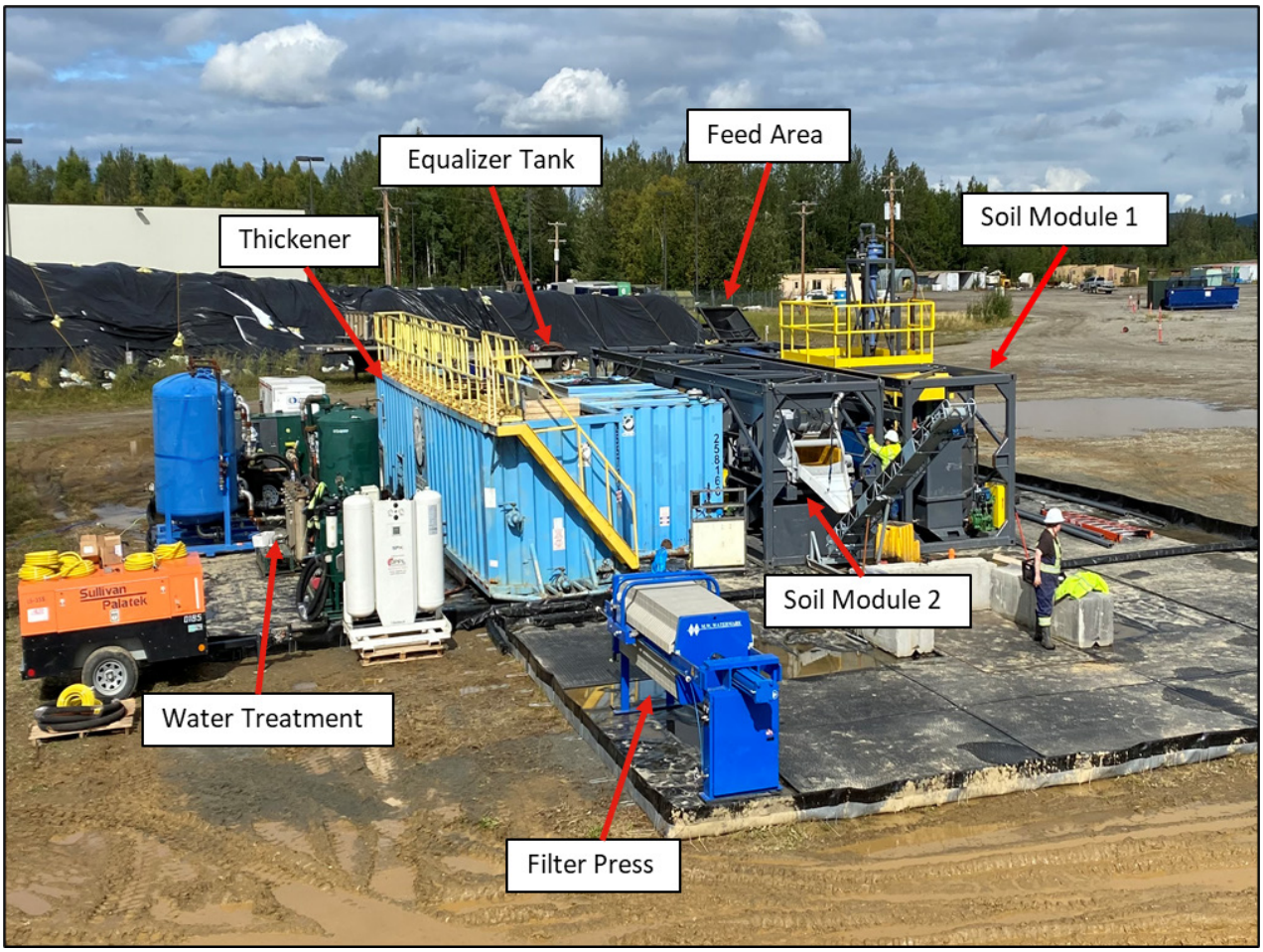


Figure 6. Eielson Pilot-Scale Soil Washing Process Elements and Equipment.

In the two-stage water treatment process, the GAC removed potential dissolved natural organics, co-contaminants, and the bulk of the PFAS mass from the water; the ion-exchange resins (IXRs) removed any potential PFAS that passed through the GAC, ensuring high removal efficiency to enable recycling of the water through the soil treatment process.

At the end of the process, three separate sized soil fractions are generated and deposited in separate material bays: gravel (-50.8 mm to +4.76 mm), sand (-4.76 mm to +0.074 mm), and fines (-0.074 mm).

During the bench-scale treatability testing, the organic compounds were successfully treated without segregation from the fines. The pilot process therefore did not segregate the organic compounds.

The wastewater treatment ensures that PFAS is removed from impacted process water and extractant solutions before the water is recycled through the soil washing system as part of the closed-loop treatment process. The process used a treatment train consisting of commercially available technologies including a thickener, filter press, and filtration columns containing filter sand, GAC, and IXR. GAC was purchased from US Ecology, and IXR was purchased from Lewatit.

5.4 FIELD TESTING

5.4.1 Mobilization

A modular 1- to 10-ton per hour pilot-scale soil washing system was designed to duplicate the unit treatment processes and sequence of treatment evaluated at the laboratory scale. The pilot-scale process was shipped to Eielson AFB, with equipment arriving on site between August 13 and 20, 2021. Commissioning (consisting of site preparation, liner installation, placement of equipment, and connection of piping and electrical) was completed by August 24, 2021. On future applications of the pilot-scale system, if equipment delivery could be coordinated to be completed within 2 consecutive days, it is estimated that commissioning durations can be reduced to 7 days. The system was designed to accommodate operation in remote locations and can be powered by a 185-kilovolt ampere (kVA) generator. Water was not available at the processing area and needed to be transported by water truck from the nearby Mullins Pit waterbody, which was tested and confirmed to be PFAS-free. The system was filled with 32,000 gallons of water, leak-tested, and wet-commissioned by running the process water through the system in the absence of soil to balance water flows. Processing of soil was completed from August 25 through September 23, when the onset of freezing temperatures brought a premature end to the soil processing phase of the pilot. Standard operating procedures (SOPs) related to the commissioning and operation of the pilot system are provided in **Appendix A**.

5.4.2 Excavation

The three stockpiles were excavated and treated sequentially to evaluate treatment performance on a stockpile-by-stockpile basis. Excavation was coordinated with Bethel Environmental Solutions, who are responsible for managing the PFAS-contaminated soils at Eielson AFB.

Before excavation, the condition of the stockpile was documented, and then tarps and sandbags covering stockpiles were partially removed to expose soil. Soil was excavated from each stockpile using an excavator and front-end loader and transported to the untreated stockpile storage pad. The untreated stockpile storage area was lined and separated from the other sections of the treatment process with a berm. After excavation, the covers were placed back on the stockpile, and the condition of the stockpile was documented. Liners were not observed to be damaged during this process.

Approximately 40 tons were excavated from EIE382-5, and 100 tons were excavated from EIE385-4. Stockpile EIE393-1 consisted of a total of approximately 11 cubic yards of soil. Soil cuttings from a PFAS remedial investigation at Eielson AFB were used to supplement soil in Stockpile EIE393-1. Soil characterization data on these cuttings were not available; however, they were obtained from potential PFAS source areas. Before treatment, the soil cuttings were emptied from the drums and mixed with Stockpile 393-1. In total, there were approximately 40 tons of soil from EIE393-1 and the soil cuttings.

5.4.3 Treatment

Each stockpile was treated separately to evaluate treatment performance on different soil types, PFAS concentrations, and treatment processes that were optimized at the bench scale. Stockpile EIE382-5 was treated first, followed by EIE385-4 and EIE393-1. Throughput ranged from 1 to 12 tons per hour during the demonstration.

Based on the stockpile characterization data, it was anticipated that Stockpile EIE382-5 and EIE385-4 could be treated using the Round 1 process, and EIE393-1 would require the Round 3 process from the bench-scale treatability trial to achieve the performance objectives. The Round 1 process primarily consisted of wash water, mechanical separation, attrition scrubbing, and dewatering. The Round 3 process includes a physical optimization step of the gravel and sand fractions and the use of a proprietary surfactant to increase PFAS desorption. The Round 3 process could not be conducted on EIE393-1 due to freezing conditions, which brought a premature end to the demonstration.

During treatment, each of the soil fractions (gravel, sand, fines) was deposited in designated material bays for sampling. After treatment, soil fractions were stockpiled in the treated stockpile storage area in accordance with the United States Air Force Civil Engineer Center (AFCEC) Standard Operating Procedure Stockpiling Contaminated Soils (AFCEC 2019). Soil fractions from each stockpile are currently stockpiled here while they undergo assessment for reuse.

The volume of soil treated for each stockpile was measured using the excavator bucket when loading soil into the feed hopper. The volume of the gravel, sand and fines fractions for each stockpile was estimated using the untreated particle size distribution data from the untreated soil.

Table 5. Soil Volumes

Soil Fraction	EIE382-5		EIE385-4		EIE393-1	
	PSD %	Tons	PSD %	Tons	PSD %	Tons
Untreated	--	40	--	100	--	41
Gravel	40%	16	24%	24	1%	1
Sand	40%	16	40%	40	34%	14
Fines	21%	8	36%	36	65%	26

Notes:
PSD % = particle size distribution percentage

At the conclusion of the demonstration, the process water was tested to confirm compliance with regional screening levels for PFAS listed in **Table 2** and groundwater and surface water cleanup levels listed in 18 Alaska Administrative Code (AAC) 75 Oil and Other Hazardous Substances Pollution Control (ADEC 2014). Approximately 20,000 gallons of water from the water treatment circuit was discharged to ground under coverage of the Alaska General Permit for Hydrostatic or Aquifer Pump Discharges (AKG003000).

At the completion of the demonstration, the GAC and IXR were sampled for waste characterization and are scheduled to be disposed of at the US Ecology, RCRA Subtitle C, Landfill in Grand View, Idaho.

5.5 SAMPLING METHODS

5.5.1 Batch and ISM Soil Sampling

Two sampling methods were used to validate the technology: batch sampling to evaluate the consistency in performance of each batch and the Incremental Sampling Methodology (ISM) to evaluate mean treatment performance for each of the three concentration ranges.

1. Batch composite sampling soil in 20-ton batches for each of the three stockpiles:
    - One sample of the untreated soil per 20-ton batch;
    - One sample of each process stream (gravel, sand, and fines) for each 20-ton batch; and
    - One sample of the reformed process streams for each 20-ton batch.
2. ISM was conducted for the three stockpiles:
    - An incremental sample collected in triplicate of each untreated stockpile; and
    - An incremental sample collected in triplicate of each process stream generated from each stockpile.

Batch sampling was conducted by collecting five equal sub-samples from each stockpile and combining the material to form one bulk sample (approximately 1 kilogram). A sub-sample from this bulk sample was then collected for laboratory analysis.

Guidance on ISM is provided by the Interstate Technology & Regulatory Council (ITRC; 2012). ISM involves the collection and combination of a large number of small increments/samples from multiple locations and is designed to reduce data variability and increased sample representativeness for a specified volume of soil under investigation (e.g., a stockpile).

For each ISM sample, a minimum of 30 increments of approximately 50 grams per increment (target bulk sample of 1,500 grams) was collected. For untreated samples, increments were collected from the untreated stockpile as it was progressively loaded into the feed hopper. For treated samples, increments were progressively collected during the generation of each process stream. Collecting progressive increment samples enabled equal access to soil from all depths of the stockpiles. Replicate ISM samples (triplicates) were collected to quantify uncertainty in the estimate of the mean concentration for each sample.

Batch samples informed treatment performance on a batch-by-batch basis, and incremental sampling informed the overall treatment performance of the demonstration. These two datasets are used in combination to validate the soil washing technology.

A list of the treated process streams is provided below:

- Gravel;
- Sand; and
- Fines.

Protocols for the collection of samples were based on the Arcadis PFAS Field Sampling Guidance SOP (**Appendix A**).

Stockpile 385-4 was identified to contain PAH concentrations exceeding ADEC screening levels. There are no treatment objectives for PAH in this demonstration, but pre- and post-treatment samples from Stockpile 385-4 were also analyzed for PAH to evaluate beneficial reuse of the soil.

5.5.2 Water Sampling

Untreated and treated water samples of the process water were collected during the processing of each of the three stockpiles. Untreated samples were collected from the thickener and treated water samples were collected from a valve of the IXR vessel following treatment.

5.5.3 Analysis

Soil and process water samples were sent to Pace Analytical in West Columbus, South Carolina for analysis of 25 target PFAS compounds via the USEPA Method 537 (modified)/US DoD (DoD 2019) QSM 5.3 (2019) (Table B-15) plus N-MeFOSA (list of 25 PFAS). Bench-scale treatability samples were analyzed for leaching via the Australian standard leaching procedure (ASLP) by method AS 4439.3. Field demonstration samples were analyzed for leaching via the synthetic precipitation leaching procedure (SPLP) method SW-846 Test Method 1312.

EOF and AOF analysis were also conducted on soil and water samples to evaluate the presence of non-target PFAS. EOF and AOF analysis were conducted by SGS in Belgium using their commercial Combustion Ion Chromatography Method. Total oxidizable precursor (TOP) assay analysis (Houtz and Sedlak 2012) was also conducted by SGS on select samples for comparison to EOF.

6.0 PERFORMANCE ASSESSMENT

6.1 BENCH-SCALE TREATABILITY TRIAL RESULTS

Table 6 and **Table 7** present a summary of the soil and leachate results from the bench-scale treatability testing. If the results were below the detection limit, the concentration is presented as less than the detection limit, and the result was not included in the sum of PFAS calculations. Bench scale laboratory analytical reports are presented in **Appendix B**.

Table 6. Stockpiles EIE377-1 and EIE379-2 Bench-Scale Treatability Results

Stockpile	Soil Fraction	PFBS		PFOA		PFOS		Sum PFAS	
		Soil (µg/kg)	Leachate (ng/L)	Soil (µg/kg)	Leachate (ng/L)	Soil (µg/kg)	Leachate (ng/L)	Soil (µg/kg)	Leachate (ng/L)
EIE377-1	**Untreated**	<0.22	3.4 J	0.78 J	20	15	450	20.24	687.5
	Rock	<0.18	<0.95	<0.18	<0.95	0.32 J	<0.95	0.32 J	<DL
	Sand	<0.24	<1	<0.24	<1	0.50 J	<1	0.5J	<DL
	Fines	<0.29	1.2 J	<0.29	<1	**5.4**	**47**	5.4	151.3
EIE379-2	**Untreated**	0.28 J	13	0.45 J	29	59	3300	62.85	4045.9
	Rock	<0.19	<1	<0.19	1.1 J	<0.19	29	<DL	147.8
	Sand	<0.22	<1	<0.22	<1	0.42 J	2.2 J	0.42 J	64
	Fines	<0.29	<0.95	<0.29	<0.95	**9.6**	7.8	11.9	116.7
Performance Goal		**1,900**	**40**	**1.7**	**40**	**3**	**40**	**--**	**--**

Notes:

<DL = No compounds were detected at concentrations above the detection limit; therefore, sum of PFAS could not be calculated.

J= estimated result, less than limit of quantitation and greater than detection limit

Bold values exceeded the performance goals.

Sum of PFAS = sum of 24 PFAS compounds in Table B-15, QSM 5.3 plus N-MeFOSA

Table 7. Stockpile EIE393-1 Bench-Scale Treatability Results

Treatment Round	Soil Fraction	PFBS		PFOA		PFOS		Sum PFAS	
		Soil µg/kg	Leachate ng/L	Soil µg/kg	Leachate ng/L	Soil µg/kg	Leachate ng/L	Soil µg/kg	Leachate ng/L
	Untreated	6.6 J	230	<4.2	350	2,700	32,000	3,155	39,795
Round 1	Rock	<0.2	<10	<0.2	<10	**88**	**200**	97	270
	Gravel	<0.2	<10	<0.2	<10	**27**	**620**	32	803
	Sand	0.26	<10	0.55 J	26 J	**150**	**900**	170	1,005
	Fines	3.1 J	22 J	<3	**53**	**2,400**	**530**	2,822	1,123
Round 2	Rock/Gravel	<0.23	<10	<0.22	<10	**8.8**	**120**	9.4	194
	Sand	<0.19	<10	<0.19	<10	**12**	**75**	14	181
Round 3	Rock/Gravel/Sand	<0.24	<20	<0.24	<20	0.34 J	36 J	0.34 J	36 J
Performance Goals		**1,900**	**40**	**1.7**	**40**	**3**	**40**	**--**	**--**

Notes:

J= estimated result, less than limit of quantitation and greater than detection limit

Bold values exceeded the performance goals.

Sum of PFAS = sum of 24 PFAS compounds on Table B-15, QSM 5.3 plus N-MeFOSA

The treatability testing was designed with sequential treatment processes to enable understanding of the mechanisms of treatment and to facilitate optimization. Three rounds of testing were required to meet the treatment objectives. Round 1 evaluated different process conditions such as basic chemistry of the wash solution, temperature, retention time, liquid-to-solid ratios, and agitation. Round 2 included the most successful conditions from Round 1 and a chemical extraction step. Round 3 included the most successful conditions from the two previous rounds and a physical optimization step.

Concentrations of PFBS and PFOA were initially low in untreated samples and often treated to concentrations below detection limits, meeting all performance goals at the end of the treatability process. Discussion of results for the bench-scale treatability trial will focus on PFOS and sum of PFAS.

For EIE377-1 and EIE379-2, the soil performance goals were achieved using the Round 1 process. For EIE393-1, the soil concentration performance goals were achieved after using the Round 3 processes. The bench-scale treatability trial indicated that, during the field demonstration, soil with lower PFAS concentrations could be successfully treated using the simpler Round 1 process conditions including basic water chemistry, size separation, and agitation. However, soil with higher PFAS concentrations would require chemical extraction and physical optimization steps included in the Round 2 and 3 processes.

Table 8 and **Table 9** present the removal efficiencies (REs) for PFOS and sum of PFAS from the bench-scale treatability test. Removal efficiencies were calculated by comparing the concentration of the treated soil fraction to the concentration of the untreated sample. If the treated sample exhibited a concentration less than the detection limit, the removal efficiency was not calculated. PFOS and sum of PFAS REs of >99 percent or PFAS removal to concentrations below detection limits were achieved for EIE379-2 and EIE393-1. EIE377-1 did not achieve the >99 percent RE; however, soil concentrations of PFBS, PFOA, and PFOS were below performance goals.

Table 8. EIE377-1 and EIE379-2 Bench-Scale Treatability PFAS Removal Efficiencies

		PFOS		Sum PFAS	
		Soil	Leachate	Soil	Leachate
Stockpile	Soil Fraction	RE%	RE%	RE%	RE%
EIE377-1	**Rock**	97.9%	<DL	98.4%	<DL
	Sand	96.7%	<DL	97.5%	<DL
	Fines	64.0%	89.6%	73.3%	78.0%
EIE379-2	**Rock**	<DL	99.1%	<DL	96.3%
	Sand	99.3%	99.9%	99.3%	98.4%
	Fines	83.7%	99.8%	81.1%	97.1%

Notes:
<DL = No compounds were detected at concentrations above the detection limit; therefore, sum of PFAS could not be calculated.
Sum of PFAS = sum of 24 PFAS compounds on Table B-15, QSM 5.3 plus N-MeFOSA

Table 9. EIE393-1 Bench-Scale Treatability PFAS Removal Efficiencies

Treatment Round	Soil Fraction	PFOS		Sum PFAS	
		Soil	Leachate	Soil	Leachate
		µg/kg	ng/L	µg/kg	ng/L
Round 1	Rock	96.7%	99.4%	96.9%	99.3%
	Gravel	99.0%	98.1%	99.0%	98.0%
	Sand	94.4%	97.2%	94.6%	97.5%
	Fines	11.1%	98.3%	10.6%	97.2%
Round 2	Rock/Gravel	99.7%	99.6%	99.7%	99.5%
	Sand	99.6%	99.8%	99.6%	99.5%
Round 3	Rock/Gravel/Sand	99.9%	98.7%	99.9%	98.7%

Notes:
<DL = No compounds were detected at concentrations above the detection limit; therefore, sum of PFAS could not be calculated.
Sum of PFAS = sum of 24 PFAS compounds on Table B-15, QSM 5.3 plus N-MeFOSA

6.2 FIELD DEMONSTRATION RESULTS

6.2.1 Treatment Performance

Table 10 and **Table 11** present the triplicate results from ISM sampling for the three stockpiles. The arithmetic mean of the three ISM results is presented in **Table 12,** and these were used to evaluate overall performance of the demonstration and compliance with the performance goals. If the primary and replicate results were below the detection limit, the concentration is presented as less than the detection limit "<DL," and the result was not included in the sum of PFAS calculations. If there was at least one detection, the arithmetic mean was calculated by substituting one half the detection limit, and the result was included in sum of PFAS calculations. The PFAS REs presented in **Table 13** were calculated by comparing the soil and leachable concentrations in treated soil to the untreated concentrations presented in **Table 12**. Field demonstration laboratory analytical reports are provided in **Appendix C**.

Table 10. ISM Soil PFAS Results

Stockpile	Soil Fraction	PFBS (µg/kg)			PFOA (µg/kg)			PFOS (µg/kg)			Sum PFAS (µg/kg)		
EIE382-5	**Untreated**	<0.19	<0.19	<0.19	0.23	<0.19	0.28 J	**5.1**	**4.6**	**3.9**	7.03	6.1	5.38
	Gravel	<0.23	<0.23	<0.23	<0.23	<0.23	<0.23	<0.23	<0.23	<0.23	0.76	<DL	<DL
	Sand	<0.23	<0.23	<0.23	<0.23	<0.23	<0.23	0.29	<0.23	<0.23	0.29	<DL	<DL
	Fines	<0.24	<0.24	<0.24	<0.24	<0.24	<0.24	1.4	1.9	1.9	1.85	2.35	2.45
EIE385-4	**Untreated**	<0.20	0.22 J	0.22 J	0.61 J	0.81 J	0.94 J	**6.7**	**8.9**	**9.1**	12.12	16.56	17.305
	Gravel	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	0.23 J	<0.20	<DL	0.23	<DL
	Sand	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	1.1	0.85 J	0.87 J	1.47	1.26	1.22
	Fines	<0.21	<0.21	<0.21	<0.21	0.2 J	0.28 J	**7.6**	**11**	**8**	9.9	13.81	10.48
EIE393-1	**Untreated**	1.1	1.4	1.6	**4.8**	**6.1**	**7.1**	**420**	**520**	**740**	514.18	636.29	874.17
	Gravel	<0.20	<0.20	<0.20	0.2 J	0.22 J	0.74 J	**30**	**29**	**32**	33.59	32.66	37.81
	Sand	<0.20	<0.20	<0.20	0.4 J	0.44 J	0.4 J	**30**	**32**	**32**	36.04	38.6	39.63
	Fines	0.72 J	0.64 J	0.8 J	**1.9**	**1.9**	**2.7**	**300**	**260**	**430**	369.68	325.11	531.18
Performance Goal			**1,900**			**1.7**			**3**			**--**	

Notes:
<DL = No compounds were detected at concentrations above the detection limit; therefore, sum of PFAS could not be calculated.
J= estimated result, less than limit of quantitation and greater than detection limit
Bold values exceeded the performance goals.
Sum of PFAS = sum of 24 PFAS compounds on Table B-15, QSM 5.3 plus N-MeFOSA

Table 11. ISM Leachate PFAS Results

Stockpile	Soil Fraction	PFBS (ng/L)			PFOA (ng/L)			PFOS (ng/L)			Sum PFAS (ng/L)		
EIE382-5	**Untreated**	<10	<10	<10	14 J	11 J	<10	**200**	**190**	**190**	327	301	305
	Gravel	<10	<10	<10	<10	<10	<10	<10	<10	<10	<DL	<DL	<DL
	Sand	<10	<10	<10	<10	<10	<10	<10	<10	<10	110	29	<DL
	Fines	<10	<10	<10	<10	<10	<10	**58**	**66**	**44**	119	138	59
EIE385-4	**Untreated**	12 J	11 J	12 J	**51**	**50**	**48**	**430**	**440**	**420**	873	863	739
	Gravel	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	32	<10
	Sand	<10	<10	<10	<10	<10	<10	11 J	15 J	14 J	123	30	25
	Fines	<10	<10	<10	15 J	16 J	17 J	**150**	**390**	**190**	235	492	273
EIE393-1	**Untreated**	**52**	**63**	32 J	**280**	**300**	**150**	**21000**	**28000**	**17000**	24860	32726	19608
	Gravel	-	<10	<10	-	14 J	23 J	-	**1700**	**1300**	-	2020	1567
	Sand	<10	<10	<10	31 J	34 J	30 J	**800**	**920**	**800**	1007	1186	1082
	Fines	13 J	11 J	13 J	**84**	**79**	**100**	**12000**	**11000**	**15000**	14015	12883	17405.5
Performance Goal			40			40			40			--	

Notes:
<DL = No compounds were detected at concentrations above the detection limit; therefore, sum of PFAS could not be calculated.
J = estimated result, less than limit of quantitation and greater than detection limit
Bold values exceeded the performance goals.
-=sample not analyzed due to processing error
Sum of PFAS = sum of 24 PFAS compounds on Table B-15, QSM 5.3 plus N-MeFOSA

Table 12. ISM Arithmetic Mean Results

Stockpile	Soil Fraction	PFBS		PFOA		PFOS		Sum PFAS	
		Soil (µg/kg)	Leachate (ng/L)	Soil (µg/kg)	Leachate (ng/L)	Soil (µg/kg)	Leachate (ng/L)	Soil (µg/kg)	Leachate (ng/L)
EIE382-5	**Untreated**	<0.19	<10	0.2	10.0	**4.5**	**193**	6	316
	Gravel	<0.23	<10	<0.23	<10	<0.23	<10	0.3	<DL
	Sand	<0.23	<10	<0.23	<10	0.2	<10	0.2	50
	Fines	<0.24	<10	<0.24	<10	1.7	**56**	2	109
EIE385-4	**Untreated**	0.2	12	0.8	36	**8**	**430**	16	825
	Gravel	<0.20	<10	<0.20	<10	0.2	<10	0.2	17
	Sand	<0.20	<10	<0.20	<10	0.9	13	1.3	66
	Fines	<0.21	<10	0.2	16	**9**	**243**	12	345
EIE393-1	**Untreated**	1.4	**49**	**6.0**	**243**	**560**	**22000**	675	25833
	Gravel	<0.20	<10	0.4	19	**30**	**1500**	35	1796
	Sand	<0.20	<10	0.4	32	**31**	**840**	38	1103
	Fines	0.7	12	**2.2**	**88**	**330**	**12667**	409	14780
Performance Goal		**1900**	**40**	**1.7**	**40**	**3**	**40**	**--**	**--**

Notes:
<DL = No compounds were detected at concentrations above the detection limit; therefore, sum of PFAS could not be calculated.
Bold values exceeded the performance goals.
Sum of PFAS = sum of 24 PFAS compounds on Table B-15, QSM 5.3 plus N-MeFOSA

Table 13. ISM Arithmetic Mean PFAS Removal Efficiencies

Stockpile	Soil Fraction	PFBS		PFOA		PFOS		Sum of PFAS	
		Total RE%	SPLP RE%	Total RE%	SPLP RE%	Total RE%	SPLP RE%	Total RE%	SPLP RE%
EIE382-5	Gravel	<DL	<DL	<DL	<DL	<DL	<DL	94.7%	<DL
	Sand	<DL	<DL	<DL	<DL	96.1%	<DL	97.2%	84.3%
	Fines	<DL	<DL	<DL	<DL	61.8%	71.0%	64.3%	65.6%
EIE385-4	Gravel	<DL	<DL	<DL	<DL	98.1%	<DL	99.0%	97.9%
	Sand	<DL	<DL	<DL	<DL	88.6%	96.9%	91.7%	92.1%
	Fines	<DL	<DL	74.4%	67.8%	-7.7%	43.4%	24.4%	58.8%
EIE393-1	Gravel	<DL	<DL	93.6%	92.4%	94.6%	93.2%	94.8%	93.0%
	Sand	<DL	<DL	93.1%	87.0%	94.4%	96.2%	94.3%	95.7%
	Fines	47.3%	74.8%	63.9%	64.0%	41.1%	42.4%	39.4%	42.8%

Notes:
<DL = Removal efficiency not calculated because treated soil concentration was below the detection limit.
Sum of PFAS = sum of 24 PFAS compounds on Table B-15, QSM 5.3 plus N-MeFOSA

Table 14 shows that untreated soil concentrations from samples collected in the pilot demonstration were up to an order of magnitude lower than the concentrations reported in the Stockpile Characterization Report (USAF 2021). The difference between the two datasets may be due to samples being collected using a Geoprobe™ and hand auger in the Stockpile Characterization Report in order to sample soil at depth in the stockpiles. The limited diameters of these sampling methods may have resulted in samples with a higher fines content than what was actually representative of the stockpile, and this could have resulted in higher PFAS concentrations.

The 95% UCLs in the Stockpile Characterization Report were also higher than the 95% UCLs reported in the pilot demonstration. In the Stockpile Characterization Report, each stockpile was divided into decision units, and at least one replicate sample was collected per stockpile. Decision unit volumes ranged from 11 to 748 cubic yards, and a 95% UCL was calculated for each decision unit. If the decision unit did not have a replicate sample, the replicates collected from the other decision units in the stockpile were used to calculate the 95% UCL in accordance with the ITRC guidance. In the pilot demonstration, each stockpile represented one decision unit, all decision units were 100 cubic yards or less, and each ISM sample was collected in triplicate. The smaller sized decision unit and a triplicate sample for each decision unit may have resulted in a lower 95% UCL.

Heterogeneity within the stockpile could also have resulted in the different concentration ranges observed between the Stockpile Characterization Report and the field demonstration. To reduce the impact of natural variability, we targeted the section of EIE382-5 that exhibited the highest concentrations from testing in the Stockpile Characterization Report, and the entirety of EIE385-4 and EIE393-1 were treated in the pilot demonstration.

Concentrations in stockpile EIE393-1 from the pilot demonstration were lower than those reported in the Stockpile Characterization Report, but this was likely due to supplementing the stockpile with soil cuttings from an ongoing PFAS RI at Eielson.

Table 14. Untreated Soil PFOS Concentration Comparison

Stockpile ID	USAF (2021) Untreated PFOS Concentration		ESTCP Demonstration Untreated PFOS Concentration	
	Primary Result	95% UCL Range	ISM Primary Result	ISM 95% UCL[b]
EIE382-5	6.47 to 50	67.61 to 111.14	3.9 to 5.1	5.5
EIE385-4[a]	20.0	29.0	6.7 to 9.1	10.5
EIE393-1	Triplicate	1,590.49	420 to 520	972

Notes:
(a) Only one sample was collected from EIE385-4 in USAF (2021).
(b) 95% UCL calculated using the ISM Calculator from the ITRC ISM Methodology Update (ITRC 2020) from the three samples collected for each stockpile.

On average, PFOS comprised 69 percent of the total PFAS in untreated soil, 84 percent of total PFAS in treated soil, and was the driver for meeting the performance goals. Concentrations of PFBS and PFOA in untreated soil were comparatively low and often already below performance goals. PFBS and PFOA soil performance goals were achieved in all stockpiles for the coarse-grained fraction. PFBS and PFOA performance goals were also achieved for the fine-grained fraction in EIE382-5 and EIE385-4. Due to the limited presence of PFBS and PFOA in soil, the remainder of this discussion will focus on PFOS and sum of PFAS results.

The soil performance goals were achieved for EIE382-5 and EIE385-4 using the treatment process verified in the bench-scale treatability trial. Mean coarse-grained soil PFOS concentrations in these stockpiles ranged from below the detection limit to 0.9 µg/kg. Soil performance goals were also achieved in the fine-grained fraction for EIE382-5. This result highlights the potential for soil washing to achieve soil performance goals without requiring secondary treatment of the fines if untreated concentrations are relatively low.

In Stockpile EIE393-1, the soil performance goals were not achieved, but this was expected because the physical optimization steps (Round 2 and 3 in treatability testing), which were required to achieve higher levels of PFAS removal, could not be completed due to freezing conditions. Based on the comparable performance of the Round 1 process at the bench and pilot scales, we expect that the pilot treatment unit or full-scale treatment would perform to meet soil performance goals. Optimization of performance parameters in the full scale and confirmation of treatment performance related to Round 2 and 3 processes would be part of any future full-scale remediation effort in this regard.

6.2.2 PFAS Removal

Concentrations of PFBS and PFOA were initially low in untreated samples and often treated to concentrations below detection limits, meeting soil concentration performance goals at the end of the treatability process for all stockpiles.

In EIE393-1, PFOS REs were generally highest in the gravel fraction (98.1 to 94.6 percent), followed by the sand fraction (96.1 to 88.6 percent), and the fines fraction (61.8 to -7.7 percent). These results aligned with bench-scale treatability testing and confirmed that soil washing was effective for the coarse-grained fraction and that the fine-grained fraction retains higher PFAS concentrations. Removal efficiencies for sum of PFAS in coarse-grained soil ranged from 91.7 to 99.0 percent and were generally higher than PFOS for each stockpile, indicating that the soil washing process was effective at removing other target PFAS.

PFOS removal in coarse-grained soil was relatively consistent across the three stockpiles. PFOS removal was greater than 94 percent in coarse grained soil except for the sand fraction of EIE385-4 which had a RE of 88.6 percent. The fines for EIE385-4 also exhibited poor PFOS RE (-7.7 percent) compared to the other two stockpiles (41.1 to 61.8 percent). This negative removal efficiency was attributed to variability of PFAS concentrations in the fines during the washing process.

The goal of >99 percent PFOS and PFAS removal was not achieved in the stockpiles; however, soil concentrations of PFOS in coarse-grained fractions of EIE382-5 and EIE385-4 achieved the performance goal, which was the primary driver for evaluating treatment performance. These results confirmed that the simple treatment process employed for these stockpiles with low concentrations was sufficient to achieve soil concentration targets, but Round 2 and Round 3 processes would be required to achieve >99 percent removal and achieve performance goals for EIE393-1.

6.2.3 Leachability

PFAS leachate results correlated to the soil PFAS results for the untreated and treated soil fractions, commonly showing approximately one order of magnitude higher soil concentrations for PFOS compared to the leachate concentrations. Leachability was reduced in all coarse-grained fractions after treatment with similar levels of PFAS removal to the soil. Untreated leachable PFOS results ranged from 193 ng/L in EIE382-5 to 22,000 ng/L in EIE393-1. The PFOS leachate concentration performance goals were achieved for EIE382-5 and EIE385-4. PFOS leachate concentrations ranged from lower than the detection limit to 13 ng/L in the coarse fractions of these stockpiles. The leachable PFOS results in EIE393-1 exceeded the performance goals, and this result correlated to the higher soil PFAS concentrations in these soil fractions.

In the treated soil fractions, leachable PFOS concentrations were generally lowest in the gravel fraction and highest in the fines fraction, except in EIE393-1, where the sand fraction exhibited the lowest leachable PFOS concentration.

6.2.4 Variability

Variability in treatment performance was evaluated by collecting batch samples at a rate of one sample per 20 tons and comparing batch results to the ISM results and the performance criteria. PFOS results from batch and ISM sampling are presented in **Table 15**. These results indicated that treatment performance was consistent during the demonstration, and treatment variability was low. Batch samples reported concentrations similar to those from ISM samples, and all batch samples for the coarse soil fractions of EIE382-5 and EIE385-4 achieved the performance objectives, consistent with ISM results. 95% UCL calculations using the ISM data for each stockpile generally resulted in slightly higher concentrations for each stockpile compared to the batch results or the arithmetic mean of ISM results; however, all coarse soil fractions from EIE382-5 and EIE385-4 still achieved the performance objectives.

Table 15. Batch, ISM, and ISM 95% UCL PFOS Results

Stockpile	Material	Batch Sample 1	Batch Sample 2	Batch Sample 3	Batch Sample 4	Batch Sample 5	Batch Mean	ISM Mean	ISM 95% UCL[a]
EIE382-5	**Untreated**	**5.2**	**4.6**	**5.3**	**--**	**--**	**5.0**	**4.5**	5.5
	Gravel	<0.11	<0.09	<0.02	--	--	<0.56	<0.23	<0.19
	Sand	0.25 J	0.25 J	0.25 J	--	--	*0.25*	0.2	0.4
	Fines	1.6 J	**3.1**	2.1	**--**	**--**	2.3	1.7	2.2
EIE385-4	**Untreated**	**9.2**	**13**	**14**	**12**	**11**	**11.8**	**8.2**	**10.5**
	Gravel	0.28	<0.17	<0.18	--	--	0.39	0.2	0.3
	Sand	0.8	0.87	1.1	--	--	*0.92*	0.9	1.2
	Fines	**5.4**	**8.5**	**6.2**	**--**	**--**	**6.7**	**8.9**	**12**
EIE393-1	**Untreated**	**640**	**480**	**1200**	**--**	**--**	**773.3**	**560.0**	**972**
	Gravel	1.5	<0.19	**5.3**	**--**	**--**	2	**30.3**	**32.9**
	Sand	**48**	**62**	**32**	**--**	**--**	*47*	**31.3**	**33.3**
	Fines	**500**	**430**	**480**	**--**	**--**	**470**	**330**	**554**
	Criteria	3	3	3	3	3	3	3	3

Notes:

Bold values exceed regional screening level for PFOS of 3 µg/kg.

a) If a sample reported a concentration less than the detection limit, half the value of the limit of detection was used to calculate the 95% UCL. If all samples reported concentrations less than the detection limit, the highest detection limit for the three samples is shown.

- No sample collected. Batch samples were collected at a rate of one sample per 20 tons; however, a minimum of three batch samples were collected for each soil fraction. Five untreated batch samples from EIE385-4 were collected because 100 tons were treated. Less than 60 tons of gravel, sand, and fines (individually) were generated so a minimum of three samples was collected for these fractions for EIE385-4. All other stockpiles at less than 60 tons of soil treated.

In EIE393-1, the batch samples reported lower concentrations in the gravel fraction compared to the ISM samples; however, all other fractions in this stockpile were comparable. Based on ISM results, the fines fraction from EIE382-5 achieved the performance objectives, but one of the batch samples marginally exceeded the criterion of 3 µg/kg with a concentration of 3.1 µg/kg. Despite this exceedance, the result should be considered in the context of the ISM sample results for this fraction when evaluating beneficial reuse options because it is representative of the whole soil fraction.

Comparison of batch sampling and ISM sampling indicates that treatment performance was consistent. Batch sampling could be a useful tool in future soil washing demonstrations if process conditions are altered midway through treating a stockpile; however, it is recommended that ISM sampling be used to evaluate overall compliance with performance objectives.

6.2.5 Non-Target PFAS

EOF analysis was conducted to assess the potential of additional PFAS compounds not included in the 25-compound target list. Results were intended to compare this to the organic fluorine equivalent detected from target PFAS analysis to determine the relative importance of non-target PFAS. However, a combination of factors led to limited utility of the EOF analysis.

For Stockpiles EIE382-5 and EIE385-4, the untreated PFAS concentrations were lower than expected compared to the reliable detection limits for the method, which were revised to be approximately 20-fold higher than expected based on matrix effects (from 10 µg/kg to 200 µg/kg). Stockpile EIE393-1 reported EOF concentrations for the untreated and fines fractions, but EOF concentrations from gravel and sand were below reliable detection limits.

The EOF and sum of PFAS (as fluorine [F]) results are compared in **Table 16**. EOF fluorine increased by 1.4-fold relative to sum of PFAS for the untreated sample, indicating that non-target PFAS may be present in untreated soil. Non-target PFAS concentrations were lower than the reporting limit of 200 micrograms as fluorine per kilogram (µgF/kg) in gravel and sand; however, the reporting limit is approximately an order of magnitude higher than the sum of PFAS as F for these fractions, which limits the value of the result. The fines reported the highest EOF concentration at 1,233 µgF/kg, which is approximately four-fold higher than the sum of PFAS as F, indicating that the non-target PFAS were concentrated in the fines fraction.

Table 16. Non-target PFAS Analysis Results

Soil Fraction	Sum of PFAS as F (µgF/kg)	EOF (µgF/kg)
Untreated	439	1,040
Gravel	23	< 200
Sand	25	< 200
Fines	266	1,233

Note:
Sum of PFAS as F was estimated assuming 65 percent of PFAS is fluorine in line with the percentage of fluorine in PFOS. Fluorine is 65 percent of the molecular weight of PFOS. Three samples for each soil fraction were analyzed for EOF; the result arithmetic mean.

TOP assay was conducted on the fines, and the sum of PFAS increased after TOP; however, the increase was within the measurement of uncertainty.

Non-target analysis was conducted by SGS Belgium, and the laboratory reports and a narrative of the results authored by SGS are provided in **Appendix C**.

6.2.6 Water

Samples of process water before and after treatment were collected during the processing of each stockpile, and PFAS concentrations in water corresponded to the PFAS concentrations in the untreated soil being processed. Water results are presented in **Table 17,** and untreated water sum of PFAS concentrations ranged from 163 ng/L during treatment of EIE382-5 (untreated sum of PFAS concentration of 8 µg/kg in soil) to 31,113 ng/L during treatment of EIE393-1 (untreated sum of PFAS concentration of 1,121 µg/kg in soil). PFOS was the dominant PFAS in untreated water and ranged in concentration from 72 ng/L to 26,000 ng/L. Untreated water results confirmed that PFAS adsorbed to soil was transferred to the aqueous phase. On average, more than 99.99 percent PFAS removal was achieved in treated water samples, indicating that PFAS was successfully adsorbed to GAC and IXR.

Table 17. Untreated and Treated Water Results (ng/L)

Stockpile	PFBS		PFOA		PFOS		Sum of PFAS	
	Untreated	Treated	Untreated	Treated	Untreated	Treated	Untreated	Treated
EIE382-5	2.2 J	<1.9	4.6	<1.9	72	1.6 J	163	1.6
EIE385-4	7.8	<1.9	25	<1.9	190	<1.9	461	<DL
EIE393-1	86	<1.7	200	<1.9	26,000	25	31,113	28

Notes:
<DL = No compounds were detected at concentrations above the detection limit; therefore, sum of PFAS could not be calculated.
Sum of PFAS = sum of 24 PFAS compounds on Table B-15, QSM 5.3 plus N-MeFOSA

6.2.7 PAH Results

Before this demonstration, characterization of Stockpile EIE385-4 identified concentrations of benzo(a)anthracene exceeding ADEC regional screening levels. Treatment of PAHs was not within the scope of this demonstration, but PAH analysis was conducted using USEPA Method 8270E on Stockpile EIE385-4 samples for beneficial reuse considerations after PFAS treatment.

The gravel and fines fractions reported PAH results below ADEC regional screening levels or below detection limits. The sand fraction reported concentrations of benzo(a)anthracene, benzo(a)pyrene, and naphthalene exceeding screening levels. **Table 18** presents the benz(a)anthracene, benzo(a)pyrene, and naphthalene results and shows that these PAHs were concentrated in the sand fraction.

Table 18. EIE385-4 PAH Results (µg/kg)

Soil Fraction	Benz(a)anthracene	Benzo(a)pyrene	Naphthalene
Untreated	**906**	1,344	47.5*
Gravel	3	3	< 2 U
Sand	**1,867**	**2,200**	**77**
Fines	537	910	<52 U
Criteria	700	1,900	38

Note:
*Three of the four samples reported concentrations less than the detection limit (110 µg/kg); therefore, half the value of the detection limit was used to calculate the average untreated concentration.

The concentration of PAHs in the sand fraction may be due to the presence of asphalt identified during treatment of the stockpile. **Figure 7** shows pieces of asphalt in the gravel fraction. The partitioning of contaminants, such as PAHs, within the soil fractions can indicate the form in which the contamination is present. PAHs present in a soil from a petroleum hydrocarbon impact will be expected to partition and concentrate in the higher surface area fine-grained soil relative to the other soil fractions. Where the PAHs show a relative concentration in the coarser soil fractions, it is typically the result of the contaminants being present in a particulate form and being concentrated to the coarse fractions through mechanical or hydraulic size separation. Common forms of PAHs present in a particulate form include asphalt, coal, or organic material that has absorbed petroleum hydrocarbons. The asphalt present in the EIE385-4 soil and physically observed in the gravel fraction could at least partially explain the elevated PAHs in the sand fraction.

It is hypothesized that asphalt was broken down into smaller pieces from mechanical processing and attrition scrubbing and reported to the sand fraction. The treatment process was not designed to separate asphalt from soil; however, the process could be modified to incorporate this feature.

Based on the PAH concentrations alone, the gravel and fines fractions could be reused beneficially on site but the sand could not. Combined with the PFAS results, only the gravel can be beneficially reused on site. It is recommended that sand and fines from EIE385-4 be returned to the original stockpile location.



Figure 7. Asphalt Observed in Gravel Fraction of EIE385-4

6.2.8 Soil Reuse

Based on ADEC regional screening levels, the gravel, sand, and fines from EIE382-5 and the gravel from EIE385-4 can be beneficially reused on site. PAH concentrations in the sand from EIE385-4 exceeded regional screening levels, and PFAS concentrations in the fines from EIE385-4 and all factions of EIE393-1 exceeded screening levels and can be returned to the original stockpile locations.

6.3 PERFORMANCE ASSESSMENT MATRIX

The bench-scale performance objectives were all achieved:

- Greater than 99 percent removal was achieved for Stockpile EIE393-1 after the Round 3 treatment process. For stockpiles EIE377-1 and EIE379-2, PFAS concentrations were lower than regional screening levels, and >99 percent removal was not required.
- Post-treatment soil and leachate PFAS concentrations were lower than ADEC regional screening levels for coarse-grained soil.

- Post-treatment water PFAS concentrations were lower than the goal of 70 ng/L for PFOA plus PFOS.

The pilot-scale performance objectives were partially achieved:

- In the bench-scale testing, the Round 3 treatment process was required to achieve greater than 99 percent PFAS removal; however, only the Round 1 process could be conducted in the pilot demonstration. Concentrations of PFOA were treated to below detection limits in two stockpiles, which is considered equivalent to greater than 99 percent, and 89 to 98 percent removal of PFOS was achieved in the three stockpiles. 94 to 99 percent removal of sum of 25 PFAS was achieved in the three stockpiles.
- Post-treatment soil and leachate PFAS concentrations were achieved for coarse-grained soil in Stockpile EIE382-5 and EIE385-4, but not for EIE393-1.
- Post-treatment water PFAS concentrations were lower than the goal of 70 ng/L for PFOA plus PFOS.

Cost optimization objectives were achieved, and a cost assessment is presented in Section 7:

- Soil washing costs vary depending on cost drivers such as the percentage of fines, PFAS concentrations in soil, and regulatory requirements.
- Low-cost soil washing, including management of residuals, can bring up to 60 percent cost savings compared to thermal desorption and up to 40 percent cost savings compared to landfilling in the lower 48 states for soil with 10 percent fines.

7.0 COST ASSESSMENT

The goal of the ESTCP Project was to demonstrate that soil washing could be implemented at costs similar to landfilling and less than thermal desorption in the lower 48 states or approximately $200 to $400 per ton including residuals management. The cost drivers for soil washing include:

1) Soil characteristics – grain size composition and fraction of fines, PFAS concentrations in soil, co-contaminants, and organic content;
2) Regulatory requirements – performance goals for PFAS in soil and leachate;
3) Logistics related to residuals management – proximity to landfills, incinerators, and thermal desorption facilities; and,
4) Stakeholder objectives regarding disposition of residuals – whether landfilling or destructive treatment are required, or if stabilization and on-site management are acceptable.

These factors combine to make it difficult to provide more than a general cost range without site-specific treatability testing results. As the demonstration site's remote location in Fairbanks, Alaska impacts the logistics and costs, particularly for residuals treatment and disposal, we frame the cost of soil washing based on drivers and scenarios to illustrate the potential savings related to the volume reduction approach below. Under this approach, the costs include treatment of the coarse fraction (gravel and sand) to meet regulatory limits via soil washing and treatment/disposal of the residuals (fines and organics).

Based on the treatability results, a relatively simple process relying on water and aggressive attrition scrubbing can be applied to meet performance goals in sand and gravel when total PFAS concentrations are low. For higher concentrations indicative of AFFF sources, advanced treatment using additives, surfactants, and other physical optimization steps would be required. This would increase the complexity of treatment, potentially reducing throughput of full-scale treatment, and ultimately increase the cost. An increased proportion of fines and organics would require additional process equipment to segregate and dewater the residuals. Finally, endpoint objectives can be a major cost driver. On one end of the spectrum, USEPA risk-based screening levels for the soil-to-groundwater leaching pathway for PFOS and PFOA are a fraction of 1 µg/kg, whereas human health criteria for direct contact and ingestion are approximately 13 µg/kg . State-specific groundwater protection standards are evolving, ranging from a fraction of 1 µg/kg to tens of µg/kg for PFOA and PFOS (Horst et al. 2022). These factors combine to a range of soil washing costs between approximately $100 to $200 per ton, excluding residuals treatment.

Table 19 presents scenarios of low-cost ($100/ton), medium-cost ($150/ton), and high-cost ($200) soil washing combined with options for residual management as a function of percentage of fines/organics in the soil. For the purposes of this analysis, we assume that the volume of soil requiring treatment would be at least 25,000 cubic yards, such that there would be economies of scale tipping the balance toward equipment mobilization versus transportation of soils to centralized disposal or treatment facilities. The assumption for the low-cost scenario for residuals would be landfilling at $200/ton; medium- and high-cost scenarios would use thermal desorption at $300/ton. These costs are based on discussions with commercial vendors; however, they could be subject to change given the evolving regulatory framework for PFAS.

The combined cost per ton resulting under these scenarios is summarized in **Table 19** below, applying unit costs for soil washing to the entire volume, treatment of the coarse fraction, and separation of fines for alternative treatment. Cost for landfilling and thermal desorption were applied to the fines fraction.

Table 19. Soil Washing Cost Scenarios (per ton) Compared to Landfilling and Thermal Desorption

	Soil Composition					
	Fines	**5%**	**10%**	**20%**	**30%**	**50%**
Scenario	**Coarse**	**95%**	**90%**	**80%**	**70%**	**50%**
Low-cost		**$110**	**$120**	**$140**	**$160**	$200
Medium-cost		**$165**	**$180**	**$210**	**$240**	$300
High-cost		**$215**	**$230**	**$260**	**$290**	$350

Notes:

Bold values are less than cost of landfilling at $200/ton (low-cost scenario) or thermal desorption at $300/ton (medium- and high-cost scenarios)

Low-Cost: treatment of coarse soil using soil washing ($100/ton) and landfilling of fines ($200/ton)

Medium-Cost: treatment of coarse soil using soil washing ($150/ton and thermal desorption of fines ($300/ton)

High-Cost: treatment of coarse soil using soil washing ($200/ton) and thermal desorption of fines ($300/ton)

By design, the low-cost scenario would be compared to landfilling at $200/ton, and the medium- and high-cost scenarios would be compared to thermal desorption at $300/ton. Here, we considered fines percentages up to 50 percent as a practical limit. At 10 percent fines, the cost savings as a percentage range between 40 percent for the low-cost scenario to 23 percent for the high-cost scenario. Even at 30 percent fines, the savings range between 13 and 20 percent, indicating that the volume reduction approach inherent in soil washing offers cost advantages. While best value is obtained when the soils have limited fines/organics content, stakeholders that are risk-averse or seek to maximize sustainability could do so with this combined treatment approach. By minimizing the residual wastes that require expensive, high-energy destructive technologies, or by implementing thermal desorption to eliminate landfilling, individual stakeholders can achieve these goals based on their priorities and sensitivity to incremental cost.

8.0 IMPLEMENTATION ISSUES & FUTURE CONSIDERATIONS

8.1 IMPLEMENTATION ISSUES

Manufacturing delays due to a steel shortage in North America pushed back the start date of the demonstration from early July to late August. This ultimately cut short the length of the demonstration, as the onset of freezing conditions in September meant that the Round 2 and Round 3 treatment processes could not be performed on Stockpile EIE393-1.

8.2 LESSONS LEARNED

The most important lesson learned from the demonstration was the need for thorough soil characterization before treatment commences. Stockpile characterization data relied upon for this demonstration were not representative of the soil encountered. When characterizing large volumes of soil for treatment, soil could be excavated, homogenized, and sampled in small batches to determine more representative PFAS concentrations and grain size distributions. Collecting samples from a stockpile using a Geoprobe™ or hand auger could bias sampling towards soil with finer grain sizes due to the diameter of the sampling tools, which may result in higher PFAS concentrations.

The statistics used to characterize soil should also be considered in the context of treating soil. Adequate characterization of soil is critical for soil washing, as it is used to determine the optimal conditions to treat soil cost-effectively. For soil with low concentrations, process conditions can be simplified, and throughput can be increased. Conversely, for soils containing higher concentrations, more intensive treatment processes are needed, and throughput may be slower. Overestimating the concentration of soil using UCLs can result in estimated concentrations much higher than what is representative of the soil. This could mean more intensive and expensive treatment processes would be used when soil could be successfully treated using a simpler and cheaper process. Comprehensive soil characterization may carry more upfront costs during the remedial investigation phase; however, these costs could be minor in comparison to the cost savings that would be realized during treatment.

8.3 CONSIDERATIONS FOR IMPLEMENTING SOIL WASHING AT PFAS SOURCES

Currently, there are limited commercially available technologies for reliable, cost-effective treatment of PFAS-contaminated soil. Thermal treatment technologies are being used to treat PFAS-contaminated soil; however, this approach is expensive, energy-intensive, and has attracted scrutiny regarding the potential for hazardous byproducts generation. With an anticipated hazardous substance designation for PFOA and PFOS by the USEPA, landfilling and containment strategies are less desirable due to long-term liability. PFAS are a complex and unique class of contaminants composed of thousands of chemicals present in a cationic, anionic, zwitterionic, or uncharged form with variable fluorinated chain lengths that influence the fate and partitioning behavior of PFASs in soil. This chemical complexity, coupled with a high aqueous solubility and remedial objectives as low as single digit part per billion range for some PFAS, make it a challenge to remediate.

The chemical properties of PFAS make it a good candidate contaminant for treatment via volume reduction by soil washing. Organic matter content, mineralogy, fine-grained soil percentage, and pH are all soil properties that interact with the chemical characteristics of PFAS to influence their retention on a given soil (Liu et al. 2020). In a soil washing process, the high aqueous solubility of PFAS (along with ability to control the pH of the process water, segregate the fine-grained fraction of the soil from the coarse-grained, and target the separation of organics or other soil minerals from the bulk soil) offer the ability to treat the coarse-grained soil and reduce the volume of contaminated soil requiring further treatment or disposal. The cost assessment in Section 7 indicates that soil washing (including secondary treatment of the fines) is more cost-effective than landfilling or thermal desorption for soil with up to 30 percent fines, and costs are comparable to these technologies, even with 50 percent fines.

The volume reduction approach has demonstrated treatment of the sand and gravel soil fractions down to the low part per billion levels; however, as soil cleanup goals become more stringent, it is anticipated that more advanced soil washing processes will be needed to consistently treat the coarse-grained soil fractions to a PFAS concentration less than 1 part per billion. In anticipation of these new cleanup goals, continued research is required to demonstrate that optimization of the physical separation approach combined with chemical treatment can achieve these levels in the coarse-grained soil as well as a portion of the fine-grained soil fraction.

The challenge with implementing soil washing is that there is not a singular soil washing process that can be evaluated. Since the first soil washing efforts in the 1980s, there have been numerous soil washing flowsheets and equipment configurations applied at contaminated sites. While many of the flowsheets have common treatment elements, the processes can vary from aggregate industry-based simple wet-screening systems to complex physical/chemical treatment circuits with custom-made equipment. **Figure 8** presents the three most common configurations ascribed to the soil washing technique. Option 1 is a basic size separation process that separates out the fine-grained soil from the coarser fractions using size and density separation techniques. The goal is to separate and concentrate the contaminants into fine-grained soil fractions. Option 2 is a soil washing technique that treats the entire mass of the soil by contacting it with a chemical extraction fluid to solubilize the contaminant into the process water, while Option 3 is a combined approach that treats soil using both physical and chemical extraction processes.

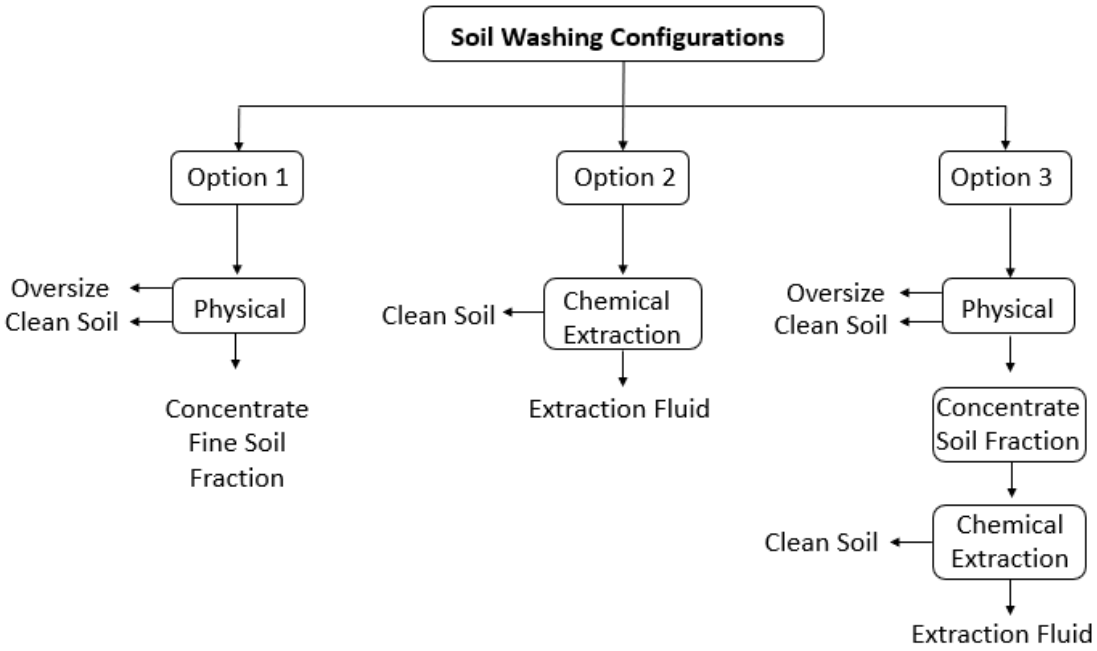


Figure 8. Soil Washing Configurations

Most of the soil washing processes that have been applied to PFAS sites fall into the description of Option 1. While the number of trials to date is limited, the results show that soil washing systems designed with a simple physical separation approach can treat the coarser soil fractions for PFAS into the low single-digit part per billion range. The separated fine-grained soil generally will not meet soil remedial objectives and will require further management.

Future efforts should focus on treatability testing and process optimization aligned with Options 2 and 3. Under Option 2, the focus is enhanced treatment of the coarse-grained fractions to meet stringent standards, especially source zones with part per million-level PFAS impacts. In the longer-term, the focus will be on further volume reduction and treatment of the fines and organics under Option 3. Efforts aimed at improving dissolution of PFAS from the soils combined with better separation of fines and organics will be key to meeting future treatment requirements and providing cost-effective treatment of PFAS-impacted soils. While it appears unlikely that elevated PFAS impacts in fines and organics can be treated to achieve single-digit part per billion clean-up targets at this time, incremental improvements in treatment processes will enhance volume reduction inherent in soil washing, thereby reducing the cost and providing more sustainable PFAS-impacted soil treatment options.

When evaluating soil washing as a treatment alternative, one should consider a systematic approach to feasibility assessment and predesign studies. Soil washing guidance developed in the 1990's provide a roadmap, whether the focus is simple volume reduction (Option 1) or enhanced treatment (Options 2 and 3). The USEPA has published several step-by-step guides outlining a systematic approach to designing and implementing treatability studies (USEPA 1991; USEPA 1992) along with guidance on planning-level process feasibility evaluations specific to physical separation for volume reduction (USEPA 1999). The following discussion is intended to be read in conjunction with the above referenced documents and follows the six-step procedure for evaluating the suitability of physical separation for a given soil outlined in the USEPA 1999 guidance which is provided as **Appendix D**.

This guidance was written in a generic form applicable to the evaluation for a range of contaminants. The sections that follow will focus specifically on the evaluation of PFAS contaminated soil based on recent laboratory and pilot-scale experience.

1. Preliminary Information

The first step in evaluating soil washing as an option at a PFAS contaminated site involves collecting preliminary information. This is typically done through a desktop review of all relevant reports available for the site and discussions with stakeholder's reports typically reviewed include site investigation or remedial investigation reports, risk assessments and any geotechnical investigations that may have been completed at any point during the history of the property.

At the conclusion of this stage information on the site for the following will be assembled:

- Sources of PFAS Contamination
- Presence of Co-Contaminants
- Concentrations of PFAS and Co-Contaminants
- Cleanup Criteria
- Volume of Material Requiring Treatment
- Site Geology
- Timelines for Treatment
- Suitable On-site Area for Soil Treatment (including water and power)
- Number of Months Above Freezing Temperatures Available for Treatment
- Disposition of Treated Material
- Budgetary Constraints

The goal of this stage is to fully understand the contaminated property with focus on remedial goals, soil types, variation of contaminant concentrations at the contaminated property, form of the contamination and identification of any data gaps present within the environmental characterization available at the property. Particular attention should be given to the cleanup criteria and the average, minimum and maximum concentrations of PFAS at the site. The current state of soil washing can treat the coarse-grained fractions to the single digit part per billion for PFOS. The ability to consistently treat to that level will be influenced by the untreated concentrations and needs to be considered at this stage. Concentrations below single digit part per million are good candidates. Concentrations beyond that will require treatability and/or pilot testing to determine the likelihood of success.

For the other items the following rule of thumb values are given for on-site treatment:

- Soil Volume – 10,000 tons or greater
- Site Geology – Coarse grained
- Suitable Area – Dependent on volumes to be treated 50 meter x 50 meter flat area for process equipment and additional space for stockpiling untreated and treated soil. A serviced site with access to water and power is also beneficial to a full scale application.

- Months Above Freezing – Soil Washing is a wet process and can only run during above freezing temperature outside. The local seasonal temperatures will need to be considered in relation to the timelines to complete the treatment
- Disposition of Treated Material – Site dependent
- Budgetary Constraints – Application of soil washing will be in the range of $100 to $200 /ton plus the cost to manage the fines.

Following the completion of this stage, conclusions can be made regarding the potential applicability of remediation by soil washing at a particular site and the likelihood of achieving the remedial goals.

2. Preliminary Materials Characterization

The preliminary materials characterization builds upon the data collected in the first step and identifies data gaps specific to application of a soil washing system. Data needs to further evaluate soil washing include representative sampling of stockpiles and not just in situ soil samples. Analysis should include PFAS, grain size, cation exchange capacity, total organic carbon, and particle size including clay content. It is recommended that soil is sampled from stockpiles after it has been excavated, and excavators should be used to collect representative soil from throughout the stockpile. Collecting soil samples from a Geoprobe™ or hand auger could bias samples to collect soil with a higher fines percentage.

Data should be compiled in a way that will ultimately be useful to soil washing vendors when evaluating the actual untreated concentration of soil that will enter the soil washing plant. Using upper confidence limit calculations are useful from a risk assessment viewpoint but understanding the true range and mean concentrations of soil is necessary to determine the most cost-effective soil washing process.

At this stage a laboratory scale feasibility study could be conducted. The feasibility studies are limited in size and scope, and it is recommended to get a professional opinion on commissioning the study at this stage of the process. A single indicator contaminant, such as PFOS, is evaluated to determine if a reduction in toxicity, mobility or volume is occurring and if the technology can meet the site cleanup goals. A discussion of the procedure for a feasibility study is beyond the scope of this document. USEPA guidance on this process can be found in Guide for Conducting Treatability Studies Under CERCLA (USEPA 1992) and Physical Separation (Soil Washing) for Volume Reduction of Contaminated Soils and Sediments - Processes and Equipment (USEPA 1999).

3. Preliminary Technical and Budgetary Feasibility Evaluation

The third step in the process evaluates the data collected to date to make a preliminary technical and budgetary feasibility evaluation. If treatment of the soil to the site cleanup criteria is amenable to volume reduction and further management of the fines, then the process is evaluated from a budgetary standpoint.

If the answer to the technical or budgetary questions are negative, then alternative technologies, approaches or disposal options must be considered.

If the technical and budgetary questions are positive, then the next step is to assess the degree of certainty with that determination.

4. Confidence in the Positive Technical and Budgetary Feasibility Evaluation

In this step the confidence of the positive assessment in step 3 is evaluated. Both internal and external reviewers should be engaged to evaluate if the feasibility process has been completed. This will include a review of the site characterization data, site data specific to the assessment of soil washing and, if conducted, the results of a laboratory scale feasibility test.

Given that PFAS is a complex contaminant with few soil washing studies to date, in most instances, it would be recommended to proceed to step 5 until a larger dataset of laboratory and pilot-scale projects have been completed to base feasibility decisions.

5. Gathering Additional Data

Step 5 involves gathering additional data to base the feasibility decision. For example, this could include addressing data gaps in the site characterization analysis for hot spots or recommending additional samples for grain size in different soil units present at a site. More commonly this step involves conducting a more detailed treatability test at the laboratory pilot or field pilot scales. Guidance on this process at the field scale is provided in the Guide for Conducting Treatability Studies Under CERCLA (USEPA 1992) and the Guide for Conducting Treatability Studies Under CERCLA: Soil Washing Interim Guidance (USEPA 1991).

If additional treatability testing is conducted vendors with the capability and experience to conduct laboratory, pilot and full-scale soil washing processes should be engaged. One of the uncertainties that can be addressed through treatability testing at this stage is the issue of scale-up. Vendors with experience scaling up soil washing processes from laboratory or pilot-scale to full scale should be able to demonstrate an understanding of how size changes will impact the physical treatment conditions created at the laboratory scale and how they will be duplicated or reasonably simulated at the larger scale. This necessity for an understanding of scale-up by the soil washing vendors will become more magnified as the soil washing process innovate to include chemical or other innovative treatment equipment to achieve more stringent cleanup standards. Both internal and external reviewers should be engaged to evaluate a given vendors rationale around scale-up issues to ensure it is being adequately addressed.

6. Final Technical and Budgetary Feasibility Evaluation

Step 6 is a repetition of step 3, but further evaluated with the additional information obtained in step 5. At this stage the technical feasibility of applying soil washing as a volume reduction technique and managing the fines using a complimentary process should be fully evaluated. If the conclusion on the technical feasibility is positive then the question of the process meeting budgetary constraints is reexamined. If the answer to this question is also positive, then the project can move to the next steps, which may include the issuance of a request for proposal or the design of a full-scale system.

9.0 REFERENCES

ADEC. 2021. 18 AAC 75 Oil and Other Hazardous Substances Pollution Control: As amended through November 18, 2021.

ADEC. 2016. ADEC Interim Technical Memorandum: Comparing DEC cleanup levels for Perfluorooctane Sulfonate (PFOS) and Perfluorooctanoic Acid (PFOA) to EPA's Health Advisory Levels.

AECOM. 2013. Conceptual Site Model for Eielson Air Force Base, Alaska. May.

Arcadis and CET. 2021. Laboratory Treatability Memo: Ex situ Soil Washing to Remove PFAS Adsorbed to Soils from Source Zones. ER20-B2-5258. Version #2

Adamson, D. T., Kulkarni, P. R., Nickerson, A., Higgins, C. P., Field, J., Schwichtenberg, T., Newell, C. and Kornuc, J.J 2022. Characterization of relevant site-specific PFAS fate and transport processes at multiple AFFF sites. Environmental Advances, 100167.

ADEC. 2016. Interim technical memorandum: Comparing DEC cleanup levels for perfluorooctane sulfonate (PFOS) and perfluorooctanoic acid (PFOA) to EPA's health advisory levels. ADEC.

ADEC. 2020a. ADEC Contaminated Sites Report for Eielson AFB Polaris Lake AFFF, File No. 107.38.146. Accessed at: https://dec.alaska.gov/Applications/SPAR/PublicMVC/CSP/SiteReport/26627. Accessed on February 27, 2020.

ADEC. 2020b. ADEC Contaminated Sites Report for Eielson AFB Building 1300 AFFF, File No. 107.38.147. Accessed at: https://dec.alaska.gov/Applications/SPAR/PublicMVC/CSP/SiteReport/26653. Accessed on February 27, 2020.

ADEC. 2020c. ADEC Contaminated Sites Report for Eielson AFB (AT304) Building 4378 AFFF, File No. 107.38.157. Accessed at: https://dec.alaska.gov/Applications/SPAR/PublicMVC/CSP/SiteReport/26858. Accessed on February 27, 2020.

Bristol. 2018. Interim Removal Action Report, Eielson AFB Granulated Activated Carbon (GAC), EAFB, Alaska.

CH2M. 2015. Final Preliminary Assessment Report for Perfluorinated Compounds (PFCs) at EAFB, Alaska.

CH2M. 2018. Site Inspection Report for Aqueous Film Forming Foam Areas Eielson Air Force Base, Alaska.

Cederstrom, D.J. 1963. *Ground-water Occurrence in an Area of Discontinuous Permafrost, Ground-Water Resources of the Fairbanks Area Alaska.* Geological Survey Water-Supply Paper 1590. U.S. Government Printing Office, Washington.

Duchesne, A. L., Brown, J. K., Patch, D. J., Major, D., Weber, K. P., & Gerhard, J. I. 2020. Remediation of PFAS-contaminated soil and granular activated carbon by smoldering combustion. Environmental Science & Technology, 54(19), 12631-12640.

Fristad, W. E. 1995. Case study: Using soil washing/leaching for the removal of heavy metal at the Twin Cities Army Ammunition Plant. Remediation Journal, 5(4), 61-72.

Griffiths, R. A. 1995. Soil-washing technology and practice. Journal of Hazardous Materials, 40(2), 175-189.

Grimison, G., Brookman, I., Hunt, J., Lucas, J. 2020. Ventia Submission - PFAS Subcommittee of the Joint Standing Committee on Foreign Affairs, Defence and Trade: Remediation of PFAS-related impacts – ongoing scrutiny and review. Ventia.

Horst, J., Divine, C., Quinnan, J., Lang, J., Carter, E., Guillette, T., & Pulikkal, V. 2022. Where Is the PFAS? innovations in PFAS detection and characterization. Groundwater Monitoring & Remediation, 42(1), 13-23.

Houtz, E. F., & Sedlak, D. L. 2012. Oxidative conversion as a means of detecting precursors to perfluoroalkyl acids in urban runoff. Environmental Science & Technology, 46(17), 9342-9349.

Interstate Technology and Regulatory Council (ITRC). 2020. Incremental sampling methodology (ISM) update. Washington, DC: ITRC, Incremental Sampling Methodology Team. www.itrcweb.org. October.

Jacobs. 2020. 2019 Garrison Slough Remedial Investigation/ Remedial Action, EAFB, Alaska.

Liu, Y., Qi, F., Fang, C., Naidu, R., Duan, L., Dharmarajan, R., & Annamalai, P. 2020. The effects of soil properties and co-contaminants on sorption of perfluorooctane sulfonate (PFOS) in contrasting soils. Environmental Technology & Innovation, 19, 100965.

McDonough, J.T., Anderson, R.H., Lang, J.R., Liles, D., Matteson, K. and Olechiw, T. 2021. Field-Scale demonstration of PFAS leachability following in situ soil stabilization. ACS Omega, 7, 1, 419-429.

Nunno, T. J. and Hyman, J. 1988. Assessment of international technologies for superfund applications: technology review and trip report results. U.S Environmental Protection Agency.

Office of the Assistant Secretary of Defense (OSD). 2021. Investigating Per- and Polyfluoroalkyl Substances within the Department of Defense Cleanup Program

Sams, G., Nay, M., Rudd, B., Beckett, A., Kunter, R., Leggiere, T., Foyle, R., Jones, C., Verner, J., Bricka, M. and Marqusee, J., 1998. Physical separation and acid leaching: A demonstration of small-rms Range Remediation at Fort Polk, Louisiana. Battelle.

Scholz, R. and Milanowski, J. 1984. Mobile system for extracting spilled hazardous materials from excavated soils. Journal of Hazardous Materials, 9(2), 241-252.

Stallings, P. 2022. Ex Situ thermal treatment of PFAS-impacted soils. ESTCP. https://www.serdp-estcp.org/Program-Areas/Environmental-Restoration/Contaminated-Groundwater/Emerging-Issues/ER20-5198

Sundance. 2020a. Expanded PFOA and PFOS Site Inspection, Eielson AFB, and Moose Creek, AK UFP-QAPP Work Plan Field Change Forms Phase IV. August.

Sundance. 2020b. Expanded PFOA and PFOS Site Inspection, Eielson AFB, and Moose Creek, AK UFP-QAPP Work Plan Field Change Forms.

USACE. 2019. Trip Report of PFAS Sampling at Three Groundwater Monitoring Wells in the Vicinity of the Pre-Filter Building Construction, Fuel Farm, on Eielson AFB (EIE338). September.

U.S. Air Force. 2017. 2015-2016 Field Activities Report for Four Areas: Transmitter Road, Community of Moose Creek, Western Area, Chena Floodplain at Eielson AFB, Alaska. January.

U.S. Air Force (USAF). 2021. Eielson Air Force Base, Alaska, stockpile characterization report perfluorooctanoic acid (PFOA), perfluorooctane sulfonate (PFOS) and comingled PFOA/PFOS and Petroleum F-35 soil stockpile characterization sampling.

U.S. Air Force Civil Engineer Center (AFCEC). 2019. Standard Operating Procedure Stockpiling Contaminated Soils

U.S. Department of Defense (DoD). 2019. Consolidated quality systems manual (QSM) for environmental laboratories. Available online at: https://denix.osd.mil/edqw/documents/manuals/qsm-version-5-3-final/

United States Environmental Protection Agency (USEPA). 1990. Engineering Bulletin: Soil Washing Treatment. EPA, Office of Emergency and Remedial Response, Washington, D.C.

USEPA. 1991. Guide for Conducting Treatability Studies Under CERCLA: Soil Washing Interim Guidance. EPA, Office of Emergency and Remedial Response, Washington, D.C.

USEPA. 1993. Demonstration bulletin: Mobile volume reduction unit. 2pp. EPA/540/MR-93/508. Center for Environmental Research Information, Cincinnati, OH.

USEPA. 1999. Physical separation (soil washing) for volume reduction of contaminated soils and sediments - processes & equipment. Chicago, IL.

USEPA. 2019a. EPA's Per- and Polyfluoroalkyl Substances (PFAS) Action Plan

USEPA. 2019b. Interim Recommendations for Addressing Groundwater Contaminated with PFOA and PFOS

USEPA. 2020. Per- and polyfluoroalkyl substances (PFAS): Incineration to manage PFAS waste streams. Washington, DC.

USEPA. 2021. Human health toxicity values for perfluorobutane sulfonic acid (CASRN 375-73-5) and related compound potassium perfluorobutane sulfonate (CASRN 29420-49-3). EPA/600/R-20/345F. Center for Public Health and Environmental Assessment, Office of Research and Development.

APPENDIX A STANDARD OPERATING PROCEDURES

Appendix A



Health | Safety | Environment Practices & Procedures

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Table of Contents

01 Safe Work Practices

01 Elevated Work Areas
- 01 Aerial Platforms
- 02 Ladders and Temporary Work Platforms
- 03 Use of Portable Ladders
- 04 Use of Step Ladders

02 Energy and Energy Isolation
- 01 Electrical Apparatus Live
- 02 Electrical Power Safety
- 03 Equipment Near Overhead Power Lines

03 Tools and Equipment
- 01 Defective Tools
- 02 Extension Cords
- 03 Grinding
- 05 Operation of Air Tools
- 06 Portable Saws
- 07 Use of Portable Arc Welders
- 08 Use of Portable Grinders
- 10 Box Cutters & Knives
- 11 Hoses & Couplings
- 12 Air Compressors
- 15 Hand & Power Tools
- 16 Circular Saw
- 17 Pressure Washers

04 Fire Protection, Hot Work & Handling of Combustibles
- 01 Fire Fighting
- 02 Use of Tiger Torches
- 03 Oxygen-Acetylene Torches

05 Heavy Equipment, Vehicles and Cranes
- 01 Battery Boosting
- 02 Cranes Hoists and Lifts
- 03 General Rigging
- 04 Safe Use of Slings, Chains & Wire Rope
- 05 Operation of Man Lifts and Scissor Lifts
- 06 Vehicle Safety
- 07 Operation of Forklift & Safe Handling of Propane Fuel
- 08 Operation of Excavators

06 Occupational Health and Environment
- 01 Eye Wash Stations
- 02 Fall Protection
- 03 Heat Stress
- 04 Manual Material Lifting
- 05 Use and Care of Respiratory Protection Equipment
- 07 Confined Space Entry

07 Other Safe Work Practices
- 04 Housekeeping
- 06 Slips, Trips, and Falls
- 08 Storage and Handling Materials
- 09 Working in Public Areas

09 Hazardous Materials & Chemical Handling
- 01 Clean Up of Chemical Spills
- 03 Handling Chemicals
- 06 Handling of Corrosives
- 12 Hydrogen Sulfide
- 14 Safe Handling of Flammable Liquids
- 15 Use of Cleaning Solvents and Flammables
- 16 Chemical & Biological Hazards

02 Safe Work Procedures

01 Water Treatment
- 01 Filter Presses
- 02 Backwash of a Media Filter Vessel

CleanEarth	**Safe Work Practice**	**Reviewed/Revised:** January 2021

SWP 01-01-01 **Aerial Lifts & Platforms**

1.0 Purpose:	This Safe Work Practice (SWP) is developed to fulfill the requirements of the Occupational Safety General Regulations and all relevant Codes of Practice and Canadian Standards. This SWP forms part of the CleanEarth HSE Program.
2.0 Definitions:	➢ **Safe Work Practice:** Safe working practice refers to ways in which work is done in an organization. This practice normally facilitates improved efficiency and small tasks to be assigned with each particular SWP
3.0 References:	➢ Policy ➢ Safe Work Procedure ➢ NS Acts & Regulation
4.0 Tasks:	General: ➢ Ensure the control operator is competent to operate the lift and that there is adequate and suitable means of communication between the lift operator and the worker. ➢ Ensure the lift mechanism will descend in a controlled manner so no worker on the platform will be endangered. ➢ Check maximum capacities and ensure the equipment has been manufactured to CSA standards. Manlifts ➢ A manlift should only be operated by a worker instructed in its operation and used on surfaces specified. ➢ A manlift should not be driven in a raised position and not be loaded with more than its rated capacity at any time. ➢ Read and follow manufacturer operator's instructions. ➢ Perform job site inspection and walk around inspections of platform Ensure ground is firm and level. ➢ All materials being lifted should be secured – overhanging loads should not be lifted on a manlift. ➢ Do not put makeshift platforms on the manlift platform. ➢ A man lift should not be used in high winds and, when not is use, the power should be turned off. ➢ Do not use the manlift for pushing, pulling, or dragging materials. ➢ A manlift with air filler tires requires stabilizers to operate. ➢ Be aware of power line proximity. ➢ No platform is to be made higher by the use of a scaffold, boxes, or ladders.

**** The safety information in this policy does not take precedence over the Occupational Health and Safety Act. All workplace parties must be familiar with the Occupational Health and Safety Act and Regulations.***

	➢ Wear a safety harness attached to the machine when operating any aerial platform. ➢ Get on and off the platform when it is in lowered position. Scissor Platforms (Mobile Work Platforms) ➢ Do not use ladders or anything else on mobile platforms higher reach. ➢ Do not attempt to travel with raised platforms.
5.0 Related Documents:	➢ Occupational Safety General Regulations ➢ Health, Safety and Environment programs

CleanEarth	Safe Work Practice	**Reviewed/Revised:** January 2021

SWP 01-01-02 **Ladders and Temporary Work Platforms**

1.0 Purpose:	This Safe Work Practice (SWP) is developed to fulfill the requirements of the Occupational Safety General Regulations and all relevant Codes of Practice and Canadian Standards. This SWP forms part of the CleanEarth HSE Program.
2.0 Definitions:	➢ **Safe Work Practice:** Safe working practice refers to ways in which work is done in an organization. This practice normally facilitates improved efficiency and small tasks to be assigned with each particular SWP ➢ **Ladder:** A structure consisting of a series of bars or steps between two lengths of wood, metal, or rope, used for climbing up or down something. ➢ **Scaffold:** a temporary structure for holding workers and materials during the erection, repair, or decoration of a building. ➢ **Work Platforms:** is a mechanical device used to provide temporary access for people or equipment to inaccessible areas, usually at height.
3.0 References:	➢ NS Acts and Regulations ➢ Safe Job Practices ➢ Safe Job Procedures
4.0 General:	**4.1 - A ladder or work platform must meet and be used in accordance with:** ○ The applicable CSA or ANSI standard in effect when the equipment or structure was manufactured. ○ Another standard acceptable to specific provincial OSGR Regulations Part 13, or ○ If there is no applicable standard under paragraphs (a) or (b), the requirements of a professional engineer. **4.2 - In designing and installing a work platform, appropriate safety factors and minimum rated loads must be used in the materials and method of installation, in accordance with:** ○ Provincial OSGR Regulations, Part 13 for, Design, Construction and Use of Wood Frame Scaffolds ○ Provincial OSGR Regulations, Part 13 for, Design, Construction and Use of Crane Supported Work Platforms ○ Provincial OSGR Regulations, Part 13, Safety Factor and Minimum Breaking Strength for Suspended Work Platforms and Associated Components **4.3 - Inspections:** ○ A ladder or work platform and associated components must be inspected before use on each shift, and after any modification, and any condition that might endanger workers must be remedied before the equipment is used.

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4.4 - Ladders:

- **Manufactured ladders:**

A manufactured portable ladder must be CSA marked for the grade of material used to construct the ladder and the use for which the ladder is constructed.

- **Position and stability:**

A ladder must:

- Be placed on a firm and level base
- Be positioned so that the horizontal distance from the base to vertical plane of support is approximately ¼ of the ladder length.
- Have sufficient length to project approximately 1m (3ft) above the upper landing to which it provides access, and;
- If necessary, be secured to ensure stability during use.

- **Use Restrictions:**

- If work cannot be done from a ladder without hazard to a worker, a work platform must be provided.
- A worker must not carry up or down a ladder, heavy or bulky objects or any other objects which may make ascent or descent unsafe. A worker shall not work from either the top 2 rungs of a portable single or extension ladder or the top 2 steps of a step ladder.
- The “three point contact” rule must be in effect at all times when ascending or descending a ladder.

4.5 - Work Platforms:

- **Access:**

Safe access must be provided to every work platform.

- **General Requirements:**

Each work platform must:

- Have sufficient strength to bear the load to be placed on it, and
- Be secured against separation from the supporting equipment, structure or surface to which it is attached.
- Must always be inspected prior to use and are not to be used if any defects are found
- Any person(s) on platforms must use CEIS fall arrest system.

- **Lines Supporting Work Platforms:**

Rigging and lines used to suspend or support work platforms must:

- Have sufficient breaking strength to withstand the loads likely to be imposed with the required factor of safety.
- Be free of knots or splices except for terminal eye-splices.
- Be suitable for the purpose for which they are used
- Be protected from abrasion or other damage from the work environment.
- Be secured to the platform and to an anchorage able to withstand the loads likely to be imposed on them.

- Be of sufficient length to lower the work platform to a safe lower landing, and
- Except for load lines, be used exclusively for suspending the work platform.

➢ **Hooks and Clamps:**

- Cornice hooks, parapet clamps and thrust-out beams must be secured by tiebacks to a solid anchor on the building or structure.
- Tiebacks for cornice hooks, parapet clamps and thrust-out beams must, as nearly as is practicable, be rigged at right angles to the structure's face.
- Each cornice hook, parapet clamp, hanger or stirrup used to support a swing stage must be manufactured of mild steel or other material having similar ductile properties.
- Counterweights must be:
  - Made of solid material not subject to loss of weight through attrition, and;
  - Secured to the thrust-out beam.

➢ **Engineering Required:**

A scaffold must be constructed, installed and used in accordance with the instructions of a professional engineer with respect to:

- Bracing, if the scaffold is enclosed by a tarpaulin or any other cover.
- A scaffold exceeding 38 m (125 ft.) in height.
- A scaffold exceeding 25 m (80 ft.) in height if stairways are included as part of the scaffold.
- A scaffold used to support a temporary floor.
- A scaffold suspended or cantilevered from a structure.
- A scaffold system supported by a catenary line.
- A needle beam scaffold, and
- An outrigger scaffold.
- Equipped with guard rails

Permanent powered platforms must be constructed, installed and used in accordance with the instructions of a professional engineer.

A signed copy of the engineer's instructions or certification referred to in subsections (1) to (3) must be available at the workplace during installation, disassembly and use of the system.

➢ **Removal from Service:**

A work platform must be removed from service until certified safe for use by the manufacturer or a professional engineer if it has:

- Been subjected to a sudden drop.
- Been in contact with exposed energized electrical equipment or conductors, or

- Shows signs of any kind of structural or mechanical damage or substantial wear.

4.6 - Scaffolds

➢ Responsibilities:

CEIS will ensure that scaffolds used by workers are in safe condition and are able to withstand the load, regardless or who erected the scaffold.

➢ **Scaffold platforms:**

The platform of each scaffold must:

- Be a minimum nominal width of 50 cm (20 in), except that a nominal 30 cm (12 in) wide work platform may be used with ladder jacks, pump jack or similar systems.
- Not leave more than one opening in the work platform, which must be no greater than 25 cm (10 in) in width, and
- A work platform 1.22 meters or more above the floor level must have guardrails on all open sides. Toe boards shall be provided. Each lumber and manufactured scaffold plank installed for use shall be secured against dislodgement.

➢ **Manufactured Components:**

Major components of scaffolds must be used in accordance with technical data provided by the manufacturer, or in writing by a professional engineer, that:

- Shows the rated load, erection procedures and compliance with an applicable provincial standard, and
- Is available at the workplace for reference.

➢ **Lumber for structural components:**

All lumber used to construct a scaffold must be graded and marked appropriate for use to the National Lumber Grades Authority Standard Grading Rules for Canadian Lumber.

➢ **Scaffold Stability:**

- A scaffold must be erected with the vertical members plump, and with the ledgers and bearers level.
- The base of a scaffold must have bearing plates or sills that rest on a solid surface and are sufficient to support the weight of the scaffold.
- The poles, legs and uprights of a scaffold must be securely and rigidly braced to prevent movement.
- A scaffold must be effectively guyed or secured to a building or structure.
- If the height of the scaffold exceeds 3 times its minimum base dimension, or
- In any other circumstances if required for stability.

- Unless otherwise specified by the manufacturer, height adjustment devices must not extend more than 2/3 of their total length or 60 cm (24 in) - whichever is less.

➢ **Connections:**

All connections between the parts of a scaffold must be secure.

➢ **Electrical Hazards:**

A scaffold must be effectively grounded if:

- It is a metal scaffold and is located close to a high voltage energized electrical conductor or equipment, and
- A hazardous level of electrical charge is likely to be induced in the scaffold.

4.7 - Marking of the equipment:

The following equipment must be clearly marked with a rated capacity:

- A platform that is suspended from or attached to a crane or hoist.
- An elevating work platform.
- A work platform that is supported by a lift truck.
- A swing stage, and
- Interchangeable load bearing components of a suspended work platform system.
- The rated load for allowable thrust-out beam projections must be clearly marked on a thrust-out beam.
- A swing stage platform, counterweight and hoist unit must each be clearly marked with their own weight.
- A work platform that is suspended from a crane or hoist or attached to a crane boom must be marked with the weight of the platform and rigging and the rated capacity.

4.8 - Manuals:

➢ For each elevating work platform in use at a workplace:

- The equipment manufacturer's operation manual must be available at the workplace, and
- The equipment manufacturer's maintenance manual, containing maintenance instructions and replacement part information, must be reasonably available to workers at the workplace.

➢ If either of the manuals required by subsection (1) is not available, the equipment must not be used until:

- The manual is obtained, or
- Written instructions for the safe operation and maintenance of the equipment are supplied by a professional engineer.

4.9 - Maintenance of Records:

➢ The employer must keep records of inspection, maintenance, repair or modification that meet the applicable provincial requirements for each:

- Elevating work platform
- Swing stage, and
- Permanent powered platform.

- If the inspection and maintenance records, other than pre-shift inspections, are not available, the equipment must not be used until it has been inspected and certified safe for use by the qualified personnel.

4.10 - Testing:

- A vehicle-mounted elevating work platform and a self-propelled boom-supported elevating work platform must be:
  - Inspected in accordance with good engineering practice at least every 12 months, and
  - Certified in writing by the equipment manufacturer or a professional engineer as complying with this Part and safe for use.
- An insulated elevating work platform must be dielectrically rested at least annually in accordance with the edition of CSA Standard CAN/CSA-C225 Vehicle-Mounted Aerial Devices that the device was designed to meet, or the most recent edition, as the circumstances require.
- The insulating capability of an insulated elevating work platform must be certified by the testing agency.
- If an insulated elevating work platform does not pass the testing method required by subsection (2) and subsection (3):
  - The platform must be considered non-insulated.
  - Any markings or identification on the device indicating insulated capability must be removed or effectively covered over, and
  - The user must be informed or the non-insulated status of the device.

4.11 - Work Platforms on Wheels:

- If a moveable work platform on wheels is not designed for or intended to be moved along the floor or other supporting surface while a person is occupying the platform, the platform must be secured to prevent that movement before a person accesses or occupies the platform.
- If a moveable work platform is designed for and intended to be moved along the floor or other supporting surface while a person is occupying the platform, the platform must be moved only in the manner and under the conditions specified by the platform's manufacturer.
- Despite subsection (2), if the height of the work platform of a rolling scaffold that is occupied by a person is:
  - Not more than one- and one-half times the least base dimension of the scaffold, the scaffold may be moved by the effort of the person occupying the platform or by the effort of a person on the floor or other supporting surface, and

- More than one- and one-half times the least base dimension of the scaffold, the scaffold must be moved only by the effort of a person on the floor or other supporting surface, and
- More than two times the least base dimension of the scaffold, the scaffold must not be moved while the person is occupying the platform.

4.12 - Warning devices on elevating work platforms:

- An elevating work platform, except a vehicle-mounted work platform, must have warning system consisting of an intermittent horn or flashing light that:
  - Is automatically activated during any motion of the work platform, and
  - Can be seen or heard by other workers in proximity to the work platform.
- If the safe operation of an elevating work platform requires its carrier vehicle to be on a level surface or level within specified degrees, the platform must be fitted, as the carrier requires, with a device to warn the operator that:
  - The carrier is not level, or
  - The carrier is outside the permitted degrees from level.

4.13 - Controls on elevating work platforms:

- The controls for an elevating work platform must:
  - Be clearly identified to indicate their functions.
  - Be “hold-to-run” (continuous pressure) type that return to the neutral or the stop position when released.
  - Be protected against inadvertent operations.
  - For each set of controls, be provided with an emergency stop device that is:
    - Within easy reach of the operator
    - Clearly labeled STOP, and
    - Colored Red, and
    - Include a clearly marked overriding lowering control that will enable a worker at the lower controls to stop and lower the platform in an emergency.

4.14 - Cranes and hoists used to suspend platforms:

- The weight of a work platform suspended from a crane or hoist or attached to a crane boom and its rigging, plus the rated capacity, must not exceed 50% of the rated capacity of the crane or hoist at the working radius or configuration.
- If a work platform attached to a crane boom causes eccentric loading on the boom:

- The effect on the rated capacity of the crane must be determined and the rated capacity certified by the crane manufacturer or a professional engineer, and
- The rated capacity of the crane must be reduced accordingly.
- The boom of a crane used to suspend a work platform must have a powered boom or a fixed boom.

➢ A work platform must not be:

- Suspended from an articulating boom crane, or
- Attached to an articulating boom crane, unless the crane manufacturer approves the installation.

➢ If workers are on a work platform suspended from a crane, a secondary hoisting line on the crane must not be used.

4.15 - Two-blocking:

➢ A crane or hoist used to raise a work platform on a load line must be equipped with:

- A device to prevent two-blocking at all points, or
- In the case of a lattice boom crane, a two-blocking warning device.

➢ Despite subsection (1), a work procedure acceptable to the Board may be followed to minimize the risk of two-blocking if it is not practicable to maintain a two-blocking prevention or warning device on a conventional lattice boom crane used for pile driving and similar applications.

4.16 - Hoisting and lowering work platforms:

➢ Cranes, winches and other devices used for hoisting and lowering movable work platforms must:

- Be operated as slowly as practicable while supporting the work platform.
- Be lowered under power, if the device is powered, and
- Can be equipped with a free running boom or hoisting winch controlled only by brakes.

➢ If a moveable work platform is suspended from a crane, winch or other device over a structure that cannot safely support its weight or if other hazards exist below the platform, lower limit travel devices compatible with the hoist system must be used to ensure the platform cannot be lowered beyond the safe lower limit of travel.

➢ If the lower limit travel devices required by subsection (2) are not practicable, the employer must ensure that work procedures acceptable to the Board are used that will minimize the risk of the platform going beyond the safe lower limit of travel.

➢ A trial lift for a work platform suspended from or attached to a crane or hoist must be performed at all work locations before the platform is occupied.

4.17 - Lift truck (forklift) mounted work platforms:

- A work platform supported by a lift truck may be used to support people only if other conventional means of access for the task, such as ladders, scaffolds, and elevating work platforms, are not practicable.
- A work platform supported by a list truck must be designed and used in accordance with applicable provincial regulations relative to Platforms supported by Lift Trucks.

4.18 - Powered platforms:

- If a portable powered platform is raised and lowered by two or more separately controlled hoists operated by one person on the platform, the controls must be located so that they can be used simultaneously by that person.
  - The work platform will exceed 10 m (32 ft.) in length, or
  - The suspension height will exceed 91 m (300 ft.)

4.19 - Fall Protection:

- A person on an elevating work platform must wear a personal fall arrest system secured to a suitable and substantial anchorage point.
- A person on a scissor lift, or on an elevating work platform with similar characteristics to a scissor lift, that is on a firm level surface with no irregularities to cause platform instability, is exempt from wearing a personal fall arrest system, provided that all manufacturer's guardrails and chains are in place.
- If a person is supported on a work platform suspended by fewer than four suspension lines, the person must use a personal fall arrest system secured to an anchor and independent of the work platform and its suspension system.
- If a person is supported on a work platform suspended by four or more suspension lines, the person must use a personal fall arrest system secured to an anchor on the platform or to an anchor and independent of the work platform and its suspension system.
- A person is not required to use a personal fall protection system on an outrigger or suspended mason's scaffold with guardrails on the open sides.
- Each person on a work platform suspended from a crane or hoist must use a personal fall arrest system with a shock absorbing lanyard, secured to:
  - An anchor above the load hook, or
  - An anchor attached to the platform and designated for that purpose by the manufacturer or a professional engineer, provided that the platform has a safety strap that will prevent the platform from falling more than 15 cm (6 in) if the platform becomes dislodged from the hook.
- Each person on a work platform attached to a crane boom must use a personal fall arrest system secured to an anchor on the boom or on the platform.

	➢ The personal fall arrest system referred to in subsection (5) must be secured on the boom or on the platform to an anchor that is designated by: o The manufacturer or a professional engineer.

CleanEarth	**Safe Work Practice**	**Reviewed/Revised:** January 2021

SWP 01-01-03 **Use of Portable Ladders**

1.0 Purpose:	This Safe Work Practice (SWP) is developed to fulfill the requirements of the Occupational Safety General Regulations and all relevant Codes of Practice and Canadian Standards. This SWP forms part of the CleanEarth HSE Program.
2.0 Definitions:	➢ **Safe Work Practice:** Safe working practice refers to ways in which work is done in an organization. This practice normally facilitates improved efficiency and small tasks to be assigned with each particular SWP
3.0 References:	➢ Policy ➢ Safe Work Procedure ➢ NS Acts & Regulation
4.0 Tasks:	➢ Always use the right ladder for the job. Consider strength, type and CSA approval. ➢ Inspect the ladder before and after each use – if defects are found, tag and remove it from service. ➢ Get help handling a heavy long ladder. ➢ When setting up a ladder, secure the base, check for overhead lines, and "walk" the ladder up into place. ➢ The ladder should be set at the proper angle of one (1) horizontal to every four (4) vertical. ➢ Before using a ladder, ensure a proper inspection and make sure it is secured against movement. ➢ When in position, the ladder should protrude one (1) metre above the intended landing point. ➢ Workers shall not work from the top two rungs of a ladder. ➢ Don't overreach while on a ladder. It is easier and safer to climb down and move the ladder over a few feet to a new position. ➢ Always face the ladder when using it. Grip it firmly and use the three-point contact method when moving up or down. ➢ Keep both metal and wood ladders, away from electrical sources. ➢ Tie yourself off with a safety harness when working 3m (10ft) or more off the ground or when working with both hands. ➢ Set up barricades and warning signs when using a ladder in a doorway or passage way. ➢ Clean muddy/slippery boot soles before mounting the ladder. ➢ Ensure that only one person is on a single width ladder. DON'T • Use a ladder as a scaffold plank or runway • Carry objects in hands – hoist materials or use a tool belt

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	• Work from top three rungs – ladder may slip at the base. • Use makeshift items as a substitute ladder. • Use a portable ladder in place of a fixed ladder or scaffold. • Splice together shorter ladders to make a longer ladder. • Rest a ladder on its rungs; ladder must rest on both side rails. • Allow anyone to stand under the ladder. • Overreach – climb down and move ladder when necessary. • Straddle the space between a ladder and another object.
5.0 Related Documents:	➢ Occupational Safety General Regulations ➢ Health, Safety and Environment programs

CleanEarth	**Safe Work Practice**	**Reviewed/Revised:** January 2021

SWP 01-01-04 **Use of Step Ladders**

1.0 Purpose:	This Safe Work Practice (SWP) is developed to fulfill the requirements of the Occupational Safety General Regulations and all relevant Codes of Practice and Canadian Standards. This SWP forms part of the CleanEarth HSE Program.
2.0 Definitions:	➢ **Safe Work Practice:** Safe working practice refers to ways in which work is done in an organization. This practice normally facilitates improved efficiency and small tasks to be assigned with each particular SWP
3.0 References:	➢ Policy ➢ Safe Work Procedure ➢ NS Acts & Regulation
4.0 Tasks:	➢ No work is to be done from the top two steps of a step ladder, counting the top platform as a rung. ➢ When in the open position ready for use, the incline of the front step section shall be one (1) horizontal to six (6) vertical. ➢ The step ladder is only to be used in the fully opened position with the spreader bars locked. ➢ Tops of step ladders are not to be used as a support for scaffolds. ➢ Don't overreach while on the ladder. Climb down and move the ladder over to a new position. ➢ Only CSA approved, non-conductive ladders will be used.
5.0 Related Documents:	➢ Occupational Safety General Regulations ➢ Health, Safety and Environment programs

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CleanEarth	**Safe Work Practice**	**Reviewed/Revised:** January 2021

SWP 01-02-01 **Electrical Apparatus Live**

1.0 Purpose:	This Safe Work Practice (SWP) is developed to fulfill the requirements of the Occupational Safety General Regulations and all relevant Codes of Practice and Canadian Standards. This SWP forms part of the CleanEarth HSE Program.
2.0 Definitions:	➢ **Safe Work Practice:** Safe working practice refers to ways in which work is done in an organization. This practice normally facilitates improved efficiency and small tasks to be assigned with each particular SWP
3.0 References:	➢ Policy ➢ Safe Work Procedure ➢ NS Acts & Regulation ➢ Canadian Electrical Code (CEC)
4.0 Tasks:	➢ When working on connections, shut off power if possible. ➢ Determine what amperage and voltage you are working on. ➢ Electrical installations shall be carried out by a properly trained and qualified journeyman or registered apprentices (competent persons). ➢ Two or more journeyman shall work together on any energized circuit. ➢ Remove panel covers with care, ensuring cover screws or panel space fillers are removed. ➢ Ensure ladders are made of non-conductive materials. ➢ Be conversant with E.R.P. (Emergency Response Plan). ➢ All tools and equipment must be in accordance with NS OSGR Section 123 and the CEC.
5.0 Related Documents:	➢ Occupational Safety General Regulations ➢ Health, Safety and Environment programs

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CleanEarth	Safe Work Practice	**Reviewed/Revised:** January 2021

SWP 01-02-02 **Electrical Power Safety**

1.0 Description:

The voltage of the electricity and the available electrical current in regular businesses and homes has enough power to cause death by electrocution. Even changing a light bulb without unplugging the lamp can be hazardous because coming in contact with the "hot", "energized" or "live" part of the socket could kill a person. The following are tips for working safely around electrical power.

2.0 Hazards:

- Power Poles
- Downed Power Lines
- Buried Cables

DO's	DON'T'S
• Take extra care when working near power lines • Ensure the cord is rated for the power requirement of the equipment • Keep all tools and cords in good condition	• Never touch a downed wire • Never touch power lines with equipment • Use power tools on wet grass or other wet surfaces • Do not use cords with frays or defects

General Electrical Safety Tips:

- Inspect portable cord-and-plug connected equipment, extension cords, power bars, and electrical fittings for damage or wear before each use. Repair or replace damaged equipment immediately.
- Always tape extension cords to walls or floors when necessary. Nails and staples can damage extension cords causing fire and shock hazards.
- Use extension cords or equipment that is rated for the level of amperage or wattage that you are using.
- Always use the correct size fuse. Replacing a fuse with one of a larger size can cause excessive currents in the wiring and possibly start a fire.
- Be aware that unusually warm or hot outlets may be a sign that unsafe wiring conditions exists. Unplug any cords or extension cords to these outlets and do not use until a qualified electrician has checked the wiring.
- Always use ladders made with non-conductive side rails (e.g., fibreglass) when working with or near electricity or power lines.
- Place halogen lights away from combustible materials such as cloths or curtains. Halogen lamps can become very hot and may be a fire hazard.
- Risk of electric shock is greater in areas that are wet or damp. **Install Ground Fault Circuit Interrupters** (GFCIs) as they will interrupt the electrical circuit before a current sufficient to cause death or serious injury occurs.

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- Use a portable in-line Ground Fault Circuit Interrupter (GFCI) if you are not certain that the receptacle you are plugging your extension cord into is GFCI protected.
- Make sure that exposed receptacle boxes are made of non-conductive materials.
- Know where the panel and circuit breakers are located in case of an emergency.
- Label all circuit breakers and fuse boxes clearly. Each switch should be positively identified as to which outlet or appliance it is for.
- Do not use outlets or cords that have exposed wiring.
- Do not use portable cord-and-plug connected power tools with the guards removed.
- Do not block access to panels and circuit breakers or fuse boxes.
- Do not touch a person or electrical apparatus in the event of an electrical accident. Always disconnect the power source first.

Two major sources of electrical injuries and fatalities are:

- running into power poles and electrical equipment with machinery, and
- coming into contact with buried cables while trenching, back hoeing, and digging fence post holes

Don't Touch Power lines:

- Do not touch or get close to a hydro wire with a ladder or antenna as this could cause serious injury.
- Ensure that no work is carried out and no person shall carry our work that may bring a person or object closer than the distances set out in the following table to an overhead energized power line or power line equipment rated at greater than or equal to 750v phase to phase:

Phase to Phase Voltage of Energized Electrical Power Line or Power line Equipment	**Distance**
750 volts and up to 69 000 volts	3.0m
Greater than 69 000 volts and up to 138 000 volts	5.0m
Greater than 138 000 volts	6.0m

  - If the limits above cannot be met then the local utility must be contacted so that proper insulation and /or guarding can be carried out.

TAKE EXTRA CARE WHEN WORKING NEAR POWER LINES:

- Don't come close to or touch lines yourself or with equipment. Anyone touching even just the equipment could be serious injured. Accidents involving equipment or people who have come too close to energized lines are very serious in nature and are to be reports to the Department of Labour. See guidelines above and refer to OSGR's for more information.
- Before digging, call your local hydro company to locate underground power lines. To cut through one is dangerous and could black out an entire area. (Calls may include Heritage Gas, Halifax Water and Nova Scotia Power).

USE PROPER CORDS:

- Power tools should have either a three-prong plug or double insulation. If you need an extension cord, use a proper, well maintained three wire, ground cord
- Keep all tools and cords in good condition and never use power tools on wet grass or other wet surfaces. Make sure the extension cord is rated for the power requirement of the equipment.

NEVER TOUCH A DOWNED WIRE:

- Even if it looks dead, touching it could be fatal.

OUTDOOR ELECTRICAL OUTLETS:

By law, all outdoor electrical outlets should be ground fault circuit interrupters (GFCI), for extra protection. This is especially important in damp locations where shocks are usually more severe and a normal fuse or circuit breaker doesn't provide enough protection.

CleanEarth	Safe Work Practice	**Reviewed/Revised:** January 2021

SWP 01-02-03 Equipment Near Overhead Lines

1.0 Description:

This SWP describes methods of working around overhead power lines, identifying overhead line dangers and what to do in the event of a power line contact.

2.0 Hazards:

- Electrical Contact, overhead lines
- Equipment damage
- Fire
- Explosion

DO's	DON'T'S
• Maintain minimum safe clearances • Install warning devices and signs. • Install telescopic non-conductive posts and flagging across R.O.W.-Right of Way at the minimum allowable clearance as allowed by regulations for the line voltage. • Position signs or other devices to determine the "Danger Zone". • Adhere to all site-specific regulations. • Beware of atmospheric conditions such as temperature, humidity and wind, which may dictate more stringent safety procedures. •	• No equipment and work is to be performed if distance is more than the safe limit. • No person shall approach or operate equipment within 6 m of a power line of unknown voltage

- Always check for overhead lines as part of your site assessment before beginning any work on any jobsite
- Operate equipment at a slower than normal rate when there are overhead lines nearby
- Ensure a spotter is assigned to ensure clearance is maintained

- The Operator of an energized overhead power line must be notified before work may be performed within the safe limit of approach distance.

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CleanEarth	Safe Work Practice	**Reviewed/Revised:** January 2021

SWP 01-03-01 **Defective Tools**

1.0 Purpose:	This Safe Work Practice (SWP) is developed to fulfill the requirements of the Occupational Safety General Regulations and all relevant Codes of Practice and Canadian Standards. This SWP forms part of the CleanEarth HSE Program.
2.0 Definitions:	➢ **Safe Work Practice:** Safe working practice refers to ways in which work is done in an organization. This practice normally facilitates improved efficiency and small tasks to be assigned with each particular SWP
3.0 References:	➢ Policy ➢ Safe Work Procedure ➢ NS Acts & Regulation
4.0 Tasks:	**4.1 - Defective tools can cause serious and painful injuries. If a tool is defective in some way, DON'T USE IT. Be aware of problems like:** ➢ chisels and wedges with mushroomed heads ➢ split or cracked handles ➢ chipped or broken drill bits ➢ wenches with worn out jaws ➢ tools which are not complete, such as files without handles **4.2 - To ensure safe use of hand tools, remember:** ➢ never use a defective tool; ➢ double check all tools prior to use; and ➢ ensure defective tools are repaired ➢ Air, gasoline or electric power tools, require skill and complete attention on the part of the user even when they are in good condition. ➢ Don't use power tools when they are defective in any way. **4.3 - Watch for problems like:** ➢ broken or inoperative guards, ➢ insufficient of improper grounding due to damage on double insulated tools, ➢ no ground wire (on plug) of cords of standard tools, ➢ The on/off switch not in good working order, tool blade is cracked, the wrong grinder wheel is being used, or the guard has been wedged back on a power saw.
5.0 Related Documents:	➢ Occupational Safety General Regulations ➢ Health, Safety and Environment programs

**** The safety information in this policy does not take precedence over the Occupational Health and Safety Act. All workplace parties must be familiar with the Occupational Health and Safety Act and Regulations.***

CleanEarth	Safe Work Practice	**Reviewed/Revised:** January 2021

SWP 01-03-02 **Extension Cords**

1.0 Purpose:	This Safe Work Practice (SWP) is developed to fulfill the requirements of the Occupational Safety General Regulations and all relevant Codes of Practice and Canadian Standards. This SWP forms part of the CleanEarth HSE Program.
2.0 Definitions:	➢ **Safe Work Practice:** Safe working practice refers to ways in which work is done in an organization. This practice normally facilitates improved efficiency and small tasks to be assigned with each particular SWP
3.0 References:	➢ Policy ➢ Safe Work Procedure ➢ NS Acts & Regulation
4.0 Tasks:	➢ If an extension cord is used, make sure the conductor size is large enough to prevent excessive voltage drop which will cause loss of power and possible motor damage. A table of recommended extension cord sizes will be found below. This table is based on limiting line voltage drop to 5 volts (10 volts for 230 volts) at 150% of rated amperes.

Tool's Ampere Rating	Cord Size in A.W.G. Cord Length in Feet				Wire Sizes in mm² Cord Length in Meters			
	25	50	100	150	15	30	60	120
3-6	18	16	16	14	0.75	0.75	1.5	2.5
6-8	18	16	14	12	0.75	1	2.5	4
8-10	18	16	14	12	0.75	1	2.5	4
10-12	16	16	14	12	1	2.5	4	—
12-16	14	12	—	—	—	—	—	—

	➢ If an extension cord is to be used outdoors it must be marked with the suffix W-A following the cord type designation. For example: SJTW-A to indicate it is acceptable for outdoor use.
5.0 Related Documents:	➢ Occupational Safety General Regulations ➢ Health, Safety and Environment programs

CleanEarth	Safe Work Practice	**Reviewed/Revised:** January 2021

SWP 01-03-03 **Grinding**

1.0 Purpose:	This Safe Work Practice (SWP) is developed to fulfill the requirements of the Occupational Safety General Regulations and all relevant Codes of Practice and Canadian Standards. This SWP forms part of the CleanEarth HSE Program.
2.0 Definitions:	➢ **Safe Work Practice:** Safe working practice refers to ways in which work is done in an organization. This practice normally facilitates improved efficiency and small tasks to be assigned with each particular SWP
3.0 References:	➢ Policy ➢ Safe Work Procedure ➢ NS Acts & Regulation
4.0 Tasks:	➢ Check the tool rest for the correct distance from the abrasive wheel, maximum 1/8" or 3 mm. ➢ Replace the grindstone when adjustment of the rest cannot provide 1/8" or 3 mm clearance. ➢ If the wheel has been abused and ground to an angle or grooved, reface the wheel with the appropriate surfacing tool. ➢ Protect your eyes with goggles or a face shield at all times when grinding. ➢ Each time a grinding wheel is mounted, the maximum approved speed stamped on the wheel bladder should be checked against the shaft rotation speed of the machine to ensure the safe peripheral speed is not exceeded. A grinding wheel must not be operated at peripheral speed exceeding the manufacturer's recommendation. ➢ The flanges supporting the grinding wheel should be a maximum of 1/3 the diameter of the wheel, and must fit the shaft rotating speed according to the manufacturer's recommendation. ➢ Bench grinders are designed for peripheral grinding. Do not grind on the side of the wheel. ➢ Do not stand directly in front of grinding wheel when it is first started.
5.0 Related Documents:	➢ Occupational Safety General Regulations ➢ Health, Safety and Environment programs

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CleanEarth	Safe Work Practice	**Reviewed/Revised:** January 2021

SWP 01-03-05 Operation of Air Tools

1.0 Purpose:	This Safe Work Practice (SWP) is developed to fulfill the requirements of the Occupational Safety General Regulations and all relevant Codes of Practice and Canadian Standards. This SWP forms part of the CleanEarth HSE Program.
2.0 Definitions:	➢ **Safe Work Practice:** Safe working practice refers to ways in which work is done in an organization. This practice normally facilitates improved efficiency and small tasks to be assigned with each particular SWP
3.0 References:	➢ Policy ➢ Safe Work Procedure ➢ NS Acts & Regulation
4.0 Tasks:	➢ Regularly inspect tools and hoses before using ➢ Obtain underground utility locates for the work area ➢ Wear suitable clothing and personal protective equipment ➢ Use proper shoring or slope equipment when air back tools are used in ditch ➢ Get assistance before lifting or moving heavy objects ➢ Practice good housekeeping ➢ Keep loose fitting clothing away from rotating equipment ➢ Bleed air before disconnecting hoses ➢ Shut-off equipment while re-fuelling ➢ Do not use an air tool for any purpose other than what it is intended for
5.0 Related Documents:	➢ Occupational Safety General Regulations ➢ Health, Safety and Environment programs

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CleanEarth	Safe Work Practice	**Reviewed/Revised:** March 2020

SWP 01-03-06 **Portable Saws**

1.0 Purpose:	This Safe Work Practice (SWP) is developed to fulfill the requirements of the Occupational Safety General Regulations and all relevant Codes of Practice and Canadian Standards. This SWP forms part of the CleanEarth HSE Program.
2.0 Definitions:	➢ **Safe Work Practice:** Safe working practice refers to ways in which work is done in an organization. This practice normally facilitates improved efficiency and small tasks to be assigned with each particular SWP
3.0 References:	➢ Policy ➢ Safe Work Procedure ➢ NS Acts & Regulation
4.0 Tasks:	➢ Always wear personal protective equipment (i.e. Safety glasses, ear plugs, hard hat). ➢ Disconnect the plug from the electrical power outlet before you inspect parts, make adjustment, or insert the blade. ➢ Make certain that you have inserted the correct blades. ➢ Hold or clamp the board to be cut so that it will not vibrate or slip loose. ➢ Always hold saw firmly. ➢ Allow the blade to come to full speed before starting to cut. ➢ Protect your clothing from the blade. (No loose clothing). ➢ Concentrate on what you are doing
5.0 Related Documents:	➢ Occupational Safety General Regulations ➢ Health, Safety and Environment programs

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CleanEarth	Safe Work Practice	**Reviewed/Revised:** January 2021

SWP 01-03-07 **Use of Portable Arc Welders**

1.0 Purpose:	This Safe Work Practice (SWP) is developed to fulfill the requirements of the Occupational Safety General Regulations and all relevant Codes of Practice and Canadian Standards. This SWP forms part of the CleanEarth HSE Program.
2.0 Definitions:	➢ **Safe Work Practice:** Safe working practice refers to ways in which work is done in an organization. This practice normally facilitates improved efficiency and small tasks to be assigned with each particular SWP
3.0 References:	➢ Policy ➢ Safe Work Procedure ➢ NS Acts & Regulation
4.0 Tasks:	➢ Be sure the machine is firmly attached to the transporting unit. ➢ Check all fluid levels, water, oil and gas to be sure they are at acceptable levels for operation. ➢ When fuelling, DO NOT "top off" the gas tank. Gasoline expands as the outside temperature rises, this may result in seepage and an ensuing fire. ➢ Do not fuel the machine while it is running. ➢ Be sure the radiator and gas caps are in proper working order and securely attached. ➢ Do a "walk around" to check for damage and obvious leaks. ➢ Any repairs should be done by qualified mechanics or technicians. ➢ Make sure all cables are wound securely when transporting. ➢ Ensure the side covers are kept closed to protect the machine from any damage from external objects and outside weather, as well as to protect the operator and others from the moving parts of the machine.
5.0 Related Documents:	➢ Occupational Safety General Regulations ➢ Health, Safety and Environment programs

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CleanEarth	Safe Work Practice	**Reviewed/Revised:** January 2021

SWP 01-03-08 **Use of Portable Grinders**

1.0 Purpose:	This Safe Work Practice (SWP) is developed to fulfill the requirements of the Occupational Safety General Regulations and all relevant Codes of Practice and Canadian Standards. This SWP forms part of the CleanEarth HSE Program.
2.0 Definitions:	➢ **Safe Work Practice:** Safe working practice refers to ways in which work is done in an organization. This practice normally facilitates improved efficiency and small tasks to be assigned with each particular SWP
3.0 References:	➢ Policy ➢ Safe Work Procedure ➢ NS Acts & Regulation
4.0 Tasks:	➢ Familiarize yourself with the grinder operation before commencing work. Ensure proper guards are in place and that safety glasses, face shields, gloves and safety boots are worn when using portable grinders. ➢ Never exceed the maximum wheel speed (every wheel is marked). Check the speed marked on the wheel and compare it to the speed on the grinder. ➢ When mounting the wheels, check them for cracks and defects, ensure that the mounting flanges are clean and the mounting blotters are used. Do not over tighten the mounting nut. ➢ Before grinding, run newly mounted wheels at operating speed to check for vibrations. ➢ Do not use grinders near flammable materials. ➢ Never use the grinder for jobs for which it is not designed, such as cutting.
5.0 Related Documents:	➢ Occupational Safety General Regulations ➢ Health, Safety and Environment programs

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CleanEarth	**Safe Work Practice – Box Cutters & Knives**	**Reviewed/Revised:** January 2021

SWP 01-03-10 **Box Cutters & Knives**

1.0 Description:

Prevention of injury while using any box cutters, blades or knives. Providing the Do's and Don't to mitigate the hazards associated with the use of sharp objects like box cutters and knives.

2.0 Hazards:

- Dull or dirty blades
- Cuts

DO's	DON'T'S
• Cut away from your body • Use a flat surface to cut on • Hold knife in your stronger hand • Keep the blade sharp • Retract blade as soon as possible • Use a flat surface to cut on • Wear gloves and safety glasses	• Do not hand or toss a utility knife from one person to another, where possible put knife down on flat surface with the blade retracted and allow the other person to pick it up • Don't twist or gouge the material being cut as this may cause the blade to snap • Do not extend blade beyond one blade segment • Do not try to catch a falling knife • Do not use a knife for anything other than cutting • Do not use a dull or dirty blade • Cut towards yourself • Put your other hand by the blade when cutting

General Safe Work Practices

- Inspect knives before use, and if broken or chipped tag knife as defective and request a new blade
- When cutting deeply, use a number of small cuts and always use a sharp blade. A dull blade requires more force to make a cute which can lead to slippage. Replace blades as soon as you notice tearing material instead of cutting
- If you must remove a blade segment of a knife, and it does not have a blade removal tool, you must:
  - Wear protective gloves
  - Use pliers to apply pressure to the blade until the tip breaks off
  - Dispose of the blade properly

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CleanEarth	Safe Work Practice	**Reviewed/Revised:** January 2021

SWP 01-03-11 Hoses & Couplings

1.0 Purpose:	This Safe Job Practice (SWJP) is developed to fulfill the requirements of the Occupational Safety General Regulations and all relevant codes of practice and Canadian standards. This SWP forms part of the CleanEarth HSE Program.
2.0 Hazards:	➢ Failure of hose and loss of fluid containment ➢ Injury due to worn rubber, causing exposed wire ➢ Weather damage and cracks causing failure or rupture
3.0 PPE:	Hard hat, Safety glasses, CSA approved boots, gloves, FR reflective coveralls
4.0 Tasks:	➢ All hoses should be externally inspected prior to each use and thoroughly inspected at least every twelve months. ➢ Some work hoses shall be hydrostatically tested to 1.5 times the working pressure (or to appropriate industry standards) by a 3rd party (Maritime Hose) every twelve months to verify the hose assembly's integrity. All hoses must be brought to 225 psi and held for a minimum of 10 minutes, to pass certification. ➢ Hose, prior to inspection, must be de-pressured and laid out straight for inspection. ➢ Hoses that requires certificates to be in use include the underground 2" and 3" PVC lines from the soil process pad to the shop, and the 2" hoses used for transfer of oil. Hoses used by vacuum trucks to unload or load product shall be certified.
5.0 Inspection Checklist:	See following page.

Inspect for:	Corrective Action:
Look for cuts, gouges, or worn spots in textile or wire reinforcement.	Remove hose from service. If possible, cut out bad spots, re-couple and hydrostatically test hose assemble before returning to service
Inspect hoses for soft spots, bulges in cover, section of mashed flat hose or kinked areas.	Remove hose from service. If possible, cut out bad spots, re-couple and hydrostatically test hose assembly before returning to service
Carefully examine a length of the hose (18' in length adjacent to where the coupling is attached) for any damage, such as kinks, soft spots, cracked covers, or permanent deformation of the hose from its original condition.	Remove hose from service. If possible, cut out bad spots, re-couple and hydrostatically test hose assembly before returning to service.
Check couplings for any slippage which is with evident by misalignment of the coupling on the hose and/or scored or exposed areas on the hose cover next to the coupling has occurred.	Remove hose from service, re-couple and hydrostatically test hose assembly before returning to service.
Inspect for hose cover blisters or loose outer cover. If this phenomenon is found remove hose from service; this may be evidence of a conveyed material passing through the carcass of the hose	Remove hose from service, re-couple and hydrostatically test hose assembly before returning to service.
Inspect the inside of the hose by looking down the inside of the bore with a flashlight. Examine the inside of the hose for blisters, soft or gummy spots, cracks in the tube, loose tubes, a tube that is worn excessively thin, or a tube swelling where the ID (inside diameter) of the hose is smaller than the manufactures shipped ID	Remove hose from service and scrap.
Inspect coupling for worn parts that prevent normal function, damage to any safety devices that prevent them from working, threads worn or damaged, excessive corrosion or rust, any cracks observed in any part of the cup fitting	Remove coupling from hose and scrap old coupling. Hydrostatically test hose.
Inspect hose grounding wire for continuity. Check with multi meter to verify grounding integrity. Check between hose fittings. (If applicable).	If readings are above 0 ohms take out of service.

CleanEarth	Safe Work Practice	**Reviewed/Revised:** January 2021

SWP 01-03-12 **Air Compressors**

1.0 Purpose:	This Safe Work Practice (SWP) is developed to fulfill the requirements of the Occupational Safety General Regulations and all relevant codes of practice and Canadian standards. This SWP forms part of the CleanEarth HSE Program.
2.0 Hazards:	➢ Injury due to air lines coming apart – improperly connected or not checked before use, powered turned on.
3.0 PPE:	The following personal protective equipment (PPE) must be worn during the operation of air compressors: 1. Safety glasses/goggles 2. Hardhat 3. Coveralls 4. Safety boots 5. Gloves 6. High visibility vests if in mobile equipment travel area 7. Hearing Protection
4.0 Tasks:	1. Ensure all flammable materials are safely stored. 2. Pre-operational safety checks are to be completed including the following: 2.1 Ensure no slip/trip hazards are present in the workspaces and walkways. 2.2 Locate the compressor in a suitable location for safe operation. 2.3 Lock the wheels on the base of the compressor to prevent movement. 2.4 Check that all fittings and connections are in good condition and securely connected prior to starting. Whip checks are required at hose joints. 2.5 Faulty equipment must not be used. Immediately report suspect machinery. 2.6 Locate and ensure you are familiar with the operation of the ON/OFF starter. 3. Operational checks should be completed while the equipment is in use, these include the following: 3.1 Start the compressor nothing pressure increase and cut-out/cut-in pressure. 3.2 Listen for any air leaks from any flexible airlines and immediately report if any leaks are observed. 3.3 Adjust pressure regulator to suit work requirements. 3.4 Check the compressor at regular intervals.

CleanEarth	Safe Work Practice	Reviewed/Revised: January 2021

SWP 01-03-15 **Hand & Power Tools**

1.0 Purpose:	This Safe Work Practice (SWP) is developed to fulfill the requirements of the Occupational Safety General Regulations and all relevant codes of practice and Canadian standards. This SWP forms part of the CleanEarth HSE Program.
2.0 Hazards:	➢ Hand injuries ➢ Eye injury ➢ Electric shock ➢ Injury due to dropping, projectiles and slips ➢ Guards not in place
3.0 PPE:	The following personal protective equipment (PPE) must be worn during the use of hand and power tools: 1. Safety glasses/goggles 2. Hardhat 3. Safety boots 4. Coveralls 5. Gloves ➢ High visibility vests if in mobile equipment travel area
4.0 Tasks:	**1. General requirements** 1.1. All tools, regardless of ownership, shall be of an approved type and maintained in good condition. (Tools are subject to inspection at any time. A supervisor has the authority and responsibility to condemn unsafe tools, regardless of ownership). 1.2. Unsafe tools shall be tagged with an unsafe tag to prevent their use. 1.3. Employees shall always use the proper tool for the job to be performed. Makeshift and substitute tools shall not be used. 1.4. Hammers with metal handles, screwdrivers with metal continuing through the handle, and metallic measuring tapes shall not be used on or near energized electrical circuit or equipment. 1.5. Tools shall not be thrown from place to place or from person to person; tools that must be raised or lowered from one elevation to another shall be placed in tool buckets or firmly attached to hand lines. 1.6. Tools shall never be placed unsecured on elevated places. 1.7. Impact tools such as chisels, punches, and drift pins that become mushroomed or cracked shall be dressed, repaired, or replaced before further use. 1.8. Chisels, drills, punches, ground rods, and pipes shall be held with suitable holders or tongs (not with the hands) while being struck by another employee. 1.9. Shims shall not be used to make a wrench fit. 1.10. Wrenches with sprung or damaged jaws shall not be used.

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1.11. Pipe shall not be used to extend a wrench handle for added leverage unless the wrench was designed for such use.

1.12. Tools shall be used only for the purposes for which they have been approved.

1.13. Tools with sharp edges shall be stored and handled so that they will not cause injury or damage.

1.14. They shall not be carried in pockets unless suitable protectors are in use to protect the edge.

1.15. Wooden handles that are loose, cracked, or splintered shall be replaced. The handle shall not be taped or lashed with wire.

1.16. Tools shall not be left lying around where they may cause a person to trip or stumble.

1.17. When working on or above open grating, a canvas or other suitable covering shall be used to cover the grating to prevent tools or parts from dropping to a lower level where others are present, or the danger area shall be barricaded or guarded.

1.18. The insulation on hand tools shall not be depended upon to protect users from high voltage shock (except approved live line tools).

2. Portable Electric Tools

2.1. The non-current carrying metal parts of portable electric tools such as drills, saws, and grinders shall be effectively grounded when connected to a power source unless:

a. The tool is an approved double-insulated type, or

b. The tool is connected to the power supply by means of an isolating transformer or other isolated power supply.

2.2. All powered tools shall be examined prior to use to insure general serviceability and the presence of all applicable safety devices.

2.3. Powered tools shall be used only within their design and shall be operated in accordance with the instructions of the manufacturer.

2.4. All tools shall be kept in good repair and shall be disconnected from the power source while repairs or adjustments are being made.

2.5. Electrical tools shall not be used where there is hazard of flammable vapours, gases, or dusts.

2.6. Ground fault circuit interrupters or assured grounding inspection programs shall be used with portable electric tools on construction sites in compliance with OSHA 29CFR 1910.309 and 29CFR 1926.404(b)(1). This does not apply to equipment run off of portable or truck mounted generators at 5kw or less that are isolated from ground or to equipment run directly off of secondaries.

3. Pneumatic and hydraulic tools

3.1. Compressed air and compressed air tools shall be used with care.

3.2. Pneumatic tools shall never be pointed at another person.

	3.3.	Pneumatic power tools shall be secured to the hose or whip by some positive means to prevent the tool from becoming accidentally disconnected.
	3.4.	Safety clips or retainers shall be securely installed and maintained on pneumatic impact (percussion) tools to prevent attachments from being accidentally expelled.
	3.5.	Compressed air shall not be used for cleaning purposes, except where reduced to less than 30 psi and then only with effective chip guarding and personal protective equipment.
	3.6.	Compressed air shall not be used to blow dust or dirt from clothing.
	3.7.	The manufacturers stated safe operating pressure for hoses, pipes, valves, filters, and other fittings shall not be exceeded.
	3.8.	The use of hoses for hoisting or lowering tools shall not be permitted.
	3.9.	Before making adjustments or changing air tools, unless equipped with quick-change connectors, the air shall be shut off at the air supply valve ahead of the hose. The hose shall be bled at the tool before breaking the connection.
	3.10.	Compressed air tools, while under pressure, must not be left unattended.
	3.11.	All connections to air tools shall be made secure before turning on air pressure. Air Hose joints are to be secured with a whip check.
	3.12.	Air at the tool shall not be turned on until the tool is properly controlled.
	3.13.	All couplings and clamps on pressurized air hose shall be bridged with suitable fasteners.
	3.14.	When fabricating air hose fittings, place the hose in warm water to ease the insertion of the end fitting.
	3.15.	Use only approved end fitting clamps (screw type heater hose clamps are not acceptable).
	3.16.	While blowing down hose, do not point it toward people.
	3.17.	Powered tools are to be operated only by competent persons who have been trained in their proper use.
	3.18.	Conductive hose shall not be used near energized equipment.

CleanEarth	**Safe Work Practice**	**Reviewed/Revised:** January 2021

SWP 01-03-16 **Circular Saw**

1.0 Purpose:	This Safe Job Procedure (SJP) is developed to fulfill the requirements of the Occupational Safety General Regulations and all relevant codes of practice and Canadian standards. This SJP forms part of CleanEarth Technologies HSE Program.
2.0 Hazards:	➢ Loose clothing ➢ Dull blade in use. ➢ Improper blade for product being cut. ➢ Item being cut not properly secured. ➢ Guards not in place. ➢ Placing hands near blade.
3.0 PPE:	The following personal protective equipment (PPE) must be worn during the operation of circular saw: ➢ Safety glasses/goggles ➢ Hardhat ➢ Safety boots ➢ Coveralls ➢ Gloves ➢ High visibility vests if in mobile equipment travel area ➢ Hearing protection
4.0 Tasks & Warnings:	1. Rings and jewellery must not be worn. 2. Long and loose hair must be contained 3. Cutting irregular stock, branches or wood with embedded nails or screws is forbidden. 4. Pre-operational safety checks are to be completed, including the following 4.1 Check workspaces and walkways to ensure that no slip/trip hazards are present. 4.2 Check that all safety guards are in position and are set to the maximum clearance from the work piece being cut. 4.3 Locate and ensure you are familiar with the operation of the ON/OFF starter and E-Stop (if fitted). 4.4 Ensure all locks are securely tightened. 4.5 Ensure table and work area is clear of all tools, off-cut timber and sawdust. 4.6 Start the dust extraction unit before using the machine. 5 During operation safety checks must be completed, including the following: 5.1 Do not cut freehand 5.2 Allow the saw blade to obtain maximum speed before making a cut. 5.3 Use push stick (at least 400 mm long) to guide timber through saw.

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	5.4 Always stand to one side of the line of cut. 5.5 Never remove off cuts or sawdust from the saw table while the saw is running. 5.6 Before making adjustments, switch off and bring the machine to a complete stand still. 5.7 Never leave the machine running unattended. 5.8 Remove the rip fence when using the mitre gauge. 5.9 Make sure someone “tails out” when cutting long material.

CleanEarth	Safe Work Practice	**Reviewed/Revised:** January 2021

SWP 01-03-17 **Pressure Washers**

1.0 Purpose:	This Safe Work Practice (SWP) is developed to fulfill the requirements of the Occupational Safety General Regulations and all relevant codes of practice and Canadian standards. This SWP forms part of the CleanEarth HSE Program.
2.0 Hazards:	➢ Eye Injuries ➢ Spraying/flying debris ➢ Electrical shock
3.0 PPE:	The following personal protective equipment (PPE) must be worn during the operation of pressure washers: 1. Safety glasses/goggles 2. Hardhat 3. Safety boots 4. Coveralls 5. Gloves 6. Hearing Protection High visibility vests if in mobile equipment travel area
4.0 Tasks:	1. Never point the spray gun at other persons or any part of the body. 2. Never put hands or fingers over the spray tip while in operation. 3. Never use your hands to stop or detect leaks. 4. Always shut off the unit and trigger the pressure gun to relieve system pressure before removing the spray tip or before performing any machine service. 5. Never exceed the factory pressure or temperature rating of the system. Be sure all accessory equipment and system components used will withstand the pressure developed. 6. Never let the pump run without water supply flowing through the unit. 7. Never let the unit run for more than five minutes with the gun in the closed position. 8. Never attempt to clean or wash down the machine using its own spray gun. 9. Never leave an operating machine unattended. Always shut off the machine and relieve pressure before leaving the machine. 10. Never spray liquids or toxic chemicals such as insecticides or weed killer. 11. Do not operate the machine where combustible fumes or dust may be present. 12. Do not use detergents, which are not compatible with the discharge hose. Read and follow the instructions given by the detergent's manufacturer. Also follow directions on the container regarding contact with the eyes, nose, and skin. 13. Always disconnect the electrical plug before performing any repairs or service on the machine. Do not attempt repairs or modifications you do not understand. Contact your servicing dealer. 14. Do not route hose in a manner that will cause sharp bending, kinking, cutting, abrasion, or exterior damage.

	15. Do not pull on the hose to move the machine, untangle knots, or use any other excessive pulling stresses.

SWP 01-04-01 **Fire Fighting**

1.0 Purpose:	This Safe Work Practice (SWP) is developed to fulfill the requirements of the Occupational Safety General Regulations and all relevant Codes of Practice and Canadian Standards. This SWP forms part of the CleanEarth HSE Program.
2.0 Definitions:	➢ **Safe Work Practice:** Safe working practice refers to ways in which work is done in an organization. This practice normally facilitates improved efficiency and small tasks to be assigned with each particular SWP
3.0 References:	➢ Policy ➢ Safe Work Procedure ➢ NS Acts & Regulation
4.0 Tasks:	**4.1 - Types of Fires** ➢ **Class A:** These fires consist of wood, paper, rags, rubbish and other ordinary combustible materials. ○ **Recommended Extinguishers:** Water from a hose, pump type water can, or pressurized extinguisher, and soda acid extinguishers. ○ **Fighting the Fire:** Soak the fire completely-even the smoking embers. ➢ **Class B:** Flammable liquids, oil and grease ○ **Recommended Extinguishers:** ABC units, dry chemical, foam and carbon dioxide extinguishers. ○ **Fighting the Fire:** Start at the base of the fire and use a swinging motion from the left to right, always keeping the fire in front of you. ➢ **Class C:** Energized Electrical Fires ○ **Recommended Extinguishers:** Carbon dioxide and dry chemical (ABC units) extinguishers. ○ **Fighting the Fire:** Use short bursts on the fire. When the electrical current is shut off on a Class C fire, it can become a Class A fire if the materials around the electrical fire are ignited. ➢ **Class D:** this class of fire involves combustible metals. Magnesium and Titanium are the most common types of metal fires. ○ **Recommended Extinguishers:** Dry powder extinguishing agent.

**** The safety information in this policy does not take precedence over the Occupational Health and Safety Act. All workplace parties must be familiar with the Occupational Health and Safety Act and Regulations.***

	○ **Fighting the Fire:** Once a metal ignites do not use water in an attempt to extinguish it. Only use a Dry Powder extinguishing agent to smother and absorb the heat. ➢ Fire Extinguishers are always of suitable types and sizes. When Identifying the type and quantity of fire protection required CEIS employers will consider; (a) where the workplace is an occupied or enclosed structure, or (b) where the workplace is a project. ➢ **P –** pull the pin **A –** aim at the base of the fire **S –** squeeze the handle **S –** sweep from side to side ➢ Fire Extinguishers are readably available ➢ Fire Extinguishers are maintained and serviced in accordance with manufacturers specifications ➢ All flammable substances are stored separately from ignition sources and other substances which they may react with.
5.0 Related Documents:	➢ Occupational Safety General Regulations ➢ Health, Safety and Environment programs

CleanEarth	Safe Work Practice	**Reviewed/Revised:** January 2021

SWP 01-04-02 **Use of Tiger Torches**

1.0 Purpose:	This Safe Work Practice (SWP) is developed to fulfill the requirements of the Occupational Safety General Regulations and all relevant Codes of Practice and Canadian Standards. This SWP forms part of the CleanEarth HSE Program.
2.0 Definitions:	➢ **Safe Work Practice:** Safe working practice refers to ways in which work is done in an organization. This practice normally facilitates improved efficiency and small tasks to be assigned with each particular SWP
3.0 References:	➢ Policy ➢ Safe Work Procedure ➢ NS Acts & Regulation
4.0 Tasks:	➢ Tiger torches, although valuable to a job-site, are sometimes misused in a manner that can make them dangerous. ➢ Tiger torches are only to be used for preheating of piping etc. prior to welding. ➢ When a torch is used, an adequate fire extinguisher must be present. ➢ Torches are not to be used for heating of work areas or thawing of lines and equipment, etc., when the equipment is not in use. ➢ Ensure that the propane bottles are properly shut off. ➢ Fuel lines are to have regulators. ➢ Propane bottles shall be secured in an upright position
5.0 Related Documents:	➢ Occupational Safety General Regulations ➢ Health, Safety and Environment programs

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CleanEarth	**Safe Work Practice**	**Reviewed/Revised:** January 2021

SWP 01-04-03 **Oxygen-Acetylene Torches**

1.0 Purpose:	This Safe Work Practice (SWP) is developed to fulfill the requirements of the Occupational Safety General Regulations and all relevant codes of practice and Canadian standards. This SWP forms part of the CleanEarth HSE Program.
2.0 Hazards:	➢ Leaking hoses ➢ Faulty/Damaged Regulators ➢ Fire ➢ Too much flow through hoses.
3.0 PPE:	The following personal protective equipment (PPE) must be worn during the use of oxygen-acetylene torches: ➢ Safety glasses/goggles ➢ Hardhat ➢ Safety boots ➢ Coveralls ➢ Gloves ➢ High visibility vests if in mobile equipment travel area
4.0 Tasks:	1. Assemble all materials to be welded and have them clamped and prepared for cutting. 2. Ensure oxygen and acetylene cylinders are secured to the cart of the wall. 3. Prior to attaching the gauges you will want to 'crack the cylinder' to remove any dirt from the cylinders valve prior to hooking up the gauges. Follow these directions to safely 'crack' a cylinder: • Stand to the side of the cylinder • Make sure the cylinder's valve is pointing away from you • Make certain that any gas coming out of the cylinder's valve will not hit any oily material • Make certain that the gas that escapes from your cylinder's valve will not create a problem for other activities going on in the area. • Before attaching regulators, open the valve slightly for an instant and then close • This removes any dust or foreign particles from the area where the gauges are to be attached • Attach the regulators and release the adjusting screw on each of the regulators (this will keep the cylinder's contents from flowing when the main valve is opened.) 4. Inspect both oxygen and acetylene hoses for signs of cracking. Do not use if cracking exists. 5. Install the desired torch head; make sure to inspect the o-rings on the torch to make sure there are no signs of cracking or splits. 6. Locate a striker and make sure it makes a spark when activated. 7. Make sure the valves are closed on the torch head. 8. Stand to the side of the gauges and open the acetylene cylinder slowly, about ¼ turn (90 degrees). Never open an acetylene cylinder more than ¾

turn (270 degrees), and never operate acetylene at pressures greater than 15 psi. Acetylene gas is very unstable and it is quite unsafe at high pressures.

9. Make sure the cylinder's key (used to open the cylinder's valve) stays on the cylinder, in the event that the cylinder needs to be shut off quickly.
10. Using the valves at the torch, purge both oxygen and fuel from the lines prior to lighting the torch.
11. Stand to the side of the gauges and slowly open the oxygen cylinder and eventually open it all the way.
12. With striker in hand, gloves on, welding goggles on, you are ready to start the flame.
13. Slightly open the acetylene valve on the torch and then use the striker to ignite the acetylene. Adjust this flame until you have the appropriate flame for what you are trying to do. To adjust this flame you will need to increase or decrease the acetylene pressure, via the adjusting screw, on the gauge mounted on the cylinder. Remember; never operate acetylene gas at pressures greater than 15 psi.
14. Once the acetylene flame is established and the flame is stable, you are ready to introduce the oxygen gas into the flame. Turn the adjusting screw on the gauge assembly to the desired pressure. Slowly open the oxygen valve at the torch head and make an adjustment to achieve the desired flame. To develop the flame you desire, you may have to increase or decrease the oxygen pressure at the gauge.
15. Cut as necessary, using precautions to avoid contacting the gas hoses against anything hot.
16. Occasionally you may want to feel the acetylene cylinder and make sure it isn't heating up. If it is heating up shut the acetylene cylinder immediately.
17. When you are finished cutting, the acetylene valve at the torch should be closed first, and then the oxygen valve should be closed secondly.
18. With both valves closed at the torch, you should then close the valves on both the oxygen and acetylene cylinders.
19. Now that the cylinders valves are closed, open the torches valves and relieve the pressure off the gauges.
20. Release the adjusting screws on the gauges so that the next time you hook them up they will be in the correct state.
21. Put all equipment away and clean up after yourself.

CleanEarth	Safe Work Practice	**Reviewed/Revised:** January 2021

SWP 01-05-01 **Battery Boosting**

1.0 Description:

Improper battery boosting can lead to serious injury. Batteries commonly explode when improperly boosted, leading employees at risk of acid burn and injuries from flying objects.

2.0 Hazards:

- Exploding battery
- Flying Objects
- Sparks

DO's	DON'T'S
• Wear basic PPE including rubber gloves • Turn the engine off in the vehicle with the good battery	• Never jumpstart a battery if fluids are frozen • If the battery is cracked or leaking do not boost the battery, this could lead to an explosion • Never let the ends of the jumper cables touch, this can lead to sparks or electrical damage

- Ensure start switch and all accessories are off on boosted vehicle.
- Stop engine of boosting vehicle.
- Ensure battery caps are in place.
- Connect positive (+) jumper cable to positive (+) cable terminal of discharged battery.
- NOTE: Batteries in series may be located in separate compartments. Use terminal that is connected to starter solenoid.
- Connect the other end of the positive (+) jump cable to the positive (+) terminal of boost battery.
- Connect one end of the negative (-) jump valve to the negative (_) boost battery terminal.
- Connect remaining negative (-) cable to frame (not battery negative post) away from battery, fuel or hydraulic lines or moving parts.
- Start engine of boost vehicle.
- Wait a minimum of two minutes for the batteries in the boosted vehicle to partially charge.
- Attempt to start the boosted vehicle.
- Immediately after starting the engine, disconnect the jump cables in reverse order.

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CleanEarth	Safe Work Practice	**Reviewed/Revised:** January 2021

SWP 01-05-02 **Cranes, Hoists, Lifts**

1.0 Purpose:	Lifting devices, such as cranes, hoists, forklifts, lift trucks, scissor lifts, etc. are used to minimize the hazards associated with materials handling operations. These devices must be operated, maintained and regularly inspected by trained competent individuals only.
2.0 Definitions:	➢ **Safe Work Practice:** Safe working practice refers to ways in which work is done in an organization. This practice normally facilitates improved efficiency and small tasks to be assigned with each particular SWP. ➢ **Cranes**: A machine used for moving heavy objects, typically by suspending them from a projecting arm or beam. ➢ **Hoists**: An act of raising or lifting something. ➢ **Forklifts**: A vehicle with a pronged device in front for lifting and carrying heavy loads. ➢ **Scissor Lifts**: An aerial device or elevating work platform is a mechanical device used to provide temporary access for people
3.0 References:	➢ NS Acts & Regulations ➢ Safe Job Procedure ➢ Safe Job Practice
4.0 General:	➢ A Crane, Hoist or Lifting device shall be operated only by a trained,designated competent person who has been authorized to operate the equipment ➢ A signal person must be utilized when operators view is obstructed ➢ An Operator shall inspect the equipment each shift before using the equipment. Any defects found during inspection or operation shall be reported to the Supervisor and written into works orders. If a defect affects he safe operation of the device, then the device will not be used until defect has been remedied. ➢ A fire extinguisher with at least a 10BC rating shall be available in each Crane cab. Every other motorized lifting device shall have an adequate fire extinguisher with the equipment. ➢ The rates capacity of the Crane or Hoist shall be permanently indicated on the Equipment. The rated capacity of the Crane or Hoist shall not be exceeded when being operated; the safe work load as determined by the Manufacturer. ➢ A record shall be provided and maintained for a Crane, Hoist or lifting Device. This record shall be available to all Operators and will contain all maintenance history, inspections and any Structural modifications. ➢ Work must be arranged so that no load passes over other workers or workers pass under the load. If this isn't possible all workers affected must be notified. No worker shall pass or stand under a suspended load. ➢ Crane or Hoist Operators shall act only on the directions of a designated and competent Signaler when the Operator does not have a clean and unobstructed view of the load and load hook throughout the entire operation.

CleanEarth	Safe Work Practice	**Reviewed/Revised:** January 2021

SWP 01-05-03 **General Rigging**

1.0 Description:

Knowledge of the equipment and materials with which we work is one of the most important factors in occupational health and safety. Each item has been designed and developed to serve a specific purpose. Recognizing its capabilities and limitations not only improves efficiency but minimizes hazards and helps prevent accidents. This SWP identifies the basic hazards in rigging and hoisting, explains the safeguards necessary to control or eliminate these hazards, and spells out other essential safety requirements.

2.0 Hazards:

- Lines breaking
- Fall objects
- Hand injuries
- Weather conditions

DO's	DON'T'S
• Determine the weight of the object or load prior to lift to make sure that the lifting equipment can operate within its capabilities. • Where chain slings are used, select only alloy chain slings • Use slings of proper length • Inspect all slings thoroughly at specified intervals and maintain them in good condition. • Inspect each chain or sling for cuts, nicks, bent links, bent hooks, etc., before each use. If in doubt, don't use it. • Ensure that safety latches on hoods are in good working condition. • Estimate the center of gravity or point of balance. The lifting device should be positioned immediately above the estimated centre of gravity. • Make sure the hoist or crane is directly over the load.	• ***NEVER*** exceed the working load limits. • Never shorten a line by twisting or knotting. With chain slings, never use bolts or nuts. • Never use equipment that looks worn or distressed

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Riggers must

- know the load
- judge distances
- properly select tackle and lifting gear, and
- direct the operation.

The most important job of any lifting operation is rigging the load. Poor rigging may result in jury to personnel, property damage, and other hazards.

The single most important rigging precaution is to determine the weight of the load before attempting to lift it. The weight of the load will in turn determine the lifting device, such as a crane, and the rigging gear to be used.

It is also important to rig a load so that it will be stable- that is, motionless while being lifted.

The rated capacity of rigging equipment is clearly marked on equipment at CleanEarth and must not be exceeded

All hooks have safety latches

Pre-use inspections are always completed before work begins

Defective equipment must be removed and serviced or replaced immediately.

General Requirements

1. When inspecting steel alloy chain slings, pay special attention to nicks, gouges, cracks, corrosion pits, stretching, and distorted or worn fittings. Replace the entire sling if any part is damaged, has more than 10% wear or 5% stretch, and if the hook is twisted more than 10 degrees or opened up more than 15% at the throat.
2. Wire rope slings must be replaced if there is severe corrosion, localized wear (shiny worn spots), a 1/3 reduction in outer wire diameter, excessive stretching, damage or displacement of end fittings, more than 10 broken wires in one lay, or evidence of damage to the rope structure such as kinking, crushing, birdcaging, or other distortion.
3. Do not use synthetic web slings that have burns, broken or worn stitches, excessive stretch, exposed warning stitches (usually red yarn), snags, punctures, tears or cuts, or distorted fittings.
4. Inspect for broken wires in metal mesh slings, lack of sling flexibility, kinks or twists in the edge, 25% reduction in wire diameter due to abrasion, and broken brazed joints or welds on the edge.
5. Store slings vertically on a rack of wall to minimize the risk of damage and for easy access.
6. Lift only from solid attachment points.
7. Before making the lift, make sure the weight and balance of the load are known and the sling is securely positioned around the load.
8. Guard against shock loading by taking up slack in the sling slowly.
9. Operators must know and must not exceed the working load limit (rated capacity) of the sling.
10. The working load limit is calculated by dividing the breaking strength of the sling by five.
11. Do not lift items that exceed the working load limits of the sling.

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CleanEarth	**Safe Work Practice**	**Reviewed/Revised:** January 2021

Safe Practices for Using Chains

1. Take up slack slowly and see that every link in the chain seats properly. Never put strain on a kinked chain. If the links do not slide freely within each other, the chain is damaged and must be removed from service.
2. Do not use a hammer to force a hook over a chain link.
3. See that the load is always properly set in the bowl of the hook.
4. Never attempt to repair the welded components on a sling. A broken chain must not be spliced with a bolt or any other type of coupling.

Safe Practices for Using Wire Rope Slings

1. Lubricate the chain for longer service life. Before applying lubricant, make sure the sling is as dry and clean as possible. Lubricating a dirty or damp sling promotes corrosion.
2. Avoid bending wire rope around small radius bends.

Safe Practices for Synthetic Web Slings

1. Synthetic web slings cannot be repaired; damaged slings must be discarded.
2. Do not join slings by knotting. Stretching is the only accepted method of attaching end fitting or forming eyes.
3. If you hear a noise like popcorn popping when using a synthetic sling, it is a signal that the sling is breaking. Immediately set the load down, remove the sling, and inspect it.

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CleanEarth	Safe Work Practice	**Reviewed/Revised:** January 2021

SWP 01-05-04 Safe Use of Slings, Chains & Wire Rope

1.0 Purpose:	This Safe Work Practice (SWP) is developed to fulfill the requirements of the Occupational Safety General Regulations and all relevant Codes of Practice and Canadian Standards. This SWP forms part of the CleanEarth HSE Program.
2.0 Definitions:	➢ **Safe Work Practice:** Safe working practice refers to ways in which work is done in an organization. This practice normally facilitates improved efficiency and small tasks to be assigned with each particular SWP
3.0 References:	➢ Policy ➢ Safe Work Procedure ➢ NS Acts & Regulation
4.0 Tasks:	**General Requirements** 1. When inspecting steel alloy chain slings, pay special attention to nicks, gouges, cracks, corrosion pits, stretching, and distorted or worn fittings. Replace the entire sling if any part is damaged, has more than 10% wear or 5% stretch, and if the hook is twisted more than 10 degrees or opened up more than 15% at the throat. 2. Wire rope slings must be replaced if there is severe corrosion, localized wear (shiny worn spots), a 1/3 reduction in outer wire diameter, excessive stretching, damage or displacement of end fittings, more than 10 broken wires in one lay, or evidence of damage to the rope structure such as kinking, crushing, birdcaging, or other distortion. 3. Do not use synthetic web slings that have burns, broken or worn stitches, excessive stretch, exposed warning stitches (usually red yarn), snags, punctures, tears or cuts, or distorted fittings. 4. Inspect for broken wires in metal mesh slings, lack of sling flexibility, kinks or twists in the edge, 25% reduction in wire diameter due to abrasion, and broken brazed joints or welds on the edge. 5. Store slings vertically on a rack of wall to minimize the risk of damage and for easy access. 6. Lift only from solid attachment points. 7. Before making the lift, make sure the weight and balance of the load are known and the sling is securely positioned around the load. 8. Guard against shock loading by taking up slack in the sling slowly. 9. Operators must know and must not exceed the working load limit (rated capacity) of the sling. 10. The working load limit is calculated by dividing the breaking strength of the sling by five. 11. Do not lift items that exceed the working load limits of the sling.

**** The safety information in this policy does not take precedence over the Occupational Health and Safety Act. All workplace parties must be familiar with the Occupational Health and Safety Act and Regulations.***

	Safe Practices for Using Chains 1. Take up slack slowly and see that every link in the chain seats properly. Never put strain on a kinked chain. If the links do not slide freely within each other, the chain is damaged and must be removed from service. 2. Do not use a hammer to force a hook over a chain link. 3. See that the load is always properly set in the bowl of the hook. 4. Never attempt to repair the welded components on a sling. A broken chain must not be spliced with a bolt or any other type of coupling. **Safe Practices for Using Wire Rope Slings** 1. Lubricate the chain for longer service life. Before applying lubricant, make sure the sling is as dry and clean as possible. Lubricating a dirty or damp sling promotes corrosion. 2. Avoid bending wire rope around small radius bends. **Safe Practices for Synthetic Web Slings** 1. Synthetic web slings cannot be repaired; damaged slings must be discarded. 2. Do not join slings by knotting. Stretching is the only accepted method of attaching end fitting or forming eyes. 3. If you hear a noise like popcorn popping when using a synthetic sling, it is a signal that the sling is breaking. Immediately set the load down, remove the sling, and inspect it. **Safe Practices for Metal Mesh Slings** 1. Do not twist or kink the edges of a metal mesh sling. 2. Never use knots, bolts, or any other unauthorized method to shorten a sling. Consult the manufacturer if it must be shortened.
5.0 Related Documents:	➢ Occupational Safety General Regulations ➢ Health, Safety and Environment programs

CleanEarth	Safe Work Practice	**Reviewed/Revised:** January 2021

SWP 01-05-05 Operation of Man & Scissor Lifts

1.0 Purpose:	This Safe Work Practice (SWP) is developed to fulfill the requirements of the Occupational Safety General Regulations and all relevant Codes of Practice and Canadian Standards. This SWP forms part of the CleanEarth HSE Program.
2.0 Definitions:	➢ **Safe Work Practice:** Safe working practice refers to ways in which work is done in an organization. This practice normally facilitates improved efficiency and small tasks to be assigned with each particular SWP
3.0 References:	➢ Policy ➢ Safe Work Procedure ➢ NS Acts & Regulation
4.0 Tasks:	➢ Only authorized and trained personnel are permitted to operate man lifts. ➢ Man lifts will be maintained, inspected and repaired by licensed technicians and mechanics. And will only be operated by competent persons ➢ Prior to each day's operation, each operator must conduct a worksite and machine inspection. ➢ Safety harness must be worn at all times when operating or riding on man lift. **4.1 - Supervisor Responsibility:** ➢ Supervisors are responsible to facilitate and/or provide proper instruction to their workers on protection requirements and training ➢ Determine type of equipment required ➢ Inspect work site **4.2 - Worker Responsibility:** ➢ Erect warning devices ➢ Erect barricades and warning signs ➢ Ensure Flag person on site ➢ Workers to be utilized and identified ➢ Ensure means of communication between operator and workers ➢ Fall protection in place
5.0 Related Documents:	➢ Occupational Safety General Regulations ➢ Health, Safety and Environment programs

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CleanEarth	**Safe Work Practice – Vehicle Safety**	Reviewed/Revised: **January 2021**

SWP 01-05-06 **Vehicle Safety**

1.0 Description:

Safe operation of vehicles while at the CleanEarth Facility and while travelling for any work related activity.

2.0 Hazards:

- Accidents
- Pedestrians
- Road Conditions
- Weather

DO's	DON'T'S
• Always wear a seatbelt • Perform a 360 inspection prior to moving your vehicle • Check fuel, oil, fluid levels and tire condition & pressure • Obey all traffic laws • Be especially cautious when driving in dangerous weather/road conditions	• Use cell phone or other technology while operating vehicles unless it is hands free equipment. • Do not ride in the back of a pickup truck • Do not overload your vehicle, check the load limit of your vehicle posted on the inside of the driver's door • Do not allow yourself to become distracting by eating, adjusting the stereo, etc • Do not carry hazardous or highly flammable items in a vehicle cab • Do not haul material in a truck bed that is not secured. • Do not position your body under the vehicle when jacked up to change a tire

General Safe Work Practices

- Exercise care for the safety of pedestrians wherever they may be crossing.
- In residential areas, slow down and be on the alert for children.
- Always observe the speed limits and adjust your speed to the conditions under which you are driving.
- Under normal conditions, follow at a distance of at least two seconds or one second for every 10 feet of vehicle length (i.e. tandem trucks should follow at least four seconds behind vehicle ahead)
- When parking your vehicle, always back into your parking stall.
- Stay alert and attentive; stop driving when tired. Follow all legislation regarding available driving hours for truck drivers.

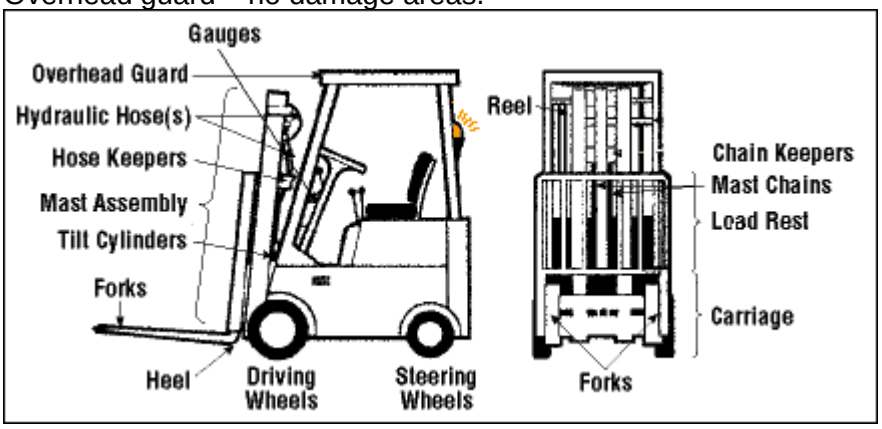
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CleanEarth	Safe Work Practice	**Reviewed/Revised:** January 2021

SWP 01-05-07 Operation of Forklift & Safe Handling of Propane Fuel

1.0 Purpose:	This Safe Work Practice (SWP) is developed to fulfill the requirements of the Occupational Safety General Regulations and all relevant codes of practice and Canadian standards. This SWP forms part of the CleanEarth HSE Program.
2.0 Hazards:	➢ Tipping of loads/machine ➢ Unit is designed for all-terrain use. Use outdoors may results in injury or damage. ➢ Turn in tight spaces – use spotters to prevent damage. ➢ Propane leaks Only trained staff are permitted to use the forklift.
3.0 PPE:	The following personal protective equipment (PPE) must be worn: ➢ Safety glasses/goggles ➢ Hardhat ➢ Coveralls ➢ Safety boots ➢ Gloves ➢ High visibility vests if in mobile equipment travel area
4.0 Tasks:	**Operation of Forklift Truck** **WHEN SHOULD AN OPERATOR INSPECT THE FORKLIFT TRUCK?** An operator should inspect the forklift truck every day before using or before each shift. **WHAT DOES A DAILY INSPECTION INVOLVE?** The operator should carry out a visual check (“circle” check) before starting the forklift. After completing the visual pre-start check, the operator should do an operational pre-use check. **WHAT SOULD AN OPERATOR INSPECT DURING THE VISUAL PRE-USE CHECK?** ➢ General condition and cleanliness ➢ Floor – clear of objects that could cause an accident ➢ Overhead – no obstructions ➢ Nearby objects to avoid as you drive away ➢ Fire extinguisher – present and charged ➢ Engine oil level, fuel level, radiator water level (LPG, gas and diesel forklifts)

- Battery – fully charged; no exposed wires; plug connections not loose, worn or dirty; vent caps not clogged; electrolyte levels in cells is adequate; secured in place by hold downs or brackets.
- Bolts, nuts, guards, chains, or hydraulic hose reels not damaged, missing or loose.
- Wheels and tires – check for wear, damage, and air pressure, if pneumatic tires.
- Forks – forks not bent; no cracks present; positioning latches in good working condition; carriage teeth not broken, chipped or worn.
- Chain anchor pins – not worn, loose or bent
- Fluid leaks – no damp spots or drips.
- Hoses – hold securely; not loose, crimped, worn or rubbing.
- Horn – working and loud enough to be heard in working environment; other warning devices operational.
- Seatbelts and/or operator restraint device (if equipped) – belts and restraints work properly; no visible wear or damage; anchors, buckles, etc. function properly.
- Overhead guard – no damage areas.



WHAT SHOULD AN OPERATOR INSPECT DURING THE OPERATIONAL PRE-USE CHECK?

- Foot Brake – pedal holds, unit stops smoothly.
- Parking Brake – holds against slight acceleration.
- Deadman Seat Break – holds when operator rises from seat.
- Clutch and Gearshift – Shifts smoothly with no jumping or jerking.
- Dash Control Panel – all lights and gauges are operational.
- Steering – moves smoothly.
- Lift Mechanism – operates smoothly (check by raising forks to maximum height then lowering forks completely).
- Tilt Mechanism – moves smoothly, holds (check by tilting mast all the way forward and backward).
- Cylinders and Hoses – not leaking after pre-use checks.
- Listen for any unusual sounds or noises.
- Lights – headlights and warning lights are operational.

Safe Handling of Propane Fuel

WHAT SHOULD AN OPERATOR DO WHEN HANDLING PROPANE FUEL?

- Position the tank so the liquid propane does not come in contact with the relief valve.
- Make sure the locking pin engages into the cylinder.
- Make sure the valve is closed tightly.
- Store the cylinder outside, in an upright position, in an area where it can be secured and is protected from being struck.
- Put the cylinder down gently. Do not drop, dent or damage.
- Always protect the valve from any damage.
- Avoid contact with liquid propane, as it can cause frostbite.
- Wear protective gloves while making or breaking connections.
- Ensure that only qualified persons repair carburetors and fuel supply systems.
- For repairs, use only components that agencies such as the CSA Group (Canadian Standards Association) have approved.
- Exchange removable cylinders outdoors or in well-ventilated area, away from sources of ignition.
- Close the valve before breaking connections.

WHAT STEPS SHOULD OPERATORS FOLLOW WHEN CHANGING FUEL TANKS?

Procedure for changing propane (LPG) cylinders:

1. Wear eye protection and insulated, loose fitting gloves such as leather (dry) or insulated neoprene.
2. Close the valve on the cylinder.
3. Run the engine until it stops. This ensures that the connection hose is empty.
4. Shut off the engine.
5. Open the connecting nut and inspect valves for leaking. DO NOT use metal tools.
6. Disconnect the hose.
7. Disconnect the holding straps.
8. Remove the empty cylinder.
9. Replace with a full cylinder in the proper position.
10. Connect the holding straps.
11. Tighten the connecting nut (wiggle hose).
12. Open the valve on the cylinder slowly and check for leaks. Use solution of soap and water. Smell – listen – look.
13. If the valve leaks:
    1st time – Tighten the nut and continue
    2nd time- Change the cylinder.
    3rd time – Change the hose.
14. Open the valve fully (slowly).
15. Check that the hose is turned inward.

**** The safety information in this policy does not take precedence over the Occupational Health and Safety Act. All workplace parties must be familiar with the Occupational Health and Safety Act and Regulations***

16. Secure the hose downward.
17. Secure the cylinder.
18. Start the engine and resume operation.

WHAT SHOULD AN OPERATOR NOT DO WHEN CHANGING A PROPANE TANK (CYLINDER)?

- Do not use metal tools when changing a cylinder.
- Do not use excessive force when opening valve
- Do not let the cylinder get too hot.
- Do not drag, drop, roll or slide cylinder or allow it to bang against other objects.
- Do not use matches or a flame to check for leaks. Use soap or a leak detector.
- Do not mount more than two LPG cylinders on any forklift truck.

CleanEarth	Safe Work Practice	**Reviewed/Revised:** January 2021

SWP 01-05-08 **Operation of Excavators**

1.0 Purpose:	This Safe Work Practice (SWP) is developed to fulfill the requirements of the Occupational Safety General Regulations and all relevant codes of practice and Canadian standards. This SWP forms part of the CleanEarth HSE Program.
2.0 Hazards:	➢ Underground and overhead lines ➢ Unstable materials ➢ Pedestrians and unnecessary people in the work area ➢ Small workspaces
3.0 PPE:	The following personal protective equipment (PPE) must be worn during operation of excavators: ➢ Safety glasses/goggles ➢ Hardhat ➢ Safety boots ➢ Coveralls ➢ Gloves ➢ High visibility vests if in mobile equipment travel area
4.0 Tasks:	1. A competent person, meaning one who is capable of identifying existing and predictable hazards in the surroundings or working conditions that are unsanitary, hazardous, or dangerous to employee and who has authorization to take prompt corrective measures to eliminate them, shall be present at all excavation work being performed. 2. All surface encumbrances that are located so as to create a hazard to employees shall be removed or supported, as necessary, to safeguard employees. 3. Utility installations, such as sewer, telephone, fuel, electric water lines, or any other underground installations that reasonably may be encountered during excavation work, shall be determined prior to opening an excavation. 4. Operators will take notice of their surrounding and will not drive or park an excavator in an area that could potentially result in the excavator tipping over. 5. No employee shall be permitted underneath loads handled by lifting or digging equipment. 6. Employees shall not be exposed to harmful levels of atmospheric contaminants such as oxygen deficient atmospheres, atmospheres containing flammable gas, and atmospheres containing other harmful gases. 7. Employees shall not work in excavations in which there is accumulated water or in excavations in which water is accumulating unless adequate precautions have been taken to protect employees against the hazards posed by water accumulation. 8. All excavated or other material shall be kept at least two feet from the edge of excavations or retaining devices shall be used to prevent excavated or

	other material and equipment from rolling into excavations. 9. Excavations more than five feet in depth, or excavations less than five feet that show indications of a potential cave-in, in which employees must work in, shall be either shored or sloped or employees must be shielded in accordance with OSHA Construction standard 1926.652.

CleanEarth	Safe Work Practice	**Reviewed/Revised:** January 2021

SWP 01-06-01 **Eye Wash Stations**

1.0 Purpose:	This Safe Work Practice (SWP) is developed to fulfill the requirements of the Occupational Safety General Regulations and all relevant Codes of Practice and Canadian Standards. This SWP forms part of the CleanEarth HSE Program.
2.0 Definitions:	➢ **Safe Work Practice:** Safe working practice refers to ways in which work is done in an organization. This practice normally facilitates improved efficiency and small tasks to be assigned with each particular SWP
3.0 References:	➢ Policy ➢ Safe Work Procedure ➢ NS Acts & Regulation
4.0 Tasks:	It is important that a safe and functional eye wash station is located in areas where chemicals are in use. Eye wash stations are important in the case of a chemical getting into or near a person's eye. The following is a list of dos and don'ts to follow when it comes to eye wash stations. 1. The eye wash should be accessible at all times. 2. It is important that the eye wash station remain operational. 3. Eye wash stations attached to sinks, as is the case with the laboratory station should be flushed weekly. 4. All employees working with chemicals during the course of their work should be aware of the location and functionality of all eye wash stations. 5. Eye wash stations should only be used for their intended purpose. 6. If it is necessary to use the eye wash station, make sure you keep your eyes in the water for a long enough period of time. It may be necessary to consult a physician in addition to flushing your eyes after contact with a chemical.
5.0 Related Documents:	➢ Occupational Safety General Regulations ➢ Health, Safety and Environment programs

**** The safety information in this policy does not take precedence over the Occupational Health and Safety Act. All workplace parties must be familiar with the Occupational Health and Safety Act and Regulations.***

CleanEarth	Safe Work Practice	**Reviewed/Revised:** January 2021

SWP 01-06-02 **Fall Protection**

1.0 Purpose:	This Safe Work Practice (SWP) is developed to fulfill the requirements of the Occupational Safety General Regulations and all relevant Codes of Practice and Canadian Standards. This SWP forms part of the CleanEarth HSE Program.
2.0 Definitions:	➢ **Safe Work Practice:** Safe working practice refers to ways in which work is done in an organization. This practice normally facilitates improved efficiency and small tasks to be assigned with each particular SWP.
3.0 References:	➢ Policy ➢ Safe Work Procedure ➢ NS Acts & Regulation
4.0 Tasks:	➢ Only Trained, designated competent staff are permitted to work at heights requiring fall protection. ➢ Be fully conversant with the fall protection system. ➢ Ensure you know capabilities of Fall Protection Equipment. ➢ Ensure barricades, ribbons and signs identify restricted areas. ➢ Ensure you understand the procedures for rescue of workers who may be unable to rescue themselves from an elevated work area. ➢ Ensure you know your anchor points. ➢ Ensure you do not wrap the lanyards and/or rope around beams, girders, pipes, etc. ➢ Utilize buddy system and continually check each other's harness and D ring to ensure that the harness in not too loose and or the D ring has not slipped down the back.
5.0 Related Documents:	➢ Occupational Safety General Regulations ➢ Health, Safety and Environment programs ➢ CleanEarth Fall Protection Policy

**** The safety information in this policy does not take precedence over the Occupational Health and Safety Act. All workplace parties must be familiar with the Occupational Health and Safety Act and Regulations.***

SWP 01-06-03 **Heat Stress**

1.0 Purpose:	This Safe Work Practice (SWP) is developed to fulfill the requirements of the Occupational Safety General Regulations and all relevant Codes of Practice and Canadian Standards. This SWP forms part of CleanEarth HSE Program.
2.0 Definitions:	➢ **Safe Work Practice:** Safe working practice refers to ways in which work is done in an organization. This practice normally facilitates improved efficiency and small tasks to be assigned with each particular SWP ➢ **Heat Stress:** General name for several medical conditions such as heat exhaustion, heat cramps (muscle pain or spasms) and heat stroke, caused by working in hot areas.
3.0 References:	➢ Policy ➢ Safe Work Procedure ➢ NS Acts & Regulation
4.0 Tasks:	➢ Workers who are exposed to extreme heat or work in hot environments may be at risk of heat stress. Exposure to extreme heat can result in occupational illnesses and injuries. Heat can also increase the risk of injuries in workers as it may result in sweaty palms, fogged-up safety glasses, and dizziness. Burns may also occur as a result of accidental contact with hot surfaces or steam. ➢ Workers at risk of heat stress include outdoor workers and workers in hot environments such as firefighters, bakery workers, farmers, construction workers, miners, boiler room workers, factory workers, and others. Workers at greater risk of heat stress include those who are 65 years of age or older, are overweight, have heart disease or high blood pressure, or take medications that may be affected by extreme heat. **4.1 - Types of Heat Stress:** Heat Stroke, Heat Exhaustion, Heat Syncope, Heat Cramps, Heat Rash ➢ **Heat Stroke:** Heat stroke is the most serious heat-related disorder. It occurs when the body becomes unable to control its temperature: the body's temperature rises rapidly, the sweating mechanism fails, and the body is unable to cool down. When heat stroke occurs, the body is unable to cool down. When heat stroke occurs, the body

temperature can rise to 106 degrees Fahrenheit or higher within 10 to 15 minutes. Heat stroke can cause death or permanent disability if emergency treatment is not given.

Symptoms of heat stroke include:

- Hot, dry skin or profuse sweating
- Hallucinations
- Chills
- Throbbing headache
- High body temperature
- Confusion/dizziness
- Slurred speech

First Aid:

Take the following steps to treat a worker with heat stroke:

- Call 911 and notify their supervisor.
- Move the sick worker to a cool shaded area.
- Cool the worker using methods such as:
  - Soaking their clothes with water.
  - Spraying, sponging, or showering them with water.
  - Fanning their body.

➢ **Heat Exhaustion:**

Heat exhaustion is the body's response to an excessive loss of the water and salt, usually through excessive sweating. Workers most prone to heat exhaustion are those that are elderly, have high blood pressure, and those working in a hot environment.

Symptoms of heat exhaustion include:

- Heavy sweating
- Extreme weakness or fatigue
- Dizziness and Confusion
- Nausea
- Clammy, moist skin
- Pale or flushed complexion
- Muscle cramps

- Slightly elevated body temperature
- Fast and shallow breathing

First Aid:

- Treat a worker suffering from heat exhaustion with the following:
- Have them rest in a cool, shaded or air-conditioned area.
- Have them drink plenty of water or other cool, non-alcoholic beverages.
- Have them take a cool shower, bath, or sponge bath.

➢ **Heat Syncope:**

Heat syncope is a fainting (syncope) episode or dizziness that usually occurs with prolonged standing or sudden rising from a sitting or lying position. Factors that may contribute to heat syncope include dehydration and lack of acclimatization.

Symptoms of heat syncope include:

- Light-headedness
- Dizziness
- Fainting

First Aid:

Workers with heat syncope should:

- Sit or lie down in a cool place when they begin to feel symptoms.
- Slowly drink water, clear juice, or a sports beverage.

➢ **Heat Cramps:**

Heat cramps usually affect workers who sweat a lot during strenuous activity. This sweating depletes the body's salt and moisture levels. Low salt levels in muscles causes painful cramps. Heat cramps may also be a symptom of heat exhaustion.

Symptoms:

- Muscle pain or spasms usually in the abdomen, arms, or legs.

First Aid:

Workers with heat cramps should:

- Stop all activity, and sit in a cool place.
- Drink clear juice or a sports beverage.
- Do not return to strenuous work for a few hours after the cramps subside because further exertion may lead to heat exhaustion or heat stroke.

- Seek medical attention if any of the following apply:
  - The worker has heart problems.
  - The worker is on a low-sodium diet.
  - The cramps do not subside within one hour.

➢ **Heat Rash:**

Heat rash is a skin irritation caused by excessive sweating during hot, humid weather.

Symptoms of heat rash include:

- Heat rash looks like a red cluster of pimples or small blisters.
- It is more likely to occur on the neck and upper chest, in the groin, under the breasts, and in elbow creases.

Workers experiencing heat rash should:

- Try to work in a cooler, less humid environment when possible.
- Keep the affected area dry.
- Dusting powder may be used to increase comfort.

4.2 - Requirements for Employers:

Employers should take the following steps to protect workers from heat stress:

- An Employer shall provide appropriate and suitable monitoring equipment in a workplace where the thermal environment is likely to pose a hazard to the Worker.
- Further provisions such as: regular monitoring, posting of warning devices, additional First Aid measures, screens or shelters, cold drinks, medical supervision, limited work schedules with rest periods can be available under unusually hot working conditions .
- Like heat stress cold stress must be dealt with in similar fashion with many of the same provisions as in #2. Some changes would be hot drinks and special equipment (heaters) and clothing.
- Schedule maintenance and repair jobs in hot areas for cooler months.
- Schedule hot jobs for the cooler part of the day.
- Acclimatize workers by exposing them for progressively longer periods to hot work environments.
- Reduce the physical demands of workers.
- Monitor workers who are at risk of heat stress.
- Provide heat stress training that includes information about:

	▪ Worker risk ▪ Prevention ▪ Symptoms ▪ The importance of monitoring yourself and coworkers for symptoms ▪ Treatment ▪ Personal protective equipment **4.3 - Requirements for Workers:** Workers should avoid exposure to extreme heat, sun exposure, and high humidity when possible. When these exposures cannot be avoided, workers should take the following steps to prevent heat stress: ○ Wear light-coloured, loose-fitting, breathable clothing such as cotton. ○ Avoid non-breathing synthetic clothing. ○ Gradually build up to heavy work. ○ Schedule heavy work during the coolest parts of day. ○ Take breaks in the shade or a cool area when possible. ○ Drink water frequently. Drink enough water that you never become thirsty. Approximately 1cup every 15-20 minutes. ○ Avoid drinks with large amounts of caffeine or sugar. ○ Monitor your physical condition and that of your coworkers. ○ Eat a healthy diet. Eat small meals more often. Avoid foods that are high in protein which increase metabolic heat. ○ Take advantage of fans and air-conditioners. ○ Get enough sleep at night. **NOTE**: See the following attachments for the general procedures for the prevention of heat stress.
5.0 Related Documents:	➢ Occupational Safety General Regulations ➢ Health, Safety and Environment programs

CleanEarth	Safe Work Practice	**Reviewed/Revised:** January 2021

SWP 01-06-04 **Manual Material Lifting**

1.0 Purpose:	This Safe Work Practice (SWP) is developed to fulfill the requirements of the Occupational Safety General Regulations and all relevant Codes of Practice and Canadian Standards. This SWP forms part of CleanEarth HSE Program.
2.0 Definitions:	Safe Work Practice: Safe working practice refers to ways in which work is done in an organization. This practice normally facilitates improved efficiency and small tasks to be assigned with each particular SWP
3.0 References:	➢ Policy ➢ Safe Work Procedure ➢ NS Acts & Regulation
4.0 Tasks:	1. Know your intended route. If you need to clear objects in the pathway before you transport material, do so. 2. Think before you lift - size up the object. Test the weight before trying to move it. 3. To lift an object, place one foot behind and the other alongside of it. With your knee's bent, grip the object firmly with both hands. Keep your back straight and vertical and your chin, elbows, and arms tucked in tight. With your body weight vertically over your feet, lift with your legs. 4. When placing the load on the ground or surface, be sure that your feet are out of the way and lower the load in one motion. Lower the load by bending at the knees and keeping the back straight. 5. If the object is either too bulky or too heavy (50 lbs. or more), get someone to help you or get a mechanical lift. 6. When moving heavy or bulky loads, move in stages and rest between moves. 7. When two or more people are carrying a heavy object, be sure to have a signal pre-arranged before lowering or releasing of the load. If you lose your balance or cannot maintain the load, try to push the load out and away from your body. 8. When two or more people are carrying an object, especially long objects, over a long distance, every person shall face the same direction in which the object is moving. 9. To set the load down, stop, place feet apart, and tell the other person or persons helping what you will be doing, the steps that will be taken, and what you expect them to do. Then, with your feet and hands out of the way of any possible injury, lower the load in one motion. Again, remember to keep your back straight and lower the load by bending at the knees.
5.0 Personal Protective Equipment:	The following personal protective equipment (PPE) must be worn: 1. Safety glasses/goggles 2. Hardhat 3. Safety boots 4. Coveralls 5. Gloves 6. High visibility vests if in mobile equipment travel area

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CleanEarth	Safe Work Practice	**Reviewed/Revised:** January 2021

SWP 01-06-05 Use and Care of Respiratory Equipment

1.0 Description:

When a worker is or may be exposed to an oxygen deficient atmosphere or hazardous airborne contaminants, proper engineering controls shall be used to prevent the atmospheric contamination. When engineering or other controls are not practicable, respiratory equipment must be utilized.

2.0 Hazards:

- Improper use of respirators leading to ineffective protection
- Chemical vapours, mists
- Ill fitting equipment leading to malfunction and ineffective protection

DO's	DON'T'S
• Complete fit testing prior to using respirators • Remain clean shaved in order to allow proper sealing of respirator • Ensure respirators are stored so they are protected from damage and contamination • Understand what contaminants and hazards you may be exposed to and ensure you are wearing proper respiratory protection • Inspect, clean and sanitize respirator prior to and after each use and store in a clean, dry container/bag	• Grow unkept facial hair that can impede with the proper function of respirators • Don't assume every respirator will work for every situation • Wear a respirator that you have not been fit tested and approved to wear • Don't wait until you smell a gas or vapor to change your chemical cartridge/canister • Don't use a respirator that is damaged or defective • Don't use an Air Purifying Respirator in an atmosphere that is oxygen deficient or immediately dangerous to life and health (IDLH)

Selection and Use:

- Adequate training for all employees so they know uses and limitations of respiratory equipment is required
- Manufacturer specifications and assigned maintenance duties for the equipment to be used.

Supervisor Responsibility:

- Supervisors are responsible to facilitate and/or provide proper instruction to their workers on protection requirements and training.

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- Selection of equipment based on existing respiratory hazards.
- Hazards analysis filled out.
- Warning signs at all access points.
- Work site inspection.

Do not allow a worker to wear a respirator with a tight-fitting face piece, if employee has:

- Hair on face or scalp that will cause an incomplete seal.
- A condition on face or scalp that interferes with the mask seal.
- Corrective lenses or glasses that will interfere with wearing of mask.

Worker Responsibility:

- Ensure you are fully trained on respiratory equipment.
- Ensure you are conversant with safe work procedures and/or site-specific procedures.
- Inspect respirator before and after each use.
- Ensure to utilize “Buddy” system.
- Ensure work masks are cleaned and disinfected after each use.
- Ensure equipment is stored properly.

NOTE: All workers that are performing work in any area that is immediately dangerous to life or health (IDLH) **MUST** use their supplied air respiratory protective equipment.

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SWP 01-06-07 Confined Space Entry

1.0 Purpose:	This Safe Work Practice (SWP) is developed to fulfill the requirements of the Occupational Safety General Regulations and all relevant Codes of Practice and Canadian Standards. This SWP forms part of CleanEarth Technologies HSE Program.
2.0 Hazards:	➢ Refer to Confined Space Entry Permit
3.0 PPE:	All standard PPE: hard hat, safety glasses, safety boots, FR clothing. May include gloves, face shield or goggles. Other required and possible equipment: 4 gas monitor, fall protection equipment, ladder, ventilation, fire extinguisher, SCBA, APR, warning signs, barricades, full body harness, tripod/hoist, lifeline
4.0 General:	➢ Worker must be competent and trained in confined space entry to identify the work procedures required to enter the confined space. ➢ Ensure that there is reasonable means of egress from all parts of the confined space. ➢ Upon entering a confined space, a worker shall assume the space is hazardous until the contrary is demonstrated. ➢ Ensure that ventilation and purging is established and allows acceptable air levels to be achieved and maintained. ➢ Establish method of communication to allow immediate contact with necessary personnel if rescue or assistance is required, confirm alarm system. ➢ Before entry, the vessel or confined space must be tested by a trained and competent worker wearing breathing apparatus, for oxygen content, combustible gas (L.E.L.) and hydrogen sulfide. ➢ Continuous monitoring may be required of the vessel or confined space atmosphere to detect changing conditions. ➢ Worker must be conversant with Rescue Procedures.

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CleanEarth	Safe Work Practice	**Reviewed/Revised:** January 2021

SWP 01-07-04 **Housekeeping**

1.0 Purpose:	This Safe Work Practice (SWP) is developed to fulfill the requirements of the Occupational Safety General Regulations and all relevant Codes of Practice and Canadian Standards. This SWP forms part of the CleanEarth HSE Program.
2.0 Definitions:	➢ **Safe Work Practice:** Safe working practice refers to ways in which work is done in an organization. This practice normally facilitates improved efficiency and small tasks to be assigned with each particular SWP
3.0 References:	➢ Policy ➢ Safe Work Procedure ➢ NS Acts & Regulation
4.0 Tasks:	➢ Floors shall be kept free from anything which may create a stumbling hazard. ➢ Spilled gasoline, oil, and grease shall be cleaned up immediately. ➢ Flammable rubbish shall be placed in the proper containers. ➢ Work areas/job sites shall be cleaned regularly and items removed from posing hazards by proper storage or disposal in appropriate containers. ➢ Every effort shall be made to control dust. ➢ Combustible materials shall be put in proper containers. ➢ Safe walking lanes shall be kept clear of obstruction at all times. ➢ Containers shall be emptied when full and at least weekly.
5.0 Related Documents:	➢ Occupational Safety General Regulations ➢ Health, Safety and Environment programs

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CleanEarth	Safe Work Practice	**Reviewed/Revised:** January 2021

SWP 01-07-06 **Slips, Trips & Falls**

1.0 Purpose:	This Safe Work Practice (SWP) is developed to fulfill the requirements of the Occupational Safety General Regulations and all relevant Codes of Practice and Canadian Standards. This SWP forms part of the CleanEarth HSE Program.
2.0 Definitions:	➢ **Safe Work Practice:** Safe working practice refers to ways in which work is done in an organization. This practice normally facilitates improved efficiency and small tasks to be assigned with each particular SWP.
3.0 References:	➢ Policy ➢ Safe Work Procedure ➢ NS Acts & Regulation
4.0 Tasks:	**Safety requirements for the prevention of injury due to slips** 1. Practice safe walking skills. If you must walk on wet surfaces, take short steps to keep your center of balance under you and point your feet slightly outward. Move slowly and pay attention to the surface on which you are walking. 2. Clean up spills right away. Whenever you see any kind of spill, clean it up yourself or report it to the appropriate person. Even minor spills can be very hazardous. 3. Do not let grease accumulate on a shop floor around machinery. If grease is present in your work area, be sure that it is cleaned up promptly. 4. Be more cautious on smooth surfaces. Move slowly on floors that have been waxed but not buffed, and other very slippery surfaces. 5. Ice and snow present especially hazardous walk surfaces. When possible, remove ice and snow from sidewalks and parking lots before heavy traffic use and recommend proper footwear for the conditions. 6. Wearing proper footwear can help reduce slips. Shoes with neoprene soles can be used safely on most wet or dry work surfaces; however, they are not recommended for oil conditions. Crepe soles are best for rough concrete, whether wet or dry, but are not suggested for tile, smooth concrete, or wood surfaces. Other devices are available to increase traction on your shoes. Strap-on cleats can be fastened to soles for greater traction on ice. There are non-skid sandals and boots available that slip over shoes and offer better traction on ice, oil, chemicals, and grease. **Safety requirements for the prevention of injury due to trips** 1. Keep work areas well lit. Turned-off lights and burned-out bulbs can interfere with your ability to see clearly. Do not grope in the dark. Use a flashlight or extension light to make your walking area visible in unlit areas.

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	2. Keep your work area clean and do not clutter aisles or stairs. Store materials and tools in closets, cabinets, or specially assigned storage areas. 3. Arrange furniture so that it does not interfere with walkways or pedestrian traffic in your area. 4. Extension or power tool cords can be dangerous tripping hazards. Tape them to the floor or arrange them so that they will not be in the way of pedestrians. 5. Eliminate hazards due to loose footing on stairs, steps, and floors. Report loose carpeting, stair treads, or handrails. Broken pavement and floorboards or loose floor tiles can also catch a foot and cause a fall. 6. Operators should be aware of the pipes that are at or near ground level as part of the operation. Pipes will be marked and signed. **Safety requirements for the prevention of injury due to falls** 1. Do not jump. Lower yourself carefully from docks, trucks, or work stages. 2. Check lighting. Make sure hallways, stairs, and work areas are properly lit. 3. Repair or replace stairs or handrails that are loose or broken. Report these types of hazards to the proper personnel in your company. 4. Do not store items on stairs or in aisles. 5. Wear good shoes. Non-skid soles are a good choice. Remember that high heels or platforms are less stable than flat shoes. 6. Always use proper equipment when you have to work at a higher level. Never use chairs or any other unstable equipment to reach higher.
5.0 Personal Protective Equipment:	The following personal protective equipment (PPE) must be worn: 1. Safety glasses/goggles 2. Hardhat 3. Safety boots 4. Coveralls 5. Gloves 6. High visibility vests if in mobile equipment travel area
6.0 Related Documents:	➢ Occupational Safety General Regulations ➢ Health, Safety and Environment programs

CleanEarth	Safe Work Practice	**Reviewed/Revised:** January 2021

SWP 01-07-08 Storage and Handling Materials

1.0 Purpose:	This Safe Work Practice (SWP) is developed to fulfill the requirements of the Occupational Safety General Regulations and all relevant Codes of Practice and Canadian Standards. This SWP forms part of the CleanEarth HSE Program.
2.0 Definitions:	➢ **Safe Work Practice:** Safe working practice refers to ways in which work is done in an organization. This practice normally facilitates improved efficiency and small tasks to be assigned with each particular SWP.
3.0 References:	➢ Policy ➢ Safe Work Procedure ➢ NS Acts & Regulation
4.0 Tasks:	This practice applies to material stored at job sites as well as in the warehouse. The main objective is to store and handle all material in such a manner that it does not pose a threat to injury or to property damage. ➢ Follow instructions on all packaging labels i.e., Fragile, This Side Up, as well as any hazardous data information. ➢ Never store materials in such a manner to block walkways or exits. ➢ Do not stack material high enough that it is unstable. ➢ Store material in dry location. ➢ When Data Information Sheets are applicable make copies available in the stored area. ➢ When material is returned to the warehouse, check with your supervisor if you are unsure to the proper storage area. Abide by all posted signage and instructions. ➢ When possible, leave all label facing forward. ➢ When transporting goods by vehicles, follow all Motor Vehicle regulations regarding overhangs from tailgates and securing cargo. ➢ If hoisting is required, follow the proper procedures. ➢ When storing pipe and other cylindrical objects above grade level brace the material to prevent it from rolling to an unwanted area.
5.0 Related Documents:	➢ Occupational Safety General Regulations ➢ Health, Safety and Environment programs

CleanEarth	Safe Work Practice	**Reviewed/Revised:** January 2021

SWP 01-07-09 **Working in Public Areas**

1.0 Description:

Changing jobsites and pedestrian traffic in offsite job locations can present new and challenging risks/hazards. The following is a guideline for safely operating in public areas.

2.0 Hazards:

- Flying debris
- Pedestrians without proper training and PPE getting injured on jobsite

DO's	DON'T'S
• Ensure high visibility, of both you and your equipment • Maintain proper housekeeping of your jobsite • Ensure jobsite is blocked off to prevent pedestrian traffic • Be aware of your surroundings and adapt your risk control accordingly	• Don't allow pedestrians or non approved workers to enter the jobsite for any reason • Do not leave exposed live circuits. • Do not leave trip hazards in the path of any pedestrians

- Isolate the work area as much as possible. When working on ladders or staging where vehicles are present, use pylons and warning tape or signs.
- If it's necessary for people to be present, they must wear appropriate PPE.
- Keep traffic areas free from materials and debris.
- Do not let extension cords pass over floor areas where people are walking.
- When working overhead, have someone stand at ground level to protect both parties.
- Inform persons in charge of the job site if any exists will be blocked while working.
- When possible back your vehicle into a parking space. When you leave, you will then have a clear view of pedestrians.

Forms/Related Documents:

CleanEarth	Safe Work Practice	**Reviewed/Revised:** January 2021

SWP 01-09-01 Cleanup of Chemical Spills

1.0 Purpose:	This Safe Work Practice (SWP) is developed to fulfill the requirements of the Occupational Safety General Regulations and all relevant codes of practice and Canadian standards. This SWP forms part of the CleanEarth HSE Program.
2.0 Definitions:	➢ **Safe Job Procedure:** is a working risk control document created by teams within the company that describe the safest and most efficient way to perform a certain task.
3.0 References:	➢ Policy ➢ Safe Work Procedure ➢ NS Acts & Regulation
4.0 Tasks:	1. Clean up all chemical spills promptly. (Refer to MSDS prior to cleaning up any spilled chemicals). 2. Avoid inhaling toxic fumes. (Refer to MSDS for appropriate respiratory protection). 3. Be prepared for a fire 4. Do not try to tackle a spill that is too large, in this case call emergency services. 5. The following are the general steps to follow in the cleanup of a spilled chemical (other than acids, for acids use acid spill kit) Spill kits specific to water treatment chemicals have been prepared. 5.1 Wear gloves and safety goggles. 5.2 Open doors and windows 5.3 Use absorbent towel in spill kit to surround and cover the spill. 5.4 Re-cover the affected area with more material to ensure all of spilled chemical has been absorbed and scoop up. 5.5 Wash the affected area with excess water. Some detergent may help. 5.6 Clean up and leave area dry. Dispose of damp material as chemical waste. 5.7 Report to supervisor.
5.0 Personal Protective Equipment:	The following personal protective equipment (PPE) must be worn while cleaning chemical spills: 1. Safety glasses/goggles 2. Hardhat 3. Safety boots 4. Coveralls 5. Gloves

**** The safety information in this policy does not take precedence over the Occupational Health and Safety Act. All workplace parties must be familiar with the Occupational Health and Safety Act and Regulations.***

6.0 Related Documents:	➢ Occupational Safety General Regulations ➢ Health, Safety and Environment programs

**** The safety information in this policy does not take precedence over the Occupational Health and Safety Act. All workplace parties must be familiar with the Occupational Health and Safety Act and Regulations.***

CleanEarth	Safe Work Practice	**Reviewed/Revised:** January 2021

SWP 01-09-03 **Handling Chemicals**

1.0 Purpose:	This Safe Work Practice (SWP) is developed to fulfill the requirements of the Occupational Safety General Regulations and all relevant Codes of Practice and Canadian Standards. This SWP forms part of the CleanEarth HSE Program.
2.0 Definitions:	➢ **Safe Work Practice:** Safe working practice refers to ways in which work is done in an organization. This practice normally facilitates improved efficiency and small tasks to be assigned with each particular SWP
3.0 References:	➢ Policy ➢ Safe Work Procedure ➢ NS Acts & Regulation
4.0 Tasks:	1. Fume hood should be used where appropriate. 2. Chemicals will be stored as to prevent reactivity (acids and basis separated, flammables and oxidisers separated), and strong acids and basis will be stored below waist height. 3. Chemicals will be properly labelled and stored. 4. MSDS will be on hand for each chemical present. 5. Chemicals will not be left open and unattended. 6. Proper PPE will be available and worn for each chemical handled.
5.0 Related Documents:	➢ Occupational Safety General Regulations ➢ Health, Safety and Environment programs

**** The safety information in this policy does not take precedence over the Occupational Health and Safety Act. All workplace parties must be familiar with the Occupational Health and Safety Act and Regulations.***

CleanEarth	Safe Work Practice	**Reviewed/Revised:** January 2021

SWP 01-09-06 Safe Handling of Corrosives

1.0 Purpose:	This Safe Work Practice (SWP) is developed to fulfill the requirements of the Occupational Safety General Regulations and all relevant codes of practice and Canadian standards. This SWP forms part of the CleanEarth HSE Program.
2.0 Definitions:	➢ **Safe Job Procedure:** is a working risk control document created by teams within the company that describe the safest and most efficient way to perform a certain task.
3.0 References:	➢ Policy ➢ Safe Work Procedure ➢ NS Acts & Regulation
4.0 Tasks:	1. Corrosives have the tendency to react with each other (acid and base) and evolve heat. Therefore the various corrosives should be stored separate from one another. 2. Corrosives tend to react with organic material to generate heat and possible conflagration. 3. Corrosives may become highly unstable when dry. 4. Use chemical splash goggles for eye protection; for operations that may involve splashing, include a face shield. Thick butyl rubber, neoprene, nitrile, or polyethylene gloves may be appropriate. Check glove manufacturer for recommendations on a suitable glove for the specific chemical. 5. Store in cool, dry well-ventilated areas, away from sunlight. The storage area should not be subject to rapid temperature change. 6. Store corrosive liquid containers in secondary containment such as a high density polyethylene tub. The secondary containment volume must exceed the combined volume of stored containers by at least 10%. 7. Strong acids will corrode most metal cabinets. Non-metallic or epoxy painted cabinets are available and will provide a better service life with these types of chemicals.
5.0 Personal Protective Equipment:	The following personal protective equipment (PPE) must be worn while handling corrosives: 1. Safety glasses/goggles 2. Lab coat 3. Hardhat 4. Safety boots (non-fabric) 5. Coveralls 6. Gloves

**** The safety information in this policy does not take precedence over the Occupational Health and Safety Act. All workplace parties must be familiar with the Occupational Health and Safety Act and Regulations.***

	7. High visibility vests if in mobile equipment travel area 8. Respirator may be required for some corrosives
6.0 Related Documents:	➢ Occupational Safety General Regulations ➢ Health, Safety and Environment programs

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CleanEarth	Safe Work Practice	Reviewed/Revised: January 2021

SWP 01-09-12 **Hydrogen Sulfide**

1.0 Purpose:	This Safe Job Practice (SWP) is developed to fulfill the requirements of the Occupational Safety General Regulations and all relevant codes of practice and Canadian standards. This SWP forms part of the CleanEarth HSE Program.
2.0 Hazards:	**Hydrogen sulphide (H2S):** is one of the deadliest occupational hazards in the industry. It is also known as H_2S, sour gas and sulfated hydrogen. CleanEarth employees who are required to work at an H_2S present worksite, must be formally trained and certified to work and perform a rescue in this environment.
3.0 Properties, Limits & Responsibilities:	**3.1 H_2S is found but not limited to the following locations:** • Oil & Gas Plants • Oil & Gas Wells • Pipelines • Compressor Stations & Batteries • Refineries • Pulp & Paper Mills • Storage Tanks • Tank Cars & Trucks • Sewers Hydrogen sulfide is a colorless, flammable gas having an offensive odor and a sweet taste. It is highly toxic, and doubly hazardous because it is heavier than air and tends to collect on low areas. **3.2 – Properties of H_2S:**

COLOR:	Colorless
ODOR:	Offensive, referred to as rotten eggs vapor
DENSITY:	1.189 (Air=1.0)
EXPLOSIVE LIMITS:	4.3-46% by volume in air auto ignition
TEMPERATURE:	260 degrees Celsius
FLAMMABILITY:	Forms explosive mixture in air/oxygen
WATER SOLUBILITY:	2.9g/100ml water at 20 degrees Celsius

Having a characteristic odor of rotten eggs and easily recognizable (at less than 1 P.P.M.), this gas quickly weakens the sense of smell (at 100 P.P.M.) making this an unreliable method of detecting hazardous concentrations. We can all protect ourselves in the following ways:

- Know where H2S may be present.
- Wear an approved Breathing Apparatus.
- Use Monitors and Detection Equipment.
- Do not rely on your sense of smell.

**** The safety information in this policy does not take precedence over the Occupational Health and Safety Act. All workplace parties must be familiar with the Occupational Health and Safety Act and Regulations.***

- Use common sense.

Symptoms range from sub-acute irritation, principally, smarting of the eyes, persistent cough, tightening or burning in the chest and skin irritation, to acute irritation with respiratory paralysis, panting, pallor, cramps, paralysis and almost immediate loss of consciousness. Hysteria is not uncommon and violent convulsions may result in the victim becoming rigid before falling, increasing the possibility of injury.

NOTE: there is a very narrow margin between sub-acute and acute condition. Very few parts per million can make the difference between consciousness and unconsciousness.

When high concentrations cause respiratory paralysis, breathing does not return unless artificial respiration is applied. Although breathing has stopped, the heart may continue beating for ten minutes after the attack.

3.3 – Warning Signs & Effects of H2S:

- **1 ppm** - Can be smelled
- **10 ppm** – No known health effects for most people. Respiratory protection is required beyond this level.

The province of Nova Scotia does not list a ceiling because is it not acceptable to accept any level of H_2S in working conditions.

- **20 -50 ppm** – Eye, nose, throat and lung irritation
- **100 - 150 ppm** - The point where serious complication may result. Severe eye, nose, throat and lung irritation, loss of smell, exposure of 8 hours or more may be fatal.
- **200 - 300 ppm.** – Headaches and drowsiness, prolonged exposures of several hours may cause lungs to fill with fluid.
- **300 - 500 ppm** – May cause unconsciousness and death in 1-4 hours
- **500-700 ppm -** Knockdown may be fatal within 1 hour at this level of exposure.
- **Greater than 700 ppm** - Immediate knockdown may be fatal.

3.4 Nova Scotia Exposure Limits:

8 hour time weighted average = 1 ppm

15 minute weighted average = 5 ppm

3.5 - Employer Responsibilities:

Employers must develop and implement an effective exposure control plan (ECP), which includes

Training workers and supervisors in relevant sections of the plan. An effective ECP for any workplace where workers are exposed to H2S must include:

- A written policy that: States the employer's commitment to health and safety
- States the plan's objectives
- Defines the responsibilities and roles of the employer, supervisors, and workers
- An assessment of the workplace hazards (for example, where workers are likely to be exposed to H2S)
- Controls used to reduce the hazards (for example, ventilation, barriers, or personal protective equipment)
- Written safe work procedures and emergency response procedures (for example, rescue procedures)
- Monitoring for H2S (for example, when , where, and how monitoring devices such as dosimeters or personal monitors will be used in the workplace)
- Training for supervisors and workers
- Records and statistics (for example, first aid records for workers "knocked down" by H2S)

3.6 - Worker responsibilities:

Workers also have responsibilities to help reduce the risk of exposure to H2S. Workers (including subcontractors) must:

- Attend education and training sessions provided by the employer
- Use controls and follow safe work practices outlined in the ECP
- Use available personal protective equipment (for example, self-contained breathing apparatus and personal monitors, as required
- Know how to report exposure incidents.

3.7 - H25 risk factors:

The following factors may increase the risk of workers being exposed to unsafe levels of H2S:

- **Confined spaces** - Workers who enter a confined space such as a sewer or tank could be overcome by H_2S.
- **Smoking and other ignition sources** - H_2S explodes easily near lit matches, cigarettes, pipes, and other sources of spark or intense heat.

The gas can explode when its concentration in the air ranges from about 4% (40,000 ppm) to 46 %(460,000 ppm).

- **Worker attitude** - Workers are more likely to be harmed if they don't know the hazards of H_2S, or if they're so used to working with H_2S they become lax about safety.
- **Still air** - The gas can build up to unsafe levels if there is no breeze or air movement.
- **Contact lenses** - Workers who are exposed to H_2S should be aware that wearing soft contact lenses may pose a risk. Soft contact lenses may absorb irritants and hold irritants such as H_2S against the eye.

3.8 - Reducing the H_2S risk:

The risk of unsafe levels of H_2S can be reduced with the following controls:

- **Engineering** - where practical, install effective exhaust ventilation.
- **Isolation controls** - Isolate workers from dangerous work areas.
- **Regular maintenance** - to lessen the risk of leaks, regularly check pipes, valves, tanks, and containers of dangerous gases and liquids.
- **Education** - Workers must be taught how to prevent and recognize H_2S poisoning, and how to give first aid to those overcome by the gas. Workers must be taught and practice how to use protective breathing equipment.
- **Monitoring** - H_2S levels must be monitored where there is a risk of H_2S exposure.
- **Labelling and posting** - Where H_2S is used, collected, or produced, all piping and valves that carry the gas must be clearly identified. Workers must also have easy access to the material safety data sheet (MSDS) for H_2S. Wherever an H_2S leak or build up is possible, warning signs bearing “Hydrogen Sulphide” plus precautions must be posted just outside or at the entrances to the area.
- **Emergency plans** - Where H_2S is used, employers must train workers in H_2S hazards, emergency procedures, escape routes, and the location of emergency equipment and safe areas.
- **Confined space precautions** - Confined spaces must be tested, ventilated, and confirmed safe before workers enter them.
- **Proper storage** - Keep cylinders containing H_2S clean, isolated, shaded, and in a ventilated area. In case of fire, remove the cylinders (if it is safe to do so) and cool with water.

3.9 - Breathing protection:

In areas with high H_2S levels or where an H_2S leak has occurred, workers must

wear one of the following

Two types of breathing protection:

1. **Positive-pressure, self-contained breathing apparatus (SCBA):** This consists of an air cylinder, which is normally worn on the back and a full-face mask to protect the eyes and face. A hose connects the face mask to the regulator and the air cylinder. "**Positive pressure**" means that the air pressure in the mask is higher than the air pressure outside the mask. This reduces the chance of toxic gases entering the face piece.
2. **Positive-pressure, supplied-air (airline) respirator:** This consists of an airline attached to a regulator and a full-face piece. The worker must also wear an "escape" air bottle to allow escape if the air supply is cut off.

- Workers who use respirators must be clean shaven where the respirator seals with the face. This helps provide a good seal that keeps harmful gases out.
- Air-purifying respirators must not be used where H_2S levels are above the 10 ppm. These respirators -when fitted with the appropriate acid-gas cartridges -may be used for escape only.
- At sites with a high risk of exposure, workers must have easy access to escape respirators, or must carry them while working. An SCBA must be used for escape where worker s might have to flee from high H_2S levels or over long distances where escape air purifying respirators would not provide enough protection.

3.10 - First aid and rescue:

If H_2S causes the eyes to sting, itch, or water see the first aid attendant. Flush the eyes with lukewarm water immediately, for at least 30 minutes. If the eyes keep itching, see a doctor as soon as possible.

3.11 - If a worker is overcome by H_2S:

- To attempt a rescue in an area with high H2S levels, wear only a positive-pressure, self-contained breathing apparatus (SCBA), or a full face, supplied air (airline) respirator with an “escape" air bottle.
- Move the worker to fresh air and give oxygen, if available.
- If the worker is having trouble breathing or is not breathing, start assisted ventilation using a pocket mask, and add oxygen to the mask if available. If the worker has no pulse, begin cardiopulmonary resuscitation (CPR). Because the body rids itself of H_2S if removed from the exposure, it is critical to continue to give the worker assisted ventilation with oxygen until medical aid arrives. Transport the worker to the nearest hospital as soon as possible.

	3.12 - In the event of an H_2S release: ○ Vacate the area ○ Secure the area if possible ○ Gather at the emergency marshalling point ○ Contact Worksite and Safety Management

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CleanEarth	Safe Work Practice	**Reviewed/Revised:** January 2021

SWP 01-09-14 Safe Handling of Flammable Liquids

1.0 Purpose:	This Safe Work Practice (SWP) is developed to fulfill the requirements of the Occupational Safety General Regulations and all relevant codes of practice and Canadian standards. This SWP forms part of the CleanEarth HSE Program.
2.0 Definitions:	➢ **Safe Job Procedure:** is a working risk control document created by teams within the company that describe the safest and most efficient way to perform a certain task.
3.0 References:	➢ Policy ➢ Safe Work Procedure ➢ NS Acts & Regulation
4.0 Tasks:	1. Transfer flammable and combustible liquids in a functioning fume hood. 2. Eliminate sources of ignition (i.e. open flames, hot plates, etc.) from work areas where flammable and combustible liquids are used. 3. Ethers shall be used ONLY in a working fume hood from which all possible ignition sources have been removed. 4. Signs and labels- All flammable liquids must be clearly labelled with the correct chemical name. 5. Wash hands and arms with soap and water immediately following any skin contact with flammable liquids
5.0 Personal Protective Equipment:	The following personal protective equipment (PPE) must be worn while handling flammable liquids: 1. Safety glasses/goggles 2. Lab coat 3. Hardhat 4. Safety boots 5. Coveralls 6. Gloves 7. High visibility vests if in mobile equipment travel area
6.0 Related Documents:	➢ Occupational Safety General Regulations ➢ Health, Safety and Environment programs

**** The safety information in this policy does not take precedence over the Occupational Health and Safety Act. All workplace parties must be familiar with the Occupational Health and Safety Act and Regulations.***

CleanEarth	Safe Work Practice	**Reviewed/Revised:** January 2021

SWP 01-09-15 Use of Cleaning Solvents & Flammables

1.0 Purpose:	This Safe Work Practice (SWP) is developed to fulfill the requirements of the Occupational Safety General Regulations and all relevant Codes of Practice and Canadian Standards. This SWP forms part of the CleanEarth HSE Program.
2.0 Definitions:	➢ **Safe Work Practice:** Safe working practice refers to ways in which work is done in an organization. This practice normally facilitates improved efficiency and small tasks to be assigned with each particular SWP
3.0 References:	➢ Policy ➢ Safe Work Procedure ➢ NS Acts & Regulation
4.0 Tasks:	➢ Use non-flammable solvents for general cleaning. ➢ When flammable liquids are used, make sure that no hot work is permitted in the area. ➢ Store flammables and solvents in special storage areas. ➢ Check toxic hazard of all solvents before use. (MSDS) ➢ Provide adequate ventilation where all solvents and flammables are being used. ➢ Control measures for internal combustion engines in hazardous conditions e.g. flame arrestors ➢ Use goggles or face shields to protect the face and eyes from splashes or sprays. ➢ Use rubber gloves to protect the hands. ➢ Wear protective clothing to prevent contamination of workers' clothes. ➢ When breathing hazards exist, use the appropriate respiratory protection. ➢ Never leave solvents in open tubs or vats - return them to storage drums or tanks. ➢ Ensure that proper containers are used for transportation, storage and field use of solvents/flammables. ➢ Where solvents are controlled products, ensure all employees using or in the vicinity of use or storage are trained and certified in the Workplace Hazardous Materials Information System. Ensure all WHMIS requirements are met. ➢ Where a volatile or flammable substance, gas, vapour is present or arises from the work process, the hazard shall be removed or controlled by ventilation or other effective means. ➢ Where work or manufacturing processes involve the use of a flammable liquid, vapour or gas, the concentration of the liquid, vapour or gas in the

	work area shall be maintained below the lower explosive limit (LEL) of the substance involved. ➢ Waste material contaminated with a solvent, oil, grease, paint of other flammable substance shall be placed in covered metal containers before disposal and shall not be stored in work areas. ➢ Where a volatile or flammable substance, gas or vapour is present, or arises out of material or equipment or from a work process, existing or potential sources of ignition shall be controlled. ➢ Where work involves more than one employer, a principal contractor shall ensure that sources of ignition resulting from the work of one employer are eliminated or adequately controlled where a flammable gas or a flammable liquid is handled, used or stored by another employer.
5.0 Related Documents:	➢ Occupational Safety General Regulations ➢ Health, Safety and Environment programs

CleanEarth	Safe Work Practice	**Reviewed/Revised:** January 2021

SWP 01-09-16 Biological & Chemical Hazards

1.0 Description

There are many types of hazards – chemical and biological to name a few - which can cause harm or adverse effects in the workplace. If chemicals are not used, stored and handled properly, they can cause injury, illness, disease, fire, explosions, or property damage. Know the hazards of chemicals and appropriate precautions to take to work safely and avoid injury.

Use the following guidelines on chemical and biological hazards and their control, including identification, risk assessment and inspections, to keep your workplace healthy and safe.

2.0 Hazards:

- **Biological Hazard:** refer to organisms or organic matters produced by these organisms that are harmful to human health. These include parasites, viruses, bacteria, fungi and protein.
- **Chemical Hazards:** exposure to any chemical preparation in the workplace in any form (solid, liquid or gas).

DO's	DON'T'S
• Wear proper PPE at all times, handling specific materials can require different or specialized PPE • Always refer to the SDS for whichever chemical you are working with or around • Ensure proper ventilation • Always perform a Field Level Hazard Assessment prior to starting any new task near or around potential hazards	• Never assume the contents of an unlabeled container • Never work with a chemical without first ensuring you know its properties

If decontamination is required:

- Provide lay down area (tarp).
- Contaminated clothing should be removed and washed or disposed of.
- Supply large container to place contaminated items in with a sealed lid.
- All entrants must have barrier cream.
- Rags for wiping hands and face.
- Hand cleaner or soap and water to wash hands thoroughly.
- Workers to bring extra clothing in the event of contamination.
- Have shower facilities available and transportation for workers.
- Equipment that was in the tank should be removed to be cleaned.
- Eye wash available.

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1.0 Purpose:	This Safe Work Procedure (SJP) is developed to fulfill the requirements of the Occupational Safety General Regulations and all relevant codes of practice and Canadian standards. This SJP forms part of the CleanEarth HSE Program.
2.0 Definitions:	➢ **Safe Work Procedure:** is a working risk control document created by teams within the company that describe the safest and most efficient way to perform a certain task.
3.0 References:	➢ Policy ➢ Safe Work Procedure ➢ NS Acts & Regulation
4.0 Tasks:	1. Close the press and verify that the proper hydraulic pressure exists at the hydraulic ram to keep the press closed during feeding. 2. Start the main feed pump at a reduced flow until the press fills with liquid (approximately 5 minutes) 3. Following the initial reduced flow period increase to appropriate flow and continue filling. 4. Continue filling until approximately 100 psi is reached, observing the filtrate quality on occasion to ensure clear filtrate is produced. 5. Once 100 psi is reached and filtrate water is discharging at a near zero flow rate the press is filled and the pump is ready to be turned off. 6. One at a time, open the filtrate valves until the excess liquid leaving the filtrate pipe is nil. 7. If after the last step pressure remains on the gauge reopen the valves until no pressure remains. 8. Open the press by retracting the moveable head. 9. One by one shift the plates ahead allowing the cake to fall, ensure all cake is removed from the plate prior to shifting the next plate. 10. NOTE: If the resulting cake remains liquid or sloppy upon open go back to step two and allow the press more time to reach and maintain pressure, if this does not correct the problem it is likely time to clean the cloths. 11. Once emptied close the press and begin cycle again.
5.0 Personal Protective Equipment:	The following personal protective equipment (PPE) must be worn while using the filter press: 1. Safety glasses/goggles 2. Hardhat 3. Safety boots 4. Coveralls 5. Gloves 6. High visibility vests if in mobile equipment travel area

6.0 Related Documents:	➢ Occupational Safety General Regulations ➢ Health, Safety and Environment programs

1.0 Purpose:	This Safe Work Procedure (SWP) is developed to fulfill the requirements of the Occupational Safety General Regulations and all relevant codes of practice and Canadian standards. This SWP forms part of the CleanEarth HSE Program.
2.0 Definitions:	➢ **Safe Work Procedure:** is a working risk control document created by teams within the company that describe the safest and most efficient way to perform a certain task.
3.0 References:	➢ Policy ➢ Safe Work Procedure ➢ NS Acts & Regulation
4.0 Tasks:	1. Disconnect hoses from top and bottom of vessel. 2. Reconnect hoses so that backwash water enters through the bottom of the vessel and exits through top of vessel. Use valves on side of vessels, valve on very bottom is used for clean-out purposes. 3. Discharge water back to excavation or dirty water tanks; do not discharge backwash water to drains. 4. Start pumping clean water to vessel. (Back wash only one vessel at a time). 5. Adjust valves to achieve desired flow rate – see table 1 below, if filter media is being discharged, decrease flow rate until it is not being discharged. 6. Pump should run continuously for a minimum of 20 minutes, if discharge water continues to look dirty continue to backwash until clean water is observed at the discharge. 7. Once completed, reconnect hoses to vessels for operation, feed to top of vessel and discharge to bottom of vessel.
5.0 Personal Protective Equipment:	The following personal protective equipment (PPE) must be worn: 1. Safety glasses/goggles 2. Hardhat 3. Coveralls 4. Safety boots 5. Gloves 6. High visibility vests if in mobile equipment travel area

Table 1 – Backwash Flow Requirements

Vessel	Flow Rate
3ft and 4ft Vessels	100gpm
8ft Vessel with Sand	700gpm
8ft Vessel with Zeolite	400gpm
8ft Vessel with Carbon	500gpm
8ft Vessel with Ion Exchange	150gpm

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6.0 Related Documents:	➢ Occupational Safety General Regulations ➢ Health, Safety and Environment programs

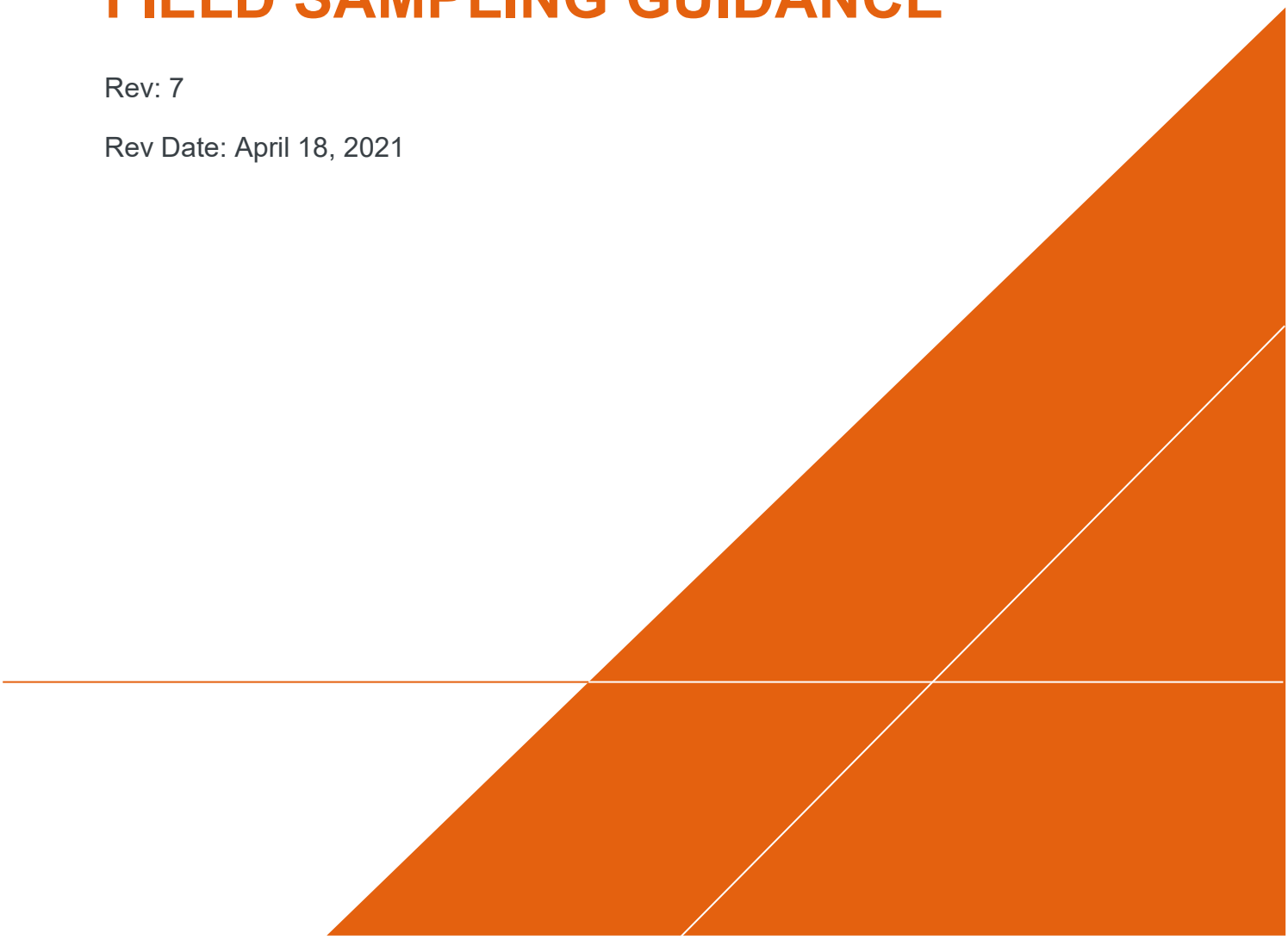
**** The safety information in this policy does not take precedence over the Occupational Health and Safety Act. All workplace parties must be familiar with the Occupational Health and Safety Act and Regulations.***

ARCADIS Design & Consultancy for natural and built assets

PER- AND POLYFLUOROALKYL SUBSTANCES (PFAS) FIELD SAMPLING GUIDANCE

Rev: 7

Rev Date: April 18, 2021



VERSION CONTROL

Revision No	Revision Date	Page No(s)	Description	Reviewed by
0	April 27, 2017	All	Initial Release	Erica Kalve Erika Houtz Sue Tauro
1	June 19, 2018	1 through 4 and 17	Updated Information on Sampling Materials	Erica Kalve Erika Houtz
2	October 15, 2018	6 to 16	Minor updates on laboratory elements, updates to decontamination procedures, and clarification on equipment and reagent blank collection	Erika Houtz Erica Kalve
3	December 17, 2018	4, 6, 17	Removed Sharpies from acceptable field writing implements; Changed language in Section 3.2 and Section 10.5 to provide stricter guidance for DoD projects.	Erika Houtz, Erica Kalve
4	March 26, 2019	4,5	Removed Citranox from acceptable Decon solutions in Table 1a, added all fluoropolymer containing materials to prohibited items in Table 1b. Made a correction that Liquinox contains trace levels of 1,4 Dioxane, not Alconox.	Erika Houtz
5	October 16, 2020	14	Added Air Force preference to sample surface water at surface for Air Force investigations.	Erika Houtz
6	March 23, 2021	4, 5, 7, 12, 13, 14, 15, 16, 17	Made clarifications that fine/ultra-fine point Sharpies are allowed. Referenced 2018 MDEQ sampling guidance. Made updates to 'After Sample Collection' in Section 7.	Kevin Engle
7	April 18, 2021	All	Changed title from Poly- and Perfluoroalkyl Substances to **"Per- and Polyfluoroalkyl Substances"** and changed PFASs to PFAS.	Rosario Varrella, Erika Houtz

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APPROVAL SIGNATURES

Prepared by:

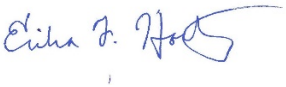


4/1/2021

Kevin Engle, PG
Geologist

Date:

Reviewed by:



4/18/2021

Erika F. Houtz, PhD, PE
Environmental Engineer and PFAS Analytical Lead

Date:

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1 INTRODUCTION

This document describes general and/or specific procedures, methods, actions, steps, and considerations to be used and observed by Arcadis staff when performing work, tasks, or actions under the scope and relevancy of this document. This document may describe expectations, requirements, guidance, recommendations, and/or instructions pertinent to the service, work task, or activity it covers.

It is the responsibility of the Arcadis Certified Project Manager (CPM) to provide this document to the persons conducting services that fall under the scope and purpose of this procedure, instruction, and/or guidance. The Arcadis CPM will also ensure that the persons conducting the work falling under this document are appropriately trained and familiar with its content. The persons conducting the work under this document are required to meet the minimum competency requirements outlined herein, and inquire to the CPM regarding any questions, misunderstanding, or discrepancy related to the work under this document.

This document is not considered to be all inclusive nor does it apply to any and all projects. It is the CPM's responsibility to determine the proper scope and personnel required for each project. There may be project- and/or client- and/or state-specific requirements that may be more or less stringent than what is described herein. The CPM is responsible for informing Arcadis and/or Subcontractor personnel of omissions and/or deviations from this document that may be required for the project. In turn, project staff are required to inform the CPM if or when there is a deviation or omission from work performed as compared to what is described herein.

In following this document to execute the scope of work for a project, it may be necessary for staff to make professional judgment decisions to meet the project's scope of work based upon site conditions, staffing expertise, state-specific requirements, health and safety concerns, etc. Staff are required to consult with the CPM when or if a deviation or omission from this document is required that has not already been previously approved by the CPM. Upon approval by the CPM, the staff can perform the deviation or omission as confirmed by the CPM.

2 SCOPE AND APPLICATION

The purpose of this Technical Guidance Instructions (TGI) is to provide guidance on field sampling to be used for **Per- and Polyfluoroalkyl Substances** (PFAS). This protocol was adapted from various sources including Arcadis Australia, Transport Canada, and the U.S Army Corp of Engineers (USACE) Omaha. In general, sampling techniques used for PFAS site characterization are consistent with conventional sampling techniques used in the environmental industry, but special consideration is made regarding PFAS-containing materials and cross-contamination potential. **Table 1a** provides a summary of materials that have been approved for site investigation; this list is expected to grow longer as industry experience increases. **Table 1b** provides a summary of field equipment and materials that have available testing information and/or industry knowledge regarding PFAS cross-contamination potential and it is recommended that these materials be prohibited for sample collection; for materials that are suspected of containing PFAS and/or to retain PFAS, these recommendations are considered preliminary and subject to change.

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Table 1a: Summary of Acceptable Sampling Equipment and Materials for PFAS Site Investigations

Sampling Materials	Additional Considerations	References
Water Sampling Materials		
High density polyethylene (HDPE) or silicone tubing materials	--	DER 2016; USACE 2016; NHDES 2016; MassDEP 2017
HDPE HydraSleeves™	Low density polyethylene (LDPE) HydraSleeves™ are not recommended	USACE 2016; MassDEP 2017
Drilling and Soil Sampling Materials		
PFAS-free drilling fluids	--	DER 2016
PFAS-free makeup water	Confirm PFAS-free water source via laboratory analysis prior to investigation	--
Acetate liners	For use in soil sampling	USACE 2016
Sample Containers and Storage		
HDPE sample containers with HDPE lined lids for soil and water samples	Laboratory should provide; whole bottle analysis of aqueous samples combined with a solvent rinse of bottle is recommended	DER 2016, MassDEP 2017
Ice contained in plastic (polyethylene) bags (double bagged)	--	DER 2016; USACE 2016; NHDES 2016; MassDEP 2017
Field Documentation		
Ball point pens	--	MassDEP 2017
Standard paper and paper labels	--	DER 2016; USACE 2016; NHDES 2016; MassDEP 2017
Fine/Ultra-Fine point Sharpies®	Larger point Sharpies® should be avoided.	MDEQ 2018
Decontamination		
Water-only decontamination	Confirm PFAS-free water source via laboratory analysis prior to investigation	DER 2016
Alconox® or Liquinox® followed by deionized water or PFAS-free water rinse	Liquinox® known to contain trace levels of 1,4-dioxane	NHDES 2016; USACE 2016; MassDEP 2017
Methanol, isopropanol, or acetone	Special health and safety precautions are necessary	UNEP 2015; USACE 2016

Note: This list is considered preliminary and additional materials may be added as additional information becomes available. Project teams are expected to follow a methodical evaluation process of materials to be used and confirm acceptance prior to implementation of field activities.

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Table 1b: Summary of Sampling Equipment and Materials Not Recommended for PFAS Site Investigations.

Sampling Materials	Known PFAS-Containing Materials	Suspected PFAS-Containing Materials	Materials with Potential to Retain PFAS	References
Water Sampling Materials				
Teflon®, PTFE-containing or other fluoropolymer coated or containing field equipment (e.g., tubing, bailers, liners, tape, plumbing paste, pump parts)	x			DER 2016; USACE 2016; NHDES 2016; MassDEP 2017
Passive diffusion bags			x	MassDEP 2017
LDPE HydraSleeves ™			x	USACE 2016; MassDEP 2017
Water particle filters			x	MassDEP 2017
Drilling and Soil Sampling Materials				
Aluminum foil			x	DER 2016; USACE 2016; NHDES 2016; MassDEP 2017
Drilling fluid containing PFAS	x	x		DER 2016
Sample Containers and Storage				
Glass sample containers with lined lids			x	DER 2016; USACE 2016; NHDES 2016; MassDEP 2017
LDPE containers and lined lids			x	USACE 2016
Teflon® or PTFE- lined lids on containers (e.g., sample containers, rinsate water storage containers)	x			DER 2016; USACE 2016; NHDES 2016; MassDEP 2017
Reusable chemical or gel ice packs (e.g., BlueIce®)		x		DER 2016; USACE 2016; NHDES 2016; MassDEP 2017
Field Documentation				
Self-sticking notes and similar office products (e.g., 3M Post-it-notes)		x		DER 2016; USACE 2016; NHDES 2016; MassDEP 2017
Waterproof paper, notebooks, and labels	x			DER 2016, MassDEP 2017
Markers		x		NHDES 2016

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Sampling Materials	Known PFAS-Containing Materials	Suspected PFAS-Containing Materials	Materials with Potential to Retain PFAS	References
Decontamination				
[Some] detergents and decontamination solutions (e.g., Decon 90® Decontamination Solution)	x	x		DER 2016; NHDES 2016; MassDEP 2017

Note: For materials that are suspected of containing PFAS, or have the potential to retain PFAS, project specific considerations may provide adequate justification for use during the field event. For example, further evaluation may be conducted in the form of pre-field equipment blank sample analysis.

Given the extremely low detection limits associated with PFAS analysis and the many potential sources of trace levels of PFAS, field personnel are advised to err on the side of caution by strictly following these protocols, frequently replacing nitrile gloves, and rinsing field equipment to help mitigate the potential for false detections of PFAS. A summary of other specific items related to field sampling for PFAS are discussed in the sections below.

This TGI applies to all Arcadis and subcontractor personnel involved in field sampling for PFAS.

3 PERSONNEL QUALIFICATIONS

3.1 Sampling Personnel

Field personnel must have current health and safety training, including 40-hour HAZWOPER training, site supervisor training, and site-specific training, as needed. In addition, field personnel will be versed in the other relevant SOPs (e.g., low flow sampling) and will possess the skills and experience necessary to successfully complete the desired field work. The site Health and Safety Plan (HASP) and other documents will identify any other training requirements such as site-specific safety training or access control requirements.

3.2 Laboratories

These laboratories are example laboratories that could be used to analyze environmental media for PFAS, pending project approval:

- United States: TestAmerica, SGS, Vista, ALS, and Eurofins
- Canada: Axys-SGS and Maxxam Laboratories

Other laboratories may be used if they are appropriately accredited for PFAS analysis according to any project requirements. It is recommended that a laboratory is Environmental Laboratory Accreditation Program (ELAP)-accredited for PFAS analysis in accordance with the Department of Defense (DoD) Quality Systems Manual (QSM) 5.1 Table B-15 or any subsequent updates. **For all data collection efforts at DoD sites, PFAS data must be obtained using a method that is DoD ELAP-accredited under QSM 5.1 or later.**

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4 EQUIPMENT LIST

The following equipment and materials must be available for sampling:

- Site plan of sampling locations, relevant work plan (or equivalent), and this TGI;
- Appropriate health and safety equipment, as specified in the site HASP;
- Dedicated plastic sheeting (preferably high-density polyethylene [HDPE]) or other clean surface to prevent sample contact with the ground;
- Conductivity/temperature/pH meter;
- Dissolved oxygen meter, oxidation reduction potential meter, and turbidity meter;
- Depth to water meter;
- If using low-flow groundwater sampling techniques, peristaltic pump (groundwater sampling)/bladder pump (with PFAS free bladder/ HDPE bladder), flow through cell, and accompanying HDPE and silicone tubing;
- Hydrasleeves, if using Hydrasleeves for groundwater sampling;
- Metal trowel for soil samples; specialized soil/sediment sampling equipment as required;
- Brushes for scrubbing sampling equipment;
- Pens, pencils, and/or fine/ultra-fine point Sharpies® for writing;
- Clipboards, field binders, and field note pages that are not waterproof;
- Labeled sample bottles:
    - Water: HDPE bottles fitted with polypropylene screw cap only; some types of PFAS samples (primarily drinking water) may require preservative, which will be indicated by the laboratory conducting the analysis. The laboratory will specify the sample bottle volume.
    - Soil and sediment: HDPE bottles fitted with polypropylene screw cap only; no preservatives. The laboratory will specify the sample bottle volume.
- If high concentrations of PFAS related to class B firefighting foams are expected, bring additional small vials to conduct field-based shaker tests for foaming;
- Ziploc® bags to hold ice and samples;
- Bottles containing “PFAS-free” water used for reagent blanks;
- Labeled coolers for samples with ice; Blue ice is not permitted;
- Deionized or distilled water for initial decontamination rinsing;
- “PFAS-free” water provided by the laboratory for final decontamination rinsing;
- Methanol, isopropanol, or acetone if able to be brought safely to field site; especially important for decontamination during soil sampling;
- Alconox or Liquinox®;

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- Packing and shipping materials;
- Groundwater Sampling Log; and
- Chain-of-Custody (COC) Forms.

5 CAUTIONS

5.1 Food Packaging

Some food packaging may be treated with PFAS-containing chemicals to prevent permeation of oil and water in the food outside of the packaging. To avoid potential food packaging-related PFAS contact:

- Do not bring any food outside of the field vehicles onsite and eat snacks and meals offsite.
- Wash hands after eating.
- Remove any field garments or outer layers prior to eating. Do not put them back on until done eating and hands are washed.

5.2 Field Gear

5.2.1 Clothing

Many types of clothing are treated with PFAS for stain and water resistance, in particular outdoor performance wear under brand names such as Gore-Tex®. To avoid potential clothing-related PFAS contact:

- Do not wear any outdoor performance wear that is water or stain resistant, or appears to be. Err on the side of caution.
- Wear pre-laundered (multiple washings, i.e., 6+) clothing that is not stain resistant or water proof.
- Natural fabrics such as cotton are preferred. Synthetic fabrics may also be acceptable if there is no indication on the label that the fabric is water and stain resistant.
- Most importantly, avoid contacting your clothing with sampling equipment, bottles, and samples.

5.2.2 Personal Protective Equipment

Safety Footwear

Some safety footwear has been treated to provide a degree of waterproofing and increased durability and may represent a source of trace PFAS. For the health and safety of field personnel, footwear must be protected at all times to avoid potential PFAS contamination. To do this:

- Do not contact your footwear with equipment, bottles, or samples in any way.
- Do not allow gloves used for sampling to come in contact with safety footwear.

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Nitrile Gloves

Wear disposable nitrile gloves at all times. Don a new pair of nitrile gloves **before** the following activities at each sample location:

- Decontamination of re-usable sampling equipment;
- Contact with sample bottles or "PFAS-free" water bottles;
- Insertion of anything into the sample ports (e.g., HDPE tubing); and
- Handling of any quality assurance/quality control (QA/QC) samples including field blanks and equipment blanks.

Don a new pair of nitrile gloves **after** the following activities:

- Handling of any non-dedicated sampling equipment;
- Contact with contaminated surfaces; or
- When judged necessary by field personnel.

5.3 Personal Hygiene

- Shower at night.
- Do not use personal care products after showering such as lotions, makeup, and perfumes, UNLESS medically necessary.
- Use sunscreen and insect repellent ONLY if necessary for health and safety. If they are necessary, apply sunscreen and repellant prior to initiating field sampling. If sunscreen and/or repellant need to be reapplied, ensure a safe distance away from the sampling locations and equipment (i.e., more than 10 meters (m) away). Wash hands after application.

5.4 Visitors

Visitors to the site are asked to remain at least 10 m from sampling areas.

5.5 Rain Events

Special care should be taken when rain is falling at the project site:

- Do not perform field sampling when rain fall is persistent at a consistent rate that saturates the ground (i.e., formation of puddles) because rain gear is not permitted while sampling. Intermittent showers or fog are acceptable conditions to proceed. If rain showers occur; field gear must be removed from the monitoring well location until the rain subsides.
- If project timelines are tight, consider the use of a gazebo tent that can be erected over the top of the monitoring well to provide shelter from the rain. The canopy material is possibly a PFAS-treated surface and should be managed as such; therefore, wear gloves when moving the tent, change them immediately after moving the tent, and avoid further contact with the tent until all sampling activities have been finished and the team is ready to move on to the next site.

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6 HEALTH AND SAFETY CONSIDERATIONS

- The ability to safely access the surface water sampling locations must be verified before sampling.
- Field activities must be performed in accordance with the site HASP, a copy of which will be present onsite during such activities.
- Safety hazards associated with sampling surface water include fast-moving water, deep water, and steep slopes close to sampling sites. Use extreme caution when approaching sampling sites.
- If thunder or lighting is present, discontinue sampling and take cover until 30 minutes have passed after the last occurrence of thunder or lighting.
- Use caution when removing well caps as well may be under pressure, cap can dislodge forcefully and cause injury.

7 PROCEDURE

7.1 Field Equipment Cleaning

Reusable field sampling equipment will require cleaning between uses. For groundwater sampling, between uses, decontaminate the flow-through cell and any non-dedicated equipment (i.e., interface probe of depth to water meter) that comes into contact with well water. Trowels and other materials used to sample soil samples will also require decontamination, although dedicated, single use equipment such as liners should be used where possible.

After donning a new pair of nitrile gloves:

- Rinse sampling equipment with Alconox or Liquinox® cleaning solution; Scrub equipment with a plastic brush if needed;
- Rinse two times with distilled water or deionized water;
- Rinse one time with “PFAS-free” water or once with methanol/isopropanol/acetone, if it is available, and once with “PFAS-free” water; organic solvents are especially useful for decontaminating soil sampling equipment. If organic cleaning solvents cannot be brought to site, scrub equipment a second time after a single distilled or deionized water rinse, then rinse two times with distilled or deionized water and once with “PFAS-free” water (i.e., two scrubbings and four water rinsings total).
- Collect all rinsate in a sealed pail for disposal. Do not reuse decontamination solutions between sampling locations.

7.2 Borehole/Monitoring Well Development

If a drill rig is being used to drill for soil cores or to install monitoring wells, wear clean nitrile gloves before collecting each continuous soil sample. Additional requirements include the following:

- Verify in writing with the manufacturer that single-use liners used to collect each sample are made of a material that does not contain PFAS;

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- Collect soil samples in laboratory-supplied HDPE bottles.
- Store the sample bottles in coolers and keep at a temperature of 0 to 6ºC until transported to the laboratory.

7.2.1 Well Condition Survey/ Water Level Monitoring

Using equipment that has been thoroughly decontaminated according to the procedures in Section 7.1, conduct the well condition surveys and water level monitoring:

- Conduct monitoring well inspections and record water levels.
- Use an interface probe to evaluate presence/absence of non-aqueous phase liquid (NAPL).
- Measure the depth to water from the top of the polyvinyl chloride (PVC) riser and the total depth of the well.
- Record information in the field notes.

7.2.2 Monitoring Well Development and Purging

Follow these requirements for monitoring well development and purging:

- Do not use Teflon™ tubing for purging or sample collection. HDPE tubing is acceptable.
- Do not re-use materials between wells. Upon completion of use, remove all disposable materials (such as HDPE and/or silicone tubing) and place in heavy duty garbage bags for disposal.
- During development of the well, create sufficient energy to agitate the water column and create flow reversals in the well screen, filter pack and formation to loosen fine-grained materials and draw them into the well. The pumping or bailing action should then draw all drilling fluids and fine-grained material out of the borehole and adjacent formation and then out of the well. Review the Arcadis Monitoring Well Development guidance (Arcadis 2010) for more detailed information.
- Follow the low-flow purge and sampling techniques per the U.S. Protection Agency's (EPA's) guidance document titled *Low Stress (Low Flow) purging and Sampling Procedure for the Collection of Ground Water Samples from Monitoring Wells* (2010) and ASTM's standard titled *Standard Practice for Low-Flow Purging and Sampling for Wells and Devices Used for Ground-Water Quality Investigations* (2002). Also available for review is the Arcadis Low-Flow Groundwater Purging and Sampling Procedures for Monitoring Wells (Arcadis 2011).
- To purge the well, if using HDPE tubing and a peristaltic pump, insert the end of the tubing to the approximate depth of the midpoint of the screened section of the monitoring wells. Measure the length of HDPE tubing to be inserted into each monitoring well and pre-cut it to approximate lengths (such as the previously measured arm span of a field technician) to avoid contact with any materials other than the monitoring well and peristaltic pump. Flow rates should be as low as can be reasonably achieved. Collect and appropriately dispose of purge water.
- Silicone tubing should direct the purge water through a flow-through cell for field parameter measurements of pH, conductivity, temperature, dissolved oxygen, and turbidity. Calibrate the

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instrument in the field prior to use. Decontaminate the instrument and flow-through cell at each monitoring well location before purging.

- Record field parameters in intervals (generally of 3-minute duration) to ensure purge water has cycled through the flow-through cell. Sample the wells after field parameter measurements indicate stabilization, which allows collection of representative formation water (generally acceptable standards are three consecutive pH readings to within ±0.1 units, and three consecutive conductivity, temperature and dissolved oxygen measurements to within 3%). Turbidity must be monitored, but does not need to be used as a stabilization indicator of purge completion. Record field parameter measurements at each well. Drawdown should be monitored throughout the purge.
- If wells are suspected to be dewatering throughout the purge (i.e., reduced flow rate/difficulty pumping water or bubbles begin to come through the flow through cell), turn off the pump and allow the water level to recover for ½ hour, followed by sample collection. Document these activities in the field notes.

7.3 Sample Collection

Different laboratories may supply sample collection bottles of varying sizes depending on the type of media to be sampled.

7.3.1 Sample Containers

- Collect samples in HDPE bottles fitted with an unlined (no Teflon™), polypropylene screw cap.
- Complete bottle labels after the caps have been placed back on each bottle.
- Do not use glass bottles due to potential loss of analyte through adsorption. This is particularly important for aqueous samples.
- Review with analytical lab the sample size, sample container, etc. depending upon the type of PFAS analysis that is being requested.

7.3.2 Soil Sampling

Before Sample Collection

- Place plastic sheeting adjacent to the sample port for use as a clean work area, if conditions allow. Otherwise, prevent sampling equipment from contacting the ground or other surface that could compromise sample integrity.
- Trowels or drilling equipment that will come into contact with a sample should be decontaminated prior to sample collection, preferably with methanol/isopropanol/acetone;
- Don a new set of nitrile gloves. Do not use gloved hands to subsequently handle papers, pens, clothes, etc., before collecting samples.
- Use the HDPE bottles that are supplied by the laboratory. Make sure that the caps remain on the bottle until immediately prior to sample collection.

During Sample Collection

- Collect soil samples using a clean stainless steel trowel or with single-use PFAS-free liners;

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- Place soil samples in labeled HDPE bottles supplied by the laboratory.
- Note the time on the sample label.
- Collect any necessary duplicates/co-located samples and matrix spikes – verify with laboratory whether they need to be collected in separate sample bottles.
- Collect any necessary equipment blanks. The best timing to collect equipment blanks is immediately after the collection of a sample likely to contain high concentrations of PFAS, after the sampling equipment has been appropriately decontaminated.
- Collect any necessary field reagent blanks. This sample should be collected after field staff return from an offsite break (e.g., lunch) to capture any potential cross-contamination from field personnel.

After Sample Collection

- Place each sample bottle in two sealed Ziploc® bags. Another brand of LDPE bag is acceptable.
- Record the label information and time of sampling in the field notes.
- Place soil sample bottles in coolers that are durable in transportation and keep the temperature between 0 and 6ºC until transported to the laboratory. Do not use blue ice.

7.3.3 Groundwater Sampling

Before Sample Collection

- Place plastic sheeting adjacent to the sample port for use as a clean work area, if conditions allow. Otherwise, prevent sampling equipment from contacting the ground or other surface that could compromise sample integrity.
- Don a new set of nitrile gloves. Do not use gloved hands to subsequently handle papers, pens, clothes, etc., before collecting samples.
- Use the labeled HDPE bottles that are supplied by the laboratory. Make sure that the caps remain on the bottle until immediately prior to sample collection.
- Measure depth to water and field parameters. Turbidity and the physical appearance of the purged water should be noted on the Groundwater Sampling Log.

During Sample Collection

- Start groundwater sample collection upon stabilization of field parameters.
- If low-flow groundwater sampling techniques are being used, disconnect the silicone tubing from the flow-through cell, enabling collection of groundwater samples prior to passing through the cell.
- Hydrasleeves are also considered acceptable for sampling of PFAS in groundwater – consult the project manager to determine which technique should be used. In general, low flow sampling is preferable.
- Collect groundwater samples (to the neck of the bottle, some headspace is acceptable) from the dedicated sampling ports at the center of the well screen. While collecting the sample, make sure the bottle cap remains in the other hand of the sampler, until replaced on the bottle.

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- To mitigate cross contamination, collect groundwater samples in a pre-determined order from least impacted to greater impacted based on previous analytical data or knowledge about past activities at the site. If no analytical data are available, samples are to be collected in the following order:
  1. First sample the upgradient well(s).
  2. Next, sample the well located furthest downgradient of the interpreted or known source.
  3. The remaining wells should be progressively sampled in order from downgradient to upgradient, such that the wells closest to the interpreted or known source are sampled last.
- NOTE: If high concentrations of PFAS related to class B firefighting foams are expected in a groundwater sample, conduct a Shaker test by collecting and shaking a small portion of the sample (~10 to 25 mL) on site in a small disposable vial. If foaming is noted within the sample, document the foaming when samples are submitted for analysis; the 'shaker test' vial can then be disposed. This shaker test provides information about how each of the samples should be handled analytically.
- After collecting the sample, tightly screw on the polypropylene cap (snug, but not too tight). This will minimize leaking or cross contamination of the sample. Most PFAS, including all analytes measured by USEPA Method 537, are not volatile at environmental pH.
- Note the time on the sample label.
- Collect any necessary duplicates and matrix spikes. As the laboratory should be analyzing the entire aqueous sample rather than sub-sampling, separate bottles will be required for these samples.
- Collect any necessary equipment blanks. The best timing to collect equipment blanks is immediately after the collection of a sample likely to contain high concentrations of PFAS, after the sampling equipment has been appropriately decontaminated.
- Collect any necessary field reagent blanks. This sample should be collected after field staff return from an offsite break (e.g., lunch) to capture any potential cross-contamination from field personnel.
- Do not rinse PFAS sample bottles during sampling. Do not filter samples.

After Sample Collection

- Place each sample bottle in two sealed Ziploc® bags. Another brand of LDPE bag is acceptable.
- Record the label information and time of sampling in the field notes and COC. Note ‘shake test’ results if appropriate.
- Place groundwater samples in coolers that are durable in transportation and keep the temperature between 0 and 6ºC until transported to the laboratory. **Do not use blue ice. Store PFAS samples in a separate cooler from other types of samples.**

  Treat all disposable sampling materials as single use and dispose of them appropriately after sampling at each monitoring well.

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7.3.4 Sediment Sampling

Before Sample Collection

- Place plastic sheeting (preferably HDPE) adjacent to the sample port for use as a clean work area, if conditions allow. Otherwise, prevent sampling equipment from contacting the ground or other surface that could compromise sample integrity.
- Don a new set of nitrile gloves. Do not use gloved hands to subsequently handle papers, pens, clothes, etc., before collecting samples.
- Use the HDPE bottles that are supplied by the laboratory. Make sure that the caps remain on the bottle until immediately prior to sample collection.

During Sample Collection

- Where surface water samples and sediment samples are collected at the same location, collect surface water samples first to minimize siltation.
- Collect sediment samples either manually using a stainless steel trowel or using a petite ponar grab sampler, depending on field conditions at each sampling location during sampling program.
- Collect sediment samples from the upper 10 cm of sediment.
- For a sample to be acceptable overlying, low turbidity water must be present.
- Decant the overlying water and use a stainless steel trowel to collect only the upper 5 centimeters (cm) of sediment.
- Collect sediment samples directly into laboratory-supplied bottles that are suitable in both material and size.
- Do not overfill the sample bottle.
- Make sure that the sample does not contain vegetation, that the sediment is undisturbed, and that the sampler shows no signs of winnowing or leaking.
- Make sure bottle caps remain in the gloved hand of the sampler until sampling is complete and caps are replaced on the bottle.
- Note the time on the sample label.
- Collect any necessary duplicates and matrix spikes.
- Collect any necessary equipment blanks. The best timing to collect equipment blanks is immediately after the collection of a sample likely to contain high concentrations of PFAS, after the sampling equipment has been appropriately decontaminated.
- Collect any necessary field reagent blanks. This sample should be collected after field staff return from an offsite break (e.g., lunch) to capture any potential cross-contamination from field personnel.

After Sample Collection

- Place each sample bottle in two sealed Ziploc® bags. Another brand of LDPE bag is acceptable.
- Record the label information and time of sampling in the field notes.

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- Place samples in coolers that are durable in transportation and keep the temperature between 0 and 6ºC until transported to the laboratory. **Do not use blue ice. Store PFAS samples in a separate cooler from other types of samples.**
- Measure surface water pH, conductivity, temperature, and total dissolved solids (TDS) at each location **after** both surface water and sediment sampling is completed.

7.3.5 Surface Water Sampling

Before Sample Collection

- Place plastic sheeting (preferably HDPE) adjacent to the sample port for use as a clean work area, if conditions allow. Otherwise, prevent sampling equipment from contacting the ground or other surface that could compromise sample integrity.
- Don a new set of nitrile gloves. Do not use gloved hands to subsequently handle papers, pens, clothes, etc., before collecting samples.
- Use the HDPE bottles that are supplied by the laboratory. Make sure that the caps remain on the bottle until immediately prior to sample collection.

During Sample Collection

- Avoid sampling the surface, in general.
- However, for Air Force investigations, collect samples from the water surface.
- Where surface water samples and sediment samples are collected at the same location, collect surface water samples first to minimize siltation.
- Collect surface water samples directly into laboratory-supplied bottles; wide-mouth bottles may be preferable to narrow mouth bottles for ease of surface water collection.
- Make sure bottle caps remain in the gloved hand of the sampler until sampling is complete and caps are replaced on the bottle.
- Note the time on the sample bottle.
- Collect any necessary duplicates and matrix spikes. As the laboratory should be analyzing the entire aqueous sample rather than sub-sampling, separate bottles will be required for these samples.
- Collect any necessary equipment blanks. The best timing to collect equipment blanks is immediately after the collection of a sample likely to contain high concentrations of PFAS, after the sampling equipment has been appropriately decontaminated.
- Collect any necessary field reagent blanks. This sample should be collected after field staff return from an offsite break (e.g., lunch) to capture any potential cross-contamination from field personnel.

After Sample Collection

- Place each sample bottle in two sealed Ziploc® bags. Another brand of LDPE bag is acceptable.
- Record the label information and time of sampling in the field notes.

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- Place samples in coolers that are durable in transportation and keep the temperature between 0 and 6ºC until transported to the laboratory. **Do not use blue ice. Store PFAS samples in a separate cooler from other types of samples.**
- Measure surface water pH, conductivity, temperature, and TDS at each location **after** both surface water and sediment sampling.

7.4 Shipping

- If samples cannot be shipped the same day as collected, arrange an appropriate means of keeping the samples cool overnight and maintain the temperature between 0 and 10°C for the first 48 hours after collection, and then between 0 and 6°C thereafter.
- Store samples in appropriate transport bottles (coolers) with ice (Ziploc© bags for use as ice containers) with appropriate labeling. **Do not use blue ice. Store PFAS samples in a separate cooler from other types of samples.**
- Complete the appropriate procedures for COC, handling, packing, and shipping.
- Fill out and check COC Forms against the labels on the sample bottles progressively after each sample is collected.
- Place all disposable sampling materials (such as plastic sheeting, and health and safety equipment) in appropriate containers.
- Ship samples via courier service with priority overnight delivery. Tracking numbers for all shipments should be provided and recorded after they have been sent out to ensure their timely delivery.
- Do not ship samples via Fed Ex for Saturday delivery.

8 WASTE MANAGEMENT

All rinsate should be collected in a sealed pail for disposal. Drill cuttings and purge water will be managed as specified in the Field Sampling Plan (FSP) or Work Plan, and according to state and/or federal requirements. PPE and decontaminated fluids will be contained separately and staged at the sampling location. Containers must be labeled at the time of collection. Labels will include date, location(s), site name, city, state, and description of matrix contained (e.g., soil, groundwater, PPE). General guidelines for investigation derived waste (IDW) handling and storage are set forth in a separate IDW guidance document (Arcadis 2009).

Typical waste characterization procedures include collection of a composite sample of the drill cutting material and a composite sample of the purge water for laboratory analysis. Samples are typically analyzed for disposal toxicity characteristic leaching procedure (TCLP) analysis for metals and VOCs. For PFAS, a simple leach test with neutral pH water may be more indicative of actual risk. Additionally, generators of waste are required to include analysis of other constituents that are reasonably believed to be present including (in this case) PFAS.

Emerging contaminants pose a unique challenge for disposal because acceptance of such waste will be based on the local facility and their permit restrictions. Project teams will be required to identify appropriate facilities based on the facility's legal ability to accept the waste and the team should confirm that the facility

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is meeting the regulatory requirements for accepting waste containing PFAS. In general, facilities that provide solidification and/or incineration will be likely to meet the necessary requirements to accept PFAS-containing waste. The facility will then provide the definitive laboratory analysis requirements needed to meet their permit requirements for waste classification.

9 DATA RECORDING AND MANAGEMENT

9.1 Field Notes

Waterproof field books must not be used for field notes. Instead, field notes should be on loose paper on Masonite, plastic, or aluminum clip boards. Other requirements for field notes include:

- Pens, pencils, and fine/ultra-fine point Sharpies® may be used.
- Keep field notes and writing implements away from samples and sampling materials.
- One person should conduct sampling while another records field notes.
- Do not write on sampling bottles unless they are closed.

9.2 Other Project Documentation

- Complete Groundwater Sampling Logs.
- Make sure COC Forms are properly completed. Verify which PFAS analytes (e.g., just PFOS and PFOA, some or all of the 537 list, etc.) are required for analysis and note on the COC.

10 QUALITY CONTROL

Refer to quality control requirements for the project to ensure that appropriate quality assurance and quality control (QA/QC) samples are collected. When collecting QA/QC samples, the same guidelines apply as when collecting regular samples – specifically that:

- Samples should be collected in laboratory-supplied HDPE bottles;
- Bottle caps must remain in the hand of the sampler until replaced on the bottle;
- Labels must be completed after the caps have been placed back on each bottle; and
- Samples must be stored in appropriate transport bottles (coolers) with ice (Ziploc© bags for use as ice containers) with appropriate labeling. **Do not use blue ice. Store PFAS samples in a separate cooler from other types of samples.**

10.1 Equipment Blanks (if relevant)

QA/QC sampling typically includes daily collection of equipment blanks using the laboratory-supplied "PFAS-free" water. For peristaltic pump tubing, laboratory supplied "PFAS-free" water should be poured into a clean HDPE sample bottle and then pumped through new HDPE tubing using the peristaltic pump (with new silicone tubing). The best timing to collect equipment blanks is immediately after the collection of

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a sample likely to contain high concentrations of PFAS, after the sampling equipment has been appropriately decontaminated.

10.2 Field Duplicates

QA/QC sampling typically includes the collection of one field duplicate for every 10 or 20 samples collected. Each duplicate sample will be collected immediately after the initial sample of which it is a duplicate into a separate laboratory-provided sample bottle. Do not indicate to the laboratory which sample the duplicate replicates, i.e. it should be given a blind reference on the COC and sample name such as "duplicate".

10.3 Field Reagent Blanks

QA/QC sampling for PFAS typically includes the submission of one laboratory supplied field reagent blank per day. The field reagent blank sample is brought to the site in a laboratory-supplied sample bottle. Field staff transfer the laboratory-supplied reagent blank to an empty sample bottle. This sample should be collected after field staff return from an offsite break (e.g., lunch) to capture any potential cross-contamination from field personnel and should be placed in the same cooler as the other PFAS samples.

10.4 Matrix Spikes (optional in some cases)

QA/QC sampling includes submitting a sample to be used as a matrix spike if the project requires it. If a separate sample bottle is required, an additional sample will be collected immediately after the initial sample of which it is a duplicate into a separate laboratory-supplied sample bottle.

10.5 Laboratory Analytical QA/QC

- Arcadis recommends that any request for PFAS analysis in groundwater or soil should be conducted by an ELAP-accredited method compliant with QSM 5.1 Table B-15. Requirements laid out in Table B-15 strictly govern acceptable laboratory data quality for PFAS analysis in environmental samples. **For all data collection efforts at DoD sites, PFAS data must be obtained using a method that is DoD ELAP-accredited under QSM 5.1 or later.**
- Laboratory QA/QC should consist of one laboratory blank and one laboratory control sample (or blank spike) per batch of samples, and additional QA/QCs as indicated by the laboratory QA/QC procedures.
- Isotope dilution should be used for quantification with isotope-labeled surrogate standards, as available, according to the guidelines of QSM 5.1 Table B-15. USEPA Method 537 does not allow for isotope dilution in their PFAS drinking water method.
- For drinking water, groundwater, and surface water samples, laboratories must extract the entire sample and include a solvent rinse of the bottle for analysis. Aqueous samples should generally not be sub-sampled prior to analysis, unless they are high concentration and require serial dilution (US DoD 2017).
- Soil samples should be analyzed in their entirety or thoroughly homogenized before extraction and analysis.

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- As part of the internal QA/QC of laboratory results, relative percent difference (RPD) should be calculated between samples and corresponding field or laboratory duplicates. The laboratory quality assurance portion of the laboratory certificates should be reviewed to verify that all calculations/recoveries were within acceptable limits as established by the laboratory method and guidelines in Table B-15 of QSM 5.1 or later (USDoD 2017).

11 REFERENCES

Arcadis Australia. 2017. Soil and Concrete Sampling for PFAS. April.

Arcadis. 2010. Monitoring Well Development, Rev. #2.2. March 22.

Arcadis. 2009. Investigation-Derived Waste Handling and Storage, Rev. #2. March 6.

Arcadis. 2011. Low-Flow Groundwater Purging and Sampling Procedures for Monitoring Wells, Rev. #4. February 2.

ASTM. 2002. ASTM D6771-02 - Standard Practice for Low-Flow Purging and Sampling for Wells and Devices Used for Ground-Water Quality Investigations (Withdrawn 2011). Available at: https://www.astm.org/Standards/D6771.htm.

Department of Environment Regulation (DER). Government of Western Australia. 2016. Interim Guideline on the Assessment and Management of Perfluoroalkyl and Polyfluoroalkyl Substances (PFAS). Contaminated Sites Guidelines. February.

Michigan Department of Environmental Quality. 2018. General PFAS Sampling Guidance. October.

Massachusetts Department of Environmental Protection (MassDEP). 2017. DRAFT Fact Sheet, Guidance on Sampling and Analysis for PFAS at Disposal Sites Regulated under the Massachusetts Contingency Plan. January.

New Hampshire Department of Environmental Services (NHDES). 2016. Perfluorinated Compound (PFC) Sample Collection Guidance. November.

United Nations Environment Programme (UNEP). 2015. PFAS analysis in water for the Global Monitoring Plan of the Stockholm Convention, Set-up and guidelines for monitoring. Jana Weiss, Jacob de Boer, Urs Berger, Derek Muir, Ting Ruan, Alejandra Torre, Foppe Smedes, Branislav Vrana, Fabrice Clavient, and Heidelore Fiedler. Division of Technology, Industry and Economics. Geneva. April.

United States Army Corps of Engineers (USACE). 2016. DRAFT – Standard Operating Procedure 047: Per/Poly Fluorinated Alkyl Substances (PFAS) Field Sampling. Revision: 1. March.

U.S. Army Corps of Engineers – Omaha District. 2016. Chemistry Requirements – PFAS.

U.S. Department of Defense (DoD). 2017. Consolidated Quality Systems Manual (QSM) for Environmental Laboratories, Version 5.1. In conjunction with the U.S. Department of Energy. January.

U.S. Environmental Protection Agency. 2009. USEPA Method 537: Determination of Selected Perfluorinated Alkyl Acids in Drinking Water by Solid Phase Extraction and Liquid Chromatography/Tandem Mass Spectrometry (LC/MS/MS), version 1.1, September. National Exposure Research Laboratory, Office of Research and Development.

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U.S. Environmental Protection Agency. 2010. Low Stress (Low Flow) purging and Sampling Procedure for the Collection of Ground Water Samples from Monitoring Wells. Available at: https://www.epa.gov/quality/low-stress-low-flow-purging-and-sampling-procedure-collection-groundwater-samples-monitoring.

Transport Canada. February 2016, Per-and Polyfluorinated Alkyl Substances (PFAS) Field Sampling Guidance.

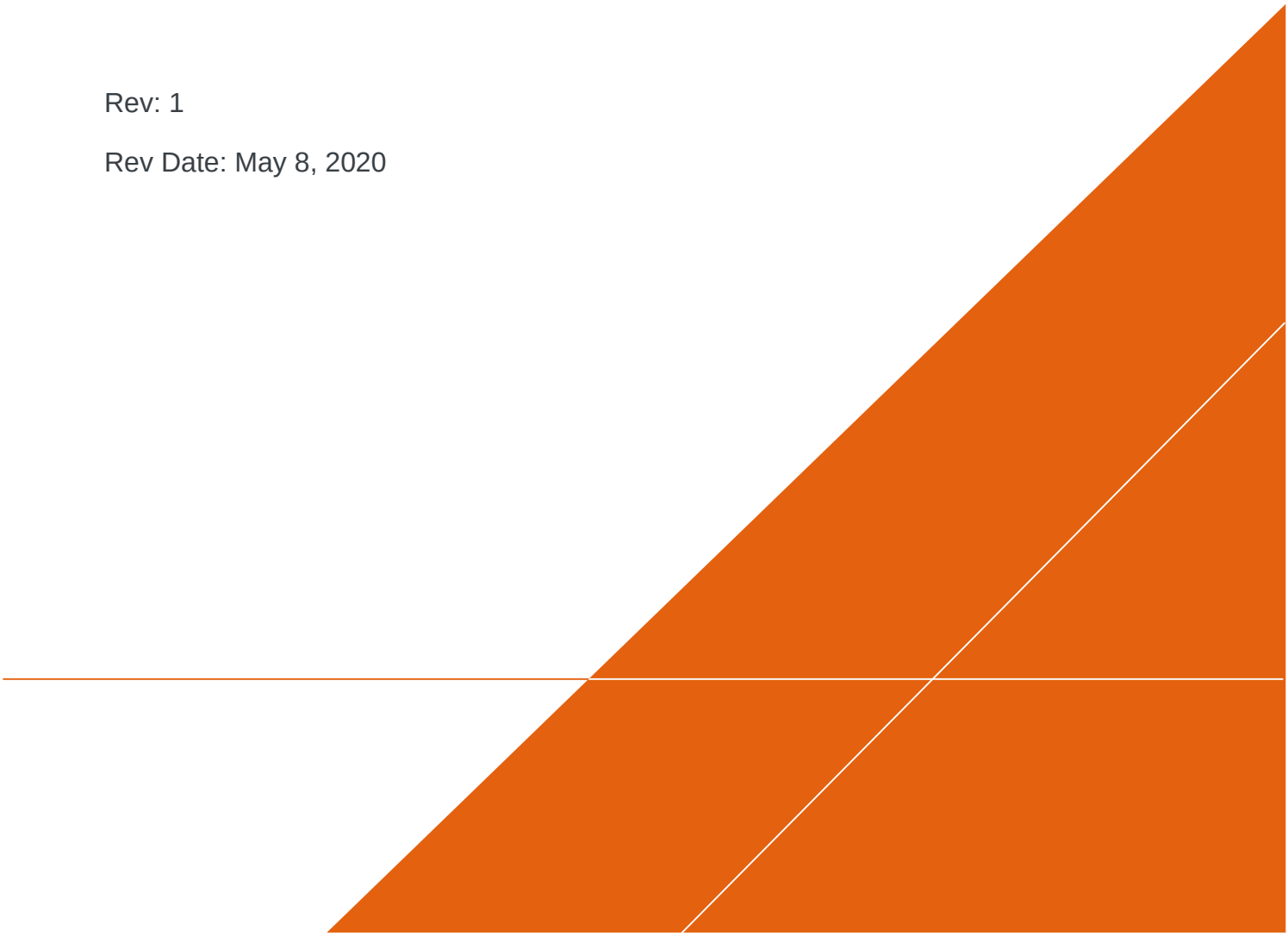
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TGI – GROUNDWATER AND SOIL SAMPLING EQUIPMENT DECONTAMINATION

Rev: 1

Rev Date: May 8, 2020



VERSION CONTROL

Revision No	Revision Date	Page No(s)	Description	Reviewed by
0	February 23, 2017	ALL	Conversion from SOP to TGI	Cassandra McCloud / Pete Frederick
1	May 8, 2020	4-5	Added note regarding use of Liquinox and 1,4-Dioxane	Marc Killingstad

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APPROVAL SIGNATURES

Prepared by:  Date: 02/23/2017

Derrick Maurer

Technical Expert Reviewed by:  Date: May 8, 2020

Marc Killingstad (Technical Expert)

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1 INTRODUCTION

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In following this document to execute the scope of work for a project, it may be necessary for staff to make professional judgment decisions to meet the project's scope of work based upon site conditions, staffing expertise, state-specific requirements, health and safety concerns, etc. Staff are required to consult with the CPM when or if a deviation or omission from this document is required that has not already been previously approved by the CPM. Upon approval by the CPM, the staff can perform the deviation or omission as confirmed by the CPM.

2 SCOPE AND APPLICATION

Decontamination is performed on sampling equipment prior to sample collection to ensure that the sampling equipment that contacts a sample, or monitoring equipment that is brought into contact with environmental media to be sampled, is free from analytes of interest and/or constituents that could interfere with laboratory analysis for analytes of interest. Sampling equipment must be appropriately cleaned prior to use for sampling or coming into contact with environmental media to be sampled, and following completion of the sampling event prior to shipment or storage. The effectiveness of the decontamination procedure should be verified by collecting and analyzing equipment blank samples.

The sampling equipment cleaning procedures described herein includes pre-field, in the field, and post-field cleaning of sampling equipment which may be conducted at an established equipment decontamination area (EDA) on site, as appropriate and necessary. Sampling equipment that may require decontamination at a given site includes: soil sampling tools; groundwater, sediment, and surface-water sampling devices; water testing instruments; down-hole instruments; and other activity-specific sampling equipment. Non-disposable equipment will be cleaned before collecting each sample, between each

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sample collected, and prior to placing sampling equipment in protective cases, or containers for transport. Cleaning procedures for sampling equipment should be monitored by collecting equipment blank samples as required in project work plans, field sampling plans, quality assurance project plans (QAPP), or other pertinent project documents. Dedicated and/or single-use (i.e., not to be re-used) sampling equipment will not require decontamination.

3 PERSONNEL QUALIFICATIONS

Arcadis field sampling personnel will have completed or are in the process of completing site-specific training as well as having current health and safety training as required by Arcadis, client, or regulations, such as 40-hour HAZWOPER training and/or OSHA HAZWOPER site supervisor training. Arcadis personnel will also have current training as specified in the Health and Safety Plan (HASP) which may include first aid, cardiopulmonary resuscitation (CPR), Blood Borne Pathogens (BBP) as needed. In addition, Arcadis field sampling personnel will be knowledgeable in the relevant processes, procedures, and Technical Guidance Instructions (TGIs) and possess the demonstrated required skills and experience necessary to successfully complete the desired field work. The project health and safety plan (HASP) and other documents will identify other training requirements or access control requirements.

4 EQUIPMENT LIST

The equipment required for equipment decontamination is presented below:

- Health and safety equipment, including appropriate PPE, as required in the site Health and Safety Plan (HASP)
- Deionized water that meets that analytical criteria for deionized water with no detectable constituents above the reporting limits for the methods to be used and analytes being analyzed for. Deionized water is used for inorganics, and organic-free water for VOCs, SVOCs, pesticides, etc.
- Non-phosphate detergent such as Alconox or, if sampling for phosphorus or phosphorus-containing compounds, Liquinox (or equivalent). NOTE: *Liquinox has shown to provide false positives for 1,4-Dioxane and should not be used at sites where that may be a constituent of concern (COC).*
- Tap water
- Rinsate collection plastic containers
- DOT-approved waste shipping container(s), as specified in the work plan, field sampling plan, or regulatory requirements if decontamination waste is to be shipped for disposal
- Brushes
- Large heavy-duty garbage bags
- Spray bottles

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- (Optional) – Isopropyl alcohol (free of ketones) or methanol. These can be wipes or diluted with water (usually 1part isopropyl/methanol to 10 parts water) if a spray is needed.
- Airtight, sealable plastic baggies, such as Ziploc-type
- Plastic sheeting

5 CAUTIONS

Rinse equipment thoroughly and allow the equipment to dry before re-use or storage to prevent introducing solvent into sample medium. If manual drying of equipment is required, use clean lint-free material to wipe the equipment dry. Ensure all rinsate materials do not adversely affect sample collection efficiency or analytical results.

Store decontaminated equipment in a clean, dry environment. Do not store near combustion engine exhausts. Properly containerize equipment to ensure cross-contamination doesn't happen from other uncontaminated surfaces or equipment.

If equipment is damaged to the extent that decontamination is uncertain due to cracks, gouges, crevices, or dents, the equipment should not be used and should be discarded or submitted for repair prior to use for sample collection.

A proper shipping determination regarding hazardous materials will be performed by a DOT-trained individual for cleaning materials shipped by Arcadis.

Caution should be exercised to avoid contact with the pump casing and water in the container while the pump is running (do not use metal drums or garbage cans) to avoid electric shock.

6 HEALTH AND SAFETY CONSIDERATIONS

Review the safety data sheets (SDS) for the cleaning agents and materials used in decontamination. If solvent is used during decontamination, use appropriate PPE and work in a well-ventilated area and stand upwind while applying solvent to equipment. Apply solvent in a manner that minimizes potential for exposure to workers and bystanders. Follow health and safety procedures outlined in the HASP.

7 PROCEDURE

A designated area will be established to clean sampling equipment in the field prior to and following sample collection. Equipment cleaning areas will be set up within or adjacent to the specific work area, but not at a location that expose equipment to contamination (i.e. exposed to combustion engine exhaust). Detergent solutions will be prepared in clean containers for use in equipment decontamination. Decontaminated equipment should be handled by workers wearing clean gloves, properly changed to prevent cross-contamination.

Cleaning Sampling Equipment

1. Wash the equipment/pump with potable water.

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2. Wash with detergent solution (Alconox, Liquinox or equivalent) to remove all visible particulate matter and any residual oils or grease. NOTE: *Liquinox has shown to provide false positives for 1,4-Dioxane and should not be used at sites where that may be a constituent of concern (COC).*
3. If equipment is very dirty, precleaning gross debris with a brush and tap water may be necessary.
4. If non-aqueous phase liquids are present, the use of isopropyl alcohol (free of ketones) or methanol is recommended. Cloth wipes or diluted solution can be used to remove the non-aqueous phase liquids that are hard to remove with detergent solution in step 2. Consult with project manager if non-aqueous phase liquids are present onsite and design an appropriate decontamination procedure that includes step 4.
5. Rinse with deionized water.

Decontaminating Submersible Pumps

Submersible pumps may be used during well development, groundwater sampling, or other investigative activities. The pumps must be cleaned and flushed before and between uses. This cleaning process will consist of an external detergent solution wash and tap water rinse, a flush of detergent solution through the pump, followed by a flush of potable water through the pump. Flushing will be accomplished by using an appropriate container filled with detergent solution and another container filled with potable water. The pump should be flushed with deionized water as the last step prior to use. The pump will run long enough to effectively flush the pump housing and hose (unless new, disposable hose is used). Disconnect the pump from the power source before handling. The pump and hose should be placed on or in clean polyethylene sheeting to avoid contact with the ground surface.

8 WASTE MANAGEMENT

Equipment decontamination rinsate will be managed in conjunction with all other waste produced during the field sampling effort. Waste management procedures are outlined in the work plan or Waste Management Plan (WMP).

9 DATA RECORDING AND MANAGEMENT

Equipment cleaning and decontamination will be noted in the field notebook for project documentation. Information will include the type of equipment cleaned, the decontamination location, specific procedures utilized, solvents and/or cleaning agents used, source of water, and deviations or omissions from this TGI.

Unusual field conditions should be noted if there is potential to impact the efficacy of the decontamination or subsequent sample collection.

An inventory of the solvents brought on site and used and removed from the site will be maintained in the project documentation. Records will be maintained for solvents used in decontamination, including lot number and expiration date.

Containers with decontamination fluids will be labeled.

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10 QUALITY ASSURANCE

Equipment blanks should be collected to verify that the decontamination procedures are effective in minimizing potential for cross contamination. The equipment blank is prepared by pouring deionized water (or organic-free water, for organic analyses) over the clean and dry tools and collecting the water into appropriate sample containers. Equipment blanks should be analyzed for the same set of parameters that are performed on the field samples collected with the equipment that was cleaned as specified in the sampling and analysis plan. Equipment blanks are collected per equipment set, which represents all of the tools needed to collect a specific sample.

11 REFERENCES

USEPA Region 9 - Field Sampling Guidance #1230, Sampling Equipment Decontamination.

USEPA Region 1 - Low Stress (low flow) Purging and Sampling Procedure for the Collection of Groundwater Samples from Monitoring Wells.

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STANDARD OPERATING PROCEDURE

SOP06 – Equipment Decontamination

1 PURPOSE

The purpose of this Standard Operating Procedure (SOP) is to standardise the process by which equipment is decontaminated prior to its re-use. Decontamination of personnel, sampling, monitoring well liquid-level gauging and other equipment is a critical step that facilitates the following:

- Safe mitigation of contaminants that may adhere to equipment during the work process to prevent cross-contamination between media sampled and gauging points.
- Eliminate liability and safety issues associated with the spread of contaminants away from designated work zones, locations and/or sites.
- Prevention of cross-contamination in order to assure the collection accurate data which is representative of site conditions and allows Arcadis to make correct decisions concerning a site.

2 EQUIPMENT

- Personal Protective Equipment (PPE)- disposable nitrile gloves, safety glasses, face shield, Tyvek or Poly-coated Tyvek;
- Plastic bags or Non-colored plastic sheeting;
- Non-phosphate detergent (Decon 90);
- Distilled or de-ionized water (MilliQ water sourced from the laboratory);
- Brushes for scrubbing;
- 2 x 20L bucket; and
- Labelled spray bottles.

3 PROCEDURE

Equipment decontamination is generally performed immediately prior to use. Uncontaminated PPE should be donned prior to the initiation of equipment decontamination procedures and disposable items changed between equipment decontamination events. If equipment is decontaminated and will not be used immediately, the item should be allowed to air dry stored in an uncontaminated environment until used. Any portion of the sampling device or equipment that has contact with contaminated media (including solid, liquid, vapor or fumes) must be cleaned, or disposed of and replaced, prior to re-use. The following procedure is required for cleaning all sampling devices and related equipment:

1. Clean plastic sheeting should be used to provide a clean work surface.
2. Wash (scrub with brushes, as needed) with a mixture of non-phosphate detergent (i.e. Decon 90) and tap water (assuming the water source is of known quality).
3. Rinse thoroughly with clean tap water (potable or de-ionized).
4. Allow to air dry.

High pressure washing (steam cleaning) may be substituted for Steps 1 and 2, provided the equipment will not be damaged in the process.

Field instruments should be cleaned in accordance with instructions of the manufacturer. When possible, instruments which are difficult to decontaminate, such as cameras and logging instruments, may be protectively wrapped to reduce or eliminate the need for decontamination.

Areas where potentially contaminated materials have come into contact with large equipment (e.g., cranes, tracks, buckets, cabs, etc.) will require washing with high pressure, hot water (100oC). Cleaning agents will be used on an as-needed basis to assist in the removal of contamination.

A decontamination pad will be constructed and will function as a wash-down area for all large equipment and/or vehicles used within contaminated work zones. The upper sections of the decontamination pad will be enclosed with plastic sheeting, if necessary, to control the spray from the pressure washer.

1. Large equipment and vehicles will be placed (driven) onto the decontamination pad where gross contamination will be removed through the use of shovels and/or brooms.
2. Large equipment and vehicles will subsequently be washed with a high pressure, hot water (100oC) washer, with cleaning agents being used on an as-needed basis, to assist in the removal of contamination.
3. Large equipment and vehicles will be held for a short period of time to allow for the drippings to be retained in the collection basin.
4. All waters should drain to a collection basin of the decontamination pad, containerised for subsequent, off-site disposal.

Decontamination fluids will be disposed of in accordance with the approved scope of work and any other federal, state and local requirements. All PPE will be containerised and disposed at a designated waste management facility that is permitted to accept the specific waste materials generated. The generation of decontamination materials or fluids will follow a specific waste management plan developed prior to the initiation of field operations, should specialised/specific disposal be required.

4 REFERENCES

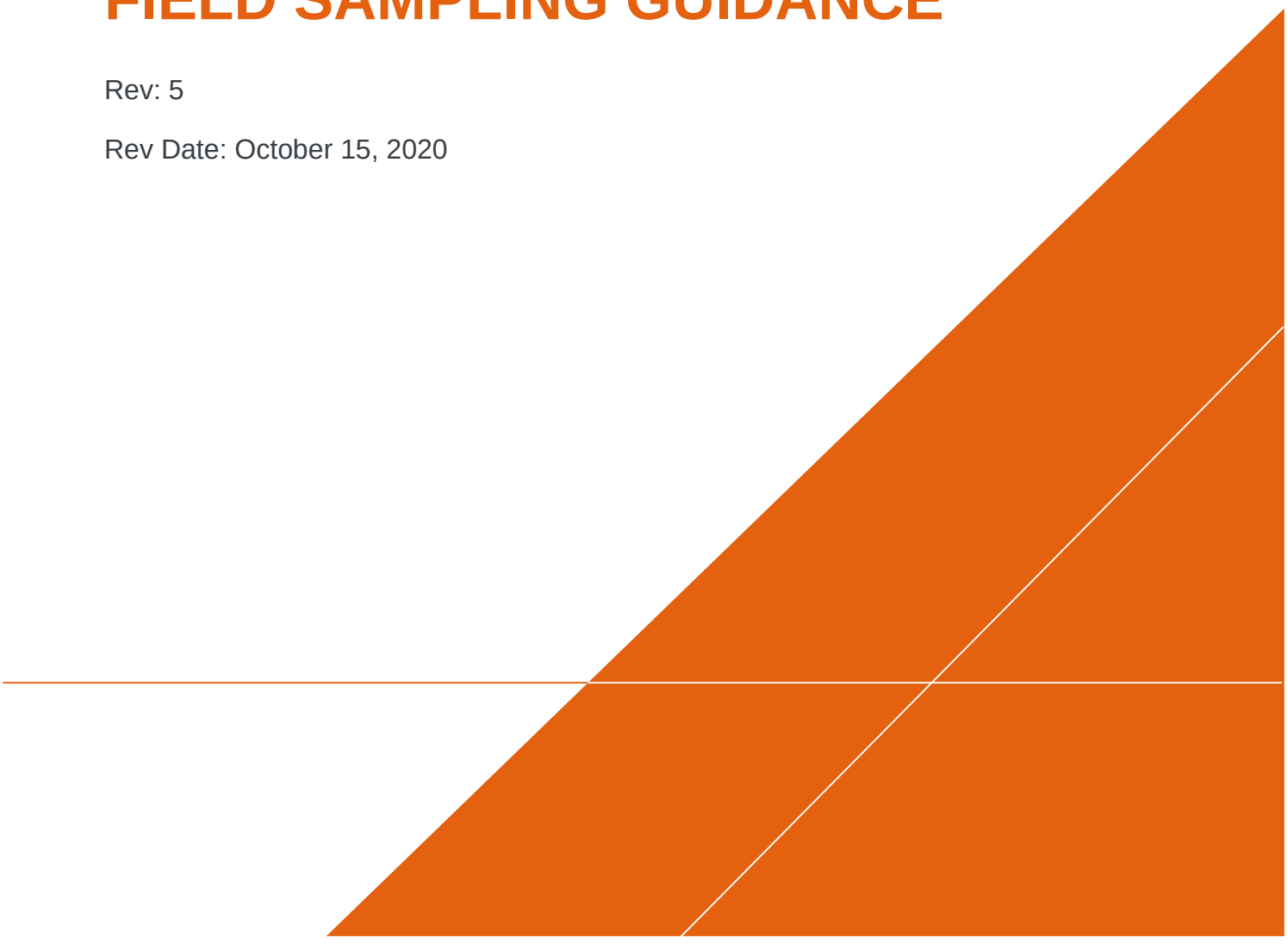
- USGS National Field Manual for the Collection of Water Quality Data

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POLY- AND PERFLUORINATED ALKYL SUBSTANCES (PFAS) FIELD SAMPLING GUIDANCE

Rev: 5

Rev Date: October 15, 2020



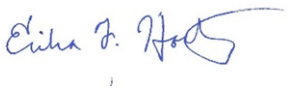
VERSION CONTROL

Revision No	Revision Date	Page No(s)	Description	Reviewed by
0	April 27, 2017	All	Initial Release	Erica Kalve Erika Houtz Sue Tauro
1	June 19, 2018	1 through 4 and 17	Updated Information on Sampling Materials	Erica Kalve Erika Houtz
2	October 15, 2018	6 to 16	Minor updates on laboratory elements, updates to decontamination procedures, and clarification on equipment and reagent blank collection	Erika Houtz Erica Kalve
3	December 17, 2018	4, 6, 17	Removed Sharpies from acceptable field writing implements; Changed language in Section 3.2 and Section 10.5 to provide stricter guidance for DoD projects.	Erika Houtz, Erica Kalve
4	March 26, 2019	4,5	Removed Citranox from acceptable Decon solutions in Table 1a, added all fluoropolymer containing materials to prohibited items in Table 1b. Made a correction that Liquinox contains trace levels of 1,4 Dioxane, not Alconox.	Erika Houtz
5	October 16, 2020	14	Added Air Force preference to sample surface water at surface for Air Force investigations.	Erika Houtz

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APPROVAL SIGNATURES

Prepared by:



10/19/2020

Erika F. Houtz, PhD, PE
Environmental Engineer and PFAS Analytical Lead

Date:

Reviewed by:



12/17/2018

Erica Kalve, PG-CA
Emerging Contaminants Focus Group Leader

Date:

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1 INTRODUCTION

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2 SCOPE AND APPLICATION

The purpose of this Technical Guidance Instructions (TGI) is to provide guidance on field sampling to be used for poly-and perfluorinated alkyl substances (PFASs). This protocol was adapted from various sources including Arcadis Australia, Transport Canada, and the U.S Army Corp of Engineers (USACE) Omaha. In general, sampling techniques used for PFAS site characterization are consistent with conventional sampling techniques used in the environmental industry, but special consideration is made regarding PFAS-containing materials and cross-contamination potential. **Table 1a** provides a summary of materials that have been approved for site investigation; this list is expected to grow longer as industry experience increases. **Table 1b** provides a summary of field equipment and materials that have available testing information and/or industry knowledge regarding PFAS cross-contamination potential and it is recommended that these materials be prohibited for sample collection; for materials that are suspected of containing PFASs and/or to retain PFASs, these recommendations are considered preliminary and subject to change.

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Table 1a: Summary of Acceptable Sampling Equipment and Materials for PFAS Site Investigations

Sampling Materials	Additional Considerations	References
Water Sampling Materials		
High density polyethylene (HDPE) or silicone tubing materials	--	DER 2016; USACE 2016; NHDES 2016; MassDEP 2017
HDPE HydraSleeves™	Low density polyethylene (LDPE) HydraSleeves™ are not recommended	USACE 2016; MassDEP 2017
Drilling and Soil Sampling Materials		
PFAS-free drilling fluids	--	DER 2016
PFAS-free makeup water	Confirm PFAS-free water source via laboratory analysis prior to investigation	--
Acetate liners	For use in soil sampling	USACE 2016
Sample Containers and Storage		
HDPE sample containers with HDPE lined lids for soil and water samples	Laboratory should provide; whole bottle analysis of aqueous samples combined with a solvent rinse of bottle is recommended	DER 2016, MassDEP 2017
Ice contained in plastic (polyethylene) bags (double bagged)	--	DER 2016; USACE 2016; NHDES 2016; MassDEP 2017
Field Documentation		
Ball point pens	--	MassDEP 2017
Standard paper and paper labels	--	DER 2016; USACE 2016; NHDES 2016; MassDEP 2017
Decontamination		
Water-only decontamination	Confirm PFAS-free water source via laboratory analysis prior to investigation	DER 2016
Alconox® or Liquinox® followed by deionized water or PFAS-free water rinse	Liquinox® known to contain trace levels of 1,4-dioxane	NHDES 2016; USACE 2016; MassDEP 2017
Methanol, isopropanol, or acetone	Special health and safety precautions are necessary	UNEP 2015; USACE 2016

Note: This list is considered preliminary and additional materials may be added as additional information becomes available. Project teams are expected to follow a methodical evaluation process of materials to be used and confirm acceptance prior to implementation of field activities.

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Table 1b: Summary of Sampling Equipment and Materials Not Recommended for PFAS Site Investigations.

Sampling Materials	Known PFAS-Containing Materials	Suspected PFAS-Containing Materials	Materials with Potential to Retain PFASs	References
Water Sampling Materials				
Teflon®, PTFE-containing or other fluoropolymer coated or containing field equipment (e.g., tubing, bailers, liners, tape, plumbing paste, pump parts)	x			DER 2016; USACE 2016; NHDES 2016; MassDEP 2017
Passive diffusion bags			x	MassDEP 2017
LDPE HydraSleeves ™			x	USACE 2016; MassDEP 2017
Water particle filters			x	MassDEP 2017
Drilling and Soil Sampling Materials				
Aluminum foil			x	DER 2016; USACE 2016; NHDES 2016; MassDEP 2017
Drilling fluid containing PFASs	x	x		DER 2016
Sample Containers and Storage				
Glass sample containers with lined lids			x	DER 2016; USACE 2016; NHDES 2016; MassDEP 2017
LDPE containers and lined lids			x	USACE 2016
Teflon® or PTFE- lined lids on containers (e.g., sample containers, rinsate water storage containers)	x			DER 2016; USACE 2016; NHDES 2016; MassDEP 2017
Reusable chemical or gel ice packs (e.g., BlueIce®)		x		DER 2016; USACE 2016; NHDES 2016; MassDEP 2017
Field Documentation				
Self-sticking notes and similar office products (e.g., 3M Post-it-notes)		x		DER 2016; USACE 2016; NHDES 2016; MassDEP 2017
Waterproof paper, notebooks, and labels	x			DER 2016, MassDEP 2017
Non-Sharpie® markers		x		NHDES 2016
Decontamination				
[Some] detergents and decontamination solutions (e.g., Decon 90® Decontamination Solution)	x	x		DER 2016; NHDES 2016; MassDEP 2017

N**ote**: For materials that are suspected of containing PFASs, or have the potential to retain PFASs, project specific considerations may provide adequate justification for use during the field event. For example, further evaluation may be conducted in the form of pre-field equipment blank sample analysis.

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Given the extremely low detection limits associated with PFAS analysis and the many potential sources of trace levels of PFASs, field personnel are advised to err on the side of caution by strictly following these protocols, frequently replacing nitrile gloves, and rinsing field equipment to help mitigate the potential for false detections of PFASs. A summary of other specific items related to field sampling for PFASs are discussed in the sections below.

This TGI applies to all Arcadis and subcontractor personnel involved in field sampling for PFAS.

3 PERSONNEL QUALIFICATIONS

3.1 Sampling Personnel

Field personnel must have current health and safety training, including 40-hour HAZWOPER training, site supervisor training, and site-specific training, as needed. In addition, field personnel will be versed in the other relevant SOPs (e.g., low flow sampling) and will possess the skills and experience necessary to successfully complete the desired field work. The site Health and Safety Plan (HASP) and other documents will identify any other training requirements such as site-specific safety training or access control requirements.

3.2 Laboratories

These laboratories are example laboratories that could be used to analyze environmental media for PFASs, pending project approval:

- United States: TestAmerica, SGS, Vista, ALS, and Eurofins
- Canada: Axys-SGS and Maxxam Laboratories

Other laboratories may be used if they are appropriately accredited for PFAS analysis according to any project requirements. It is recommended that a laboratory is Environmental Laboratory Accreditation Program (ELAP)-accredited for PFAS analysis in accordance with the Department of Defense (DoD) Quality Systems Manual (QSM) 5.1 Table B-15 or any subsequent updates. **For all data collection efforts at DoD sites, PFAS data must be obtained using a method that is DoD ELAP-accredited under QSM 5.1 or later.**

4 EQUIPMENT LIST

The following equipment and materials must be available for sampling:

- Site plan of sampling locations, relevant work plan (or equivalent), and this TGI;
- Appropriate health and safety equipment, as specified in the site HASP;
- Dedicated plastic sheeting (preferably high-density polyethylene [HDPE]) or other clean surface to prevent sample contact with the ground;
- Conductivity/temperature/pH meter;
- Dissolved oxygen meter, oxidation reduction potential meter, and turbidity meter;
- Depth to water meter;

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- If using low-flow groundwater sampling techniques, peristaltic pump (groundwater sampling)/bladder pump (with PFAS free bladder/ HDPE bladder), flow through cell, and accompanying HDPE and silicone tubing;
- Hydrasleeves, if using Hydrasleeves for groundwater sampling;
- Metal trowel for soil samples; specialized soil/sediment sampling equipment as required;
- Brushes for scrubbing sampling equipment;
- Pens, pencils, and/or Sharpies for writing;
- Clipboards, field binders, and field note pages that are not waterproof;
- Labeled sample bottles:
    - Water: HDPE bottles fitted with polypropylene screw cap only; some types of PFAS samples (primarily drinking water) may require preservative, which will be indicated by the laboratory conducting the analysis. The laboratory will specify the sample bottle volume.
    - Soil and sediment: HDPE bottles fitted with polypropylene screw cap only; no preservatives. The laboratory will specify the sample bottle volume.
- If high concentrations of PFASs related to class B firefighting foams are expected, bring additional small vials to conduct field-based shaker tests for foaming;
- Ziploc® bags to hold ice and samples;
- Bottles containing “PFAS-free” water used for reagent blanks;
- Labeled coolers for samples with ice; Blue ice is not permitted;
- Deionized or distilled water for initial decontamination rinsing;
- “PFAS-free” water provided by the laboratory for final decontamination rinsing;
- Methanol, isopropanol, or acetone if able to be brought safely to field site; especially important for decontamination during soil sampling;
- Alconox or Liquinox®;
- Packing and shipping materials;
- Groundwater Sampling Log; and
- Chain-of-Custody (COC) Forms.

5 CAUTIONS

5.1 Food Packaging

Some food packaging may be treated with PFAS-containing chemicals to prevent permeation of oil and water in the food outside of the packaging. To avoid potential food packaging-related PFAS contact:

- Do not bring any food outside of the field vehicles onsite and eat snacks and meals offsite.
- Wash hands after eating.
- Remove any field garments or outer layers prior to eating. Do not put them back on until done eating and hands are washed.

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5.2 Field Gear

5.2.1 Clothing

Many types of clothing are treated with PFASs for stain and water resistance, in particular outdoor performance wear under brand names such as Gore-Tex®. To avoid potential clothing-related PFAS contact:

- Do not wear any outdoor performance wear that is water or stain resistant, or appears to be. Err on the side of caution.
- Wear pre-laundered (multiple washings, i.e. 6+) clothing that is not stain resistant or water proof.
- Natural fabrics such as cotton are preferred. Synthetic fabrics may also be acceptable if there is no indication on the label that the fabric is water and stain resistant.
- Most importantly, avoid contacting your clothing with sampling equipment, bottles, and samples.

5.2.2 Personal Protective Equipment

Safety Footwear

Some safety footwear has been treated to provide a degree of waterproofing and increased durability and may represent a source of trace PFASs. For the health and safety of field personnel, footwear must be protected at all times to avoid potential PFAS contamination. To do this:

- Do not contact your footwear with equipment, bottles, or samples in any way.
- Do not allow gloves used for sampling to come in contact with safety footwear.

Nitrile Gloves

Wear disposable nitrile gloves at all times. Don a new pair of nitrile gloves **before** the following activities at each sample location:

- Decontamination of re-usable sampling equipment;
- Contact with sample bottles or “PFAS-free” water bottles;
- Insertion of anything into the sample ports (e.g., HDPE tubing); and
- Handling of any quality assurance/quality control (QA/QC) samples including field blanks and equipment blanks.

Don a new pair of nitrile gloves **after** the following activities:

- Handling of any non-dedicated sampling equipment;
- Contact with contaminated surfaces; or
- When judged necessary by field personnel.

5.3 Personal Hygiene

- Shower at night.
- Do not use personal care products after showering such as lotions, makeup, and perfumes, UNLESS medically necessary.
- Use sunscreen and insect repellent ONLY if necessary for health and safety. If they are necessary, apply sunscreen and repellant prior to initiating field sampling. If sunscreen and/or repellant need to

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be reapplied, ensure a safe distance away from the sampling locations and equipment (i.e., more than 10 meters (m) away). Wash hands after application.

5.4 Visitors

Visitors to the site are asked to remain at least 10 m from sampling areas.

5.5 Rain Events

Special care should be taken when rain is falling at the project site:

- Do not perform field sampling when rain fall is persistent at a consistent rate that saturates the ground (i.e., formation of puddles) because rain gear is not permitted while sampling. Intermittent showers or fog are acceptable conditions to proceed. If rain showers occur; field gear must be removed from the monitoring well location until the rain subsides.
- If project timelines are tight, consider the use of a gazebo tent that can be erected over the top of the monitoring well to provide shelter from the rain. The canopy material is possibly a PFAS-treated surface and should be managed as such; therefore, wear gloves when moving the tent, change them immediately after moving the tent, and avoid further contact with the tent until all sampling activities have been finished and the team is ready to move on to the next site.

6 HEALTH AND SAFETY CONSIDERATIONS

- The ability to safely access the surface water sampling locations must be verified before sampling.
- Field activities must be performed in accordance with the site HASP, a copy of which will be present onsite during such activities.
- Safety hazards associated with sampling surface water include fast-moving water, deep water, and steep slopes close to sampling sites. Use extreme caution when approaching sampling sites.
- If thunder or lighting is present, discontinue sampling and take cover until 30 minutes have passed after the last occurrence of thunder or lighting.
- Use caution when removing well caps as well may be under pressure, cap can dislodge forcefully and cause injury.

7 PROCEDURE

7.1 Field Equipment Cleaning

Reusable field sampling equipment will require cleaning between uses. For groundwater sampling, between uses, decontaminate the flow-through cell and any non-dedicated equipment (i.e., interface probe of depth to water meter) that comes into contact with well water. Trowels and other materials used to sample soil samples will also require decontamination, although dedicated, single use equipment such as liners should be used where possible.

After donning a new pair of nitrile gloves:

- Rinse sampling equipment with Alconox or Liquinox® cleaning solution; Scrub equipment with a plastic brush if needed;
- Rinse two times with distilled water or deionized water;

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- Rinse one time with “PFAS-free” water or once with methanol/isopropanol/acetone, if it is available, and once with “PFAS-free” water; organic solvents are especially useful for decontaminating soil sampling equipment. If organic cleaning solvents cannot be brought to site, scrub equipment a second time after a single distilled or deionized water rinse, then rinse two times with distilled or deionized water and once with “PFAS-free” water (i.e., two scrubbings and four water rinsings total).
- Collect all rinsate in a sealed pail for disposal. Do not reuse decontamination solutions between sampling locations.

7.2 Borehole/Monitoring Well Development

If a drill rig is being used to drill for soil cores or to install monitoring wells, wear clean nitrile gloves before collecting each continuous soil sample. Additional requirements include the following:

- Verify in writing with the manufacturer that single-use liners used to collect each sample are made of a material that does not contain PFASs;
- Collect soil samples in laboratory-supplied HDPE bottles.
- Store the sample bottles in coolers and keep at a temperature of 0 to 6ºC until transported to the laboratory.

7.2.1 Well Condition Survey/ Water Level Monitoring

Using equipment that has been thoroughly decontaminated according to the procedures in Section 7.1, conduct the well condition surveys and water level monitoring:

- Conduct monitoring well inspections and record water levels.
- Use an interface probe to evaluate presence/absence of non-aqueous phase liquid (NAPL).
- Measure the depth to water from the top of the polyvinyl chloride (PVC) riser and the total depth of the well.
- Record information in the field notes.

7.2.2 Monitoring Well Development and Purging

Follow these requirements for monitoring well development and purging:

- Do not use Teflon™ tubing for purging or sample collection. HDPE tubing is acceptable.
- Do not re-use materials between wells. Upon completion of use, remove all disposable materials (such as HDPE and/or silicone tubing) and place in heavy duty garbage bags for disposal.
- During development of the well, create sufficient energy to agitate the water column and create flow reversals in the well screen, filter pack and formation to loosen fine-grained materials and draw them into the well. The pumping or bailing action should then draw all drilling fluids and fine-grained material out of the borehole and adjacent formation and then out of the well. Review the Arcadis Monitoring Well Development guidance (Arcadis 2010) for more detailed information.
- Follow the low-flow purge and sampling techniques per the U.S. Protection Agency’s (EPA’s) guidance document titled *Low Stress (Low Flow) purging and Sampling Procedure for the Collection of Ground Water Samples from Monitoring Wells* (2010) and ASTM’s standard titled *Standard Practice for Low-Flow Purging and Sampling for Wells and Devices Used for Ground-Water Quality Investigations* (2002). Also available for review is the Arcadis Low-Flow Groundwater Purging and Sampling Procedures for Monitoring Wells (Arcadis 2011).

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- To purge the well, if using HDPE tubing and a peristaltic pump, insert the end of the tubing to the approximate depth of the midpoint of the screened section of the monitoring wells. Measure the length of HDPE tubing to be inserted into each monitoring well and pre-cut it to approximate lengths (such as the previously measured arm span of a field technician) to avoid contact with any materials other than the monitoring well and peristaltic pump. Flow rates should be as low as can be reasonably achieved. Collect and appropriately dispose of purge water.
- Silicone tubing should direct the purge water through a flow-through cell for field parameter measurements of pH, conductivity, temperature, dissolved oxygen, and turbidity. Calibrate the instrument in the field prior to use. Decontaminate the instrument and flow-through cell at each monitoring well location before purging.
- Record field parameters in intervals (generally of 3-minute duration) to ensure purge water has cycled through the flow-through cell. Sample the wells after field parameter measurements indicate stabilization, which allows collection of representative formation water (generally acceptable standards are three consecutive pH readings to within ±0.1 units, and three consecutive conductivity, temperature and dissolved oxygen measurements to within 3%). Turbidity must be monitored, but does not need to be used as a stabilization indicator of purge completion. Record field parameter measurements at each well. Drawdown should be monitored throughout the purge.
- If wells are suspected to be dewatering throughout the purge (i.e., reduced flow rate/difficulty pumping water or bubbles begin to come through the flow through cell), turn off the pump and allow the water level to recover for ½ hour, followed by sample collection. Document these activities in the field notes.

7.3 Sample Collection

Different laboratories may supply sample collection bottles of varying sizes depending on the type of media to be sampled.

7.3.1 Sample Containers

- Collect samples in HDPE bottles fitted with an unlined (no Teflon™), polypropylene screw cap.
- Complete bottle labels after the caps have been placed back on each bottle.
- Do not use glass bottles due to potential loss of analyte through adsorption. This is particularly important for aqueous samples.
- Review with analytical lab the sample size, sample container, etc. depending upon the type of PFAS analysis that is being requested.

7.3.2 Soil Sampling

Before Sample Collection

- Place plastic sheeting adjacent to the sample port for use as a clean work area, if conditions allow. Otherwise, prevent sampling equipment from contacting the ground or other surface that could compromise sample integrity.
- Trowels or drilling equipment that will come into contact with a sample should be decontaminated prior to sample collection, preferably with methanol/isopropanol/acetone;
- Don a new set of nitrile gloves. Do not use gloved hands to subsequently handle papers, pens, clothes, etc., before collecting samples.
- Use the HDPE bottles that are supplied by the laboratory. Make sure that the caps remain on the bottle until immediately prior to sample collection.

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During Sample Collection

- Collect soil samples using a clean stainless steel trowel or with single-use PFAS-free liners;
- Place soil samples in labeled HDPE bottles supplied by the laboratory.
- Note the time on the sample label.
- Collect any necessary duplicates/co-located samples and matrix spikes – verify with laboratory whether they need to be collected in separate sample bottles.
- Collect any necessary equipment blanks. The best timing to collect equipment blanks is immediately after the collection of a sample likely to contain high concentrations of PFASs, after the sampling equipment has been appropriately decontaminated.
- Collect any necessary field reagent blanks. This sample should be collected after field staff return from an offsite break (e.g., lunch) to capture any potential cross-contamination from field personnel.

After Sample Collection

- Place soil sample bottles in a sealed Ziploc© bag (optional).
- Record the label information and time of sampling in the field notes.
- Place soil sample bottles in coolers that are durable in transportation and keep the temperature between 0 and 6ºC until transported to the laboratory. Do not use blue ice.

7.3.3 Groundwater Sampling

Before Sample Collection

- Place plastic sheeting adjacent to the sample port for use as a clean work area, if conditions allow. Otherwise, prevent sampling equipment from contacting the ground or other surface that could compromise sample integrity.
- Don a new set of nitrile gloves. Do not use gloved hands to subsequently handle papers, pens, clothes, etc., before collecting samples.
- Use the labeled HDPE bottles that are supplied by the laboratory. Make sure that the caps remain on the bottle until immediately prior to sample collection.
- Measure depth to water and field parameters. Turbidity and the physical appearance of the purged water should be noted on the Groundwater Sampling Log.

During Sample Collection

- Start groundwater sample collection upon stabilization of field parameters.
- If low-flow groundwater sampling techniques are being used, disconnect the silicone tubing from the flow-through cell, enabling collection of groundwater samples prior to passing through the cell.
- Hydrasleeves are also considered acceptable for sampling of PFAS in groundwater – consult the project manager to determine which technique should be used. In general, low flow sampling is preferable.
- Collect groundwater samples (to the neck of the bottle, some headspace is acceptable) from the dedicated sampling ports at the center of the well screen. While collecting the sample, make sure the bottle cap remains in the other hand of the sampler, until replaced on the bottle.
- To mitigate cross contamination, collect groundwater samples in a pre-determined order from least impacted to greater impacted based on previous analytical data or knowledge about past activities at the site. If no analytical data are available, samples are to be collected in the following order:
  1. First sample the upgradient well(s).

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2. Next, sample the well located furthest downgradient of the interpreted or known source.
3. The remaining wells should be progressively sampled in order from downgradient to upgradient, such that the wells closest to the interpreted or known source are sampled last.

- NOTE: If high concentrations of PFASs related to class B firefighting foams are expected in a groundwater sample, conduct a Shaker test by collecting and shaking a small portion of the sample (~10 to 25 mL) on site in a small disposable vial. If foaming is noted within the sample, document the foaming when samples are submitted for analysis; the 'shaker test' vial can then be disposed. This shaker test provides information about how each of the samples should be handled analytically.
- After collecting the sample, tightly screw on the polypropylene cap (snug, but not too tight). This will minimize leaking or cross contamination of the sample. Most PFASs, including all analytes measured by USEPA Method 537, are not volatile at environmental pH.
- Note the time on the sample label.
- Collect any necessary duplicates and matrix spikes. As the laboratory should be analyzing the entire aqueous sample rather than sub-sampling, separate bottles will be required for these samples.
- Collect any necessary equipment blanks. The best timing to collect equipment blanks is immediately after the collection of a sample likely to contain high concentrations of PFASs, after the sampling equipment has been appropriately decontaminated.
- Collect any necessary field reagent blanks. This sample should be collected after field staff return from an offsite break (e.g., lunch) to capture any potential cross-contamination from field personnel.
- Do not rinse PFAS sample bottles during sampling. Do not filter samples.

After Sample Collection

- Place groundwater sample bottles in a sealed Ziploc© bag (optional).
- Record the label information and time of sampling in the field notes and COC. Note ‘shake test’ results if appropriate.
- Place groundwater samples in coolers that are durable in transportation and keep the temperature between 0 and 6ºC until transported to the laboratory. **Do not use blue ice. Store PFAS samples in a separate cooler from other types of samples.**
- Treat all disposable sampling materials as single use and dispose of them appropriately after sampling at each monitoring well.

7.3.4 Sediment Sampling

Before Sample Collection

- Place plastic sheeting (preferably HDPE) adjacent to the sample port for use as a clean work area, if conditions allow. Otherwise, prevent sampling equipment from contacting the ground or other surface that could compromise sample integrity.
- Don a new set of nitrile gloves. Do not use gloved hands to subsequently handle papers, pens, clothes, etc., before collecting samples.
- Use the HDPE bottles that are supplied by the laboratory. Make sure that the caps remain on the bottle until immediately prior to sample collection.

During Sample Collection

- Where surface water samples and sediment samples are collected at the same location, collect surface water samples first to minimize siltation.

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- Collect sediment samples either manually using a stainless steel trowel or using a petite ponar grab sampler, depending on field conditions at each sampling location during sampling program.
- Collect sediment samples from the upper 10 cm of sediment.
- For a sample to be acceptable overlying, low turbidity water must be present.
- Decant the overlying water and use a stainless steel trowel to collect only the upper 5 centimeters (cm) of sediment.
- Collect sediment samples directly into laboratory-supplied bottles that are suitable in both material and size.
- Do not overfill the sample bottle.
- Make sure that the sample does not contain vegetation, that the sediment is undisturbed, and that the sampler shows no signs of winnowing or leaking.
- Make sure bottle caps remain in the gloved hand of the sampler until sampling is complete and caps are replaced on the bottle.
- Note the time on the sample label.
- Collect any necessary duplicates and matrix spikes.
- Collect any necessary equipment blanks. The best timing to collect equipment blanks is immediately after the collection of a sample likely to contain high concentrations of PFASs, after the sampling equipment has been appropriately decontaminated.
- Collect any necessary field reagent blanks. This sample should be collected after field staff return from an offsite break (e.g., lunch) to capture any potential cross-contamination from field personnel.

After Sample Collection

- Place sample bottles in a sealed Ziploc© bag (optional).
- Record the label information and time of sampling in the field notes.
- Place samples in coolers that are durable in transportation and keep the temperature between 0 and 6ºC until transported to the laboratory. **Do not use blue ice. Store PFAS samples in a separate cooler from other types of samples.**
- Measure surface water pH, conductivity, temperature, and total dissolved solids (TDS) at each location **after** both surface water and sediment sampling is completed.

7.3.5 Surface Water Sampling

Before Sample Collection

- Place plastic sheeting (preferably HDPE) adjacent to the sample port for use as a clean work area, if conditions allow. Otherwise, prevent sampling equipment from contacting the ground or other surface that could compromise sample integrity.
- Don a new set of nitrile gloves. Do not use gloved hands to subsequently handle papers, pens, clothes, etc., before collecting samples.
- Use the HDPE bottles that are supplied by the laboratory. Make sure that the caps remain on the bottle until immediately prior to sample collection.

During Sample Collection

- Avoid sampling the surface, in general.
- However, for Air Force investigations, collect samples from the water surface.

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- Where surface water samples and sediment samples are collected at the same location, collect surface water samples first to minimize siltation.
- Collect surface water samples directly into laboratory-supplied bottles; wide-mouth bottles may be preferable to narrow mouth bottles for ease of surface water collection.
- Make sure bottle caps remain in the gloved hand of the sampler until sampling is complete and caps are replaced on the bottle.
- Note the time on the sample bottle.
- Collect any necessary duplicates and matrix spikes. As the laboratory should be analyzing the entire aqueous sample rather than sub-sampling, separate bottles will be required for these samples.
- Collect any necessary equipment blanks. The best timing to collect equipment blanks is immediately after the collection of a sample likely to contain high concentrations of PFASs, after the sampling equipment has been appropriately decontaminated.
- Collect any necessary field reagent blanks. This sample should be collected after field staff return from an offsite break (e.g., lunch) to capture any potential cross-contamination from field personnel.

After Sample Collection

- Place sample bottles in a sealed Ziploc© bag (optional).
- Record the label information and time of sampling in the field notes.
- Place samples in coolers that are durable in transportation and keep the temperature between 0 and 6ºC until transported to the laboratory. **Do not use blue ice. Store PFAS samples in a separate cooler from other types of samples.**
- Measure surface water pH, conductivity, temperature, and TDS at each location **after** both surface water and sediment sampling.

7.4 Shipping

- If samples cannot be shipped the same day as collected, arrange an appropriate means of keeping the samples cool overnight and maintain the temperature between 0 and 10°C for the first 48 hours after collection, and then between 0 and 6°C thereafter.
- Store samples in appropriate transport bottles (coolers) with ice (Ziploc© bags for use as ice containers) with appropriate labeling. **Do not use blue ice. Store PFAS samples in a separate cooler from other types of samples.**
- Complete the appropriate procedures for COC, handling, packing, and shipping.
- Fill out and check COC Forms against the labels on the sample bottles progressively after each sample is collected.
- Place all disposable sampling materials (such as plastic sheeting, and health and safety equipment) in appropriate containers.
- Ship samples via courier service with priority overnight delivery. Tracking numbers for all shipments should be provided and recorded after they have been sent out to ensure their timely delivery.
- Do not ship samples via Fed Ex for Saturday delivery.

8 WASTE MANAGEMENT

All rinsate should be collected in a sealed pail for disposal. Drill cuttings and purge water will be managed as specified in the Field Sampling Plan (FSP) or Work Plan, and according to state and/or federal

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requirements. PPE and decontaminated fluids will be contained separately and staged at the sampling location. Containers must be labeled at the time of collection. Labels will include date, location(s), site name, city, state, and description of matrix contained (e.g., soil, groundwater, PPE). General guidelines for investigation derived waste (IDW) handling and storage are set forth in a separate IDW guidance document (Arcadis 2009).

Typical waste characterization procedures include collection of a composite sample of the drill cutting material and a composite sample of the purge water for laboratory analysis. Samples are typically analyzed for disposal toxicity characteristic leaching procedure (TCLP) analysis for metals and VOCs. For PFASs, a simple leach test with neutral pH water may be more indicative of actual risk. Additionally, generators of waste are required to include analysis of other constituents that are reasonably believed to be present including (in this case) PFASs.

Emerging contaminants pose a unique challenge for disposal because acceptance of such waste will be based on the local facility and their permit restrictions. Project teams will be required to identify appropriate facilities based on the facility's legal ability to accept the waste and the team should confirm that the facility is meeting the regulatory requirements for accepting waste containing PFASs. In general, facilities that provide solidification and/or incineration will be likely to meet the necessary requirements to accept PFAS-containing waste. The facility will then provide the definitive laboratory analysis requirements needed to meet their permit requirements for waste classification.

9 DATA RECORDING AND MANAGEMENT

9.1 Field Notes

Waterproof field books must not be used for field notes. Instead, field notes should be on loose paper on Masonite, plastic, or aluminum clip boards. Other requirements for field notes include:

- Pens, pencils, and Sharpies may be used.
- Keep field notes and writing implements away from samples and sampling materials.
- One person should conduct sampling while another records field notes.
- Do not write on sampling bottles unless they are closed.

9.2 Other Project Documentation

- Complete Groundwater Sampling Logs.
- Make sure COC Forms are properly completed. Verify which PFAS analytes (e.g., just PFOS and PFOA, some or all of the 537 list, etc.) are required for analysis and note on the COC.

10 QUALITY CONTROL

Refer to quality control requirements for the project to ensure that appropriate quality assurance and quality control (QA/QC) samples are collected. When collecting QA/QC samples, the same guidelines apply as when collecting regular samples – specifically that:

- Samples should be collected in laboratory-supplied HDPE bottles;
- Bottle caps must remain in the hand of the sampler until replaced on the bottle;
- Labels must be completed after the caps have been placed back on each bottle; and

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- Samples must be stored in appropriate transport bottles (coolers) with ice (Ziploc© bags for use as ice containers) with appropriate labeling. **Do not use blue ice. Store PFAS samples in a separate cooler from other types of samples.**

10.1 Equipment Blanks (if relevant)

QA/QC sampling typically includes daily collection of equipment blanks using the laboratory-supplied "PFAS-free" water. For peristaltic pump tubing, laboratory supplied "PFAS-free" water should be poured into a clean HDPE sample bottle and then pumped through new HDPE tubing using the peristaltic pump (with new silicone tubing). The best timing to collect equipment blanks is immediately after the collection of a sample likely to contain high concentrations of PFASs, after the sampling equipment has been appropriately decontaminated.

10.2 Field Duplicates

QA/QC sampling typically includes the collection of one field duplicate for every 10 or 20 samples collected. Each duplicate sample will be collected immediately after the initial sample of which it is a duplicate into a separate laboratory-provided sample bottle. Do not indicate to the laboratory which sample the duplicate replicates, i.e. it should be given a blind reference on the COC and sample name such as "duplicate".

10.3 Field Reagent Blanks

QA/QC sampling for PFASs typically includes the submission of one laboratory supplied field reagent blank per day. The field reagent blank sample is brought to the site in a laboratory-supplied sample bottle. Field staff transfer the laboratory-supplied reagent blank to an empty sample bottle. This sample should be collected after field staff return from an offsite break (e.g., lunch) to capture any potential cross-contamination from field personnel and should be placed in the same cooler as the other PFAS samples.

10.4 Matrix Spikes (optional in some cases)

QA/QC sampling includes submitting a sample to be used as a matrix spike if the project requires it. If a separate sample bottle is required, an additional sample will be collected immediately after the initial sample of which it is a duplicate into a separate laboratory-supplied sample bottle.

10.5 Laboratory Analytical QA/QC

- Arcadis recommends that any request for PFAS analysis in groundwater or soil should be conducted by an ELAP-accredited method compliant with QSM 5.1 Table B-15. Requirements laid out in Table B-15 strictly govern acceptable laboratory data quality for PFAS analysis in environmental samples. **For all data collection efforts at DoD sites, PFAS data must be obtained using a method that is DoD ELAP-accredited under QSM 5.1 or later.**
- Laboratory QA/QC should consist of one laboratory blank and one laboratory control sample (or blank spike) per batch of samples, and additional QA/QCs as indicated by the laboratory QA/QC procedures.
- Isotope dilution should be used for quantification with isotope-labeled surrogate standards, as available, according to the guidelines of QSM 5.1 Table B-15. USEPA Method 537 does not allow for isotope dilution in their PFAS drinking water method.

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- For drinking water, groundwater, and surface water samples, laboratories must extract the entire sample and include a solvent rinse of the bottle for analysis. Aqueous samples should generally not be sub-sampled prior to analysis, unless they are high concentration and require serial dilution (US DoD 2017).
- Soil samples should be analyzed in their entirety or thoroughly homogenized before extraction and analysis.
- As part of the internal QA/QC of laboratory results, relative percent difference (RPD) should be calculated between samples and corresponding field or laboratory duplicates. The laboratory quality assurance portion of the laboratory certificates should be reviewed to verify that all calculations/recoveries were within acceptable limits as established by the laboratory method and guidelines in Table B-15 of QSM 5.1 or later (USDoD 2017).

11 REFERENCES

Arcadis Australia. 2017. Soil and Concrete Sampling for PFAS. April.

Arcadis. 2010. Monitoring Well Development, Rev. #2.2. March 22.

Arcadis. 2009. Investigation-Derived Waste Handling and Storage, Rev. #2. March 6.

Arcadis. 2011. Low-Flow Groundwater Purging and Sampling Procedures for Monitoring Wells, Rev. #4. February 2.

ASTM. 2002. ASTM D6771-02 - Standard Practice for Low-Flow Purging and Sampling for Wells and Devices Used for Ground-Water Quality Investigations (Withdrawn 2011). Available at: https://www.astm.org/Standards/D6771.htm.

Department of Environment Regulation (DER). Government of Western Australia. 2016. Interim Guideline on the Assessment and Management of Perfluoroalkyl and Polyfluoroalkyl Substances (PFAS). Contaminated Sites Guidelines. February.

Massachusetts Department of Environmental Protection (MassDEP). 2017. DRAFT Fact Sheet, Guidance on Sampling and Analysis for PFAS at Disposal Sites Regulated under the Massachusetts Contingency Plan. January.

New Hampshire Department of Environmental Services (NHDES). 2016. Perfluorinated Compound (PFC) Sample Collection Guidance. November.

United Nations Environment Programme (UNEP). 2015. PFAS analysis in water for the Global Monitoring Plan of the Stockholm Convention, Set-up and guidelines for monitoring. Jana Weiss, Jacob de Boer, Urs Berger, Derek Muir, Ting Ruan, Alejandra Torre, Foppe Smedes, Branislav Vrana, Fabrice Clavient, and Heidelore Fiedler. Division of Technology, Industry and Economics. Geneva. April.

United States Army Corps of Engineers (USACE). 2016. DRAFT – Standard Operating Procedure 047: Per/Poly Fluorinated Alkyl Substances (PFAS) Field Sampling. Revision: 1. March.

U.S. Army Corps of Engineers – Omaha District. 2016. Chemistry Requirements – PFAS.

U.S. Department of Defense (DoD). 2017. Consolidated Quality Systems Manual (QSM) for Environmental Laboratories, Version 5.1. In conjunction with the U.S. Department of Energy. January.

U.S. Environmental Protection Agency. 2009. USEPA Method 537: Determination of Selected Perfluorinated Alkyl Acids in Drinking Water by Solid Phase Extraction and Liquid Chromatography/Tandem Mass Spectrometry (LC/MS/MS), version 1.1, September. National Exposure Research Laboratory, Office of Research and Development.

U.S. Environmental Protection Agency. 2010. Low Stress (Low Flow) purging and Sampling Procedure for the Collection of Ground Water Samples from Monitoring Wells. Available at:

Downloaded and printed copies from the Approved Procedure Library are uncontrolled documents.

https://www.epa.gov/quality/low-stress-low-flow-purging-and-sampling-procedure-collection-groundwater-samples-monitoring.

Transport Canada. February 2016, Per-and Polyfluorinated Alkyl Substances (PFAS) Field Sampling Guidance.

Downloaded and printed copies from the Approved Procedure Library are uncontrolled documents.

APPENDIX B LABORATORY TREATABILITY MEMO

Appendix B

Laboratory Treatability Memo
Ex situ Soil Washing to Remove PFAS Adsorbed to Soils from Source Zones

ER20-B2-5258

Version #2

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TABLE OF CONTENTS

1 Introduction 1
1.1 Background 1
1.2 Overall Objectives 2
1.3 Regulatory Drivers 2
2 Technology 4
2.1 Technology Description 4
2.2 Technical Risks 6
3 Performance Objectives 7
4 Experimental Design 9
4.1 Test Setup 9
4.1.1 Screening 10
4.1.2 Attrition Scrubbing 10
4.1.3 Density Separation 11
4.1.4 Chemical Extraction 12
4.2 Sampling Plan 13
4.3 Sample Documentation 14
5 Results and Discussion 15
5.1 Untreated Sample Characterization 15
5.1.1 Particle Size Characterization of the Source Area Samples 15
5.1.2 PFAS Characterization 16
5.2 PFAS Soil Treatment Optimization Testing 17
5.2.1 Round 1 – Baseline Treatment Results 18
5.2.2 Round 1 - Amended Process Water Results 18
5.2.3 Round 2 – Crushing and Magnetic Separation Results 20
5.2.4 Round 3 – Finer Crushing and Magnetic Separation Results 22
5.2.5 Summary of Results 24
5.3 Process Water Testing 26
6 Conclusions and Recommendations 28
6.1 Treatability Performance 28
6.2 Next Steps 29

6.2.1 Implications for Application at Eielson 29
7 Go/No-Go Decision 30
8 Bibliography 31

TABLES

Table 1 Performance Objectives 7
Table 2 Regional PFAS Screening Levels 7
Table 3 Analytical Results 14
Table 4 Stockpile 393-1 Grain Size Analysis 15
Table 5 Stockpile 393 Particle Size Distribution 16
Table 6 Untreated PFAS Concentrations – Stockpile 393-1 17
Table 7 Round 1 Total PFAS Results – Amended Process Water 19
Table 8 Round 1 Leachable PFAS Results – Amended Process Water 20
Table 9 Round 2 Total PFAS Results – Crushing and Magnetic Separation 22
Table 10 Round 2 Leachable PFAS Results – Crushing and Magnetic Separation 23
Table 11 Round 3 Total PFAS Results – Finer Crushing Magnetic Separation 23
Table 12 Round 3 Leachable PFAS Results – Finer Crushing and Magnetic Separation 24
Table 13 Summary of Total PFAS Results 25
Table 14 Summary of Leachable PFAS Results 26
Table 15 Treated Process Water Results 27

FIGURES

Figure 1 Soil Washing Process Flow 6
Figure 2 Treatability Test Experimental Design 9
Figure 3 18-inch SWECO Round Vibratory Screen 10
Figure 4 Attrition Mill 11
Figure 5 Density Separator 12
Figure 6 Laboratory Scale Chemical Mixer 13

APPENDICES

Appendix A Laboratory Reports
Appendix A-1 Total and Leachable PFAS Results
Appendix B ASLP Method

1 Introduction

This Laboratory Test Memo for Ex-situ Soil Washing to Remove PFAS Adsorbed to Soils from Source Zones describes the activities completed to date to confirm the feasibility of the soil washing process on a PFAS-contaminated soil and to optimize the various unit modules of the process.

This plan provides an overview of the technology, summarizes the associated performance objectives, provides details on the laboratory work, and discusses the results relative to the performance objectives. The "go/no go" decision milestone based on the treatability results is addressed. The results of the treatability testing will be used to optimize the design for the pilot test demonstration at Eielson Air Force Base (AFB).

This report has a companion document titled "Privileged and Confidential Additional Information" which contains proprietary information relating to the soil washing process flow used in the treatability trial.

1.1 Background

Terminal perfluoroalkyl acids (PFAAs), including perfluorooctane sulfonate (PFOS) and perfluorooctanoic acid (PFOA), are highly persistent in the environment and resistant to conventional treatment. The USEPA's PFAS Action Plan established goals to develop groundwater clean-up standards for PFOS and PFOA. To mitigate future groundwater impacts, cost-effective and field-proven technologies are needed for source zones to prevent the migration of PFASs from soil into groundwater. Currently, there are limited commercially available technologies for reliable, cost-effective treatment of PFAS-contaminated soil. Thermal treatment technologies are being used to treat PFAS-contaminated soil; however, this approach is expensive, energy-intensive, and has attracted scrutiny regarding the potential for incomplete treatment and hazardous byproducts generation. With an anticipated hazardous substance designation for PFOA and PFOS by the USEPA, landfilling and containment strategies are less desirable due to long-term liability. Alternatively, soil washing represents a practical and cost-effective source zone treatment technology that can be used to remove the mass of PFAS from soil, directly mitigating adverse groundwater impacts. Additional advantages of soil washing include: 1) Reuse of treated soil on site; 2) Low water requirements, as water can be treated and recycled; 3) Customizable extractant solutions according to site-specific conditions to optimize performance; 4) Applicable to a wide range of material types and target compounds; 5) Lower-cost treatment solution relative to thermal treatment and; 6) Produces only minimal volumes of waste, including small quantities of sludge and fine fraction residuals.

1.2 Overall Objectives

The objective of this project is to demonstrate and validate soil washing as a cost-effective mass removal technology that can be applied to treat soil in source zones contaminated with poly- and perfluoroalkyl substances (PFAS). Consistent with the objectives of the Defense Environmental Restoration Program, this project seeks to protect Defense's groundwater resources by preventing the vertical migration of PFAS from soil into groundwater. Ex-situ soil washing will be demonstrated at field scale by conducting a treatment trial at Eielson AFB using a mobile-scale soil washing plant. The technology will be validated using the United States Environmental Protection Agency (USEPA) Method 537/DoD QSM 5.3 for the DoD target analyte list. Incorporation of lessons learned from a recent Australian soil washing trial will be critical to the success of this project and will aid in the optimization of the treatment processes to ensure that the system can achieve U.S. remediation standards. Success will be measured by the mass removal efficiencies achieved for each size fraction treated, reliability and scalability of the treatment process, ability to achieve the target U.S. remediation and groundwater protection standards, and treatment cost per ton of soil. Successful demonstration of the ex-situ soil washing system will enable the commercialization and application of the technology at multiple sites, provide a cost-effective alternative to destruction technologies, and facilitate the beneficial reuse of treated soils.

Soil washing is a physico-chemical mass removal technology that can be used to treat PFAS contaminated soil in source zones and prevent groundwater contamination. The process desorbs PFAS from soil and transfers them into an aqueous solution, where they can be treated using conventional water treatment technologies. This project seeks to demonstrate and validate a PFAS soil washing technology at the field scale by:

1) Completing treatability testing and a pilot-scale field trial;

2) Evaluating treatment performance in the presence of common co-contaminants; and

3) Determining the site-specific cost and performance requirements of the technology.

1.3 Regulatory Drivers

Regulations for PFAS have been evolving since the USEPA promulgated lifetime health advisory levels (HALs) for PFOS and PFOA in 2016. In February 2019, the USEPA issued its PFAS action plan which included initiation of steps to evaluate the need for a maximum contaminant level (MCL) for PFOS and PFOA, beginning the steps to propose designating PFOS and PFOA as hazardous substances, developing clean up recommendations for PFOS and PFOA, and developing toxicity values or oral reference doses for GenX chemicals and PFBS (USEPA 2019a). USEPA issued interim recommendations to address groundwater impacted with PFOA and PFOS in December 2019 (USEPA 2019b) that recommended groundwater screening levels

of 40 nanograms per liter (ng/L) for PFOS and PFOA and using the lifetime HALs of 70 ng/L (combined or individually) for preliminary remediation goals for groundwater used as drinking water.

The Office of the Secretary of Defense (OSD) issued policy for screening values of PFOS, PFOA and PFBS in October 2019 based on USEPA risk-based screening levels that established screening values for these PFAS compounds in soil and groundwater. The USEPA issued revised toxicology values for PFBS in April 2021 and the OSD has subsequently adopted them. The groundwater screening levels are 40 ng/L for PFOA and PFOS and 600 ng/L for PFBS. The soil screening levels for direct contact are 0.13 mg/kg for PFOA and PFOS and 1.9 mg/kg for PFBS (OSD, 2019; USEPA, 2021).

Although Federal MCLs and hazardous substance designations are still under consideration, the DoD has initiated preliminary assessments/site inspections (PA/SIs) to assess the occurrence of PFOS and PFOA at its installations throughout the US, and remedial investigations (RIs) to evaluate potential threats to off-site drinking water receptors. These evaluations are now generating investigative derived wastes (IDW) and identifying AFFF sources that will require treatment.

Soil treatment and disposal options are limited and expensive for PFAS-impacted soils. Major national landfill operators are limiting disposal of PFAS-impacted soils to Subtitle-D facilities with specialized leachate treatment, Subtitle-C hazardous waste facilities, or landfills in arid environments with zero-net leachate production. Landfilling costs are increasing for PFAS-impacted soils and the limited facilities can require significant costs related to shipping and transport. Public attention aimed at incineration facilities, which previously were considered best option for cradle-to-grave management, has increased regulatory scrutiny about potential incomplete treatment and off-gas emissions. The result is that more reliable and cost-effective soils treatment methods are required to meet DoD’s needs.

2 Technology

This section provides an overview of the soil washing technology designed to remove PFAS from the source zones of contaminated sites. cleaning methods to remove residual fluorinated AFFF from fire suppression systems.

2.1 Technology Description

The soil washing process is a physical and chemical treatment train that incorporates **size**, **density,** and **chemical** separation processes (**Figure 1**). Soil washing is designed to incorporate a series of treatment techniques in a carefully calculated process sequence. The process operates on the principal that contaminants are associated with specific size fractions within a bulk soil matrix and separates contaminants, clay, and silt particles from the bulk soil matrix according to physical differences. In the case of PFAS treatment, the soil washing process is designed to treat the coarse-grained fractions of the soil. Varying levels of treatment and removal efficiency (RE) can be achieved through each module of the soil washing process as illustrated below:

1) Desorption within the physical separation portion of the soil washing process using a high solution-to-soil ratio and the optimization of basic chemistry – 95 to 98% RE
2) Secondary density treatment processes - 98 to 99 % RE
3) Enhanced chemical desorption – 99 to 99.99 % RE.

The final design and associated flow of material through the process varies according to site-specific conditions and remedial criteria (See Figure 1). Soil treatment begins with the removal of debris and larger than boulder sized objects before contaminated soil enters the soil washing process **(1)**. The remaining contaminated soil is slurried and reports to the physical separation modules **(2)**. The physical separation modules involve particle size separation and attrition scrubbing. Fine-grained soils (silt and clay) are subsequently separated from the bulk material and dewatered. During this part of the process, density separation modules can also be incorporated to target and discretely remove PFAS-laden components of the soil matrix such as organic matter. During processing through this section, a portion of the PFAS is removed from the soil, transferred to the aqueous phase, and sent to the wastewater treatment circuit **(3)**. The treated water is recycled through the soil washing process for further treatment of soils. The sand and fine gravel fraction of the soil report to the leaching module **(4)** to further remove PFAS from the sand fraction of the soil. The amended process water or leach solution is sent to a separate wastewater treatment circuit **(5),** where it is regenerated and returned to the leaching module to process additional soil. The processed soil stockpiles are analyzed to confirm that the post-treatment environmental soil quality objectives have been met. The separated silts and clays, organics, and exhausted wastewater treatment media are prepared either for off-site

disposal or further treatment. The key stages of the soil washing process are described in further detail below.

Soil Preparation - The first stage of the process involves soil preparation. This stage uses a wet screen capable of processing rocks and boulders up to 48 inches in diameter. The rock is exposed to a high-pressure water flush to separate and slurry soil fractions less than 1.5 inches in size. Applying a wet spray at the initial bulk material input point minimizes dust and volatile emissions.

Physical Separation - The final configuration of the soil washing process is based on site-specific conditions and remedial objectives. However, the unit process employed will be a combination of the following equipment:

- ***Size Separation*** – Particle size separations are conducted on the bulk contaminated material through the use of physical or hydrodynamic separation techniques. Examples of equipment used include multi-deck screeners, linear motion screens, cyclones, and rising current classifiers.

- ***Density Separation*** – Particles with different densities respond differently to gravity and to one or more other forces applied simultaneously in opposition to gravity. Although density difference is the main criterion for gravity separation, particle size and shape also influence the separation. In the application of PFAS treatment, one of the targeted soil components for removal by density separation is the enriched organic fraction of the soil.

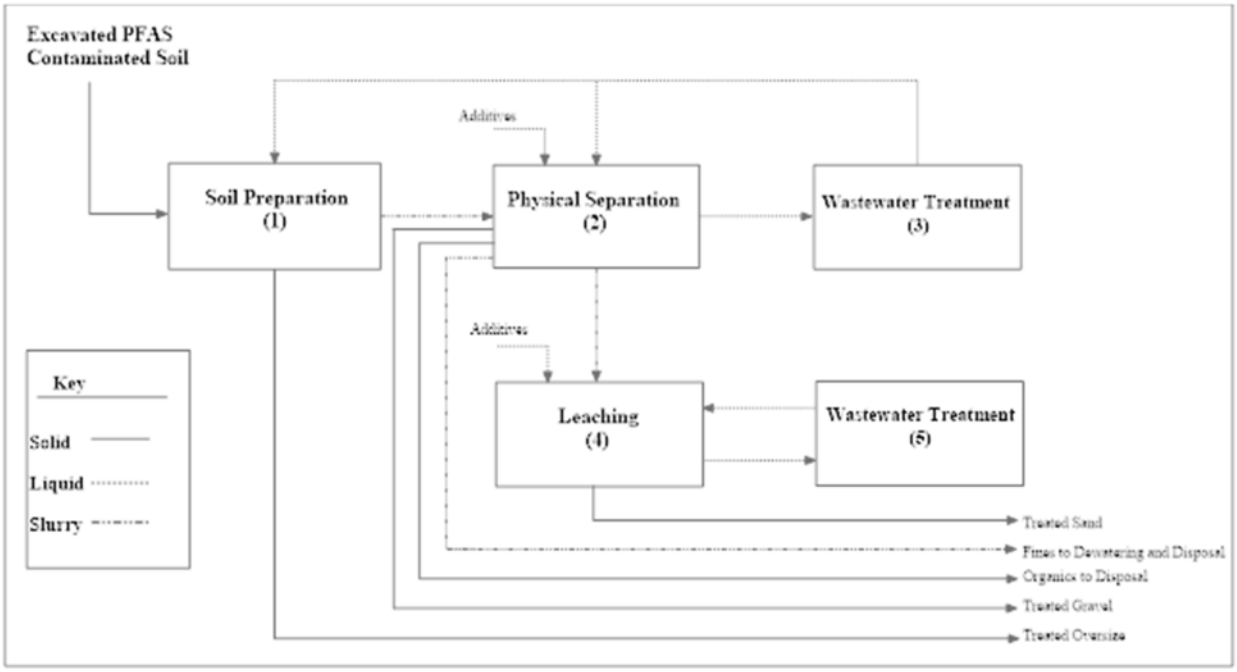
- ***Dewatering*** – The dewatering equipment is used to separate the wash water from the treated soil and contaminated fine-grained soil, allowing the process water from these soil fractions to be sent to the wastewater treatment plant and used in a continuous closed-loop process. Examples of dewatering equipment include filter presses, linear motion screens, and centrifuges.

Wastewater Treatment - The wastewater treatment ensures that PFAS is removed from impacted process water and extractant solutions before the water is recycled through the soil washing system as part of the closed-loop treatment process. Current circuit designs use a treatment train consisting of commercially available technologies including a clarifier, filter press, and filtration columns containing multi-media, zeolite, activated carbon, and ion-exchange resins. The process is designed to remove total suspended solids and co-contaminants.

Leaching – The leaching process employs a chemically amended process water to increase PFAS removal efficiencies in the sand fraction of the soil. Within this section of the process, an increased residence time within the extraction system allows for greater contact times and extraction efficiencies. The technique operates on the principal that the contaminants will have a greater solubility in the wash water solution than in the soil or mineral matter matrix. The

equilibrium concentration gradient drives the mass transport process such that the contaminant transfers from the soil to the wash water.

Figure 1 Soil Washing Process Flow



2.2 Technical Risks

The three technical risks to the implementation of soil washing are water treatment optimization, the treatment efficiency of fine-grained soil, and the addition of the enhanced chemical desorption to the base soil washing process being demonstrated in Australia. First, the success of soil washing depends on the continual reduction of PFAS in the process water through multiple regeneration cycles of water treatment. The presence of co-contaminants and the inevitable changes to the geochemical characteristics of the process water as the PFAS-contaminated soil is processed will require engineered management. Second, the total treatment cost is sensitive to the percentage of fine-grained soil. Sites with high percentages of fine-grained soil and stringent remedial objectives may generate less competitive treatment costs. Initial applications of the technology would be best conducted on sites with a high percentage of coarse-grained soil. Mitigation of these risks is managed through the bench-scale testing, and lessons learned (such as the field-scale trial in Australia) will be examined in Q2 2019 (described in 7f). Third, the addition of the enhanced chemical desorption to achieve percent reductions of more than 99% introduces a change in the processing flow and a potential effect on the water treatment process, which will need to be fully investigated at a bench scale and then at the pilot scale to evaluate the effects on the water treatment circuit over the range of conditions present at a contaminated site.

3 Performance Objectives

The overall objective of the laboratory work is to develop and demonstrate the effective removal of PFASs adsorbed to soils. Soil washing is a physico-chemical mass removal technology that can be used to treat PFAS contaminated soil in source zones and prevent groundwater contamination. The process desorbs PFAS from soil and transfers them into an aqueous solution, where they can be treated using conventional water treatment technologies. This project seeks to demonstrate and validate a PFAS soil washing technology at the field scale by 1) Completing treatability testing; 2) Evaluating treatment performance in the presence of common co-contaminants; and 3) Determining the site-specific cost and performance requirements of the technology.

Table 1 outlines the performance objectives of the laboratory scale trials.

Table 1 Performance Objectives

Performance Objective	Data Requirements	Success Criteria
1. Bench-scale testing to demonstrate site suitability and optimize treatment process	Particle size distribution, physico-chemical soil parameters, total concentration, and leachable concentration of individual PFAS in soil, co-contaminants, and total organic carbon (TOC)	>99% removal of PFOS, PFOA, PFBS and >99% removal of sum of 24 PFAS on the USEPA Method 537/DoD QSM analyte list. Post-treatment soil concentrations and leachate concentrations < regional screening levels. Post-treatment water concentrations < USEPA Health Advisory Level (HAL)

Regional screening levels for this trial are adopted from Alaska Department of Environmental Conservation (ADEC) (2016), ADEC (2019) and OSD (2019, 2021) and are listed in Table 2.

Table 2 Regional PFAS Screening Levels

Screening Levels	PFOS	PFOA	PFOS + PFOA	PFBS
Soil migrating to groundwater (ADEC 2016)	3 ug/kg	1.7 ug/kg	-	-
Groundwater (ADEC 2019)/ US EPA HAL	-	-	70 ng/L	-
Groundwater (OSD 2019, 2021)	40 ng/L	40 ng/L	-	600 ng/L

PFAS mass removal will be evaluated by comparing soil PFAS concentrations pre- and post-treatment. Based on the Australian soil washing trial, treatability testing was consistent with bench testing and we anticipate that >99% of the PFAS mass will be removed from the soil and transferred to the wash solution which will then pass through the water treatment circuit. During this trial, treated water will be tested to confirm compliance with the performance objectives in Table 1.

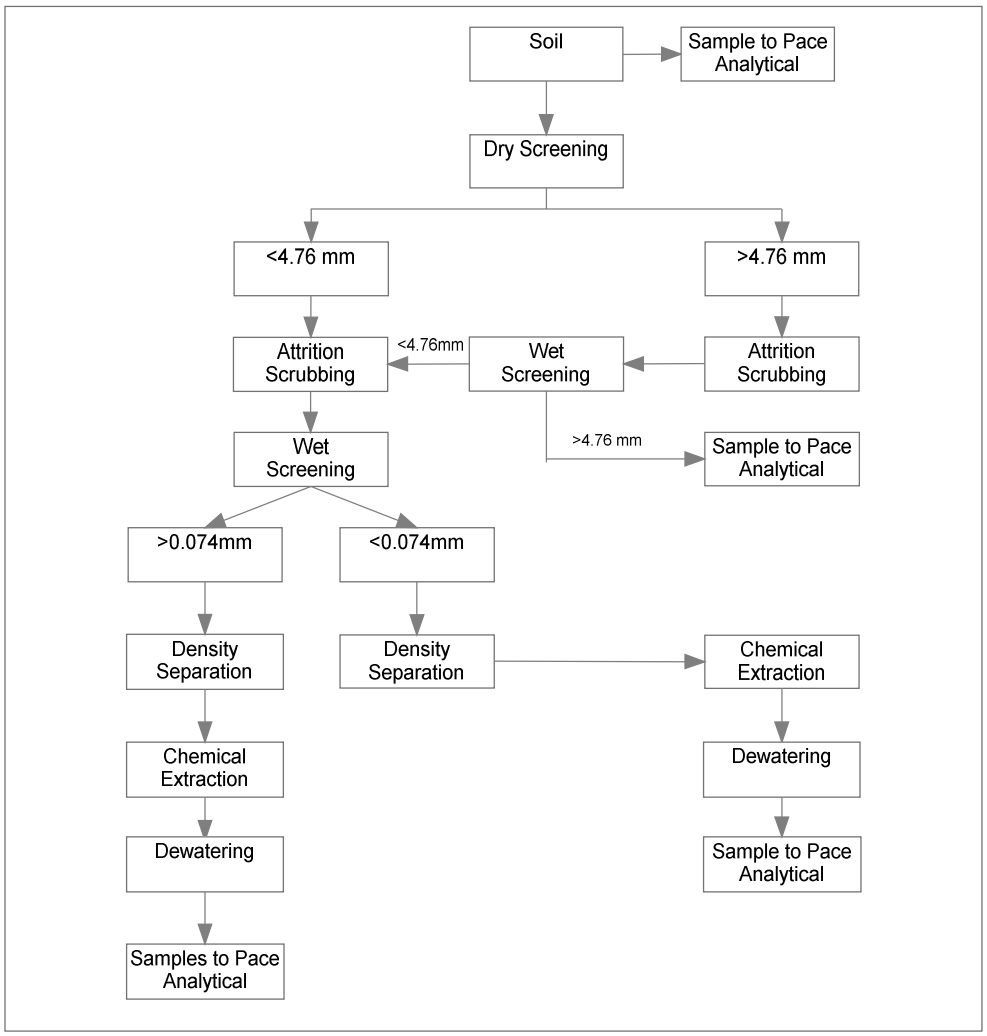
4 Experimental Design

This section provides the detailed description of the laboratory testing to be conducted to address the performance objectives described in Section 3.

4.1 Test Setup

Figure 2 shows the series of treatment stages that comprise the experimental design of the treatability test. The design for this test consisted of three main stages; 1) size separation comprised of dry screening, attrition scrubbing and wet screening; 2) density Separation; and 3) chemical extraction.

Figure 2 Treatability Test Experimental Design



4.1.1 Screening

Both dry screening and wet screening are conducted using an 18-inch SWECO round vibratory screener (**Figure 3**). The screen can separate a soil sample into various size fractions. For this test three separate fractions will be created with different sized meshed screens placed in sequence. The mechanical screen uses rectangular meshed screen cloths and separates the soil into different effective particle ranges entirely based on the size and shape of the soil particles.

Screens of 2.5, 4 and 200 Tyler mesh are used to separate the soil into the various size fractions. These mesh sizes equal 8.00 mm, 4.76 mm, and 0.074 mm openings, respectively.

Figure 3 18-inch SWECO Round Vibratory Screen



4.1.2 Attrition Scrubbing

Following the dry screening stage, the plus and minus 4.76 mm fractions of the soil sample are placed in a Denver attrition mill and processed separately (**Figure 4**). A 5:1 liquid/solid slurry is maintained in the attrition mill with processing times of 3 minutes for the plus 4.76 mm fraction and 10 minutes for the minus 4.76 mm fraction. The times are maintained to simulate the retention achievable in the larger scale soil washing processes. At the end of the attrition scrubbing the slurry from each run will be passed through the SWECO screen to separate into the final soil fractions. In the full-scale process, foam and process water generated from attrition scrubbing will be raked to a froth tank and transferred into the water treatment circuit. **Figure 4** presents the Denver Attrition Mill used for the attrition scrubbing.

Figure 4 Attrition Mill



4.1.3 Density Separation

Figure 5 presents one of the lab scale density classifiers used in the treatability testing. Density separation is used to separate as a discrete process stream specific soil component that may be PFAS enriched. This would include any organics present in the soil. The density separator presented below operates by feeding a metered mass of the PFAS impacted soil at the top of the separator. As the soil settles through the vertical length of the separator, a countercurrent flow of water is metered at the bottom of the device to create a hindered settling condition out of the PFAS impacted soil that acts as a pseudo dense medium. Once this “teeter bed” condition is created particles can be separated on the basis of density. The denser, heavier particles discharge through a valve at the bottom of the classifier, while the less dense organics overflow the discharge pipe at the top of the unit and are collected on a 325 Tyler mesh screen. Organics will then be dewatered and separated from other material, however due to the low percentage of organics in the soil for this treatability study, it is not anticipated that there will be a sufficient volume of organics to collect a sample for PFAS analysis.

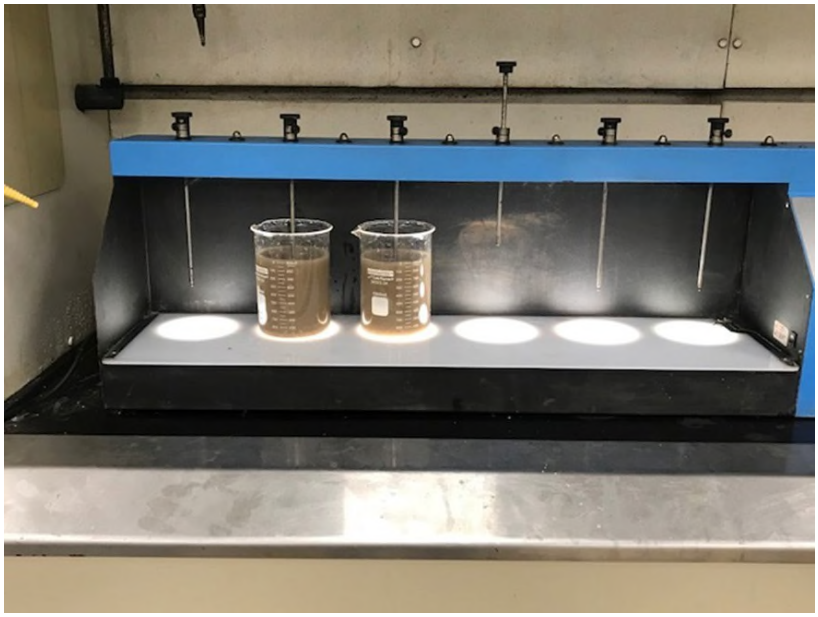
Figure 5 Density Separator



4.1.4 Chemical Extraction

Various extraction solutions are tested on the different sized soil fractions. The laboratory extraction equipment used is a modified Phipps and Bird six-paddle stirrer with a variable speed mixer. For PFAS treatment, as a minimum, the chemical extraction experiments evaluate the effects of varying temperature, pH, concentrations of anionic surfactants and mixing intensity and time. The actual concentrations and conditions brought forward for evaluation are proprietary in nature and not provided in this report. If requested, this can be provided under separate cover and in a manner that would preserve the confidentiality of the information. Approximately 200 ml samples of soil from the underflow of the density separator are reacted with the extracting solution at a 5:1 (v:v) ratio of solution to soil. The slurry is mixed for 30 minutes at the specified mixing intensity. Upon completion of the extraction period the coarser soil fractions are allowed to settle, decanted and screened on a 200-mesh screen. The 200-mesh plus material is simply mechanically dewatered without the aid of a polymer. The finer grained soil fractions are mixed with a polymer to create a flocculated slurry, allowed to settle for 10 minutes, and decanted before final dewatering using a laboratory scale filter press. **Figure 6** shows the lab scale mixer apparatus.

Figure 6 Laboratory Scale Chemical Mixer



4.2 Sampling Plan

Soil samples obtained during the treatability testing were submitted by CleanEarth to Pace Analytical in West Columbus, South Carolina to evaluate the predicted remedial performance of the soil washing process. The samples obtained support an iterative process where results from one treatment run are used to evaluate and optimize the system. As a minimum analytical test, results will be obtained from the following process streams once the optimal treatment sequence has been determined.

1) One sample from the untreated soil
2) One sample from each of the following treated process streams:

Stones/Cobbles/Coarse Gravel	*- diameter > 20 mm.*
Medium and Fine Gravel	*- diameter < 20 mm and > 2 mm.*
Sand	*- diameter < 2 mm and > 0.063 mm.*
Silt/Clay	*- diameter < 0.063 cm.*

3) One sample from the separated residual (organics from all size fractions), if applicable.
4) One sample of the untreated and treated water.

Refer to **Table 1** for performance objectives of the bench-scale testing.

Soil samples will be analyzed for total PFAS (PFAS compounds listed on Table B15, DoD QSM 5.3) and leaching via the Australian Standard Leaching Procedure (ASLP). The analytical methods are summarized in **Table 3**.

Table 3 Analytical Methods

Matrix	Analysis	Method
Soil	Total PFASs	EPA Method 537/DoD QSM 5.3
	ASLP	AS 4439.3; leachate via EPA Method 537/DoD QSM 5.3
Water	Total PFAS	EPA Method 537//DoD QSM 5.3`
Soil	Particle Size Analysis	CleanEarth SOP - 10

The ASLP is a modification of the US Toxicity Characteristic Leaching Procedure using pH 7 deionized water. The ASLP method is provided in **Appendix B.**

4.3 Sample Documentation

A bound laboratory logbook is used to document daily activities. Sample collection and handling as well as visual observations will be documented. All entries will be dated, legible, and contain accurate and inclusive documentation of project activities.

Laboratory approved PFAS sample containers, shipping procedures and holding times were implemented. Immediately after the samples were collected, they were stored at 4°C until shipment in insulated coolers pre-chilled using double-bags of ice. Chains-of-custody (COCs) documented sample shipment and sample coolers were sealed with custody seals prior to shipment.

Each sample was given a unique identification based upon the sample matrix and treatment sequence. Labels with sample identification including sample date, time, and preservation are attached to each container. Sample information will also be recorded on the COC and Daily Log Data Analyses.

5 Results and Discussion

5.1 Untreated Sample Characterization

A 5-gallon bucket of soil was obtained from stockpile 393-1 at Eielson AFB for bench testing. This 11 cubic yard pile represents the worst case PFOS and Total PFAS concentrations at Eielson with prior testing results indicating maximum combined concentrations of 1,500 micrograms per kilograms (ug/kg) PFOA and PFOS. This pile was selected to demonstrate broad applicability of the soil washing process to treat PFAS-impacted soils at significant sources such as fire training areas across the DoD. However, it should be noted that the general PFAS levels in the 150,000 cubic yards of stockpiled soils is much less. PFOA sampling results are generally in the single digit ug/kg range; whereas PFOS sampling results are typically higher, ranging from single digits to just over one hundred ug/kg. Less than 10 percent of the total soil stockpile volumes contain concentrations of PFOA and PFOS above 100 ug/kg (Arcadis, 2021a, 2021b).

5.1.1 Particle Size Characterization of the Source Area Samples

A one (1) kilogram subsample from the Eielson AFB stockpile 393 source soil samples was obtained and wet screened on a series of sieves to determine the gradation of the soil. A wet screening technique was used to characterize the soil as dry screening can underestimate the fines content if balls of fine clay are retained on the coarser sieves.

The size distribution data is listed in the **Table 4**.

Table 4 Stockpile 393-1 Grain Size Analysis

Mesh	Size (micron)	Weight %
5	4000	59.1
-5 + 10	-4000 + 2000	3.7
-10 + 30	-2000 + 600	2.2
-30 + 60	-600 + 250	17.0
-60 + 100	-250 + 150	2.3
-100 + 250	-150 + 64	6.8
-250	-64	8.9

Based on the data in Table 4, Table 5 presents an approximate particle size distribution for the untreated soil in comparison to the process streams that will be generated as part of the treatment process.

Table 5 Stockpile 393 Particle Size Distribution

Size (mm)	Material Type	Weight %
<20 mm	Rock	62.8
<20mm + 2mm	Gravel	19.2
<2mm + 0.063 mm	Sand	9.1
<0.063 mm	Fines	8.9

5.1.2 PFAS Characterization

Table 6 presents the PFAS compounds in the untreated stockpile 393 that presented concentrations of either Total or Leachable PFAS above detection limits. The samples were analyzed for PFAS by USEPA Method 537 and the associated leachate concentrations by ASLP (AS 4439.3) and leachate via Method 537. Laboratory reports are included in Appendix A.

The predominant PFAS detected in the untreated sample is PFOS with a reported concentration of 2,700 µg/kg, which is approximately 1.7 times higher than the expected concentrations based on previous testing results of the stockpile. Concentrations of 8:2 FTS and PFHxS were reported in the 100 ug/kg range with lesser concentrations reported of the remaining PFAS compounds reported. Note that the remaining PFAS compounds reported on Table B-15 were not detected and are not summarized in Table 6 for clarity, however a full suite of results is provided in Table A-1.

In general, the leachate concentrations were correlated to the reported totals with the highest leachate concentration reported for PFOS at 32,000 ng/L. PFHxS, PFHxA and 8:2 FTS reported in the thousands of ng/L. All other detectable PFAS leachate concentrations were reported in the 100's of ng/L. Of note, PFOA was reported at less than the limit of quantification (LOQ) at 11 ug/kg, but reported a detectable leachate concentration of 350 ng/L.

Table 6 Untreated PFAS Concentrations – Stockpile 393-1

PFAS	Stockpile 393-Untreated (393-1-UT)	
	Total (ug/kg)	ASLP (ng/L)
PFOS	2700	32000
PFOA	11 U	350
PFBS	6.6 J	230
8:2 FTS	120	1400
PFHxS	98	2500
PFOSA	97	210
PFHxA	40	1400
PFNS	19 J	100
6:2 FTS	19 J	480
PFDS	17 J	100
PFPeA	12 J	460
PFNA	11 U	62 J
PFPeS	8.1 J	200
PFHpA	5 J	200
PFUdA	4.6 J	100 U
PFBA	4.6 J	170
PFDoA	4.2 J	100 U

J = Estimated result <LOQ and >DL
U = Not detected at or above the LOQ

5.2 PFAS Soil Treatment Optimization Testing

Treatability testing is an iterative process where the results of one round of testing are used to inform and optimize the treatment results for a specific soil.

The objectives of the treatability study were threefold:

- Achieve greater than 99% removal of PFOS and PFOA, and other PFAS on the USEPA Method 537/DoD QSM analyte list in the coarse-grained fractions of the soil.
- Post-treatment soil concentrations and leachate concentrations less than regional screening levels for the coarse-grained soil fractions.
- Post-treatment water concentrations less than the USEPA Health Advisory Level (HAL)

Alaska currently has established soil to groundwater leaching criteria for PFOS and PFOA of 3.0 and 1.3 ug/kg, respectively (ADEC 2016) and groundwater screening levels of 70 ng/L for the sum PFOA and PFOS (ADEC, 2019).

Three rounds of testing were completed for this study and results for PFBS, PFOA, PFOS and Sum PFAS are presented in **Tables 7** through **14**. The treatability conditions and results from each round of testing are discussed below. Results for the full set of 24 PFAS are presented in Table A-1 and the complete laboratory reports are presented in Appendix A.

There was an insufficient volume of organics generated to collect a sample for PFAS analysis in this trial. Residual concentrations of PFAS in the organic fraction (if generated) are anticipated to be high and it should be treated as a waste product.

5.2.1 Round 1 – Baseline Treatment Results

The results in **Table 7** and **8** present the untreated concentrations from stockpile 393-1, a baseline of treatment and the effect of optimizing the treatment beyond baseline conditions for each soil fraction. The baseline conditions represent typical soil washing treatment using retention times, liquid to solid ratios and unamended process water, i.e., municipal water only. The second sample for each soil fraction presents the treatment results obtained by applying an amended process water to increase the treatment efficiencies.

The baseline conditions are effective for the treatment of the rock, gravel, and sand range soils for PFBS and PFOA. Soil and leachate concentrations reported for PFBS and PFOA for these three fractions were reported at less than detection limits and met the regional screening levels for soil and leachable concentrations.

The fine-grained fraction reported percent reductions of soil and leachable PFBS and PFOA in the 53 to 90 percent range with detectable levels of Total PFBS and PFOA in the single digit ug/kg and associated leachate concentrations in the 10’s of ng/L for both compounds.

PFOS reductions using baseline conditions did not meet the greater than 99 percent reduction performance objective and did not meet the total and leachable regional screening levels.

5.2.2 Round 1 - Amended Process Water Results

The second row for each soil fraction in **Table 7** presents the incremental improvement by applying the amended process water. In general, the recovery efficiencies increased, however, the ADEC screening levels for PFOS and PFOA in soil were not achieved during this round of testing. The amended process water sample for gravel (G-TH) reported an increase in total PFOS and total Sum PFAS compared to baseline conditions. This result could not be explained and did not correlate to the amended process water leachate results which showed an improvement in PFOS removal compared to baseline conditions.

Table 7 Round 1 Total PFAS Results – Amended Process Water

Total PFAS (ug/kg)						
			PFBS	PFOA	PFOS	SUM* PFAS
Untreated		ug/kg	**6.6 J**	11 U	**2700**	**3155**
Rock (> 20 mm)	**R-TC (Baseline)**	ug/kg	0.5 U	0.5 U	**88**	**97**
		RE %			96.7%	96.9%
	R-TH (Amended Process Water)	ug/kg	0.45 U	0.45 U	**14**	**15**
		RE %			99.5%	99.5%
Gravel (<20 mm + 2 mm)	**G-TC (Baseline)**	ug/kg	0.5 U	0.5 U	**27**	**32**
		RE %			99.0%	99.0%
	G-TH (Amended Process Water)	ug/kg	2.4 U	2.4 U	**270**	**302**
		RE %			90.0%	90.4%
Sand (<2 mm + 0.063 mm)	**SFIF2STTC (Baseline)**	ug/kg	0.26 J	0.55 J	**150**	**170**
		RE %	96.1%		94.4%	94.6%
	SF1F2STDIH (Amended Process Water)	ug/kg	0.49 U	0.49 U	**51**	**58**
		RE %			98.1%	98.2%
Fines (<0.063 mm)	**F-F1F2 (Baseline)**	ug/kg	**3.1 J**	7.5 U	**2400**	**2822**
		RE %	53%		11.1%	8.5%
	F-F1F2HS5050TC (Amended Process Water)	ug/kg	2	3.8	480	592
		RE %	69.7%	65.5%	82.2%	81.3%
Criteria			1.9	1.7	3	

* = Sum of PFAS >U
J = Estimated Result <LOQ and ≥DL
RE = Removal Efficiency
U = Not detected at or above the LOQ

Table 8 Round 1 Leachable PFAS Results – Amended Process Water

Leachable PFAS ng/L						
			PFBS	PFOA	PFOS	SUM* PFAS
Untreated		ng/L	230	350	32000	39759
Rock (> 20 mm)	R-TC (Baseline)	ng/L	20 U	20 U	200	270
		RE %			99.4%	99.3%
	R-TH (Amended Process Water)	ng/L	20 U	20 U	370	401
		RE %			98.8%	99.0%
Gravel (<20 mm + 2 mm)	G-TC (Baseline)	ng/L	20 U	20 U	620	803
		RE %			98.1%	98.0%
	G-TH (Amended Process Water)	ng/L	20 U	20 U	190	277
		RE %			99.4%	99.3%
Sand (<2 mm + 0.063 mm)	SFIF2STTC (Baseline)	ng/L	20 U	26 J	900	1005
		RE %		92.6%	97.2%	97.5%
	SF1F2STDIH (Amended Process Water)	ng/L	20 U	20 U	460	506
		RE %			98.6%	98.7%
Fines (<0.063 mm)	F-F1F2 (Baseline)	ng/L	22 J	53	530	1123
		RE %	90%	84.9%	98.3%	97.2%
	F-F1F2HS5050TC (Amended Process Water)	ng/L	20 U	20 U	120	425
		RE %			99.6%	98.9%
Criteria			600	40	40	

* = Sum of PFAS >U
J = Estimated Result <LOQ and ≥DL
U = Not detected at or above the LOQ
RE = Removal Efficiency

5.2.3 Round 2 – Crushing and Magnetic Separation Results

Based on the results in round 1, the greater than 20mm, greater than 2mm and greater than 0.064mm sized fractions were brought forward for a second round of treatability testing. Changes made to this round of testing included crushing the rock and gravel fractions to reduce the particle size and "mine" or expose the PFOS that may be absorbed into these fractions and make them available for treatment. It was also noted that the coarser grained samples had a significant percentage of magnetic iron present. All three of the fractions were also subjected to magnetic separation to remove the ferromagnetic component to evaluate any incremental improvements in treatment by segregating this portion of the soil.

Tables 9 and **10** present the results of the second round of treatability testing comparing the baseline results to the second round of treatment of PFAS present in the crushed rock/gravel, sand, and separated iron fractions.

The results of the second round of testing evaluating the effect of particle size reduction and iron removal in conjunction with the amended process water show an increased removal efficiency for PFOS in the coarse-grained soil fractions. Percent removal of PFOS and PFOA were increased to greater than 99 percent. Soil PFOA concentrations were reduced to below detection limits meeting the ADEC screening levels. PFOS concentrations were reported at 8.8 and 12 ug/kg in the crushed rock/gravel and sand fractions, respectively, which exceeded the ADEC screening level of 3.0 ug/kg.

Leachable PFOA and PFBS concentrations were reported below detection limits. Leachable PFOS concentrations were 82 ng/L and 75 ng/L in the crushed rock/gravel and sand samples, respectively. These concentrations marginally exceed the remedial objective of 40 ng/L for PFOS.

The sum of PFAS concentrations for both soil and leachable concentrations were reduced by over 99 percent in this round of testing.

Table 9 Round 2 Total PFAS Results - Crushing and Magnetic Separation

Total PFAS (ug/kg)						
			PFBS	PFOA	PFOS	SUM PFAS
Untreated		ug/kg	**6.6 J**	11 U	**2700**	**3155**
Rock/Gravel Crushed	**Baseline**	ug/kg	0.5 U	0.5 U	**88**	**97**
		RE %			96.7%	96.9%
	R4-HSDIHILIM (Crushing and Magnetic Separation)	ug/kg	0.55 U	0.55 U	**8.8**	**9**
		RE %			99.7%	99.7%
Sand (<2 mm + 0.063 mm)	**Baseline**	ug/kg	0.5 U	0.5 U	**27**	**32**
		RE %			99.0%	99.0%
	RGS-HSDIH505 (Crushing and Magnetic Separation)	ug/kg	0.47 U	0.47 U	**12**	**14**
		RE %			99.6%	99.6%
Magnetic Fraction of Sand	**S-F1F2-M**	ug/kg	1.6 J	2.1 U	**190**	**227**
		RE %	76%		93.0%	92.8%
Criteria			1.9	1.7	3	

* = Sum of PFAS >U
J = Estimated Result <LOQ and ≥DL
U = Not detected at or above the LOQ
RE = Removal Efficiency

The results for the magnetically separated iron fraction are presented in Table 8 and 9. Elevated concentrations of Total and leachable concentrations were reported relative to baseline conditions for both total and leachable PFAS.

5.2.4 Round 3 – Finer Crushing and Magnetic Separation Results

A third round of testing included further size reduction and iron removal steps and evaluated the effect of increased mixing intensity and increased retention time.

Results from the third round of testing are presented in Table 11 and Table 12. In the third round, the rock, gravel, and sand fractions were finely crushed and combined during treatment. Total PFBS and PFOA concentrations were < LOQ and PFOS and Sum PFAS concentration were both 0.34 J. Leachable concentrations of PFBS and PFOA were < LOQ and PFOS and Sum PFAS concentrations were both 36 J. In the third round, PFAS concentrations were less than the total and leachable regional screening levels and PFAS RE was >99%. The performance objectives were therefore achieved for the coarse fraction of soil at Eielson AFB.

Table 10 Round 2 Leachable PFAS Results - Crushing and Magnetic Separation

Leachable PFAS (ng/L)						
			PFBS	**PFOA**	**PFOS**	**SUM* PFAS**
Untreated		ng/L	**230**	**350**	**32000**	**39759**
Rock/Gravel Crushed	**Baseline**	ng/L RE %	20 U	020 U	**410** 98.7%	**536** 98.7%
	R4-HSDIH5050ILIM (Crushing and Magnetic Separation)	ng/L RE %	20 U	20 U	**82** 99.7%	**174** 99.6%
Sand (<2 mm + 0.063 mm)	**Baseline**	ng/L RE %	020 U	**26 J**	**900** 97.2%	**1005** 97.5%
	S-HSDIH505ILIM (Crushing and Magnetic Separation)	ng/L RE %	20 U	20 U	**75** 99.8%	**181** 99.5%
Iron	**S-F1F2-M**	ug/kg RE %	**11 J** 95.2%	**59** 83.1%	**1900** 94.1%	**2550** 93.6%
Criteria			600	40	40	

* = Sum of PFAS >U
J = Estimated Result <LOQ and ≥DL
U = Not detected at or above the LOQ
RE = Removal Efficiency

Table 11 Round 3 Total PFAS Results - Finer Crushing and Magnetic Separation

Total PFAS (ug/kg)						
			PFBS	**PFOA**	**PFOS**	**SUM PFAS**
Untreated		ug/kg	**6.6 J**	11 U	**2700**	**3155**
Rock/Gravel/Sand Crushed	**Baseline**	ug/kg RE %	0.5 U	0.5 U	**88** 96.7%	**97** 96.9%
	SCDIHHSSUR23RT1 (Finer Crushing and Magnetic Separation)	ug/kg RE %	0.6 U	0.6 U	**0.34 J** 99.9%	**0.34 J** 99.9%
Criteria			1.9	1.7	3	

* = Sum of PFAS >U
J = Estimated Result <LOQ and ≥DL
U = Not detected at or above the LOQ
RE = Removal Efficiency

Table 12 Round 3 Leachable PFAS Results - Finer Crushing and Magnetic Separation

Leachable PFAS (ng/L)						
			PFBS	PFOA	PFOS	SUM* PFAS
Untreated		ng/L	**230**	**350**	**32000**	**39759**
Rock/Gravel/Sand Crushed	**Baseline**	ng/L	20 U	020 U	**410**	**536**
		RE %			98.7%	98.7%
	SCDIHHSSUR23RT1 (Finer Crushing and Magnetic Separation)	ng/L	40 U	40 U	40 U	**35 J**
		RE %				99.9%
Criteria			600	40	40	

* = Sum of PFAS >U
J = Estimated Result <LOQ and ≥DL
U = Not detected at or above the LOQ
RE = Removal Efficiency

5.2.5 Summary of Results

Table 13 and Table 14 illustrate the iterative improvements during each treatment round. By the completion of round three, the regional screening level and RE% criteria were achieved for the coarse grained fraction.

Table 13 Summary of Total PFAS Results

Total PFAS (ug/kg)						
Material Type	**Sample ID**	**Unit**	**PFBS**	**PFOA**	**PFOS**	**SUM PFAS**
Untreated	393-1-UT		6.6 J	11 U	2700	3155
Round 1 - Amended process water						
Rock (<20 mm)	R-TC	ug/kg RE%	0.5 U	0.5 U	**88** 96.74%	97.06 96.92%
Gravel (<20mm + 2mm)	G-TC	ug/kg RE%	0.5 U	0.5 U	27 99.00%	32.39 98.97%
Sand (<2mm + 0.063 mm)	SFIF2STTC	ug/kg RE%	0.26	0.55 J	150 94.44%	169.79 94.62%
Fines (<0.063 mm)	F-F1F2	ug/kg RE%	3.1 J 53.03%	7.5 U	2400 11.11%	2821.5 10.57%
Round 2 - Crushing and magnetic separation						
Crushed Rock/Gravel	R4-HSDIHILIM	ug/kg RE%	0.55 U	0.55 U	8.8 99.67%	9.37 99.70%
Sand (<2mm + 0.063 mm)	RGS-HS505ILIM	ug/kg RE%	0.47 U	0.47 U	12 99.56%	14 99.56%
Iron	S-F1F2-M	ug/kg RE%	1.6 J	2.1 U	190 93%	226.8 93%
Round 3 - Finer crushing and magnetic separation						
Rock/Gravel/Sand	SCDIHHSSUR23RT1	ug/kg RE%	0.60 U	0.60 U	0.34 J 99.99%	0.34 J 99.99%
Criteria			1.9	1.7	3	N/A

* = Sum of PFAS >U
J = Estimated Result <LOQ and ≥DL
U = Not detected at or above the LOQ
RE = Removal Efficiency

Table 14 Summary of Leachable PFAS Results

Leachable PFAS (ng/L)						
Material Type	**Sample ID**	**Unit**	**PFBS**	**PFOA**	**PFOS**	**SUM PFAS**
Untreated	393-1-UT		230	350	32000	39759
Round 1 - Amended process water						
Rock (<20 mm)	R-TC	ng/L RE%	20 U	20 U	**200** 99.38%	270 99.32%
Gravel (<20mm + 2mm)	G-TC	ng/L RE%	20 U	20 U	**620** 98.06%	803 97.98%
Sand (<2mm + 0.063 mm)	SFIF2STTC	ng/L RE%	20 U	26 J 92.57%	**900** 97.19%	1005 97.47%
Fines <0.150 mm)	F-F1F2	ng/L RE%	22 J	53 84.86%	**530** 98.34%	1123 97.18%
Round 2 - Crushing and magnetic separation						
Crushed Rock/Gravel	R4-HSDIHILIM	ng/L RE%	20 U	20 U	120 99.63%	194 99.51%
Sand (<2mm + 0.063 mm)	RGS-HS505ILIM	ng/L RE%	20 U	20 U	75 99.77%	181 99.54%
Iron	S-F1F2-M	ng/L RE%	11 J	59 83.14%	1900 94.06%	2550 93.59%
Round 3 - Finer crushing and magnetic separation						
Rock/Gravel/Sand	SCDIHHSSUR23RT1	ng/L RE%	40 U	40 U	40 U	35 J 99.91%
Criteria			N/A	1.7	3	N/A

* = Sum of PFAS >U
J = Estimated Result <LOQ and ≥DL
U = Not detected at or above the LOQ
RE = Removal Efficiency

5.3 Process Water Testing

Treated process water from the laboratory testing was submitted for analysis of total PFAS to evaluated treatment efficacy to USEPA HAL. The samples PWG and PWIX reference water treated through granular activated carbon (GAC) and GAC and ion exchange resin in series (IX). The post treatment water samples treated through GAC and IX are below the USEPA HAL and OSD screening level concentrations for PFOS and PFOA; refer to Table 15.

The lab reports are included in Appendix A.

Table 15 Treated Process Water Results

Sample	PFOA (ng/L)	PFOS (ng/L)	PFOA + PFOS (ng/L)	PFBS (ng/L)
PWG	1.5 J	2.7 J	4.7 J	1.8 U
PWIX	1.1 J	1.7 U	1.1 U	1.7 U
Criteria	40	40	70	600

J = Estimated Result <LOQ and ≥DL
U = Not detected at or above the LOQ

6 Conclusions and Recommendations

The soil tested for this treatability study was obtained from stockpile 393-1, which represents about 11 cubic yards out of approximately 150,000 cubic yards of stockpiled PFAS-impacted soils. Prior PFOA sampling results from the site were generally in the single digit micrograms per kilograms ug/kg range; whereas PFOS sampling results are typically higher, ranging from single digits to just over one hundred ug/kg. Less than 10 percent of the total soil stockpile volumes contain concentrations of PFOA and PFOS above 100 ug/kg.

Arcadis/CET choose this pile to test the worst possible case scenario present at Eielson and to demonstrate treatment efficacy on PFOS concentrations at levels that may be more representative of PFAS source areas at other DoD locations. Based on treatability testing results, Pile 393-1 contains maximum combined PFOA and PFOS concentrations of greater than 2,700 ug/kg.

The soil washing approach will focus on separating the coarse fraction (rock, gravel, and sand) from the fine (silt and clay) and organic fractions to optimize treatment for the coarse fraction, which will increase production rates and decrease cost compared to an approach that attempts to achieve clean up goals in the fines and organics. When fines and organics cannot be cost-effectively treated via soil washing, the fines and organics can be thermally treated to meet goals or stabilized to minimize leaching for disposal or on-site management, depending on the site-specific objectives.

6.1 Treatability Performance

The primary objective of the treatability testing was to demonstrate that the soil washing approach would effectively treat the coarse fraction to achieve: 1) greater than 99% removal of PFOS, PFOA, PFBS and total PFAS (e.g., sum of PFAS analytes from Table B-15); 2) reduce concentrations to meet regional screening levels for PFOS and PFOA, and 3) reduce leachability to meet OSD screening levels for water for PFOS, PFOA, and PFBS.

- **Percent removal**: In the second round of treatment, greater than 99% removal of PFOS, PFOA and Sum PFAS was achieved for the coarse grained fractions. This result meets the performance objective.
- **Regional screening levels**: The regional screening levels were achieved for PFBS and PFOA in the first round of treatment for the coarse-grained fractions. PFOS concentrations initially exceeded the regional screening level, however through incremental improvements in PFOS removal, the regional screening level was achieved in the third treatment round for the coarse-grained fraction. This result meets the performance objective.
- **Leaching**: The leachable regional screening levels for PFBS and PFOA were achieved in the coarse-grained fractions in the first round of treatment. In the third round of treatment, the

regional screening level for PFOS was also achieved for the coarse-grained fraction. This result meets the performance objective.

- **Fines**: Regional screening levels were not achieved for the fine-grained soil in stockpile 393-1; however, PFOS concentrations in this stockpile are significantly higher than the majority of soil currently stockpiled at Eielson. Based on the removal efficiencies achieved in this study, it is anticipated that the fine-grained fraction could be successfully treated to concentrations less than the regional screening levels in stockpiles with PFAS concentrations < 100 ug/kg. It is estimated that this will result in the treatment of greater than 90 percent of the currently stockpiled soil

6.2 Next Steps

When the weather allows, Arcadis plans on collecting a sample from stockpiles reporting PFOS concentrations in the single digits and the hundreds of ug/kg to validate the treatment on these soil concentrations and to investigate if a simpler treatment sequence can be applied than that required for the highest PFOS concentration soils. It will also allow verification the volume of fine-grained soil that can be treated to either the Total and/or Leachable PFAS remedial objectives for PFOS.

6.2.1 Implications for Application at Eielson

The current treatability results and treatment sequence investigated will be effective in treating the coarse-grained fraction of the stockpiled PFOS/PFOA impacted soils at Eielson AFB. Based on treatability removal efficiencies demonstrated this far, the results indicate the following:

- A minimum treatment efficacy of < 3 ug/kg PFOS, <1.3 ug/kg PFOA and < 40 ng/L of leachable PFOS and PFOA for the coarse-grained soils.
- The fine-grained fraction of the stockpiled soil reporting PFOS/PFOA concentrations in the single digits to less than 100 of ug/kg can also be treated to meet either the soil concentration and/or leachable criteria for soil. It is estimated that this will result in the treatment of greater than 90 percent of the currently stockpiled soil – coarse grained and fined grained fraction volumes. The ability to treat a portion of the fines and organics cost-effectively would reduce costs related to alternative treatment in full-scale application.

7 Go/No-Go Decision

Based on the results from the three rounds of treatability testing, and the treatment sequence investigated, it is recommended that soil washing will be effective in treating the coarse-grained fraction of the PFOS/PFOA impacted soils at Eielson in the range of 3 ug/kg to 2,700 ug/kg to achieve the performance objectives:

1. greater than 99% removal of PFOS, PFOA, and total PFAS (e.g., sum of PFAS analytes from Table B-15);
2. reduce concentrations to meet regional screening levels for PFOS and PFOA, and
3. reduce leachability to meet OSD screening levels for water for PFOS, PFOA, and PFBS.

Although the intent is to optimize the process for performance for the coarse-grained fraction, results indicate that the fine-grained fraction can be treated to meet the above performance objectives for the fines with PFOS concentrations up to 100 ug/kg. Based on the removal efficiencies observed in this study, it is recommended that this will result in the treatment of greater than 90 percent of the currently stockpiled soil – coarse grained and fined grained fraction volumes. The remaining volume could be treated using thermal or stabilization as contemplated in our proposal strategy.

The third round of treatability testing was designed to optimize treatment to achieve the objectives for stockpile 391-1, which is considered representative of significant sources across the DoD. The performance objectives were achieved in the third round of treatment, indicating that soil washing can be an effective treatment technology for soils across the DoD portfolio. It is not expected that the fine-grained fraction of soils at these starting concentrations can be treated to meet the remedial objectives; however, separation and alternative treatment methods were contemplated for the fines and organics as indicated above.

It is also recommended that additional samples are obtained from stockpiles reporting PFOS in the single digits and the hundreds of ug/kg to validate the treatment on these soil concentrations and to investigate if a simpler treatment sequence can be applied than that required for the highest PFOS concentration soils. This additional treatability testing will also allow verification of the volume of fine-grained soil that can be treated to either the total and/or leachable remedial objectives for PFOS.

Based on the foregoing discussion, we recommend that the current treatability testing results are consistent with a “Go” decision. The results of the ongoing and proposed treatability testing will enable more targeted treatment for the range of PFAS impacted soils during the pilot at Eielson AFB and verify performance for the range of PFAS concentrations, including the worst-case soils at stockpile 393-1.

8 Bibliography

ADEC, 2019. Technical memorandum – action levels for PFAS in water and guidance on sampling groundwater and drinking water. https://dec.alaska.gov/media/15773/pfas-drinking-water-action-levels-technical-memorandum-10-2-19.pdf, October. pp 1-4

ADEC, 2016. Interim technical memorandum – action levels for PFAS in water and guidance on sampling groundwater and drinking water comparing DEC cleanup levels for perfluorooctane sulfonate (PFOS) and perfluorooctanoic acid (PFOA) to EPA's Health Advisory Levels. August. pp 1-2.

Arcadis, 2021a. Treatability Plan Memo – Ex situ soil washing to remove PFAS adsorbed to soils from source zones, ER-10-5258, version #1, January.

Arcadis, 2021b. Site Selection Memo – Ex situ soil washing to remove PFAS adsorbed to soils from source zones, ER-10-5258, version #1, January.

Office of the Secretary of Defense (OSD), 2019. Investigating Per- and Polyfluoroalkyl Substances within the Department of Defense Clean up program. October.

USEPA, 2019a. EPA's per- and polyfluoroalkyl substance (PFAS) action plan. EPA 823R18004. https://www.epa.gov/sites/production/files/2020-1/documents/pfas_action_plan_feb2020.pdf

USEPA, 2019b. Interim recommendations for addressing groundwater contaminated with PFOA and PFOS. https://www.epa.gov/pfas/interim-recommendations-addressing-groundwater-contaminated-pfoa-and-pfos

USEPA, 2020. EPA PFAS action plan: program update. EPA 100K20002. https://www.epa.gov/sites/production/files/2020-1/documents/pfas_action_plan_feb2020.pdf

U.S. EPA. Human Health Toxicity Values for Perfluorobutane Sulfonic Acid and Related Compound Potassium Perfluorobutane Sulfonate. U.S. Environmental Protection Agency, Washington, DC, EPA/600/R-20/345F, 2021.

Appendix A
Laboratory Results

Appendix A
Laboratory Results

Report of Analysis

Arcadis U.S., Inc.
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Suite 600
Highlands Ranch, CO 80129
Attention: Joseph Quinnan

Project Name: Eielson AFB

Project Number: 30030317

Lot Number:**WA20017**

Date Completed:01/26/2021

02/15/2021 11:39 AM
Approved and released by:
Project Manager II: **Marcia K. McGinnity**

The electronic signature above is the equivalent of a handwritten signature.
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Case Narrative
Arcadis U.S., Inc.
Lot Number: WA20017

This Report of Analysis contains the analytical result(s) for the sample(s) listed on the Sample Summary following this Case Narrative. The sample receiving date is documented in the header information associated with each sample.

All results listed in this report relate only to the samples that are contained within this report.

Sample receipt, sample analysis, and data review have been performed in accordance with the most current approved The NELAC Institute (TNI) standards, the Pace Analytical Services, LLC ("Pace") Laboratory Quality Manual, standard operating procedures (SOPs), and Pace policies. Additionally, the DoD QSM version 5.3 has been followed for these samples, and specifically Table B-15 was followed for all PFAS samples. Any exceptions to the TNI standards, the Laboratory Quality Manual, SOPs, the DoD QSM, or policies are qualified on the results page or discussed below.

Where applicable, all soil sample analysis are reported on a dry weight basis unless flagged with a "W" qualifier

If you have any questions regarding this report please contact the Pace Project Manager listed on the cover page.

PFAS

Correction factors (CF) are used to calculate the original sample concentration. The CF is the inverse of the concentration factor (sample volume / extract final volume) times the dilution factor (DF). For undiluted analysis, the extract is prepared for injection by adding 182 uL of sample extract + 8 uL of reagent water + 10 uL of internal standard solution to a polypropylene autosampler vial. An extra correction factor of 0.91 (182 uL / 200 uL = 0.91) applies. The CF is calculated as follows:

For solid samples:

CF = DF * FV / Ws/S/1000

FV is volume of extract (mL)
Ws is initial sample weight (gram)
S is %Solids
DF is dilution factor. For undiluted analysis, DF = 1/0.91.

Concentration (ug/kg) = Cs*CF,

$$C_s = \frac{\left(\frac{(A_s x C_{is})}{A_{is}}\right) - B}{M1}$$

Where

C_s is on column concentration of target analyte in the sample (ng/L)
C_{is} is concentration of internal standard in the sample (ng/L)
A_s is peak response of target analyte in the sample
A_{is} is peak response of internal standard in the sample
M1 is the average RF from ICAL or the slope from linear regression ICAL
B is the y-intercept from the ICAL

For aqueous samples:

CF = DF * FV / Vo

FV is volume of extract (mL)
Vo is initial sample volume (mL)
DF is dilution factor.

Concentration (ng/L) = Cs*CF,

$$C_s = \frac{\left(\frac{(A_s x C_{is})}{A_{is}}\right) - B}{M1}$$

Where

C_s is on column concentration of target analyte in the sample (ng/L)
C_{is} is concentration of internal standard in the sample (ng/L)
A_s is peak response of target analyte in the sample
A_{is} is peak response of internal standard in the sample
M1 is the average RF from ICAL or the slope from linear regression ICAL
B is the y-intercept from the ICAL

Dilutions greater than 5X impact the surrogate recoveries, thus negating their usefulness concerning quality control. The sample results are reported and no corrective action is required.

Due to insufficient sample received, the initial sample amount used for the following sample(s) deviated from the standard procedure: WA20017-001, WA20017-002. The LOQ has been adjusted accordingly.

For samples WA20017-001, WA20017-002, the leaching solution generated from the SPLP leaching process and used for PFAS SPE sample prep was recieved in bottles with foam lined caps.

ASLP results are qualified with an "H" due to a conservative interpretation of the ASLP method which applies a 14 day holding time from sampling to ASLP leachate preparation. Please note that the standard holding time for PFAS is 28 days for water or soil.

Sample Summary
Arcadis U.S., Inc.
Lot Number: WA20017

Sample Number	Sample ID	Matrix	Date Sampled	Date Received
001	R4-HSDIH505ILIM	Solid	12/29/2020	01/20/2021
002	S-HSDIH505ILM	Solid	12/29/2020	01/20/2021

(2 samples)

Detection Summary

Arcadis U.S., Inc.

Lot Number: WA20017

Sample	Sample ID	Matrix	Parameter	Method	Result	Q	Units	Page
001	R4-HSDIH505ILIM	Solid	8:2 FTS	PFAS by ID	2.5		ug/kg	5
001	R4-HSDIH505ILIM	Solid	PFNS	PFAS by ID	0.31	J	ug/kg	5
001	R4-HSDIH505ILIM	Solid	PFOSA	PFAS by ID	1.5		ug/kg	5
001	R4-HSDIH505ILIM	Solid	PFHxS	PFAS by ID	0.59	J	ug/kg	5
001	R4-HSDIH505ILIM	Solid	PFOS	PFAS by ID	130		ug/kg	5
001	R4-HSDIH505ILIM	Solid	6:2 FTS	PFAS by ID	92	H	ng/L	7
001	R4-HSDIH505ILIM	Solid	PFOS	PFAS by ID	82	H	ng/L	7
002	S-HSDIH505ILM	Solid	8:2 FTS	PFAS by ID	1.3	J	ug/kg	9
002	S-HSDIH505ILM	Solid	PFDS	PFAS by ID	0.50	J	ug/kg	9
002	S-HSDIH505ILM	Solid	PFOSA	PFAS by ID	0.53	J	ug/kg	9
002	S-HSDIH505ILM	Solid	PFOS	PFAS by ID	46		ug/kg	9
002	S-HSDIH505ILM	Solid	6:2 FTS	PFAS by ID	180	H	ng/L	11
002	S-HSDIH505ILM	Solid	PFOS	PFAS by ID	75	H	ng/L	11

(13 detections)

PFAS by LC/MS/MS

Client: **Arcadis U.S., Inc.** Laboratory ID: **WA20017-001**

Description: **R4-HSDIH505ILIM** Matrix: **Solid**

Date Sampled: **12/29/2020** % Solids: **93.9** **01/20/2021 2342**

Date Received: **01/20/2021**

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch
1	SOP SPE	PFAS by ID SOP QSM B-15	1	01/25/2021 1327	MMM	01/22/2021 1136	80346
2	SOP SPE	PFAS by ID SOP QSM B-15	1	01/26/2021 1049	MMM	01/22/2021 1136	80346

Parameter	CAS Number	Analytical Method	Result	Q	LOQ	LOD	DL	Units	Run
1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS)	**39108-34-4**	**PFAS by ID SOP**	**2.5**		**2.0**	1.0	**0.49**	**ug/kg**	**1**
1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS)	27619-97-2	PFAS by ID SOP	1.0	U	2.0	1.0	0.49	ug/kg	1
1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS)	757124-72-4	PFAS by ID SOP	1.0	U	2.0	1.0	0.49	ug/kg	1
N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA)	2991-50-6	PFAS by ID SOP	1.0	U	2.0	1.0	0.49	ug/kg	1
N-methylperfluoro-1-octanesulfonamide (MeFOSA)	31506-32-8	PFAS by ID SOP	1.0	U	2.0	1.0	0.49	ug/kg	2
N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA)	2355-31-9	PFAS by ID SOP	1.0	U	2.0	1.0	0.49	ug/kg	1
Perfluoro-1-butanesulfonic acid (PFBS)	375-73-5	PFAS by ID SOP	0.50	U	0.99	0.50	0.20	ug/kg	1
Perfluoro-1-decanesulfonic acid (PFDS)	335-77-3	PFAS by ID SOP	0.50	U	0.99	0.50	0.20	ug/kg	1
Perfluoro-1-heptanesulfonic acid (PFHpS)	375-92-8	PFAS by ID SOP	0.50	U	0.99	0.50	0.20	ug/kg	1
Perfluoro-1-nonanesulfonic acid (PFNS)	**68259-12-1**	**PFAS by ID SOP**	**0.31**	**J**	**0.99**	0.50	**0.20**	**ug/kg**	**1**
Perfluoro-1-octanesulfonamide (PFOSA)	**754-91-6**	**PFAS by ID SOP**	**1.5**		**0.99**	0.50	**0.20**	**ug/kg**	**1**
Perfluoro-1-pentanesulfonic acid (PFPeS)	2706-91-4	PFAS by ID SOP	0.50	U	0.99	0.50	0.20	ug/kg	1
Perfluorohexanesulfonic acid (PFHxS)	**355-46-4**	**PFAS by ID SOP**	**0.59**	**J**	**0.99**	0.50	**0.20**	**ug/kg**	**1**
Perfluoro-n-butanoic acid (PFBA)	375-22-4	PFAS by ID SOP	0.50	U	0.99	0.50	0.20	ug/kg	1
Perfluoro-n-decanoic acid (PFDA)	335-76-2	PFAS by ID SOP	0.50	U	0.99	0.50	0.20	ug/kg	1
Perfluoro-n-dodecanoic acid (PFDoA)	307-55-1	PFAS by ID SOP	0.50	U	0.99	0.50	0.20	ug/kg	1
Perfluoro-n-heptanoic acid (PFHpA)	375-85-9	PFAS by ID SOP	0.50	U	0.99	0.50	0.20	ug/kg	1
Perfluoro-n-hexanoic acid (PFHxA)	307-24-4	PFAS by ID SOP	0.50	U	0.99	0.50	0.20	ug/kg	1
Perfluoro-n-nonanoic acid (PFNA)	375-95-1	PFAS by ID SOP	0.50	U	0.99	0.50	0.20	ug/kg	1
Perfluoro-n-octanoic acid (PFOA)	335-67-1	PFAS by ID SOP	0.50	U	0.99	0.50	0.20	ug/kg	1
Perfluoro-n-pentanoic acid (PFPeA)	2706-90-3	PFAS by ID SOP	0.50	U	0.99	0.50	0.20	ug/kg	1
Perfluoro-n-tetradecanoic acid (PFTeDA)	376-06-7	PFAS by ID SOP	0.50	U	0.99	0.50	0.20	ug/kg	1
Perfluoro-n-tridecanoic acid (PFTrDA)	72629-94-8	PFAS by ID SOP	0.50	U	0.99	0.50	0.20	ug/kg	1
Perfluoro-n-undecanoic acid (PFUdA)	2058-94-8	PFAS by ID SOP	0.50	U	0.99	0.50	0.20	ug/kg	1
Perfluorooctanesulfonic acid (PFOS)	**1763-23-1**	**PFAS by ID SOP**	**130**		**0.99**	0.50	**0.20**	**ug/kg**	**1**

Surrogate	Q	Run 1 % Recovery	Acceptance Limits	Q	Run 2 % Recovery	Acceptance Limits
13C2_4:2FTS		96	50-150		90	50-150
13C2_6:2FTS		103	50-150		89	50-150
13C2_8:2FTS		88	50-150		119	50-150
13C2_PFDoA		103	50-150		86	50-150
13C2_PFTeDA		93	50-150		92	50-150
13C3_PFBS		82	50-150		86	50-150
13C3_PFHxS		90	50-150		89	50-150
13C4_PFBA		93	50-150		91	50-150
13C4_PFHpA		96	50-150		90	50-150
13C5_PFHxA		93	50-150		92	50-150
13C5_PFPeA		93	50-150		91	50-150
13C6_PFDA		94	50-150		89	50-150
13C7_PFUdA		94	50-150		83	50-150
13C8_PFOA		92	50-150		94	50-150
13C8_PFOS		90	50-150		78	50-150
13C8_PFOSA		95	50-150		91	50-150

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

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PFAS by LC/MS/MS

Client: **Arcadis U.S., Inc.**
Description: **R4-HSDIH505ILIM**
Date Sampled: **12/29/2020**
Date Received: **01/20/2021**

Laboratory ID: **WA20017-001**
Matrix: **Solid**
% Solids: **93.9** **01/20/2021 2342**

Surrogate	Q	Run 1 % Recovery	Acceptance Limits	Q	Run 2 % Recovery	Acceptance Limits
13C9_PFNA		95	50-150		90	50-150
d5-EtFOSAA		92	50-150		87	50-150
d-MeFOSA		92	50-150		89	50-150
d3-MeFOSAA		94	50-150		94	50-150

LOQ = Limit of Quantitation	B = Detected in the method blank	E = Quantitation of compound exceeded the calibration range	DL = Detection Limit	Q = Surrogate failure
U = Not detected at or above the LOQ	N = Recovery is out of criteria	P = The RPD between two GC columns exceeds 40%	J = Estimated result < LOQ and ≥ DL	L = LCS/LCSD failure
H = Out of holding time	W = Reported on wet weight basis	LOD = Limit of Detection		S = MS/MSD failure

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SPLP PFAS (Australian)

Client: **Arcadis U.S., Inc.**
Laboratory ID: **WA20017-001**
Description: **R4-HSDIH505ILIM**
Matrix: **Solid**
Date Sampled: **12/29/2020**
% Solids: **93.9** **01/20/2021 2342**
Date Received: **01/20/2021**

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch	Leachate Date
1	AS4439.3/PF	PFAS by ID SOP QSM B-15	1	01/25/2021 1929	MMM	01/22/2021 1119	80339	01/20/2021 2300

Parameter	CAS Number	Analytical Method	Result	Q	LOQ	LOD	DL	Units	Run
1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS)	39108-34-4	PFAS by ID SOP	40	UH	80	40	20	ng/L	1
1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS)	**27619-97-2**	**PFAS by ID SOP**	**92**	**H**	**80**	40	**20**	**ng/L**	**1**
1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS)	757124-72-4	PFAS by ID SOP	40	UH	80	40	20	ng/L	1
N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA)	2991-50-6	PFAS by ID SOP	40	UH	80	40	20	ng/L	1
N-methylperfluoro-1-octanesulfonamide (MeFOSA)	31506-32-8	PFAS by ID SOP	80	UH	160	80	40	ng/L	1
N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA)	2355-31-9	PFAS by ID SOP	40	UH	80	40	20	ng/L	1
Perfluoro-1-butanesulfonic acid (PFBS)	375-73-5	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-1-decanesulfonic acid (PFDS)	335-77-3	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-1-heptanesulfonic acid (PFHpS)	375-92-8	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-1-nonanesulfonic acid (PFNS)	68259-12-1	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-1-octanesulfonamide (PFOSA)	754-91-6	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-1-pentanesulfonic acid (PFPeS)	2706-91-4	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluorohexanesulfonic acid (PFHxS)	355-46-4	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-butanoic acid (PFBA)	375-22-4	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-decanoic acid (PFDA)	335-76-2	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-dodecanoic acid (PFDoA)	307-55-1	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-heptanoic acid (PFHpA)	375-85-9	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-hexanoic acid (PFHxA)	307-24-4	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-nonanoic acid (PFNA)	375-95-1	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-octanoic acid (PFOA)	335-67-1	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-pentanoic acid (PFPeA)	2706-90-3	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-tetradecanoic acid (PFTeDA)	376-06-7	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-tridecanoic acid (PFTrDA)	72629-94-8	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-undecanoic acid (PFUdA)	2058-94-8	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluorooctanesulfonic acid (PFOS)	**1763-23-1**	**PFAS by ID SOP**	**82**	**H**	**40**	20	**10**	**ng/L**	**1**

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
13C2_4:2FTS	H	103	50-150
13C2_6:2FTS	H	108	50-150
13C2_8:2FTS	H	99	50-150
13C2_PFDoA	H	94	50-150
13C2_PFTeDA	H	85	50-150
13C3_PFBS	H	91	50-150
13C3_PFHxS	H	92	50-150
13C4_PFBA	H	101	50-150
13C4_PFHpA	H	96	50-150
13C5_PFHxA	H	100	50-150
13C5_PFPeA	H	101	50-150
13C6_PFDA	H	93	50-150
13C7_PFUdA	H	93	50-150
13C8_PFOA	H	98	50-150
13C8_PFOS	H	92	50-150
13C8_PFOSA	H	95	50-150
13C9_PFNA	H	93	50-150

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

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SPLP PFAS (Australian)

Client: **Arcadis U.S., Inc.**
Laboratory ID: **WA20017-001**
Description: **R4-HSDIH505ILIM**
Matrix: **Solid**
Date Sampled: **12/29/2020**
% Solids: **93.9** **01/20/2021 2342**
Date Received: **01/20/2021**

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
d5-EtFOSAA	H	88	50-150
d-MeFOSA	H	73	50-150
d3-MeFOSAA	H	95	50-150

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

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PFAS by LC/MS/MS

Client: **Arcadis U.S., Inc.** Laboratory ID: **WA20017-002**

Description: **S-HSDIH505ILM** Matrix: **Solid**

Date Sampled: **12/29/2020** % Solids: **79.5** **01/20/2021 2342**

Date Received: **01/20/2021**

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch
1	SOP SPE	PFAS by ID SOP QSM B-15	1	01/25/2021 1338	MMM	01/22/2021 1136	80346
2	SOP SPE	PFAS by ID SOP QSM B-15	1	01/26/2021 1059	MMM	01/22/2021 1136	80346

Parameter	CAS Number	Analytical Method	Result	Q	LOQ	LOD	DL	Units	Run
1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS)	**39108-34-4**	**PFAS by ID SOP**	**1.3**	**J**	**2.2**	1.1	**0.54**	**ug/kg**	**1**
1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS)	27619-97-2	PFAS by ID SOP	1.1	U	2.2	1.1	0.54	ug/kg	1
1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS)	757124-72-4	PFAS by ID SOP	1.1	U	2.2	1.1	0.54	ug/kg	1
N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA)	2991-50-6	PFAS by ID SOP	1.1	U	2.2	1.1	0.54	ug/kg	1
N-methylperfluoro-1-octanesulfonamide (MeFOSA)	31506-32-8	PFAS by ID SOP	1.1	U	2.2	1.1	0.54	ug/kg	2
N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA)	2355-31-9	PFAS by ID SOP	1.1	U	2.2	1.1	0.54	ug/kg	1
Perfluoro-1-butanesulfonic acid (PFBS)	375-73-5	PFAS by ID SOP	0.55	U	1.1	0.55	0.22	ug/kg	1
Perfluoro-1-decanesulfonic acid (PFDS)	**335-77-3**	**PFAS by ID SOP**	**0.50**	**J**	**1.1**	0.55	**0.22**	**ug/kg**	**1**
Perfluoro-1-heptanesulfonic acid (PFHpS)	375-92-8	PFAS by ID SOP	0.55	U	1.1	0.55	0.22	ug/kg	1
Perfluoro-1-nonanesulfonic acid (PFNS)	68259-12-1	PFAS by ID SOP	0.55	U	1.1	0.55	0.22	ug/kg	1
Perfluoro-1-octanesulfonamide (PFOSA)	**754-91-6**	**PFAS by ID SOP**	**0.53**	**J**	**1.1**	0.55	**0.22**	**ug/kg**	**1**
Perfluoro-1-pentanesulfonic acid (PFPeS)	2706-91-4	PFAS by ID SOP	0.55	U	1.1	0.55	0.22	ug/kg	1
Perfluorohexanesulfonic acid (PFHxS)	355-46-4	PFAS by ID SOP	0.55	U	1.1	0.55	0.22	ug/kg	1
Perfluoro-n-butanoic acid (PFBA)	375-22-4	PFAS by ID SOP	0.55	U	1.1	0.55	0.22	ug/kg	1
Perfluoro-n-decanoic acid (PFDA)	335-76-2	PFAS by ID SOP	0.55	U	1.1	0.55	0.22	ug/kg	1
Perfluoro-n-dodecanoic acid (PFDoA)	307-55-1	PFAS by ID SOP	0.55	U	1.1	0.55	0.22	ug/kg	1
Perfluoro-n-heptanoic acid (PFHpA)	375-85-9	PFAS by ID SOP	0.55	U	1.1	0.55	0.22	ug/kg	1
Perfluoro-n-hexanoic acid (PFHxA)	307-24-4	PFAS by ID SOP	0.55	U	1.1	0.55	0.22	ug/kg	1
Perfluoro-n-nonanoic acid (PFNA)	375-95-1	PFAS by ID SOP	0.55	U	1.1	0.55	0.22	ug/kg	1
Perfluoro-n-octanoic acid (PFOA)	335-67-1	PFAS by ID SOP	0.55	U	1.1	0.55	0.22	ug/kg	1
Perfluoro-n-pentanoic acid (PFPeA)	2706-90-3	PFAS by ID SOP	0.55	U	1.1	0.55	0.22	ug/kg	1
Perfluoro-n-tetradecanoic acid (PFTeDA)	376-06-7	PFAS by ID SOP	0.55	U	1.1	0.55	0.22	ug/kg	1
Perfluoro-n-tridecanoic acid (PFTrDA)	72629-94-8	PFAS by ID SOP	0.55	U	1.1	0.55	0.22	ug/kg	1
Perfluoro-n-undecanoic acid (PFUdA)	2058-94-8	PFAS by ID SOP	0.55	U	1.1	0.55	0.22	ug/kg	1
Perfluorooctanesulfonic acid (PFOS)	**1763-23-1**	**PFAS by ID SOP**	**46**		**1.1**	0.55	**0.22**	**ug/kg**	**1**

Surrogate	Run 1 Q	Run 1 % Recovery	Run 1 Acceptance Limits	Run 2 Q	Run 2 % Recovery	Run 2 Acceptance Limits
13C2_4:2FTS		86	50-150		76	50-150
13C2_6:2FTS		92	50-150		77	50-150
13C2_8:2FTS		81	50-150		101	50-150
13C2_PFDoA		93	50-150		82	50-150
13C2_PFTeDA		86	50-150		87	50-150
13C3_PFBS		79	50-150		84	50-150
13C3_PFHxS		84	50-150		81	50-150
13C4_PFBA		88	50-150		87	50-150
13C4_PFHpA		90	50-150		80	50-150
13C5_PFHxA		90	50-150		78	50-150
13C5_PFPeA		89	50-150		81	50-150
13C6_PFDA		86	50-150		87	50-150
13C7_PFUdA		91	50-150		66	50-150
13C8_PFOA		89	50-150		89	50-150
13C8_PFOS		87	50-150		85	50-150
13C8_PFOSA		87	50-150		82	50-150

LOQ = Limit of Quantitation
B = Detected in the method blank
E = Quantitation of compound exceeded the calibration range
DL = Detection Limit
Q = Surrogate failure
U = Not detected at or above the LOQ
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
J = Estimated result < LOQ and ≥ DL
L = LCS/LCSD failure
H = Out of holding time
W = Reported on wet weight basis
LOD = Limit of Detection
S = MS/MSD failure

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PFAS by LC/MS/MS

Client: **Arcadis U.S., Inc.**
Laboratory ID: **WA20017-002**
Description: **S-HSDIH505ILM**
Matrix: **Solid**
Date Sampled: **12/29/2020**
% Solids: **79.5** **01/20/2021 2342**
Date Received: **01/20/2021**

Surrogate	Q	Run 1 % Recovery	Acceptance Limits	Q	Run 2 % Recovery	Acceptance Limits
13C9_PFNA		91	50-150		91	50-150
d5-EtFOSAA		92	50-150		85	50-150
d-MeFOSA		80	50-150		91	50-150
d3-MeFOSAA		88	50-150		93	50-150

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

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SPLP PFAS (Australian)

Client: **Arcadis U.S., Inc.** Laboratory ID: **WA20017-002**

Description: **S-HSDIH505ILM** Matrix: **Solid**

Date Sampled: **12/29/2020** % Solids: **79.5** **01/20/2021 2342**

Date Received: **01/20/2021**

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch	Leachate Date
1	AS4439.3/PF	PFAS by ID SOP QSM B-15	1	01/25/2021 1940	MMM	01/22/2021 1119	80339	01/20/2021 2300

Parameter	CAS Number	Analytical Method	Result	Q	LOQ	LOD	DL	Units	Run
1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS)	39108-34-4	PFAS by ID SOP	40	UH	80	40	20	ng/L	1
1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS)	**27619-97-2**	**PFAS by ID SOP**	**180**	**H**	**80**	40	**20**	**ng/L**	**1**
1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS)	757124-72-4	PFAS by ID SOP	40	UH	80	40	20	ng/L	1
N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA)	2991-50-6	PFAS by ID SOP	40	UH	80	40	20	ng/L	1
N-methylperfluoro-1-octanesulfonamide (MeFOSA)	31506-32-8	PFAS by ID SOP	80	UH	160	80	40	ng/L	1
N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA)	2355-31-9	PFAS by ID SOP	40	UH	80	40	20	ng/L	1
Perfluoro-1-butanesulfonic acid (PFBS)	375-73-5	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-1-decanesulfonic acid (PFDS)	335-77-3	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-1-heptanesulfonic acid (PFHpS)	375-92-8	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-1-nonanesulfonic acid (PFNS)	68259-12-1	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-1-octanesulfonamide (PFOSA)	754-91-6	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-1-pentanesulfonic acid (PFPeS)	2706-91-4	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluorohexanesulfonic acid (PFHxS)	355-46-4	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-butanoic acid (PFBA)	375-22-4	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-decanoic acid (PFDA)	335-76-2	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-dodecanoic acid (PFDoA)	307-55-1	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-heptanoic acid (PFHpA)	375-85-9	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-hexanoic acid (PFHxA)	307-24-4	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-nonanoic acid (PFNA)	375-95-1	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-octanoic acid (PFOA)	335-67-1	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-pentanoic acid (PFPeA)	2706-90-3	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-tetradecanoic acid (PFTeDA)	376-06-7	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-tridecanoic acid (PFTrDA)	72629-94-8	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-undecanoic acid (PFUdA)	2058-94-8	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluorooctanesulfonic acid (PFOS)	**1763-23-1**	**PFAS by ID SOP**	**75**	**H**	**40**	20	**10**	**ng/L**	**1**

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
13C2_4:2FTS	H	95	50-150
13C2_6:2FTS	H	96	50-150
13C2_8:2FTS	H	91	50-150
13C2_PFDoA	H	89	50-150
13C2_PFTeDA	H	84	50-150
13C3_PFBS	H	90	50-150
13C3_PFHxS	H	89	50-150
13C4_PFBA	H	97	50-150
13C4_PFHpA	H	88	50-150
13C5_PFHxA	H	96	50-150
13C5_PFPeA	H	96	50-150
13C6_PFDA	H	89	50-150
13C7_PFUdA	H	89	50-150
13C8_PFOA	H	94	50-150
13C8_PFOS	H	87	50-150
13C8_PFOSA	H	92	50-150
13C9_PFNA	H	92	50-150

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

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SPLP PFAS (Australian)

Client: **Arcadis U.S., Inc.**
Laboratory ID: **WA20017-002**
Description: **S-HSDIH505ILM**
Matrix: **Solid**
Date Sampled: **12/29/2020**
% Solids: **79.5** **01/20/2021 2342**
Date Received: **01/20/2021**

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
d5-EtFOSAA	H	89	50-150
d-MeFOSA	H	76	50-150
d3-MeFOSAA	H	89	50-150

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

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QC Summary

SPLP PFAS (Australian) - MB

Sample ID: WQ80339-001
Batch: 80339
Analytical Method: PFAS by ID SOP QSM B-15
Matrix: Solid
Prep Method: AS4439.3/PFAS
Prep Date: 01/22/2021 1119 **Leachate Date:** 01/20/2021 2300

Parameter	Result	Q	Dil	LOQ	LOD	DL	Units	Analysis Date
8:2 FTS	40	U	1	80	40	20	ng/L	01/25/2021 1524
6:2 FTS	40	U	1	80	40	20	ng/L	01/25/2021 1524
4:2 FTS	40	U	1	80	40	20	ng/L	01/25/2021 1524
EtFOSAA	40	U	1	80	40	20	ng/L	01/25/2021 1524
MeFOSA	80	U	1	160	80	40	ng/L	01/25/2021 1524
MeFOSAA	40	U	1	80	40	20	ng/L	01/25/2021 1524
PFBS	20	U	1	40	20	10	ng/L	01/25/2021 1524
PFDS	20	U	1	40	20	10	ng/L	01/25/2021 1524
PFHpS	20	U	1	40	20	10	ng/L	01/25/2021 1524
PFNS	20	U	1	40	20	10	ng/L	01/25/2021 1524
PFOSA	20	U	1	40	20	10	ng/L	01/25/2021 1524
PFPeS	20	U	1	40	20	10	ng/L	01/25/2021 1524
PFHxS	20	U	1	40	20	10	ng/L	01/25/2021 1524
PFBA	20	U	1	40	20	10	ng/L	01/25/2021 1524
PFDA	20	U	1	40	20	10	ng/L	01/25/2021 1524
PFDoA	20	U	1	40	20	10	ng/L	01/25/2021 1524
PFHpA	20	U	1	40	20	10	ng/L	01/25/2021 1524
PFHxA	20	U	1	40	20	10	ng/L	01/25/2021 1524
PFNA	20	U	1	40	20	10	ng/L	01/25/2021 1524
PFOA	20	U	1	40	20	10	ng/L	01/25/2021 1524
PFPeA	20	U	1	40	20	10	ng/L	01/25/2021 1524
PFTeDA	20	U	1	40	20	10	ng/L	01/25/2021 1524
PFTrDA	20	U	1	40	20	10	ng/L	01/25/2021 1524
PFUdA	20	U	1	40	20	10	ng/L	01/25/2021 1524
PFOS	20	U	1	40	20	10	ng/L	01/25/2021 1524

Surrogate	Q	% Rec	Acceptance Limit
13C2_4:2FTS		104	50-150
13C2_6:2FTS		109	50-150
13C2_8:2FTS		97	50-150
13C2_PFDoA		108	50-150
13C2_PFTeDA		93	50-150
13C3_PFBS		99	50-150
13C3_PFHxS		97	50-150
13C4_PFBA		109	50-150
13C4_PFHpA		105	50-150
13C5_PFHxA		104	50-150
13C5_PFPeA		106	50-150
13C6_PFDA		102	50-150
13C7_PFUdA		98	50-150
13C8_PFOA		108	50-150

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection
U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

SPLP PFAS (Australian) - MB

Sample ID: WQ80339-001
Batch: 80339
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Solid
Prep Method: AS4439.3/PFAS
Prep Date: 01/22/2021 1119 **Leachate Date:** 01/20/2021 2300

Surrogate	Q	% Rec	Acceptance Limit
13C8_PFOS		95	50-150
13C8_PFOSA		104	50-150
13C9_PFNA		106	50-150
d5-EtFOSAA		97	50-150
d-MeFOSA		102	50-150
d3-MeFOSAA		106	50-150

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

SPLP PFAS (Australian) - LCS

Sample ID: WQ80339-002 **Matrix:** Solid
Batch: 80339 **Prep Method:** AS4439.3/PFAS
Analytical Method: PFAS by ID SOP QSM B-15 **Prep Date:** 01/22/2021 1119 **Leachate Date:** 01/20/2021 2300

Parameter	Spike Amount (ng/L)	Result (ng/L)	Q	Dil	% Rec	% Rec Limit	Analysis Date
8:2 FTS	150	190		1	124	67-138	01/25/2021 1545
6:2 FTS	150	180		1	117	64-140	01/25/2021 1545
4:2 FTS	150	160		1	109	63-143	01/25/2021 1545
EtFOSAA	160	180		1	111	61-135	01/25/2021 1545
MeFOSA	160	210		1	130	68-141	01/25/2021 1545
MeFOSAA	160	180		1	113	65-136	01/25/2021 1545
PFBS	140	150		1	108	72-130	01/25/2021 1545
PFDS	150	150		1	96	53-142	01/25/2021 1545
PFHpS	150	150		1	99	69-134	01/25/2021 1545
PFNS	150	170		1	110	69-127	01/25/2021 1545
PFOSA	160	180		1	115	67-137	01/25/2021 1545
PFPeS	150	160		1	106	71-127	01/25/2021 1545
PFHxS	150	170		1	116	68-131	01/25/2021 1545
PFBA	160	170		1	107	73-129	01/25/2021 1545
PFDA	160	170		1	105	71-129	01/25/2021 1545
PFDoA	160	190		1	117	72-134	01/25/2021 1545
PFHpA	160	170		1	105	72-130	01/25/2021 1545
PFHxA	160	180		1	114	72-129	01/25/2021 1545
PFNA	160	160		1	102	69-130	01/25/2021 1545
PFOA	160	170		1	107	71-133	01/25/2021 1545
PFPeA	160	170		1	108	72-129	01/25/2021 1545
PFTeDA	160	180		1	111	71-132	01/25/2021 1545
PFTrDA	160	180		1	112	65-144	01/25/2021 1545
PFUdA	160	170		1	108	69-133	01/25/2021 1545
PFOS	150	170		1	112	65-140	01/25/2021 1545

Surrogate	Q	% Rec	Acceptance Limit
13C2_4:2FTS		100	50-150
13C2_6:2FTS		95	50-150
13C2_8:2FTS		79	50-150
13C2_PFDoA		93	50-150
13C2_PFTeDA		87	50-150
13C3_PFBS		89	50-150
13C3_PFHxS		92	50-150
13C4_PFBA		97	50-150
13C4_PFHpA		95	50-150
13C5_PFHxA		92	50-150
13C5_PFPeA		94	50-150
13C6_PFDA		87	50-150
13C7_PFUdA		90	50-150
13C8_PFOA		93	50-150

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection
U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

SPLP PFAS (Australian) - LCS

Sample ID: WQ80339-002
Batch: 80339
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Solid
Prep Method: AS4439.3/PFAS
Prep Date: 01/22/2021 1119 **Leachate Date:** 01/20/2021 2300

Surrogate	Q	% Rec	Acceptance Limit
13C8_PFOS		90	50-150
13C8_PFOSA		95	50-150
13C9_PFNA		95	50-150
d5-EtFOSAA		84	50-150
d-MeFOSA		65	50-150
d3-MeFOSAA		89	50-150

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

PFAS by LC/MS/MS - MB

Sample ID: WQ80346-001
Batch: 80346
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Solid
Prep Method: SOP SPE
Prep Date: 01/22/2021 1136

Parameter	Result	Q	Dil	LOQ	LOD	DL	Units	Analysis Date
8:2 FTS	1.0	U	1	2.0	1.0	0.50	ug/kg	01/25/2021 1245
6:2 FTS	1.0	U	1	2.0	1.0	0.50	ug/kg	01/25/2021 1245
4:2 FTS	1.0	U	1	2.0	1.0	0.50	ug/kg	01/25/2021 1245
EtFOSAA	1.0	U	1	2.0	1.0	0.50	ug/kg	01/25/2021 1245
MeFOSA	1.0	U	1	2.0	1.0	0.50	ug/kg	01/25/2021 1245
MeFOSAA	1.0	U	1	2.0	1.0	0.50	ug/kg	01/25/2021 1245
PFBS	0.50	U	1	1.0	0.50	0.20	ug/kg	01/25/2021 1245
PFDS	0.50	U	1	1.0	0.50	0.20	ug/kg	01/25/2021 1245
PFHpS	0.50	U	1	1.0	0.50	0.20	ug/kg	01/25/2021 1245
PFNS	0.50	U	1	1.0	0.50	0.20	ug/kg	01/25/2021 1245
PFOSA	0.50	U	1	1.0	0.50	0.20	ug/kg	01/25/2021 1245
PFPeS	0.50	U	1	1.0	0.50	0.20	ug/kg	01/25/2021 1245
PFHxS	0.50	U	1	1.0	0.50	0.20	ug/kg	01/25/2021 1245
PFBA	0.50	U	1	1.0	0.50	0.20	ug/kg	01/25/2021 1245
PFDA	0.50	U	1	1.0	0.50	0.20	ug/kg	01/25/2021 1245
PFDoA	0.50	U	1	1.0	0.50	0.20	ug/kg	01/25/2021 1245
PFHpA	0.50	U	1	1.0	0.50	0.20	ug/kg	01/25/2021 1245
PFHxA	0.50	U	1	1.0	0.50	0.20	ug/kg	01/25/2021 1245
PFNA	0.50	U	1	1.0	0.50	0.20	ug/kg	01/25/2021 1245
PFOA	0.50	U	1	1.0	0.50	0.20	ug/kg	01/25/2021 1245
PFPeA	0.50	U	1	1.0	0.50	0.20	ug/kg	01/25/2021 1245
PFTeDA	0.50	U	1	1.0	0.50	0.20	ug/kg	01/25/2021 1245
PFTrDA	0.50	U	1	1.0	0.50	0.20	ug/kg	01/25/2021 1245
PFUdA	0.50	U	1	1.0	0.50	0.20	ug/kg	01/25/2021 1245
PFOS	0.50	U	1	1.0	0.50	0.20	ug/kg	01/25/2021 1245

Surrogate	Q	% Rec	Acceptance Limit
13C2_4:2FTS		98	50-150
13C2_6:2FTS		99	50-150
13C2_8:2FTS		98	50-150
13C2_PFDoA		102	50-150
13C2_PFTeDA		96	50-150
13C3_PFBS		85	50-150
13C3_PFHxS		91	50-150
13C4_PFBA		94	50-150
13C4_PFHpA		94	50-150
13C5_PFHxA		95	50-150
13C5_PFPeA		96	50-150
13C6_PFDA		93	50-150
13C7_PFUdA		94	50-150
13C8_PFOA		91	50-150

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

PFAS by LC/MS/MS - MB

Sample ID: WQ80346-001
Batch: 80346
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Solid
Prep Method: SOP SPE
Prep Date: 01/22/2021 1136

Surrogate	Q	% Rec	Acceptance Limit
13C8_PFOS		95	50-150
13C8_PFOSA		89	50-150
13C9_PFNA		98	50-150
d5-EtFOSAA		93	50-150
d-MeFOSA		100	50-150
d3-MeFOSAA		95	50-150

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

PFAS by LC/MS/MS - LCS

Sample ID: WQ80346-002
Batch: 80346
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Solid
Prep Method: SOP SPE
Prep Date: 01/22/2021 1136

Parameter	Spike Amount (ug/kg)	Result (ug/kg)	Q	Dil	% Rec	% Rec Limit	Analysis Date
8:2 FTS	1.9	2.6		1	136	65-137	01/25/2021 1255
6:2 FTS	1.9	2.3		1	122	64-140	01/25/2021 1255
4:2 FTS	1.9	1.8		1	96	62-145	01/25/2021 1255
EtFOSAA	2.0	1.9		1	97	61-139	01/25/2021 1255
MeFOSA	2.0	1.7		1	83	70-150	01/25/2021 1255
MeFOSAA	2.0	2.4		1	119	63-144	01/25/2021 1255
PFBS	1.8	1.9		1	110	72-128	01/25/2021 1255
PFDS	1.9	2.0		1	102	59-134	01/25/2021 1255
PFHpS	1.9	2.1		1	112	70-132	01/25/2021 1255
PFNS	1.9	1.8		1	93	69-125	01/25/2021 1255
PFOSA	2.0	2.3		1	116	67-137	01/25/2021 1255
PFPeS	1.9	1.9		1	102	73-123	01/25/2021 1255
PFHxS	1.8	1.8		1	97	67-130	01/25/2021 1255
PFBA	2.0	2.2		1	108	71-135	01/25/2021 1255
PFDA	2.0	2.2		1	108	69-133	01/25/2021 1255
PFDoA	2.0	2.1		1	105	69-135	01/25/2021 1255
PFHpA	2.0	2.4		1	118	71-131	01/25/2021 1255
PFHxA	2.0	2.3		1	115	70-132	01/25/2021 1255
PFNA	2.0	2.0		1	100	72-129	01/25/2021 1255
PFOA	2.0	2.2		1	110	69-133	01/25/2021 1255
PFPeA	2.0	2.2		1	108	69-132	01/25/2021 1255
PFTeDA	2.0	2.3		1	116	69-133	01/25/2021 1255
PFTrDA	2.0	2.2		1	111	66-139	01/25/2021 1255
PFUdA	2.0	2.4		1	120	64-136	01/25/2021 1255
PFOS	1.9	2.0		1	105	68-136	01/25/2021 1255

Surrogate	Q	% Rec	Acceptance Limit
13C2_4:2FTS		103	50-150
13C2_6:2FTS		102	50-150
13C2_8:2FTS		91	50-150
13C2_PFDoA		105	50-150
13C2_PFTeDA		93	50-150
13C3_PFBS		89	50-150
13C3_PFHxS		99	50-150
13C4_PFBA		97	50-150
13C4_PFHpA		98	50-150
13C5_PFHxA		97	50-150
13C5_PFPeA		97	50-150
13C6_PFDA		98	50-150
13C7_PFUdA		97	50-150
13C8_PFOA		100	50-150

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

PFAS by LC/MS/MS - LCS

Sample ID: WQ80346-002
Batch: 80346
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Solid
Prep Method: SOP SPE
Prep Date: 01/22/2021 1136

Surrogate	Q	% Rec	Acceptance Limit
13C8_PFOS		100	50-150
13C8_PFOSA		93	50-150
13C9_PFNA		102	50-150
d5-EtFOSAA		101	50-150
d-MeFOSA		92	50-150
d3-MeFOSAA		102	50-150

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

Chain of Custody
and
Miscellaneous Documents

Shealy Environmental Services, Inc.
106 Vantage Point Drive
West Columbia, South Carolina 29172
Telephone No. (803) 791-9700 Fax No. (803) 791-9111
www.shealylab.com

Chain of Custody Record

Number

Client	Report to Contact	Telephone No. / E-mail	Quote No.
Arcadis	Colin Morrell	902.209.3476 / colin@clearearthtechnologies.ca	Mike McFadden

Address	Sampler's Signature	Analysis (Attach list if more space is needed)	Page
	X	PFAS DoD QSM 5.3 ELAP Table B-15	1 of 1

City	State	Zip Code	Printed Name

Project Name:

Project Number	P.O. No.
1000-EI	

WA20017 MKV

WA20016 MKV

Sample ID / Description (Containers for each sample may be combined on one line)	Date	Time	C-Grab C-Composite	Matrix: Aqueous	Matrix: Solid	Matrix: Non-Aqueous	No of Containers by Preservative Type: Unpres.	H2SO4	HNO3	HCl	NaOH	5035 Kit	DoD Comp 457 Table B-15	ASLP	Remarks / Cooler ID
R4-HSDIHILIM	Dec 29/20		C		x								x	x	PFAS
R4-HSDIH505ILIM	Dec 29/20		C		x								x	x	PFAS
R4-SDSDICILIM	Dec 29/20		C		x								x	x	PFAS
S-HSDIHILIM	Dec 29/20		C		x								x	x	PFAS
S-SDSDICILIM	Dec 29/20		C		x								x	x	PFAS
S-HSDIH505ILM	Dec 29/20		C		x								x	x	PFAS
F-HSDIH505I_IM	Dec 29/20		C		x								x	x	PFAS
S-F1F2 M	Dec 29/20		C		x								x	x	PFAS
	Dec 29/20		C												
	Dec 29/20		C												

Turn Around Time Required (Prior approval required for expedited TAT)	Sample Disposal	Possible Hazard Identification (List any known hazards in the remarks)	QC Requirements
☐ Standard ☒ Rush (Please Specify)	☐ Return to Client ☐ Disposal by Lab	☐ Non-Hazardous ☐ Flammable ☐ Skin Irritant ☐ RCRA pickled ☐ Unknown	

	Date	Time		Date	Time
1. Relinquished by: Colin Morre	Dec 15/21		1. Received by		
2. Relinquished by			2. Received by		
3. Relinquished by			3. Received by		
4. Relinquished by: Fedex	1/20/21	0935	4. Laboratory Received by	1/20/21	0935

Note: All samples are retained for four weeks from receipt unless other arrangements are made.

LAB USE ONLY
Received on Ice (Check) ☒ Y ☐ N ☐ Ice Pack

Receipt Temp. 5.3 °C

Document Number: ME0020W.01

PACE ANALYTICAL SERVICES, LLC

Pace Analytical

Samples Receipt Checklist (SRC) (ME0018C-15)
Issuing Authority: Pace ENV - WCOL

Revised:9/29/2020
Page 1 of 1

Sample Receipt Checklist (SRC)

Client: Arcadis Cooler Inspected by/date: JSH / 01/20/2021 Lot #: WA20016/WA20017

Means of receipt: ☐ Pace ☐ Client ☐ UPS ☑ FedEx ☐ Other: _____

☐ Yes	☑ No		1. Were custody seals present on the cooler?
☐ Yes	☐ No	☑ NA	2. If custody seals were present, were they intact and unbroken?

pH Strip ID: NA Chlorine Strip ID: NA Tested by: NA

Original temperature upon receipt / Derived (Corrected) temperature upon receipt %Solid Snap-Cup ID: 20-875

5.3 / 5.3 °C NA / NA °C NA / NA °C NA / NA °C

Method: ☐ Temperature Blank ☑ Against Bottles IR Gun ID: 5 IR Gun Correction Factor: 0 °C

Method of coolant: ☑ Wet Ice ☐ Ice Packs ☐ Dry Ice ☐ None

☐ Yes	☐ No	☑ NA	3. If temperature of any cooler exceeded 6.0°C, was Project Manager Notified? PM was Notified by: phone / email / face-to-face (circle one).
☑ Yes	☐ No	☐ NA	4. Is the commercial courier's packing slip attached to this form?
☑ Yes	☐ No		5. Were proper custody procedures (relinquished/received) followed?
☑ Yes	☐ No		6. Were sample IDs listed on the COC?
☑ Yes	☐ No		7. Were sample IDs listed on all sample containers?
☐ Yes	☑ No		8. Was collection date & time listed on the COC?
☐ Yes	☑ No		9. Was collection date & time listed on all sample containers?
☐ Yes	☑ No		10. Did all container label information (ID, date, time) agree with the COC?
☑ Yes	☐ No		11. Were tests to be performed listed on the COC?
☑ Yes	☐ No		12. Did all samples arrive in the proper containers for each test and/or in good condition (unbroken, lids on, etc.)?
☑ Yes	☐ No		13. Was adequate sample volume available?
☐ Yes	☑ No		14. Were all samples received within ½ the holding time or 48 hours, whichever comes first?
☐ Yes	☑ No		15. Were any samples containers missing/excess (circle one) samples Not listed on COC?
☐ Yes	☐ No	☑ NA	16. For VOA and RSK-175 samples, were bubbles present >"pea-size" (¼"or 6mm in diameter) in any of the VOA vials?
☐ Yes	☐ No	☑ NA	17. Were all DRO/metals/nutrient samples received at a pH of < 2?
☐ Yes	☐ No	☑ NA	18. Were all cyanide samples received at a pH > 12 and sulfide samples received at a pH > 9?
☐ Yes	☐ No	☑ NA	19. Were all applicable NH_3/TKN/cyanide/phenol/625.1/608.3 (< 0.5mg/L) samples free of residual chlorine?
☐ Yes	☐ No	☑ NA	20. Were client remarks/requests (i.e. requested dilutions, MS/MSD designations, etc…) correctly transcribed from the COC into the comment section in LIMS?
☐ Yes	☑ No		21. Was the quote number listed on the container label? If yes, Quote # _____

Sample Preservation (Must be completed for any sample(s) incorrectly preserved or with headspace.)

Sample(s) NA were received incorrectly preserved and were adjusted accordingly in sample receiving with NA mL of circle one: H_2SO_4, HNO_3, HCl, NaOH using SR # NA.
Time of preservation NA. If more than one preservative is needed, please note in the comments below.

Sample(s) NA were received with bubbles >6 mm in diameter.

Samples(s) NA were received with TRC > 0.5 mg/L (If #19 is ***no***) and were adjusted accordingly in sample receiving with sodium thiosulfate ($Na_2S_2O_3$) with Shealy ID: NA.

SR barcode labels applied by: MEH Date: 01/20/2021

Comments: Dates on containers are Jan 15/20 and Jan 15/21

Report of Analysis

Arcadis U.S., Inc.
630 Plaza Drive
Suite 600
Highlands Ranch, CO 80129
Attention: Colin Morrell

Project Name: Eielson AFB

Project Number: 1000-EI

Lot Number:**WA26010**

Date Completed:02/16/2021

02/17/2021 11:41 AM
Approved and released by:
Project Manager II: **Marcia K. McGinnity**

The electronic signature above is the equivalent of a handwritten signature.
This report shall not be reproduced, except in its entirety, without the written approval of Pace Analytical Services, LLC.

Pace Analytical Services, LLC (*formerly Shealy Environmental Services, Inc.*)
106 Vantage Point Drive West Columbia, SC 29172
Tel: 803-791-9700 Fax: 803-791-9111 www.pacelabs.com

Case Narrative
Arcadis U.S., Inc.
Lot Number: WA26010

This Report of Analysis contains the analytical result(s) for the sample(s) listed on the Sample Summary following this Case Narrative. The sample receiving date is documented in the header information associated with each sample.

All results listed in this report relate only to the samples that are contained within this report.

Sample receipt, sample analysis, and data review have been performed in accordance with the most current approved The NELAC Institute (TNI) standards, the Pace Analytical Services, LLC ("Pace") Laboratory Quality Manual, standard operating procedures (SOPs), and Pace policies. Additionally, the DoD QSM version 5.3 has been followed for these samples, and specifically Table B-15 was followed for all PFAS samples. Any exceptions to the TNI standards, the Laboratory Quality Manual, SOPs, the DoD QSM, or policies are qualified on the results page or discussed below.

Where applicable, all soil sample analysis are reported on a dry weight basis unless flagged with a "W" qualifier

If you have any questions regarding this report please contact the Pace Project Manager listed on the cover page.

PFAS Issues:

Sample WA26010-001 was collected in client provided HDPE bottles. While this is method compliant, the sample bottles were not provided by the laboratory.

Recoveries and/or relative percent differences exceeded limits for many of the analytes in the MS/MSD performed on solid sample WA26010-001. This is suspected to be due to incorrect surrogate spiking but cannot be quantitatively verified. Results are qualified accordingly.

PFAS

Correction factors (CF) are used to calculate the original sample concentration. The CF is the inverse of the concentration factor (sample volume / extract final volume) times the dilution factor (DF). For undiluted analysis, the extract is prepared for injection by adding 182 uL of sample extract + 8 uL of reagent water + 10 uL of internal standard solution to a polypropylene autosampler vial. An extra correction factor of 0.91 (182 uL / 200 uL = 0.91) applies. The CF is calculated as follows:

For solid samples:

CF = DF * FV / Ws/S/1000

FV is volume of extract (mL)
Ws is initial sample weight (gram)
S is %Solids
DF is dilution factor. For undiluted analysis, DF = 1/0.91.

Concentration (ug/kg) = Cs*CF,

$$C_s = \frac{\left(\frac{(A_s x C_{is})}{A_{is}}\right) - B}{M1}$$

Where

C_s is on column concentration of target analyte in the sample (ng/L)
C_{is} is concentration of internal standard in the sample (ng/L)
A_s is peak response of target analyte in the sample
A_{is} is peak response of internal standard in the sample
M1 is the average RF from ICAL or the slope from linear regression ICAL
B is the y-intercept from the ICAL

For aqueous samples:

CF = DF * FV / Vo

FV is volume of extract (mL)
Vo is initial sample volume (mL)
DF is dilution factor.

Concentration (ng/L) = Cs*CF,

$$C_s = \frac{\left(\frac{(A_s x C_{is})}{A_{is}}\right) - B}{M1}$$

Where

C_s is on column concentration of target analyte in the sample (ng/L)
C_{is} is concentration of internal standard in the sample (ng/L)
A_s is peak response of target analyte in the sample
A_{is} is peak response of internal standard in the sample
M1 is the average RF from ICAL or the slope from linear regression ICAL
B is the y-intercept from the ICAL

Dilutions greater than 5X impact the surrogate recoveries, thus negating their usefulness concerning quality control. The sample results are reported and no corrective action is required.

Sample Summary
Arcadis U.S., Inc.
Lot Number: WA26010

Sample Number	Sample ID	Matrix	Date Sampled	Date Received
001	RGS-HSDIH505	Solid	01/22/2021	01/26/2021

(1 sample)

Detection Summary

Arcadis U.S., Inc.

Lot Number: WA26010

Sample	Sample ID	Matrix	Parameter	Method	Result	Q	Units	Page
001	RGS-HSDIH505	Solid	8:2 FTS	PFAS by ID	1.1	JS	ug/kg	5
001	RGS-HSDIH505	Solid	PFNS	PFAS by ID	0.53	JS	ug/kg	5
001	RGS-HSDIH505	Solid	PFOSA	PFAS by ID	0.39	JS	ug/kg	5
001	RGS-HSDIH505	Solid	PFOS	PFAS by ID	12	S	ug/kg	5
001	RGS-HSDIH505	Solid	6:2 FTS	PFAS by ID	53	J	ng/L	7
001	RGS-HSDIH505	Solid	PFOS	PFAS by ID	100		ng/L	7

(6 detections)

PFAS by LC/MS/MS

Client: **Arcadis U.S., Inc.** Laboratory ID: **WA26010-001**

Description: **RGS-HSDIH505** Matrix: **Solid**

Date Sampled: **01/22/2021** % Solids: **99.9** **01/27/2021 0024**

Date Received: **01/26/2021**

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch
1	SOP SPE	PFAS by ID SOP QSM B-15	1	01/30/2021 0818	SES	01/28/2021 1101	81010

Parameter	CAS Number	Analytical Method	Result	Q	LOQ	LOD	DL	Units	Run
1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS)	**39108-34-4**	**PFAS by ID SOP**	**1.1**	**JS**	**1.9**	0.95	**0.46**	**ug/kg**	**1**
1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS)	27619-97-2	PFAS by ID SOP	0.95	US	1.9	0.95	0.46	ug/kg	1
1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS)	757124-72-4	PFAS by ID SOP	0.95	US	1.9	0.95	0.46	ug/kg	1
N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA)	2991-50-6	PFAS by ID SOP	0.95	US	1.9	0.95	0.46	ug/kg	1
N-methylperfluoro-1-octanesulfonamide (MeFOSA)	31506-32-8	PFAS by ID SOP	0.95	US	1.9	0.95	0.46	ug/kg	1
N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA)	2355-31-9	PFAS by ID SOP	0.95	US	1.9	0.95	0.46	ug/kg	1
Perfluoro-1-butanesulfonic acid (PFBS)	375-73-5	PFAS by ID SOP	0.47	US	0.93	0.47	0.19	ug/kg	1
Perfluoro-1-decanesulfonic acid (PFDS)	335-77-3	PFAS by ID SOP	0.47	US	0.93	0.47	0.19	ug/kg	1
Perfluoro-1-heptanesulfonic acid (PFHpS)	375-92-8	PFAS by ID SOP	0.47	US	0.93	0.47	0.19	ug/kg	1
Perfluoro-1-nonanesulfonic acid (PFNS)	**68259-12-1**	**PFAS by ID SOP**	**0.53**	**JS**	**0.93**	0.47	**0.19**	**ug/kg**	**1**
Perfluoro-1-octanesulfonamide (PFOSA)	**754-91-6**	**PFAS by ID SOP**	**0.39**	**JS**	**0.93**	0.47	**0.19**	**ug/kg**	**1**
Perfluoro-1-pentanesulfonic acid (PFPeS)	2706-91-4	PFAS by ID SOP	0.47	US	0.93	0.47	0.19	ug/kg	1
Perfluorohexanesulfonic acid (PFHxS)	355-46-4	PFAS by ID SOP	0.47	US	0.93	0.47	0.19	ug/kg	1
Perfluoro-n-butanoic acid (PFBA)	375-22-4	PFAS by ID SOP	0.47	US	0.93	0.47	0.19	ug/kg	1
Perfluoro-n-decanoic acid (PFDA)	335-76-2	PFAS by ID SOP	0.47	US	0.93	0.47	0.19	ug/kg	1
Perfluoro-n-dodecanoic acid (PFDoA)	307-55-1	PFAS by ID SOP	0.47	US	0.93	0.47	0.19	ug/kg	1
Perfluoro-n-heptanoic acid (PFHpA)	375-85-9	PFAS by ID SOP	0.47	US	0.93	0.47	0.19	ug/kg	1
Perfluoro-n-hexanoic acid (PFHxA)	307-24-4	PFAS by ID SOP	0.47	US	0.93	0.47	0.19	ug/kg	1
Perfluoro-n-nonanoic acid (PFNA)	375-95-1	PFAS by ID SOP	0.47	US	0.93	0.47	0.19	ug/kg	1
Perfluoro-n-octanoic acid (PFOA)	335-67-1	PFAS by ID SOP	0.47	US	0.93	0.47	0.19	ug/kg	1
Perfluoro-n-pentanoic acid (PFPeA)	2706-90-3	PFAS by ID SOP	0.47	US	0.93	0.47	0.19	ug/kg	1
Perfluoro-n-tetradecanoic acid (PFTeDA)	376-06-7	PFAS by ID SOP	0.47	US	0.93	0.47	0.19	ug/kg	1
Perfluoro-n-tridecanoic acid (PFTrDA)	72629-94-8	PFAS by ID SOP	0.47	US	0.93	0.47	0.19	ug/kg	1
Perfluoro-n-undecanoic acid (PFUdA)	2058-94-8	PFAS by ID SOP	0.47	US	0.93	0.47	0.19	ug/kg	1
Perfluorooctanesulfonic acid (PFOS)	**1763-23-1**	**PFAS by ID SOP**	**12**	**S**	**0.93**	0.47	**0.19**	**ug/kg**	**1**

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
13C2_4:2FTS		90	50-150
13C2_6:2FTS		89	50-150
13C2_8:2FTS		89	50-150
13C2_PFDoA		89	50-150
13C2_PFTeDA		93	50-150
13C3_PFBS		80	50-150
13C3_PFHxS		89	50-150
13C4_PFBA		87	50-150
13C4_PFHpA		88	50-150
13C5_PFHxA		90	50-150
13C5_PFPeA		87	50-150
13C6_PFDA		86	50-150
13C7_PFUdA		87	50-150
13C8_PFOA		88	50-150
13C8_PFOS		82	50-150
13C8_PFOSA		82	50-150
13C9_PFNA		86	50-150

LOQ = Limit of Quantitation
B = Detected in the method blank
E = Quantitation of compound exceeded the calibration range
DL = Detection Limit
Q = Surrogate failure
U = Not detected at or above the LOQ
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
J = Estimated result < LOQ and ≥ DL
L = LCS/LCSD failure
H = Out of holding time
W = Reported on wet weight basis
LOD = Limit of Detection
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

PFAS by LC/MS/MS

Client: **Arcadis U.S., Inc.**
Laboratory ID: **WA26010-001**
Description: **RGS-HSDIH505**
Matrix: **Solid**
Date Sampled: **01/22/2021**
% Solids: **99.9** **01/27/2021 0024**
Date Received: **01/26/2021**

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
d5-EtFOSAA		86	50-150
d-MeFOSA		86	50-150
d3-MeFOSAA		97	50-150

LOQ = Limit of Quantitation	B = Detected in the method blank	E = Quantitation of compound exceeded the calibration range	DL = Detection Limit	Q = Surrogate failure
U = Not detected at or above the LOQ	N = Recovery is out of criteria	P = The RPD between two GC columns exceeds 40%	J = Estimated result < LOQ and ≥ DL	L = LCS/LCSD failure
H = Out of holding time	W = Reported on wet weight basis	LOD = Limit of Detection		S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

SPLP PFAS (Australian)

Client: **Arcadis U.S., Inc.** Laboratory ID: **WA26010-001**

Description: **RGS-HSDIH505** Matrix: **Solid**

Date Sampled: **01/22/2021** % Solids: **99.9** **01/27/2021 0024**

Date Received: **01/26/2021**

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch	Leachate Date
2	AS4439.3/PF	PFAS by ID SOP QSM B-15	1	02/12/2021 1808	JJG	02/11/2021 1137	82591	02/01/2021 1849

Parameter	CAS Number	Analytical Method	Result	Q	LOQ	LOD	DL	Units	Run
1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS)	39108-34-4	PFAS by ID SOP	40	U	80	40	20	ng/L	2
1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS)	**27619-97-2**	**PFAS by ID SOP**	**53**	**J**	**80**	40	**20**	**ng/L**	**2**
1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS)	757124-72-4	PFAS by ID SOP	40	U	80	40	20	ng/L	2
N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA)	2991-50-6	PFAS by ID SOP	40	U	80	40	20	ng/L	2
N-methylperfluoro-1-octanesulfonamide (MeFOSA)	31506-32-8	PFAS by ID SOP	80	U	160	80	40	ng/L	2
N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA)	2355-31-9	PFAS by ID SOP	40	U	80	40	20	ng/L	2
Perfluoro-1-butanesulfonic acid (PFBS)	375-73-5	PFAS by ID SOP	20	U	40	20	10	ng/L	2
Perfluoro-1-decanesulfonic acid (PFDS)	335-77-3	PFAS by ID SOP	20	U	40	20	10	ng/L	2
Perfluoro-1-heptanesulfonic acid (PFHpS)	375-92-8	PFAS by ID SOP	20	U	40	20	10	ng/L	2
Perfluoro-1-nonanesulfonic acid (PFNS)	68259-12-1	PFAS by ID SOP	20	U	40	20	10	ng/L	2
Perfluoro-1-octanesulfonamide (PFOSA)	754-91-6	PFAS by ID SOP	20	U	40	20	10	ng/L	2
Perfluoro-1-pentanesulfonic acid (PFPeS)	2706-91-4	PFAS by ID SOP	20	U	40	20	10	ng/L	2
Perfluorohexanesulfonic acid (PFHxS)	355-46-4	PFAS by ID SOP	20	U	40	20	10	ng/L	2
Perfluoro-n-butanoic acid (PFBA)	375-22-4	PFAS by ID SOP	20	U	40	20	10	ng/L	2
Perfluoro-n-decanoic acid (PFDA)	335-76-2	PFAS by ID SOP	20	U	40	20	10	ng/L	2
Perfluoro-n-dodecanoic acid (PFDoA)	307-55-1	PFAS by ID SOP	20	U	40	20	10	ng/L	2
Perfluoro-n-heptanoic acid (PFHpA)	375-85-9	PFAS by ID SOP	20	U	40	20	10	ng/L	2
Perfluoro-n-hexanoic acid (PFHxA)	307-24-4	PFAS by ID SOP	20	U	40	20	10	ng/L	2
Perfluoro-n-nonanoic acid (PFNA)	375-95-1	PFAS by ID SOP	20	U	40	20	10	ng/L	2
Perfluoro-n-octanoic acid (PFOA)	335-67-1	PFAS by ID SOP	20	U	40	20	10	ng/L	2
Perfluoro-n-pentanoic acid (PFPeA)	2706-90-3	PFAS by ID SOP	20	U	40	20	10	ng/L	2
Perfluoro-n-tetradecanoic acid (PFTeDA)	376-06-7	PFAS by ID SOP	20	U	40	20	10	ng/L	2
Perfluoro-n-tridecanoic acid (PFTrDA)	72629-94-8	PFAS by ID SOP	20	U	40	20	10	ng/L	2
Perfluoro-n-undecanoic acid (PFUdA)	2058-94-8	PFAS by ID SOP	20	U	40	20	10	ng/L	2
Perfluorooctanesulfonic acid (PFOS)	**1763-23-1**	**PFAS by ID SOP**	**100**		**40**	20	**10**	**ng/L**	**2**

Surrogate	Q	Run 2 % Recovery	Acceptance Limits
13C2_4:2FTS		108	50-150
13C2_6:2FTS		105	50-150
13C2_8:2FTS		111	50-150
13C2_PFDoA		99	50-150
13C2_PFTeDA		101	50-150
13C3_PFBS		105	50-150
13C3_PFHxS		104	50-150
13C4_PFBA		112	50-150
13C4_PFHpA		108	50-150
13C5_PFHxA		120	50-150
13C5_PFPeA		110	50-150
13C6_PFDA		103	50-150
13C7_PFUdA		104	50-150
13C8_PFOA		110	50-150
13C8_PFOS		93	50-150
13C8_PFOSA		103	50-150
13C9_PFNA		110	50-150

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

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SPLP PFAS (Australian)

Client: **Arcadis U.S., Inc.**
Laboratory ID: **WA26010-001**
Description: **RGS-HSDIH505**
Matrix: **Solid**
Date Sampled: **01/22/2021**
% Solids: **99.9** **01/27/2021 0024**
Date Received: **01/26/2021**

Surrogate	Q	Run 2 % Recovery	Acceptance Limits
d5-EtFOSAA		103	50-150
d-MeFOSA		100	50-150
d3-MeFOSAA		100	50-150

LOQ = Limit of Quantitation	B = Detected in the method blank	E = Quantitation of compound exceeded the calibration range	DL = Detection Limit	Q = Surrogate failure
U = Not detected at or above the LOQ	N = Recovery is out of criteria	P = The RPD between two GC columns exceeds 40%	J = Estimated result < LOQ and ≥ DL	L = LCS/LCSD failure
H = Out of holding time	W = Reported on wet weight basis	LOD = Limit of Detection		S = MS/MSD failure

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QC Summary

PFAS by LC/MS/MS - MB

Sample ID: WQ81010-001
Batch: 81010
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Solid
Prep Method: SOP SPE
Prep Date: 01/28/2021 1101

Parameter	Result	Q	Dil	LOQ	LOD	DL	Units	Analysis Date
8:2 FTS	1.0	U	1	2.0	1.0	0.50	ug/kg	01/29/2021 1559
6:2 FTS	1.0	U	1	2.0	1.0	0.50	ug/kg	01/29/2021 1559
4:2 FTS	1.0	U	1	2.0	1.0	0.50	ug/kg	01/29/2021 1559
EtFOSAA	1.0	U	1	2.0	1.0	0.50	ug/kg	01/29/2021 1559
MeFOSA	1.0	U	1	2.0	1.0	0.50	ug/kg	01/29/2021 1559
MeFOSAA	1.0	U	1	2.0	1.0	0.50	ug/kg	01/29/2021 1559
PFBS	0.50	U	1	1.0	0.50	0.20	ug/kg	01/29/2021 1559
PFDS	0.50	U	1	1.0	0.50	0.20	ug/kg	01/29/2021 1559
PFHpS	0.50	U	1	1.0	0.50	0.20	ug/kg	01/29/2021 1559
PFNS	0.50	U	1	1.0	0.50	0.20	ug/kg	01/29/2021 1559
PFOSA	0.50	U	1	1.0	0.50	0.20	ug/kg	01/29/2021 1559
PFPeS	0.50	U	1	1.0	0.50	0.20	ug/kg	01/29/2021 1559
PFHxS	0.50	U	1	1.0	0.50	0.20	ug/kg	01/29/2021 1559
PFBA	0.50	U	1	1.0	0.50	0.20	ug/kg	01/29/2021 1559
PFDA	0.50	U	1	1.0	0.50	0.20	ug/kg	01/29/2021 1559
PFDoA	0.50	U	1	1.0	0.50	0.20	ug/kg	01/29/2021 1559
PFHpA	0.50	U	1	1.0	0.50	0.20	ug/kg	01/29/2021 1559
PFHxA	0.50	U	1	1.0	0.50	0.20	ug/kg	01/29/2021 1559
PFNA	0.50	U	1	1.0	0.50	0.20	ug/kg	01/29/2021 1559
PFOA	0.50	U	1	1.0	0.50	0.20	ug/kg	01/29/2021 1559
PFPeA	0.50	U	1	1.0	0.50	0.20	ug/kg	01/29/2021 1559
PFTeDA	0.50	U	1	1.0	0.50	0.20	ug/kg	01/29/2021 1559
PFTrDA	0.50	U	1	1.0	0.50	0.20	ug/kg	01/29/2021 1559
PFUdA	0.50	U	1	1.0	0.50	0.20	ug/kg	01/29/2021 1559
PFOS	0.50	U	1	1.0	0.50	0.20	ug/kg	01/29/2021 1559

Surrogate	Q	% Rec	Acceptance Limit
13C2_4:2FTS		94	50-150
13C2_6:2FTS		99	50-150
13C2_8:2FTS		98	50-150
13C2_PFDoA		103	50-150
13C2_PFTeDA		101	50-150
13C3_PFBS		90	50-150
13C3_PFHxS		95	50-150
13C4_PFBA		98	50-150
13C4_PFHpA		105	50-150
13C5_PFHxA		102	50-150
13C5_PFPeA		101	50-150
13C6_PFDA		98	50-150
13C7_PFUdA		93	50-150
13C8_PFOA		99	50-150

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

PFAS by LC/MS/MS - MB

Sample ID: WQ81010-001
Batch: 81010
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Solid
Prep Method: SOP SPE
Prep Date: 01/28/2021 1101

Surrogate	Q	% Rec	Acceptance Limit
13C8_PFOS		96	50-150
13C8_PFOSA		106	50-150
13C9_PFNA		97	50-150
d5-EtFOSAA		105	50-150
d-MeFOSA		95	50-150
d3-MeFOSAA		106	50-150

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

PFAS by LC/MS/MS - LCS

Sample ID: WQ81010-002
Batch: 81010
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Solid
Prep Method: SOP SPE
Prep Date: 01/28/2021 1101

Parameter	Spike Amount (ug/kg)	Result (ug/kg)	Q	Dil	% Rec	% Rec Limit	Analysis Date
8:2 FTS	1.9	1.6		1	85	65-137	01/29/2021 1609
6:2 FTS	1.9	2.2		1	116	64-140	01/29/2021 1609
4:2 FTS	1.9	1.7		1	93	62-145	01/29/2021 1609
EtFOSAA	2.0	2.1		1	104	61-139	01/29/2021 1609
MeFOSA	2.0	1.9		1	97	70-150	01/29/2021 1609
MeFOSAA	2.0	2.2		1	108	63-144	01/29/2021 1609
PFBS	1.8	1.6		1	93	72-128	01/29/2021 1609
PFDS	1.9	1.8		1	95	59-134	01/29/2021 1609
PFHpS	1.9	2.0		1	104	70-132	01/29/2021 1609
PFNS	1.9	1.8		1	95	69-125	01/29/2021 1609
PFOSA	2.0	1.9		1	96	67-137	01/29/2021 1609
PFPeS	1.9	2.0		1	108	73-123	01/29/2021 1609
PFHxS	1.8	1.9		1	104	67-130	01/29/2021 1609
PFBA	2.0	2.0		1	102	71-135	01/29/2021 1609
PFDA	2.0	2.1		1	106	69-133	01/29/2021 1609
PFDoA	2.0	2.1		1	104	69-135	01/29/2021 1609
PFHpA	2.0	2.1		1	104	71-131	01/29/2021 1609
PFHxA	2.0	1.9		1	95	70-132	01/29/2021 1609
PFNA	2.0	2.1		1	103	72-129	01/29/2021 1609
PFOA	2.0	2.0		1	100	69-133	01/29/2021 1609
PFPeA	2.0	1.9		1	97	69-132	01/29/2021 1609
PFTeDA	2.0	2.0		1	98	69-133	01/29/2021 1609
PFTrDA	2.0	2.1		1	103	66-139	01/29/2021 1609
PFUdA	2.0	1.9		1	94	64-136	01/29/2021 1609
PFOS	1.9	1.7		1	93	68-136	01/29/2021 1609

Surrogate	Q	% Rec	Acceptance Limit
13C2_4:2FTS		99	50-150
13C2_6:2FTS		104	50-150
13C2_8:2FTS		110	50-150
13C2_PFDoA		100	50-150
13C2_PFTeDA		100	50-150
13C3_PFBS		91	50-150
13C3_PFHxS		95	50-150
13C4_PFBA		97	50-150
13C4_PFHpA		99	50-150
13C5_PFHxA		101	50-150
13C5_PFPeA		103	50-150
13C6_PFDA		99	50-150
13C7_PFUdA		97	50-150
13C8_PFOA		102	50-150

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

PFAS by LC/MS/MS - LCS

Sample ID: WQ81010-002
Batch: 81010
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Solid
Prep Method: SOP SPE
Prep Date: 01/28/2021 1101

Surrogate	Q	% Rec	Acceptance Limit
13C8_PFOS		95	50-150
13C8_PFOSA		106	50-150
13C9_PFNA		101	50-150
d5-EtFOSAA		100	50-150
d-MeFOSA		91	50-150
d3-MeFOSAA		106	50-150

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

PFAS by LC/MS/MS - MS

Sample ID: WA26010-001MS
Batch: 81010
Analytical Method: PFAS by ID SOP QSM B-15
Matrix: Solid
Prep Method: SOP SPE
Prep Date: 01/28/2021 1101

Parameter	Sample Amount (ug/kg)	Spike Amount (ug/kg)	Result (ug/kg)	Q	Dil	% Rec	% Rec Limit	Analysis Date
8:2 FTS	1.1	1.8	5.8	N	1	260	65-137	01/30/2021 0829
6:2 FTS	ND	1.8	2.7	N	1	150	64-140	01/30/2021 0829
4:2 FTS	ND	1.8	2.6	N	1	148	62-145	01/30/2021 0829
EtFOSAA	ND	1.9	2.8	N	1	145	61-139	01/30/2021 0829
MeFOSA	ND	1.9	3.6	N	1	189	70-150	01/30/2021 0829
MeFOSAA	ND	1.9	2.9	N	1	152	63-144	01/30/2021 0829
PFBS	ND	1.7	2.4	N	1	144	72-128	01/30/2021 0829
PFDS	ND	1.8	3.5	N	1	190	59-134	01/30/2021 0829
PFHpS	ND	1.8	2.9	N	1	160	70-132	01/30/2021 0829
PFNS	0.53	1.8	3.4	N	1	157	69-125	01/30/2021 0829
PFOSA	0.39	1.9	3.3	N	1	152	67-137	01/30/2021 0829
PFPeS	ND	1.8	2.7	N	1	150	73-123	01/30/2021 0829
PFHxS	ND	1.7	2.8	N	1	161	67-130	01/30/2021 0829
PFBA	ND	1.9	2.9	N	1	152	71-135	01/30/2021 0829
PFDA	ND	1.9	3.3	N	1	172	69-133	01/30/2021 0829
PFDoA	ND	1.9	3.1	N	1	164	69-135	01/30/2021 0829
PFHpA	ND	1.9	2.9	N	1	151	71-131	01/30/2021 0829
PFHxA	ND	1.9	3.2	N	1	166	70-132	01/30/2021 0829
PFNA	ND	1.9	2.9	N	1	152	72-129	01/30/2021 0829
PFOA	ND	1.9	3.0	N	1	157	69-133	01/30/2021 0829
PFPeA	ND	1.9	2.8	N	1	149	69-132	01/30/2021 0829
PFTeDA	ND	1.9	2.9	N	1	152	69-133	01/30/2021 0829
PFTrDA	ND	1.9	3.4	N	1	179	66-139	01/30/2021 0829
PFUdA	ND	1.9	3.0	N	1	158	64-136	01/30/2021 0829
PFOS	12	1.8	21	N	1	558	68-136	01/30/2021 0829

Surrogate	Q	% Rec	Acceptance Limit
13C2_4:2FTS		55	50-150
13C2_6:2FTS		53	50-150
13C2_8:2FTS	N	47	50-150
13C2_PFDoA		51	50-150
13C2_PFTeDA		50	50-150
13C3_PFBS	N	45	50-150
13C3_PFHxS		52	50-150
13C4_PFBA	N	49	50-150
13C4_PFHpA		52	50-150
13C5_PFHxA	N	49	50-150
13C5_PFPeA	N	49	50-150
13C6_PFDA	N	46	50-150
13C7_PFUdA		50	50-150
13C8_PFOA		51	50-150

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection
U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

PFAS by LC/MS/MS - MS

Sample ID: WA26010-001MS
Batch: 81010
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Solid
Prep Method: SOP SPE
Prep Date: 01/28/2021 1101

Surrogate	Q	% Rec	Acceptance Limit
13C8_PFOS	N	46	50-150
13C8_PFOSA	N	49	50-150
13C9_PFNA	N	47	50-150
d5-EtFOSAA		50	50-150
d-MeFOSA		51	50-150
d3-MeFOSAA		54	50-150

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

PFAS by LC/MS/MS - MSD

Sample ID: WA26010-001MD
Batch: 81010
Analytical Method: PFAS by ID SOP QSM B-15
Matrix: Solid
Prep Method: SOP SPE
Prep Date: 01/28/2021 1101

Parameter	Sample Amount (ug/kg)	Spike Amount (ug/kg)	Result (ug/kg)	Q	Dil	% Rec	% RPD	% Rec Limit	% RPD Limit	Analysis Date
8:2 FTS	1.1	1.6	4.1	N,+	1	186	35	65-137	30	01/30/2021 0839
6:2 FTS	ND	1.6	1.8	+	1	110	43	64-140	30	01/30/2021 0839
4:2 FTS	ND	1.6	1.9	+	1	119	34	62-145	30	01/30/2021 0839
EtFOSAA	ND	1.7	2.5	N	1	148	11	61-139	30	01/30/2021 0839
MeFOSA	ND	1.7	2.4	+	1	143	40	70-150	30	01/30/2021 0839
MeFOSAA	ND	1.7	2.6	N	1	156	10	63-144	30	01/30/2021 0839
PFBS	ND	1.5	2.1	N	1	142	14	72-128	30	01/30/2021 0839
PFDS	ND	1.6	2.5	N,+	1	152	34	59-134	30	01/30/2021 0839
PFHpS	ND	1.6	2.4	N	1	147	21	70-132	30	01/30/2021 0839
PFNS	0.53	1.6	2.7	N	1	135	22	69-125	30	01/30/2021 0839
PFOSA	0.39	1.7	2.9	N	1	148	13	67-137	30	01/30/2021 0839
PFPeS	ND	1.6	2.6	N	1	163	4.4	73-123	30	01/30/2021 0839
PFHxS	ND	1.5	2.4	N	1	155	16	67-130	30	01/30/2021 0839
PFBA	ND	1.7	2.4	N	1	142	19	71-135	30	01/30/2021 0839
PFDA	ND	1.7	2.4	N	1	143	30	69-133	30	01/30/2021 0839
PFDoA	ND	1.7	2.4	N	1	143	26	69-135	30	01/30/2021 0839
PFHpA	ND	1.7	2.4	N	1	140	20	71-131	30	01/30/2021 0839
PFHxA	ND	1.7	2.4	N	1	145	25	70-132	30	01/30/2021 0839
PFNA	ND	1.7	2.5	N	1	149	15	72-129	30	01/30/2021 0839
PFOA	ND	1.7	2.3	N	1	136	26	69-133	30	01/30/2021 0839
PFPeA	ND	1.7	2.5	N	1	152	11	69-132	30	01/30/2021 0839
PFTeDA	ND	1.7	2.4	N	1	140	20	69-133	30	01/30/2021 0839
PFTrDA	ND	1.7	2.7	N	1	161	23	66-139	30	01/30/2021 0839
PFUdA	ND	1.7	2.3		1	136	27	64-136	30	01/30/2021 0839
PFOS	12	1.6	25	N	1	891	17	68-136	30	01/30/2021 0839

Surrogate	Q	% Rec	Acceptance Limit
13C2_4:2FTS		64	50-150
13C2_6:2FTS		61	50-150
13C2_8:2FTS		61	50-150
13C2_PFDoA		58	50-150
13C2_PFTeDA		54	50-150
13C3_PFBS		52	50-150
13C3_PFHxS		58	50-150
13C4_PFBA		56	50-150
13C4_PFHpA		59	50-150
13C5_PFHxA		59	50-150
13C5_PFPeA		57	50-150
13C6_PFDA		55	50-150
13C7_PFUdA		61	50-150
13C8_PFOA		61	50-150

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection
U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

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PFAS by LC/MS/MS - MSD

Sample ID: WA26010-001MD
Batch: 81010
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Solid
Prep Method: SOP SPE
Prep Date: 01/28/2021 1101

Surrogate	Q	% Rec	Acceptance Limit
13C8_PFOS		58	50-150
13C8_PFOSA		59	50-150
13C9_PFNA		56	50-150
d5-EtFOSAA		56	50-150
d-MeFOSA		63	50-150
d3-MeFOSAA		62	50-150

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

SPLP PFAS (Australian) - MB

Sample ID: WQ82591-001
Batch: 82591
Analytical Method: PFAS by ID SOP QSM B-15
Matrix: Solid
Prep Method: AS4439.3/PFAS
Prep Date: 02/11/2021 1137 **Leachate Date:** 02/01/2021 1849

Parameter	Result	Q	Dil	LOQ	LOD	DL	Units	Analysis Date
8:2 FTS	40	U	1	80	40	20	ng/L	02/12/2021 1424
6:2 FTS	40	U	1	80	40	20	ng/L	02/12/2021 1424
4:2 FTS	40	U	1	80	40	20	ng/L	02/12/2021 1424
EtFOSAA	40	U	1	80	40	20	ng/L	02/12/2021 1424
MeFOSA	80	U	1	160	80	40	ng/L	02/12/2021 1424
MeFOSAA	40	U	1	80	40	20	ng/L	02/12/2021 1424
PFBS	20	U	1	40	20	10	ng/L	02/12/2021 1424
PFDS	20	U	1	40	20	10	ng/L	02/12/2021 1424
PFHpS	20	U	1	40	20	10	ng/L	02/12/2021 1424
PFNS	20	U	1	40	20	10	ng/L	02/12/2021 1424
PFOSA	20	U	1	40	20	10	ng/L	02/12/2021 1424
PFPeS	20	U	1	40	20	10	ng/L	02/12/2021 1424
PFHxS	20	U	1	40	20	10	ng/L	02/12/2021 1424
PFBA	20	U	1	40	20	10	ng/L	02/12/2021 1424
PFDA	20	U	1	40	20	10	ng/L	02/12/2021 1424
PFDoA	20	U	1	40	20	10	ng/L	02/12/2021 1424
PFHpA	20	U	1	40	20	10	ng/L	02/12/2021 1424
PFHxA	20	U	1	40	20	10	ng/L	02/12/2021 1424
PFNA	20	U	1	40	20	10	ng/L	02/12/2021 1424
PFOA	20	U	1	40	20	10	ng/L	02/12/2021 1424
PFPeA	20	U	1	40	20	10	ng/L	02/12/2021 1424
PFTeDA	20	U	1	40	20	10	ng/L	02/12/2021 1424
PFTrDA	20	U	1	40	20	10	ng/L	02/12/2021 1424
PFUdA	20	U	1	40	20	10	ng/L	02/12/2021 1424
PFOS	20	U	1	40	20	10	ng/L	02/12/2021 1424

Surrogate	Q	% Rec	Acceptance Limit
13C2_4:2FTS		117	50-150
13C2_6:2FTS		118	50-150
13C2_8:2FTS		119	50-150
13C2_PFDoA		114	50-150
13C2_PFTeDA		118	50-150
13C3_PFBS		120	50-150
13C3_PFHxS		121	50-150
13C4_PFBA		123	50-150
13C4_PFHpA		124	50-150
13C5_PFHxA		124	50-150
13C5_PFPeA		120	50-150
13C6_PFDA		119	50-150
13C7_PFUdA		121	50-150
13C8_PFOA		125	50-150

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection
U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

SPLP PFAS (Australian) - MB

Sample ID: WQ82591-001
Batch: 82591
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Solid
Prep Method: AS4439.3/PFAS
Prep Date: 02/11/2021 1137 **Leachate Date:** 02/01/2021 1849

Surrogate	Q	% Rec	Acceptance Limit
13C8_PFOS		103	50-150
13C8_PFOSA		122	50-150
13C9_PFNA		124	50-150
d5-EtFOSAA		118	50-150
d-MeFOSA		104	50-150
d3-MeFOSAA		122	50-150

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

SPLP PFAS (Australian) - LCS

Sample ID: WQ82591-002
Batch: 82591
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Solid
Prep Method: AS4439.3/PFAS
Prep Date: 02/11/2021 1137 **Leachate Date:** 02/01/2021 1849

Parameter	Spike Amount (ng/L)	Result (ng/L)	Q	Dil	% Rec	% Rec Limit	Analysis Date
8:2 FTS	150	150		1	97	67-138	02/12/2021 1435
6:2 FTS	150	170		1	111	64-140	02/12/2021 1435
4:2 FTS	150	150		1	103	63-143	02/12/2021 1435
EtFOSAA	160	140		1	90	61-135	02/12/2021 1435
MeFOSA	160	130		1	84	68-141	02/12/2021 1435
MeFOSAA	160	140		1	91	65-136	02/12/2021 1435
PFBS	140	130		1	88	72-130	02/12/2021 1435
PFDS	150	140		1	89	53-142	02/12/2021 1435
PFHpS	150	140		1	91	69-134	02/12/2021 1435
PFNS	150	170		1	110	69-127	02/12/2021 1435
PFOSA	160	150		1	91	67-137	02/12/2021 1435
PFPeS	150	140		1	93	71-127	02/12/2021 1435
PFHxS	150	130		1	88	68-131	02/12/2021 1435
PFBA	160	140		1	91	73-129	02/12/2021 1435
PFDA	160	150		1	93	71-129	02/12/2021 1435
PFDoA	160	160		1	99	72-134	02/12/2021 1435
PFHpA	160	160		1	103	72-130	02/12/2021 1435
PFHxA	160	150		1	91	72-129	02/12/2021 1435
PFNA	160	150		1	94	69-130	02/12/2021 1435
PFOA	160	150		1	93	71-133	02/12/2021 1435
PFPeA	160	150		1	95	72-129	02/12/2021 1435
PFTeDA	160	150		1	92	71-132	02/12/2021 1435
PFTrDA	160	180		1	112	65-144	02/12/2021 1435
PFUdA	160	150		1	96	69-133	02/12/2021 1435
PFOS	150	140		1	92	65-140	02/12/2021 1435

Surrogate	Q	% Rec	Acceptance Limit
13C2_4:2FTS		110	50-150
13C2_6:2FTS		112	50-150
13C2_8:2FTS		116	50-150
13C2_PFDoA		110	50-150
13C2_PFTeDA		112	50-150
13C3_PFBS		115	50-150
13C3_PFHxS		118	50-150
13C4_PFBA		119	50-150
13C4_PFHpA		113	50-150
13C5_PFHxA		118	50-150
13C5_PFPeA		113	50-150
13C6_PFDA		109	50-150
13C7_PFUdA		112	50-150
13C8_PFOA		122	50-150

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection
U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

SPLP PFAS (Australian) - LCS

Sample ID: WQ82591-002
Batch: 82591
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Solid
Prep Method: AS4439.3/PFAS
Prep Date: 02/11/2021 1137 **Leachate Date:** 02/01/2021 1849

Surrogate	Q	% Rec	Acceptance Limit
13C8_PFOS		102	50-150
13C8_PFOSA		114	50-150
13C9_PFNA		112	50-150
d5-EtFOSAA		107	50-150
d-MeFOSA		97	50-150
d3-MeFOSAA		112	50-150

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

SPLP PFAS (Australian) - MS

Sample ID: WA26010-001MS
Batch: 82591
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Solid
Prep Method: AS4439.3/PFAS
Prep Date: 02/11/2021 1137 **Leachate Date:** 02/01/2021 1849

Parameter	Sample Amount (ng/L)	Spike Amount (ng/L)	Result (ng/L)	Q	Dil	% Rec	% Rec Limit	Analysis Date
8:2 FTS	ND	150	180		1	116	67-138	02/12/2021 1818
6:2 FTS	53	150	170		1	79	64-140	02/12/2021 1818
4:2 FTS	ND	150	140		1	95	63-143	02/12/2021 1818
EtFOSAA	ND	160	150		1	96	61-135	02/12/2021 1818
MeFOSA	ND	160	150		1	91	68-141	02/12/2021 1818
MeFOSAA	ND	160	140		1	90	65-136	02/12/2021 1818
PFBS	ND	140	120		1	88	72-130	02/12/2021 1818
PFDS	ND	150	120		1	78	53-142	02/12/2021 1818
PFHpS	ND	150	140		1	94	69-134	02/12/2021 1818
PFNS	ND	150	150		1	97	69-127	02/12/2021 1818
PFOSA	ND	160	140		1	88	67-137	02/12/2021 1818
PFPeS	ND	150	150		1	102	71-127	02/12/2021 1818
PFHxS	ND	150	150		1	105	68-131	02/12/2021 1818
PFBA	ND	160	150		1	91	73-129	02/12/2021 1818
PFDA	ND	160	140		1	90	71-129	02/12/2021 1818
PFDoA	ND	160	160		1	98	72-134	02/12/2021 1818
PFHpA	ND	160	150		1	92	72-130	02/12/2021 1818
PFHxA	ND	160	150		1	96	72-129	02/12/2021 1818
PFNA	ND	160	150		1	92	69-130	02/12/2021 1818
PFOA	ND	160	150		1	92	71-133	02/12/2021 1818
PFPeA	ND	160	160		1	100	72-129	02/12/2021 1818
PFTeDA	ND	160	140		1	89	71-132	02/12/2021 1818
PFTrDA	ND	160	190		1	117	65-144	02/12/2021 1818
PFUdA	ND	160	150		1	95	69-133	02/12/2021 1818
PFOS	100	150	210		1	73	65-140	02/12/2021 1818

Surrogate	Q	% Rec	Acceptance Limit
13C2_4:2FTS		105	50-150
13C2_6:2FTS		110	50-150
13C2_8:2FTS		107	50-150
13C2_PFDoA		96	50-150
13C2_PFTeDA		100	50-150
13C3_PFBS		105	50-150
13C3_PFHxS		103	50-150
13C4_PFBA		109	50-150
13C4_PFHpA		104	50-150
13C5_PFHxA		109	50-150
13C5_PFPeA		103	50-150
13C6_PFDA		104	50-150
13C7_PFUdA		100	50-150
13C8_PFOA		111	50-150

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

SPLP PFAS (Australian) - MS

Sample ID: WA26010-001MS
Batch: 82591
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Solid
Prep Method: AS4439.3/PFAS
Prep Date: 02/11/2021 1137 **Leachate Date:** 02/01/2021 1849

Surrogate	Q	% Rec	Acceptance Limit
13C8_PFOS		94	50-150
13C8_PFOSA		107	50-150
13C9_PFNA		105	50-150
d5-EtFOSAA		94	50-150
d-MeFOSA		86	50-150
d3-MeFOSAA		102	50-150

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

SPLP PFAS (Australian) - MSD

Sample ID: WA26010-001MD
Batch: 82591
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Solid
Prep Method: AS4439.3/PFAS
Prep Date: 02/11/2021 1137 **Leachate Date:** 02/01/2021 1849

Parameter	Sample Amount (ng/L)	Spike Amount (ng/L)	Result (ng/L)	Q	Dil	% Rec	% RPD	% Rec Limit	% RPD Limit	Analysis Date
8:2 FTS	ND	150	140		1	93	22	67-138	30	02/12/2021 1829
6:2 FTS	53	150	230		1	117	29	64-140	30	02/12/2021 1829
4:2 FTS	ND	150	160		1	106	11	63-143	30	02/12/2021 1829
EtFOSAA	ND	160	140		1	88	9.1	61-135	30	02/12/2021 1829
MeFOSA	ND	160	150		1	96	5.5	68-141	30	02/12/2021 1829
MeFOSAA	ND	160	160		1	101	12	65-136	30	02/12/2021 1829
PFBS	ND	140	130		1	90	2.0	72-130	30	02/12/2021 1829
PFDS	ND	150	130		1	85	8.7	53-142	30	02/12/2021 1829
PFHpS	ND	150	160		1	102	7.7	69-134	30	02/12/2021 1829
PFNS	ND	150	150		1	98	1.4	69-127	30	02/12/2021 1829
PFOSA	ND	160	170		1	106	19	67-137	30	02/12/2021 1829
PFPeS	ND	150	140		1	95	7.1	71-127	30	02/12/2021 1829
PFHxS	ND	150	140		1	98	6.6	68-131	30	02/12/2021 1829
PFBA	ND	160	150		1	95	3.8	73-129	30	02/12/2021 1829
PFDA	ND	160	150		1	95	5.1	71-129	30	02/12/2021 1829
PFDoA	ND	160	160		1	97	0.59	72-134	30	02/12/2021 1829
PFHpA	ND	160	150		1	96	4.3	72-130	30	02/12/2021 1829
PFHxA	ND	160	150		1	95	1.2	72-129	30	02/12/2021 1829
PFNA	ND	160	150		1	91	0.78	69-130	30	02/12/2021 1829
PFOA	ND	160	160		1	101	8.5	71-133	30	02/12/2021 1829
PFPeA	ND	160	150		1	94	6.0	72-129	30	02/12/2021 1829
PFTeDA	ND	160	140		1	89	0.36	71-132	30	02/12/2021 1829
PFTrDA	ND	160	170		1	106	10	65-144	30	02/12/2021 1829
PFUdA	ND	160	140		1	90	5.1	69-133	30	02/12/2021 1829
PFOS	100	150	220		1	80	4.4	65-140	30	02/12/2021 1829

Surrogate	Q	% Rec	Acceptance Limit
13C2_4:2FTS		106	50-150
13C2_6:2FTS		108	50-150
13C2_8:2FTS		119	50-150
13C2_PFDoA		102	50-150
13C2_PFTeDA		106	50-150
13C3_PFBS		109	50-150
13C3_PFHxS		108	50-150
13C4_PFBA		112	50-150
13C4_PFHpA		109	50-150
13C5_PFHxA		113	50-150
13C5_PFPeA		109	50-150
13C6_PFDA		106	50-150
13C7_PFUdA		104	50-150
13C8_PFOA		109	50-150

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection
U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

SPLP PFAS (Australian) - MSD

Sample ID: WA26010-001MD
Batch: 82591
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Solid
Prep Method: AS4439.3/PFAS
Prep Date: 02/11/2021 1137 **Leachate Date:** 02/01/2021 1849

Surrogate	Q	% Rec	Acceptance Limit
13C8_PFOS		100	50-150
13C8_PFOSA		101	50-150
13C9_PFNA		114	50-150
d5-EtFOSAA		104	50-150
d-MeFOSA		102	50-150
d3-MeFOSAA		100	50-150

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

Chain of Custody
and
Miscellaneous Documents

Shealy Environmental Services, Inc.
106 Vantage Point Drive
West Columbia, South Carolina 29172
Telephone No. (803) 791-9700 Fax No. (803) 791-9111
www.shealylab.com

Chain of Custody Record

Number

Client: Arcadis	Report to Contact: Colin Morrell	Telephone No. / E-mail: 902.209.3476 / colin@cleanearthtechnologies.ca	Quote No.: Mike McFadden
Address:	Sampler's Signature: C. Morrell	Analysis (Attach list if more space is needed): PFAS DoD QSM 5.3 ELAP Table B-15 cmpds and ASLP	Page: 1 of 1
City / State / Zip Code:	Printed Name:		
Project Name:			

WA26012 MKM

WA26010 MKM

Project Number: 1000-EI	P.O No.:		G=Grab C=Composite	Matrix: Aqueous	Solid	Non-Aqueous		No of Containers by Preservative Type: Unpres.	H2SO4	HNO3	HCl	NaOH	5035 Kit									Remarks / Cooler I.D.
Sample ID / Description (Containers for each sample may be combined on one line)	Date	Time																				
RGS-HSDIH505	Jan 22/21		C		x									x	x							PFAS
PWG	Jan 22 / 21		C	x										x								PFAS
PWGIX	Jan 22 /21		C	x										x								PFAS

Turn Around Time Required (Prior lab approval required for expedited TAT)
☐ Standard ☒ Rush (Please Specify)

Sample Disposal
☐ Return to Client ☐ Disposal by Lab

Possible Hazard Identification (List any known hazards in the remarks)
☐ Non-Hazardous ☐ Flammable ☐ Skin Irritant ☐ SDS provided ☐ Unknown

QC Requirements

1. Relinquished by: Colin Morrell	Date: Jan 22/21	Time:	1. Received by:	Date:	Time:
2. Relinquished by:	Date:	Time:	2. Received by:	Date:	Time:
3. Relinquished by:	Date:	Time:	3. Received by:	Date:	Time:
4. Relinquished by: Fed Ex	Date: 1/26/21	Time: 0935	4. Laboratory Received by:	Date: 1/26/21	Time: 0935

Note: All samples are retained for four weeks from receipt unless other arrangements are made.

LAB USE ONLY
Received on Ice (Check) ☒ Y ☐ N ☐ Ice Pack

Receipt Temp. 12.8 °C

Document Number: ME002OW-01

PACE ANALYTICAL SERVICES, LLC

Pace Analytical

Samples Receipt Checklist (SRC) (ME0018C-15)
Issuing Authority: Pace ENV - WCOL

Revised:9/29/2020
Page 1 of 1

Sample Receipt Checklist (SRC)

Client: Arcadis Cooler Inspected by/date: KSC / 01/26/2021 Lot #: WA26010/WA26012

Means of receipt: ☐ Pace ☐ Client ☐ UPS ☑ FedEx ☐ Other:

☐ Yes	☑ No		1. Were custody seals present on the cooler?
☐ Yes	☐ No	☑ NA	2. If custody seals were present, were they intact and unbroken?

pH Strip ID: NA Chlorine Strip ID: NA Tested by: NA

Original temperature upon receipt / Derived (Corrected) temperature upon receipt %Solid Snap-Cup ID: 20-875

12.8 / 12.8 °C NA / NA °C NA / NA °C NA / NA °C

Method: ☐ Temperature Blank ☑ Against Bottles IR Gun ID: 5 IR Gun Correction Factor: 0 °C

Method of coolant: ☑ Wet Ice ☐ Ice Packs ☐ Dry Ice ☐ None

☑ Yes	☐ No	☐ NA	3. If temperature of any cooler exceeded 6.0°C, was Project Manager Notified? PM was Notified by: phone ~~e-mail~~/ face-to-face (circle one).
☐ Yes	☑ No	☐ NA	4. Is the commercial courier's packing slip attached to this form? Illegible
☑ Yes	☐ No		5. Were proper custody procedures (relinquished/received) followed?
☑ Yes	☐ No		6. Were sample IDs listed on the COC?
☑ Yes	☐ No		7. Were sample IDs listed on all sample containers?
☐ Yes	☑ No		8. Was collection date & time listed on the COC?
☐ Yes	☑ No		9. Was collection date & time listed on all sample containers?
☑ Yes	☐ No		10. Did all container label information (ID, date, time) agree with the COC?
☑ Yes	☐ No		11. Were tests to be performed listed on the COC?
☑ Yes	☐ No		12. Did all samples arrive in the proper containers for each test and/or in good condition (unbroken, lids on, etc.)?
☑ Yes	☐ No		13. Was adequate sample volume available?
☐ Yes	☑ No		14. Were all samples received within ½ the holding time or 48 hours, whichever comes first?
☐ Yes	☑ No		15. Were any samples containers missing/excess (circle one) samples Not listed on COC?
☐ Yes	☐ No	☑ NA	16. For VOA and RSK-175 samples, were bubbles present >"pea-size" (¼"or 6mm in diameter) in any of the VOA vials?
☐ Yes	☐ No	☑ NA	17. Were all DRO/metals/nutrient samples received at a pH of < 2?
☐ Yes	☐ No	☑ NA	18. Were all cyanide samples received at a pH > 12 and sulfide samples received at a pH > 9?
☐ Yes	☐ No	☑ NA	19. Were all applicable NH_3/TKN/cyanide/phenol/625.1/608.3 (< 0.5mg/L) samples free of residual chlorine?
☐ Yes	☐ No	☑ NA	20. Were client remarks/requests (i.e. requested dilutions, MS/MSD designations, etc…) correctly transcribed from the COC into the comment section in LIMS?
☐ Yes	☑ No		21. Was the quote number listed on the container label? If yes, Quote #

Sample Preservation (Must be completed for any sample(s) incorrectly preserved or with headspace.)

Sample(s) NA were received incorrectly preserved and were adjusted accordingly in sample receiving with NA mL of circle one: H2SO4, HNO3, HCl, NaOH using SR # NA.
Time of preservation NA. If more than one preservative is needed, please note in the comments below.

Sample(s) NA were received with bubbles >6 mm in diameter.

Samples(s) NA were received with TRC > 0.5 mg/L (If #19 is *no*) and were adjusted accordingly in sample receiving with sodium thiosulfate ($Na_2S_2O_3$) with Shealy ID: NA.

SR barcode labels applied by: MEH Date: 01/26/2021

Comments: Ice was melted

Report of Analysis

Arcadis U.S., Inc.
630 Plaza Drive
Suite 600
Highlands Ranch, CO 80129
Attention: Colin Morrell

Project Name: Eielson AFB

Project Number: 1000-EI

Lot Number:**WA26012**

Date Completed:01/31/2021

02/01/2021 1:05 PM
Approved and released by:
Project Manager II: **Marcia K. McGinnity**

The electronic signature above is the equivalent of a handwritten signature.
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Case Narrative
Arcadis U.S., Inc.
Lot Number: WA26012

This Report of Analysis contains the analytical result(s) for the sample(s) listed on the Sample Summary following this Case Narrative. The sample receiving date is documented in the header information associated with each sample.

All results listed in this report relate only to the samples that are contained within this report.

Sample receipt, sample analysis, and data review have been performed in accordance with the most current approved The NELAC Institute (TNI) standards, the Pace Analytical Services, LLC ("Pace") Laboratory Quality Manual, standard operating procedures (SOPs), and Pace policies. Additionally, the DoD QSM version 5.3 has been followed for these samples, and specifically Table B-15 was followed for all PFAS samples. Any exceptions to the TNI standards, the Laboratory Quality Manual, SOPs, the DoD QSM, or policies are qualified on the results page or discussed below.

If you have any questions regarding this report please contact the Pace Project Manager listed on the cover page.

The MS/MD/DU for prep batch 80843 also applies to prep batch 80844

Samples WA26012-001and WA26012-002 were collected in client-provided bottles which do not conform to method requirements.

Surrogate recovery for the following sample(s) was outside the upper control limit: WA26012-001. This sample did not contain any target analytes; therefore, re-extraction and/or re-analysis was not performed.

Sample Summary
Arcadis U.S., Inc.
Lot Number: WA26012

Sample Number	Sample ID	Matrix	Date Sampled	Date Received
001	PWG	Aqueous	01/22/2021	01/26/2021
002	PWGIX	Aqueous	01/22/2021	01/26/2021

(2 samples)

Detection Summary

Arcadis U.S., Inc.

Lot Number: WA26012

Sample	Sample ID	Matrix	Parameter	Method	Result	Q	Units	Page
001	PWG	Aqueous	6:2 FTS	PFAS by ID	2.4	J	ng/L	5
001	PWG	Aqueous	PFOA	PFAS by ID	1.5	J	ng/L	5
001	PWG	Aqueous	PFOS	PFAS by ID	2.7	J	ng/L	5
002	PWGIX	Aqueous	6:2 FTS	PFAS by ID	3.1	J	ng/L	7
002	PWGIX	Aqueous	PFOSA	PFAS by ID	0.91	J	ng/L	7
002	PWGIX	Aqueous	PFBA	PFAS by ID	1.4	J	ng/L	7
002	PWGIX	Aqueous	PFOA	PFAS by ID	1.1	J	ng/L	7

(7 detections)

PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: WA26012-001
Description: PWG | Matrix: Aqueous
Date Sampled: 01/22/2021
Date Received: 01/26/2021

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch
1	SOP SPE	PFAS by ID SOP QSM B-15	1	01/28/2021 1629	JJG	01/27/2021 1043	80844

Parameter	CAS Number	Analytical Method	Result	Q	LOQ	LOD	DL	Units	Run
1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS)	39108-34-4	PFAS by ID SOP	3.6	UQ	7.1	3.6	1.8	ng/L	1
1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS)	27619-97-2	PFAS by ID SOP	2.4	J	7.1	3.6	1.8	ng/L	1
1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS)	757124-72-4	PFAS by ID SOP	3.6	U	7.1	3.6	1.8	ng/L	1
N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA)	2991-50-6	PFAS by ID SOP	3.6	U	7.1	3.6	1.8	ng/L	1
N-methylperfluoro-1-octanesulfonamide (MeFOSA)	31506-32-8	PFAS by ID SOP	7.0	U	14	7.0	3.6	ng/L	1
N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA)	2355-31-9	PFAS by ID SOP	3.6	U	7.1	3.6	1.8	ng/L	1
Perfluoro-1-butanesulfonic acid (PFBS)	375-73-5	PFAS by ID SOP	1.8	U	3.6	1.8	0.89	ng/L	1
Perfluoro-1-decanesulfonic acid (PFDS)	335-77-3	PFAS by ID SOP	1.8	U	3.6	1.8	0.89	ng/L	1
Perfluoro-1-heptanesulfonic acid (PFHpS)	375-92-8	PFAS by ID SOP	1.8	U	3.6	1.8	0.89	ng/L	1
Perfluoro-1-nonanesulfonic acid (PFNS)	68259-12-1	PFAS by ID SOP	1.8	U	3.6	1.8	0.89	ng/L	1
Perfluoro-1-octanesulfonamide (PFOSA)	754-91-6	PFAS by ID SOP	1.8	U	3.6	1.8	0.89	ng/L	1
Perfluoro-1-pentanesulfonic acid (PFPeS)	2706-91-4	PFAS by ID SOP	1.8	U	3.6	1.8	0.89	ng/L	1
Perfluorohexanesulfonic acid (PFHxS)	355-46-4	PFAS by ID SOP	1.8	U	3.6	1.8	0.89	ng/L	1
Perfluoro-n-butanoic acid (PFBA)	375-22-4	PFAS by ID SOP	1.8	U	3.6	1.8	0.89	ng/L	1
Perfluoro-n-decanoic acid (PFDA)	335-76-2	PFAS by ID SOP	1.8	U	3.6	1.8	0.89	ng/L	1
Perfluoro-n-dodecanoic acid (PFDoA)	307-55-1	PFAS by ID SOP	1.8	U	3.6	1.8	0.89	ng/L	1
Perfluoro-n-heptanoic acid (PFHpA)	375-85-9	PFAS by ID SOP	1.8	U	3.6	1.8	0.89	ng/L	1
Perfluoro-n-hexanoic acid (PFHxA)	307-24-4	PFAS by ID SOP	1.8	U	3.6	1.8	0.89	ng/L	1
Perfluoro-n-nonanoic acid (PFNA)	375-95-1	PFAS by ID SOP	1.8	U	3.6	1.8	0.89	ng/L	1
Perfluoro-n-octanoic acid (PFOA)	335-67-1	PFAS by ID SOP	1.5	J	3.6	1.8	0.89	ng/L	1
Perfluoro-n-pentanoic acid (PFPeA)	2706-90-3	PFAS by ID SOP	1.8	U	3.6	1.8	0.89	ng/L	1
Perfluoro-n-tetradecanoic acid (PFTeDA)	376-06-7	PFAS by ID SOP	1.8	U	3.6	1.8	0.89	ng/L	1
Perfluoro-n-tridecanoic acid (PFTrDA)	72629-94-8	PFAS by ID SOP	1.8	U	3.6	1.8	0.89	ng/L	1
Perfluoro-n-undecanoic acid (PFUdA)	2058-94-8	PFAS by ID SOP	1.8	U	3.6	1.8	0.89	ng/L	1
Perfluorooctanesulfonic acid (PFOS)	1763-23-1	PFAS by ID SOP	2.7	J	3.6	1.8	0.89	ng/L	1

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
13C2_4:2FTS		140	50-150
13C2_6:2FTS		114	50-150
13C2_8:2FTS	N	168	50-150
13C2_PFDoA		118	50-150
13C2_PFTeDA		87	50-150
13C3_PFBS		87	50-150
13C3_PFHxS		71	50-150
13C4_PFBA		103	50-150
13C4_PFHpA		104	50-150
13C5_PFHxA		103	50-150
13C5_PFPeA		102	50-150
13C6_PFDA		118	50-150
13C7_PFUdA		93	50-150
13C8_PFOA		95	50-150
13C8_PFOS		79	50-150
13C8_PFOSA		99	50-150
13C9_PFNA		93	50-150

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

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PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.
Laboratory ID: WA26012-001
Description: PWG
Matrix: Aqueous
Date Sampled: 01/22/2021
Date Received: 01/26/2021

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
d5-EtFOSAA		95	50-150
d-MeFOSA		97	50-150
d3-MeFOSAA		102	50-150

LOQ = Limit of Quantitation	B = Detected in the method blank	E = Quantitation of compound exceeded the calibration range	DL = Detection Limit	Q = Surrogate failure
U = Not detected at or above the LOQ	N = Recovery is out of criteria	P = The RPD between two GC columns exceeds 40%	J = Estimated result < LOQ and ≥ DL	L = LCS/LCSD failure
H = Out of holding time	W = Reported on wet weight basis	LOD = Limit of Detection		S = MS/MSD failure

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PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: WA26012-002
Description: PWGIX | Matrix: Aqueous
Date Sampled: 01/22/2021
Date Received: 01/26/2021

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch
1	SOP SPE	PFAS by ID SOP QSM B-15	1	01/28/2021 1640	JJG	01/27/2021 1043	80844

Parameter	CAS Number	Analytical Method	Result	Q	LOQ	LOD	DL	Units	Run
1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS)	39108-34-4	PFAS by ID SOP	3.3	U	6.5	3.3	1.6	ng/L	1
1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS)	27619-97-2	PFAS by ID SOP	3.1	J	6.5	3.3	1.6	ng/L	1
1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS)	757124-72-4	PFAS by ID SOP	3.3	U	6.5	3.3	1.6	ng/L	1
N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA)	2991-50-6	PFAS by ID SOP	3.3	U	6.5	3.3	1.6	ng/L	1
N-methylperfluoro-1-octanesulfonamide (MeFOSA)	31506-32-8	PFAS by ID SOP	6.5	U	13	6.5	3.3	ng/L	1
N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA)	2355-31-9	PFAS by ID SOP	3.3	U	6.5	3.3	1.6	ng/L	1
Perfluoro-1-butanesulfonic acid (PFBS)	375-73-5	PFAS by ID SOP	1.7	U	3.3	1.7	0.82	ng/L	1
Perfluoro-1-decanesulfonic acid (PFDS)	335-77-3	PFAS by ID SOP	1.7	U	3.3	1.7	0.82	ng/L	1
Perfluoro-1-heptanesulfonic acid (PFHpS)	375-92-8	PFAS by ID SOP	1.7	U	3.3	1.7	0.82	ng/L	1
Perfluoro-1-nonanesulfonic acid (PFNS)	68259-12-1	PFAS by ID SOP	1.7	U	3.3	1.7	0.82	ng/L	1
Perfluoro-1-octanesulfonamide (PFOSA)	754-91-6	PFAS by ID SOP	0.91	J	3.3	1.7	0.82	ng/L	1
Perfluoro-1-pentanesulfonic acid (PFPeS)	2706-91-4	PFAS by ID SOP	1.7	U	3.3	1.7	0.82	ng/L	1
Perfluorohexanesulfonic acid (PFHxS)	355-46-4	PFAS by ID SOP	1.7	U	3.3	1.7	0.82	ng/L	1
Perfluoro-n-butanoic acid (PFBA)	375-22-4	PFAS by ID SOP	1.4	J	3.3	1.7	0.82	ng/L	1
Perfluoro-n-decanoic acid (PFDA)	335-76-2	PFAS by ID SOP	1.7	U	3.3	1.7	0.82	ng/L	1
Perfluoro-n-dodecanoic acid (PFDoA)	307-55-1	PFAS by ID SOP	1.7	U	3.3	1.7	0.82	ng/L	1
Perfluoro-n-heptanoic acid (PFHpA)	375-85-9	PFAS by ID SOP	1.7	U	3.3	1.7	0.82	ng/L	1
Perfluoro-n-hexanoic acid (PFHxA)	307-24-4	PFAS by ID SOP	1.7	U	3.3	1.7	0.82	ng/L	1
Perfluoro-n-nonanoic acid (PFNA)	375-95-1	PFAS by ID SOP	1.7	U	3.3	1.7	0.82	ng/L	1
Perfluoro-n-octanoic acid (PFOA)	335-67-1	PFAS by ID SOP	1.1	J	3.3	1.7	0.82	ng/L	1
Perfluoro-n-pentanoic acid (PFPeA)	2706-90-3	PFAS by ID SOP	1.7	U	3.3	1.7	0.82	ng/L	1
Perfluoro-n-tetradecanoic acid (PFTeDA)	376-06-7	PFAS by ID SOP	1.7	U	3.3	1.7	0.82	ng/L	1
Perfluoro-n-tridecanoic acid (PFTrDA)	72629-94-8	PFAS by ID SOP	1.7	U	3.3	1.7	0.82	ng/L	1
Perfluoro-n-undecanoic acid (PFUdA)	2058-94-8	PFAS by ID SOP	1.7	U	3.3	1.7	0.82	ng/L	1
Perfluorooctanesulfonic acid (PFOS)	1763-23-1	PFAS by ID SOP	1.7	U	3.3	1.7	0.82	ng/L	1

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
13C2_4:2FTS		136	50-150
13C2_6:2FTS		126	50-150
13C2_8:2FTS		119	50-150
13C2_PFDoA		90	50-150
13C2_PFTeDA		86	50-150
13C3_PFBS		94	50-150
13C3_PFHxS		99	50-150
13C4_PFBA		97	50-150
13C4_PFHpA		115	50-150
13C5_PFHxA		107	50-150
13C5_PFPeA		104	50-150
13C6_PFDA		92	50-150
13C7_PFUdA		89	50-150
13C8_PFOA		98	50-150
13C8_PFOS		88	50-150
13C8_PFOSA		93	50-150
13C9_PFNA		103	50-150

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

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PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.
Laboratory ID: WA26012-002
Description: PWGIX
Matrix: Aqueous
Date Sampled: 01/22/2021
Date Received: 01/26/2021

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
d5-EtFOSAA		88	50-150
d-MeFOSA		86	50-150
d3-MeFOSAA		99	50-150

LOQ = Limit of Quantitation	B = Detected in the method blank	E = Quantitation of compound exceeded the calibration range	DL = Detection Limit	Q = Surrogate failure
U = Not detected at or above the LOQ	N = Recovery is out of criteria	P = The RPD between two GC columns exceeds 40%	J = Estimated result < LOQ and ≥ DL	L = LCS/LCSD failure
H = Out of holding time	W = Reported on wet weight basis	LOD = Limit of Detection		S = MS/MSD failure

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QC Summary

PFAS by LC/MS/MS - MB

Sample ID: WQ80844-001
Batch: 80844
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Aqueous
Prep Method: SOP SPE
Prep Date: 01/27/2021 1043

Parameter	Result	Q	Dil	LOQ	LOD	DL	Units	Analysis Date
8:2 FTS	4.0	U	1	8.0	4.0	2.0	ng/L	01/28/2021 1400
6:2 FTS	4.0	U	1	8.0	4.0	2.0	ng/L	01/28/2021 1400
4:2 FTS	4.0	U	1	8.0	4.0	2.0	ng/L	01/28/2021 1400
EtFOSAA	4.0	U	1	8.0	4.0	2.0	ng/L	01/28/2021 1400
MeFOSA	8.0	U	1	16	8.0	4.0	ng/L	01/28/2021 1400
MeFOSAA	4.0	U	1	8.0	4.0	2.0	ng/L	01/28/2021 1400
PFBS	2.0	U	1	4.0	2.0	1.0	ng/L	01/28/2021 1400
PFDS	2.0	U	1	4.0	2.0	1.0	ng/L	01/28/2021 1400
PFHpS	2.0	U	1	4.0	2.0	1.0	ng/L	01/28/2021 1400
PFNS	2.0	U	1	4.0	2.0	1.0	ng/L	01/28/2021 1400
PFOSA	2.0	U	1	4.0	2.0	1.0	ng/L	01/28/2021 1400
PFPeS	2.0	U	1	4.0	2.0	1.0	ng/L	01/28/2021 1400
PFHxS	2.0	U	1	4.0	2.0	1.0	ng/L	01/28/2021 1400
PFBA	2.0	U	1	4.0	2.0	1.0	ng/L	01/28/2021 1400
PFDA	2.0	U	1	4.0	2.0	1.0	ng/L	01/28/2021 1400
PFDoA	2.0	U	1	4.0	2.0	1.0	ng/L	01/28/2021 1400
PFHpA	2.0	U	1	4.0	2.0	1.0	ng/L	01/28/2021 1400
PFHxA	2.0	U	1	4.0	2.0	1.0	ng/L	01/28/2021 1400
PFNA	2.0	U	1	4.0	2.0	1.0	ng/L	01/28/2021 1400
PFOA	2.0	U	1	4.0	2.0	1.0	ng/L	01/28/2021 1400
PFPeA	2.0	U	1	4.0	2.0	1.0	ng/L	01/28/2021 1400
PFTeDA	2.0	U	1	4.0	2.0	1.0	ng/L	01/28/2021 1400
PFTrDA	2.0	U	1	4.0	2.0	1.0	ng/L	01/28/2021 1400
PFUdA	2.0	U	1	4.0	2.0	1.0	ng/L	01/28/2021 1400
PFOS	2.0	U	1	4.0	2.0	1.0	ng/L	01/28/2021 1400

Surrogate	Q	% Rec	Acceptance Limit
13C2_4:2FTS		110	50-150
13C2_6:2FTS		108	50-150
13C2_8:2FTS		108	50-150
13C2_PFDoA		100	50-150
13C2_PFTeDA		102	50-150
13C3_PFBS		97	50-150
13C3_PFHxS		95	50-150
13C4_PFBA		103	50-150
13C4_PFHpA		119	50-150
13C5_PFHxA		103	50-150
13C5_PFPeA		103	50-150
13C6_PFDA		99	50-150
13C7_PFUdA		99	50-150
13C8_PFOA		106	50-150

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

PFAS by LC/MS/MS - MB

Sample ID: WQ80844-001
Batch: 80844
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Aqueous
Prep Method: SOP SPE
Prep Date: 01/27/2021 1043

Surrogate	Q	% Rec	Acceptance Limit
13C8_PFOS		92	50-150
13C8_PFOSA		102	50-150
13C9_PFNA		101	50-150
d5-EtFOSAA		100	50-150
d-MeFOSA		106	50-150
d3-MeFOSAA		103	50-150

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

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PFAS by LC/MS/MS - LCS

Sample ID: WQ80844-002
Batch: 80844
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Aqueous
Prep Method: SOP SPE
Prep Date: 01/27/2021 1043

Parameter	Spike Amount (ng/L)	Result (ng/L)	Q	Dil	% Rec	% Rec Limit	Analysis Date
8:2 FTS	15	15		1	97	67-138	01/29/2021 1506
6:2 FTS	15	21		1	138	64-140	01/29/2021 1506
4:2 FTS	15	14		1	97	63-143	01/29/2021 1506
EtFOSAA	16	16		1	99	61-135	01/29/2021 1506
MeFOSA	16	16		1	98	68-141	01/29/2021 1506
MeFOSAA	16	15		1	95	65-136	01/29/2021 1506
PFBS	14	13		1	95	72-130	01/29/2021 1506
PFDS	15	15		1	97	53-142	01/29/2021 1506
PFHpS	15	16		1	107	69-134	01/29/2021 1506
PFNS	15	15		1	94	69-127	01/29/2021 1506
PFOSA	16	16		1	100	67-137	01/29/2021 1506
PFPeS	15	16		1	109	71-127	01/29/2021 1506
PFHxS	15	14		1	96	68-131	01/29/2021 1506
PFBA	16	17		1	103	73-129	01/29/2021 1506
PFDA	16	16		1	98	71-129	01/29/2021 1506
PFDoA	16	16		1	101	72-134	01/29/2021 1506
PFHpA	16	17		1	104	72-130	01/29/2021 1506
PFHxA	16	16		1	102	72-129	01/29/2021 1506
PFNA	16	16		1	99	69-130	01/29/2021 1506
PFOA	16	16		1	99	71-133	01/29/2021 1506
PFPeA	16	16		1	102	72-129	01/29/2021 1506
PFTeDA	16	16		1	100	71-132	01/29/2021 1506
PFTrDA	16	17		1	108	65-144	01/29/2021 1506
PFUdA	16	17		1	104	69-133	01/29/2021 1506
PFOS	15	14		1	94	65-140	01/29/2021 1506

Surrogate	Q	% Rec	Acceptance Limit
13C2_4:2FTS		98	50-150
13C2_6:2FTS		102	50-150
13C2_8:2FTS		88	50-150
13C2_PFDoA		95	50-150
13C2_PFTeDA		93	50-150
13C3_PFBS		89	50-150
13C3_PFHxS		92	50-150
13C4_PFBA		98	50-150
13C4_PFHpA		100	50-150
13C5_PFHxA		99	50-150
13C5_PFPeA		99	50-150
13C6_PFDA		100	50-150
13C7_PFUdA		90	50-150
13C8_PFOA		95	50-150

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

PFAS by LC/MS/MS - LCS

Sample ID: WQ80844-002
Batch: 80844
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Aqueous
Prep Method: SOP SPE
Prep Date: 01/27/2021 1043

Surrogate	Q	% Rec	Acceptance Limit
13C8_PFOS		90	50-150
13C8_PFOSA		97	50-150
13C9_PFNA		99	50-150
d5-EtFOSAA		93	50-150
d-MeFOSA		80	50-150
d3-MeFOSAA		94	50-150

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

Chain of Custody

and

Miscellaneous Documents

Shealy Environmental Services, Inc.
106 Vantage Point Drive
West Columbia, South Carolina 29172
Telephone No. (803) 791-9700 Fax No. (803) 791-9111
www.shealylab.com

Chain of Custody Record

Number

Client: Arcadis	Report to Contact: Colin Morrell	Telephone No. / E-mail: 902.209.3476 / colin@deancarhtechnologies.ca
Address:	Sampler's Signature: C. Morrell	Quote No.: Mike McFadden
City / State / Zip Code:	Printed Name:	Analysis (Attach list if more space is needed): PFAS DoD QSM 5.3 ELAP Table B-15 cmpds and ASLP
Project Name:		Page: 1 of 1
Project Number: 1000 EI	P.O No.:	

WA26012 MKM

WA26010 MKM

Sample ID / Description (Containers for each sample may be combined on one line)	Date	Time	G=Grab C=Composite	Matrix: Aqueous	Solid	Non-Aqueous	No of Containers by Preservative Type: Unpres.	H2SO4	HNO3	HCl	NaOH	5035 Kit		Remarks / Cooler I.D.
RGS-HSDH505	Jan 22/21		C		x								x x	PFAS
PWG	Jan 22 / 21		C	x									x	PFAS
PWGIX	Jan 22 /21		C	x									x	PFAS

Turn Around Time Required (Prior lab approval required for expedited TAT)
☐ Standard ☒ Rush (Please Specify)

Sample Disposal
☐ Return to Client ☐ Disposal by Lab

Possible Hazard Identification (List any known hazards in the remarks)
☐ Non-hazardous ☐ Flammable ☐ Skin Irritant ☐ SDS provided ☐ Unknown

QC Requirements

1. Relinquished by: Colin Morrell	Date: Jan 22/21	Time	1. Received by	Date / Time
2. Relinquished by	Date	Time	2. Received by	Date / Time
3. Relinquished by	Date	Time	3. Received by	Date / Time
4. Relinquished by: Fed Ex	Date: 1/26/21	Time: 0935	4. Laboratory Received by	Date: 1/26/21 Time: 0935

Note: All samples are retained for four weeks from receipt unless other arrangements are made.

LAB USE ONLY
Received on Ice (Check) ☒ Y ☐ N ☐ Ice Pack
Receipt Temp. 12.8 °C

Document Number: WE002OW-01

PACE ANALYTICAL SERVICES, LLC

Pace Analytical

Samples Receipt Checklist (SRC) (ME0018C-15)
Issuing Authority: Pace ENV - WCOL

Revised:9/29/2020
Page 1 of 1

Sample Receipt Checklist (SRC)

Client: Arcadis — Cooler Inspected by/date: KSC / 01/26/2021 — Lot #: WA26013/WA25012

Means of receipt: ☐ Pace ☐ Client ☐ UPS ☑ FedEx ☐ Other:

☐ Yes	☑ No		1. Were custody seals present on the cooler?
☐ Yes	☐ No	☑ NA	2. If custody seals were present, were they intact and unbroken?

pH Strip ID: NA — Chlorine Strip ID: NA — Tested by: NA

Original temperature upon receipt / Derived (Corrected) temperature upon receipt — %Solid Snap-Cup ID: 20-875

12.8 / 12.8 °C NA / NA °C NA / NA °C NA / NA °C

Method: ☐ Temperature Blank ☑ Against Bottles IR Gun ID: 5 IR Gun Correction Factor: 0 °C

Method of coolant: ☑ Wet Ice ☐ Ice Packs ☐ Dry Ice ☐ None

☑ Yes	☐ No	☐ NA	3. If temperature of any cooler exceeded 6.0°C, was Project Manager Notified? PM was Notified by: phone ~~email~~/ face-to-face (circle one).
☐ Yes	☑ No	☐ NA	4. Is the commercial courier's packing slip attached to this form? Illegible
☑ Yes	☐ No		5. Were proper custody procedures (relinquished/received) followed?
☑ Yes	☐ No		6. Were sample IDs listed on the COC?
☑ Yes	☐ No		7. Were sample IDs listed on all sample containers?
☐ Yes	☑ No		8. Was collection date & time listed on the COC?
☐ Yes	☑ No		9. Was collection date & time listed on all sample containers?
☑ Yes	☐ No		10. Did all container label information (ID, date, time) agree with the COC?
☑ Yes	☐ No		11. Were tests to be performed listed on the COC?
☑ Yes	☐ No		12. Did all samples arrive in the proper containers for each test and/or in good condition (unbroken, lids on, etc.)?
☑ Yes	☐ No		13. Was adequate sample volume available?
☐ Yes	☑ No		14. Were all samples received within ½ the holding time or 48 hours, whichever comes first?
☐ Yes	☑ No		15. Were any samples containers missing/excess (circle one) samples Not listed on COC?
☐ Yes	☐ No	☑ NA	16. For VOA and RSK-175 samples, were bubbles present >"pea-size" (¼"or 6mm in diameter) in any of the VOA vials?
☐ Yes	☐ No	☑ NA	17. Were all DRO/metals/nutrient samples received at a pH of < 2?
☐ Yes	☐ No	☑ NA	18. Were all cyanide samples received at a pH > 12 and sulfide samples received at a pH > 9?
☐ Yes	☐ No	☑ NA	19. Were all applicable NH_3/TKN/cyanide/phenol/625.1/608.3 (< 0.5mg/L) samples free of residual chlorine?
☐ Yes	☐ No	☑ NA	20. Were client remarks/requests (i.e. requested dilutions, MS/MSD designations, etc...) correctly transcribed from the COC into the comment section in LIMS?
☐ Yes	☑ No		21. Was the quote number listed on the container label? If yes, Quote #

Sample Preservation (Must be completed for any sample(s) incorrectly preserved or with headspace.)

Sample(s) NA were received incorrectly preserved and were adjusted accordingly in sample receiving with NA mL of circle one: H2SO4, HNO3, HCl, NaOH using SR # NA. Time of preservation NA. If more than one preservative is needed, please note in the comments below.

Sample(s) NA were received with bubbles >6 mm in diameter.

Samples(s) NA were received with TRC > 0.5 mg/L (If #19 is *no*) and were adjusted accordingly in sample receiving with sodium thiosulfate ($Na_2S_2O_3$) with Shealy ID: NA.

SR barcode labels applied by: MEH Date: 01/26/2021

Comments: Ice was melted

Report of Analysis

Arcadis U.S., Inc.
630 Plaza Drive
Suite 600
Highlands Ranch, CO 80129
Attention: Joseph Quinnan

Project Name: Eielson AFB

Project Number: 1000-EI

Lot Number:**WC15028**

Date Completed:04/05/2021

04/05/2021 5:35 PM
Approved and released by:
Project Manager II: **Marcia K. McGinnity**

The electronic signature above is the equivalent of a handwritten signature.
This report shall not be reproduced, except in its entirety, without the written approval of Pace Analytical Services, LLC.

Pace Analytical Services, LLC (*formerly Shealy Environmental Services, Inc.*)
106 Vantage Point Drive West Columbia, SC 29172
Tel: 803-791-9700 Fax: 803-791-9111 www.pacelabs.com

Case Narrative
Arcadis U.S., Inc.
Lot Number: WC15028

This Report of Analysis contains the analytical result(s) for the sample(s) listed on the Sample Summary following this Case Narrative. The sample receiving date is documented in the header information associated with each sample.

All results listed in this report relate only to the samples that are contained within this report.

Sample receipt, sample analysis, and data review have been performed in accordance with the most current approved The NELAC Institute (TNI) standards, the Pace Analytical Services, LLC ("Pace") Laboratory Quality Manual, standard operating procedures (SOPs), and Pace policies. Additionally, the DoD QSM version 5.3 has been followed for these samples, and specifically Table B-15 was followed for all PFAS samples. Any exceptions to the TNI standards, the Laboratory Quality Manual, SOPs, the DoD QSM, or policies are qualified on the results page or discussed below.

Where applicable, all soil sample results (including LOQ and DL if requested) are corrected for dry weight unless flagged with a "W" qualifier.

If you have any questions regarding this report please contact the Pace Project Manager listed on the cover page.

Issues:

Due to insufficient sample received, the initial sample amount used for the lot samples deviated from the standard procedure. Leachate volume was adjusted proportionately so no adjustment to LOQ was required.

The leachate blank (WQ86908-038) associated with the reported samples contained 6:2FTS greater than method criteria. The data has been reported.

Recovery of 6:2FTS exceeded recovery limits at 141%>140%. Re-preparation of the affected samples provided improved results. The re-prep results are reported for 6:2 FTS on all but WC15028-004.

Recovery of 6:2FTS exceeded limits with a positive bias in the matrix spike performed on sample WC15028-001. All other recoveries and relative percent differences were within limits. Re-preparation of the MS/MSD provided improved results. The re-prep MS/MSD results are reported for 6:2 FTS.

Sample Summary

Arcadis U.S., Inc.

Lot Number: WC15028

Sample Number	Sample ID	Matrix	Date Sampled	Date Received
001	SC-DIHHSRT1	Solid	03/12/2021	03/15/2021
002	SC-DIHHSSUR240TCRT1	Solid	03/12/2021	03/15/2021
003	SC-DIHHS5050RT1	Solid	03/12/2021	03/15/2021
004	SCDIHHSSUR340	Solid	03/12/2021	03/15/2021
005	S-DIHHSSUR240TC	Solid	03/12/2021	03/15/2021
006	S-HSSUR140TC	Solid	03/12/2021	03/15/2021

(6 samples)

Detection Summary

Arcadis U.S., Inc.

Lot Number: WC15028

Sample	Sample ID	Matrix	Parameter	Method	Result	Q	Units	Page
001	SC-DIHHSRT1	Solid	8:2 FTS	PFAS by ID	51	J	ng/L	6
001	SC-DIHHSRT1	Solid	6:2 FTS	PFAS by ID	390		ng/L	6
001	SC-DIHHSRT1	Solid	PFHxS	PFAS by ID	78		ng/L	6
001	SC-DIHHSRT1	Solid	PFHxA	PFAS by ID	23	J	ng/L	6
001	SC-DIHHSRT1	Solid	PFOA	PFAS by ID	16	J	ng/L	6
001	SC-DIHHSRT1	Solid	PFPeA	PFAS by ID	13	J	ng/L	6
001	SC-DIHHSRT1	Solid	PFOS	PFAS by ID	700		ng/L	6
002	SC-DIHHSSUR240TCRT1	Solid	8:2 FTS	PFAS by ID	80		ng/L	8
002	SC-DIHHSSUR240TCRT1	Solid	6:2 FTS	PFAS by ID	470		ng/L	8
002	SC-DIHHSSUR240TCRT1	Solid	PFHxS	PFAS by ID	66		ng/L	8
002	SC-DIHHSSUR240TCRT1	Solid	PFHxA	PFAS by ID	26	J	ng/L	8
002	SC-DIHHSSUR240TCRT1	Solid	PFPeA	PFAS by ID	14	J	ng/L	8
002	SC-DIHHSSUR240TCRT1	Solid	PFOS	PFAS by ID	810		ng/L	8
003	SC-DIHHS5050RT1	Solid	8:2 FTS	PFAS by ID	34	J	ng/L	10
003	SC-DIHHS5050RT1	Solid	6:2 FTS	PFAS by ID	350		ng/L	10
003	SC-DIHHS5050RT1	Solid	PFHxS	PFAS by ID	71		ng/L	10
003	SC-DIHHS5050RT1	Solid	PFBA	PFAS by ID	19	J	ng/L	10
003	SC-DIHHS5050RT1	Solid	PFHxA	PFAS by ID	75		ng/L	10
003	SC-DIHHS5050RT1	Solid	PFOA	PFAS by ID	28	J	ng/L	10
003	SC-DIHHS5050RT1	Solid	PFPeA	PFAS by ID	28	J	ng/L	10
003	SC-DIHHS5050RT1	Solid	PFOS	PFAS by ID	790		ng/L	10
004	SCDIHHSSUR340	Solid	PFOS	PFAS by ID	36	J	ng/L	12
005	S-DIHHSSUR240TC	Solid	6:2 FTS	PFAS by ID	94		ng/L	14
005	S-DIHHSSUR240TC	Solid	PFHxS	PFAS by ID	41		ng/L	14
005	S-DIHHSSUR240TC	Solid	PFHxA	PFAS by ID	21	J	ng/L	14
005	S-DIHHSSUR240TC	Solid	PFOS	PFAS by ID	510		ng/L	14
006	S-HSSUR140TC	Solid	6:2 FTS	PFAS by ID	82		ng/L	16
006	S-HSSUR140TC	Solid	PFHxS	PFAS by ID	22	J	ng/L	16
006	S-HSSUR140TC	Solid	PFHxA	PFAS by ID	21	J	ng/L	16
006	S-HSSUR140TC	Solid	PFOS	PFAS by ID	170		ng/L	16

(30 detections)

SPLP PFAS (Australian)

Client: Arcadis U.S., Inc.
Laboratory ID: WC15028-001
Description: SC-DIHHSRT1
Matrix: Solid
Date Sampled: 03/12/2021
Date Received: 03/15/2021

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch	Leachate Date
1	AS4439.3/PF	PFAS by ID SOP QSM B-15	1	03/30/2021 1506	JJG	03/29/2021 1117	87155	03/24/2021 0231
2	AS4439.3/PF	PFAS by ID SOP QSM B-15	1	04/02/2021 1607	JJG	04/01/2021 1054	87560	03/24/2021 0231

Parameter	CAS Number	Analytical Method	Result	Q	LOQ	LOD	DL	Units	Run
1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS)	39108-34-4	PFAS by ID SOP	51	J	80	40	20	ng/L	1
1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS)	27619-97-2	PFAS by ID SOP	390		80	40	20	ng/L	2
1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS)	757124-72-4	PFAS by ID SOP	40	U	80	40	20	ng/L	1
N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA)	2991-50-6	PFAS by ID SOP	40	U	80	40	20	ng/L	1
N-methylperfluoro-1-octanesulfonamide (MeFOSA)	31506-32-8	PFAS by ID SOP	80	U	160	80	40	ng/L	1
N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA)	2355-31-9	PFAS by ID SOP	40	U	80	40	20	ng/L	1
Perfluoro-1-butanesulfonic acid (PFBS)	375-73-5	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-1-decanesulfonic acid (PFDS)	335-77-3	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-1-heptanesulfonic acid (PFHpS)	375-92-8	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-1-nonanesulfonic acid (PFNS)	68259-12-1	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-1-octanesulfonamide (PFOSA)	754-91-6	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-1-pentanesulfonic acid (PFPeS)	2706-91-4	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluorohexanesulfonic acid (PFHxS)	355-46-4	PFAS by ID SOP	78		40	20	10	ng/L	1
Perfluoro-n-butanoic acid (PFBA)	375-22-4	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-n-decanoic acid (PFDA)	335-76-2	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-n-dodecanoic acid (PFDoA)	307-55-1	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-n-heptanoic acid (PFHpA)	375-85-9	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-n-hexanoic acid (PFHxA)	307-24-4	PFAS by ID SOP	23	J	40	20	10	ng/L	1
Perfluoro-n-nonanoic acid (PFNA)	375-95-1	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-n-octanoic acid (PFOA)	335-67-1	PFAS by ID SOP	16	J	40	20	10	ng/L	1
Perfluoro-n-pentanoic acid (PFPeA)	2706-90-3	PFAS by ID SOP	13	J	40	20	10	ng/L	1
Perfluoro-n-tetradecanoic acid (PFTeDA)	376-06-7	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-n-tridecanoic acid (PFTrDA)	72629-94-8	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-n-undecanoic acid (PFUdA)	2058-94-8	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluorooctanesulfonic acid (PFOS)	1763-23-1	PFAS by ID SOP	700		40	20	10	ng/L	1

Surrogate	Run 1 Q	Run 1 % Recovery	Run 1 Acceptance Limits	Run 2 Q	Run 2 % Recovery	Run 2 Acceptance Limits
13C2_4:2FTS		125	50-150		114	50-150
13C2_6:2FTS		117	50-150		117	50-150
13C2_8:2FTS		108	50-150		101	50-150
13C2_PFDoA		108	50-150		108	50-150
13C2_PFTeDA		101	50-150		101	50-150
13C3_PFBS		99	50-150		90	50-150
13C3_PFHxS		112	50-150		110	50-150
13C4_PFBA		116	50-150		109	50-150
13C4_PFHpA		122	50-150		121	50-150
13C5_PFHxA		113	50-150		111	50-150
13C5_PFPeA		118	50-150		108	50-150
13C6_PFDA		110	50-150		109	50-150
13C7_PFUdA		105	50-150		109	50-150
13C8_PFOA		126	50-150		116	50-150
13C8_PFOS		101	50-150		107	50-150
13C8_PFOSA		112	50-150		111	50-150

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
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SPLP PFAS (Australian)

Client: Arcadis U.S., Inc.
Laboratory ID: WC15028-001
Description: SC-DIHHSRT1
Matrix: Solid
Date Sampled: 03/12/2021
Date Received: 03/15/2021

Surrogate	Q	Run 1 % Recovery	Acceptance Limits	Q	Run 2 % Recovery	Acceptance Limits
13C9_PFNA		112	50-150		116	50-150
d5-EtFOSAA		101	50-150		106	50-150
d-MeFOSA		91	50-150		82	50-150
d3-MeFOSAA		105	50-150		107	50-150

LOQ = Limit of Quantitation	B = Detected in the method blank	E = Quantitation of compound exceeded the calibration range	DL = Detection Limit	Q = Surrogate failure
U = Not detected at or above the LOQ	N = Recovery is out of criteria	P = The RPD between two GC columns exceeds 40%	J = Estimated result < LOQ and ≥ DL	L = LCS/LCSD failure
H = Out of holding time	W = Reported on wet weight basis	LOD = Limit of Detection		S = MS/MSD failure

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106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

SPLP PFAS (Australian)

Client: Arcadis U.S., Inc.
Laboratory ID: WC15028-002
Description: SC-DIHHSSUR240TCRT1
Matrix: Solid
Date Sampled: 03/12/2021
Date Received: 03/15/2021

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch	Leachate Date
1	AS4439.3/PF	PFAS by ID SOP QSM B-15	1	03/30/2021 1538	JJG	03/29/2021 1117	87155	03/24/2021 0231
2	AS4439.3/PF	PFAS by ID SOP QSM B-15	1	04/02/2021 1618	JJG	04/01/2021 1054	87560	03/24/2021 0231

Parameter	CAS Number	Analytical Method	Result	Q	LOQ	LOD	DL	Units	Run
1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS)	39108-34-4	PFAS by ID SOP	80		80	40	20	ng/L	1
1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS)	27619-97-2	PFAS by ID SOP	470		80	40	20	ng/L	2
1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS)	757124-72-4	PFAS by ID SOP	40	U	80	40	20	ng/L	1
N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA)	2991-50-6	PFAS by ID SOP	40	U	80	40	20	ng/L	1
N-methylperfluoro-1-octanesulfonamide (MeFOSA)	31506-32-8	PFAS by ID SOP	80	U	160	80	40	ng/L	1
N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA)	2355-31-9	PFAS by ID SOP	40	U	80	40	20	ng/L	1
Perfluoro-1-butanesulfonic acid (PFBS)	375-73-5	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-1-decanesulfonic acid (PFDS)	335-77-3	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-1-heptanesulfonic acid (PFHpS)	375-92-8	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-1-nonanesulfonic acid (PFNS)	68259-12-1	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-1-octanesulfonamide (PFOSA)	754-91-6	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-1-pentanesulfonic acid (PFPeS)	2706-91-4	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluorohexanesulfonic acid (PFHxS)	355-46-4	PFAS by ID SOP	66		40	20	10	ng/L	1
Perfluoro-n-butanoic acid (PFBA)	375-22-4	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-n-decanoic acid (PFDA)	335-76-2	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-n-dodecanoic acid (PFDoA)	307-55-1	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-n-heptanoic acid (PFHpA)	375-85-9	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-n-hexanoic acid (PFHxA)	307-24-4	PFAS by ID SOP	26	J	40	20	10	ng/L	1
Perfluoro-n-nonanoic acid (PFNA)	375-95-1	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-n-octanoic acid (PFOA)	335-67-1	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-n-pentanoic acid (PFPeA)	2706-90-3	PFAS by ID SOP	14	J	40	20	10	ng/L	1
Perfluoro-n-tetradecanoic acid (PFTeDA)	376-06-7	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-n-tridecanoic acid (PFTrDA)	72629-94-8	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-n-undecanoic acid (PFUdA)	2058-94-8	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluorooctanesulfonic acid (PFOS)	1763-23-1	PFAS by ID SOP	810		40	20	10	ng/L	1

Surrogate	Run 1 Q	Run 1 % Recovery	Run 1 Acceptance Limits	Run 2 Q	Run 2 % Recovery	Run 2 Acceptance Limits
13C2_4:2FTS		110	50-150		115	50-150
13C2_6:2FTS		110	50-150		113	50-150
13C2_8:2FTS		98	50-150		108	50-150
13C2_PFDoA		98	50-150		108	50-150
13C2_PFTeDA		96	50-150		106	50-150
13C3_PFBS		91	50-150		97	50-150
13C3_PFHxS		100	50-150		110	50-150
13C4_PFBA		108	50-150		111	50-150
13C4_PFHpA		109	50-150		117	50-150
13C5_PFHxA		109	50-150		107	50-150
13C5_PFPeA		107	50-150		113	50-150
13C6_PFDA		106	50-150		112	50-150
13C7_PFUdA		103	50-150		108	50-150
13C8_PFOA		114	50-150		115	50-150
13C8_PFOS		98	50-150		99	50-150
13C8_PFOSA		109	50-150		112	50-150

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

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SPLP PFAS (Australian)

Client: Arcadis U.S., Inc.
Laboratory ID: WC15028-002
Description: SC-DIHHSSUR240TCRT1
Matrix: Solid
Date Sampled: 03/12/2021
Date Received: 03/15/2021

Surrogate	Q	Run 1 % Recovery	Acceptance Limits	Q	Run 2 % Recovery	Acceptance Limits
13C9_PFNA		104	50-150		114	50-150
d5-EtFOSAA		91	50-150		106	50-150
d-MeFOSA		93	50-150		91	50-150
d3-MeFOSAA		104	50-150		104	50-150

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

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SPLP PFAS (Australian)

Client: Arcadis U.S., Inc.
Laboratory ID: WC15028-003
Description: SC-DIHHS5050RT1
Matrix: Solid
Date Sampled: 03/12/2021
Date Received: 03/15/2021

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch	Leachate Date
1	AS4439.3/PF	PFAS by ID SOP QSM B-15	1	03/30/2021 1549	JJG	03/29/2021 1117	87155	03/24/2021 0231
2	AS4439.3/PF	PFAS by ID SOP QSM B-15	1	04/02/2021 1628	JJG	04/01/2021 1054	87560	03/24/2021 0231

Parameter	CAS Number	Analytical Method	Result	Q	LOQ	LOD	DL	Units	Run
1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS)	39108-34-4	PFAS by ID SOP	34	J	80	40	20	ng/L	1
1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS)	27619-97-2	PFAS by ID SOP	350		80	40	20	ng/L	2
1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS)	757124-72-4	PFAS by ID SOP	40	U	80	40	20	ng/L	1
N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA)	2991-50-6	PFAS by ID SOP	40	U	80	40	20	ng/L	1
N-methylperfluoro-1-octanesulfonamide (MeFOSA)	31506-32-8	PFAS by ID SOP	80	U	160	80	40	ng/L	1
N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA)	2355-31-9	PFAS by ID SOP	40	U	80	40	20	ng/L	1
Perfluoro-1-butanesulfonic acid (PFBS)	375-73-5	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-1-decanesulfonic acid (PFDS)	335-77-3	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-1-heptanesulfonic acid (PFHpS)	375-92-8	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-1-nonanesulfonic acid (PFNS)	68259-12-1	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-1-octanesulfonamide (PFOSA)	754-91-6	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-1-pentanesulfonic acid (PFPeS)	2706-91-4	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluorohexanesulfonic acid (PFHxS)	355-46-4	PFAS by ID SOP	71		40	20	10	ng/L	1
Perfluoro-n-butanoic acid (PFBA)	375-22-4	PFAS by ID SOP	19	J	40	20	10	ng/L	1
Perfluoro-n-decanoic acid (PFDA)	335-76-2	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-n-dodecanoic acid (PFDoA)	307-55-1	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-n-heptanoic acid (PFHpA)	375-85-9	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-n-hexanoic acid (PFHxA)	307-24-4	PFAS by ID SOP	75		40	20	10	ng/L	1
Perfluoro-n-nonanoic acid (PFNA)	375-95-1	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-n-octanoic acid (PFOA)	335-67-1	PFAS by ID SOP	28	J	40	20	10	ng/L	1
Perfluoro-n-pentanoic acid (PFPeA)	2706-90-3	PFAS by ID SOP	28	J	40	20	10	ng/L	1
Perfluoro-n-tetradecanoic acid (PFTeDA)	376-06-7	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-n-tridecanoic acid (PFTrDA)	72629-94-8	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-n-undecanoic acid (PFUdA)	2058-94-8	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluorooctanesulfonic acid (PFOS)	1763-23-1	PFAS by ID SOP	790		40	20	10	ng/L	1

Surrogate	Run 1 Q	Run 1 % Recovery	Run 1 Acceptance Limits	Run 2 Q	Run 2 % Recovery	Run 2 Acceptance Limits
13C2_4:2FTS		108	50-150		114	50-150
13C2_6:2FTS		107	50-150		107	50-150
13C2_8:2FTS		100	50-150		93	50-150
13C2_PFDoA		93	50-150		100	50-150
13C2_PFTeDA		92	50-150		100	50-150
13C3_PFBS		86	50-150		92	50-150
13C3_PFHxS		97	50-150		111	50-150
13C4_PFBA		105	50-150		109	50-150
13C4_PFHpA		104	50-150		117	50-150
13C5_PFHxA		103	50-150		103	50-150
13C5_PFPeA		105	50-150		106	50-150
13C6_PFDA		98	50-150		103	50-150
13C7_PFUdA		92	50-150		103	50-150
13C8_PFOA		112	50-150		114	50-150
13C8_PFOS		91	50-150		101	50-150
13C8_PFOSA		104	50-150		106	50-150

LOQ = Limit of Quantitation
B = Detected in the method blank
E = Quantitation of compound exceeded the calibration range
DL = Detection Limit
Q = Surrogate failure
U = Not detected at or above the LOQ
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
J = Estimated result < LOQ and ≥ DL
L = LCS/LCSD failure
H = Out of holding time
W = Reported on wet weight basis
LOD = Limit of Detection
S = MS/MSD failure

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SPLP PFAS (Australian)

Client: Arcadis U.S., Inc.
Laboratory ID: WC15028-003
Description: SC-DIHHS5050RT1
Matrix: Solid
Date Sampled: 03/12/2021
Date Received: 03/15/2021

Surrogate	Q	Run 1 % Recovery	Acceptance Limits	Q	Run 2 % Recovery	Acceptance Limits
13C9_PFNA		101	50-150		113	50-150
d5-EtFOSAA		95	50-150		101	50-150
d-MeFOSA		100	50-150		87	50-150
d3-MeFOSAA		105	50-150		99	50-150

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
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J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
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SPLP PFAS (Australian)

Client: Arcadis U.S., Inc.
Description: SCDIHHSSUR340
Date Sampled: 03/12/2021
Date Received: 03/15/2021

Laboratory ID: WC15028-004
Matrix: Solid
% Solids: 82.1 03/17/2021 0318

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch	Leachate Date
1	AS4439.3/PF	PFAS by ID SOP QSM B-15	1	03/30/2021 1600	JJG	03/29/2021 1117	87155	03/24/2021 0231

Parameter	CAS Number	Analytical Method	Result	Q	LOQ	LOD	DL	Units	Run
1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS)	39108-34-4	PFAS by ID SOP	40	U	80	40	20	ng/L	1
1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS)	27619-97-2	PFAS by ID SOP	40	UL	80	40	20	ng/L	1
1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS)	757124-72-4	PFAS by ID SOP	40	U	80	40	20	ng/L	1
N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA)	2991-50-6	PFAS by ID SOP	40	U	80	40	20	ng/L	1
N-methylperfluoro-1-octanesulfonamide (MeFOSA)	31506-32-8	PFAS by ID SOP	80	U	160	80	40	ng/L	1
N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA)	2355-31-9	PFAS by ID SOP	40	U	80	40	20	ng/L	1
Perfluoro-1-butanesulfonic acid (PFBS)	375-73-5	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-1-decanesulfonic acid (PFDS)	335-77-3	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-1-heptanesulfonic acid (PFHpS)	375-92-8	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-1-nonanesulfonic acid (PFNS)	68259-12-1	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-1-octanesulfonamide (PFOSA)	754-91-6	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-1-pentanesulfonic acid (PFPeS)	2706-91-4	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluorohexanesulfonic acid (PFHxS)	355-46-4	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-n-butanoic acid (PFBA)	375-22-4	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-n-decanoic acid (PFDA)	335-76-2	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-n-dodecanoic acid (PFDoA)	307-55-1	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-n-heptanoic acid (PFHpA)	375-85-9	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-n-hexanoic acid (PFHxA)	307-24-4	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-n-nonanoic acid (PFNA)	375-95-1	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-n-octanoic acid (PFOA)	335-67-1	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-n-pentanoic acid (PFPeA)	2706-90-3	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-n-tetradecanoic acid (PFTeDA)	376-06-7	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-n-tridecanoic acid (PFTrDA)	72629-94-8	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-n-undecanoic acid (PFUdA)	2058-94-8	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluorooctanesulfonic acid (PFOS)	1763-23-1	PFAS by ID SOP	36	J	40	20	10	ng/L	1

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
13C2_4:2FTS		108	50-150
13C2_6:2FTS		106	50-150
13C2_8:2FTS		103	50-150
13C2_PFDoA		113	50-150
13C2_PFTeDA		90	50-150
13C3_PFBS		92	50-150
13C3_PFHxS		100	50-150
13C4_PFBA		107	50-150
13C4_PFHpA		110	50-150
13C5_PFHxA		112	50-150
13C5_PFPeA		113	50-150
13C6_PFDA		103	50-150
13C7_PFUdA		103	50-150
13C8_PFOA		112	50-150
13C8_PFOS		100	50-150
13C8_PFOSA		108	50-150
13C9_PFNA		103	50-150

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

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SPLP PFAS (Australian)

Client: Arcadis U.S., Inc.
Description: SCDIHHSSUR340
Date Sampled: 03/12/2021
Date Received: 03/15/2021

Laboratory ID: WC15028-004
Matrix: Solid
% Solids: 82.1 03/17/2021 0318

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
d5-EtFOSAA		98	50-150
d-MeFOSA		107	50-150
d3-MeFOSAA		109	50-150

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

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SPLP PFAS (Australian)

Client: Arcadis U.S., Inc.
Laboratory ID: WC15028-005
Description: S-DIHHSSUR240TC
Matrix: Solid
Date Sampled: 03/12/2021
Date Received: 03/15/2021

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch	Leachate Date
1	AS4439.3/PF	PFAS by ID SOP QSM B-15	1	03/30/2021 1610	JJG	03/29/2021 1117	87155	03/24/2021 0231
2	AS4439.3/PF	PFAS by ID SOP QSM B-15	1	04/02/2021 1639	JJG	04/01/2021 1054	87560	03/24/2021 0231

Parameter	CAS Number	Analytical Method	Result	Q	LOQ	LOD	DL	Units	Run
1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS)	39108-34-4	PFAS by ID SOP	40	U	80	40	20	ng/L	1
1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS)	27619-97-2	PFAS by ID SOP	94		80	40	20	ng/L	2
1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS)	757124-72-4	PFAS by ID SOP	40	U	80	40	20	ng/L	1
N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA)	2991-50-6	PFAS by ID SOP	40	U	80	40	20	ng/L	1
N-methylperfluoro-1-octanesulfonamide (MeFOSA)	31506-32-8	PFAS by ID SOP	80	U	160	80	40	ng/L	1
N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA)	2355-31-9	PFAS by ID SOP	40	U	80	40	20	ng/L	1
Perfluoro-1-butanesulfonic acid (PFBS)	375-73-5	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-1-decanesulfonic acid (PFDS)	335-77-3	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-1-heptanesulfonic acid (PFHpS)	375-92-8	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-1-nonanesulfonic acid (PFNS)	68259-12-1	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-1-octanesulfonamide (PFOSA)	754-91-6	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-1-pentanesulfonic acid (PFPeS)	2706-91-4	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluorohexanesulfonic acid (PFHxS)	355-46-4	PFAS by ID SOP	41		40	20	10	ng/L	1
Perfluoro-n-butanoic acid (PFBA)	375-22-4	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-n-decanoic acid (PFDA)	335-76-2	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-n-dodecanoic acid (PFDoA)	307-55-1	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-n-heptanoic acid (PFHpA)	375-85-9	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-n-hexanoic acid (PFHxA)	307-24-4	PFAS by ID SOP	21	J	40	20	10	ng/L	1
Perfluoro-n-nonanoic acid (PFNA)	375-95-1	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-n-octanoic acid (PFOA)	335-67-1	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-n-pentanoic acid (PFPeA)	2706-90-3	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-n-tetradecanoic acid (PFTeDA)	376-06-7	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-n-tridecanoic acid (PFTrDA)	72629-94-8	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-n-undecanoic acid (PFUdA)	2058-94-8	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluorooctanesulfonic acid (PFOS)	1763-23-1	PFAS by ID SOP	510		40	20	10	ng/L	1

Surrogate	Run 1 Q	Run 1 % Recovery	Run 1 Acceptance Limits	Run 2 Q	Run 2 % Recovery	Run 2 Acceptance Limits
13C2_4:2FTS		119	50-150		109	50-150
13C2_6:2FTS		114	50-150		110	50-150
13C2_8:2FTS		106	50-150		99	50-150
13C2_PFDoA		97	50-150		100	50-150
13C2_PFTeDA		62	50-150		78	50-150
13C3_PFBS		91	50-150		93	50-150
13C3_PFHxS		103	50-150		112	50-150
13C4_PFBA		107	50-150		110	50-150
13C4_PFHpA		109	50-150		114	50-150
13C5_PFHxA		108	50-150		108	50-150
13C5_PFPeA		110	50-150		110	50-150
13C6_PFDA		107	50-150		105	50-150
13C7_PFUdA		101	50-150		102	50-150
13C8_PFOA		111	50-150		109	50-150
13C8_PFOS		106	50-150		98	50-150
13C8_PFOSA		112	50-150		113	50-150

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

SPLP PFAS (Australian)

Client: Arcadis U.S., Inc.
Laboratory ID: WC15028-005
Description: S-DIHHSSUR240TC
Matrix: Solid
Date Sampled: 03/12/2021
Date Received: 03/15/2021

Surrogate	Q	Run 1 % Recovery	Acceptance Limits	Q	Run 2 % Recovery	Acceptance Limits
13C9_PFNA		110	50-150		116	50-150
d5-EtFOSAA		92	50-150		98	50-150
d-MeFOSA		108	50-150		92	50-150
d3-MeFOSAA		93	50-150		95	50-150

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

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SPLP PFAS (Australian)

Client: Arcadis U.S., Inc.
Laboratory ID: WC15028-006
Description: S-HSSUR140TC
Matrix: Solid
Date Sampled: 03/12/2021
Date Received: 03/15/2021

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch	Leachate Date
1	AS4439.3/PF	PFAS by ID SOP QSM B-15	1	03/30/2021 1621	JJG	03/29/2021 1117	87155	03/24/2021 0231
2	AS4439.3/PF	PFAS by ID SOP QSM B-15	1	04/02/2021 1650	JJG	04/01/2021 1054	87560	03/24/2021 0231

Parameter	CAS Number	Analytical Method	Result	Q	LOQ	LOD	DL	Units	Run
1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS)	39108-34-4	PFAS by ID SOP	40	U	80	40	20	ng/L	1
1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS)	27619-97-2	PFAS by ID SOP	82		80	40	20	ng/L	2
1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS)	757124-72-4	PFAS by ID SOP	40	U	80	40	20	ng/L	1
N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA)	2991-50-6	PFAS by ID SOP	40	U	80	40	20	ng/L	1
N-methylperfluoro-1-octanesulfonamide (MeFOSA)	31506-32-8	PFAS by ID SOP	80	U	160	80	40	ng/L	1
N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA)	2355-31-9	PFAS by ID SOP	40	U	80	40	20	ng/L	1
Perfluoro-1-butanesulfonic acid (PFBS)	375-73-5	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-1-decanesulfonic acid (PFDS)	335-77-3	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-1-heptanesulfonic acid (PFHpS)	375-92-8	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-1-nonanesulfonic acid (PFNS)	68259-12-1	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-1-octanesulfonamide (PFOSA)	754-91-6	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-1-pentanesulfonic acid (PFPeS)	2706-91-4	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluorohexanesulfonic acid (PFHxS)	355-46-4	PFAS by ID SOP	22	J	40	20	10	ng/L	1
Perfluoro-n-butanoic acid (PFBA)	375-22-4	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-n-decanoic acid (PFDA)	335-76-2	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-n-dodecanoic acid (PFDoA)	307-55-1	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-n-heptanoic acid (PFHpA)	375-85-9	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-n-hexanoic acid (PFHxA)	307-24-4	PFAS by ID SOP	21	J	40	20	10	ng/L	1
Perfluoro-n-nonanoic acid (PFNA)	375-95-1	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-n-octanoic acid (PFOA)	335-67-1	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-n-pentanoic acid (PFPeA)	2706-90-3	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-n-tetradecanoic acid (PFTeDA)	376-06-7	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-n-tridecanoic acid (PFTrDA)	72629-94-8	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-n-undecanoic acid (PFUdA)	2058-94-8	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluorooctanesulfonic acid (PFOS)	1763-23-1	PFAS by ID SOP	170		40	20	10	ng/L	1

Surrogate	Run 1 Q	Run 1 % Recovery	Run 1 Acceptance Limits	Run 2 Q	Run 2 % Recovery	Run 2 Acceptance Limits
13C2_4:2FTS		107	50-150		105	50-150
13C2_6:2FTS		113	50-150		106	50-150
13C2_8:2FTS		109	50-150		99	50-150
13C2_PFDoA		100	50-150		104	50-150
13C2_PFTeDA		97	50-150		101	50-150
13C3_PFBS		91	50-150		89	50-150
13C3_PFHxS		100	50-150		103	50-150
13C4_PFBA		108	50-150		109	50-150
13C4_PFHpA		110	50-150		109	50-150
13C5_PFHxA		107	50-150		104	50-150
13C5_PFPeA		114	50-150		105	50-150
13C6_PFDA		110	50-150		113	50-150
13C7_PFUdA		98	50-150		100	50-150
13C8_PFOA		112	50-150		109	50-150
13C8_PFOS		99	50-150		98	50-150
13C8_PFOSA		108	50-150		110	50-150

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

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SPLP PFAS (Australian)

Client: Arcadis U.S., Inc.
Laboratory ID: WC15028-006
Description: S-HSSUR140TC
Matrix: Solid
Date Sampled: 03/12/2021
Date Received: 03/15/2021

Surrogate	Q	Run 1 % Recovery	Acceptance Limits	Q	Run 2 % Recovery	Acceptance Limits
13C9_PFNA		102	50-150		113	50-150
d5-EtFOSAA		96	50-150		103	50-150
d-MeFOSA		93	50-150		87	50-150
d3-MeFOSAA		103	50-150		107	50-150

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

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QC Summary

SPLP PFAS (Australian) - MB

Sample ID: WQ87155-001
Batch: 87155
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Solid
Prep Method: AS4439.3/PFAS
Prep Date: 03/29/2021 1117 Leachate Date: 03/24/2021 0231

Parameter	Result	Q	Dil	LOQ	LOD	DL	Units	Analysis Date
8:2 FTS	40	U	1	80	40	20	ng/L	03/30/2021 1434
6:2 FTS	40	U	1	80	40	20	ng/L	03/30/2021 1434
4:2 FTS	40	U	1	80	40	20	ng/L	03/30/2021 1434
EtFOSAA	40	U	1	80	40	20	ng/L	03/30/2021 1434
MeFOSA	80	U	1	160	80	40	ng/L	03/30/2021 1434
MeFOSAA	40	U	1	80	40	20	ng/L	03/30/2021 1434
PFBS	20	U	1	40	20	10	ng/L	03/30/2021 1434
PFDS	20	U	1	40	20	10	ng/L	03/30/2021 1434
PFHpS	20	U	1	40	20	10	ng/L	03/30/2021 1434
PFNS	20	U	1	40	20	10	ng/L	03/30/2021 1434
PFOSA	20	U	1	40	20	10	ng/L	03/30/2021 1434
PFPeS	20	U	1	40	20	10	ng/L	03/30/2021 1434
PFHxS	20	U	1	40	20	10	ng/L	03/30/2021 1434
PFBA	20	U	1	40	20	10	ng/L	03/30/2021 1434
PFDA	20	U	1	40	20	10	ng/L	03/30/2021 1434
PFDoA	20	U	1	40	20	10	ng/L	03/30/2021 1434
PFHpA	20	U	1	40	20	10	ng/L	03/30/2021 1434
PFHxA	20	U	1	40	20	10	ng/L	03/30/2021 1434
PFNA	20	U	1	40	20	10	ng/L	03/30/2021 1434
PFOA	20	U	1	40	20	10	ng/L	03/30/2021 1434
PFPeA	20	U	1	40	20	10	ng/L	03/30/2021 1434
PFTeDA	20	U	1	40	20	10	ng/L	03/30/2021 1434
PFTrDA	20	U	1	40	20	10	ng/L	03/30/2021 1434
PFUdA	20	U	1	40	20	10	ng/L	03/30/2021 1434
PFOS	20	U	1	40	20	10	ng/L	03/30/2021 1434

Surrogate	Q	% Rec	Acceptance Limit
13C2_4:2FTS		136	50-150
13C2_6:2FTS		122	50-150
13C2_8:2FTS		119	50-150
13C2_PFDoA		104	50-150
13C2_PFTeDA		101	50-150
13C3_PFBS		97	50-150
13C3_PFHxS		106	50-150
13C4_PFBA		115	50-150
13C4_PFHpA		115	50-150
13C5_PFHxA		114	50-150
13C5_PFPeA		115	50-150
13C6_PFDA		111	50-150
13C7_PFUdA		106	50-150
13C8_PFOA		118	50-150

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

SPLP PFAS (Australian) - MB

Sample ID: WQ87155-001
Batch: 87155
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Solid
Prep Method: AS4439.3/PFAS
Prep Date: 03/29/2021 1117 Leachate Date: 03/24/2021 0231

Surrogate	Q	% Rec	Acceptance Limit
13C8_PFOS		105	50-150
13C8_PFOSA		110	50-150
13C9_PFNA		108	50-150
d5-EtFOSAA		109	50-150
d-MeFOSA		87	50-150
d3-MeFOSAA		114	50-150

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

SPLP PFAS (Australian) - LCS

Sample ID: WQ87155-002
Batch: 87155
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Solid
Prep Method: AS4439.3/PFAS
Prep Date: 03/29/2021 1117 Leachate Date: 03/24/2021 0231

Parameter	Spike Amount (ng/L)	Result (ng/L)	Q	Dil	% Rec	%Rec Limit	Analysis Date
8:2 FTS	150	170		1	109	67-138	03/30/2021 1456
6:2 FTS	150	210	N	1	141	64-140	03/30/2021 1456
4:2 FTS	150	140		1	96	63-143	03/30/2021 1456
EtFOSAA	160	140		1	90	61-135	03/30/2021 1456
MeFOSA	160	140		1	88	68-141	03/30/2021 1456
MeFOSAA	160	160		1	97	65-136	03/30/2021 1456
PFBS	140	140		1	100	72-130	03/30/2021 1456
PFDS	150	130		1	83	53-142	03/30/2021 1456
PFHpS	150	140		1	91	69-134	03/30/2021 1456
PFNS	150	150		1	95	69-127	03/30/2021 1456
PFOSA	160	150		1	92	67-137	03/30/2021 1456
PFPeS	150	160		1	103	71-127	03/30/2021 1456
PFHxS	150	150		1	101	68-131	03/30/2021 1456
PFBA	160	150		1	94	73-129	03/30/2021 1456
PFDA	160	150		1	93	71-129	03/30/2021 1456
PFDoA	160	150		1	96	72-134	03/30/2021 1456
PFHpA	160	150		1	91	72-130	03/30/2021 1456
PFHxA	160	150		1	92	72-129	03/30/2021 1456
PFNA	160	150		1	94	69-130	03/30/2021 1456
PFOA	160	160		1	99	71-133	03/30/2021 1456
PFPeA	160	150		1	93	72-129	03/30/2021 1456
PFTeDA	160	150		1	95	71-132	03/30/2021 1456
PFTrDA	160	160		1	97	65-144	03/30/2021 1456
PFUdA	160	150		1	96	69-133	03/30/2021 1456
PFOS	150	150		1	101	65-140	03/30/2021 1456

Surrogate	Q	% Rec	Acceptance Limit
13C2_4:2FTS		115	50-150
13C2_6:2FTS		103	50-150
13C2_8:2FTS		100	50-150
13C2_PFDoA		104	50-150
13C2_PFTeDA		96	50-150
13C3_PFBS		93	50-150
13C3_PFHxS		106	50-150
13C4_PFBA		113	50-150
13C4_PFHpA		112	50-150
13C5_PFHxA		109	50-150
13C5_PFPeA		107	50-150
13C6_PFDA		106	50-150
13C7_PFUdA		105	50-150
13C8_PFOA		113	50-150

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection
U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

SPLP PFAS (Australian) - LCS

Sample ID: WQ87155-002
Batch: 87155
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Solid
Prep Method: AS4439.3/PFAS
Prep Date: 03/29/2021 1117 Leachate Date: 03/24/2021 0231

Surrogate	Q	% Rec	Acceptance Limit
13C8_PFOS		98	50-150
13C8_PFOSA		109	50-150
13C9_PFNA		108	50-150
d5-EtFOSAA		94	50-150
d-MeFOSA		77	50-150
d3-MeFOSAA		102	50-150

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

SPLP PFAS (Australian) - MS

Sample ID: WC15028-001MS
Batch: 87155
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Solid
Prep Method: AS4439.3/PFAS
Prep Date: 03/29/2021 1117 Leachate Date: 03/24/2021 0231

Parameter	Sample Amount (ng/L)	Spike Amount (ng/L)	Result (ng/L)	Q	Dil	% Rec	%Rec Limit	Analysis Date
8:2 FTS	51	150	230		1	115	67-138	03/30/2021 1517
6:2 FTS	420	150	650	N	1	155	64-140	03/30/2021 1517
4:2 FTS	ND	150	140		1	92	63-143	03/30/2021 1517
EtFOSAA	ND	160	160		1	98	61-135	03/30/2021 1517
MeFOSA	ND	160	170		1	105	68-141	03/30/2021 1517
MeFOSAA	ND	160	150		1	91	65-136	03/30/2021 1517
PFBS	ND	140	170		1	117	72-130	03/30/2021 1517
PFDS	ND	150	130		1	86	53-142	03/30/2021 1517
PFHpS	ND	150	160		1	102	69-134	03/30/2021 1517
PFNS	ND	150	140		1	94	69-127	03/30/2021 1517
PFOSA	ND	160	160		1	100	67-137	03/30/2021 1517
PFPeS	ND	150	170		1	113	71-127	03/30/2021 1517
PFHxS	78	150	230		1	103	68-131	03/30/2021 1517
PFBA	ND	160	160		1	100	73-129	03/30/2021 1517
PFDA	ND	160	170		1	107	71-129	03/30/2021 1517
PFDoA	ND	160	160		1	99	72-134	03/30/2021 1517
PFHpA	ND	160	150		1	95	72-130	03/30/2021 1517
PFHxA	23	160	170		1	94	72-129	03/30/2021 1517
PFNA	ND	160	150		1	92	69-130	03/30/2021 1517
PFOA	16	160	150		1	86	71-133	03/30/2021 1517
PFPeA	13	160	160		1	95	72-129	03/30/2021 1517
PFTeDA	ND	160	150		1	92	71-132	03/30/2021 1517
PFTrDA	ND	160	160		1	101	65-144	03/30/2021 1517
PFUdA	ND	160	150		1	96	69-133	03/30/2021 1517
PFOS	700	150	820		1	79	65-140	03/30/2021 1517

Surrogate	Q	% Rec	Acceptance Limit
13C2_4:2FTS		113	50-150
13C2_6:2FTS		103	50-150
13C2_8:2FTS		101	50-150
13C2_PFDoA		96	50-150
13C2_PFTeDA		93	50-150
13C3_PFBS		88	50-150
13C3_PFHxS		100	50-150
13C4_PFBA		106	50-150
13C4_PFHpA		109	50-150
13C5_PFHxA		109	50-150
13C5_PFPeA		106	50-150
13C6_PFDA		98	50-150
13C7_PFUdA		97	50-150
13C8_PFOA		115	50-150

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

SPLP PFAS (Australian) - MS

Sample ID: WC15028-001MS
Batch: 87155
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Solid
Prep Method: AS4439.3/PFAS
Prep Date: 03/29/2021 1117 Leachate Date: 03/24/2021 0231

Surrogate	Q	% Rec	Acceptance Limit
13C8_PFOS		100	50-150
13C8_PFOSA		103	50-150
13C9_PFNA		107	50-150
d5-EtFOSAA		93	50-150
d-MeFOSA		85	50-150
d3-MeFOSAA		99	50-150

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

SPLP PFAS (Australian) - MSD

Sample ID: WC15028-001MD
Batch: 87155
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Solid
Prep Method: AS4439.3/PFAS
Prep Date: 03/29/2021 1117 Leachate Date: 03/24/2021 0231

Parameter	Sample Amount (ng/L)	Spike Amount (ng/L)	Result (ng/L)	Q	Dil	% Rec	% RPD	%Rec Limit	% RPD Limit	Analysis Date
8:2 FTS	51	150	200		1	97	12	67-138	30	03/30/2021 1528
6:2 FTS	420	150	570		1	101	13	64-140	30	03/30/2021 1528
4:2 FTS	ND	150	160		1	106	14	63-143	30	03/30/2021 1528
EtFOSAA	ND	160	150		1	91	8.0	61-135	30	03/30/2021 1528
MeFOSA	ND	160	160		1	97	8.3	68-141	30	03/30/2021 1528
MeFOSAA	ND	160	150		1	95	4.9	65-136	30	03/30/2021 1528
PFBS	ND	140	170		1	118	0.34	72-130	30	03/30/2021 1528
PFDS	ND	150	150		1	94	8.8	53-142	30	03/30/2021 1528
PFHpS	ND	150	150		1	98	4.0	69-134	30	03/30/2021 1528
PFNS	ND	150	160		1	106	12	69-127	30	03/30/2021 1528
PFOSA	ND	160	150		1	95	5.2	67-137	30	03/30/2021 1528
PFPeS	ND	150	180		1	120	6.1	71-127	30	03/30/2021 1528
PFHxS	78	150	220		1	96	4.1	68-131	30	03/30/2021 1528
PFBA	ND	160	150		1	95	5.5	73-129	30	03/30/2021 1528
PFDA	ND	160	150		1	97	9.8	71-129	30	03/30/2021 1528
PFDoA	ND	160	160		1	97	1.8	72-134	30	03/30/2021 1528
PFHpA	ND	160	150		1	91	4.5	72-130	30	03/30/2021 1528
PFHxA	23	160	170		1	91	2.9	72-129	30	03/30/2021 1528
PFNA	ND	160	150		1	96	3.8	69-130	30	03/30/2021 1528
PFOA	16	160	160		1	91	4.9	71-133	30	03/30/2021 1528
PFPeA	13	160	150		1	88	6.6	72-129	30	03/30/2021 1528
PFTeDA	ND	160	160		1	97	5.9	71-132	30	03/30/2021 1528
PFTrDA	ND	160	150		1	95	6.0	65-144	30	03/30/2021 1528
PFUdA	ND	160	150		1	91	5.8	69-133	30	03/30/2021 1528
PFOS	700	150	800		1	65	2.5	65-140	30	03/30/2021 1528

Surrogate	Q	% Rec	Acceptance Limit
13C2_4:2FTS		109	50-150
13C2_6:2FTS		114	50-150
13C2_8:2FTS		102	50-150
13C2_PFDoA		100	50-150
13C2_PFTeDA		91	50-150
13C3_PFBS		88	50-150
13C3_PFHxS		102	50-150
13C4_PFBA		111	50-150
13C4_PFHpA		111	50-150
13C5_PFHxA		108	50-150
13C5_PFPeA		104	50-150
13C6_PFDA		99	50-150
13C7_PFUdA		99	50-150
13C8_PFOA		114	50-150

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection
U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

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SPLP PFAS (Australian) - MSD

Sample ID: WC15028-001MD
Batch: 87155
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Solid
Prep Method: AS4439.3/PFAS
Prep Date: 03/29/2021 1117 Leachate Date: 03/24/2021 0231

Surrogate	Q	% Rec	Acceptance Limit
13C8_PFOS		98	50-150
13C8_PFOSA		103	50-150
13C9_PFNA		101	50-150
d5-EtFOSAA		94	50-150
d-MeFOSA		83	50-150
d3-MeFOSAA		103	50-150

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

SPLP PFAS (Australian) - MB

Sample ID: WQ87560-001
Batch: 87560
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Solid
Prep Method: AS4439.3/PFAS
Prep Date: 04/01/2021 1054 Leachate Date: 03/24/2021 0231

Parameter	Result	Q	Dil	LOQ	LOD	DL	Units	Analysis Date
6:2 FTS	40	U	1	80	40	20	ng/L	04/02/2021 1535

Surrogate	Q	% Rec	Acceptance Limit
13C2_4:2FTS		114	50-150
13C2_6:2FTS		114	50-150
13C2_8:2FTS		103	50-150
13C2_PFDoA		99	50-150
13C2_PFTeDA		106	50-150
13C3_PFBS		91	50-150
13C3_PFHxS		109	50-150
13C4_PFBA		117	50-150
13C4_PFHpA		117	50-150
13C5_PFHxA		111	50-150
13C5_PFPeA		110	50-150
13C6_PFDA		107	50-150
13C7_PFUdA		109	50-150
13C8_PFOA		120	50-150
13C8_PFOS		99	50-150
13C8_PFOSA		111	50-150
13C9_PFNA		116	50-150
d5-EtFOSAA		106	50-150
d-MeFOSA		105	50-150
d3-MeFOSAA		102	50-150

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

SPLP PFAS (Australian) - LCS

Sample ID: WQ87560-002
Batch: 87560
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Solid
Prep Method: AS4439.3/PFAS
Prep Date: 04/01/2021 1054 Leachate Date: 03/24/2021 0231

Parameter	Spike Amount (ng/L)	Result (ng/L)	Q	Dil	% Rec	%Rec Limit	Analysis Date
6:2 FTS	150	190		1	124	64-140	04/02/2021 1546

Surrogate	Q	% Rec	Acceptance Limit
13C2_4:2FTS		106	50-150
13C2_6:2FTS		112	50-150
13C2_8:2FTS		95	50-150
13C2_PFDoA		98	50-150
13C2_PFTeDA		100	50-150
13C3_PFBS		90	50-150
13C3_PFHxS		112	50-150
13C4_PFBA		104	50-150
13C4_PFHpA		108	50-150
13C5_PFHxA		101	50-150
13C5_PFPeA		104	50-150
13C6_PFDA		102	50-150
13C7_PFUdA		98	50-150
13C8_PFOA		106	50-150
13C8_PFOS		99	50-150
13C8_PFOSA		101	50-150
13C9_PFNA		106	50-150
d5-EtFOSAA		94	50-150
d-MeFOSA		80	50-150
d3-MeFOSAA		101	50-150

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

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SPLP PFAS (Australian) - MS

Sample ID: WC15028-006MS
Batch: 87560
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Solid
Prep Method: AS4439.3/PFAS
Prep Date: 04/01/2021 1054 Leachate Date: 03/24/2021 0231

Parameter	Sample Amount (ng/L)	Spike Amount (ng/L)	Result (ng/L)	Q	Dil	% Rec	%Rec Limit	Analysis Date
6:2 FTS	82	150	210		1	87	64-140	04/02/2021 1700

Surrogate	Q	% Rec	Acceptance Limit
13C2_4:2FTS		111	50-150
13C2_6:2FTS		109	50-150
13C2_8:2FTS		92	50-150
13C2_PFDoA		106	50-150
13C2_PFTeDA		109	50-150
13C3_PFBS		94	50-150
13C3_PFHxS		113	50-150
13C4_PFBA		110	50-150
13C4_PFHpA		115	50-150
13C5_PFHxA		109	50-150
13C5_PFPeA		112	50-150
13C6_PFDA		115	50-150
13C7_PFUdA		106	50-150
13C8_PFOA		118	50-150
13C8_PFOS		107	50-150
13C8_PFOSA		110	50-150
13C9_PFNA		120	50-150
d5-EtFOSAA		111	50-150
d-MeFOSA		97	50-150
d3-MeFOSAA		107	50-150

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

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SPLP PFAS (Australian) - MSD

Sample ID: WC15028-006MD
Batch: 87560
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Solid
Prep Method: AS4439.3/PFAS
Prep Date: 04/01/2021 1054 Leachate Date: 03/24/2021 0231

Parameter	Sample Amount (ng/L)	Spike Amount (ng/L)	Result (ng/L)	Q	Dil	% Rec	% RPD	%Rec Limit	% RPD Limit	Analysis Date
6:2 FTS	82	150	200		1	79	6.2	64-140	30	04/02/2021 1711

Surrogate	Q	% Rec	Acceptance Limit
13C2_4:2FTS		111	50-150
13C2_6:2FTS		113	50-150
13C2_8:2FTS		101	50-150
13C2_PFDoA		108	50-150
13C2_PFTeDA		106	50-150
13C3_PFBS		96	50-150
13C3_PFHxS		118	50-150
13C4_PFBA		111	50-150
13C4_PFHpA		121	50-150
13C5_PFHxA		109	50-150
13C5_PFPeA		112	50-150
13C6_PFDA		109	50-150
13C7_PFUdA		113	50-150
13C8_PFOA		111	50-150
13C8_PFOS		103	50-150
13C8_PFOSA		109	50-150
13C9_PFNA		118	50-150
d5-EtFOSAA		105	50-150
d-MeFOSA		79	50-150
d3-MeFOSAA		107	50-150

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
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Note: Calculations are performed before rounding to avoid round-off errors in calculated results

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Chain of Custody

and

Miscellaneous Documents

Shealy Environmental Services, Inc.
106 Vantage Point Drive
West Columbia, South Carolina 29172
Telephone No. (803) 791-9700 Fax No. (803) 791-9111
www.shealylab.com

Chain of Custody Record

Number

Report to Contact: Colin Morrell	Telephone No. / E-mail: 902.209.3476 / colin@cleanearthtechnologies.ca
Sampler's Signature: x Colin Morrell	Quote No.: Mike MacFadden
Printed Name	Page: 1 of 1
State: Zip Code:	Analysis (Attach list if more space is needed): PFAS DoD QSM 5.3 ELAP Table B-15 cmpds and ASLP

WC15028 MKM

WC15026 MKM

Project Number: 00-EI	P.O No.			Matrix			No of Containers by Preservative Type								
Sample ID / Description (Containers for each sample may be combined on one line)	Date	Time	G=Grab C=Composite	Aqueous	Solid	Non-Aqueous	Unpres.	H2SO4	HNO3	HCl	NaOH	5035 Kit	Total PFAS	ASLP	Remarks / Cooler I.D.
SC-DIHHSRT1	Mar 12 /21		C		x								x	x	PFAS
SC-DIHHSSUR240TCRT1	Mar 12 /21		C		x								x	x	PFAS
SC-DIHHS5050RT1	Mar 12 /21		C		x								x	x	PFAS
SCDIHHSSUR340	Mar 12 /21		C		x									x	PFAS
S-DIHHSSUR240TC	Mar 12 /21		C		x								x	x	PFAS
S-HSSUR140TC	Mar 12 /21		C		x								x	x	PFAS

Turn Around Time Required (Prior lab approval required for expedited TAT): ☐ Standard ☒ Rush (Please Specify) 1 week total 2 week ASLP

Sample Disposal: ☐ Return to Client ☑ Disposal by Lab

Possible Hazard Identification (List any known hazards in the remarks): ☐ Non-Hazardous ☐ Flammable ☐ Skin Irritant ☐ SDS provided ☐ Unknown

QC Requirements

	Date	Time
1. Relinquished by: Colin Morrell	Mar 12/21	
2. Relinquished by:		
3. Relinquished by:		
4. Relinquished by: Fedex	3/15/21	950

	Date	Time
1. Received by		
2. Received by		
3. Received by		
4. Laboratory Received by: Amy Hardwick	3/15/21	950

LAB USE ONLY — Received on Ice (Check): ☑ Y ☐ N ☐ Ice Pack — Receipt Temp. 16.6°C

Note: All samples are retained for four weeks from receipt unless other arrangements are made.

Document Number: ME002OW-01

FW: Arcadis COC

Marcia McGinnity <Marcia.McGinnity@pacelabs.com>
Mon 3/15/2021 11:57 AM
To: WCOLSR Group <WCOLSRGroup@pacelabs.com>

Client has requested that we proceed and analyze the Arcadis Eielson AFB samples received at 16.6°C. Please print this e-mail and add to the COC documentation. Thanks - Marcia

[redacted]

Marcia K. McGinnity
Project Manager II | Pace South Carolina
formerly Shealy Environmental Services, Inc.
106 Vantage Point Drive, West Columbia, SC 29172
direct: 803.227.2704 | main: 803.791.9700 | mobile: 615.414.9969 | pacelabs.com

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From: Quinnan, Joseph <Joseph.Quinnan@arcadis.com>
Sent: Monday, March 15, 2021 11:43 AM
To: Marcia McGinnity <Marcia.McGinnity@pacelabs.com>; Colin <colin@cleanearthtechnologies.ca>
Cc: Mike McFadden <Mike.McFadden@pacelabs.com>
Subject: RE: Arcadis COC

CAUTION: This email originated from outside Pace Analytical. Do not click links or open attachments unless you recognize the sender and know the content is safe.
Please proceed and analyze. Thanks Marcia.

From: Marcia McGinnity <Marcia.McGinnity@pacelabs.com>
Sent: Monday, March 15, 2021 11:38 AM
To: Colin <colin@cleanearthtechnologies.ca>
Cc: Quinnan, Joseph <Joseph.Quinnan@arcadis.com>; Mike McFadden <Mike.McFadden@pacelabs.com>
Subject: FW: Arcadis COC

Colin - samples on the attached COC were received today instead of Saturday. Temperature was 16.6°C - how would you like us to proceed? Marcia

[redacted]

Marcia K. McGinnity
Project Manager II | Pace South Carolina
formerly Shealy Environmental Services, Inc.
106 Vantage Point Drive, West Columbia, SC 29172
direct: 803.227.2704 | main: 803.791.9700 | mobile: 615.414.9969 | pacelabs.com



From: Kevin Chavis <Kevin.Chavis@pacelabs.com>
Sent: Monday, March 15, 2021 10:45 AM
To: Marcia McGinnity <Marcia.McGinnity@pacelabs.com>
Subject: Arcadis COC

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Pace Analytical

Samples Receipt Checklist (SRC) (ME0018C-15)
Issuing Authority: Pace ENV - WCOL

Revised:9/29/2020
Page 1 of 1

Sample Receipt Checklist (SRC)

Client: Arcadis Cooler Inspected by/date: JRG2 / 03/15/2021 Lot #: WC15026 WC15028

Means of receipt: ☐ Pace ☐ Client ☐ UPS ☑ FedEx ☐ Other: _____

☐ Yes	☑ No		1. Were custody seals present on the cooler?
☐ Yes	☐ No	☑ NA	2. If custody seals were present, were they intact and unbroken?

pH Strip ID: NA Chlorine Strip ID: NA Tested by: NA

Original temperature upon receipt / Derived (Corrected) temperature upon receipt %Solid Snap-Cup ID: 21-443

16.6 / 16.6 °C NA / NA °C NA / NA °C NA / NA °C

Method: ☐ Temperature Blank ☑ Against Bottles IR Gun ID: 6 IR Gun Correction Factor: 0 °C

Method of coolant: ☑ Wet Ice ☐ Ice Packs ☐ Dry Ice ☐ None

☑ Yes	☐ No	☐ NA	3. If temperature of any cooler exceeded 6.0°C, was Project Manager Notified? PM was Notified by: phone (email) face-to-face (circle one).
☑ Yes	☐ No	☐ NA	4. Is the commercial courier's packing slip attached to this form?
☑ Yes	☐ No		5. Were proper custody procedures (relinquished/received) followed?
☑ Yes	☐ No		6. Were sample IDs listed on the COC?
☑ Yes	☐ No		7. Were sample IDs listed on all sample containers?
☐ Yes	☑ No		8. Was collection date & time listed on the COC?
☐ Yes	☑ No		9. Was collection date & time listed on all sample containers?
☑ Yes	☐ No		10. Did all container label information (ID, date, time) agree with the COC?
☑ Yes	☐ No		11. Were tests to be performed listed on the COC?
☑ Yes	☐ No		12. Did all samples arrive in the proper containers for each test and/or in good condition (unbroken, lids on, etc.)?
☑ Yes	☐ No		13. Was adequate sample volume available?
☑ Yes	☐ No		14. Were all samples received within ½ the holding time or 48 hours, whichever comes first?
☐ Yes	☑ No		15. Were any samples containers missing/excess (circle one) samples Not listed on COC?
☐ Yes	☐ No	☑ NA	16. For VOA and RSK-175 samples, were bubbles present >"pea-size" (¼"or 6mm in diameter) in any of the VOA vials?
☐ Yes	☐ No	☑ NA	17. Were all DRO/metals/nutrient samples received at a pH of < 2?
☐ Yes	☐ No	☑ NA	18. Were all cyanide samples received at a pH > 12 and sulfide samples received at a pH > 9?
☐ Yes	☐ No	☑ NA	19. Were all applicable NH_3/TKN/cyanide/phenol/625.1/608.3 (< 0.5mg/L) samples free of residual chlorine?
☐ Yes	☐ No	☑ NA	20. Were client remarks/requests (i.e. requested dilutions, MS/MSD designations, etc…) correctly transcribed from the COC into the comment section in LIMS?
☐ Yes	☑ No		21. Was the quote number listed on the container label? If yes, Quote #

Sample Preservation (Must be completed for any sample(s) incorrectly preserved or with headspace.)

Sample(s) NA were received incorrectly preserved and were adjusted accordingly in sample receiving with NA mL of circle one: H2SO4, HNO3, HCl, NaOH using SR # NA. Time of preservation NA. If more than one preservative is needed, please note in the comments below.

Sample(s) NA were received with bubbles >6 mm in diameter.

Samples(s) NA were received with TRC > 0.5 mg/L (If #19 is *no*) and were adjusted accordingly in sample receiving with sodium thiosulfate ($Na_2S_2O_3$) with Shealy ID: NA.

SR barcode labels applied by: JRG2 Date: 03/15/2021

Comments: Ice was melted

No times on COC or containers

Report of Analysis

Arcadis U.S., Inc.
630 Plaza Drive
Suite 600
Highlands Ranch, CO 80129
Attention: Colin Morrell

Project Name: Eielson AFB

Project Number: 30030317

Lot Number:**WD07012**

Date Completed:04/14/2021

Project Manager:**none**

04/14/2021 9:46 AM
Approved and released by:
Project Manager II: **Kathy E. Smith**

The electronic signature above is the equivalent of a handwritten signature.
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106 Vantage Point Drive West Columbia, SC 29172
Tel: 803-791-9700 Fax: 803-791-9111 www.pacelabs.com

Case Narrative
Arcadis U.S., Inc.
Lot Number: WD07012

This Report of Analysis contains the analytical result(s) for the sample(s) listed on the Sample Summary following this Case Narrative. The sample receiving date is documented in the header information associated with each sample.

All results listed in this report relate only to the samples that are contained within this report.

Sample receipt, sample analysis, and data review have been performed in accordance with the Pace Quality Assurance Management Plan (QAMP), applicable Shealy standard operating procedures (SOPs), the 2003 NELAC standard, and Shealy policies. Additionally, the DoD QSM version 5.3 has been followed for these samples, and specifically Table B-15 was followed for all PFAS samples. Any exceptions to the QAMP, SOPs, NELAC standards, the DoD QSM, or policies are qualified on the results page or discussed below.

Correction factors (CF) are used to calculate the original sample concentration. The CF is the inverse of the concentration factor (sample volume / extract final volume) times the dilution factor (DF). For undiluted analysis. The extract is prepared for injection by adding 182 uL of sample extract + 8 uL of reagent water + 10 uL of internal standard solution to a polypropylene autosampler vial. An extra correction factor of 0.91 (182 uL / 200 uL = 0.91) applies. The CF is calculated as follows:

For solid samples:

CF = DF * FV / Ws/S/1000

FV is volume of extract (mL)
Ws is initial sample weight (gram)
S is %Solids
DF is dilution factor. For undiluted analysis, DF = 1/0.91.

Concentration (ug/kg) = Cs*CF,

$$C_s = \frac{\left(\frac{(A_s x C_{is})}{A_{is}}\right) - B}{M1}$$

Where

C_s is on column concentration of target analyte in the sample (ng/L)
C_{is} is concentration of internal standard in the sample (ng/L)
A_s is peak response of target analyte in the sample
A_{is} is peak response of internal standard in the sample
M1 is the average RF from ICAL or the slope from linear regression ICAL
B is the y-intercept from the ICAL

Sample Summary
Arcadis U.S., Inc.
Lot Number: WD07012

Sample Number	Sample ID	Matrix	Date Sampled	Date Received
001	SCDIHHSSUR23ILIM	Solid	04/05/2021	04/07/2021
002	SCDIHHSUR23	Solid	04/05/2021	04/07/2021
003	SCDIHHSSUR23RT1	Solid	04/05/2021	04/07/2021

(3 samples)

Detection Summary

Arcadis U.S., Inc.

Lot Number: WD07012

Sample	Sample ID	Matrix	Parameter	Method	Result	Q	Units	Page
001	SCDIHHSSUR23ILIM	Solid	6:2 FTS	PFAS by ID	1.5	J	ug/kg	5
001	SCDIHHSSUR23ILIM	Solid	PFHxS	PFAS by ID	0.23	J	ug/kg	5
001	SCDIHHSSUR23ILIM	Solid	PFOS	PFAS by ID	2.0		ug/kg	5
002	SCDIHHSUR23	Solid	8:2 FTS	PFAS by ID	1.3	J	ug/kg	7
002	SCDIHHSUR23	Solid	6:2 FTS	PFAS by ID	4.8	S	ug/kg	7
002	SCDIHHSUR23	Solid	PFOSA	PFAS by ID	1.5		ug/kg	7
002	SCDIHHSUR23	Solid	PFHxS	PFAS by ID	0.76	J	ug/kg	7
002	SCDIHHSUR23	Solid	PFOS	PFAS by ID	5.6	S	ug/kg	7
003	SCDIHHSSUR23RT1	Solid	PFOS	PFAS by ID	0.34	J	ug/kg	9

(9 detections)

PFAS by LC/MS/MS

Client: **Arcadis U.S., Inc.** Laboratory ID: **WD07012-001**

Description: **SCDIHHSSUR23ILIM** Matrix: **Solid**

Date Sampled: **04/05/2021** % Solids: **74.3** **04/08/2021 0019**

Date Received: **04/07/2021**

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch
1	SOP SPE	PFAS by ID SOP QSM B-15	1	04/09/2021 2115	JJG	04/08/2021 1123	88361

Parameter	CAS Number	Analytical Method	Result	Q	LOQ	LOD	DL	Units	Run
1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS)	39108-34-4	PFAS by ID SOP	1.2	U	2.3	1.2	0.57	ug/kg	1
1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS)	**27619-97-2**	**PFAS by ID SOP**	**1.5**	**J**	**2.3**	1.2	**0.57**	**ug/kg**	**1**
1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS)	757124-72-4	PFAS by ID SOP	1.2	U	2.3	1.2	0.57	ug/kg	1
N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA)	2991-50-6	PFAS by ID SOP	1.2	U	2.3	1.2	0.57	ug/kg	1
N-methylperfluoro-1-octanesulfonamide (MeFOSA)	31506-32-8	PFAS by ID SOP	1.2	U	2.3	1.2	0.57	ug/kg	1
N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA)	2355-31-9	PFAS by ID SOP	1.2	U	2.3	1.2	0.57	ug/kg	1
Perfluoro-1-butanesulfonic acid (PFBS)	375-73-5	PFAS by ID SOP	0.55	U	1.1	0.55	0.23	ug/kg	1
Perfluoro-1-decanesulfonic acid (PFDS)	335-77-3	PFAS by ID SOP	0.55	U	1.1	0.55	0.23	ug/kg	1
Perfluoro-1-heptanesulfonic acid (PFHpS)	375-92-8	PFAS by ID SOP	0.55	U	1.1	0.55	0.23	ug/kg	1
Perfluoro-1-nonanesulfonic acid (PFNS)	68259-12-1	PFAS by ID SOP	0.55	U	1.1	0.55	0.23	ug/kg	1
Perfluoro-1-octanesulfonamide (PFOSA)	754-91-6	PFAS by ID SOP	0.55	U	1.1	0.55	0.23	ug/kg	1
Perfluoro-1-pentanesulfonic acid (PFPeS)	2706-91-4	PFAS by ID SOP	0.55	U	1.1	0.55	0.23	ug/kg	1
Perfluorohexanesulfonic acid (PFHxS)	**355-46-4**	**PFAS by ID SOP**	**0.23**	**J**	**1.1**	0.55	**0.23**	**ug/kg**	**1**
Perfluoro-n-butanoic acid (PFBA)	375-22-4	PFAS by ID SOP	0.55	U	1.1	0.55	0.23	ug/kg	1
Perfluoro-n-decanoic acid (PFDA)	335-76-2	PFAS by ID SOP	0.55	U	1.1	0.55	0.23	ug/kg	1
Perfluoro-n-dodecanoic acid (PFDoA)	307-55-1	PFAS by ID SOP	0.55	U	1.1	0.55	0.23	ug/kg	1
Perfluoro-n-heptanoic acid (PFHpA)	375-85-9	PFAS by ID SOP	0.55	U	1.1	0.55	0.23	ug/kg	1
Perfluoro-n-hexanoic acid (PFHxA)	307-24-4	PFAS by ID SOP	0.55	U	1.1	0.55	0.23	ug/kg	1
Perfluoro-n-nonanoic acid (PFNA)	375-95-1	PFAS by ID SOP	0.55	U	1.1	0.55	0.23	ug/kg	1
Perfluoro-n-octanoic acid (PFOA)	335-67-1	PFAS by ID SOP	0.55	U	1.1	0.55	0.23	ug/kg	1
Perfluoro-n-pentanoic acid (PFPeA)	2706-90-3	PFAS by ID SOP	0.55	U	1.1	0.55	0.23	ug/kg	1
Perfluoro-n-tetradecanoic acid (PFTeDA)	376-06-7	PFAS by ID SOP	0.55	U	1.1	0.55	0.23	ug/kg	1
Perfluoro-n-tridecanoic acid (PFTrDA)	72629-94-8	PFAS by ID SOP	0.55	U	1.1	0.55	0.23	ug/kg	1
Perfluoro-n-undecanoic acid (PFUdA)	2058-94-8	PFAS by ID SOP	0.55	U	1.1	0.55	0.23	ug/kg	1
Perfluorooctanesulfonic acid (PFOS)	**1763-23-1**	**PFAS by ID SOP**	**2.0**		**1.1**	0.55	**0.23**	**ug/kg**	**1**

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
13C2_4:2FTS		89	50-150
13C2_6:2FTS		87	50-150
13C2_8:2FTS		83	50-150
13C2_PFDoA		81	50-150
13C2_PFTeDA		82	50-150
13C3_PFBS		76	50-150
13C3_PFHxS		90	50-150
13C4_PFBA		90	50-150
13C4_PFHpA		93	50-150
13C5_PFHxA		92	50-150
13C5_PFPeA		88	50-150
13C6_PFDA		92	50-150
13C7_PFUdA		84	50-150
13C8_PFOA		88	50-150
13C8_PFOS		91	50-150
13C8_PFOSA		86	50-150
13C9_PFNA		92	50-150

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

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PFAS by LC/MS/MS

Client: **Arcadis U.S., Inc.**
Laboratory ID: **WD07012-001**
Description: **SCDIHHSSUR23ILIM**
Matrix: **Solid**
Date Sampled: **04/05/2021**
% Solids: **74.3** **04/08/2021 0019**
Date Received: **04/07/2021**

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
d5-EtFOSAA		88	50-150
d-MeFOSA		53	50-150
d3-MeFOSAA		96	50-150

LOQ = Limit of Quantitation	B = Detected in the method blank	E = Quantitation of compound exceeded the calibration range	DL = Detection Limit	Q = Surrogate failure
U = Not detected at or above the LOQ	N = Recovery is out of criteria	P = The RPD between two GC columns exceeds 40%	J = Estimated result < LOQ and ≥ DL	L = LCS/LCSD failure
H = Out of holding time	W = Reported on wet weight basis	LOD = Limit of Detection		S = MS/MSD failure

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PFAS by LC/MS/MS

Client: **Arcadis U.S., Inc.** Laboratory ID: **WD07012-002**

Description: **SCDIHHSUR23** Matrix: **Solid**

Date Sampled: **04/05/2021** % Solids: **72.0** **04/08/2021 0019**

Date Received: **04/07/2021**

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch
2	SOP SPE	PFAS by ID SOP QSM B-15	1	04/13/2021 1522	MMM	04/12/2021 1154	88717

Parameter	CAS Number	Analytical Method	Result	Q	LOQ	LOD	DL	Units	Run
1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS)	**39108-34-4**	**PFAS by ID SOP**	**1.3**	**J**	**2.7**	1.4	**0.67**	**ug/kg**	**2**
1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS)	**27619-97-2**	**PFAS by ID SOP**	**4.8**	**S**	**2.7**	1.4	**0.67**	**ug/kg**	**2**
1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS)	757124-72-4	PFAS by ID SOP	1.4	U	2.7	1.4	0.67	ug/kg	2
N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA)	2991-50-6	PFAS by ID SOP	1.4	U	2.7	1.4	0.67	ug/kg	2
N-methylperfluoro-1-octanesulfonamide (MeFOSA)	31506-32-8	PFAS by ID SOP	1.4	U	2.7	1.4	0.67	ug/kg	2
N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA)	2355-31-9	PFAS by ID SOP	1.4	U	2.7	1.4	0.67	ug/kg	2
Perfluoro-1-butanesulfonic acid (PFBS)	375-73-5	PFAS by ID SOP	0.65	U	1.3	0.65	0.27	ug/kg	2
Perfluoro-1-decanesulfonic acid (PFDS)	335-77-3	PFAS by ID SOP	0.65	U	1.3	0.65	0.27	ug/kg	2
Perfluoro-1-heptanesulfonic acid (PFHpS)	375-92-8	PFAS by ID SOP	0.65	U	1.3	0.65	0.27	ug/kg	2
Perfluoro-1-nonanesulfonic acid (PFNS)	68259-12-1	PFAS by ID SOP	0.65	U	1.3	0.65	0.27	ug/kg	2
Perfluoro-1-octanesulfonamide (PFOSA)	**754-91-6**	**PFAS by ID SOP**	**1.5**		**1.3**	0.65	**0.27**	**ug/kg**	**2**
Perfluoro-1-pentanesulfonic acid (PFPeS)	2706-91-4	PFAS by ID SOP	0.65	U	1.3	0.65	0.27	ug/kg	2
Perfluorohexanesulfonic acid (PFHxS)	**355-46-4**	**PFAS by ID SOP**	**0.76**	**J**	**1.3**	0.65	**0.27**	**ug/kg**	**2**
Perfluoro-n-butanoic acid (PFBA)	375-22-4	PFAS by ID SOP	0.65	U	1.3	0.65	0.27	ug/kg	2
Perfluoro-n-decanoic acid (PFDA)	335-76-2	PFAS by ID SOP	0.65	U	1.3	0.65	0.27	ug/kg	2
Perfluoro-n-dodecanoic acid (PFDoA)	307-55-1	PFAS by ID SOP	0.65	U	1.3	0.65	0.27	ug/kg	2
Perfluoro-n-heptanoic acid (PFHpA)	375-85-9	PFAS by ID SOP	0.65	U	1.3	0.65	0.27	ug/kg	2
Perfluoro-n-hexanoic acid (PFHxA)	307-24-4	PFAS by ID SOP	0.65	U	1.3	0.65	0.27	ug/kg	2
Perfluoro-n-nonanoic acid (PFNA)	375-95-1	PFAS by ID SOP	0.65	U	1.3	0.65	0.27	ug/kg	2
Perfluoro-n-octanoic acid (PFOA)	335-67-1	PFAS by ID SOP	0.65	U	1.3	0.65	0.27	ug/kg	2
Perfluoro-n-pentanoic acid (PFPeA)	2706-90-3	PFAS by ID SOP	0.65	U	1.3	0.65	0.27	ug/kg	2
Perfluoro-n-tetradecanoic acid (PFTeDA)	376-06-7	PFAS by ID SOP	0.65	U	1.3	0.65	0.27	ug/kg	2
Perfluoro-n-tridecanoic acid (PFTrDA)	72629-94-8	PFAS by ID SOP	0.65	U	1.3	0.65	0.27	ug/kg	2
Perfluoro-n-undecanoic acid (PFUdA)	2058-94-8	PFAS by ID SOP	0.65	U	1.3	0.65	0.27	ug/kg	2
Perfluorooctanesulfonic acid (PFOS)	**1763-23-1**	**PFAS by ID SOP**	**5.6**	**S**	**1.3**	0.65	**0.27**	**ug/kg**	**2**

Surrogate	Q	Run 2 % Recovery	Acceptance Limits
13C2_4:2FTS		93	50-150
13C2_6:2FTS		93	50-150
13C2_8:2FTS		92	50-150
13C2_PFDoA		116	50-150
13C2_PFTeDA		88	50-150
13C3_PFBS		84	50-150
13C3_PFHxS		90	50-150
13C4_PFBA		98	50-150
13C4_PFHpA		100	50-150
13C5_PFHxA		98	50-150
13C5_PFPeA		94	50-150
13C6_PFDA		104	50-150
13C7_PFUdA		96	50-150
13C8_PFOA		114	50-150
13C8_PFOS		100	50-150
13C8_PFOSA		93	50-150
13C9_PFNA		101	50-150

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

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PFAS by LC/MS/MS

Client: **Arcadis U.S., Inc.**
Laboratory ID: **WD07012-002**
Description: **SCDIHHSUR23**
Matrix: **Solid**
Date Sampled: **04/05/2021**
% Solids: **72.0** **04/08/2021 0019**
Date Received: **04/07/2021**

Surrogate	Q	Run 2 % Recovery	Acceptance Limits
d5-EtFOSAA		131	50-150
d-MeFOSA		106	50-150
d3-MeFOSAA		65	50-150

LOQ = Limit of Quantitation	B = Detected in the method blank	E = Quantitation of compound exceeded the calibration range	DL = Detection Limit	Q = Surrogate failure
U = Not detected at or above the LOQ	N = Recovery is out of criteria	P = The RPD between two GC columns exceeds 40%	J = Estimated result < LOQ and ≥ DL	L = LCS/LCSD failure
H = Out of holding time	W = Reported on wet weight basis	LOD = Limit of Detection		S = MS/MSD failure

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PFAS by LC/MS/MS

Client: **Arcadis U.S., Inc.** Laboratory ID: **WD07012-003**

Description: **SCDIHHSSUR23RT1** Matrix: **Solid**

Date Sampled: **04/05/2021** % Solids: **75.1** **04/08/2021 0019**

Date Received: **04/07/2021**

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch
1	SOP SPE	PFAS by ID SOP QSM B-15	1	04/09/2021 2136	JJG	04/08/2021 1123	88361

Parameter	CAS Number	Analytical Method	Result	Q	LOQ	LOD	DL	Units	Run
1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS)	39108-34-4	PFAS by ID SOP	1.2	US	2.4	1.2	0.60	ug/kg	1
1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS)	27619-97-2	PFAS by ID SOP	1.2	U	2.4	1.2	0.60	ug/kg	1
1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS)	757124-72-4	PFAS by ID SOP	1.2	U	2.4	1.2	0.60	ug/kg	1
N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA)	2991-50-6	PFAS by ID SOP	1.2	U	2.4	1.2	0.60	ug/kg	1
N-methylperfluoro-1-octanesulfonamide (MeFOSA)	31506-32-8	PFAS by ID SOP	1.2	U	2.4	1.2	0.60	ug/kg	1
N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA)	2355-31-9	PFAS by ID SOP	1.2	U	2.4	1.2	0.60	ug/kg	1
Perfluoro-1-butanesulfonic acid (PFBS)	375-73-5	PFAS by ID SOP	0.60	U	1.2	0.60	0.24	ug/kg	1
Perfluoro-1-decanesulfonic acid (PFDS)	335-77-3	PFAS by ID SOP	0.60	U	1.2	0.60	0.24	ug/kg	1
Perfluoro-1-heptanesulfonic acid (PFHpS)	375-92-8	PFAS by ID SOP	0.60	U	1.2	0.60	0.24	ug/kg	1
Perfluoro-1-nonanesulfonic acid (PFNS)	68259-12-1	PFAS by ID SOP	0.60	U	1.2	0.60	0.24	ug/kg	1
Perfluoro-1-octanesulfonamide (PFOSA)	754-91-6	PFAS by ID SOP	0.60	U	1.2	0.60	0.24	ug/kg	1
Perfluoro-1-pentanesulfonic acid (PFPeS)	2706-91-4	PFAS by ID SOP	0.60	U	1.2	0.60	0.24	ug/kg	1
Perfluorohexanesulfonic acid (PFHxS)	355-46-4	PFAS by ID SOP	0.60	U	1.2	0.60	0.24	ug/kg	1
Perfluoro-n-butanoic acid (PFBA)	375-22-4	PFAS by ID SOP	0.60	U	1.2	0.60	0.24	ug/kg	1
Perfluoro-n-decanoic acid (PFDA)	335-76-2	PFAS by ID SOP	0.60	U	1.2	0.60	0.24	ug/kg	1
Perfluoro-n-dodecanoic acid (PFDoA)	307-55-1	PFAS by ID SOP	0.60	U	1.2	0.60	0.24	ug/kg	1
Perfluoro-n-heptanoic acid (PFHpA)	375-85-9	PFAS by ID SOP	0.60	U	1.2	0.60	0.24	ug/kg	1
Perfluoro-n-hexanoic acid (PFHxA)	307-24-4	PFAS by ID SOP	0.60	U	1.2	0.60	0.24	ug/kg	1
Perfluoro-n-nonanoic acid (PFNA)	375-95-1	PFAS by ID SOP	0.60	U	1.2	0.60	0.24	ug/kg	1
Perfluoro-n-octanoic acid (PFOA)	335-67-1	PFAS by ID SOP	0.60	U	1.2	0.60	0.24	ug/kg	1
Perfluoro-n-pentanoic acid (PFPeA)	2706-90-3	PFAS by ID SOP	0.60	U	1.2	0.60	0.24	ug/kg	1
Perfluoro-n-tetradecanoic acid (PFTeDA)	376-06-7	PFAS by ID SOP	0.60	U	1.2	0.60	0.24	ug/kg	1
Perfluoro-n-tridecanoic acid (PFTrDA)	72629-94-8	PFAS by ID SOP	0.60	U	1.2	0.60	0.24	ug/kg	1
Perfluoro-n-undecanoic acid (PFUdA)	2058-94-8	PFAS by ID SOP	0.60	U	1.2	0.60	0.24	ug/kg	1
Perfluorooctanesulfonic acid (PFOS)	**1763-23-1**	**PFAS by ID SOP**	**0.34**	**J**	**1.2**	0.60	**0.24**	**ug/kg**	**1**

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
13C2_4:2FTS		87	50-150
13C2_6:2FTS		81	50-150
13C2_8:2FTS		92	50-150
13C2_PFDoA		84	50-150
13C2_PFTeDA		77	50-150
13C3_PFBS		74	50-150
13C3_PFHxS		91	50-150
13C4_PFBA		86	50-150
13C4_PFHpA		94	50-150
13C5_PFHxA		88	50-150
13C5_PFPeA		86	50-150
13C6_PFDA		89	50-150
13C7_PFUdA		88	50-150
13C8_PFOA		90	50-150
13C8_PFOS		93	50-150
13C8_PFOSA		84	50-150
13C9_PFNA		87	50-150

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

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PFAS by LC/MS/MS

Client: **Arcadis U.S., Inc.**
Laboratory ID: **WD07012-003**
Description: **SCDIHHSSUR23RT1**
Matrix: **Solid**
Date Sampled: **04/05/2021**
% Solids: **75.1** **04/08/2021 0019**
Date Received: **04/07/2021**

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
d5-EtFOSAA		78	50-150
d-MeFOSA		94	50-150
d3-MeFOSAA		89	50-150

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

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QC Summary

PFAS by LC/MS/MS - MB

Sample ID: WQ88361-001
Batch: 88361
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Solid
Prep Method: SOP SPE
Prep Date: 04/08/2021 1123

Parameter	Result	Q	Dil	LOQ	LOD	DL	Units	Analysis Date
8:2 FTS	1.0	U	1	2.0	1.0	0.50	ug/kg	04/09/2021 2021
6:2 FTS	1.0	U	1	2.0	1.0	0.50	ug/kg	04/09/2021 2021
4:2 FTS	1.0	U	1	2.0	1.0	0.50	ug/kg	04/09/2021 2021
EtFOSAA	1.0	U	1	2.0	1.0	0.50	ug/kg	04/09/2021 2021
MeFOSA	1.0	U	1	2.0	1.0	0.50	ug/kg	04/09/2021 2021
MeFOSAA	1.0	U	1	2.0	1.0	0.50	ug/kg	04/09/2021 2021
PFBS	0.50	U	1	1.0	0.50	0.20	ug/kg	04/09/2021 2021
PFDS	0.50	U	1	1.0	0.50	0.20	ug/kg	04/09/2021 2021
PFHpS	0.50	U	1	1.0	0.50	0.20	ug/kg	04/09/2021 2021
PFNS	0.50	U	1	1.0	0.50	0.20	ug/kg	04/09/2021 2021
PFOSA	0.50	U	1	1.0	0.50	0.20	ug/kg	04/09/2021 2021
PFPeS	0.50	U	1	1.0	0.50	0.20	ug/kg	04/09/2021 2021
PFHxS	0.50	U	1	1.0	0.50	0.20	ug/kg	04/09/2021 2021
PFBA	0.50	U	1	1.0	0.50	0.20	ug/kg	04/09/2021 2021
PFDA	0.50	U	1	1.0	0.50	0.20	ug/kg	04/09/2021 2021
PFDoA	0.50	U	1	1.0	0.50	0.20	ug/kg	04/09/2021 2021
PFHpA	0.50	U	1	1.0	0.50	0.20	ug/kg	04/09/2021 2021
PFHxA	0.50	U	1	1.0	0.50	0.20	ug/kg	04/09/2021 2021
PFNA	0.50	U	1	1.0	0.50	0.20	ug/kg	04/09/2021 2021
PFOA	0.50	U	1	1.0	0.50	0.20	ug/kg	04/09/2021 2021
PFPeA	0.50	U	1	1.0	0.50	0.20	ug/kg	04/09/2021 2021
PFTeDA	0.50	U	1	1.0	0.50	0.20	ug/kg	04/09/2021 2021
PFTrDA	0.50	U	1	1.0	0.50	0.20	ug/kg	04/09/2021 2021
PFUdA	0.50	U	1	1.0	0.50	0.20	ug/kg	04/09/2021 2021
PFOS	0.50	U	1	1.0	0.50	0.20	ug/kg	04/09/2021 2021

Surrogate	Q	% Rec	Acceptance Limit
13C2_4:2FTS		90	50-150
13C2_6:2FTS		87	50-150
13C2_8:2FTS		86	50-150
13C2_PFDoA		93	50-150
13C2_PFTeDA		88	50-150
13C3_PFBS		72	50-150
13C3_PFHxS		91	50-150
13C4_PFBA		89	50-150
13C4_PFHpA		95	50-150
13C5_PFHxA		92	50-150
13C5_PFPeA		87	50-150
13C6_PFDA		91	50-150
13C7_PFUdA		85	50-150
13C8_PFOA		92	50-150

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

PFAS by LC/MS/MS - MB

Sample ID: WQ88361-001
Batch: 88361
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Solid
Prep Method: SOP SPE
Prep Date: 04/08/2021 1123

Surrogate	Q	% Rec	Acceptance Limit
13C8_PFOS		92	50-150
13C8_PFOSA		85	50-150
13C9_PFNA		91	50-150
d5-EtFOSAA		88	50-150
d-MeFOSA		103	50-150
d3-MeFOSAA		85	50-150

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

PFAS by LC/MS/MS - LCS

Sample ID: WQ88361-002
Batch: 88361
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Solid
Prep Method: SOP SPE
Prep Date: 04/08/2021 1123

Parameter	Spike Amount (ug/kg)	Result (ug/kg)	Q	Dil	% Rec	%Rec Limit	Analysis Date
8:2 FTS	1.9	2.1		1	112	65-137	04/09/2021 2032
6:2 FTS	1.9	1.9		1	101	64-140	04/09/2021 2032
4:2 FTS	1.9	2.0		1	106	62-145	04/09/2021 2032
EtFOSAA	2.0	1.7		1	86	61-139	04/09/2021 2032
MeFOSA	2.0	1.7		1	83	70-150	04/09/2021 2032
MeFOSAA	2.0	2.0		1	99	63-144	04/09/2021 2032
PFBS	1.8	1.9		1	110	72-128	04/09/2021 2032
PFDS	1.9	2.0		1	105	59-134	04/09/2021 2032
PFHpS	1.9	1.7		1	89	70-132	04/09/2021 2032
PFNS	1.9	1.7		1	88	69-125	04/09/2021 2032
PFOSA	2.0	2.0		1	99	67-137	04/09/2021 2032
PFPeS	1.9	2.1		1	112	73-123	04/09/2021 2032
PFHxS	1.8	1.8		1	99	67-130	04/09/2021 2032
PFBA	2.0	2.1		1	105	71-135	04/09/2021 2032
PFDA	2.0	1.8		1	92	69-133	04/09/2021 2032
PFDoA	2.0	2.1		1	106	69-135	04/09/2021 2032
PFHpA	2.0	1.8		1	89	71-131	04/09/2021 2032
PFHxA	2.0	1.9		1	93	70-132	04/09/2021 2032
PFNA	2.0	2.0		1	99	72-129	04/09/2021 2032
PFOA	2.0	2.0		1	100	69-133	04/09/2021 2032
PFPeA	2.0	1.8		1	92	69-132	04/09/2021 2032
PFTeDA	2.0	1.9		1	96	69-133	04/09/2021 2032
PFTrDA	2.0	2.1		1	105	66-139	04/09/2021 2032
PFUdA	2.0	1.9		1	95	64-136	04/09/2021 2032
PFOS	1.9	1.8		1	100	68-136	04/09/2021 2032

Surrogate	Q	% Rec	Acceptance Limit
13C2_4:2FTS		84	50-150
13C2_6:2FTS		84	50-150
13C2_8:2FTS		86	50-150
13C2_PFDoA		87	50-150
13C2_PFTeDA		82	50-150
13C3_PFBS		72	50-150
13C3_PFHxS		87	50-150
13C4_PFBA		87	50-150
13C4_PFHpA		93	50-150
13C5_PFHxA		91	50-150
13C5_PFPeA		89	50-150
13C6_PFDA		86	50-150
13C7_PFUdA		96	50-150
13C8_PFOA		90	50-150

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

PFAS by LC/MS/MS - LCS

Sample ID: WQ88361-002
Batch: 88361
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Solid
Prep Method: SOP SPE
Prep Date: 04/08/2021 1123

Surrogate	Q	% Rec	Acceptance Limit
13C8_PFOS		92	50-150
13C8_PFOSA		83	50-150
13C9_PFNA		89	50-150
d5-EtFOSAA		89	50-150
d-MeFOSA		100	50-150
d3-MeFOSAA		94	50-150

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

PFAS by LC/MS/MS - MS

Sample ID: WD07012-003MS
Batch: 88361
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Solid
Prep Method: SOP SPE
Prep Date: 04/08/2021 1123

Parameter	Sample Amount (ug/kg)	Spike Amount (ug/kg)	Result (ug/kg)	Q	Dil	% Rec	%Rec Limit	Analysis Date
8:2 FTS	ND	2.4	3.4	N	1	143	65-137	04/09/2021 2147
6:2 FTS	ND	2.4	2.3		1	95	64-140	04/09/2021 2147
4:2 FTS	ND	2.3	2.0		1	85	62-145	04/09/2021 2147
EtFOSAA	ND	2.5	2.4		1	98	61-139	04/09/2021 2147
MeFOSA	ND	2.5	2.9		1	116	70-150	04/09/2021 2147
MeFOSAA	ND	2.5	2.7		1	109	63-144	04/09/2021 2147
PFBS	ND	2.2	2.5		1	114	72-128	04/09/2021 2147
PFDS	ND	2.4	2.6		1	107	59-134	04/09/2021 2147
PFHpS	ND	2.4	2.4		1	100	70-132	04/09/2021 2147
PFNS	ND	2.4	2.7		1	113	69-125	04/09/2021 2147
PFOSA	ND	2.5	2.4		1	95	67-137	04/09/2021 2147
PFPeS	ND	2.3	2.6		1	110	73-123	04/09/2021 2147
PFHxS	ND	2.3	2.2		1	96	67-130	04/09/2021 2147
PFBA	ND	2.5	2.6		1	104	71-135	04/09/2021 2147
PFDA	ND	2.5	2.4		1	97	69-133	04/09/2021 2147
PFDoA	ND	2.5	2.5		1	98	69-135	04/09/2021 2147
PFHpA	ND	2.5	2.2		1	88	71-131	04/09/2021 2147
PFHxA	ND	2.5	2.4		1	96	70-132	04/09/2021 2147
PFNA	ND	2.5	2.5		1	101	72-129	04/09/2021 2147
PFOA	ND	2.5	3.0		1	119	69-133	04/09/2021 2147
PFPeA	ND	2.5	2.3		1	90	69-132	04/09/2021 2147
PFTeDA	ND	2.5	2.4		1	96	69-133	04/09/2021 2147
PFTrDA	ND	2.5	2.9		1	116	66-139	04/09/2021 2147
PFUdA	ND	2.5	2.5		1	99	64-136	04/09/2021 2147
PFOS	0.34	2.3	2.4		1	90	68-136	04/09/2021 2147

Surrogate	Q	% Rec	Acceptance Limit
13C2_4:2FTS		85	50-150
13C2_6:2FTS		84	50-150
13C2_8:2FTS		87	50-150
13C2_PFDoA		82	50-150
13C2_PFTeDA		79	50-150
13C3_PFBS		73	50-150
13C3_PFHxS		86	50-150
13C4_PFBA		86	50-150
13C4_PFHpA		91	50-150
13C5_PFHxA		91	50-150
13C5_PFPeA		88	50-150
13C6_PFDA		92	50-150
13C7_PFUdA		86	50-150
13C8_PFOA		85	50-150

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

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PFAS by LC/MS/MS - MS

Sample ID: WD07012-003MS
Batch: 88361
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Solid
Prep Method: SOP SPE
Prep Date: 04/08/2021 1123

Surrogate	Q	% Rec	Acceptance Limit
13C8_PFOS		89	50-150
13C8_PFOSA		86	50-150
13C9_PFNA		83	50-150
d5-EtFOSAA		86	50-150
d-MeFOSA		79	50-150
d3-MeFOSAA		88	50-150

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

PFAS by LC/MS/MS - MSD

Sample ID: WD07012-003MD
Batch: 88361
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Solid
Prep Method: SOP SPE
Prep Date: 04/08/2021 1123

Parameter	Sample Amount (ug/kg)	Spike Amount (ug/kg)	Result (ug/kg)	Q	Dil	% Rec	% RPD	%Rec Limit	% RPD Limit	Analysis Date
8:2 FTS	ND	2.5	2.1	+	1	85	46	65-137	30	04/09/2021 2157
6:2 FTS	ND	2.5	2.9		1	117	25	64-140	30	04/09/2021 2157
4:2 FTS	ND	2.4	2.0		1	82	1.8	62-145	30	04/09/2021 2157
EtFOSAA	ND	2.6	2.6		1	100	7.3	61-139	30	04/09/2021 2157
MeFOSA	ND	2.6	2.0	+	1	76	36	70-150	30	04/09/2021 2157
MeFOSAA	ND	2.6	2.4		1	90	14	63-144	30	04/09/2021 2157
PFBS	ND	2.3	2.7		1	115	6.0	72-128	30	04/09/2021 2157
PFDS	ND	2.5	2.4		1	93	9.0	59-134	30	04/09/2021 2157
PFHpS	ND	2.5	2.2		1	87	9.5	70-132	30	04/09/2021 2157
PFNS	ND	2.5	2.1		1	84	24	69-125	30	04/09/2021 2157
PFOSA	ND	2.6	2.8		1	106	16	67-137	30	04/09/2021 2157
PFPeS	ND	2.5	2.5		1	103	1.1	73-123	30	04/09/2021 2157
PFHxS	ND	2.4	2.0		1	85	7.1	67-130	30	04/09/2021 2157
PFBA	ND	2.6	2.7		1	101	2.2	71-135	30	04/09/2021 2157
PFDA	ND	2.6	2.4		1	91	1.4	69-133	30	04/09/2021 2157
PFDoA	ND	2.6	2.7		1	102	9.1	69-135	30	04/09/2021 2157
PFHpA	ND	2.6	2.5		1	93	11	71-131	30	04/09/2021 2157
PFHxA	ND	2.6	2.6		1	99	8.3	70-132	30	04/09/2021 2157
PFNA	ND	2.6	2.5		1	96	0.39	72-129	30	04/09/2021 2157
PFOA	ND	2.6	2.7		1	101	11	69-133	30	04/09/2021 2157
PFPeA	ND	2.6	2.4		1	91	5.7	69-132	30	04/09/2021 2157
PFTeDA	ND	2.6	2.5		1	96	5.0	69-133	30	04/09/2021 2157
PFTrDA	ND	2.6	2.9		1	110	0.33	66-139	30	04/09/2021 2157
PFUdA	ND	2.6	2.8		1	105	10	64-136	30	04/09/2021 2157
PFOS	0.34	2.4	2.3		1	79	6.5	68-136	30	04/09/2021 2157

Surrogate	Q	% Rec	Acceptance Limit
13C2_4:2FTS		86	50-150
13C2_6:2FTS		83	50-150
13C2_8:2FTS		80	50-150
13C2_PFDoA		77	50-150
13C2_PFTeDA		73	50-150
13C3_PFBS		70	50-150
13C3_PFHxS		89	50-150
13C4_PFBA		86	50-150
13C4_PFHpA		89	50-150
13C5_PFHxA		84	50-150
13C5_PFPeA		88	50-150
13C6_PFDA		91	50-150
13C7_PFUdA		82	50-150
13C8_PFOA		84	50-150

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

PFAS by LC/MS/MS - MSD

Sample ID: WD07012-003MD
Batch: 88361
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Solid
Prep Method: SOP SPE
Prep Date: 04/08/2021 1123

Surrogate	Q	% Rec	Acceptance Limit
13C8_PFOS		86	50-150
13C8_PFOSA		80	50-150
13C9_PFNA		88	50-150
d5-EtFOSAA		83	50-150
d-MeFOSA		87	50-150
d3-MeFOSAA		86	50-150

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

PFAS by LC/MS/MS - MB

Sample ID: WQ88717-001
Batch: 88717
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Solid
Prep Method: SOP SPE
Prep Date: 04/12/2021 1154

Parameter	Result	Q	Dil	LOQ	LOD	DL	Units	Analysis Date
8:2 FTS	1.0	U	1	2.0	1.0	0.50	ug/kg	04/13/2021 1208
6:2 FTS	1.0	U	1	2.0	1.0	0.50	ug/kg	04/13/2021 1208
4:2 FTS	1.0	U	1	2.0	1.0	0.50	ug/kg	04/13/2021 1208
EtFOSAA	1.0	U	1	2.0	1.0	0.50	ug/kg	04/13/2021 1208
MeFOSA	1.0	U	1	2.0	1.0	0.50	ug/kg	04/13/2021 1208
MeFOSAA	1.0	U	1	2.0	1.0	0.50	ug/kg	04/13/2021 1208
PFBS	0.50	U	1	1.0	0.50	0.20	ug/kg	04/13/2021 1208
PFDS	0.50	U	1	1.0	0.50	0.20	ug/kg	04/13/2021 1208
PFHpS	0.50	U	1	1.0	0.50	0.20	ug/kg	04/13/2021 1208
PFNS	0.50	U	1	1.0	0.50	0.20	ug/kg	04/13/2021 1208
PFOSA	0.50	U	1	1.0	0.50	0.20	ug/kg	04/13/2021 1208
PFPeS	0.50	U	1	1.0	0.50	0.20	ug/kg	04/13/2021 1208
PFHxS	0.50	U	1	1.0	0.50	0.20	ug/kg	04/13/2021 1208
PFBA	0.50	U	1	1.0	0.50	0.20	ug/kg	04/13/2021 1208
PFDA	0.50	U	1	1.0	0.50	0.20	ug/kg	04/13/2021 1208
PFDoA	0.50	U	1	1.0	0.50	0.20	ug/kg	04/13/2021 1208
PFHpA	0.50	U	1	1.0	0.50	0.20	ug/kg	04/13/2021 1208
PFHxA	0.50	U	1	1.0	0.50	0.20	ug/kg	04/13/2021 1208
PFNA	0.50	U	1	1.0	0.50	0.20	ug/kg	04/13/2021 1208
PFOA	0.50	U	1	1.0	0.50	0.20	ug/kg	04/13/2021 1208
PFPeA	0.50	U	1	1.0	0.50	0.20	ug/kg	04/13/2021 1208
PFTeDA	0.50	U	1	1.0	0.50	0.20	ug/kg	04/13/2021 1208
PFTrDA	0.50	U	1	1.0	0.50	0.20	ug/kg	04/13/2021 1208
PFUdA	0.50	U	1	1.0	0.50	0.20	ug/kg	04/13/2021 1208
PFOS	0.50	U	1	1.0	0.50	0.20	ug/kg	04/13/2021 1208

Surrogate	Q	% Rec	Acceptance Limit
13C2_4:2FTS		93	50-150
13C2_6:2FTS		89	50-150
13C2_8:2FTS		94	50-150
13C2_PFDoA		104	50-150
13C2_PFTeDA		92	50-150
13C3_PFBS		79	50-150
13C3_PFHxS		85	50-150
13C4_PFBA		97	50-150
13C4_PFHpA		97	50-150
13C5_PFHxA		94	50-150
13C5_PFPeA		95	50-150
13C6_PFDA		96	50-150
13C7_PFUdA		110	50-150
13C8_PFOA		114	50-150

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

PFAS by LC/MS/MS - MB

Sample ID: WQ88717-001
Batch: 88717
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Solid
Prep Method: SOP SPE
Prep Date: 04/12/2021 1154

Surrogate	Q	% Rec	Acceptance Limit
13C8_PFOS		92	50-150
13C8_PFOSA		89	50-150
13C9_PFNA		113	50-150
d5-EtFOSAA		103	50-150
d-MeFOSA		89	50-150
d3-MeFOSAA		94	50-150

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

PFAS by LC/MS/MS - LCS

Sample ID: WQ88717-002
Batch: 88717
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Solid
Prep Method: SOP SPE
Prep Date: 04/12/2021 1154

Parameter	Spike Amount (ug/kg)	Result (ug/kg)	Q	Dil	% Rec	%Rec Limit	Analysis Date
8:2 FTS	1.9	1.8		1	95	65-137	04/13/2021 1219
6:2 FTS	1.9	1.9		1	101	64-140	04/13/2021 1219
4:2 FTS	1.9	1.6		1	85	62-145	04/13/2021 1219
EtFOSAA	2.0	2.2		1	112	61-139	04/13/2021 1219
MeFOSA	2.0	2.2		1	112	70-150	04/13/2021 1219
MeFOSAA	2.0	1.9		1	94	63-144	04/13/2021 1219
PFBS	1.8	1.7		1	98	72-128	04/13/2021 1219
PFDS	1.9	1.9		1	97	59-134	04/13/2021 1219
PFHpS	1.9	1.8		1	94	70-132	04/13/2021 1219
PFNS	1.9	2.0		1	102	69-125	04/13/2021 1219
PFOSA	2.0	1.9		1	97	67-137	04/13/2021 1219
PFPeS	1.9	1.8		1	97	73-123	04/13/2021 1219
PFHxS	1.8	1.8		1	98	67-130	04/13/2021 1219
PFBA	2.0	1.8		1	90	71-135	04/13/2021 1219
PFDA	2.0	1.9		1	96	69-133	04/13/2021 1219
PFDoA	2.0	1.9		1	97	69-135	04/13/2021 1219
PFHpA	2.0	1.8		1	90	71-131	04/13/2021 1219
PFHxA	2.0	2.0		1	102	70-132	04/13/2021 1219
PFNA	2.0	2.2		1	109	72-129	04/13/2021 1219
PFOA	2.0	1.9		1	94	69-133	04/13/2021 1219
PFPeA	2.0	1.9		1	96	69-132	04/13/2021 1219
PFTeDA	2.0	1.9		1	93	69-133	04/13/2021 1219
PFTrDA	2.0	1.7		1	86	66-139	04/13/2021 1219
PFUdA	2.0	2.0		1	102	64-136	04/13/2021 1219
PFOS	1.9	1.6		1	85	68-136	04/13/2021 1219

Surrogate	Q	% Rec	Acceptance Limit
13C2_4:2FTS		99	50-150
13C2_6:2FTS		87	50-150
13C2_8:2FTS		85	50-150
13C2_PFDoA		101	50-150
13C2_PFTeDA		94	50-150
13C3_PFBS		78	50-150
13C3_PFHxS		90	50-150
13C4_PFBA		96	50-150
13C4_PFHpA		96	50-150
13C5_PFHxA		90	50-150
13C5_PFPeA		93	50-150
13C6_PFDA		88	50-150
13C7_PFUdA		99	50-150
13C8_PFOA		107	50-150

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

PFAS by LC/MS/MS - LCS

Sample ID: WQ88717-002
Batch: 88717
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Solid
Prep Method: SOP SPE
Prep Date: 04/12/2021 1154

Surrogate	Q	% Rec	Acceptance Limit
13C8_PFOS		96	50-150
13C8_PFOSA		91	50-150
13C9_PFNA		107	50-150
d5-EtFOSAA		95	50-150
d-MeFOSA		89	50-150
d3-MeFOSAA		93	50-150

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

PFAS by LC/MS/MS - MS

Sample ID: WD07012-002MS
Batch: 88717
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Solid
Prep Method: SOP SPE
Prep Date: 04/12/2021 1154

Parameter	Sample Amount (ug/kg)	Spike Amount (ug/kg)	Result (ug/kg)	Q	Dil	% Rec	%Rec Limit	Analysis Date
8:2 FTS	1.3	2.5	3.6		1	92	65-137	04/13/2021 1533
6:2 FTS	4.8	2.5	6.2	N	1	57	64-140	04/13/2021 1533
4:2 FTS	ND	2.4	2.5		1	105	62-145	04/13/2021 1533
EtFOSAA	ND	2.6	2.6		1	102	61-139	04/13/2021 1533
MeFOSA	ND	2.6	2.7		1	105	70-150	04/13/2021 1533
MeFOSAA	ND	2.6	2.6		1	101	63-144	04/13/2021 1533
PFBS	ND	2.3	1.9		1	84	72-128	04/13/2021 1533
PFDS	ND	2.5	1.7		1	68	59-134	04/13/2021 1533
PFHpS	ND	2.5	2.5		1	103	70-132	04/13/2021 1533
PFNS	ND	2.5	2.6		1	106	69-125	04/13/2021 1533
PFOSA	1.5	2.6	3.3		1	71	67-137	04/13/2021 1533
PFPeS	ND	2.4	2.7		1	110	73-123	04/13/2021 1533
PFHxS	0.76	2.4	3.1		1	98	67-130	04/13/2021 1533
PFBA	ND	2.6	2.5		1	99	71-135	04/13/2021 1533
PFDA	ND	2.6	3.0		1	118	69-133	04/13/2021 1533
PFDoA	ND	2.6	2.3		1	88	69-135	04/13/2021 1533
PFHpA	ND	2.6	2.3		1	90	71-131	04/13/2021 1533
PFHxA	ND	2.6	2.9		1	111	70-132	04/13/2021 1533
PFNA	ND	2.6	2.6		1	101	72-129	04/13/2021 1533
PFOA	ND	2.6	2.7		1	106	69-133	04/13/2021 1533
PFPeA	ND	2.6	2.7		1	104	69-132	04/13/2021 1533
PFTeDA	ND	2.6	2.6		1	100	69-133	04/13/2021 1533
PFTrDA	ND	2.6	2.4		1	94	66-139	04/13/2021 1533
PFUdA	ND	2.6	2.5		1	98	64-136	04/13/2021 1533
PFOS	5.6	2.4	7.5		1	80	68-136	04/13/2021 1533

Surrogate	Q	% Rec	Acceptance Limit
13C2_4:2FTS		90	50-150
13C2_6:2FTS		109	50-150
13C2_8:2FTS		94	50-150
13C2_PFDoA		110	50-150
13C2_PFTeDA		88	50-150
13C3_PFBS		83	50-150
13C3_PFHxS		87	50-150
13C4_PFBA		96	50-150
13C4_PFHpA		92	50-150
13C5_PFHxA		98	50-150
13C5_PFPeA		91	50-150
13C6_PFDA		94	50-150
13C7_PFUdA		87	50-150
13C8_PFOA		105	50-150

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

PFAS by LC/MS/MS - MS

Sample ID: WD07012-002MS
Batch: 88717
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Solid
Prep Method: SOP SPE
Prep Date: 04/12/2021 1154

Surrogate	Q	% Rec	Acceptance Limit
13C8_PFOS		95	50-150
13C8_PFOSA		102	50-150
13C9_PFNA		97	50-150
d5-EtFOSAA		112	50-150
d-MeFOSA		109	50-150
d3-MeFOSAA		68	50-150

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

PFAS by LC/MS/MS - MSD

Sample ID: WD07012-002MD
Batch: 88717
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Solid
Prep Method: SOP SPE
Prep Date: 04/12/2021 1154

Parameter	Sample Amount (ug/kg)	Spike Amount (ug/kg)	Result (ug/kg)	Q	Dil	% Rec	% RPD	%Rec Limit	% RPD Limit	Analysis Date
8:2 FTS	1.3	2.2	3.7		1	107	1.5	65-137	30	04/13/2021 1543
6:2 FTS	4.8	2.2	5.9	N	1	47	6.4	64-140	30	04/13/2021 1543
4:2 FTS	ND	2.1	2.0		1	95	22	62-145	30	04/13/2021 1543
EtFOSAA	ND	2.3	2.1		1	91	25	61-139	30	04/13/2021 1543
MeFOSA	ND	2.3	2.4		1	105	14	70-150	30	04/13/2021 1543
MeFOSAA	ND	2.3	2.7		1	121	4.7	63-144	30	04/13/2021 1543
PFBS	ND	2.0	2.0		1	102	5.6	72-128	30	04/13/2021 1543
PFDS	ND	2.2	1.7		1	75	2.6	59-134	30	04/13/2021 1543
PFHpS	ND	2.2	2.3		1	107	8.1	70-132	30	04/13/2021 1543
PFNS	ND	2.2	2.2		1	99	20	69-125	30	04/13/2021 1543
PFOSA	1.5	2.3	3.4		1	85	2.7	67-137	30	04/13/2021 1543
PFPeS	ND	2.1	2.5		1	120	5.0	73-123	30	04/13/2021 1543
PFHxS	0.76	2.1	2.3		1	76	27	67-130	30	04/13/2021 1543
PFBA	ND	2.3	2.2		1	98	14	71-135	30	04/13/2021 1543
PFDA	ND	2.3	2.4		1	107	23	69-133	30	04/13/2021 1543
PFDoA	ND	2.3	2.3		1	100	0.92	69-135	30	04/13/2021 1543
PFHpA	ND	2.3	2.5		1	109	6.0	71-131	30	04/13/2021 1543
PFHxA	ND	2.3	2.8		1	123	2.8	70-132	30	04/13/2021 1543
PFNA	ND	2.3	2.3		1	101	13	72-129	30	04/13/2021 1543
PFOA	ND	2.3	2.4		1	106	13	69-133	30	04/13/2021 1543
PFPeA	ND	2.3	2.2		1	98	19	69-132	30	04/13/2021 1543
PFTeDA	ND	2.3	2.4		1	104	8.7	69-133	30	04/13/2021 1543
PFTrDA	ND	2.3	2.1		1	91	16	66-139	30	04/13/2021 1543
PFUdA	ND	2.3	2.1		1	92	20	64-136	30	04/13/2021 1543
PFOS	5.6	2.1	6.9	N	1	65	7.4	68-136	30	04/13/2021 1543

Surrogate	Q	% Rec	Acceptance Limit
13C2_4:2FTS		88	50-150
13C2_6:2FTS		100	50-150
13C2_8:2FTS		99	50-150
13C2_PFDoA		105	50-150
13C2_PFTeDA		85	50-150
13C3_PFBS		79	50-150
13C3_PFHxS		86	50-150
13C4_PFBA		94	50-150
13C4_PFHpA		84	50-150
13C5_PFHxA		92	50-150
13C5_PFPeA		94	50-150
13C6_PFDA		94	50-150
13C7_PFUdA		93	50-150
13C8_PFOA		106	50-150

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

PFAS by LC/MS/MS - MSD

Sample ID: WD07012-002MD
Batch: 88717
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Solid
Prep Method: SOP SPE
Prep Date: 04/12/2021 1154

Surrogate	Q	% Rec	Acceptance Limit
13C8_PFOS		92	50-150
13C8_PFOSA		88	50-150
13C9_PFNA		104	50-150
d5-EtFOSAA		113	50-150
d-MeFOSA		101	50-150
d3-MeFOSAA		55	50-150

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

Chain of Custody
and
Miscellaneous Documents

Shealy Environmental Services, Inc.
106 Vantage Point Drive
West Columbia, South Carolina 29172
Telephone No. (803) 791-9700 Fax No. (803) 791-9111
www.shealylab.com

Chain of Custody Record

Number

Client	Report to Contact	Telephone No. / E-mail	Quote No.
Arcadis	Colin Morrell	802.209.3476 / colin@cleanearthtechnologies.ca	Mike McFadden
Address	Sampler's Signature	Analysis (Attach list if more space is needed)	Page
	X	PFAS DoD QSM 5.3 ELAP Table B-15 cmpds and ASLP	1 of 1
City / State / Zip Code	Printed Name		
Project Name			
Project Number 1000-EI	P.O No.		

Sample ID / Description (Containers for each sample may be combined on one line)	Date	Time	G-Grab C-Composite	Matrix: Aqueous	Matrix: Solid	Matrix: Non-Aqueous	No of Containers by Preservative Type: Unpres.	H2SO4	HNO3	HCl	NaOH	5035 Kit	PFAS DoD QSM 5.3 ELAP Table B-15	ASLP	Remarks / Cooler I.D.
SCDIHHSSUR23ILIM	April 5/21		C		x								x	x	PFAS
SCDIHHSUR23	April 5/21		C		x								x	x	PFAS
SCDIHHSSUR23RT1	April 5/21		C		x								x	x	PFAS

WD07013 KES2

WD07012 KES2

Turn Around Time Required (Prior lab approval required for expedited TAT)
Standard [x] Rush (Please Specify) 1 week Total PFAS 2 week ASLP

Sample Disposal
[ ] Return to Client [x] Disposal by Lab

Possible Hazard Identification (List any known hazards in the remarks)
[ ] Non-Hazardous [ ] Flammable [ ] Skin Irritant [ ] SDS provided [ ] Unknown

QC Requirements

Relinquished by	Date	Time	Received by	Date	Time
Colin Morrell	April 5/21		1. Received by		
Relinquished by	Date	Time	2. Received by	Date	Time
Relinquished by	Date	Time	3. Received by	Date	Time
Relinquished by FedEx	Date 4/6/21	Time 0935	4. Laboratory Received by	Date 4/6/21	Time 0935

Note: All samples are retained for four weeks from receipt unless other arrangements are made.

LAB USE ONLY
Received on Ice (Check) [x] Y [ ] N [ ] Ice Pack

Receipt Temp. 2.0 °C

Document Number: ME002DW-01

PaceAnalytical

Samples Receipt Checklist (SRC) (ME0018C-15)
Issuing Authority: Pace ENV - WCOL

Revised:9/29/2020
Page 1 of 1

Sample Receipt Checklist (SRC)

Client: Arcadis Cooler Inspected by/date: KSC / 04/07/2021 Lot #: WD09012/WD07013

Means of receipt: ☐ Pace ☐ Client ☐ UPS ☑ FedEx ☐ Other: ____

☐ Yes	☑ No		1. Were custody seals present on the cooler?
☐ Yes	☐ No	☑ NA	2. If custody seals were present, were they intact and unbroken?

pH Strip ID: NA Chlorine Strip ID: NA Tested by: NA

Original temperature upon receipt / Derived (Corrected) temperature upon receipt %Solid Snap Cup ID: 21-443

2.0 / 2.0 °C NA / NA °C NA / NA °C NA / NA °C

Method: ☐ Temperature Blank ☑ Against Bottles IR Gun ID: 5 IR Gun Correction Factor: 0 °C

Method of coolant: ☑ Wet Ice ☐ Ice Packs ☐ Dry Ice ☐ None

☐ Yes	☐ No	☑ NA	3. If temperature of any cooler exceeded 6.0°C, was Project Manager Notified? PM was Notified by: phone / email / face-to-face (circle one).
☐ Yes	☐ No	☑ NA	4. Is the commercial courier's packing slip attached to this form?
☑ Yes	☐ No		5. Were proper custody procedures (relinquished/received) followed?
☑ Yes	☐ No		6. Were sample IDs listed on the COC?
☑ Yes	☐ No		7. Were sample IDs listed on all sample containers?
☐ Yes	☑ No		8. Was collection date & time listed on the COC?
☐ Yes	☑ No		9. Was collection date & time listed on all sample containers?
☑ Yes	☐ No		10. Did all container label information (ID, date, time) agree with the COC?
☑ Yes	☐ No		11. Were tests to be performed listed on the COC?
☑ Yes	☐ No		12. Did all samples arrive in the proper containers for each test and/or in good condition (unbroken, lids on, etc.)? ____
☑ Yes	☐ No		13. Was adequate sample volume available?
☑ Yes	☐ No		14. Were all samples received within ½ the holding time or 48 hours, whichever comes first?
☐ Yes	☑ No		15. Were any samples containers missing/excess (circle one) samples Not listed on COC?
☐ Yes	☐ No	☑ NA	16. For VOA and RSK-175 samples, were bubbles present >"pea-size" (¼"or 6mm in diameter) in any of the VOA vials?
☐ Yes	☐ No	☑ NA	17. Were all DRO/metals/nutrient samples received at a pH of < 2?
☐ Yes	☐ No	☑ NA	18. Were all cyanide samples received at a pH > 12 and sulfide samples received at a pH > 9?
☐ Yes	☐ No	☑ NA	19. Were all applicable NH_3/TKN/cyanide/phenol/625.1/608.3 (< 0.5mg/L) samples free of residual chlorine?
☐ Yes	☐ No	☑ NA	20. Were client remarks/requests (i.e. requested dilutions, MS/MSD designations, etc…) correctly transcribed from the COC into the comment section in LIMS?
☐ Yes	☑ No		21. Was the quote number listed on the container label? If yes, Quote # ____

Sample Preservation (Must be completed for any sample(s) incorrectly preserved or with headspace.)

Sample(s) NA ____ were received incorrectly preserved and were adjusted accordingly in sample receiving with NA mL of circle one: H2SO4, HNO3, HCl, NaOH using SR # NA.
Time of preservation NA. If more than one preservative is needed, please note in the comments below.

Sample(s) NA ____ were received with bubbles >6 mm in diameter.

Samples(s) NA ____ were received with TRC > 0.5 mg/L (If #19 is *no*) and were adjusted accordingly in sample receiving with sodium thiosulfate ($Na_2S_2O_3$) with Shealy ID: NA.

SR barcode labels applied by: JRG2 Date: 04/07/2021

Comments: No dates listed on COC or on containers

Report of Analysis

Arcadis U.S., Inc.
630 Plaza Drive
Suite 600
Highlands Ranch, CO 80129
Attention: Colin Morrell

Project Name: Eielson AFB

Project Number: 30030317

Lot Number:**WD07013**

Date Completed:04/22/2021

04/26/2021 3:48 PM
Approved and released by:
Project Manager II: **Kathy E. Smith**

The electronic signature above is the equivalent of a handwritten signature.
This report shall not be reproduced, except in its entirety, without the written approval of Pace Analytical Services, LLC.

Pace Analytical Services, LLC (*formerly Shealy Environmental Services, Inc.*)
106 Vantage Point Drive West Columbia, SC 29172
Tel: 803-791-9700 Fax: 803-791-9111 www.pacelabs.com

Case Narrative
Arcadis U.S., Inc.
Lot Number: WD07013

This Report of Analysis contains the analytical result(s) for the sample(s) listed on the Sample Summary following this Case Narrative. The sample receiving date is documented in the header information associated with each sample.
All results listed in this report relate only to the samples that are contained within this report.

Sample receipt, sample analysis, and data review have been performed in accordance with the Pace Quality Assurance Management Plan (QAMP), applicable Shealy standard operating procedures (SOPs), the 2003 NELAC standard, and Shealy policies. Additionally, the DoD QSM version 5.3 has been followed for these samples, and specifically Table B-15 was followed for all PFAS samples. Any exceptions to the QAMP, SOPs, NELAC standards, the DoD QSM, or policies are qualified on the results page or discussed below.

All QC associated with these samples was in compliance with DOD QSM 5.3 table B-15 and our PFAS SOP.

Correction factors (CF) are used to calculate the original sample concentration. The CF is the inverse of the concentration factor (sample volume / extract final volume) times the dilution factor (DF). For undiluted analysis. For undiluted analysis, the extract is prepared for injection by adding 182 uL of sample extract + 8 uL of reagent water + 10 uL of internal standard solution to a polypropylene autosampler vial. An extra correction factor of 0.91 (182 uL / 200 uL = 0.91) applies. The CF is calculated as follows:

CF = DF * FV / Vo

FV is volume of extract (mL)
Vo is initial sample volume (mL)
DF is dilution factor. For undiluted analysis, DF = 1/0.91.

Sample concentration for aqueous samples:
Concentration (ng/L) = Cs*CF,

$$C_s = \frac{\left(\frac{(A_s x C_{is})}{A_{is}}\right) - B}{M1}$$

Where

C_s is on column concentration of target analyte in the sample (ng/L)
C_{is} is concentration of internal standard in the sample (ng/L)
A_s is peak response of target analyte in the sample
A_{is} is peak response of internal standard in the sample
M1 is the average RF from ICAL or the slope from linear regression ICAL
B is the y-intercept from the ICAL

Sample Summary
Arcadis U.S., Inc.
Lot Number: WD07013

Sample Number	Sample ID	Matrix	Date Sampled	Date Received
001	SCDIHHSSUR23ILIM	Solid	04/05/2021	04/07/2021
002	SCDIHHSUR23	Solid	04/05/2021	04/07/2021
003	SCDIHHSSUR23RT1	Solid	04/05/2021	04/07/2021

(3 samples)

Detection Summary

Arcadis U.S., Inc.

Lot Number: WD07013

Sample	Sample ID	Matrix	Parameter	Method	Result	Q	Units	Page
001	SCDIHHSSUR23ILIM	Solid	6:2 FTS	PFAS by ID	36	J	ng/L	5
002	SCDIHHSUR23	Solid	6:2 FTS	PFAS by ID	32	J	ng/L	7
003	SCDIHHSSUR23RT1	Solid	6:2 FTS	PFAS by ID	35	J	ng/L	9

(3 detections)

SPLP PFAS (Australian)

Client: **Arcadis U.S., Inc.** Laboratory ID: **WD07013-001**

Description: **SCDIHHSSUR23ILIM** Matrix: **Solid**

Date Sampled: **04/05/2021**

Date Received: **04/07/2021**

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch	Leachate Date
1	AS4439.3/PF	PFAS by ID SOP QSM B-15	1	04/21/2021 2236	JJG	04/20/2021 1618	89635	04/14/2021 0259

Parameter	CAS Number	Analytical Method	Result	Q	LOQ	LOD	DL	Units	Run
1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS)	39108-34-4	PFAS by ID SOP	20	U	80	40	20	ng/L	1
1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS)	**27619-97-2**	**PFAS by ID SOP**	**36**	**J**	**80**	40	**20**	**ng/L**	**1**
1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS)	757124-72-4	PFAS by ID SOP	20	U	80	40	20	ng/L	1
N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA)	2991-50-6	PFAS by ID SOP	20	U	80	40	20	ng/L	1
N-methylperfluoro-1-octanesulfonamide (MeFOSA)	31506-32-8	PFAS by ID SOP	40	U	160	80	40	ng/L	1
N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA)	2355-31-9	PFAS by ID SOP	20	U	80	40	20	ng/L	1
Perfluoro-1-butanesulfonic acid (PFBS)	375-73-5	PFAS by ID SOP	10	U	40	20	10	ng/L	1
Perfluoro-1-decanesulfonic acid (PFDS)	335-77-3	PFAS by ID SOP	10	U	40	20	10	ng/L	1
Perfluoro-1-heptanesulfonic acid (PFHpS)	375-92-8	PFAS by ID SOP	10	U	40	20	10	ng/L	1
Perfluoro-1-nonanesulfonic acid (PFNS)	68259-12-1	PFAS by ID SOP	10	U	40	20	10	ng/L	1
Perfluoro-1-octanesulfonamide (PFOSA)	754-91-6	PFAS by ID SOP	10	U	40	20	10	ng/L	1
Perfluoro-1-pentanesulfonic acid (PFPeS)	2706-91-4	PFAS by ID SOP	10	U	40	20	10	ng/L	1
Perfluorohexanesulfonic acid (PFHxS)	355-46-4	PFAS by ID SOP	10	U	40	20	10	ng/L	1
Perfluoro-n-butanoic acid (PFBA)	375-22-4	PFAS by ID SOP	10	U	40	20	10	ng/L	1
Perfluoro-n-decanoic acid (PFDA)	335-76-2	PFAS by ID SOP	10	U	40	20	10	ng/L	1
Perfluoro-n-dodecanoic acid (PFDoA)	307-55-1	PFAS by ID SOP	10	U	40	20	10	ng/L	1
Perfluoro-n-heptanoic acid (PFHpA)	375-85-9	PFAS by ID SOP	10	U	40	20	10	ng/L	1
Perfluoro-n-hexanoic acid (PFHxA)	307-24-4	PFAS by ID SOP	10	U	40	20	10	ng/L	1
Perfluoro-n-nonanoic acid (PFNA)	375-95-1	PFAS by ID SOP	10	U	40	20	10	ng/L	1
Perfluoro-n-octanoic acid (PFOA)	335-67-1	PFAS by ID SOP	10	U	40	20	10	ng/L	1
Perfluoro-n-pentanoic acid (PFPeA)	2706-90-3	PFAS by ID SOP	10	U	40	20	10	ng/L	1
Perfluoro-n-tetradecanoic acid (PFTeDA)	376-06-7	PFAS by ID SOP	10	U	40	20	10	ng/L	1
Perfluoro-n-tridecanoic acid (PFTrDA)	72629-94-8	PFAS by ID SOP	10	U	40	20	10	ng/L	1
Perfluoro-n-undecanoic acid (PFUdA)	2058-94-8	PFAS by ID SOP	10	U	40	20	10	ng/L	1
Perfluorooctanesulfonic acid (PFOS)	1763-23-1	PFAS by ID SOP	10	U	40	20	10	ng/L	1

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
13C2_4:2FTS		103	50-150
13C2_6:2FTS		101	50-150
13C2_8:2FTS		106	50-150
13C2_PFDoA		95	50-150
13C2_PFTeDA		93	50-150
13C3_PFBS		89	50-150
13C3_PFHxS		96	50-150
13C4_PFBA		106	50-150
13C4_PFHpA		109	50-150
13C5_PFHxA		102	50-150
13C5_PFPeA		101	50-150
13C6_PFDA		89	50-150
13C7_PFUdA		103	50-150
13C8_PFOA		98	50-150
13C8_PFOS		93	50-150
13C8_PFOSA		96	50-150
13C9_PFNA		91	50-150

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

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SPLP PFAS (Australian)

Client: **Arcadis U.S., Inc.**
Laboratory ID: **WD07013-001**
Description: **SCDIHHSSUR23ILIM**
Matrix: **Solid**
Date Sampled: **04/05/2021**
Date Received: **04/07/2021**

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
d5-EtFOSAA		98	50-150
d-MeFOSA		105	50-150
d3-MeFOSAA		96	50-150

LOQ = Limit of Quantitation	B = Detected in the method blank	E = Quantitation of compound exceeded the calibration range	DL = Detection Limit	Q = Surrogate failure
U = Not detected at or above the LOQ	N = Recovery is out of criteria	P = The RPD between two GC columns exceeds 40%	J = Estimated result < LOQ and ≥ DL	L = LCS/LCSD failure
H = Out of holding time	W = Reported on wet weight basis	LOD = Limit of Detection		S = MS/MSD failure

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SPLP PFAS (Australian)

Client: **Arcadis U.S., Inc.** Laboratory ID: **WD07013-002**

Description: **SCDIHHSUR23** Matrix: **Solid**

Date Sampled: **04/05/2021**

Date Received: **04/07/2021**

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch	Leachate Date
1	AS4439.3/PF	PFAS by ID SOP QSM B-15	1	04/21/2021 2308	JJG	04/20/2021 1618	89635	04/14/2021 0259

Parameter	CAS Number	Analytical Method	Result	Q	LOQ	LOD	DL	Units	Run
1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS)	39108-34-4	PFAS by ID SOP	20	U	80	40	20	ng/L	1
1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS)	**27619-97-2**	**PFAS by ID SOP**	**32**	**J**	**80**	40	**20**	**ng/L**	**1**
1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS)	757124-72-4	PFAS by ID SOP	20	U	80	40	20	ng/L	1
N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA)	2991-50-6	PFAS by ID SOP	20	U	80	40	20	ng/L	1
N-methylperfluoro-1-octanesulfonamide (MeFOSA)	31506-32-8	PFAS by ID SOP	40	U	160	80	40	ng/L	1
N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA)	2355-31-9	PFAS by ID SOP	20	U	80	40	20	ng/L	1
Perfluoro-1-butanesulfonic acid (PFBS)	375-73-5	PFAS by ID SOP	10	U	40	20	10	ng/L	1
Perfluoro-1-decanesulfonic acid (PFDS)	335-77-3	PFAS by ID SOP	10	U	40	20	10	ng/L	1
Perfluoro-1-heptanesulfonic acid (PFHpS)	375-92-8	PFAS by ID SOP	10	U	40	20	10	ng/L	1
Perfluoro-1-nonanesulfonic acid (PFNS)	68259-12-1	PFAS by ID SOP	10	U	40	20	10	ng/L	1
Perfluoro-1-octanesulfonamide (PFOSA)	754-91-6	PFAS by ID SOP	10	U	40	20	10	ng/L	1
Perfluoro-1-pentanesulfonic acid (PFPeS)	2706-91-4	PFAS by ID SOP	10	U	40	20	10	ng/L	1
Perfluorohexanesulfonic acid (PFHxS)	355-46-4	PFAS by ID SOP	10	U	40	20	10	ng/L	1
Perfluoro-n-butanoic acid (PFBA)	375-22-4	PFAS by ID SOP	10	U	40	20	10	ng/L	1
Perfluoro-n-decanoic acid (PFDA)	335-76-2	PFAS by ID SOP	10	U	40	20	10	ng/L	1
Perfluoro-n-dodecanoic acid (PFDoA)	307-55-1	PFAS by ID SOP	10	U	40	20	10	ng/L	1
Perfluoro-n-heptanoic acid (PFHpA)	375-85-9	PFAS by ID SOP	10	U	40	20	10	ng/L	1
Perfluoro-n-hexanoic acid (PFHxA)	307-24-4	PFAS by ID SOP	10	U	40	20	10	ng/L	1
Perfluoro-n-nonanoic acid (PFNA)	375-95-1	PFAS by ID SOP	10	U	40	20	10	ng/L	1
Perfluoro-n-octanoic acid (PFOA)	335-67-1	PFAS by ID SOP	10	U	40	20	10	ng/L	1
Perfluoro-n-pentanoic acid (PFPeA)	2706-90-3	PFAS by ID SOP	10	U	40	20	10	ng/L	1
Perfluoro-n-tetradecanoic acid (PFTeDA)	376-06-7	PFAS by ID SOP	10	U	40	20	10	ng/L	1
Perfluoro-n-tridecanoic acid (PFTrDA)	72629-94-8	PFAS by ID SOP	10	U	40	20	10	ng/L	1
Perfluoro-n-undecanoic acid (PFUdA)	2058-94-8	PFAS by ID SOP	10	U	40	20	10	ng/L	1
Perfluorooctanesulfonic acid (PFOS)	1763-23-1	PFAS by ID SOP	10	U	40	20	10	ng/L	1

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
13C2_4:2FTS		107	50-150
13C2_6:2FTS		102	50-150
13C2_8:2FTS		102	50-150
13C2_PFDoA		91	50-150
13C2_PFTeDA		61	50-150
13C3_PFBS		87	50-150
13C3_PFHxS		94	50-150
13C4_PFBA		101	50-150
13C4_PFHpA		106	50-150
13C5_PFHxA		103	50-150
13C5_PFPeA		103	50-150
13C6_PFDA		89	50-150
13C7_PFUdA		97	50-150
13C8_PFOA		92	50-150
13C8_PFOS		80	50-150
13C8_PFOSA		82	50-150
13C9_PFNA		87	50-150

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

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SPLP PFAS (Australian)

Client: **Arcadis U.S., Inc.**
Laboratory ID: **WD07013-002**
Description: **SCDIHHSUR23**
Matrix: **Solid**
Date Sampled: **04/05/2021**
Date Received: **04/07/2021**

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
d5-EtFOSAA		94	50-150
d-MeFOSA		108	50-150
d3-MeFOSAA		85	50-150

LOQ = Limit of Quantitation	B = Detected in the method blank	E = Quantitation of compound exceeded the calibration range	DL = Detection Limit	Q = Surrogate failure
U = Not detected at or above the LOQ	N = Recovery is out of criteria	P = The RPD between two GC columns exceeds 40%	J = Estimated result < LOQ and ≥ DL	L = LCS/LCSD failure
H = Out of holding time	W = Reported on wet weight basis	LOD = Limit of Detection		S = MS/MSD failure

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SPLP PFAS (Australian)

Client: **Arcadis U.S., Inc.** Laboratory ID: **WD07013-003**

Description: **SCDIHHSSUR23RT1** Matrix: **Solid**

Date Sampled: **04/05/2021**

Date Received: **04/07/2021**

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch	Leachate Date
1	AS4439.3/PF	PFAS by ID SOP QSM B-15	1	04/21/2021 2319	JJG	04/20/2021 1618	89635	04/14/2021 0259

Parameter	CAS Number	Analytical Method	Result	Q	LOQ	LOD	DL	Units	Run
1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS)	39108-34-4	PFAS by ID SOP	20	U	80	40	20	ng/L	1
1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS)	**27619-97-2**	**PFAS by ID SOP**	**35**	**J**	**80**	40	**20**	**ng/L**	**1**
1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS)	757124-72-4	PFAS by ID SOP	20	U	80	40	20	ng/L	1
N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA)	2991-50-6	PFAS by ID SOP	20	U	80	40	20	ng/L	1
N-methylperfluoro-1-octanesulfonamide (MeFOSA)	31506-32-8	PFAS by ID SOP	40	U	160	80	40	ng/L	1
N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA)	2355-31-9	PFAS by ID SOP	20	U	80	40	20	ng/L	1
Perfluoro-1-butanesulfonic acid (PFBS)	375-73-5	PFAS by ID SOP	10	U	40	20	10	ng/L	1
Perfluoro-1-decanesulfonic acid (PFDS)	335-77-3	PFAS by ID SOP	10	U	40	20	10	ng/L	1
Perfluoro-1-heptanesulfonic acid (PFHpS)	375-92-8	PFAS by ID SOP	10	U	40	20	10	ng/L	1
Perfluoro-1-nonanesulfonic acid (PFNS)	68259-12-1	PFAS by ID SOP	10	U	40	20	10	ng/L	1
Perfluoro-1-octanesulfonamide (PFOSA)	754-91-6	PFAS by ID SOP	10	U	40	20	10	ng/L	1
Perfluoro-1-pentanesulfonic acid (PFPeS)	2706-91-4	PFAS by ID SOP	10	U	40	20	10	ng/L	1
Perfluorohexanesulfonic acid (PFHxS)	355-46-4	PFAS by ID SOP	10	U	40	20	10	ng/L	1
Perfluoro-n-butanoic acid (PFBA)	375-22-4	PFAS by ID SOP	10	U	40	20	10	ng/L	1
Perfluoro-n-decanoic acid (PFDA)	335-76-2	PFAS by ID SOP	10	U	40	20	10	ng/L	1
Perfluoro-n-dodecanoic acid (PFDoA)	307-55-1	PFAS by ID SOP	10	U	40	20	10	ng/L	1
Perfluoro-n-heptanoic acid (PFHpA)	375-85-9	PFAS by ID SOP	10	U	40	20	10	ng/L	1
Perfluoro-n-hexanoic acid (PFHxA)	307-24-4	PFAS by ID SOP	10	U	40	20	10	ng/L	1
Perfluoro-n-nonanoic acid (PFNA)	375-95-1	PFAS by ID SOP	10	U	40	20	10	ng/L	1
Perfluoro-n-octanoic acid (PFOA)	335-67-1	PFAS by ID SOP	10	U	40	20	10	ng/L	1
Perfluoro-n-pentanoic acid (PFPeA)	2706-90-3	PFAS by ID SOP	10	U	40	20	10	ng/L	1
Perfluoro-n-tetradecanoic acid (PFTeDA)	376-06-7	PFAS by ID SOP	10	U	40	20	10	ng/L	1
Perfluoro-n-tridecanoic acid (PFTrDA)	72629-94-8	PFAS by ID SOP	10	U	40	20	10	ng/L	1
Perfluoro-n-undecanoic acid (PFUdA)	2058-94-8	PFAS by ID SOP	10	U	40	20	10	ng/L	1
Perfluorooctanesulfonic acid (PFOS)	1763-23-1	PFAS by ID SOP	10	U	40	20	10	ng/L	1

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
13C2_4:2FTS		97	50-150
13C2_6:2FTS		92	50-150
13C2_8:2FTS		100	50-150
13C2_PFDoA		96	50-150
13C2_PFTeDA		89	50-150
13C3_PFBS		83	50-150
13C3_PFHxS		91	50-150
13C4_PFBA		98	50-150
13C4_PFHpA		104	50-150
13C5_PFHxA		103	50-150
13C5_PFPeA		94	50-150
13C6_PFDA		90	50-150
13C7_PFUdA		96	50-150
13C8_PFOA		96	50-150
13C8_PFOS		87	50-150
13C8_PFOSA		91	50-150
13C9_PFNA		92	50-150

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

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SPLP PFAS (Australian)

Client: **Arcadis U.S., Inc.**
Laboratory ID: **WD07013-003**
Description: **SCDIHHSSUR23RT1**
Matrix: **Solid**
Date Sampled: **04/05/2021**
Date Received: **04/07/2021**

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
d5-EtFOSAA		101	50-150
d-MeFOSA		96	50-150
d3-MeFOSAA		93	50-150

LOQ = Limit of Quantitation	B = Detected in the method blank	E = Quantitation of compound exceeded the calibration range	DL = Detection Limit	Q = Surrogate failure
U = Not detected at or above the LOQ	N = Recovery is out of criteria	P = The RPD between two GC columns exceeds 40%	J = Estimated result < LOQ and ≥ DL	L = LCS/LCSD failure
H = Out of holding time	W = Reported on wet weight basis	LOD = Limit of Detection		S = MS/MSD failure

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QC Summary

SPLP PFAS (Australian) - MB

Sample ID: WQ89635-001
Batch: 89635
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Solid
Prep Method: AS4439.3/PFAS
Prep Date: 04/20/2021 1618 **Leachate Date:** 04/14/2021 0259

Parameter	Result	Q	Dil	LOQ	LOD	DL	Units	Analysis Date
8:2 FTS	20	U	1	80	40	20	ng/L	04/21/2021 2143
6:2 FTS	20	U	1	80	40	20	ng/L	04/21/2021 2143
4:2 FTS	20	U	1	80	40	20	ng/L	04/21/2021 2143
EtFOSAA	20	U	1	80	40	20	ng/L	04/21/2021 2143
MeFOSA	40	U	1	160	80	40	ng/L	04/21/2021 2143
MeFOSAA	20	U	1	80	40	20	ng/L	04/21/2021 2143
PFBS	10	U	1	40	20	10	ng/L	04/21/2021 2143
PFDS	10	U	1	40	20	10	ng/L	04/21/2021 2143
PFHpS	10	U	1	40	20	10	ng/L	04/21/2021 2143
PFNS	10	U	1	40	20	10	ng/L	04/21/2021 2143
PFOSA	10	U	1	40	20	10	ng/L	04/21/2021 2143
PFPeS	10	U	1	40	20	10	ng/L	04/21/2021 2143
PFHxS	10	U	1	40	20	10	ng/L	04/21/2021 2143
PFBA	10	U	1	40	20	10	ng/L	04/21/2021 2143
PFDA	10	U	1	40	20	10	ng/L	04/21/2021 2143
PFDoA	10	U	1	40	20	10	ng/L	04/21/2021 2143
PFHpA	10	U	1	40	20	10	ng/L	04/21/2021 2143
PFHxA	10	U	1	40	20	10	ng/L	04/21/2021 2143
PFNA	10	U	1	40	20	10	ng/L	04/21/2021 2143
PFOA	10	U	1	40	20	10	ng/L	04/21/2021 2143
PFPeA	10	U	1	40	20	10	ng/L	04/21/2021 2143
PFTeDA	10	U	1	40	20	10	ng/L	04/21/2021 2143
PFTrDA	10	U	1	40	20	10	ng/L	04/21/2021 2143
PFUdA	10	U	1	40	20	10	ng/L	04/21/2021 2143
PFOS	10	U	1	40	20	10	ng/L	04/21/2021 2143

Surrogate	Q	% Rec	Acceptance Limit
13C2_4:2FTS		114	50-150
13C2_6:2FTS		97	50-150
13C2_8:2FTS		102	50-150
13C2_PFDoA		100	50-150
13C2_PFTeDA		100	50-150
13C3_PFBS		95	50-150
13C3_PFHxS		99	50-150
13C4_PFBA		104	50-150
13C4_PFHpA		106	50-150
13C5_PFHxA		106	50-150
13C5_PFPeA		102	50-150
13C6_PFDA		89	50-150
13C7_PFUdA		103	50-150
13C8_PFOA		104	50-150

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

SPLP PFAS (Australian) - MB

Sample ID: WQ89635-001
Batch: 89635
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Solid
Prep Method: AS4439.3/PFAS
Prep Date: 04/20/2021 1618 **Leachate Date:** 04/14/2021 0259

Surrogate	Q	% Rec	Acceptance Limit
13C8_PFOS		104	50-150
13C8_PFOSA		99	50-150
13C9_PFNA		106	50-150
d5-EtFOSAA		110	50-150
d-MeFOSA		99	50-150
d3-MeFOSAA		100	50-150

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

SPLP PFAS (Australian) - LCS

Sample ID: WQ89635-002 **Matrix:** Solid
Batch: 89635 **Prep Method:** AS4439.3/PFAS
Analytical Method: PFAS by ID SOP QSM B-15 **Prep Date:** 04/20/2021 1618 **Leachate Date:** 04/14/2021 0259

Parameter	Spike Amount (ng/L)	Result (ng/L)	Q	Dil	% Rec	%Rec Limit	Analysis Date
8:2 FTS	150	150		1	101	67-138	04/21/2021 2154
6:2 FTS	150	190		1	125	64-140	04/21/2021 2154
4:2 FTS	150	140		1	96	63-143	04/21/2021 2154
EtFOSAA	160	180		1	113	61-135	04/21/2021 2154
MeFOSA	160	150		1	95	68-141	04/21/2021 2154
MeFOSAA	160	150		1	95	65-136	04/21/2021 2154
PFBS	140	160		1	110	72-130	04/21/2021 2154
PFDS	150	160		1	106	53-142	04/21/2021 2154
PFHpS	150	150		1	98	69-134	04/21/2021 2154
PFNS	150	150		1	96	69-127	04/21/2021 2154
PFOSA	160	160		1	103	67-137	04/21/2021 2154
PFPeS	150	180		1	118	71-127	04/21/2021 2154
PFHxS	150	150		1	101	68-131	04/21/2021 2154
PFBA	160	160		1	103	73-129	04/21/2021 2154
PFDA	160	160		1	103	71-129	04/21/2021 2154
PFDoA	160	160		1	103	72-134	04/21/2021 2154
PFHpA	160	170		1	104	72-130	04/21/2021 2154
PFHxA	160	180		1	110	72-129	04/21/2021 2154
PFNA	160	170		1	104	69-130	04/21/2021 2154
PFOA	160	160		1	102	71-133	04/21/2021 2154
PFPeA	160	170		1	103	72-129	04/21/2021 2154
PFTeDA	160	170		1	104	71-132	04/21/2021 2154
PFTrDA	160	160		1	102	65-144	04/21/2021 2154
PFUdA	160	170		1	105	69-133	04/21/2021 2154
PFOS	150	140		1	94	65-140	04/21/2021 2154

Surrogate	Q	% Rec	Acceptance Limit
13C2_4:2FTS		102	50-150
13C2_6:2FTS		95	50-150
13C2_8:2FTS		94	50-150
13C2_PFDoA		94	50-150
13C2_PFTeDA		92	50-150
13C3_PFBS		86	50-150
13C3_PFHxS		93	50-150
13C4_PFBA		96	50-150
13C4_PFHpA		99	50-150
13C5_PFHxA		96	50-150
13C5_PFPeA		94	50-150
13C6_PFDA		81	50-150
13C7_PFUdA		91	50-150
13C8_PFOA		95	50-150

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection
U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

SPLP PFAS (Australian) - LCS

Sample ID: WQ89635-002
Batch: 89635
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Solid
Prep Method: AS4439.3/PFAS
Prep Date: 04/20/2021 1618 **Leachate Date:** 04/14/2021 0259

Surrogate	Q	% Rec	Acceptance Limit
13C8_PFOS		90	50-150
13C8_PFOSA		97	50-150
13C9_PFNA		92	50-150
d5-EtFOSAA		94	50-150
d-MeFOSA		96	50-150
d3-MeFOSAA		92	50-150

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

SPLP PFAS (Australian) - MS

Sample ID: WD07013-001MS
Batch: 89635
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Solid
Prep Method: AS4439.3/PFAS
Prep Date: 04/20/2021 1618 **Leachate Date:** 04/14/2021 0259

Parameter	Sample Amount (ng/L)	Spike Amount (ng/L)	Result (ng/L)	Q	Dil	% Rec	%Rec Limit	Analysis Date
8:2 FTS	ND	150	150		1	101	67-138	04/21/2021 2247
6:2 FTS	36	150	180		1	97	64-140	04/21/2021 2247
4:2 FTS	ND	150	140		1	93	63-143	04/21/2021 2247
EtFOSAA	ND	160	150		1	96	61-135	04/21/2021 2247
MeFOSA	ND	160	140		1	86	68-141	04/21/2021 2247
MeFOSAA	ND	160	160		1	101	65-136	04/21/2021 2247
PFBS	ND	140	150		1	105	72-130	04/21/2021 2247
PFDS	ND	150	150		1	100	53-142	04/21/2021 2247
PFHpS	ND	150	140		1	93	69-134	04/21/2021 2247
PFNS	ND	150	150		1	96	69-127	04/21/2021 2247
PFOSA	ND	160	160		1	100	67-137	04/21/2021 2247
PFPeS	ND	150	160		1	109	71-127	04/21/2021 2247
PFHxS	ND	150	150		1	103	68-131	04/21/2021 2247
PFBA	ND	160	150		1	95	73-129	04/21/2021 2247
PFDA	ND	160	160		1	99	71-129	04/21/2021 2247
PFDoA	ND	160	170		1	104	72-134	04/21/2021 2247
PFHpA	ND	160	140		1	89	72-130	04/21/2021 2247
PFHxA	ND	160	170		1	104	72-129	04/21/2021 2247
PFNA	ND	160	150		1	96	69-130	04/21/2021 2247
PFOA	ND	160	160		1	98	71-133	04/21/2021 2247
PFPeA	ND	160	150		1	94	72-129	04/21/2021 2247
PFTeDA	ND	160	160		1	101	71-132	04/21/2021 2247
PFTrDA	ND	160	160		1	99	65-144	04/21/2021 2247
PFUdA	ND	160	180		1	111	69-133	04/21/2021 2247
PFOS	ND	150	140		1	96	65-140	04/21/2021 2247

Surrogate	Q	% Rec	Acceptance Limit
13C2_4:2FTS		104	50-150
13C2_6:2FTS		97	50-150
13C2_8:2FTS		106	50-150
13C2_PFDoA		88	50-150
13C2_PFTeDA		95	50-150
13C3_PFBS		87	50-150
13C3_PFHxS		92	50-150
13C4_PFBA		100	50-150
13C4_PFHpA		102	50-150
13C5_PFHxA		97	50-150
13C5_PFPeA		100	50-150
13C6_PFDA		89	50-150
13C7_PFUdA		94	50-150
13C8_PFOA		98	50-150

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

SPLP PFAS (Australian) - MS

Sample ID: WD07013-001MS
Batch: 89635
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Solid
Prep Method: AS4439.3/PFAS
Prep Date: 04/20/2021 1618 **Leachate Date:** 04/14/2021 0259

Surrogate	Q	% Rec	Acceptance Limit
13C8_PFOS		92	50-150
13C8_PFOSA		98	50-150
13C9_PFNA		94	50-150
d5-EtFOSAA		96	50-150
d-MeFOSA		102	50-150
d3-MeFOSAA		96	50-150

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

SPLP PFAS (Australian) - MSD

Sample ID: WD07013-001MD
Batch: 89635
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Solid
Prep Method: AS4439.3/PFAS
Prep Date: 04/20/2021 1618 **Leachate Date:** 04/14/2021 0259

Parameter	Sample Amount (ng/L)	Spike Amount (ng/L)	Result (ng/L)	Q	Dil	% Rec	% RPD	%Rec Limit	% RPD Limit	Analysis Date
8:2 FTS	ND	150	180		1	119	17	67-138	30	04/21/2021 2257
6:2 FTS	36	150	180		1	92	4.2	64-140	30	04/21/2021 2257
4:2 FTS	ND	150	160		1	108	16	63-143	30	04/21/2021 2257
EtFOSAA	ND	160	140		1	89	7.5	61-135	30	04/21/2021 2257
MeFOSA	ND	160	170		1	108	22	68-141	30	04/21/2021 2257
MeFOSAA	ND	160	180		1	110	8.4	65-136	30	04/21/2021 2257
PFBS	ND	140	150		1	107	2.2	72-130	30	04/21/2021 2257
PFDS	ND	150	170		1	109	9.4	53-142	30	04/21/2021 2257
PFHpS	ND	150	140		1	92	1.3	69-134	30	04/21/2021 2257
PFNS	ND	150	190		1	122	24	69-127	30	04/21/2021 2257
PFOSA	ND	160	160		1	98	2.2	67-137	30	04/21/2021 2257
PFPeS	ND	150	180		1	123	12	71-127	30	04/21/2021 2257
PFHxS	ND	150	160		1	107	3.8	68-131	30	04/21/2021 2257
PFBA	ND	160	160		1	98	3.6	73-129	30	04/21/2021 2257
PFDA	ND	160	160		1	102	2.8	71-129	30	04/21/2021 2257
PFDoA	ND	160	160		1	102	2.4	72-134	30	04/21/2021 2257
PFHpA	ND	160	160		1	100	12	72-130	30	04/21/2021 2257
PFHxA	ND	160	150		1	95	9.2	72-129	30	04/21/2021 2257
PFNA	ND	160	160		1	103	7.6	69-130	30	04/21/2021 2257
PFOA	ND	160	150		1	97	1.1	71-133	30	04/21/2021 2257
PFPeA	ND	160	160		1	99	5.3	72-129	30	04/21/2021 2257
PFTeDA	ND	160	160		1	101	0.75	71-132	30	04/21/2021 2257
PFTrDA	ND	160	150		1	96	3.2	65-144	30	04/21/2021 2257
PFUdA	ND	160	150		1	94	17	69-133	30	04/21/2021 2257
PFOS	ND	150	140		1	96	0.70	65-140	30	04/21/2021 2257

Surrogate	Q	% Rec	Acceptance Limit
13C2_4:2FTS		89	50-150
13C2_6:2FTS		94	50-150
13C2_8:2FTS		90	50-150
13C2_PFDoA		89	50-150
13C2_PFTeDA		90	50-150
13C3_PFBS		76	50-150
13C3_PFHxS		88	50-150
13C4_PFBA		95	50-150
13C4_PFHpA		98	50-150
13C5_PFHxA		92	50-150
13C5_PFPeA		92	50-150
13C6_PFDA		83	50-150
13C7_PFUdA		92	50-150
13C8_PFOA		89	50-150

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

SPLP PFAS (Australian) - MSD

Sample ID: WD07013-001MD
Batch: 89635
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Solid
Prep Method: AS4439.3/PFAS
Prep Date: 04/20/2021 1618 **Leachate Date:** 04/14/2021 0259

Surrogate	Q	% Rec	Acceptance Limit
13C8_PFOS		80	50-150
13C8_PFOSA		91	50-150
13C9_PFNA		84	50-150
d5-EtFOSAA		98	50-150
d-MeFOSA		80	50-150
d3-MeFOSAA		93	50-150

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

Chain of Custody
and
Miscellaneous Documents

Shealy Environmental Services, Inc.
106 Vantage Point Drive
West Columbia, South Carolina 29172
Telephone No. (803) 791-9700 Fax No. (803) 791-9111
www.shealylab.com

Chain of Custody Record

Number

ient rcadis	Report to Contact Colin Morrell	Telephone No. / E-mail 902.209.3476 / colin@cleanearthtechnologies.ca	Quote No. Mike McFadden
ddress	Sampler's Signature X Printed Name	Analysis (Attach list if more space is needed) PFAS DoD QSM 5.3 ELAP Table B-15 cmpds and ASLP	Page 1 of 1
ity / State / Zip Code			
roject Name			

roject Number CC-EI	P.O No.		G=Grab C=Composite	Matrix: Aqueous	Solid	Non-Aqueous		No of Containers by Preservative Type: Unpres.	H2SO4	HNO3	HCl	NaOH	5035 Kit		PFAS DoD QSM 5.3 ELAP Table B-15	ASLP								Remarks / Cooler I.D.
Sample ID / Description (Containers for each sample may be combined on one line)	Date	Time																						
CDIHHSSUR23ILIM	April 5/21		C		x										x	x								PFAS
CDIHHSUR23	April 5/21		C		x										x	x								PFAS
CDIHHSSUR23RT1	April 5/21		C		x										x	x								PFAS

WD07013 KE82

WD07012 KE82

Turn Around Time Required (Prior lab approval required for expedited TAT)	Sample Disposal	Possible Hazard Identification (List any known hazards in the remarks)	QC Requirements
Standard [x] Rush (Please Specify) 1 week Total PFAS 2 week ASLP	[ ] Return to Client [x] Disposal by Lab	[ ] Non-Hazardous [ ] Flammable [ ] Skin Irritant [ ] SDS provided [ ] Unknown	

Relinquished by	Date	Time	Received by	Date	Time
Colin Morrell	April 5/21		1. Received by		
Relinquished by	Date	Time	2. Received by	Date	Time
Relinquished by	Date	Time	3. Received by	Date	Time
Relinquished by FedEx	Date 4/6/21	Time 0935	4. Laboratory Received by	Date 4/6/21	Time 0935

Note: All samples are retained for four weeks from receipt unless other arrangements are made.

LAB USE ONLY
Received on Ice (Check) [x] Y [ ] N [ ] Ice Pack

Receipt Temp. 2.0 °C

Document Number: ME002OW-01

PACE ANALYTICAL SERVICES, LLC

Pace Analytical

Samples Receipt Checklist (SRC) (ME0018C-15)
Issuing Authority: Pace ENV - WCOL

Revised:9/29/2020
Page 1 of 1

Sample Receipt Checklist (SRC)

Client: Arcadis Cooler Inspected by/date: KSC / 04/07/2021 Lot #: WD07012/WD07013

Means of receipt: ☐ Pace ☐ Client ☐ UPS ☑ FedEx ☐ Other: _____

☐ Yes	☑ No		1. Were custody seals present on the cooler?
☐ Yes	☐ No	☑ NA	2. If custody seals were present, were they intact and unbroken?

pH Strip ID: NA Chlorine Strip ID: NA Tested by: NA

Original temperature upon receipt / Derived (Corrected) temperature upon receipt %Solid Snap-Cup ID: 21-443

2.0 / 2.0 °C NA / NA °C NA / NA °C NA / NA °C

Method: ☐ Temperature Blank ☑ Against Bottles IR Gun ID: 5 IR Gun Correction Factor: 0 °C

Method of coolant: ☑ Wet Ice ☐ Ice Packs ☐ Dry Ice ☐ None

☐ Yes	☐ No	☑ NA	3. If temperature of any cooler exceeded 6.0°C, was Project Manager Notified? PM was Notified by: phone / email / face-to-face (circle one).
☐ Yes	☐ No	☑ NA	4. Is the commercial courier's packing slip attached to this form?
☑ Yes	☐ No		5. Were proper custody procedures (relinquished/received) followed?
☑ Yes	☐ No		6. Were sample IDs listed on the COC?
☑ Yes	☐ No		7. Were sample IDs listed on all sample containers?
☐ Yes	☑ No		8. Was collection date & time listed on the COC?
☐ Yes	☑ No		9. Was collection date & time listed on all sample containers?
☑ Yes	☐ No		10. Did all container label information (ID, date, time) agree with the COC?
☑ Yes	☐ No		11. Were tests to be performed listed on the COC?
☑ Yes	☐ No		12. Did all samples arrive in the proper containers for each test and/or in good condition (unbroken, lids on, etc.)?
☑ Yes	☐ No		13. Was adequate sample volume available?
☑ Yes	☐ No		14. Were all samples received within ½ the holding time or 48 hours, whichever comes first?
☐ Yes	☑ No		15. Were any samples containers missing/excess (circle one) samples Not listed on COC?
☐ Yes	☐ No	☑ NA	16. For VOA and RSK-175 samples, were bubbles present >"pea-size" (¼"or 6mm in diameter) in any of the VOA vials?
☐ Yes	☐ No	☑ NA	17. Were all DRO/metals/nutrient samples received at a pH of < 2?
☐ Yes	☐ No	☑ NA	18. Were all cyanide samples received at a pH > 12 and sulfide samples received at a pH > 9?
☐ Yes	☐ No	☑ NA	19. Were all applicable NH_3/TKN/cyanide/phenol/625.1/608.3 (< 0.5mg/L) samples free of residual chlorine?
☐ Yes	☐ No	☑ NA	20. Were client remarks/requests (i.e. requested dilutions, MS/MSD designations, etc…) correctly transcribed from the COC into the comment section in LIMS?
☐ Yes	☑ No		21. Was the quote number listed on the container label? If yes, Quote #

Sample Preservation (Must be completed for any sample(s) incorrectly preserved or with headspace.)

Sample(s) NA were received incorrectly preserved and were adjusted accordingly in sample receiving with NA mL of circle one: H2SO4, HNO3, HCl, NaOH using SR # NA.
Time of preservation NA. If more than one preservative is needed, please note in the comments below.

Sample(s) NA were received with bubbles >6 mm in diameter.

Samples(s) NA were received with TRC > 0.5 mg/L (If #19 is *no*) and were adjusted accordingly in sample receiving with sodium thiosulfate ($Na_2S_2O_3$) with Shealy ID: NA.

SR barcode labels applied by: JkG2 Date: 04/07/2021

Comments: No dates listed on COC or on containers

Report of Analysis

Arcadis U.S., Inc.
630 Plaza Drive
Suite 600
Highlands Ranch, CO 80129
Attention: Joseph Quinnan

Project Name: Eielson AFB

Project Number: 30030317

Lot Number:**WA04033**

Date Completed:01/11/2021

Project Manager:**Marcia K. McGinnity**

N. Saikaly

01/11/2021 2:46 PM
Approved and released by:
Project Manager II: **Nisreen Saikaly**

The electronic signature above is the equivalent of a handwritten signature.
This report shall not be reproduced, except in its entirety, without the written approval of Pace Analytical Services, LLC.

Pace Analytical Services, LLC (*formerly Shealy Environmental Services, Inc.*)
106 Vantage Point Drive West Columbia, SC 29172
Tel: 803-791-9700 Fax: 803-791-9111 www.pacelabs.com

Case Narrative
Arcadis U.S., Inc.
Lot Number: WA04033

This Report of Analysis contains the analytical result(s) for the sample(s) listed on the Sample Summary following this Case Narrative. The sample receiving date is documented in the header information associated with each sample.

All results listed in this report relate only to the samples that are contained within this report.

Sample receipt, sample analysis, and data review have been performed in accordance with the most current approved The NELAC Institute (TNI) standards, the Pace Analytical Services, LLC ("Pace") Laboratory Quality Manual, standard operating procedures (SOPs), and Pace policies. Additionally, the DoD QSM version 5.3 has been followed for these samples, and specifically Table B-15 was followed for all PFAS samples. Any exceptions to the TNI standards, the Laboratory Quality Manual, SOPs, the DoD QSM, or policies are qualified on the results page or discussed below.

Where applicable, all soil sample analysis are reported on a dry weight basis unless flagged with a "W" qualifier

If you have any questions regarding this report please contact the Pace Project Manager listed on the cover page.

Sample Summary
Arcadis U.S., Inc.
Lot Number: WA04033

Sample Number	Sample ID	Matrix	Date Sampled	Date Received
001	393-1-UT	Solid	12/29/2020	01/04/2021
002	R-TC	Solid	12/29/2020	01/04/2021
003	R-TH	Solid	12/29/2020	01/04/2021
004	G-TC	Solid	12/29/2020	01/04/2021
005	G-TH	Solid	12/29/2020	01/04/2021
006	SFIF2STTC	Solid	12/29/2020	01/04/2021
007	SF1F2STDIH	Solid	12/29/2020	01/04/2021
008	SFIF2STM	Solid	12/29/2020	01/04/2021
009	F-F1F2	Solid	12/29/2020	01/04/2021
010	F-F1F2HSTC	Solid	12/29/2020	01/04/2021
011	F-F1F2HS5050TC	Solid	12/29/2020	01/04/2021

(11 samples)

Detection Summary

Arcadis U.S., Inc.

Lot Number: WA04033

Sample	Sample ID	Matrix	Parameter	Method	Result	Q	Units	Page
001	393-1-UT	Solid	8:2 FTS	PFAS by ID	120		ug/kg	7
001	393-1-UT	Solid	6:2 FTS	PFAS by ID	19	J	ug/kg	7
001	393-1-UT	Solid	PFBS	PFAS by ID	6.6	J	ug/kg	7
001	393-1-UT	Solid	PFDS	PFAS by ID	17	J	ug/kg	7
001	393-1-UT	Solid	PFNS	PFAS by ID	19	J	ug/kg	7
001	393-1-UT	Solid	PFOSA	PFAS by ID	97		ug/kg	7
001	393-1-UT	Solid	PFPeS	PFAS by ID	8.1	J	ug/kg	7
001	393-1-UT	Solid	PFHxS	PFAS by ID	98		ug/kg	7
001	393-1-UT	Solid	PFBA	PFAS by ID	4.6	J	ug/kg	7
001	393-1-UT	Solid	PFDoA	PFAS by ID	4.2	J	ug/kg	7
001	393-1-UT	Solid	PFHpA	PFAS by ID	5.0	J	ug/kg	7
001	393-1-UT	Solid	PFHxA	PFAS by ID	40		ug/kg	7
001	393-1-UT	Solid	PFPeA	PFAS by ID	12	J	ug/kg	7
001	393-1-UT	Solid	PFUdA	PFAS by ID	4.6	J	ug/kg	7
001	393-1-UT	Solid	PFOS	PFAS by ID	2700		ug/kg	7
002	R-TC	Solid	8:2 FTS	PFAS by ID	2.6		ug/kg	9
002	R-TC	Solid	PFDS	PFAS by ID	0.73	J	ug/kg	9
002	R-TC	Solid	PFNS	PFAS by ID	0.99	J	ug/kg	9
002	R-TC	Solid	PFOSA	PFAS by ID	3.4		ug/kg	9
002	R-TC	Solid	PFHxS	PFAS by ID	0.61	J	ug/kg	9
002	R-TC	Solid	PFHxA	PFAS by ID	0.50	J	ug/kg	9
002	R-TC	Solid	PFPeA	PFAS by ID	0.23	J	ug/kg	9
002	R-TC	Solid	PFOS	PFAS by ID	88		ug/kg	9
003	R-TH	Solid	8:2 FTS	PFAS by ID	0.60	J	ug/kg	11
003	R-TH	Solid	PFDS	PFAS by ID	0.38	J	ug/kg	11
003	R-TH	Solid	PFOSA	PFAS by ID	0.46	J	ug/kg	11
003	R-TH	Solid	PFOS	PFAS by ID	14		ug/kg	11
004	G-TC	Solid	8:2 FTS	PFAS by ID	1.1	J	ug/kg	13
004	G-TC	Solid	PFNS	PFAS by ID	0.25	J	ug/kg	13
004	G-TC	Solid	PFOSA	PFAS by ID	2.0		ug/kg	13
004	G-TC	Solid	PFHxS	PFAS by ID	1.4		ug/kg	13
004	G-TC	Solid	PFHxA	PFAS by ID	0.43	J	ug/kg	13
004	G-TC	Solid	PFPeA	PFAS by ID	0.21	J	ug/kg	13
004	G-TC	Solid	PFOS	PFAS by ID	27		ug/kg	13
005	G-TH	Solid	8:2 FTS	PFAS by ID	8.7	J	ug/kg	15
005	G-TH	Solid	PFDS	PFAS by ID	3.6	J	ug/kg	15
005	G-TH	Solid	PFNS	PFAS by ID	3.1	J	ug/kg	15
005	G-TH	Solid	PFOSA	PFAS by ID	12		ug/kg	15
005	G-TH	Solid	PFHxS	PFAS by ID	3.0	J	ug/kg	15
005	G-TH	Solid	PFBA	PFAS by ID	1.4	J	ug/kg	15
005	G-TH	Solid	PFOS	PFAS by ID	270		ug/kg	15
006	SFIF2STTC	Solid	8:2 FTS	PFAS by ID	5.7		ug/kg	17
006	SFIF2STTC	Solid	6:2 FTS	PFAS by ID	0.71	J	ug/kg	17
006	SFIF2STTC	Solid	PFBS	PFAS by ID	0.26	J	ug/kg	17
006	SFIF2STTC	Solid	PFDS	PFAS by ID	2.7		ug/kg	17

Detection Summary (Continued)

Lot Number: WA04033

Sample	Sample ID	Matrix	Parameter	Method	Result	Q	Units	Page
006	SFIF2STTC	Solid	PFHpS	PFAS by ID	0.36	J	ug/kg	17
006	SFIF2STTC	Solid	PFNS	PFAS by ID	1.6		ug/kg	17
006	SFIF2STTC	Solid	PFOSA	PFAS by ID	5.4		ug/kg	17
006	SFIF2STTC	Solid	PFPeS	PFAS by ID	0.29	J	ug/kg	17
006	SFIF2STTC	Solid	PFHxS	PFAS by ID	5.5		ug/kg	17
006	SFIF2STTC	Solid	PFDoA	PFAS by ID	0.67	J	ug/kg	17
006	SFIF2STTC	Solid	PFHpA	PFAS by ID	0.23	J	ug/kg	17
006	SFIF2STTC	Solid	PFHxA	PFAS by ID	0.92		ug/kg	17
006	SFIF2STTC	Solid	PFOA	PFAS by ID	0.55	J	ug/kg	17
006	SFIF2STTC	Solid	PFPeA	PFAS by ID	0.19	J	ug/kg	17
006	SFIF2STTC	Solid	PFTeDA	PFAS by ID	0.29	J	ug/kg	17
006	SFIF2STTC	Solid	PFTrDA	PFAS by ID	0.25	J	ug/kg	17
006	SFIF2STTC	Solid	PFUdA	PFAS by ID	0.58	J	ug/kg	17
006	SFIF2STTC	Solid	PFOS	PFAS by ID	150		ug/kg	17
007	SF1F2STDIH	Solid	8:2 FTS	PFAS by ID	3.3		ug/kg	19
007	SF1F2STDIH	Solid	PFDS	PFAS by ID	1.5		ug/kg	19
007	SF1F2STDIH	Solid	PFNS	PFAS by ID	1.0		ug/kg	19
007	SF1F2STDIH	Solid	PFOSA	PFAS by ID	1.6		ug/kg	19
007	SF1F2STDIH	Solid	PFHxS	PFAS by ID	0.95	J	ug/kg	19
007	SF1F2STDIH	Solid	PFDA	PFAS by ID	0.23	J	ug/kg	19
007	SF1F2STDIH	Solid	PFDoA	PFAS by ID	0.38	J	ug/kg	19
007	SF1F2STDIH	Solid	PFHxA	PFAS by ID	0.29	J	ug/kg	19
007	SF1F2STDIH	Solid	PFTeDA	PFAS by ID	0.20	J	ug/kg	19
007	SF1F2STDIH	Solid	PFTrDA	PFAS by ID	0.20	J	ug/kg	19
007	SF1F2STDIH	Solid	PFUdA	PFAS by ID	0.36	J	ug/kg	19
007	SF1F2STDIH	Solid	PFOS	PFAS by ID	51		ug/kg	19
008	SFIF2STM	Solid	8:2 FTS	PFAS by ID	3.8		ug/kg	21
008	SFIF2STM	Solid	6:2 FTS	PFAS by ID	0.81	J	ug/kg	21
008	SFIF2STM	Solid	PFDS	PFAS by ID	1.5		ug/kg	21
008	SFIF2STM	Solid	PFNS	PFAS by ID	1.1		ug/kg	21
008	SFIF2STM	Solid	PFOSA	PFAS by ID	3.5		ug/kg	21
008	SFIF2STM	Solid	PFHxS	PFAS by ID	2.4		ug/kg	21
008	SFIF2STM	Solid	PFBA	PFAS by ID	0.19	J	ug/kg	21
008	SFIF2STM	Solid	PFDoA	PFAS by ID	0.44	J	ug/kg	21
008	SFIF2STM	Solid	PFHxA	PFAS by ID	1.8		ug/kg	21
008	SFIF2STM	Solid	PFPeA	PFAS by ID	0.35	J	ug/kg	21
008	SFIF2STM	Solid	PFTeDA	PFAS by ID	0.22	J	ug/kg	21
008	SFIF2STM	Solid	PFUdA	PFAS by ID	0.27	J	ug/kg	21
008	SFIF2STM	Solid	PFOS	PFAS by ID	59		ug/kg	21
009	F-F1F2	Solid	8:2 FTS	PFAS by ID	170		ug/kg	23
009	F-F1F2	Solid	PFBS	PFAS by ID	3.1	J	ug/kg	23
009	F-F1F2	Solid	PFDS	PFAS by ID	60		ug/kg	23
009	F-F1F2	Solid	PFNS	PFAS by ID	65		ug/kg	23
009	F-F1F2	Solid	PFOSA	PFAS by ID	170		ug/kg	23
009	F-F1F2	Solid	PFPeS	PFAS by ID	4.3	J	ug/kg	23
009	F-F1F2	Solid	PFHxS	PFAS by ID	58		ug/kg	23
009	F-F1F2	Solid	PFDA	PFAS by ID	8.4	J	ug/kg	23
009	F-F1F2	Solid	PFDoA	PFAS by ID	15		ug/kg	23

Detection Summary (Continued)

Lot Number: WA04033

Sample	Sample ID	Matrix	Parameter	Method	Result	Q	Units	Page
009	F-F1F2	Solid	PFHxA	PFAS by ID	9.4	J	ug/kg	23
009	F-F1F2	Solid	PFTeDA	PFAS by ID	3.4	J	ug/kg	23
009	F-F1F2	Solid	PFTrDA	PFAS by ID	3.9	J	ug/kg	23
009	F-F1F2	Solid	PFUdA	PFAS by ID	21		ug/kg	23
009	F-F1F2	Solid	PFOS	PFAS by ID	2400		ug/kg	23
010	F-F1F2HSTC	Solid	8:2 FTS	PFAS by ID	65		ug/kg	25
010	F-F1F2HSTC	Solid	PFDS	PFAS by ID	50		ug/kg	25
010	F-F1F2HSTC	Solid	PFNS	PFAS by ID	40		ug/kg	25
010	F-F1F2HSTC	Solid	PFOSA	PFAS by ID	100		ug/kg	25
010	F-F1F2HSTC	Solid	PFHxS	PFAS by ID	47		ug/kg	25
010	F-F1F2HSTC	Solid	PFDA	PFAS by ID	4.5	J	ug/kg	25
010	F-F1F2HSTC	Solid	PFDoA	PFAS by ID	15	J	ug/kg	25
010	F-F1F2HSTC	Solid	PFHxA	PFAS by ID	9.3	J	ug/kg	25
010	F-F1F2HSTC	Solid	PFTrDA	PFAS by ID	4.4	J	ug/kg	25
010	F-F1F2HSTC	Solid	PFUdA	PFAS by ID	12	J	ug/kg	25
010	F-F1F2HSTC	Solid	PFOS	PFAS by ID	1000		ug/kg	25
011	F-F1F2HS5050TC	Solid	8:2 FTS	PFAS by ID	24		ug/kg	27
011	F-F1F2HS5050TC	Solid	6:2 FTS	PFAS by ID	6.6	J	ug/kg	27
011	F-F1F2HS5050TC	Solid	PFBS	PFAS by ID	2.0	J	ug/kg	27
011	F-F1F2HS5050TC	Solid	PFDS	PFAS by ID	22		ug/kg	27
011	F-F1F2HS5050TC	Solid	PFHpS	PFAS by ID	3.0	J	ug/kg	27
011	F-F1F2HS5050TC	Solid	PFNS	PFAS by ID	12		ug/kg	27
011	F-F1F2HS5050TC	Solid	PFOSA	PFAS by ID	31		ug/kg	27
011	F-F1F2HS5050TC	Solid	PFPeS	PFAS by ID	3.2	J	ug/kg	27
011	F-F1F2HS5050TC	Solid	PFHxS	PFAS by ID	41		ug/kg	27
011	F-F1F2HS5050TC	Solid	PFDA	PFAS by ID	1.6	J	ug/kg	27
011	F-F1F2HS5050TC	Solid	PFDoA	PFAS by ID	5.0	J	ug/kg	27
011	F-F1F2HS5050TC	Solid	PFHxA	PFAS by ID	5.9	J	ug/kg	27
011	F-F1F2HS5050TC	Solid	PFPeA	PFAS by ID	1.7	J	ug/kg	27
011	F-F1F2HS5050TC	Solid	PFTeDA	PFAS by ID	3.8	J	ug/kg	27
011	F-F1F2HS5050TC	Solid	PFTrDA	PFAS by ID	2.8	J	ug/kg	27
011	F-F1F2HS5050TC	Solid	PFUdA	PFAS by ID	3.5	J	ug/kg	27
011	F-F1F2HS5050TC	Solid	PFOS	PFAS by ID	480		ug/kg	27

(126 detections)

PFAS by LC/MS/MS

Client: **Arcadis U.S., Inc.** Laboratory ID: **WA04033-001**

Description: **393-1-UT** Matrix: **Solid**

Date Sampled: **12/29/2020** % Solids: **94.3** **01/04/2021 2321**

Date Received: **01/04/2021**

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch
1	SOP SPE	PFAS by ID SOP QSM B-15	20	01/08/2021 1704	SES	01/06/2021 1210	78621

Parameter	CAS Number	Analytical Method	Result	Q	LOQ	LOD	DL	Units	Run
1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS)	**39108-34-4**	**PFAS by ID SOP**	**120**		**42**	21	**11**	**ug/kg**	**1**
1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS)	**27619-97-2**	**PFAS by ID SOP**	**19**	**J**	**42**	21	**11**	**ug/kg**	**1**
1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS)	757124-72-4	PFAS by ID SOP	21	U	42	21	11	ug/kg	1
N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA)	2991-50-6	PFAS by ID SOP	21	U	42	21	11	ug/kg	1
N-methylperfluoro-1-octanesulfonamide (MeFOSA)	31506-32-8	PFAS by ID SOP	21	U	42	21	11	ug/kg	1
N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA)	2355-31-9	PFAS by ID SOP	21	U	42	21	11	ug/kg	1
Perfluoro-1-butanesulfonic acid (PFBS)	**375-73-5**	**PFAS by ID SOP**	**6.6**	**J**	**21**	11	**4.2**	**ug/kg**	**1**
Perfluoro-1-decanesulfonic acid (PFDS)	**335-77-3**	**PFAS by ID SOP**	**17**	**J**	**21**	11	**4.2**	**ug/kg**	**1**
Perfluoro-1-heptanesulfonic acid (PFHpS)	375-92-8	PFAS by ID SOP	11	U	21	11	4.2	ug/kg	1
Perfluoro-1-nonanesulfonic acid (PFNS)	**68259-12-1**	**PFAS by ID SOP**	**19**	**J**	**21**	11	**4.2**	**ug/kg**	**1**
Perfluoro-1-octanesulfonamide (PFOSA)	**754-91-6**	**PFAS by ID SOP**	**97**		**21**	11	**4.2**	**ug/kg**	**1**
Perfluoro-1-pentanesulfonic acid (PFPeS)	**2706-91-4**	**PFAS by ID SOP**	**8.1**	**J**	**21**	11	**4.2**	**ug/kg**	**1**
Perfluorohexanesulfonic acid (PFHxS)	**355-46-4**	**PFAS by ID SOP**	**98**		**21**	11	**4.2**	**ug/kg**	**1**
Perfluoro-n-butanoic acid (PFBA)	**375-22-4**	**PFAS by ID SOP**	**4.6**	**J**	**21**	11	**4.2**	**ug/kg**	**1**
Perfluoro-n-decanoic acid (PFDA)	335-76-2	PFAS by ID SOP	11	U	21	11	4.2	ug/kg	1
Perfluoro-n-dodecanoic acid (PFDoA)	**307-55-1**	**PFAS by ID SOP**	**4.2**	**J**	**21**	11	**4.2**	**ug/kg**	**1**
Perfluoro-n-heptanoic acid (PFHpA)	**375-85-9**	**PFAS by ID SOP**	**5.0**	**J**	**21**	11	**4.2**	**ug/kg**	**1**
Perfluoro-n-hexanoic acid (PFHxA)	**307-24-4**	**PFAS by ID SOP**	**40**		**21**	11	**4.2**	**ug/kg**	**1**
Perfluoro-n-nonanoic acid (PFNA)	375-95-1	PFAS by ID SOP	11	U	21	11	4.2	ug/kg	1
Perfluoro-n-octanoic acid (PFOA)	335-67-1	PFAS by ID SOP	11	U	21	11	4.2	ug/kg	1
Perfluoro-n-pentanoic acid (PFPeA)	**2706-90-3**	**PFAS by ID SOP**	**12**	**J**	**21**	11	**4.2**	**ug/kg**	**1**
Perfluoro-n-tetradecanoic acid (PFTeDA)	376-06-7	PFAS by ID SOP	11	U	21	11	4.2	ug/kg	1
Perfluoro-n-tridecanoic acid (PFTrDA)	72629-94-8	PFAS by ID SOP	11	U	21	11	4.2	ug/kg	1
Perfluoro-n-undecanoic acid (PFUdA)	**2058-94-8**	**PFAS by ID SOP**	**4.6**	**J**	**21**	11	**4.2**	**ug/kg**	**1**
Perfluorooctanesulfonic acid (PFOS)	**1763-23-1**	**PFAS by ID SOP**	**2700**		**21**	11	**4.2**	**ug/kg**	**1**

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
13C2_4:2FTS		87	50-150
13C2_6:2FTS		96	50-150
13C2_8:2FTS		87	50-150
13C2_PFDoA		96	50-150
13C2_PFTeDA		94	50-150
13C3_PFBS		93	50-150
13C3_PFHxS		93	50-150
13C4_PFBA		97	50-150
13C4_PFHpA		96	50-150
13C5_PFHxA		94	50-150
13C5_PFPeA		95	50-150
13C6_PFDA		96	50-150
13C7_PFUdA		96	50-150
13C8_PFOA		94	50-150
13C8_PFOS		95	50-150
13C8_PFOSA		96	50-150
13C9_PFNA		93	50-150

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

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PFAS by LC/MS/MS

Client: **Arcadis U.S., Inc.**
Laboratory ID: **WA04033-001**
Description: **393-1-UT**
Matrix: **Solid**
Date Sampled: **12/29/2020**
% Solids: **94.3** **01/04/2021 2321**
Date Received: **01/04/2021**

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
d5-EtFOSAA		95	50-150
d-MeFOSA		98	50-150
d3-MeFOSAA		97	50-150

LOQ = Limit of Quantitation	B = Detected in the method blank	E = Quantitation of compound exceeded the calibration range	DL = Detection Limit	Q = Surrogate failure
U = Not detected at or above the LOQ	N = Recovery is out of criteria	P = The RPD between two GC columns exceeds 40%	J = Estimated result < LOQ and ≥ DL	L = LCS/LCSD failure
H = Out of holding time	W = Reported on wet weight basis	LOD = Limit of Detection		S = MS/MSD failure

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PFAS by LC/MS/MS

Client: **Arcadis U.S., Inc.** Laboratory ID: **WA04033-002**

Description: **R-TC** Matrix: **Solid**

Date Sampled: **12/29/2020** % Solids: **99.7** **01/04/2021 2321**

Date Received: **01/04/2021**

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch
1	SOP SPE	PFAS by ID SOP QSM B-15	1	01/08/2021 1539	SES	01/06/2021 1210	78621

Parameter	CAS Number	Analytical Method	Result	Q	LOQ	LOD	DL	Units	Run
1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS)	**39108-34-4**	**PFAS by ID SOP**	**2.6**		**2.0**	1.0	**0.50**	**ug/kg**	**1**
1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS)	27619-97-2	PFAS by ID SOP	1.0	U	2.0	1.0	0.50	ug/kg	1
1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS)	757124-72-4	PFAS by ID SOP	1.0	U	2.0	1.0	0.50	ug/kg	1
N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA)	2991-50-6	PFAS by ID SOP	1.0	U	2.0	1.0	0.50	ug/kg	1
N-methylperfluoro-1-octanesulfonamide (MeFOSA)	31506-32-8	PFAS by ID SOP	1.0	U	2.0	1.0	0.50	ug/kg	1
N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA)	2355-31-9	PFAS by ID SOP	1.0	U	2.0	1.0	0.50	ug/kg	1
Perfluoro-1-butanesulfonic acid (PFBS)	375-73-5	PFAS by ID SOP	0.50	U	1.0	0.50	0.20	ug/kg	1
Perfluoro-1-decanesulfonic acid (PFDS)	**335-77-3**	**PFAS by ID SOP**	**0.73**	**J**	**1.0**	0.50	**0.20**	**ug/kg**	**1**
Perfluoro-1-heptanesulfonic acid (PFHpS)	375-92-8	PFAS by ID SOP	0.50	U	1.0	0.50	0.20	ug/kg	1
Perfluoro-1-nonanesulfonic acid (PFNS)	**68259-12-1**	**PFAS by ID SOP**	**0.99**	**J**	**1.0**	0.50	**0.20**	**ug/kg**	**1**
Perfluoro-1-octanesulfonamide (PFOSA)	**754-91-6**	**PFAS by ID SOP**	**3.4**		**1.0**	0.50	**0.20**	**ug/kg**	**1**
Perfluoro-1-pentanesulfonic acid (PFPeS)	2706-91-4	PFAS by ID SOP	0.50	U	1.0	0.50	0.20	ug/kg	1
Perfluorohexanesulfonic acid (PFHxS)	**355-46-4**	**PFAS by ID SOP**	**0.61**	**J**	**1.0**	0.50	**0.20**	**ug/kg**	**1**
Perfluoro-n-butanoic acid (PFBA)	375-22-4	PFAS by ID SOP	0.50	U	1.0	0.50	0.20	ug/kg	1
Perfluoro-n-decanoic acid (PFDA)	335-76-2	PFAS by ID SOP	0.50	U	1.0	0.50	0.20	ug/kg	1
Perfluoro-n-dodecanoic acid (PFDoA)	307-55-1	PFAS by ID SOP	0.50	U	1.0	0.50	0.20	ug/kg	1
Perfluoro-n-heptanoic acid (PFHpA)	375-85-9	PFAS by ID SOP	0.50	U	1.0	0.50	0.20	ug/kg	1
Perfluoro-n-hexanoic acid (PFHxA)	**307-24-4**	**PFAS by ID SOP**	**0.50**	**J**	**1.0**	0.50	**0.20**	**ug/kg**	**1**
Perfluoro-n-nonanoic acid (PFNA)	375-95-1	PFAS by ID SOP	0.50	U	1.0	0.50	0.20	ug/kg	1
Perfluoro-n-octanoic acid (PFOA)	335-67-1	PFAS by ID SOP	0.50	U	1.0	0.50	0.20	ug/kg	1
Perfluoro-n-pentanoic acid (PFPeA)	**2706-90-3**	**PFAS by ID SOP**	**0.23**	**J**	**1.0**	0.50	**0.20**	**ug/kg**	**1**
Perfluoro-n-tetradecanoic acid (PFTeDA)	376-06-7	PFAS by ID SOP	0.50	U	1.0	0.50	0.20	ug/kg	1
Perfluoro-n-tridecanoic acid (PFTrDA)	72629-94-8	PFAS by ID SOP	0.50	U	1.0	0.50	0.20	ug/kg	1
Perfluoro-n-undecanoic acid (PFUdA)	2058-94-8	PFAS by ID SOP	0.50	U	1.0	0.50	0.20	ug/kg	1
Perfluorooctanesulfonic acid (PFOS)	**1763-23-1**	**PFAS by ID SOP**	**88**		**1.0**	0.50	**0.20**	**ug/kg**	**1**

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
13C2_4:2FTS		84	50-150
13C2_6:2FTS		97	50-150
13C2_8:2FTS		79	50-150
13C2_PFDoA		80	50-150
13C2_PFTeDA		87	50-150
13C3_PFBS		75	50-150
13C3_PFHxS		79	50-150
13C4_PFBA		87	50-150
13C4_PFHpA		90	50-150
13C5_PFHxA		84	50-150
13C5_PFPeA		85	50-150
13C6_PFDA		89	50-150
13C7_PFUdA		87	50-150
13C8_PFOA		86	50-150
13C8_PFOS		80	50-150
13C8_PFOSA		91	50-150
13C9_PFNA		84	50-150

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

PFAS by LC/MS/MS

Client: **Arcadis U.S., Inc.**
Laboratory ID: **WA04033-002**
Description: **R-TC**
Matrix: **Solid**
Date Sampled: **12/29/2020**
% Solids: **99.7** **01/04/2021 2321**
Date Received: **01/04/2021**

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
d5-EtFOSAA		92	50-150
d-MeFOSA		86	50-150
d3-MeFOSAA		92	50-150

LOQ = Limit of Quantitation	B = Detected in the method blank	E = Quantitation of compound exceeded the calibration range	DL = Detection Limit	Q = Surrogate failure
U = Not detected at or above the LOQ	N = Recovery is out of criteria	P = The RPD between two GC columns exceeds 40%	J = Estimated result < LOQ and ≥ DL	L = LCS/LCSD failure
H = Out of holding time	W = Reported on wet weight basis	LOD = Limit of Detection		S = MS/MSD failure

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PFAS by LC/MS/MS

Client: **Arcadis U.S., Inc.** Laboratory ID: **WA04033-003**

Description: **R-TH** Matrix: **Solid**

Date Sampled: **12/29/2020** % Solids: **99.6** **01/04/2021 2321**

Date Received: **01/04/2021**

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch
1	SOP SPE	PFAS by ID SOP QSM B-15	1	01/08/2021 1550	SES	01/06/2021 1210	78621

Parameter	CAS Number	Analytical Method	Result	Q	LOQ	LOD	DL	Units	Run
1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS)	**39108-34-4**	**PFAS by ID SOP**	**0.60**	**J**	**1.8**	0.90	**0.45**	**ug/kg**	**1**
1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS)	27619-97-2	PFAS by ID SOP	0.90	U	1.8	0.90	0.45	ug/kg	1
1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS)	757124-72-4	PFAS by ID SOP	0.90	U	1.8	0.90	0.45	ug/kg	1
N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA)	2991-50-6	PFAS by ID SOP	0.90	U	1.8	0.90	0.45	ug/kg	1
N-methylperfluoro-1-octanesulfonamide (MeFOSA)	31506-32-8	PFAS by ID SOP	0.90	U	1.8	0.90	0.45	ug/kg	1
N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA)	2355-31-9	PFAS by ID SOP	0.90	U	1.8	0.90	0.45	ug/kg	1
Perfluoro-1-butanesulfonic acid (PFBS)	375-73-5	PFAS by ID SOP	0.45	U	0.90	0.45	0.18	ug/kg	1
Perfluoro-1-decanesulfonic acid (PFDS)	**335-77-3**	**PFAS by ID SOP**	**0.38**	**J**	**0.90**	0.45	**0.18**	**ug/kg**	**1**
Perfluoro-1-heptanesulfonic acid (PFHpS)	375-92-8	PFAS by ID SOP	0.45	U	0.90	0.45	0.18	ug/kg	1
Perfluoro-1-nonanesulfonic acid (PFNS)	68259-12-1	PFAS by ID SOP	0.45	U	0.90	0.45	0.18	ug/kg	1
Perfluoro-1-octanesulfonamide (PFOSA)	**754-91-6**	**PFAS by ID SOP**	**0.46**	**J**	**0.90**	0.45	**0.18**	**ug/kg**	**1**
Perfluoro-1-pentanesulfonic acid (PFPeS)	2706-91-4	PFAS by ID SOP	0.45	U	0.90	0.45	0.18	ug/kg	1
Perfluorohexanesulfonic acid (PFHxS)	355-46-4	PFAS by ID SOP	0.45	U	0.90	0.45	0.18	ug/kg	1
Perfluoro-n-butanoic acid (PFBA)	375-22-4	PFAS by ID SOP	0.45	U	0.90	0.45	0.18	ug/kg	1
Perfluoro-n-decanoic acid (PFDA)	335-76-2	PFAS by ID SOP	0.45	U	0.90	0.45	0.18	ug/kg	1
Perfluoro-n-dodecanoic acid (PFDoA)	307-55-1	PFAS by ID SOP	0.45	U	0.90	0.45	0.18	ug/kg	1
Perfluoro-n-heptanoic acid (PFHpA)	375-85-9	PFAS by ID SOP	0.45	U	0.90	0.45	0.18	ug/kg	1
Perfluoro-n-hexanoic acid (PFHxA)	307-24-4	PFAS by ID SOP	0.45	U	0.90	0.45	0.18	ug/kg	1
Perfluoro-n-nonanoic acid (PFNA)	375-95-1	PFAS by ID SOP	0.45	U	0.90	0.45	0.18	ug/kg	1
Perfluoro-n-octanoic acid (PFOA)	335-67-1	PFAS by ID SOP	0.45	U	0.90	0.45	0.18	ug/kg	1
Perfluoro-n-pentanoic acid (PFPeA)	2706-90-3	PFAS by ID SOP	0.45	U	0.90	0.45	0.18	ug/kg	1
Perfluoro-n-tetradecanoic acid (PFTeDA)	376-06-7	PFAS by ID SOP	0.45	U	0.90	0.45	0.18	ug/kg	1
Perfluoro-n-tridecanoic acid (PFTrDA)	72629-94-8	PFAS by ID SOP	0.45	U	0.90	0.45	0.18	ug/kg	1
Perfluoro-n-undecanoic acid (PFUdA)	2058-94-8	PFAS by ID SOP	0.45	U	0.90	0.45	0.18	ug/kg	1
Perfluorooctanesulfonic acid (PFOS)	**1763-23-1**	**PFAS by ID SOP**	**14**		**0.90**	0.45	**0.18**	**ug/kg**	**1**

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
13C2_4:2FTS		89	50-150
13C2_6:2FTS		91	50-150
13C2_8:2FTS		85	50-150
13C2_PFDoA		90	50-150
13C2_PFTeDA		94	50-150
13C3_PFBS		78	50-150
13C3_PFHxS		91	50-150
13C4_PFBA		94	50-150
13C4_PFHpA		91	50-150
13C5_PFHxA		90	50-150
13C5_PFPeA		89	50-150
13C6_PFDA		94	50-150
13C7_PFUdA		92	50-150
13C8_PFOA		92	50-150
13C8_PFOS		90	50-150
13C8_PFOSA		99	50-150
13C9_PFNA		89	50-150

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

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PFAS by LC/MS/MS

Client: **Arcadis U.S., Inc.**
Laboratory ID: **WA04033-003**
Description: **R-TH**
Matrix: **Solid**
Date Sampled: **12/29/2020**
% Solids: **99.6** **01/04/2021 2321**
Date Received: **01/04/2021**

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
d5-EtFOSAA		95	50-150
d-MeFOSA		99	50-150
d3-MeFOSAA		101	50-150

LOQ = Limit of Quantitation	B = Detected in the method blank	E = Quantitation of compound exceeded the calibration range	DL = Detection Limit	Q = Surrogate failure
U = Not detected at or above the LOQ	N = Recovery is out of criteria	P = The RPD between two GC columns exceeds 40%	J = Estimated result < LOQ and ≥ DL	L = LCS/LCSD failure
H = Out of holding time	W = Reported on wet weight basis	LOD = Limit of Detection		S = MS/MSD failure

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PFAS by LC/MS/MS

Client: **Arcadis U.S., Inc.** Laboratory ID: **WA04033-004**

Description: **G-TC** Matrix: **Solid**

Date Sampled: **12/29/2020** % Solids: **96.2** **01/04/2021 2321**

Date Received: **01/04/2021**

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch
1	SOP SPE	PFAS by ID SOP QSM B-15	1	01/08/2021 1600	SES	01/06/2021 1210	78621

Parameter	CAS Number	Analytical Method	Result	Q	LOQ	LOD	DL	Units	Run
1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS)	**39108-34-4**	**PFAS by ID SOP**	**1.1**	**J**	**2.0**	1.0	**0.50**	**ug/kg**	**1**
1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS)	27619-97-2	PFAS by ID SOP	1.0	U	2.0	1.0	0.50	ug/kg	1
1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS)	757124-72-4	PFAS by ID SOP	1.0	U	2.0	1.0	0.50	ug/kg	1
N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA)	2991-50-6	PFAS by ID SOP	1.0	U	2.0	1.0	0.50	ug/kg	1
N-methylperfluoro-1-octanesulfonamide (MeFOSA)	31506-32-8	PFAS by ID SOP	1.0	U	2.0	1.0	0.50	ug/kg	1
N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA)	2355-31-9	PFAS by ID SOP	1.0	U	2.0	1.0	0.50	ug/kg	1
Perfluoro-1-butanesulfonic acid (PFBS)	375-73-5	PFAS by ID SOP	0.50	U	1.0	0.50	0.20	ug/kg	1
Perfluoro-1-decanesulfonic acid (PFDS)	335-77-3	PFAS by ID SOP	0.50	U	1.0	0.50	0.20	ug/kg	1
Perfluoro-1-heptanesulfonic acid (PFHpS)	375-92-8	PFAS by ID SOP	0.50	U	1.0	0.50	0.20	ug/kg	1
Perfluoro-1-nonanesulfonic acid (PFNS)	**68259-12-1**	**PFAS by ID SOP**	**0.25**	**J**	**1.0**	0.50	**0.20**	**ug/kg**	**1**
Perfluoro-1-octanesulfonamide (PFOSA)	**754-91-6**	**PFAS by ID SOP**	**2.0**		**1.0**	0.50	**0.20**	**ug/kg**	**1**
Perfluoro-1-pentanesulfonic acid (PFPeS)	2706-91-4	PFAS by ID SOP	0.50	U	1.0	0.50	0.20	ug/kg	1
Perfluorohexanesulfonic acid (PFHxS)	**355-46-4**	**PFAS by ID SOP**	**1.4**		**1.0**	0.50	**0.20**	**ug/kg**	**1**
Perfluoro-n-butanoic acid (PFBA)	375-22-4	PFAS by ID SOP	0.50	U	1.0	0.50	0.20	ug/kg	1
Perfluoro-n-decanoic acid (PFDA)	335-76-2	PFAS by ID SOP	0.50	U	1.0	0.50	0.20	ug/kg	1
Perfluoro-n-dodecanoic acid (PFDoA)	307-55-1	PFAS by ID SOP	0.50	U	1.0	0.50	0.20	ug/kg	1
Perfluoro-n-heptanoic acid (PFHpA)	375-85-9	PFAS by ID SOP	0.50	U	1.0	0.50	0.20	ug/kg	1
Perfluoro-n-hexanoic acid (PFHxA)	**307-24-4**	**PFAS by ID SOP**	**0.43**	**J**	**1.0**	0.50	**0.20**	**ug/kg**	**1**
Perfluoro-n-nonanoic acid (PFNA)	375-95-1	PFAS by ID SOP	0.50	U	1.0	0.50	0.20	ug/kg	1
Perfluoro-n-octanoic acid (PFOA)	335-67-1	PFAS by ID SOP	0.50	U	1.0	0.50	0.20	ug/kg	1
Perfluoro-n-pentanoic acid (PFPeA)	**2706-90-3**	**PFAS by ID SOP**	**0.21**	**J**	**1.0**	0.50	**0.20**	**ug/kg**	**1**
Perfluoro-n-tetradecanoic acid (PFTeDA)	376-06-7	PFAS by ID SOP	0.50	U	1.0	0.50	0.20	ug/kg	1
Perfluoro-n-tridecanoic acid (PFTrDA)	72629-94-8	PFAS by ID SOP	0.50	U	1.0	0.50	0.20	ug/kg	1
Perfluoro-n-undecanoic acid (PFUdA)	2058-94-8	PFAS by ID SOP	0.50	U	1.0	0.50	0.20	ug/kg	1
Perfluorooctanesulfonic acid (PFOS)	**1763-23-1**	**PFAS by ID SOP**	**27**		**1.0**	0.50	**0.20**	**ug/kg**	**1**

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
13C2_4:2FTS		83	50-150
13C2_6:2FTS		98	50-150
13C2_8:2FTS		79	50-150
13C2_PFDoA		97	50-150
13C2_PFTeDA		96	50-150
13C3_PFBS		85	50-150
13C3_PFHxS		92	50-150
13C4_PFBA		93	50-150
13C4_PFHpA		95	50-150
13C5_PFHxA		92	50-150
13C5_PFPeA		92	50-150
13C6_PFDA		96	50-150
13C7_PFUdA		91	50-150
13C8_PFOA		92	50-150
13C8_PFOS		86	50-150
13C8_PFOSA		101	50-150
13C9_PFNA		95	50-150

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

PFAS by LC/MS/MS

Client: **Arcadis U.S., Inc.**
Laboratory ID: **WA04033-004**
Description: **G-TC**
Matrix: **Solid**
Date Sampled: **12/29/2020**
% Solids: **96.2** **01/04/2021 2321**
Date Received: **01/04/2021**

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
d5-EtFOSAA		96	50-150
d-MeFOSA		103	50-150
d3-MeFOSAA		103	50-150

LOQ = Limit of Quantitation
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PFAS by LC/MS/MS

Client: **Arcadis U.S., Inc.** Laboratory ID: **WA04033-005**

Description: **G-TH** Matrix: **Solid**

Date Sampled: **12/29/2020** % Solids: **98.9** **01/04/2021 2321**

Date Received: **01/04/2021**

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch
1	SOP SPE	PFAS by ID SOP QSM B-15	5	01/08/2021 1414	SES	01/06/2021 1210	78621

Parameter	CAS Number	Analytical Method	Result	Q	LOQ	LOD	DL	Units	Run
1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS)	**39108-34-4**	**PFAS by ID SOP**	**8.7**	**J**	**9.6**	4.8	**2.4**	**ug/kg**	**1**
1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS)	27619-97-2	PFAS by ID SOP	4.8	U	9.6	4.8	2.4	ug/kg	1
1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS)	757124-72-4	PFAS by ID SOP	4.8	U	9.6	4.8	2.4	ug/kg	1
N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA)	2991-50-6	PFAS by ID SOP	4.8	U	9.6	4.8	2.4	ug/kg	1
N-methylperfluoro-1-octanesulfonamide (MeFOSA)	31506-32-8	PFAS by ID SOP	4.8	U	9.6	4.8	2.4	ug/kg	1
N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA)	2355-31-9	PFAS by ID SOP	4.8	U	9.6	4.8	2.4	ug/kg	1
Perfluoro-1-butanesulfonic acid (PFBS)	375-73-5	PFAS by ID SOP	2.4	U	4.8	2.4	0.96	ug/kg	1
Perfluoro-1-decanesulfonic acid (PFDS)	**335-77-3**	**PFAS by ID SOP**	**3.6**	**J**	**4.8**	2.4	**0.96**	**ug/kg**	**1**
Perfluoro-1-heptanesulfonic acid (PFHpS)	375-92-8	PFAS by ID SOP	2.4	U	4.8	2.4	0.96	ug/kg	1
Perfluoro-1-nonanesulfonic acid (PFNS)	**68259-12-1**	**PFAS by ID SOP**	**3.1**	**J**	**4.8**	2.4	**0.96**	**ug/kg**	**1**
Perfluoro-1-octanesulfonamide (PFOSA)	**754-91-6**	**PFAS by ID SOP**	**12**		**4.8**	2.4	**0.96**	**ug/kg**	**1**
Perfluoro-1-pentanesulfonic acid (PFPeS)	2706-91-4	PFAS by ID SOP	2.4	U	4.8	2.4	0.96	ug/kg	1
Perfluorohexanesulfonic acid (PFHxS)	**355-46-4**	**PFAS by ID SOP**	**3.0**	**J**	**4.8**	2.4	**0.96**	**ug/kg**	**1**
Perfluoro-n-butanoic acid (PFBA)	**375-22-4**	**PFAS by ID SOP**	**1.4**	**J**	**4.8**	2.4	**0.96**	**ug/kg**	**1**
Perfluoro-n-decanoic acid (PFDA)	335-76-2	PFAS by ID SOP	2.4	U	4.8	2.4	0.96	ug/kg	1
Perfluoro-n-dodecanoic acid (PFDoA)	307-55-1	PFAS by ID SOP	2.4	U	4.8	2.4	0.96	ug/kg	1
Perfluoro-n-heptanoic acid (PFHpA)	375-85-9	PFAS by ID SOP	2.4	U	4.8	2.4	0.96	ug/kg	1
Perfluoro-n-hexanoic acid (PFHxA)	307-24-4	PFAS by ID SOP	2.4	U	4.8	2.4	0.96	ug/kg	1
Perfluoro-n-nonanoic acid (PFNA)	375-95-1	PFAS by ID SOP	2.4	U	4.8	2.4	0.96	ug/kg	1
Perfluoro-n-octanoic acid (PFOA)	335-67-1	PFAS by ID SOP	2.4	U	4.8	2.4	0.96	ug/kg	1
Perfluoro-n-pentanoic acid (PFPeA)	2706-90-3	PFAS by ID SOP	2.4	U	4.8	2.4	0.96	ug/kg	1
Perfluoro-n-tetradecanoic acid (PFTeDA)	376-06-7	PFAS by ID SOP	2.4	U	4.8	2.4	0.96	ug/kg	1
Perfluoro-n-tridecanoic acid (PFTrDA)	72629-94-8	PFAS by ID SOP	2.4	U	4.8	2.4	0.96	ug/kg	1
Perfluoro-n-undecanoic acid (PFUdA)	2058-94-8	PFAS by ID SOP	2.4	U	4.8	2.4	0.96	ug/kg	1
Perfluorooctanesulfonic acid (PFOS)	**1763-23-1**	**PFAS by ID SOP**	**270**		**4.8**	2.4	**0.96**	**ug/kg**	**1**

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
13C2_4:2FTS		88	50-150
13C2_6:2FTS		107	50-150
13C2_8:2FTS		91	50-150
13C2_PFDoA		95	50-150
13C2_PFTeDA		100	50-150
13C3_PFBS		96	50-150
13C3_PFHxS		94	50-150
13C4_PFBA		99	50-150
13C4_PFHpA		99	50-150
13C5_PFHxA		98	50-150
13C5_PFPeA		97	50-150
13C6_PFDA		100	50-150
13C7_PFUdA		95	50-150
13C8_PFOA		96	50-150
13C8_PFOS		93	50-150
13C8_PFOSA		103	50-150
13C9_PFNA		98	50-150

LOQ = Limit of Quantitation
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E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

PFAS by LC/MS/MS

Client: **Arcadis U.S., Inc.**
Description: **G-TH**
Date Sampled: **12/29/2020**
Date Received: **01/04/2021**

Laboratory ID: **WA04033-005**
Matrix: **Solid**
% Solids: **98.9** **01/04/2021 2321**

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
d5-EtFOSAA		96	50-150
d-MeFOSA		99	50-150
d3-MeFOSAA		104	50-150

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

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PFAS by LC/MS/MS

Client: **Arcadis U.S., Inc.** Laboratory ID: **WA04033-006**

Description: **SFIF2STTC** Matrix: **Solid**

Date Sampled: **12/29/2020** % Solids: **99.8** **01/04/2021 2321**

Date Received: **01/04/2021**

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch
1	SOP SPE	PFAS by ID SOP QSM B-15	1	01/08/2021 1611	SES	01/06/2021 1210	78621

Parameter	CAS Number	Analytical Method	Result	Q	LOQ	LOD	DL	Units	Run
1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS)	**39108-34-4**	**PFAS by ID SOP**	**5.7**		**1.8**	0.90	**0.46**	**ug/kg**	**1**
1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS)	**27619-97-2**	**PFAS by ID SOP**	**0.71**	**J**	**1.8**	0.90	**0.46**	**ug/kg**	**1**
1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS)	757124-72-4	PFAS by ID SOP	0.90	U	1.8	0.90	0.46	ug/kg	1
N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA)	2991-50-6	PFAS by ID SOP	0.90	U	1.8	0.90	0.46	ug/kg	1
N-methylperfluoro-1-octanesulfonamide (MeFOSA)	31506-32-8	PFAS by ID SOP	0.90	U	1.8	0.90	0.46	ug/kg	1
N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA)	2355-31-9	PFAS by ID SOP	0.90	U	1.8	0.90	0.46	ug/kg	1
Perfluoro-1-butanesulfonic acid (PFBS)	**375-73-5**	**PFAS by ID SOP**	**0.26**	**J**	**0.91**	0.46	**0.18**	**ug/kg**	**1**
Perfluoro-1-decanesulfonic acid (PFDS)	**335-77-3**	**PFAS by ID SOP**	**2.7**		**0.91**	0.46	**0.18**	**ug/kg**	**1**
Perfluoro-1-heptanesulfonic acid (PFHpS)	**375-92-8**	**PFAS by ID SOP**	**0.36**	**J**	**0.91**	0.46	**0.18**	**ug/kg**	**1**
Perfluoro-1-nonanesulfonic acid (PFNS)	**68259-12-1**	**PFAS by ID SOP**	**1.6**		**0.91**	0.46	**0.18**	**ug/kg**	**1**
Perfluoro-1-octanesulfonamide (PFOSA)	**754-91-6**	**PFAS by ID SOP**	**5.4**		**0.91**	0.46	**0.18**	**ug/kg**	**1**
Perfluoro-1-pentanesulfonic acid (PFPeS)	**2706-91-4**	**PFAS by ID SOP**	**0.29**	**J**	**0.91**	0.46	**0.18**	**ug/kg**	**1**
Perfluorohexanesulfonic acid (PFHxS)	**355-46-4**	**PFAS by ID SOP**	**5.5**		**0.91**	0.46	**0.18**	**ug/kg**	**1**
Perfluoro-n-butanoic acid (PFBA)	375-22-4	PFAS by ID SOP	0.46	U	0.91	0.46	0.18	ug/kg	1
Perfluoro-n-decanoic acid (PFDA)	335-76-2	PFAS by ID SOP	0.46	U	0.91	0.46	0.18	ug/kg	1
Perfluoro-n-dodecanoic acid (PFDoA)	**307-55-1**	**PFAS by ID SOP**	**0.67**	**J**	**0.91**	0.46	**0.18**	**ug/kg**	**1**
Perfluoro-n-heptanoic acid (PFHpA)	**375-85-9**	**PFAS by ID SOP**	**0.23**	**J**	**0.91**	0.46	**0.18**	**ug/kg**	**1**
Perfluoro-n-hexanoic acid (PFHxA)	**307-24-4**	**PFAS by ID SOP**	**0.92**		**0.91**	0.46	**0.18**	**ug/kg**	**1**
Perfluoro-n-nonanoic acid (PFNA)	375-95-1	PFAS by ID SOP	0.46	U	0.91	0.46	0.18	ug/kg	1
Perfluoro-n-octanoic acid (PFOA)	**335-67-1**	**PFAS by ID SOP**	**0.55**	**J**	**0.91**	0.46	**0.18**	**ug/kg**	**1**
Perfluoro-n-pentanoic acid (PFPeA)	**2706-90-3**	**PFAS by ID SOP**	**0.19**	**J**	**0.91**	0.46	**0.18**	**ug/kg**	**1**
Perfluoro-n-tetradecanoic acid (PFTeDA)	**376-06-7**	**PFAS by ID SOP**	**0.29**	**J**	**0.91**	0.46	**0.18**	**ug/kg**	**1**
Perfluoro-n-tridecanoic acid (PFTrDA)	**72629-94-8**	**PFAS by ID SOP**	**0.25**	**J**	**0.91**	0.46	**0.18**	**ug/kg**	**1**
Perfluoro-n-undecanoic acid (PFUdA)	**2058-94-8**	**PFAS by ID SOP**	**0.58**	**J**	**0.91**	0.46	**0.18**	**ug/kg**	**1**
Perfluorooctanesulfonic acid (PFOS)	**1763-23-1**	**PFAS by ID SOP**	**150**		**0.91**	0.46	**0.18**	**ug/kg**	**1**

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
13C2_4:2FTS		86	50-150
13C2_6:2FTS		93	50-150
13C2_8:2FTS		88	50-150
13C2_PFDoA		90	50-150
13C2_PFTeDA		89	50-150
13C3_PFBS		81	50-150
13C3_PFHxS		79	50-150
13C4_PFBA		90	50-150
13C4_PFHpA		90	50-150
13C5_PFHxA		86	50-150
13C5_PFPeA		88	50-150
13C6_PFDA		92	50-150
13C7_PFUdA		88	50-150
13C8_PFOA		90	50-150
13C8_PFOS		84	50-150
13C8_PFOSA		91	50-150
13C9_PFNA		86	50-150

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

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PFAS by LC/MS/MS

Client: **Arcadis U.S., Inc.**
Description: **SFIF2STTC**
Date Sampled: **12/29/2020**
Date Received: **01/04/2021**

Laboratory ID: **WA04033-006**
Matrix: **Solid**
% Solids: **99.8** **01/04/2021 2321**

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
d5-EtFOSAA		94	50-150
d-MeFOSA		97	50-150
d3-MeFOSAA		99	50-150

LOQ = Limit of Quantitation	B = Detected in the method blank	E = Quantitation of compound exceeded the calibration range	DL = Detection Limit	Q = Surrogate failure
U = Not detected at or above the LOQ	N = Recovery is out of criteria	P = The RPD between two GC columns exceeds 40%	J = Estimated result < LOQ and ≥ DL	L = LCS/LCSD failure
H = Out of holding time	W = Reported on wet weight basis	LOD = Limit of Detection		S = MS/MSD failure

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PFAS by LC/MS/MS

Client: **Arcadis U.S., Inc.** Laboratory ID: **WA04033-007**

Description: **SF1F2STDIH** Matrix: **Solid**

Date Sampled: **12/29/2020** % Solids: **92.5** **01/04/2021 2321**

Date Received: **01/04/2021**

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch
1	SOP SPE	PFAS by ID SOP QSM B-15	1	01/08/2021 1622	SES	01/06/2021 1210	78621

Parameter	CAS Number	Analytical Method	Result	Q	LOQ	LOD	DL	Units	Run
1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS)	**39108-34-4**	**PFAS by ID SOP**	**3.3**		**2.0**	1.0	**0.49**	**ug/kg**	**1**
1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS)	27619-97-2	PFAS by ID SOP	1.0	U	2.0	1.0	0.49	ug/kg	1
1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS)	757124-72-4	PFAS by ID SOP	1.0	U	2.0	1.0	0.49	ug/kg	1
N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA)	2991-50-6	PFAS by ID SOP	1.0	U	2.0	1.0	0.49	ug/kg	1
N-methylperfluoro-1-octanesulfonamide (MeFOSA)	31506-32-8	PFAS by ID SOP	1.0	U	2.0	1.0	0.49	ug/kg	1
N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA)	2355-31-9	PFAS by ID SOP	1.0	U	2.0	1.0	0.49	ug/kg	1
Perfluoro-1-butanesulfonic acid (PFBS)	375-73-5	PFAS by ID SOP	0.49	U	0.98	0.49	0.20	ug/kg	1
Perfluoro-1-decanesulfonic acid (PFDS)	**335-77-3**	**PFAS by ID SOP**	**1.5**		**0.98**	0.49	**0.20**	**ug/kg**	**1**
Perfluoro-1-heptanesulfonic acid (PFHpS)	375-92-8	PFAS by ID SOP	0.49	U	0.98	0.49	0.20	ug/kg	1
Perfluoro-1-nonanesulfonic acid (PFNS)	**68259-12-1**	**PFAS by ID SOP**	**1.0**		**0.98**	0.49	**0.20**	**ug/kg**	**1**
Perfluoro-1-octanesulfonamide (PFOSA)	**754-91-6**	**PFAS by ID SOP**	**1.6**		**0.98**	0.49	**0.20**	**ug/kg**	**1**
Perfluoro-1-pentanesulfonic acid (PFPeS)	2706-91-4	PFAS by ID SOP	0.49	U	0.98	0.49	0.20	ug/kg	1
Perfluorohexanesulfonic acid (PFHxS)	**355-46-4**	**PFAS by ID SOP**	**0.95**	**J**	**0.98**	0.49	**0.20**	**ug/kg**	**1**
Perfluoro-n-butanoic acid (PFBA)	375-22-4	PFAS by ID SOP	0.49	U	0.98	0.49	0.20	ug/kg	1
Perfluoro-n-decanoic acid (PFDA)	**335-76-2**	**PFAS by ID SOP**	**0.23**	**J**	**0.98**	0.49	**0.20**	**ug/kg**	**1**
Perfluoro-n-dodecanoic acid (PFDoA)	**307-55-1**	**PFAS by ID SOP**	**0.38**	**J**	**0.98**	0.49	**0.20**	**ug/kg**	**1**
Perfluoro-n-heptanoic acid (PFHpA)	375-85-9	PFAS by ID SOP	0.49	U	0.98	0.49	0.20	ug/kg	1
Perfluoro-n-hexanoic acid (PFHxA)	**307-24-4**	**PFAS by ID SOP**	**0.29**	**J**	**0.98**	0.49	**0.20**	**ug/kg**	**1**
Perfluoro-n-nonanoic acid (PFNA)	375-95-1	PFAS by ID SOP	0.49	U	0.98	0.49	0.20	ug/kg	1
Perfluoro-n-octanoic acid (PFOA)	335-67-1	PFAS by ID SOP	0.49	U	0.98	0.49	0.20	ug/kg	1
Perfluoro-n-pentanoic acid (PFPeA)	2706-90-3	PFAS by ID SOP	0.49	U	0.98	0.49	0.20	ug/kg	1
Perfluoro-n-tetradecanoic acid (PFTeDA)	**376-06-7**	**PFAS by ID SOP**	**0.20**	**J**	**0.98**	0.49	**0.20**	**ug/kg**	**1**
Perfluoro-n-tridecanoic acid (PFTrDA)	**72629-94-8**	**PFAS by ID SOP**	**0.20**	**J**	**0.98**	0.49	**0.20**	**ug/kg**	**1**
Perfluoro-n-undecanoic acid (PFUdA)	**2058-94-8**	**PFAS by ID SOP**	**0.36**	**J**	**0.98**	0.49	**0.20**	**ug/kg**	**1**
Perfluorooctanesulfonic acid (PFOS)	**1763-23-1**	**PFAS by ID SOP**	**51**		**0.98**	0.49	**0.20**	**ug/kg**	**1**

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
13C2_4:2FTS		86	50-150
13C2_6:2FTS		90	50-150
13C2_8:2FTS		88	50-150
13C2_PFDoA		100	50-150
13C2_PFTeDA		91	50-150
13C3_PFBS		79	50-150
13C3_PFHxS		86	50-150
13C4_PFBA		91	50-150
13C4_PFHpA		91	50-150
13C5_PFHxA		89	50-150
13C5_PFPeA		89	50-150
13C6_PFDA		93	50-150
13C7_PFUdA		90	50-150
13C8_PFOA		90	50-150
13C8_PFOS		90	50-150
13C8_PFOSA		98	50-150
13C9_PFNA		89	50-150

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

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PFAS by LC/MS/MS

Client: **Arcadis U.S., Inc.**
Description: **SF1F2STDIH**
Date Sampled: **12/29/2020**
Date Received: **01/04/2021**

Laboratory ID: **WA04033-007**
Matrix: **Solid**
% Solids: **92.5** **01/04/2021 2321**

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
d5-EtFOSAA		93	50-150
d-MeFOSA		100	50-150
d3-MeFOSAA		97	50-150

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
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LOD = Limit of Detection
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J = Estimated result < LOQ and ≥ DL
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L = LCS/LCSD failure
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PFAS by LC/MS/MS

Client: **Arcadis U.S., Inc.** Laboratory ID: **WA04033-008**

Description: **SFIF2STM** Matrix: **Solid**

Date Sampled: **12/29/2020** % Solids: **99.7** **01/04/2021 2321**

Date Received: **01/04/2021**

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch
1	SOP SPE	PFAS by ID SOP QSM B-15	1	01/08/2021 1632	SES	01/06/2021 1210	78621

Parameter	CAS Number	Analytical Method	Result	Q	LOQ	LOD	DL	Units	Run
1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS)	**39108-34-4**	**PFAS by ID SOP**	**3.8**		**1.8**	0.90	**0.45**	**ug/kg**	**1**
1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS)	**27619-97-2**	**PFAS by ID SOP**	**0.81**	**J**	**1.8**	0.90	**0.45**	**ug/kg**	**1**
1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS)	757124-72-4	PFAS by ID SOP	0.90	U	1.8	0.90	0.45	ug/kg	1
N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA)	2991-50-6	PFAS by ID SOP	0.90	U	1.8	0.90	0.45	ug/kg	1
N-methylperfluoro-1-octanesulfonamide (MeFOSA)	31506-32-8	PFAS by ID SOP	0.90	U	1.8	0.90	0.45	ug/kg	1
N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA)	2355-31-9	PFAS by ID SOP	0.90	U	1.8	0.90	0.45	ug/kg	1
Perfluoro-1-butanesulfonic acid (PFBS)	375-73-5	PFAS by ID SOP	0.45	U	0.90	0.45	0.18	ug/kg	1
Perfluoro-1-decanesulfonic acid (PFDS)	**335-77-3**	**PFAS by ID SOP**	**1.5**		**0.90**	0.45	**0.18**	**ug/kg**	**1**
Perfluoro-1-heptanesulfonic acid (PFHpS)	375-92-8	PFAS by ID SOP	0.45	U	0.90	0.45	0.18	ug/kg	1
Perfluoro-1-nonanesulfonic acid (PFNS)	**68259-12-1**	**PFAS by ID SOP**	**1.1**		**0.90**	0.45	**0.18**	**ug/kg**	**1**
Perfluoro-1-octanesulfonamide (PFOSA)	**754-91-6**	**PFAS by ID SOP**	**3.5**		**0.90**	0.45	**0.18**	**ug/kg**	**1**
Perfluoro-1-pentanesulfonic acid (PFPeS)	2706-91-4	PFAS by ID SOP	0.45	U	0.90	0.45	0.18	ug/kg	1
Perfluorohexanesulfonic acid (PFHxS)	**355-46-4**	**PFAS by ID SOP**	**2.4**		**0.90**	0.45	**0.18**	**ug/kg**	**1**
Perfluoro-n-butanoic acid (PFBA)	**375-22-4**	**PFAS by ID SOP**	**0.19**	**J**	**0.90**	0.45	**0.18**	**ug/kg**	**1**
Perfluoro-n-decanoic acid (PFDA)	335-76-2	PFAS by ID SOP	0.45	U	0.90	0.45	0.18	ug/kg	1
Perfluoro-n-dodecanoic acid (PFDoA)	**307-55-1**	**PFAS by ID SOP**	**0.44**	**J**	**0.90**	0.45	**0.18**	**ug/kg**	**1**
Perfluoro-n-heptanoic acid (PFHpA)	375-85-9	PFAS by ID SOP	0.45	U	0.90	0.45	0.18	ug/kg	1
Perfluoro-n-hexanoic acid (PFHxA)	**307-24-4**	**PFAS by ID SOP**	**1.8**		**0.90**	0.45	**0.18**	**ug/kg**	**1**
Perfluoro-n-nonanoic acid (PFNA)	375-95-1	PFAS by ID SOP	0.45	U	0.90	0.45	0.18	ug/kg	1
Perfluoro-n-octanoic acid (PFOA)	335-67-1	PFAS by ID SOP	0.45	U	0.90	0.45	0.18	ug/kg	1
Perfluoro-n-pentanoic acid (PFPeA)	**2706-90-3**	**PFAS by ID SOP**	**0.35**	**J**	**0.90**	0.45	**0.18**	**ug/kg**	**1**
Perfluoro-n-tetradecanoic acid (PFTeDA)	**376-06-7**	**PFAS by ID SOP**	**0.22**	**J**	**0.90**	0.45	**0.18**	**ug/kg**	**1**
Perfluoro-n-tridecanoic acid (PFTrDA)	72629-94-8	PFAS by ID SOP	0.45	U	0.90	0.45	0.18	ug/kg	1
Perfluoro-n-undecanoic acid (PFUdA)	**2058-94-8**	**PFAS by ID SOP**	**0.27**	**J**	**0.90**	0.45	**0.18**	**ug/kg**	**1**
Perfluorooctanesulfonic acid (PFOS)	**1763-23-1**	**PFAS by ID SOP**	**59**		**0.90**	0.45	**0.18**	**ug/kg**	**1**

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
13C2_4:2FTS		91	50-150
13C2_6:2FTS		105	50-150
13C2_8:2FTS		88	50-150
13C2_PFDoA		97	50-150
13C2_PFTeDA		94	50-150
13C3_PFBS		87	50-150
13C3_PFHxS		89	50-150
13C4_PFBA		97	50-150
13C4_PFHpA		100	50-150
13C5_PFHxA		94	50-150
13C5_PFPeA		94	50-150
13C6_PFDA		96	50-150
13C7_PFUdA		94	50-150
13C8_PFOA		95	50-150
13C8_PFOS		89	50-150
13C8_PFOSA		101	50-150
13C9_PFNA		97	50-150

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
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N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

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PFAS by LC/MS/MS

Client: **Arcadis U.S., Inc.**
Description: **SFIF2STM**
Date Sampled: **12/29/2020**
Date Received: **01/04/2021**

Laboratory ID: **WA04033-008**
Matrix: **Solid**
% Solids: **99.7** **01/04/2021 2321**

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
d5-EtFOSAA		104	50-150
d-MeFOSA		100	50-150
d3-MeFOSAA		109	50-150

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

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PFAS by LC/MS/MS

Client: **Arcadis U.S., Inc.** Laboratory ID: **WA04033-009**

Description: **F-F1F2** Matrix: **Solid**

Date Sampled: **12/29/2020** % Solids: **57.9** **01/04/2021 2321**

Date Received: **01/04/2021**

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch
1	SOP SPE	PFAS by ID SOP QSM B-15	10	01/08/2021 1643	SES	01/06/2021 1210	78621

Parameter	CAS Number	Analytical Method	Result	Q	LOQ	LOD	DL	Units	Run
1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS)	**39108-34-4**	**PFAS by ID SOP**	**170**		**30**	15	**7.5**	**ug/kg**	**1**
1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS)	27619-97-2	PFAS by ID SOP	15	U	30	15	7.5	ug/kg	1
1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS)	757124-72-4	PFAS by ID SOP	15	U	30	15	7.5	ug/kg	1
N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA)	2991-50-6	PFAS by ID SOP	15	U	30	15	7.5	ug/kg	1
N-methylperfluoro-1-octanesulfonamide (MeFOSA)	31506-32-8	PFAS by ID SOP	15	U	30	15	7.5	ug/kg	1
N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA)	2355-31-9	PFAS by ID SOP	15	U	30	15	7.5	ug/kg	1
Perfluoro-1-butanesulfonic acid (PFBS)	**375-73-5**	**PFAS by ID SOP**	**3.1**	**J**	**15**	7.5	**3.0**	**ug/kg**	**1**
Perfluoro-1-decanesulfonic acid (PFDS)	**335-77-3**	**PFAS by ID SOP**	**60**		**15**	7.5	**3.0**	**ug/kg**	**1**
Perfluoro-1-heptanesulfonic acid (PFHpS)	375-92-8	PFAS by ID SOP	7.5	U	15	7.5	3.0	ug/kg	1
Perfluoro-1-nonanesulfonic acid (PFNS)	**68259-12-1**	**PFAS by ID SOP**	**65**		**15**	7.5	**3.0**	**ug/kg**	**1**
Perfluoro-1-octanesulfonamide (PFOSA)	**754-91-6**	**PFAS by ID SOP**	**170**		**15**	7.5	**3.0**	**ug/kg**	**1**
Perfluoro-1-pentanesulfonic acid (PFPeS)	**2706-91-4**	**PFAS by ID SOP**	**4.3**	**J**	**15**	7.5	**3.0**	**ug/kg**	**1**
Perfluorohexanesulfonic acid (PFHxS)	**355-46-4**	**PFAS by ID SOP**	**58**		**15**	7.5	**3.0**	**ug/kg**	**1**
Perfluoro-n-butanoic acid (PFBA)	375-22-4	PFAS by ID SOP	7.5	U	15	7.5	3.0	ug/kg	1
Perfluoro-n-decanoic acid (PFDA)	**335-76-2**	**PFAS by ID SOP**	**8.4**	**J**	**15**	7.5	**3.0**	**ug/kg**	**1**
Perfluoro-n-dodecanoic acid (PFDoA)	**307-55-1**	**PFAS by ID SOP**	**15**		**15**	7.5	**3.0**	**ug/kg**	**1**
Perfluoro-n-heptanoic acid (PFHpA)	375-85-9	PFAS by ID SOP	7.5	U	15	7.5	3.0	ug/kg	1
Perfluoro-n-hexanoic acid (PFHxA)	**307-24-4**	**PFAS by ID SOP**	**9.4**	**J**	**15**	7.5	**3.0**	**ug/kg**	**1**
Perfluoro-n-nonanoic acid (PFNA)	375-95-1	PFAS by ID SOP	7.5	U	15	7.5	3.0	ug/kg	1
Perfluoro-n-octanoic acid (PFOA)	335-67-1	PFAS by ID SOP	7.5	U	15	7.5	3.0	ug/kg	1
Perfluoro-n-pentanoic acid (PFPeA)	2706-90-3	PFAS by ID SOP	7.5	U	15	7.5	3.0	ug/kg	1
Perfluoro-n-tetradecanoic acid (PFTeDA)	**376-06-7**	**PFAS by ID SOP**	**3.4**	**J**	**15**	7.5	**3.0**	**ug/kg**	**1**
Perfluoro-n-tridecanoic acid (PFTrDA)	**72629-94-8**	**PFAS by ID SOP**	**3.9**	**J**	**15**	7.5	**3.0**	**ug/kg**	**1**
Perfluoro-n-undecanoic acid (PFUdA)	**2058-94-8**	**PFAS by ID SOP**	**21**		**15**	7.5	**3.0**	**ug/kg**	**1**
Perfluorooctanesulfonic acid (PFOS)	**1763-23-1**	**PFAS by ID SOP**	**2400**		**15**	7.5	**3.0**	**ug/kg**	**1**

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
13C2_4:2FTS		88	50-150
13C2_6:2FTS		104	50-150
13C2_8:2FTS		87	50-150
13C2_PFDoA		94	50-150
13C2_PFTeDA		97	50-150
13C3_PFBS		99	50-150
13C3_PFHxS		96	50-150
13C4_PFBA		100	50-150
13C4_PFHpA		98	50-150
13C5_PFHxA		100	50-150
13C5_PFPeA		95	50-150
13C6_PFDA		98	50-150
13C7_PFUdA		92	50-150
13C8_PFOA		96	50-150
13C8_PFOS		95	50-150
13C8_PFOSA		103	50-150
13C9_PFNA		95	50-150

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

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PFAS by LC/MS/MS

Client: **Arcadis U.S., Inc.** Laboratory ID: **WA04033-009**

Description: **F-F1F2** Matrix: **Solid**

Date Sampled: **12/29/2020** % Solids: **57.9** **01/04/2021 2321**

Date Received: **01/04/2021**

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
d5-EtFOSAA		99	50-150
d-MeFOSA		112	50-150
d3-MeFOSAA		100	50-150

LOQ = Limit of Quantitation	B = Detected in the method blank	E = Quantitation of compound exceeded the calibration range	DL = Detection Limit	Q = Surrogate failure
U = Not detected at or above the LOQ	N = Recovery is out of criteria	P = The RPD between two GC columns exceeds 40%	J = Estimated result < LOQ and ≥ DL	L = LCS/LCSD failure
H = Out of holding time	W = Reported on wet weight basis	LOD = Limit of Detection		S = MS/MSD failure

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PFAS by LC/MS/MS

Client: **Arcadis U.S., Inc.** Laboratory ID: **WA04033-010**

Description: **F-F1F2HSTC** Matrix: **Solid**

Date Sampled: **12/29/2020** % Solids: **55.3** **01/04/2021 2321**

Date Received: **01/04/2021**

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch
1	SOP SPE	PFAS by ID SOP QSM B-15	10	01/08/2021 1654	SES	01/06/2021 1210	78621

Parameter	CAS Number	Analytical Method	Result	Q	LOQ	LOD	DL	Units	Run
1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS)	**39108-34-4**	**PFAS by ID SOP**	**65**		**35**	18	**8.7**	**ug/kg**	**1**
1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS)	27619-97-2	PFAS by ID SOP	18	U	35	18	8.7	ug/kg	1
1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS)	757124-72-4	PFAS by ID SOP	18	U	35	18	8.7	ug/kg	1
N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA)	2991-50-6	PFAS by ID SOP	18	U	35	18	8.7	ug/kg	1
N-methylperfluoro-1-octanesulfonamide (MeFOSA)	31506-32-8	PFAS by ID SOP	18	U	35	18	8.7	ug/kg	1
N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA)	2355-31-9	PFAS by ID SOP	18	U	35	18	8.7	ug/kg	1
Perfluoro-1-butanesulfonic acid (PFBS)	375-73-5	PFAS by ID SOP	8.5	U	17	8.5	3.5	ug/kg	1
Perfluoro-1-decanesulfonic acid (PFDS)	**335-77-3**	**PFAS by ID SOP**	**50**		**17**	8.5	**3.5**	**ug/kg**	**1**
Perfluoro-1-heptanesulfonic acid (PFHpS)	375-92-8	PFAS by ID SOP	8.5	U	17	8.5	3.5	ug/kg	1
Perfluoro-1-nonanesulfonic acid (PFNS)	**68259-12-1**	**PFAS by ID SOP**	**40**		**17**	8.5	**3.5**	**ug/kg**	**1**
Perfluoro-1-octanesulfonamide (PFOSA)	**754-91-6**	**PFAS by ID SOP**	**100**		**17**	8.5	**3.5**	**ug/kg**	**1**
Perfluoro-1-pentanesulfonic acid (PFPeS)	2706-91-4	PFAS by ID SOP	8.5	U	17	8.5	3.5	ug/kg	1
Perfluorohexanesulfonic acid (PFHxS)	**355-46-4**	**PFAS by ID SOP**	**47**		**17**	8.5	**3.5**	**ug/kg**	**1**
Perfluoro-n-butanoic acid (PFBA)	375-22-4	PFAS by ID SOP	8.5	U	17	8.5	3.5	ug/kg	1
Perfluoro-n-decanoic acid (PFDA)	**335-76-2**	**PFAS by ID SOP**	**4.5**	**J**	**17**	8.5	**3.5**	**ug/kg**	**1**
Perfluoro-n-dodecanoic acid (PFDoA)	**307-55-1**	**PFAS by ID SOP**	**15**	**J**	**17**	8.5	**3.5**	**ug/kg**	**1**
Perfluoro-n-heptanoic acid (PFHpA)	375-85-9	PFAS by ID SOP	8.5	U	17	8.5	3.5	ug/kg	1
Perfluoro-n-hexanoic acid (PFHxA)	**307-24-4**	**PFAS by ID SOP**	**9.3**	**J**	**17**	8.5	**3.5**	**ug/kg**	**1**
Perfluoro-n-nonanoic acid (PFNA)	375-95-1	PFAS by ID SOP	8.5	U	17	8.5	3.5	ug/kg	1
Perfluoro-n-octanoic acid (PFOA)	335-67-1	PFAS by ID SOP	8.5	U	17	8.5	3.5	ug/kg	1
Perfluoro-n-pentanoic acid (PFPeA)	2706-90-3	PFAS by ID SOP	8.5	U	17	8.5	3.5	ug/kg	1
Perfluoro-n-tetradecanoic acid (PFTeDA)	376-06-7	PFAS by ID SOP	8.5	U	17	8.5	3.5	ug/kg	1
Perfluoro-n-tridecanoic acid (PFTrDA)	**72629-94-8**	**PFAS by ID SOP**	**4.4**	**J**	**17**	8.5	**3.5**	**ug/kg**	**1**
Perfluoro-n-undecanoic acid (PFUdA)	**2058-94-8**	**PFAS by ID SOP**	**12**	**J**	**17**	8.5	**3.5**	**ug/kg**	**1**
Perfluorooctanesulfonic acid (PFOS)	**1763-23-1**	**PFAS by ID SOP**	**1000**		**17**	8.5	**3.5**	**ug/kg**	**1**

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
13C2_4:2FTS		83	50-150
13C2_6:2FTS		94	50-150
13C2_8:2FTS		89	50-150
13C2_PFDoA		92	50-150
13C2_PFTeDA		94	50-150
13C3_PFBS		96	50-150
13C3_PFHxS		99	50-150
13C4_PFBA		98	50-150
13C4_PFHpA		93	50-150
13C5_PFHxA		93	50-150
13C5_PFPeA		93	50-150
13C6_PFDA		95	50-150
13C7_PFUdA		92	50-150
13C8_PFOA		96	50-150
13C8_PFOS		96	50-150
13C8_PFOSA		99	50-150
13C9_PFNA		95	50-150

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

PFAS by LC/MS/MS

Client: **Arcadis U.S., Inc.**
Laboratory ID: **WA04033-010**
Description: **F-F1F2HSTC**
Matrix: **Solid**
Date Sampled: **12/29/2020**
% Solids: **55.3** **01/04/2021 2321**
Date Received: **01/04/2021**

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
d5-EtFOSAA		95	50-150
d-MeFOSA		104	50-150
d3-MeFOSAA		103	50-150

LOQ = Limit of Quantitation	B = Detected in the method blank	E = Quantitation of compound exceeded the calibration range	DL = Detection Limit	Q = Surrogate failure
U = Not detected at or above the LOQ	N = Recovery is out of criteria	P = The RPD between two GC columns exceeds 40%	J = Estimated result < LOQ and ≥ DL	L = LCS/LCSD failure
H = Out of holding time	W = Reported on wet weight basis	LOD = Limit of Detection		S = MS/MSD failure

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PFAS by LC/MS/MS

Client: **Arcadis U.S., Inc.** Laboratory ID: **WA04033-011**

Description: **F-F1F2HS5050TC** Matrix: **Solid**

Date Sampled: **12/29/2020** % Solids: **61.9** **01/04/2021 2321**

Date Received: **01/04/2021**

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch
1	SOP SPE	PFAS by ID SOP QSM B-15	5	01/08/2021 1425	SES	01/06/2021 1210	78621

Parameter	CAS Number	Analytical Method	Result	Q	LOQ	LOD	DL	Units	Run
1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS)	**39108-34-4**	**PFAS by ID SOP**	**24**		**15**	7.5	**3.7**	**ug/kg**	**1**
1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS)	**27619-97-2**	**PFAS by ID SOP**	**6.6**	**J**	**15**	7.5	**3.7**	**ug/kg**	**1**
1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS)	757124-72-4	PFAS by ID SOP	7.5	U	15	7.5	3.7	ug/kg	1
N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA)	2991-50-6	PFAS by ID SOP	7.5	U	15	7.5	3.7	ug/kg	1
N-methylperfluoro-1-octanesulfonamide (MeFOSA)	31506-32-8	PFAS by ID SOP	7.5	U	15	7.5	3.7	ug/kg	1
N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA)	2355-31-9	PFAS by ID SOP	7.5	U	15	7.5	3.7	ug/kg	1
Perfluoro-1-butanesulfonic acid (PFBS)	**375-73-5**	**PFAS by ID SOP**	**2.0**	**J**	**7.5**	3.8	**1.5**	**ug/kg**	**1**
Perfluoro-1-decanesulfonic acid (PFDS)	**335-77-3**	**PFAS by ID SOP**	**22**		**7.5**	3.8	**1.5**	**ug/kg**	**1**
Perfluoro-1-heptanesulfonic acid (PFHpS)	**375-92-8**	**PFAS by ID SOP**	**3.0**	**J**	**7.5**	3.8	**1.5**	**ug/kg**	**1**
Perfluoro-1-nonanesulfonic acid (PFNS)	**68259-12-1**	**PFAS by ID SOP**	**12**		**7.5**	3.8	**1.5**	**ug/kg**	**1**
Perfluoro-1-octanesulfonamide (PFOSA)	**754-91-6**	**PFAS by ID SOP**	**31**		**7.5**	3.8	**1.5**	**ug/kg**	**1**
Perfluoro-1-pentanesulfonic acid (PFPeS)	**2706-91-4**	**PFAS by ID SOP**	**3.2**	**J**	**7.5**	3.8	**1.5**	**ug/kg**	**1**
Perfluorohexanesulfonic acid (PFHxS)	**355-46-4**	**PFAS by ID SOP**	**41**		**7.5**	3.8	**1.5**	**ug/kg**	**1**
Perfluoro-n-butanoic acid (PFBA)	375-22-4	PFAS by ID SOP	3.8	U	7.5	3.8	1.5	ug/kg	1
Perfluoro-n-decanoic acid (PFDA)	**335-76-2**	**PFAS by ID SOP**	**1.6**	**J**	**7.5**	3.8	**1.5**	**ug/kg**	**1**
Perfluoro-n-dodecanoic acid (PFDoA)	**307-55-1**	**PFAS by ID SOP**	**5.0**	**J**	**7.5**	3.8	**1.5**	**ug/kg**	**1**
Perfluoro-n-heptanoic acid (PFHpA)	375-85-9	PFAS by ID SOP	3.8	U	7.5	3.8	1.5	ug/kg	1
Perfluoro-n-hexanoic acid (PFHxA)	**307-24-4**	**PFAS by ID SOP**	**5.9**	**J**	**7.5**	3.8	**1.5**	**ug/kg**	**1**
Perfluoro-n-nonanoic acid (PFNA)	375-95-1	PFAS by ID SOP	3.8	U	7.5	3.8	1.5	ug/kg	1
Perfluoro-n-octanoic acid (PFOA)	335-67-1	PFAS by ID SOP	3.8	U	7.5	3.8	1.5	ug/kg	1
Perfluoro-n-pentanoic acid (PFPeA)	**2706-90-3**	**PFAS by ID SOP**	**1.7**	**J**	**7.5**	3.8	**1.5**	**ug/kg**	**1**
Perfluoro-n-tetradecanoic acid (PFTeDA)	**376-06-7**	**PFAS by ID SOP**	**3.8**	**J**	**7.5**	3.8	**1.5**	**ug/kg**	**1**
Perfluoro-n-tridecanoic acid (PFTrDA)	**72629-94-8**	**PFAS by ID SOP**	**2.8**	**J**	**7.5**	3.8	**1.5**	**ug/kg**	**1**
Perfluoro-n-undecanoic acid (PFUdA)	**2058-94-8**	**PFAS by ID SOP**	**3.5**	**J**	**7.5**	3.8	**1.5**	**ug/kg**	**1**
Perfluorooctanesulfonic acid (PFOS)	**1763-23-1**	**PFAS by ID SOP**	**480**		**7.5**	3.8	**1.5**	**ug/kg**	**1**

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
13C2_4:2FTS		94	50-150
13C2_6:2FTS		102	50-150
13C2_8:2FTS		100	50-150
13C2_PFDoA		104	50-150
13C2_PFTeDA		104	50-150
13C3_PFBS		102	50-150
13C3_PFHxS		98	50-150
13C4_PFBA		105	50-150
13C4_PFHpA		105	50-150
13C5_PFHxA		97	50-150
13C5_PFPeA		101	50-150
13C6_PFDA		104	50-150
13C7_PFUdA		99	50-150
13C8_PFOA		101	50-150
13C8_PFOS		102	50-150
13C8_PFOSA		107	50-150
13C9_PFNA		106	50-150

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

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PFAS by LC/MS/MS

Client: **Arcadis U.S., Inc.**
Description: **F-F1F2HS5050TC**
Date Sampled: **12/29/2020**
Date Received: **01/04/2021**

Laboratory ID: **WA04033-011**
Matrix: **Solid**
% Solids: **61.9** **01/04/2021 2321**

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
d5-EtFOSAA		105	50-150
d-MeFOSA		111	50-150
d3-MeFOSAA		107	50-150

LOQ = Limit of Quantitation	B = Detected in the method blank	E = Quantitation of compound exceeded the calibration range	DL = Detection Limit	Q = Surrogate failure
U = Not detected at or above the LOQ	N = Recovery is out of criteria	P = The RPD between two GC columns exceeds 40%	J = Estimated result < LOQ and ≥ DL	L = LCS/LCSD failure
H = Out of holding time	W = Reported on wet weight basis	LOD = Limit of Detection		S = MS/MSD failure

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QC Summary

PFAS by LC/MS/MS - MB

Sample ID: WQ78621-001
Batch: 78621
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Solid
Prep Method: SOP SPE
Prep Date: 01/06/2021 1210

Parameter	Result	Q	Dil	LOQ	LOD	DL	Units	Analysis Date
8:2 FTS	1.0	U	1	2.0	1.0	0.50	ug/kg	01/07/2021 1754
6:2 FTS	1.0	U	1	2.0	1.0	0.50	ug/kg	01/07/2021 1754
4:2 FTS	1.0	U	1	2.0	1.0	0.50	ug/kg	01/07/2021 1754
EtFOSAA	1.0	U	1	2.0	1.0	0.50	ug/kg	01/07/2021 1754
MeFOSA	1.0	U	1	2.0	1.0	0.50	ug/kg	01/07/2021 1754
MeFOSAA	1.0	U	1	2.0	1.0	0.50	ug/kg	01/07/2021 1754
PFBS	0.50	U	1	1.0	0.50	0.20	ug/kg	01/07/2021 1754
PFDS	0.50	U	1	1.0	0.50	0.20	ug/kg	01/07/2021 1754
PFHpS	0.50	U	1	1.0	0.50	0.20	ug/kg	01/07/2021 1754
PFNS	0.50	U	1	1.0	0.50	0.20	ug/kg	01/07/2021 1754
PFOSA	0.50	U	1	1.0	0.50	0.20	ug/kg	01/07/2021 1754
PFPeS	0.50	U	1	1.0	0.50	0.20	ug/kg	01/07/2021 1754
PFHxS	0.50	U	1	1.0	0.50	0.20	ug/kg	01/07/2021 1754
PFBA	0.50	U	1	1.0	0.50	0.20	ug/kg	01/07/2021 1754
PFDA	0.50	U	1	1.0	0.50	0.20	ug/kg	01/07/2021 1754
PFDoA	0.50	U	1	1.0	0.50	0.20	ug/kg	01/07/2021 1754
PFHpA	0.50	U	1	1.0	0.50	0.20	ug/kg	01/07/2021 1754
PFHxA	0.50	U	1	1.0	0.50	0.20	ug/kg	01/07/2021 1754
PFNA	0.50	U	1	1.0	0.50	0.20	ug/kg	01/07/2021 1754
PFOA	0.50	U	1	1.0	0.50	0.20	ug/kg	01/07/2021 1754
PFPeA	0.50	U	1	1.0	0.50	0.20	ug/kg	01/07/2021 1754
PFTeDA	0.50	U	1	1.0	0.50	0.20	ug/kg	01/07/2021 1754
PFTrDA	0.50	U	1	1.0	0.50	0.20	ug/kg	01/07/2021 1754
PFUdA	0.50	U	1	1.0	0.50	0.20	ug/kg	01/07/2021 1754
PFOS	0.50	U	1	1.0	0.50	0.20	ug/kg	01/07/2021 1754

Surrogate	Q	% Rec	Acceptance Limit
13C2_4:2FTS		97	50-150
13C2_6:2FTS		92	50-150
13C2_8:2FTS		83	50-150
13C2_PFDoA		98	50-150
13C2_PFTeDA		95	50-150
13C3_PFBS		89	50-150
13C3_PFHxS		91	50-150
13C4_PFBA		97	50-150
13C4_PFHpA		95	50-150
13C5_PFHxA		98	50-150
13C5_PFPeA		97	50-150
13C6_PFDA		98	50-150
13C7_PFUdA		93	50-150
13C8_PFOA		93	50-150

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

PFAS by LC/MS/MS - MB

Sample ID: WQ78621-001
Batch: 78621
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Solid
Prep Method: SOP SPE
Prep Date: 01/06/2021 1210

Surrogate	Q	% Rec	Acceptance Limit
13C8_PFOS		94	50-150
13C8_PFOSA		98	50-150
13C9_PFNA		101	50-150
d5-EtFOSAA		105	50-150
d-MeFOSA		106	50-150
d3-MeFOSAA		103	50-150

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

PFAS by LC/MS/MS - LCS

Sample ID: WQ78621-002
Batch: 78621
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Solid
Prep Method: SOP SPE
Prep Date: 01/06/2021 1210

Parameter	Spike Amount (ug/kg)	Result (ug/kg)	Q	Dil	% Rec	% Rec Limit	Analysis Date
8:2 FTS	1.9	2.4		1	127	65-137	01/07/2021 1805
6:2 FTS	1.9	1.8		1	95	64-140	01/07/2021 1805
4:2 FTS	1.9	1.5		1	83	62-145	01/07/2021 1805
EtFOSAA	2.0	1.8		1	91	61-139	01/07/2021 1805
MeFOSA	2.0	2.5		1	124	70-150	01/07/2021 1805
MeFOSAA	2.0	1.9		1	95	63-144	01/07/2021 1805
PFBS	1.8	1.9		1	106	72-128	01/07/2021 1805
PFDS	1.9	2.2		1	116	59-134	01/07/2021 1805
PFHpS	1.9	2.0		1	106	70-132	01/07/2021 1805
PFNS	1.9	2.0		1	107	69-125	01/07/2021 1805
PFOSA	2.0	1.9		1	97	67-137	01/07/2021 1805
PFPeS	1.9	2.0		1	109	73-123	01/07/2021 1805
PFHxS	1.8	1.9		1	102	67-130	01/07/2021 1805
PFBA	2.0	2.1		1	105	71-135	01/07/2021 1805
PFDA	2.0	2.0		1	101	69-133	01/07/2021 1805
PFDoA	2.0	2.0		1	102	69-135	01/07/2021 1805
PFHpA	2.0	2.2		1	108	71-131	01/07/2021 1805
PFHxA	2.0	2.0		1	101	70-132	01/07/2021 1805
PFNA	2.0	2.0		1	100	72-129	01/07/2021 1805
PFOA	2.0	2.0		1	100	69-133	01/07/2021 1805
PFPeA	2.0	2.0		1	101	69-132	01/07/2021 1805
PFTeDA	2.0	2.0		1	100	69-133	01/07/2021 1805
PFTrDA	2.0	2.1		1	103	66-139	01/07/2021 1805
PFUdA	2.0	1.9		1	93	64-136	01/07/2021 1805
PFOS	1.9	1.8		1	97	68-136	01/07/2021 1805

Surrogate	Q	% Rec	Acceptance Limit
13C2_4:2FTS		89	50-150
13C2_6:2FTS		89	50-150
13C2_8:2FTS		86	50-150
13C2_PFDoA		102	50-150
13C2_PFTeDA		98	50-150
13C3_PFBS		86	50-150
13C3_PFHxS		91	50-150
13C4_PFBA		99	50-150
13C4_PFHpA		99	50-150
13C5_PFHxA		100	50-150
13C5_PFPeA		99	50-150
13C6_PFDA		94	50-150
13C7_PFUdA		100	50-150
13C8_PFOA		90	50-150

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

PFAS by LC/MS/MS - LCS

Sample ID: WQ78621-002
Batch: 78621
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Solid
Prep Method: SOP SPE
Prep Date: 01/06/2021 1210

Surrogate	Q	% Rec	Acceptance Limit
13C8_PFOS		95	50-150
13C8_PFOSA		103	50-150
13C9_PFNA		99	50-150
d5-EtFOSAA		104	50-150
d-MeFOSA		104	50-150
d3-MeFOSAA		106	50-150

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

Chain of Custody
and
Miscellaneous Documents

Shealy Environmental Services, Inc.
106 Vantage Point Drive
West Columbia, South Carolina 29172
Telephone No. (803) 791-9700 Fax No. (803) 791-9111
www.shealylab.com

SHEALY

Chain of Custody Record

Number

Client	Report to Contact	Telephone No. / E-mail	Quote No
Arcadis	Colin Morrell	902.209.3476 / colin@dicansaltatechnologies.ca	Mike McFadden
Address	Sampler's Signature	Analysis (Attach list if more space is needed)	Page
	x Colin Morrell	PFAS DoD QSM 5.3 ELAP Table B-15 cmpds and ASLP	1 of 1
City / State / Zip Code	Printed Name		
Project Name			

| Project Number | P.O No. | | G=Grab C=Composite | Matrix | | | No of Containers by Preservative Type | | | | | | | PFAS DoD QSM 5.3 ELAP Table B-15 | ASLP | | | | | | |

Shealy Environmental Services, Inc.
106 Vantage Point Drive
West Columbia, South Carolina 29172
Telephone No. (803) 791-9700 Fax No. (803) 791-9111
www.shealylab.com

SHEALY

Chain of Custody Record

Number

Client	Report to Contact	Telephone No. / E-mail	Quote No.
Arcadis	Colin Morrell	902.209.3476 / colin@cleanearthtechnologies.ca	Mike McFedden
Address	Sampler's Signature	Analysis (Attach list if more space is needed)	Page
	x Colin Morrell	PFAS DoD QSM 5.3 ELAP Table B.15 cmpds and ASLP	2 of 2
City / State / Zip Code	Project Name		
Project Name			
Project Number	P.O. No.		

Sample ID / Description (Containers for each sample may be combined on one line)	Date	Time	G=Grab C=Composite	Matrix: Aqueous	Solid	Non-Aqueous	No of Containers by Preservative Type: Unpres.	H2SO4	HNO3	HCl	NaOH	SDS Kit		PFAS DoD QSM 5.3 ELAP Table B.15	ASLP								Remarks / Cooler I.D.
F-F1F2HS5050TC	Dec 29/20		C		x									x	x								PFAS

WA04033

NMS

Turn Around Time Required (Prior lab approval required for expedited TAT)
☐ Standard ☒ Rush (Please Specify) Rel PFAS - 1 week ASLP - 2 weeks.

Sample Disposal
☐ Return to Client ☐ Disposal by Lab

Possible Hazard Identification (List any known hazards in the remarks)
☐ Non-Hazardous ☐ Flammable ☐ Skin Irritant ☐ SDS provided ☐ Unknown

QC Requirements

1. Relinquished by Colin Morrell	Date Dec 29/20	Time	1. Received by	Date	Time
2. Relinquished by	Date	Time	2. Received by	Date	Time
3. Relinquished by	Date	Time	3. Received by	Date	Time
4. Relinquished by Fedex	Date 01/4/21	Time 0914	4. Laboratory Received by	Date 1/4/21	Time 0914

Note: All samples are retained for four weeks from receipt unless other arrangements are made.

LAB USE ONLY
Received on Ice (Check) ☒ Y ☐ N ☐ Ice Pack - melted

Receipt Temp. 17.6 °C

Document Number: ME002OW-01

PACE ANALYTICAL SERVICES, LLC

Pace Analytical

Samples Receipt Checklist (SRC) (ME0018C-15)
Issuing Authority: Pace ENV - WCOL

Revised:9/29/2020
Page 1 of 1

Sample Receipt Checklist (SRC)

Client: ARCADIS Cooler Inspected by/date: JSH / 01/04/2021 Lot #: WA04033

Means of receipt: ☐ Pace ☐ Client ☐ UPS ☑ FedEx ☐ Other:

☐ Yes	☑ No		1. Were custody seals present on the cooler?
☐ Yes	☐ No	☑ NA	2. If custody seals were present, were they intact and unbroken?

pH Strip ID: NA Chlorine Strip ID: NA Tested by: NA

Original temperature upon receipt / Derived (Corrected) temperature upon receipt %Solid Snap-Cup ID: 30-875

17.6 / 17.6 °C NA / NA °C NA / NA °C NA / NA °C

Method: ☐Temperature Blank ☑Against Bottles IR Gun ID: 5 IR Gun Correction Factor: 0 °C

Method of coolant: ☑ Wet Ice ☐ Ice Packs ☐ Dry Ice ☐ None

☑ Yes	☐ No	☐ NA	3. If temperature of any cooler exceeded 6.0°C, was Project Manager Notified? PM was Notified by: phone (email) face-to-face (circle one).
☑ Yes	☐ No	☐ NA	4. Is the commercial courier's packing slip attached to this form?
☑ Yes	☐ No		5. Were proper custody procedures (relinquished/received) followed?
☑ Yes	☐ No		6. Were sample IDs listed on the COC?
☑ Yes	☐ No		7. Were sample IDs listed on all sample containers?
☐ Yes	☑ No		8. Was collection date & time listed on the COC?
☐ Yes	☑ No		9. Was collection date & time listed on all sample containers?
☐ Yes	☑ No		10. Did all container label information (ID, date, time) agree with the COC?
☑ Yes	☐ No		11. Were tests to be performed listed on the COC?
☑ Yes	☐ No		12. Did all samples arrive in the proper containers for each test and/or in good condition (unbroken, lids on, etc.)?
☑ Yes	☐ No		13. Was adequate sample volume available?
☐ Yes	☑ No		14. Were all samples received within ½ the holding time or 48 hours, whichever comes first?
☐ Yes	☑ No		15. Were any samples containers missing/excess (circle one) samples Not listed on COC?
☐ Yes	☐ No	☑ NA	16. For VOA and RSK-175 samples, were bubbles present >"pea-size" (¼"or 6mm in diameter) in any of the VOA vials?
☐ Yes	☐ No	☑ NA	17. Were all DRO/metals/nutrient samples received at a pH of < 2?
☐ Yes	☐ No	☑ NA	18. Were all cyanide samples received at a pH > 12 and sulfide samples received at a pH > 9?
☐ Yes	☐ No	☑ NA	19. Were all applicable NH_3/TKN/cyanide/phenol/625.1/608.3 (< 0.5mg/L) samples free of residual chlorine?
☐ Yes	☐ No	☑ NA	20. Were client remarks/requests (i.e. requested dilutions, MS/MSD designations, etc…) correctly transcribed from the COC into the comment section in LIMS?
☐ Yes	☑ No		21. Was the quote number listed on the container label? If yes, Quote # NA

Sample Preservation (Must be completed for any sample(s) incorrectly preserved or with headspace.)

Sample(s) NA were received incorrectly preserved and were adjusted accordingly in sample receiving with NA mL of circle one: H2SO4, HNO3, HCl, NaOH using SR # NA.
Time of preservation NA. If more than one preservative is needed, please note in the comments below.

Sample(s) NA were received with bubbles >6 mm in diameter.

Samples(s) NA were received with TRC > 0.5 mg/L (If #19 is *no*) and were adjusted accordingly in sample receiving with sodium thiosulfate ($Na_2S_2O_3$) with Shealy ID: NA.

SR barcode labels applied by: MEH Date: 01/04/2021

Comments: ICE MELTED

SAMPLE IDS LISTED ON CONTAINERS: WA04033-006/SFIF2STTC: S-FIF2TC: WA04033-007/SFIF2STDIH: S-FIF2DIH

Report of Analysis

Arcadis U.S., Inc.
630 Plaza Drive
Suite 600
Highlands Ranch, CO 80129
Attention: Joseph Quinnan

Project Name: Eielson AFB

Project Number: 30030317

Lot Number:**WA05015**

Date Completed:01/26/2021

Project Manager:**Marcia K. McGinnity**

01/26/2021 1:57 PM
Approved and released by:
Project Manager I: **Hannah K. Lucas**

The electronic signature above is the equivalent of a handwritten signature.
This report shall not be reproduced, except in its entirety, without the written approval of Pace Analytical Services, LLC.

Pace Analytical Services, LLC (*formerly Shealy Environmental Services, Inc.*)
106 Vantage Point Drive West Columbia, SC 29172
Tel: 803-791-9700 Fax: 803-791-9111 www.pacelabs.com

Case Narrative
Arcadis U.S., Inc.
Lot Number: WA05015

This Report of Analysis contains the analytical result(s) for the sample(s) listed on the Sample Summary following this Case Narrative. The sample receiving date is documented in the header information associated with each sample.

All results listed in this report relate only to the samples that are contained within this report.

Sample receipt, sample analysis, and data review have been performed in accordance with the most current approved The NELAC Institute (TNI) standards, the Pace Analytical Services, LLC ("Pace") Laboratory Quality Manual, standard operating procedures (SOPs), and Pace policies. Additionally, the DoD QSM version 5.3 has been followed for these samples, and specifically Table B-15 was followed for all PFAS samples. Any exceptions to the TNI standards, the Laboratory Quality Manual, SOPs, the DoD QSM, or policies are qualified on the results page or discussed below.

Where applicable, all soil sample analysis are reported on a dry weight basis unless flagged with a "W" qualifier

If you have any questions regarding this report please contact the Pace Project Manager listed on the cover page.

********** NCM **********

Due to insufficient sample received, the initial sample amount used for the following sample(s) deviated from the standard procedure:WA05015-

006, WA05015-007, WA05015-008, WA05015-009, WA05015-010, WA05015-011, WA20016-001, WA20016-002, WA20016-003, WA20016-004, WA20016-005, WA20016-006, WA20017-001, WA20017-002. The LOQ has been adjusted accordingly.

WA05015-006 (SFIF2STTC) (Run 1) (Analysis Batch 80480) (Prep Batch 80339) SPLP PFAS (Australian) (QSM 5.3)

WA05015-007 (SF1F2STDIH) (Run 1) (Analysis Batch 80480) (Prep Batch 80339) SPLP PFAS (Australian) (QSM 5.3)

WA05015-008 (SFIF2STM) (Run 1) (Analysis Batch 80480) (Prep Batch 80339) SPLP PFAS (Australian) (QSM 5.3)

WA05015-009 (F-F1F2) (Run 1) (Analysis Batch 80480) (Prep Batch 80339) SPLP PFAS (Australian) (QSM 5.3)

WA05015-010 (F-F1F2HSTC) (Run 1) (Analysis Batch 80480) (Prep Batch 80339) SPLP PFAS (Australian) (QSM 5.3)

WA05015-011 (F-F1F2HS5050TC) (Run 1) (Analysis Batch 80480) (Prep Batch 80339) SPLP PFAS (Australian) (QSM 5.3)

For samples WQ80269-038, WA05015-001, WA05015-002, WA05015-003, WA05015-004, WA05015-005, WA05015-006, WA05015-007, WA05015-008, WA05015-009, WA05015-010, WA05015-011, WA20016-001, WA20016-002, WA20016-003, WA20016-004, WA20016-005, WA20016-006, WA20017-001, and WA20017-002, the leaching solution generated from the SPLP leaching process, and used for PFAS SPE sample prep, was recieved in bottles with foam lined caps.

WA05015-001 (393-1-UT) (Run 1) (Analysis Batch 80480) (Prep Batch 80339) SPLP PFAS (Australian) (QSM 5.3)

WA05015-002 (R-TC) (Run 1) (Analysis Batch 80480) (Prep Batch 80339) SPLP PFAS (Australian) (QSM 5.3)

WA05015-003 (R-TH) (Run 1) (Analysis Batch 80480) (Prep Batch 80339) SPLP PFAS (Australian) (QSM 5.3)

WA05015-004 (G-TC) (Run 1) (Analysis Batch 80480) (Prep Batch 80339) SPLP PFAS (Australian) (QSM 5.3)

WA05015-005 (G-TH) (Run 1) (Analysis Batch 80480) (Prep Batch 80339) SPLP PFAS (Australian) (QSM 5.3)

WA05015-006 (SFIF2STTC) (Run 1) (Analysis Batch 80480) (Prep Batch 80339) SPLP PFAS (Australian) (QSM 5.3)

WA05015-007 (SF1F2STDIH) (Run 1) (Analysis Batch 80480) (Prep Batch 80339) SPLP PFAS (Australian) (QSM 5.3)

WA05015-008 (SFIF2STM) (Run 1) (Analysis Batch 80480) (Prep Batch 80339) SPLP PFAS (Australian) (QSM 5.3)

WA05015-009 (F-F1F2) (Run 1) (Analysis Batch 80480) (Prep Batch 80339) SPLP PFAS (Australian) (QSM 5.3)

WA05015-010 (F-F1F2HSTC) (Run 1) (Analysis Batch 80480) (Prep Batch 80339) SPLP PFAS (Australian) (QSM 5.3)

WA05015-011 (F-F1F2HS5050TC) (Run 1) (Analysis Batch 80480) (Prep Batch 80339) SPLP PFAS (Australian) (QSM 5.3)

****

These are special SPLP samples. You need some notes from Brad for the narrative. As Brad (and CC MIke)

Sample Summary
Arcadis U.S., Inc.
Lot Number: WA05015

Sample Number	Sample ID	Matrix	Date Sampled	Date Received
001	393-1-UT	Solid	12/29/2020	01/04/2021
002	R-TC	Solid	12/29/2020	01/04/2021
003	R-TH	Solid	12/29/2020	01/04/2021
004	G-TC	Solid	12/29/2020	01/04/2021
005	G-TH	Solid	12/29/2020	01/04/2021
006	SFIF2STTC	Solid	12/29/2020	01/04/2021
007	SF1F2STDIH	Solid	12/29/2020	01/04/2021
008	SFIF2STM	Solid	12/29/2020	01/04/2021
009	F-F1F2	Solid	12/29/2020	01/04/2021
010	F-F1F2HSTC	Solid	12/29/2020	01/04/2021
011	F-F1F2HS5050TC	Solid	12/29/2020	01/04/2021

(11 samples)

Detection Summary

Arcadis U.S., Inc.

Lot Number: WA05015

Sample	Sample ID	Matrix	Parameter	Method	Result	Q	Units	Page
001	393-1-UT	Solid	8:2 FTS	PFAS by ID	1400	H	ng/L	7
001	393-1-UT	Solid	6:2 FTS	PFAS by ID	480	H	ng/L	7
001	393-1-UT	Solid	PFBS	PFAS by ID	230	H	ng/L	7
001	393-1-UT	Solid	PFOSA	PFAS by ID	210	H	ng/L	7
001	393-1-UT	Solid	PFPeS	PFAS by ID	200	H	ng/L	7
001	393-1-UT	Solid	PFHxS	PFAS by ID	2500	H	ng/L	7
001	393-1-UT	Solid	PFBA	PFAS by ID	170	HJ	ng/L	7
001	393-1-UT	Solid	PFDA	PFAS by ID	97	HJ	ng/L	7
001	393-1-UT	Solid	PFHpA	PFAS by ID	200	H	ng/L	7
001	393-1-UT	Solid	PFHxA	PFAS by ID	1400	H	ng/L	7
001	393-1-UT	Solid	PFNA	PFAS by ID	62	HJ	ng/L	7
001	393-1-UT	Solid	PFOA	PFAS by ID	350	H	ng/L	7
001	393-1-UT	Solid	PFPeA	PFAS by ID	460	H	ng/L	7
001	393-1-UT	Solid	PFOS	PFAS by ID	32000	H	ng/L	7
002	R-TC	Solid	PFHxS	PFAS by ID	18	HJ	ng/L	9
002	R-TC	Solid	PFHxA	PFAS by ID	36	HJ	ng/L	9
002	R-TC	Solid	PFPeA	PFAS by ID	16	HJ	ng/L	9
002	R-TC	Solid	PFOS	PFAS by ID	200	H	ng/L	9
003	R-TH	Solid	PFOSA	PFAS by ID	10	HJ	ng/L	11
003	R-TH	Solid	PFHxS	PFAS by ID	21	HJ	ng/L	11
003	R-TH	Solid	PFOS	PFAS by ID	370	H	ng/L	11
004	G-TC	Solid	6:2 FTS	PFAS by ID	34	HJ	ng/L	13
004	G-TC	Solid	PFHxS	PFAS by ID	89	H	ng/L	13
004	G-TC	Solid	PFHxA	PFAS by ID	45	H	ng/L	13
004	G-TC	Solid	PFPeA	PFAS by ID	15	HJ	ng/L	13
004	G-TC	Solid	PFOS	PFAS by ID	620	H	ng/L	13
005	G-TH	Solid	6:2 FTS	PFAS by ID	26	HJ	ng/L	15
005	G-TH	Solid	PFHxS	PFAS by ID	43	H	ng/L	15
005	G-TH	Solid	PFHxA	PFAS by ID	18	HJ	ng/L	15
005	G-TH	Solid	PFOS	PFAS by ID	190	H	ng/L	15
006	SFIF2STTC	Solid	8:2 FTS	PFAS by ID	43	HJ	ng/L	17
006	SFIF2STTC	Solid	6:2 FTS	PFAS by ID	38	HJ	ng/L	17
006	SFIF2STTC	Solid	PFHxS	PFAS by ID	48	H	ng/L	17
006	SFIF2STTC	Solid	PFHxA	PFAS by ID	31	HJ	ng/L	17
006	SFIF2STTC	Solid	PFOA	PFAS by ID	26	HJ	ng/L	17
006	SFIF2STTC	Solid	PFOS	PFAS by ID	900	H	ng/L	17
007	SF1F2STDIH	Solid	PFHxS	PFAS by ID	31	HJ	ng/L	19
007	SF1F2STDIH	Solid	PFHxA	PFAS by ID	15	HJ	ng/L	19
007	SF1F2STDIH	Solid	PFOS	PFAS by ID	460	H	ng/L	19
008	SFIF2STM	Solid	6:2 FTS	PFAS by ID	330	H	ng/L	21
008	SFIF2STM	Solid	PFOSA	PFAS by ID	46	H	ng/L	21
008	SFIF2STM	Solid	PFHxS	PFAS by ID	63	H	ng/L	21
008	SFIF2STM	Solid	PFBA	PFAS by ID	16	HJ	ng/L	21
008	SFIF2STM	Solid	PFHxA	PFAS by ID	120	H	ng/L	21
008	SFIF2STM	Solid	PFOA	PFAS by ID	32	HJ	ng/L	21

Sample	Sample ID	Matrix	Parameter	Method	Result	Q	Units	Page
008	SFIF2STM	Solid	PFPeA	PFAS by ID	23	HJ	ng/L	21
008	SFIF2STM	Solid	PFOS	PFAS by ID	710	H	ng/L	21
009	F-F1F2	Solid	8:2 FTS	PFAS by ID	180	H	ng/L	23
009	F-F1F2	Solid	6:2 FTS	PFAS by ID	90	H	ng/L	23
009	F-F1F2	Solid	PFBS	PFAS by ID	22	HJ	ng/L	23
009	F-F1F2	Solid	PFOSA	PFAS by ID	46	H	ng/L	23
009	F-F1F2	Solid	PFPeS	PFAS by ID	28	HJ	ng/L	23
009	F-F1F2	Solid	PFHxS	PFAS by ID	160	H	ng/L	23
009	F-F1F2	Solid	PFBA	PFAS by ID	12	HJ	ng/L	23
009	F-F1F2	Solid	PFHpA	PFAS by ID	31	HJ	ng/L	23
009	F-F1F2	Solid	PFHxA	PFAS by ID	200	H	ng/L	23
009	F-F1F2	Solid	PFOA	PFAS by ID	53	H	ng/L	23
009	F-F1F2	Solid	PFPeA	PFAS by ID	41	H	ng/L	23
009	F-F1F2	Solid	PFOS	PFAS by ID	530	H	ng/L	23
010	F-F1F2HSTC	Solid	8:2 FTS	PFAS by ID	61	HJ	ng/L	25
010	F-F1F2HSTC	Solid	6:2 FTS	PFAS by ID	84	H	ng/L	25
010	F-F1F2HSTC	Solid	PFOSA	PFAS by ID	27	HJ	ng/L	25
010	F-F1F2HSTC	Solid	PFPeS	PFAS by ID	11	HJ	ng/L	25
010	F-F1F2HSTC	Solid	PFHxS	PFAS by ID	62	H	ng/L	25
010	F-F1F2HSTC	Solid	PFHpA	PFAS by ID	13	HJ	ng/L	25
010	F-F1F2HSTC	Solid	PFHxA	PFAS by ID	64	H	ng/L	25
010	F-F1F2HSTC	Solid	PFOA	PFAS by ID	25	HJ	ng/L	25
010	F-F1F2HSTC	Solid	PFPeA	PFAS by ID	11	HJ	ng/L	25
010	F-F1F2HSTC	Solid	PFOS	PFAS by ID	240	H	ng/L	25
011	F-F1F2HS5050TC	Solid	8:2 FTS	PFAS by ID	93	H	ng/L	27
011	F-F1F2HS5050TC	Solid	6:2 FTS	PFAS by ID	100	H	ng/L	27
011	F-F1F2HS5050TC	Solid	PFOSA	PFAS by ID	14	HJ	ng/L	27
011	F-F1F2HS5050TC	Solid	PFHxS	PFAS by ID	52	H	ng/L	27
011	F-F1F2HS5050TC	Solid	PFHxA	PFAS by ID	46	H	ng/L	27
011	F-F1F2HS5050TC	Solid	PFOS	PFAS by ID	120	H	ng/L	27

(75 detections)

SPLP PFAS (Australian)

Client: Arcadis U.S., Inc.
Laboratory ID: WA05015-001
Description: 393-1-UT
Matrix: Solid
Date Sampled: 12/29/2020
Date Received: 01/04/2021

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch	Leachate Date
1	AS4439.3/PF	PFAS by ID SOP QSM B-15	5	01/25/2021 1556	MMM	01/22/2021 1119	80339	01/20/2021 2300

Parameter	CAS Number	Analytical Method	Result	Q	LOQ	LOD	DL	Units	Run
1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS)	39108-34-4	PFAS by ID SOP	1400	H	400	200	100	ng/L	1
1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS)	27619-97-2	PFAS by ID SOP	480	H	400	200	100	ng/L	1
1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS)	757124-72-4	PFAS by ID SOP	200	UH	400	200	100	ng/L	1
N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA)	2991-50-6	PFAS by ID SOP	200	UH	400	200	100	ng/L	1
N-methylperfluoro-1-octanesulfonamide (MeFOSA)	31506-32-8	PFAS by ID SOP	400	UH	800	400	200	ng/L	1
N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA)	2355-31-9	PFAS by ID SOP	200	UH	400	200	100	ng/L	1
Perfluoro-1-butanesulfonic acid (PFBS)	375-73-5	PFAS by ID SOP	230	H	200	100	50	ng/L	1
Perfluoro-1-decanesulfonic acid (PFDS)	335-77-3	PFAS by ID SOP	100	UH	200	100	50	ng/L	1
Perfluoro-1-heptanesulfonic acid (PFHpS)	375-92-8	PFAS by ID SOP	100	UH	200	100	50	ng/L	1
Perfluoro-1-nonanesulfonic acid (PFNS)	68259-12-1	PFAS by ID SOP	100	UH	200	100	50	ng/L	1
Perfluoro-1-octanesulfonamide (PFOSA)	754-91-6	PFAS by ID SOP	210	H	200	100	50	ng/L	1
Perfluoro-1-pentanesulfonic acid (PFPeS)	2706-91-4	PFAS by ID SOP	200	H	200	100	50	ng/L	1
Perfluorohexanesulfonic acid (PFHxS)	355-46-4	PFAS by ID SOP	2500	H	200	100	50	ng/L	1
Perfluoro-n-butanoic acid (PFBA)	375-22-4	PFAS by ID SOP	170	HJ	200	100	50	ng/L	1
Perfluoro-n-decanoic acid (PFDA)	335-76-2	PFAS by ID SOP	97	HJ	200	100	50	ng/L	1
Perfluoro-n-dodecanoic acid (PFDoA)	307-55-1	PFAS by ID SOP	100	UH	200	100	50	ng/L	1
Perfluoro-n-heptanoic acid (PFHpA)	375-85-9	PFAS by ID SOP	200	H	200	100	50	ng/L	1
Perfluoro-n-hexanoic acid (PFHxA)	307-24-4	PFAS by ID SOP	1400	H	200	100	50	ng/L	1
Perfluoro-n-nonanoic acid (PFNA)	375-95-1	PFAS by ID SOP	62	HJ	200	100	50	ng/L	1
Perfluoro-n-octanoic acid (PFOA)	335-67-1	PFAS by ID SOP	350	H	200	100	50	ng/L	1
Perfluoro-n-pentanoic acid (PFPeA)	2706-90-3	PFAS by ID SOP	460	H	200	100	50	ng/L	1
Perfluoro-n-tetradecanoic acid (PFTeDA)	376-06-7	PFAS by ID SOP	100	UH	200	100	50	ng/L	1
Perfluoro-n-tridecanoic acid (PFTrDA)	72629-94-8	PFAS by ID SOP	100	UH	200	100	50	ng/L	1
Perfluoro-n-undecanoic acid (PFUdA)	2058-94-8	PFAS by ID SOP	100	UH	200	100	50	ng/L	1
Perfluorooctanesulfonic acid (PFOS)	1763-23-1	PFAS by ID SOP	32000	H	200	100	50	ng/L	1

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
13C2_4:2FTS	H	104	50-150
13C2_6:2FTS	H	101	50-150
13C2_8:2FTS	H	87	50-150
13C2_PFDoA	H	105	50-150
13C2_PFTeDA	H	93	50-150
13C3_PFBS	H	97	50-150
13C3_PFHxS	H	102	50-150
13C4_PFBA	H	100	50-150
13C4_PFHpA	H	94	50-150
13C5_PFHxA	H	97	50-150
13C5_PFPeA	H	100	50-150
13C6_PFDA	H	97	50-150
13C7_PFUdA	H	98	50-150
13C8_PFOA	H	98	50-150
13C8_PFOS	H	100	50-150
13C8_PFOSA	H	103	50-150
13C9_PFNA	H	96	50-150

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

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SPLP PFAS (Australian)

Client: Arcadis U.S., Inc.
Laboratory ID: WA05015-001
Description: 393-1-UT
Matrix: Solid
Date Sampled: 12/29/2020
Date Received: 01/04/2021

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
d5-EtFOSAA	H	99	50-150
d-MeFOSA	H	93	50-150
d3-MeFOSAA	H	101	50-150

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

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SPLP PFAS (Australian)

Client: Arcadis U.S., Inc.
Laboratory ID: WA05015-002
Description: R-TC
Matrix: Solid
Date Sampled: 12/29/2020
Date Received: 01/04/2021

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch	Leachate Date
1	AS4439.3/PF	PFAS by ID SOP QSM B-15	1	01/25/2021 1606	MMM	01/22/2021 1119	80339	01/20/2021 2300

Parameter	CAS Number	Analytical Method	Result	Q	LOQ	LOD	DL	Units	Run
1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS)	39108-34-4	PFAS by ID SOP	40	UH	80	40	20	ng/L	1
1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS)	27619-97-2	PFAS by ID SOP	40	UH	80	40	20	ng/L	1
1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS)	757124-72-4	PFAS by ID SOP	40	UH	80	40	20	ng/L	1
N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA)	2991-50-6	PFAS by ID SOP	40	UH	80	40	20	ng/L	1
N-methylperfluoro-1-octanesulfonamide (MeFOSA)	31506-32-8	PFAS by ID SOP	80	UH	160	80	40	ng/L	1
N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA)	2355-31-9	PFAS by ID SOP	40	UH	80	40	20	ng/L	1
Perfluoro-1-butanesulfonic acid (PFBS)	375-73-5	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-1-decanesulfonic acid (PFDS)	335-77-3	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-1-heptanesulfonic acid (PFHpS)	375-92-8	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-1-nonanesulfonic acid (PFNS)	68259-12-1	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-1-octanesulfonamide (PFOSA)	754-91-6	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-1-pentanesulfonic acid (PFPeS)	2706-91-4	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluorohexanesulfonic acid (PFHxS)	355-46-4	PFAS by ID SOP	18	HJ	40	20	10	ng/L	1
Perfluoro-n-butanoic acid (PFBA)	375-22-4	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-decanoic acid (PFDA)	335-76-2	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-dodecanoic acid (PFDoA)	307-55-1	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-heptanoic acid (PFHpA)	375-85-9	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-hexanoic acid (PFHxA)	307-24-4	PFAS by ID SOP	36	HJ	40	20	10	ng/L	1
Perfluoro-n-nonanoic acid (PFNA)	375-95-1	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-octanoic acid (PFOA)	335-67-1	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-pentanoic acid (PFPeA)	2706-90-3	PFAS by ID SOP	16	HJ	40	20	10	ng/L	1
Perfluoro-n-tetradecanoic acid (PFTeDA)	376-06-7	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-tridecanoic acid (PFTrDA)	72629-94-8	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-undecanoic acid (PFUdA)	2058-94-8	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluorooctanesulfonic acid (PFOS)	1763-23-1	PFAS by ID SOP	200	H	40	20	10	ng/L	1

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
13C2_4:2FTS	H	109	50-150
13C2_6:2FTS	H	112	50-150
13C2_8:2FTS	H	95	50-150
13C2_PFDoA	H	98	50-150
13C2_PFTeDA	H	89	50-150
13C3_PFBS	H	95	50-150
13C3_PFHxS	H	97	50-150
13C4_PFBA	H	102	50-150
13C4_PFHpA	H	100	50-150
13C5_PFHxA	H	101	50-150
13C5_PFPeA	H	103	50-150
13C6_PFDA	H	97	50-150
13C7_PFUdA	H	94	50-150
13C8_PFOA	H	101	50-150
13C8_PFOS	H	91	50-150
13C8_PFOSA	H	95	50-150
13C9_PFNA	H	99	50-150

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

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SPLP PFAS (Australian)

Client: Arcadis U.S., Inc.
Laboratory ID: WA05015-002
Description: R-TC
Matrix: Solid
Date Sampled: 12/29/2020
Date Received: 01/04/2021

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
d5-EtFOSAA	H	93	50-150
d-MeFOSA	H	82	50-150
d3-MeFOSAA	H	101	50-150

LOQ = Limit of Quantitation	B = Detected in the method blank	E = Quantitation of compound exceeded the calibration range	DL = Detection Limit	Q = Surrogate failure
U = Not detected at or above the LOQ	N = Recovery is out of criteria	P = The RPD between two GC columns exceeds 40%	J = Estimated result < LOQ and ≥ DL	L = LCS/LCSD failure
H = Out of holding time	W = Reported on wet weight basis	LOD = Limit of Detection		S = MS/MSD failure

SPLP PFAS (Australian)

Client: Arcadis U.S., Inc.
Laboratory ID: WA05015-003
Description: R-TH
Matrix: Solid
Date Sampled: 12/29/2020
Date Received: 01/04/2021

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch	Leachate Date
1	AS4439.3/PF	PFAS by ID SOP QSM B-15	1	01/25/2021 1617	MMM	01/22/2021 1119	80339	01/20/2021 2300

Parameter	CAS Number	Analytical Method	Result	Q	LOQ	LOD	DL	Units	Run
1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS)	39108-34-4	PFAS by ID SOP	40	UH	80	40	20	ng/L	1
1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS)	27619-97-2	PFAS by ID SOP	40	UH	80	40	20	ng/L	1
1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS)	757124-72-4	PFAS by ID SOP	40	UH	80	40	20	ng/L	1
N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA)	2991-50-6	PFAS by ID SOP	40	UH	80	40	20	ng/L	1
N-methylperfluoro-1-octanesulfonamide (MeFOSA)	31506-32-8	PFAS by ID SOP	80	UH	160	80	40	ng/L	1
N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA)	2355-31-9	PFAS by ID SOP	40	UH	80	40	20	ng/L	1
Perfluoro-1-butanesulfonic acid (PFBS)	375-73-5	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-1-decanesulfonic acid (PFDS)	335-77-3	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-1-heptanesulfonic acid (PFHpS)	375-92-8	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-1-nonanesulfonic acid (PFNS)	68259-12-1	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-1-octanesulfonamide (PFOSA)	754-91-6	PFAS by ID SOP	10	HJ	40	20	10	ng/L	1
Perfluoro-1-pentanesulfonic acid (PFPeS)	2706-91-4	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluorohexanesulfonic acid (PFHxS)	355-46-4	PFAS by ID SOP	21	HJ	40	20	10	ng/L	1
Perfluoro-n-butanoic acid (PFBA)	375-22-4	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-decanoic acid (PFDA)	335-76-2	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-dodecanoic acid (PFDoA)	307-55-1	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-heptanoic acid (PFHpA)	375-85-9	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-hexanoic acid (PFHxA)	307-24-4	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-nonanoic acid (PFNA)	375-95-1	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-octanoic acid (PFOA)	335-67-1	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-pentanoic acid (PFPeA)	2706-90-3	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-tetradecanoic acid (PFTeDA)	376-06-7	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-tridecanoic acid (PFTrDA)	72629-94-8	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-undecanoic acid (PFUdA)	2058-94-8	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluorooctanesulfonic acid (PFOS)	1763-23-1	PFAS by ID SOP	370	H	40	20	10	ng/L	1

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
13C2_4:2FTS	H	97	50-150
13C2_6:2FTS	H	102	50-150
13C2_8:2FTS	H	90	50-150
13C2_PFDoA	H	100	50-150
13C2_PFTeDA	H	85	50-150
13C3_PFBS	H	96	50-150
13C3_PFHxS	H	93	50-150
13C4_PFBA	H	100	50-150
13C4_PFHpA	H	92	50-150
13C5_PFHxA	H	99	50-150
13C5_PFPeA	H	101	50-150
13C6_PFDA	H	90	50-150
13C7_PFUdA	H	92	50-150
13C8_PFOA	H	99	50-150
13C8_PFOS	H	93	50-150
13C8_PFOSA	H	97	50-150
13C9_PFNA	H	95	50-150

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

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SPLP PFAS (Australian)

Client: Arcadis U.S., Inc.
Laboratory ID: WA05015-003
Description: R-TH
Matrix: Solid
Date Sampled: 12/29/2020
Date Received: 01/04/2021

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
d5-EtFOSAA	H	90	50-150
d-MeFOSA	H	86	50-150
d3-MeFOSAA	H	95	50-150

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

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SPLP PFAS (Australian)

Client: Arcadis U.S., Inc.
Laboratory ID: WA05015-004
Description: G-TC
Matrix: Solid
Date Sampled: 12/29/2020
Date Received: 01/04/2021

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch	Leachate Date
1	AS4439.3/PF	PFAS by ID SOP QSM B-15	1	01/25/2021 1628	MMM	01/22/2021 1119	80339	01/20/2021 2300

Parameter	CAS Number	Analytical Method	Result	Q	LOQ	LOD	DL	Units	Run
1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS)	39108-34-4	PFAS by ID SOP	40	UH	80	40	20	ng/L	1
1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS)	27619-97-2	PFAS by ID SOP	34	HJ	80	40	20	ng/L	1
1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS)	757124-72-4	PFAS by ID SOP	40	UH	80	40	20	ng/L	1
N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA)	2991-50-6	PFAS by ID SOP	40	UH	80	40	20	ng/L	1
N-methylperfluoro-1-octanesulfonamide (MeFOSA)	31506-32-8	PFAS by ID SOP	80	UH	160	80	40	ng/L	1
N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA)	2355-31-9	PFAS by ID SOP	40	UH	80	40	20	ng/L	1
Perfluoro-1-butanesulfonic acid (PFBS)	375-73-5	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-1-decanesulfonic acid (PFDS)	335-77-3	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-1-heptanesulfonic acid (PFHpS)	375-92-8	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-1-nonanesulfonic acid (PFNS)	68259-12-1	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-1-octanesulfonamide (PFOSA)	754-91-6	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-1-pentanesulfonic acid (PFPeS)	2706-91-4	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluorohexanesulfonic acid (PFHxS)	355-46-4	PFAS by ID SOP	89	H	40	20	10	ng/L	1
Perfluoro-n-butanoic acid (PFBA)	375-22-4	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-decanoic acid (PFDA)	335-76-2	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-dodecanoic acid (PFDoA)	307-55-1	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-heptanoic acid (PFHpA)	375-85-9	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-hexanoic acid (PFHxA)	307-24-4	PFAS by ID SOP	45	H	40	20	10	ng/L	1
Perfluoro-n-nonanoic acid (PFNA)	375-95-1	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-octanoic acid (PFOA)	335-67-1	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-pentanoic acid (PFPeA)	2706-90-3	PFAS by ID SOP	15	HJ	40	20	10	ng/L	1
Perfluoro-n-tetradecanoic acid (PFTeDA)	376-06-7	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-tridecanoic acid (PFTrDA)	72629-94-8	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-undecanoic acid (PFUdA)	2058-94-8	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluorooctanesulfonic acid (PFOS)	1763-23-1	PFAS by ID SOP	620	H	40	20	10	ng/L	1

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
13C2_4:2FTS	H	93	50-150
13C2_6:2FTS	H	90	50-150
13C2_8:2FTS	H	76	50-150
13C2_PFDoA	H	84	50-150
13C2_PFTeDA	H	77	50-150
13C3_PFBS	H	78	50-150
13C3_PFHxS	H	75	50-150
13C4_PFBA	H	88	50-150
13C4_PFHpA	H	85	50-150
13C5_PFHxA	H	83	50-150
13C5_PFPeA	H	89	50-150
13C6_PFDA	H	83	50-150
13C7_PFUdA	H	79	50-150
13C8_PFOA	H	87	50-150
13C8_PFOS	H	75	50-150
13C8_PFOSA	H	84	50-150
13C9_PFNA	H	86	50-150

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

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SPLP PFAS (Australian)

Client: Arcadis U.S., Inc.
Laboratory ID: WA05015-004
Description: G-TC
Matrix: Solid
Date Sampled: 12/29/2020
Date Received: 01/04/2021

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
d5-EtFOSAA	H	81	50-150
d-MeFOSA	H	68	50-150
d3-MeFOSAA	H	80	50-150

LOQ = Limit of Quantitation	B = Detected in the method blank	E = Quantitation of compound exceeded the calibration range	DL = Detection Limit	Q = Surrogate failure
U = Not detected at or above the LOQ	N = Recovery is out of criteria	P = The RPD between two GC columns exceeds 40%	J = Estimated result < LOQ and ≥ DL	L = LCS/LCSD failure
H = Out of holding time	W = Reported on wet weight basis	LOD = Limit of Detection		S = MS/MSD failure

SPLP PFAS (Australian)

Client: Arcadis U.S., Inc.
Laboratory ID: WA05015-005
Description: G-TH
Matrix: Solid
Date Sampled: 12/29/2020
Date Received: 01/04/2021

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch	Leachate Date
1	AS4439.3/PF	PFAS by ID SOP QSM B-15	1	01/25/2021 1638	MMM	01/22/2021 1119	80339	01/20/2021 2300

Parameter	CAS Number	Analytical Method	Result	Q	LOQ	LOD	DL	Units	Run
1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS)	39108-34-4	PFAS by ID SOP	40	UH	80	40	20	ng/L	1
1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS)	27619-97-2	PFAS by ID SOP	26	HJ	80	40	20	ng/L	1
1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS)	757124-72-4	PFAS by ID SOP	40	UH	80	40	20	ng/L	1
N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA)	2991-50-6	PFAS by ID SOP	40	UH	80	40	20	ng/L	1
N-methylperfluoro-1-octanesulfonamide (MeFOSA)	31506-32-8	PFAS by ID SOP	80	UH	160	80	40	ng/L	1
N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA)	2355-31-9	PFAS by ID SOP	40	UH	80	40	20	ng/L	1
Perfluoro-1-butanesulfonic acid (PFBS)	375-73-5	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-1-decanesulfonic acid (PFDS)	335-77-3	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-1-heptanesulfonic acid (PFHpS)	375-92-8	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-1-nonanesulfonic acid (PFNS)	68259-12-1	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-1-octanesulfonamide (PFOSA)	754-91-6	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-1-pentanesulfonic acid (PFPeS)	2706-91-4	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluorohexanesulfonic acid (PFHxS)	355-46-4	PFAS by ID SOP	43	H	40	20	10	ng/L	1
Perfluoro-n-butanoic acid (PFBA)	375-22-4	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-decanoic acid (PFDA)	335-76-2	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-dodecanoic acid (PFDoA)	307-55-1	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-heptanoic acid (PFHpA)	375-85-9	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-hexanoic acid (PFHxA)	307-24-4	PFAS by ID SOP	18	HJ	40	20	10	ng/L	1
Perfluoro-n-nonanoic acid (PFNA)	375-95-1	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-octanoic acid (PFOA)	335-67-1	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-pentanoic acid (PFPeA)	2706-90-3	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-tetradecanoic acid (PFTeDA)	376-06-7	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-tridecanoic acid (PFTrDA)	72629-94-8	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-undecanoic acid (PFUdA)	2058-94-8	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluorooctanesulfonic acid (PFOS)	1763-23-1	PFAS by ID SOP	190	H	40	20	10	ng/L	1

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
13C2_4:2FTS	H	91	50-150
13C2_6:2FTS	H	92	50-150
13C2_8:2FTS	H	89	50-150
13C2_PFDoA	H	87	50-150
13C2_PFTeDA	H	81	50-150
13C3_PFBS	H	86	50-150
13C3_PFHxS	H	85	50-150
13C4_PFBA	H	92	50-150
13C4_PFHpA	H	87	50-150
13C5_PFHxA	H	91	50-150
13C5_PFPeA	H	90	50-150
13C6_PFDA	H	92	50-150
13C7_PFUdA	H	80	50-150
13C8_PFOA	H	90	50-150
13C8_PFOS	H	80	50-150
13C8_PFOSA	H	88	50-150
13C9_PFNA	H	89	50-150

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

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SPLP PFAS (Australian)

Client: Arcadis U.S., Inc.
Laboratory ID: WA05015-005
Description: G-TH
Matrix: Solid
Date Sampled: 12/29/2020
Date Received: 01/04/2021

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
d5-EtFOSAA	H	86	50-150
d-MeFOSA	H	80	50-150
d3-MeFOSAA	H	88	50-150

LOQ = Limit of Quantitation	B = Detected in the method blank	E = Quantitation of compound exceeded the calibration range	DL = Detection Limit	Q = Surrogate failure
U = Not detected at or above the LOQ	N = Recovery is out of criteria	P = The RPD between two GC columns exceeds 40%	J = Estimated result < LOQ and ≥ DL	L = LCS/LCSD failure
H = Out of holding time	W = Reported on wet weight basis	LOD = Limit of Detection		S = MS/MSD failure

SPLP PFAS (Australian)

Client: Arcadis U.S., Inc.
Laboratory ID: WA05015-006
Description: SFIF2STTC
Matrix: Solid
Date Sampled: 12/29/2020
Date Received: 01/04/2021

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch	Leachate Date
1	AS4439.3/PF	PFAS by ID SOP QSM B-15	1	01/25/2021 1649	MMM	01/22/2021 1119	80339	01/20/2021 2300

Parameter	CAS Number	Analytical Method	Result	Q	LOQ	LOD	DL	Units	Run
1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS)	39108-34-4	PFAS by ID SOP	43	HJ	80	40	20	ng/L	1
1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS)	27619-97-2	PFAS by ID SOP	38	HJ	80	40	20	ng/L	1
1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS)	757124-72-4	PFAS by ID SOP	40	UH	80	40	20	ng/L	1
N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA)	2991-50-6	PFAS by ID SOP	40	UH	80	40	20	ng/L	1
N-methylperfluoro-1-octanesulfonamide (MeFOSA)	31506-32-8	PFAS by ID SOP	80	UH	160	80	40	ng/L	1
N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA)	2355-31-9	PFAS by ID SOP	40	UH	80	40	20	ng/L	1
Perfluoro-1-butanesulfonic acid (PFBS)	375-73-5	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-1-decanesulfonic acid (PFDS)	335-77-3	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-1-heptanesulfonic acid (PFHpS)	375-92-8	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-1-nonanesulfonic acid (PFNS)	68259-12-1	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-1-octanesulfonamide (PFOSA)	754-91-6	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-1-pentanesulfonic acid (PFPeS)	2706-91-4	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluorohexanesulfonic acid (PFHxS)	355-46-4	PFAS by ID SOP	48	H	40	20	10	ng/L	1
Perfluoro-n-butanoic acid (PFBA)	375-22-4	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-decanoic acid (PFDA)	335-76-2	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-dodecanoic acid (PFDoA)	307-55-1	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-heptanoic acid (PFHpA)	375-85-9	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-hexanoic acid (PFHxA)	307-24-4	PFAS by ID SOP	31	HJ	40	20	10	ng/L	1
Perfluoro-n-nonanoic acid (PFNA)	375-95-1	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-octanoic acid (PFOA)	335-67-1	PFAS by ID SOP	26	HJ	40	20	10	ng/L	1
Perfluoro-n-pentanoic acid (PFPeA)	2706-90-3	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-tetradecanoic acid (PFTeDA)	376-06-7	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-tridecanoic acid (PFTrDA)	72629-94-8	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-undecanoic acid (PFUdA)	2058-94-8	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluorooctanesulfonic acid (PFOS)	1763-23-1	PFAS by ID SOP	900	H	40	20	10	ng/L	1

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
13C2_4:2FTS	H	99	50-150
13C2_6:2FTS	H	99	50-150
13C2_8:2FTS	H	90	50-150
13C2_PFDoA	H	91	50-150
13C2_PFTeDA	H	81	50-150
13C3_PFBS	H	87	50-150
13C3_PFHxS	H	89	50-150
13C4_PFBA	H	95	50-150
13C4_PFHpA	H	91	50-150
13C5_PFHxA	H	95	50-150
13C5_PFPeA	H	96	50-150
13C6_PFDA	H	88	50-150
13C7_PFUdA	H	88	50-150
13C8_PFOA	H	91	50-150
13C8_PFOS	H	85	50-150
13C8_PFOSA	H	95	50-150
13C9_PFNA	H	88	50-150

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

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SPLP PFAS (Australian)

Client: Arcadis U.S., Inc.
Laboratory ID: WA05015-006
Description: SFIF2STTC
Matrix: Solid
Date Sampled: 12/29/2020
Date Received: 01/04/2021

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
d5-EtFOSAA	H	88	50-150
d-MeFOSA	H	69	50-150
d3-MeFOSAA	H	93	50-150

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

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SPLP PFAS (Australian)

Client: Arcadis U.S., Inc.
Laboratory ID: WA05015-007
Description: SF1F2STDIH
Matrix: Solid
Date Sampled: 12/29/2020
Date Received: 01/04/2021

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch	Leachate Date
1	AS4439.3/PF	PFAS by ID SOP QSM B-15	1	01/25/2021 1700	MMM	01/22/2021 1119	80339	01/20/2021 2300

Parameter	CAS Number	Analytical Method	Result	Q	LOQ	LOD	DL	Units	Run
1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS)	39108-34-4	PFAS by ID SOP	40	UH	80	40	20	ng/L	1
1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS)	27619-97-2	PFAS by ID SOP	40	UH	80	40	20	ng/L	1
1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS)	757124-72-4	PFAS by ID SOP	40	UH	80	40	20	ng/L	1
N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA)	2991-50-6	PFAS by ID SOP	40	UH	80	40	20	ng/L	1
N-methylperfluoro-1-octanesulfonamide (MeFOSA)	31506-32-8	PFAS by ID SOP	80	UH	160	80	40	ng/L	1
N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA)	2355-31-9	PFAS by ID SOP	40	UH	80	40	20	ng/L	1
Perfluoro-1-butanesulfonic acid (PFBS)	375-73-5	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-1-decanesulfonic acid (PFDS)	335-77-3	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-1-heptanesulfonic acid (PFHpS)	375-92-8	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-1-nonanesulfonic acid (PFNS)	68259-12-1	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-1-octanesulfonamide (PFOSA)	754-91-6	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-1-pentanesulfonic acid (PFPeS)	2706-91-4	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluorohexanesulfonic acid (PFHxS)	355-46-4	PFAS by ID SOP	31	HJ	40	20	10	ng/L	1
Perfluoro-n-butanoic acid (PFBA)	375-22-4	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-decanoic acid (PFDA)	335-76-2	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-dodecanoic acid (PFDoA)	307-55-1	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-heptanoic acid (PFHpA)	375-85-9	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-hexanoic acid (PFHxA)	307-24-4	PFAS by ID SOP	15	HJ	40	20	10	ng/L	1
Perfluoro-n-nonanoic acid (PFNA)	375-95-1	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-octanoic acid (PFOA)	335-67-1	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-pentanoic acid (PFPeA)	2706-90-3	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-tetradecanoic acid (PFTeDA)	376-06-7	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-tridecanoic acid (PFTrDA)	72629-94-8	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-undecanoic acid (PFUdA)	2058-94-8	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluorooctanesulfonic acid (PFOS)	1763-23-1	PFAS by ID SOP	460	H	40	20	10	ng/L	1

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
13C2_4:2FTS	H	92	50-150
13C2_6:2FTS	H	91	50-150
13C2_8:2FTS	H	82	50-150
13C2_PFDoA	H	86	50-150
13C2_PFTeDA	H	79	50-150
13C3_PFBS	H	85	50-150
13C3_PFHxS	H	80	50-150
13C4_PFBA	H	88	50-150
13C4_PFHpA	H	87	50-150
13C5_PFHxA	H	87	50-150
13C5_PFPeA	H	86	50-150
13C6_PFDA	H	79	50-150
13C7_PFUdA	H	78	50-150
13C8_PFOA	H	84	50-150
13C8_PFOS	H	83	50-150
13C8_PFOSA	H	84	50-150
13C9_PFNA	H	84	50-150

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

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SPLP PFAS (Australian)

Client: Arcadis U.S., Inc.
Laboratory ID: WA05015-007
Description: SF1F2STDIH
Matrix: Solid
Date Sampled: 12/29/2020
Date Received: 01/04/2021

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
d5-EtFOSAA	H	80	50-150
d-MeFOSA	H	75	50-150
d3-MeFOSAA	H	79	50-150

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

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SPLP PFAS (Australian)

Client: Arcadis U.S., Inc.
Laboratory ID: WA05015-008
Description: SFIF2STM
Matrix: Solid
Date Sampled: 12/29/2020
Date Received: 01/04/2021

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch	Leachate Date
1	AS4439.3/PF	PFAS by ID SOP QSM B-15	1	01/25/2021 1731	MMM	01/22/2021 1119	80339	01/20/2021 2300

Parameter	CAS Number	Analytical Method	Result	Q	LOQ	LOD	DL	Units	Run
1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS)	39108-34-4	PFAS by ID SOP	40	UH	80	40	20	ng/L	1
1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS)	27619-97-2	PFAS by ID SOP	330	H	80	40	20	ng/L	1
1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS)	757124-72-4	PFAS by ID SOP	40	UH	80	40	20	ng/L	1
N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA)	2991-50-6	PFAS by ID SOP	40	UH	80	40	20	ng/L	1
N-methylperfluoro-1-octanesulfonamide (MeFOSA)	31506-32-8	PFAS by ID SOP	80	UH	160	80	40	ng/L	1
N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA)	2355-31-9	PFAS by ID SOP	40	UH	80	40	20	ng/L	1
Perfluoro-1-butanesulfonic acid (PFBS)	375-73-5	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-1-decanesulfonic acid (PFDS)	335-77-3	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-1-heptanesulfonic acid (PFHpS)	375-92-8	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-1-nonanesulfonic acid (PFNS)	68259-12-1	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-1-octanesulfonamide (PFOSA)	754-91-6	PFAS by ID SOP	46	H	40	20	10	ng/L	1
Perfluoro-1-pentanesulfonic acid (PFPeS)	2706-91-4	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluorohexanesulfonic acid (PFHxS)	355-46-4	PFAS by ID SOP	63	H	40	20	10	ng/L	1
Perfluoro-n-butanoic acid (PFBA)	375-22-4	PFAS by ID SOP	16	HJ	40	20	10	ng/L	1
Perfluoro-n-decanoic acid (PFDA)	335-76-2	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-dodecanoic acid (PFDoA)	307-55-1	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-heptanoic acid (PFHpA)	375-85-9	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-hexanoic acid (PFHxA)	307-24-4	PFAS by ID SOP	120	H	40	20	10	ng/L	1
Perfluoro-n-nonanoic acid (PFNA)	375-95-1	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-octanoic acid (PFOA)	335-67-1	PFAS by ID SOP	32	HJ	40	20	10	ng/L	1
Perfluoro-n-pentanoic acid (PFPeA)	2706-90-3	PFAS by ID SOP	23	HJ	40	20	10	ng/L	1
Perfluoro-n-tetradecanoic acid (PFTeDA)	376-06-7	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-tridecanoic acid (PFTrDA)	72629-94-8	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-undecanoic acid (PFUdA)	2058-94-8	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluorooctanesulfonic acid (PFOS)	1763-23-1	PFAS by ID SOP	710	H	40	20	10	ng/L	1

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
13C2_4:2FTS	H	93	50-150
13C2_6:2FTS	H	90	50-150
13C2_8:2FTS	H	79	50-150
13C2_PFDoA	H	89	50-150
13C2_PFTeDA	H	80	50-150
13C3_PFBS	H	82	50-150
13C3_PFHxS	H	86	50-150
13C4_PFBA	H	90	50-150
13C4_PFHpA	H	87	50-150
13C5_PFHxA	H	92	50-150
13C5_PFPeA	H	89	50-150
13C6_PFDA	H	86	50-150
13C7_PFUdA	H	85	50-150
13C8_PFOA	H	89	50-150
13C8_PFOS	H	86	50-150
13C8_PFOSA	H	89	50-150
13C9_PFNA	H	86	50-150

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

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SPLP PFAS (Australian)

Client: Arcadis U.S., Inc.
Laboratory ID: WA05015-008
Description: SFIF2STM
Matrix: Solid
Date Sampled: 12/29/2020
Date Received: 01/04/2021

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
d5-EtFOSAA	H	83	50-150
d-MeFOSA	H	64	50-150
d3-MeFOSAA	H	90	50-150

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
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SPLP PFAS (Australian)

Client: Arcadis U.S., Inc.
Laboratory ID: WA05015-009
Description: F-F1F2
Matrix: Solid
Date Sampled: 12/29/2020
Date Received: 01/04/2021

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch	Leachate Date
1	AS4439.3/PF	PFAS by ID SOP QSM B-15	1	01/25/2021 1742	MMM	01/22/2021 1119	80339	01/20/2021 2300

Parameter	CAS Number	Analytical Method	Result	Q	LOQ	LOD	DL	Units	Run
1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS)	39108-34-4	PFAS by ID SOP	180	H	80	40	20	ng/L	1
1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS)	27619-97-2	PFAS by ID SOP	90	H	80	40	20	ng/L	1
1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS)	757124-72-4	PFAS by ID SOP	40	UH	80	40	20	ng/L	1
N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA)	2991-50-6	PFAS by ID SOP	40	UH	80	40	20	ng/L	1
N-methylperfluoro-1-octanesulfonamide (MeFOSA)	31506-32-8	PFAS by ID SOP	80	UH	160	80	40	ng/L	1
N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA)	2355-31-9	PFAS by ID SOP	40	UH	80	40	20	ng/L	1
Perfluoro-1-butanesulfonic acid (PFBS)	375-73-5	PFAS by ID SOP	22	HJ	40	20	10	ng/L	1
Perfluoro-1-decanesulfonic acid (PFDS)	335-77-3	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-1-heptanesulfonic acid (PFHpS)	375-92-8	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-1-nonanesulfonic acid (PFNS)	68259-12-1	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-1-octanesulfonamide (PFOSA)	754-91-6	PFAS by ID SOP	46	H	40	20	10	ng/L	1
Perfluoro-1-pentanesulfonic acid (PFPeS)	2706-91-4	PFAS by ID SOP	28	HJ	40	20	10	ng/L	1
Perfluorohexanesulfonic acid (PFHxS)	355-46-4	PFAS by ID SOP	160	H	40	20	10	ng/L	1
Perfluoro-n-butanoic acid (PFBA)	375-22-4	PFAS by ID SOP	12	HJ	40	20	10	ng/L	1
Perfluoro-n-decanoic acid (PFDA)	335-76-2	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-dodecanoic acid (PFDoA)	307-55-1	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-heptanoic acid (PFHpA)	375-85-9	PFAS by ID SOP	31	HJ	40	20	10	ng/L	1
Perfluoro-n-hexanoic acid (PFHxA)	307-24-4	PFAS by ID SOP	200	H	40	20	10	ng/L	1
Perfluoro-n-nonanoic acid (PFNA)	375-95-1	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-octanoic acid (PFOA)	335-67-1	PFAS by ID SOP	53	H	40	20	10	ng/L	1
Perfluoro-n-pentanoic acid (PFPeA)	2706-90-3	PFAS by ID SOP	41	H	40	20	10	ng/L	1
Perfluoro-n-tetradecanoic acid (PFTeDA)	376-06-7	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-tridecanoic acid (PFTrDA)	72629-94-8	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-undecanoic acid (PFUdA)	2058-94-8	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluorooctanesulfonic acid (PFOS)	1763-23-1	PFAS by ID SOP	530	H	40	20	10	ng/L	1

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
13C2_4:2FTS	H	96	50-150
13C2_6:2FTS	H	89	50-150
13C2_8:2FTS	H	83	50-150
13C2_PFDoA	H	84	50-150
13C2_PFTeDA	H	77	50-150
13C3_PFBS	H	81	50-150
13C3_PFHxS	H	82	50-150
13C4_PFBA	H	88	50-150
13C4_PFHpA	H	85	50-150
13C5_PFHxA	H	86	50-150
13C5_PFPeA	H	87	50-150
13C6_PFDA	H	82	50-150
13C7_PFUdA	H	79	50-150
13C8_PFOA	H	81	50-150
13C8_PFOS	H	78	50-150
13C8_PFOSA	H	89	50-150
13C9_PFNA	H	87	50-150

LOQ = Limit of Quantitation
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H = Out of holding time
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W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
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S = MS/MSD failure

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SPLP PFAS (Australian)

Client: Arcadis U.S., Inc.
Laboratory ID: WA05015-009
Description: F-F1F2
Matrix: Solid
Date Sampled: 12/29/2020
Date Received: 01/04/2021

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
d5-EtFOSAA	H	80	50-150
d-MeFOSA	H	61	50-150
d3-MeFOSAA	H	86	50-150

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
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SPLP PFAS (Australian)

Client: Arcadis U.S., Inc. | Laboratory ID: WA05015-010
Description: F-F1F2HSTC | Matrix: Solid
Date Sampled: 12/29/2020
Date Received: 01/04/2021

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch	Leachate Date
1	AS4439.3/PF	PFAS by ID SOP QSM B-15	1	01/25/2021 1804	MMM	01/22/2021 1119	80339	01/20/2021 2300

Parameter	CAS Number	Analytical Method	Result	Q	LOQ	LOD	DL	Units	Run
1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS)	39108-34-4	PFAS by ID SOP	61	HJ	80	40	20	ng/L	1
1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS)	27619-97-2	PFAS by ID SOP	84	H	80	40	20	ng/L	1
1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS)	757124-72-4	PFAS by ID SOP	40	UH	80	40	20	ng/L	1
N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA)	2991-50-6	PFAS by ID SOP	40	UH	80	40	20	ng/L	1
N-methylperfluoro-1-octanesulfonamide (MeFOSA)	31506-32-8	PFAS by ID SOP	80	UH	160	80	40	ng/L	1
N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA)	2355-31-9	PFAS by ID SOP	40	UH	80	40	20	ng/L	1
Perfluoro-1-butanesulfonic acid (PFBS)	375-73-5	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-1-decanesulfonic acid (PFDS)	335-77-3	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-1-heptanesulfonic acid (PFHpS)	375-92-8	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-1-nonanesulfonic acid (PFNS)	68259-12-1	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-1-octanesulfonamide (PFOSA)	754-91-6	PFAS by ID SOP	27	HJ	40	20	10	ng/L	1
Perfluoro-1-pentanesulfonic acid (PFPeS)	2706-91-4	PFAS by ID SOP	11	HJ	40	20	10	ng/L	1
Perfluorohexanesulfonic acid (PFHxS)	355-46-4	PFAS by ID SOP	62	H	40	20	10	ng/L	1
Perfluoro-n-butanoic acid (PFBA)	375-22-4	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-decanoic acid (PFDA)	335-76-2	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-dodecanoic acid (PFDoA)	307-55-1	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-heptanoic acid (PFHpA)	375-85-9	PFAS by ID SOP	13	HJ	40	20	10	ng/L	1
Perfluoro-n-hexanoic acid (PFHxA)	307-24-4	PFAS by ID SOP	64	H	40	20	10	ng/L	1
Perfluoro-n-nonanoic acid (PFNA)	375-95-1	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-octanoic acid (PFOA)	335-67-1	PFAS by ID SOP	25	HJ	40	20	10	ng/L	1
Perfluoro-n-pentanoic acid (PFPeA)	2706-90-3	PFAS by ID SOP	11	HJ	40	20	10	ng/L	1
Perfluoro-n-tetradecanoic acid (PFTeDA)	376-06-7	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-tridecanoic acid (PFTrDA)	72629-94-8	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-undecanoic acid (PFUdA)	2058-94-8	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluorooctanesulfonic acid (PFOS)	1763-23-1	PFAS by ID SOP	240	H	40	20	10	ng/L	1

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
13C2_4:2FTS	H	93	50-150
13C2_6:2FTS	H	94	50-150
13C2_8:2FTS	H	90	50-150
13C2_PFDoA	H	94	50-150
13C2_PFTeDA	H	82	50-150
13C3_PFBS	H	88	50-150
13C3_PFHxS	H	85	50-150
13C4_PFBA	H	99	50-150
13C4_PFHpA	H	91	50-150
13C5_PFHxA	H	94	50-150
13C5_PFPeA	H	96	50-150
13C6_PFDA	H	89	50-150
13C7_PFUdA	H	84	50-150
13C8_PFOA	H	90	50-150
13C8_PFOS	H	80	50-150
13C8_PFOSA	H	94	50-150
13C9_PFNA	H	92	50-150

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

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SPLP PFAS (Australian)

Client: Arcadis U.S., Inc.
Laboratory ID: WA05015-010
Description: F-F1F2HSTC
Matrix: Solid
Date Sampled: 12/29/2020
Date Received: 01/04/2021

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
d5-EtFOSAA	H	85	50-150
d-MeFOSA	H	80	50-150
d3-MeFOSAA	H	94	50-150

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
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SPLP PFAS (Australian)

Client: Arcadis U.S., Inc.
Laboratory ID: WA05015-011
Description: F-F1F2HS5050TC
Matrix: Solid
Date Sampled: 12/29/2020
Date Received: 01/04/2021

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch	Leachate Date
1	AS4439.3/PF	PFAS by ID SOP QSM B-15	1	01/25/2021 1814	MMM	01/22/2021 1119	80339	01/20/2021 2300

Parameter	CAS Number	Analytical Method	Result	Q	LOQ	LOD	DL	Units	Run
1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS)	39108-34-4	PFAS by ID SOP	93	H	80	40	20	ng/L	1
1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS)	27619-97-2	PFAS by ID SOP	100	H	80	40	20	ng/L	1
1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS)	757124-72-4	PFAS by ID SOP	40	UH	80	40	20	ng/L	1
N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA)	2991-50-6	PFAS by ID SOP	40	UH	80	40	20	ng/L	1
N-methylperfluoro-1-octanesulfonamide (MeFOSA)	31506-32-8	PFAS by ID SOP	80	UH	160	80	40	ng/L	1
N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA)	2355-31-9	PFAS by ID SOP	40	UH	80	40	20	ng/L	1
Perfluoro-1-butanesulfonic acid (PFBS)	375-73-5	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-1-decanesulfonic acid (PFDS)	335-77-3	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-1-heptanesulfonic acid (PFHpS)	375-92-8	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-1-nonanesulfonic acid (PFNS)	68259-12-1	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-1-octanesulfonamide (PFOSA)	754-91-6	PFAS by ID SOP	14	HJ	40	20	10	ng/L	1
Perfluoro-1-pentanesulfonic acid (PFPeS)	2706-91-4	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluorohexanesulfonic acid (PFHxS)	355-46-4	PFAS by ID SOP	52	H	40	20	10	ng/L	1
Perfluoro-n-butanoic acid (PFBA)	375-22-4	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-decanoic acid (PFDA)	335-76-2	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-dodecanoic acid (PFDoA)	307-55-1	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-heptanoic acid (PFHpA)	375-85-9	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-hexanoic acid (PFHxA)	307-24-4	PFAS by ID SOP	46	H	40	20	10	ng/L	1
Perfluoro-n-nonanoic acid (PFNA)	375-95-1	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-octanoic acid (PFOA)	335-67-1	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-pentanoic acid (PFPeA)	2706-90-3	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-tetradecanoic acid (PFTeDA)	376-06-7	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-tridecanoic acid (PFTrDA)	72629-94-8	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-undecanoic acid (PFUdA)	2058-94-8	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluorooctanesulfonic acid (PFOS)	1763-23-1	PFAS by ID SOP	120	H	40	20	10	ng/L	1

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
13C2_4:2FTS	H	95	50-150
13C2_6:2FTS	H	98	50-150
13C2_8:2FTS	H	85	50-150
13C2_PFDoA	H	89	50-150
13C2_PFTeDA	H	80	50-150
13C3_PFBS	H	84	50-150
13C3_PFHxS	H	80	50-150
13C4_PFBA	H	96	50-150
13C4_PFHpA	H	91	50-150
13C5_PFHxA	H	89	50-150
13C5_PFPeA	H	94	50-150
13C6_PFDA	H	95	50-150
13C7_PFUdA	H	93	50-150
13C8_PFOA	H	91	50-150
13C8_PFOS	H	84	50-150
13C8_PFOSA	H	89	50-150
13C9_PFNA	H	92	50-150

LOQ = Limit of Quantitation
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E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

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SPLP PFAS (Australian)

Client: Arcadis U.S., Inc.
Laboratory ID: WA05015-011
Description: F-F1F2HS5050TC
Matrix: Solid
Date Sampled: 12/29/2020
Date Received: 01/04/2021

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
d5-EtFOSAA	H	89	50-150
d-MeFOSA	H	78	50-150
d3-MeFOSAA	H	92	50-150

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

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QC Summary

SPLP PFAS (Australian) - MB

Sample ID: WQ80339-001
Batch: 80339
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Solid
Prep Method: AS4439.3/PFAS
Prep Date: 01/22/2021 1119 Leachate Date: 01/20/2021 2300

Parameter	Result	Q	Dil	LOQ	LOD	DL	Units	Analysis Date
8:2 FTS	40	U	1	80	40	20	ng/L	01/25/2021 1524
6:2 FTS	40	U	1	80	40	20	ng/L	01/25/2021 1524
4:2 FTS	40	U	1	80	40	20	ng/L	01/25/2021 1524
EtFOSAA	40	U	1	80	40	20	ng/L	01/25/2021 1524
MeFOSA	80	U	1	160	80	40	ng/L	01/25/2021 1524
MeFOSAA	40	U	1	80	40	20	ng/L	01/25/2021 1524
PFBS	20	U	1	40	20	10	ng/L	01/25/2021 1524
PFDS	20	U	1	40	20	10	ng/L	01/25/2021 1524
PFHpS	20	U	1	40	20	10	ng/L	01/25/2021 1524
PFNS	20	U	1	40	20	10	ng/L	01/25/2021 1524
PFOSA	20	U	1	40	20	10	ng/L	01/25/2021 1524
PFPeS	20	U	1	40	20	10	ng/L	01/25/2021 1524
PFHxS	20	U	1	40	20	10	ng/L	01/25/2021 1524
PFBA	20	U	1	40	20	10	ng/L	01/25/2021 1524
PFDA	20	U	1	40	20	10	ng/L	01/25/2021 1524
PFDoA	20	U	1	40	20	10	ng/L	01/25/2021 1524
PFHpA	20	U	1	40	20	10	ng/L	01/25/2021 1524
PFHxA	20	U	1	40	20	10	ng/L	01/25/2021 1524
PFNA	20	U	1	40	20	10	ng/L	01/25/2021 1524
PFOA	20	U	1	40	20	10	ng/L	01/25/2021 1524
PFPeA	20	U	1	40	20	10	ng/L	01/25/2021 1524
PFTeDA	20	U	1	40	20	10	ng/L	01/25/2021 1524
PFTrDA	20	U	1	40	20	10	ng/L	01/25/2021 1524
PFUdA	20	U	1	40	20	10	ng/L	01/25/2021 1524
PFOS	20	U	1	40	20	10	ng/L	01/25/2021 1524

Surrogate	Q	% Rec	Acceptance Limit
13C2_4:2FTS		104	50-150
13C2_6:2FTS		109	50-150
13C2_8:2FTS		97	50-150
13C2_PFDoA		108	50-150
13C2_PFTeDA		93	50-150
13C3_PFBS		99	50-150
13C3_PFHxS		97	50-150
13C4_PFBA		109	50-150
13C4_PFHpA		105	50-150
13C5_PFHxA		104	50-150
13C5_PFPeA		106	50-150
13C6_PFDA		102	50-150
13C7_PFUdA		98	50-150
13C8_PFOA		108	50-150

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

SPLP PFAS (Australian) - MB

Sample ID: WQ80339-001
Batch: 80339
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Solid
Prep Method: AS4439.3/PFAS
Prep Date: 01/22/2021 1119 Leachate Date: 01/20/2021 2300

Surrogate	Q	% Rec	Acceptance Limit
13C8_PFOS		95	50-150
13C8_PFOSA		104	50-150
13C9_PFNA		106	50-150
d5-EtFOSAA		97	50-150
d-MeFOSA		102	50-150
d3-MeFOSAA		106	50-150

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

SPLP PFAS (Australian) - LCS

Sample ID: WQ80339-002
Batch: 80339
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Solid
Prep Method: AS4439.3/PFAS
Prep Date: 01/22/2021 1119 Leachate Date: 01/20/2021 2300

Parameter	Spike Amount (ng/L)	Result (ng/L)	Q	Dil	% Rec	% Rec Limit	Analysis Date
8:2 FTS	150	190		1	124	67-138	01/25/2021 1545
6:2 FTS	150	180		1	117	64-140	01/25/2021 1545
4:2 FTS	150	160		1	109	63-143	01/25/2021 1545
EtFOSAA	160	180		1	111	61-135	01/25/2021 1545
MeFOSA	160	210		1	130	68-141	01/25/2021 1545
MeFOSAA	160	180		1	113	65-136	01/25/2021 1545
PFBS	140	150		1	108	72-130	01/25/2021 1545
PFDS	150	150		1	96	53-142	01/25/2021 1545
PFHpS	150	150		1	99	69-134	01/25/2021 1545
PFNS	150	170		1	110	69-127	01/25/2021 1545
PFOSA	160	180		1	115	67-137	01/25/2021 1545
PFPeS	150	160		1	106	71-127	01/25/2021 1545
PFHxS	150	170		1	116	68-131	01/25/2021 1545
PFBA	160	170		1	107	73-129	01/25/2021 1545
PFDA	160	170		1	105	71-129	01/25/2021 1545
PFDoA	160	190		1	117	72-134	01/25/2021 1545
PFHpA	160	170		1	105	72-130	01/25/2021 1545
PFHxA	160	180		1	114	72-129	01/25/2021 1545
PFNA	160	160		1	102	69-130	01/25/2021 1545
PFOA	160	170		1	107	71-133	01/25/2021 1545
PFPeA	160	170		1	108	72-129	01/25/2021 1545
PFTeDA	160	180		1	111	71-132	01/25/2021 1545
PFTrDA	160	180		1	112	65-144	01/25/2021 1545
PFUdA	160	170		1	108	69-133	01/25/2021 1545
PFOS	150	170		1	112	65-140	01/25/2021 1545

Surrogate	Q	% Rec	Acceptance Limit
13C2_4:2FTS		100	50-150
13C2_6:2FTS		95	50-150
13C2_8:2FTS		79	50-150
13C2_PFDoA		93	50-150
13C2_PFTeDA		87	50-150
13C3_PFBS		89	50-150
13C3_PFHxS		92	50-150
13C4_PFBA		97	50-150
13C4_PFHpA		95	50-150
13C5_PFHxA		92	50-150
13C5_PFPeA		94	50-150
13C6_PFDA		87	50-150
13C7_PFUdA		90	50-150
13C8_PFOA		93	50-150

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

SPLP PFAS (Australian) - LCS

Sample ID: WQ80339-002
Batch: 80339
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Solid
Prep Method: AS4439.3/PFAS
Prep Date: 01/22/2021 1119 Leachate Date: 01/20/2021 2300

Surrogate	Q	% Rec	Acceptance Limit
13C8_PFOS		90	50-150
13C8_PFOSA		95	50-150
13C9_PFNA		95	50-150
d5-EtFOSAA		84	50-150
d-MeFOSA		65	50-150
d3-MeFOSAA		89	50-150

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

SPLP PFAS (Australian) - MS

Sample ID: WA05015-007MS
Batch: 80339
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Solid
Prep Method: AS4439.3/PFAS
Prep Date: 01/22/2021 1119 Leachate Date: 01/20/2021 2300

Parameter	Sample Amount (ng/L)	Spike Amount (ng/L)	Result (ng/L)	Q	Dil	% Rec	% Rec Limit	Analysis Date
8:2 FTS	ND	150	190		1	123	67-138	01/25/2021 1710
6:2 FTS	ND	150	170		1	114	64-140	01/25/2021 1710
4:2 FTS	ND	150	200		1	133	63-143	01/25/2021 1710
EtFOSAA	ND	160	180		1	112	61-135	01/25/2021 1710
MeFOSA	ND	160	140		1	85	68-141	01/25/2021 1710
MeFOSAA	ND	160	160		1	99	65-136	01/25/2021 1710
PFBS	ND	140	160		1	114	72-130	01/25/2021 1710
PFDS	ND	150	180		1	119	53-142	01/25/2021 1710
PFHpS	ND	150	180		1	119	69-134	01/25/2021 1710
PFNS	ND	150	160		1	102	69-127	01/25/2021 1710
PFOSA	ND	160	200		1	126	67-137	01/25/2021 1710
PFPeS	ND	150	170		1	113	71-127	01/25/2021 1710
PFHxS	31	150	210		1	123	68-131	01/25/2021 1710
PFBA	ND	160	180		1	113	73-129	01/25/2021 1710
PFDA	ND	160	180		1	109	71-129	01/25/2021 1710
PFDoA	ND	160	170		1	107	72-134	01/25/2021 1710
PFHpA	ND	160	200		1	122	72-130	01/25/2021 1710
PFHxA	15	160	190		1	111	72-129	01/25/2021 1710
PFNA	ND	160	180		1	111	69-130	01/25/2021 1710
PFOA	ND	160	200		1	125	71-133	01/25/2021 1710
PFPeA	ND	160	180		1	113	72-129	01/25/2021 1710
PFTeDA	ND	160	180		1	113	71-132	01/25/2021 1710
PFTrDA	ND	160	170		1	109	65-144	01/25/2021 1710
PFUdA	ND	160	190		1	119	69-133	01/25/2021 1710
PFOS	460	150	620		1	105	65-140	01/25/2021 1710

Surrogate	Q	% Rec	Acceptance Limit
13C2_4:2FTS		84	50-150
13C2_6:2FTS		92	50-150
13C2_8:2FTS		82	50-150
13C2_PFDoA		88	50-150
13C2_PFTeDA		76	50-150
13C3_PFBS		77	50-150
13C3_PFHxS		77	50-150
13C4_PFBA		89	50-150
13C4_PFHpA		82	50-150
13C5_PFHxA		87	50-150
13C5_PFPeA		87	50-150
13C6_PFDA		83	50-150
13C7_PFUdA		78	50-150
13C8_PFOA		84	50-150

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

SPLP PFAS (Australian) - MS

Sample ID: WA05015-007MS
Batch: 80339
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Solid
Prep Method: AS4439.3/PFAS
Prep Date: 01/22/2021 1119 Leachate Date: 01/20/2021 2300

Surrogate	Q	% Rec	Acceptance Limit
13C8_PFOS		77	50-150
13C8_PFOSA		82	50-150
13C9_PFNA		85	50-150
d5-EtFOSAA		77	50-150
d-MeFOSA		73	50-150
d3-MeFOSAA		79	50-150

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

SPLP PFAS (Australian) - MSD

Sample ID: WA05015-007MD
Batch: 80339
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Solid
Prep Method: AS4439.3/PFAS
Prep Date: 01/22/2021 1119 Leachate Date: 01/20/2021 2300

Parameter	Sample Amount (ng/L)	Spike Amount (ng/L)	Result (ng/L)	Q	Dil	% Rec	% RPD	% Rec Limit	% RPD Limit	Analysis Date
8:2 FTS	ND	150	210		1	134	8.8	67-138	30	01/25/2021 1721
6:2 FTS	ND	150	190		1	124	8.0	64-140	30	01/25/2021 1721
4:2 FTS	ND	150	170		1	117	13	63-143	30	01/25/2021 1721
EtFOSAA	ND	160	190		1	116	3.8	61-135	30	01/25/2021 1721
MeFOSA	ND	160	180		1	113	28	68-141	30	01/25/2021 1721
MeFOSAA	ND	160	150		1	97	2.7	65-136	30	01/25/2021 1721
PFBS	ND	140	150		1	109	3.9	72-130	30	01/25/2021 1721
PFDS	ND	150	160		1	103	14	53-142	30	01/25/2021 1721
PFHpS	ND	150	170		1	113	5.1	69-134	30	01/25/2021 1721
PFNS	ND	150	160		1	102	0.80	69-127	30	01/25/2021 1721
PFOSA	ND	160	170		1	109	14	67-137	30	01/25/2021 1721
PFPeS	ND	150	160		1	108	4.0	71-127	30	01/25/2021 1721
PFHxS	31	150	170		1	95	21	68-131	30	01/25/2021 1721
PFBA	ND	160	170		1	107	5.6	73-129	30	01/25/2021 1721
PFDA	ND	160	170		1	106	3.2	71-129	30	01/25/2021 1721
PFDoA	ND	160	180		1	112	4.6	72-134	30	01/25/2021 1721
PFHpA	ND	160	180		1	114	7.5	72-130	30	01/25/2021 1721
PFHxA	15	160	190		1	110	0.99	72-129	30	01/25/2021 1721
PFNA	ND	160	180		1	113	2.1	69-130	30	01/25/2021 1721
PFOA	ND	160	180		1	111	12	71-133	30	01/25/2021 1721
PFPeA	ND	160	180		1	110	3.1	72-129	30	01/25/2021 1721
PFTeDA	ND	160	180		1	113	0.19	71-132	30	01/25/2021 1721
PFTrDA	ND	160	180		1	110	1.6	65-144	30	01/25/2021 1721
PFUdA	ND	160	180		1	114	4.6	69-133	30	01/25/2021 1721
PFOS	460	150	580		1	78	6.7	65-140	30	01/25/2021 1721

Surrogate	Q	% Rec	Acceptance Limit
13C2_4:2FTS		103	50-150
13C2_6:2FTS		110	50-150
13C2_8:2FTS		90	50-150
13C2_PFDoA		100	50-150
13C2_PFTeDA		90	50-150
13C3_PFBS		93	50-150
13C3_PFHxS		95	50-150
13C4_PFBA		104	50-150
13C4_PFHpA		98	50-150
13C5_PFHxA		99	50-150
13C5_PFPeA		99	50-150
13C6_PFDA		98	50-150
13C7_PFUdA		95	50-150
13C8_PFOA		99	50-150

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

SPLP PFAS (Australian) - MSD

Sample ID: WA05015-007MD
Batch: 80339
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Solid
Prep Method: AS4439.3/PFAS
Prep Date: 01/22/2021 1119 Leachate Date: 01/20/2021 2300

Surrogate	Q	% Rec	Acceptance Limit
13C8_PFOS		98	50-150
13C8_PFOSA		100	50-150
13C9_PFNA		99	50-150
d5-EtFOSAA		88	50-150
d-MeFOSA		87	50-150
d3-MeFOSAA		95	50-150

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

Chain of Custody

and

Miscellaneous Documents

Shealy Environmental Services, Inc.
106 Vantage Point Drive
West Columbia, South Carolina 29172
Telephone No. (803) 791-9700 Fax No. (803) 791-9111
www.shealylab.com

Chain of Custody Record

Number

WA05015

WA04033

Client: Arcadis	Report to Contact: Colin Morrell	Telephone No. / E-mail: 902.209.3476 / colin@clearwatertechnologies
Address:	Sampler's Signature: x Colin Morrell	Analysis (Attach list if more space is needed): PFAS DoD QSM 5.3 ELAP Table B-15 cmpds and ...
City / State / Zip Code	Printed Name	
Project Name		
Project Number	P.O. No.	

Sample I.D. / Description (Containers for each sample may be combined on one line)	Date	Time	G=Grab C=Composite	Matrix: Aqueous	Solid	Non-Aqueous	No of Containers by Preservative Type: Unpres.	H2SO4	HNO3	HCl	NaOH	5035 Kit		PFAS DoD QSM 5.3 ELAP Table B-15	ASLP								Remarks / Cooler I.D.
393-1-UT	Dec 29/20		C		x									x	x								PFAS 1.5 mg/kg
R-TC	Dec 29/20		C		x									x	x								PFAS
R-TH	Dec 29/20		C		x									x	x								PFAS
G-TC	Dec 29/20		C		x									x	x								PFAS
G-TH	Dec 29/20		C		x									x	x								PFAS
SF1F2STTC	Dec 29/20		C		x									x	x								PFAS
SF1F2STDIH	Dec 29/20		C		x									x	x								PFAS
SF1F2STM	Dec 29/20		C		x									x	x								PFAS
F-F1F2	Dec 29/20		C		x									x	x								PFAS
F-F1F2HSTC	Dec 29/20		C		x									x	x								PFAS

Turn Around Time Required (Prior approval required for expedited TAT): ☐ Standard ☒ Rush (Please Specify): Total PFAS - 1 week; ASLP - 2 weeks

Sample Disposal: ☐ Return to Client ☑ Dispose by Lab

Possible Hazard Identification: (List any known hazards in the remarks) ☐ Non Hazardous ☐ Flammable ☐ Skin Irritant ☐ SDS provided ☐ Unknown

QC Requirements

	Date	Time		Date	Time
1. Relinquished by: Colin Morrell	Dec 30/20		1. Received by		
2. Relinquished by			2. Received by		
3. Relinquished by			3. Received by		
4. Relinquished by: FedEx	1/4/21	0914	4. Laboratory Received by	1/4/21	0914

Note: All samples are retained for four weeks from receipt unless other arrangements are made.

LAB USE ONLY
Received on Ice (Check) ☑ Y ☐ N ☐ Ice Pack - Melted

Receipt Temp. 17.6 °C

Document Number: ME002CW-C1

Pace Analytical Services, LLC (formerly Shealy Environmental Services, Inc.)
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

PACE ANALYTICAL SERVICES, LLC

Shealy Environmental Services, Inc.
106 Vantage Point Drive
West Columbia, South Carolina 29172
Telephone No. (803) 791-9700 Fax No. (803) 791-9111
www.shealylab.com

SHEALY

Chain of Custody Record

Number WA05015

Client: Arcadis	Report to Contact: Colin Morrell	Telephone No. / E-mail: 902.209.3476 / colin@oceanearthtechnologies.ca	
Address	Sampler's Signature: x Colin Morrell	Analysis (Attach list if more space is needed): PFAS DoD QSM 5.3 ELAP Table B-15 cmpds and ASLP	Page: 2 of 2
City / State / Zip Code	Printed Name		
Project Name			
Project Number	P.O No.		

WA04033

Sample ID / Description (Containers for each sample may be combined on one line)	Date	Time	C=Grab C=Composite	Matrix: Aqueous	Solid	Non-Aqueous	Other	No of Containers by Preservative Type: Unpres.	H_2SO_4	HNO_3	HCl	NaOH	SC35 Kit	Other	PFAS DoD QSM 5.3 ELAP Table B-15	ASLP							Remarks / Cooler I.D.
F-F1F2HS505CTC	Dec 29/20		C		x										x	x							PFAS

Turn Around Time Required (Prior lab approval required for expedited TAT): ☐ Standard ☒ Rush (Please Specify) TOTAL PFAS - 1 week, ASLP - 2 weeks.

Sample Disposal: ☐ Return to Client ☐ Disposal by Lab

Possible Hazard Identification (List any known hazards in the remarks): ☐ Non-Hazardous ☐ Flammable ☐ Skin Irritant ☐ EDS provided ☐ Unknown

QC Requirements

	Date	Time		Date	Time
1. Relinquished by: Colin Morrell	Dec 30/20		1. Received by		
2. Relinquished by			2. Received by		
3. Relinquished by			3. Received by		
4. Relinquished by: Fedex	1/4/21	0914	4. Laboratory Received by	1/4/21	0914

Note: All samples are retained for four weeks from receipt unless other arrangements are made.

LAB USE ONLY
Received on Ice (Check) ☒ Y ☐ N ☐ Ice Pack - melted

Receipt Temp. 17.6 °C

Document Number: ME0C2OW-01

PACE ANALYTICAL SERVICES, LLC

Pace Analytical

Samples Receipt Checklist (SRC) (ME0018C-15)
Issuing Authority: Pace ENV - WCOL

WA05015

d:9/29/2020
Page 1 of 1

Sample Receipt Checklist (SRC)

Client: ARCADIS Cooler Inspected by/date: JSH / 01/04/2021 Lot #: WA04033

Means of receipt: ☐ Pace ☐ Client ☐ UPS ☑ FedEx ☐ Other:			
☐ Yes	☑ No		1. Were custody seals present on the cooler?
☐ Yes	☐ No	☑ NA	2. If custody seals were present, were they intact and unbroken?

pH Strip ID: NA Chlorine Strip ID: NA Tested by: NA

Original temperature upon receipt / Derived (Corrected) temperature upon receipt %Solid Snap-Cup ID: 20-875

17.6 / 17.6 °C NA / NA °C NA / NA °C NA / NA °C

Method: ☐ Temperature Blank ☑ Against Bottles IR Gun ID: 5 IR Gun Correction Factor: 0 °C

Method of coolant: ☑ Wet Ice ☐ Ice Packs ☐ Dry Ice ☐ None

☑ Yes	☐ No	☐ NA	3. If temperature of any cooler exceeded 6.0°C, was Project Manager Notified? PM was Notified by: phone / (gmail) / face-to-face (circle one).
☑ Yes	☐ No	☐ NA	4. Is the commercial courier's packing slip attached to this form?
☑ Yes	☐ No		5. Were proper custody procedures (relinquished/received) followed?
☑ Yes	☐ No		6. Were sample IDs listed on the COC?
☑ Yes	☐ No		7. Were sample IDs listed on all sample containers?
☐ Yes	☑ No		8. Was collection date & time listed on the COC?
☐ Yes	☑ No		9. Was collection date & time listed on all sample containers?
☐ Yes	☑ No		10. Did all container label information (ID, date, time) agree with the COC?
☑ Yes	☐ No		11. Were tests to be performed listed on the COC?
☑ Yes	☐ No		12. Did all samples arrive in the proper containers for each test and/or in good condition (unbroken, lids on, etc.)?
☑ Yes	☐ No		13. Was adequate sample volume available?
☐ Yes	☑ No		14. Were all samples received within ½ the holding time or 48 hours, whichever comes first?
☐ Yes	☑ No		15. Were any samples containers missing/excess (circle one) samples Not listed on COC?
☐ Yes	☐ No	☑ NA	16. For VOA and RSK-175 samples, were bubbles present >"pea-size" (¼"or 6mm in diameter) in any of the VOA vials?
☐ Yes	☐ No	☑ NA	17. Were all DRO/metals/nutrient samples received at a pH of < 2?
☐ Yes	☐ No	☑ NA	18. Were all cyanide samples received at a pH > 12 and sulfide samples received at a pH > 9?
☐ Yes	☐ No	☑ NA	19. Were all applicable NH_3/TKN/cyanide/phenol/625.1/608.3 (< 0.5mg/L) samples free of residual chlorine?
☐ Yes	☐ No	☑ NA	20. Were client remarks/requests (i.e. requested dilutions, MS/MSD designations, etc…) correctly transcribed from the COC into the comment section in LIMS?
☐ Yes	☑ No		21. Was the quote number listed on the container label? If yes, Quote #: NA

Sample Preservation (Must be completed for any sample(s) incorrectly preserved or with headspace.)

Sample(s) NA were received incorrectly preserved and were adjusted accordingly in sample receiving with NA mL of circle one: H2SO4, HNO3, HCl, NaOH using SR # NA.
Time of preservation NA. If more than one preservative is needed, please note in the comments below.

Sample(s) NA were received with bubbles >6 mm in diameter.

Samples(s) NA were received with TRC > 0.5 mg/L (If #19 is ***no***) and were adjusted accordingly in sample receiving with sodium thiosulfate ($Na_2S_2O_3$) with Shealy ID: NA.

SR barcode labels applied by: MEH Date: 01/04/2021

Comments: ICE MELTED

SAMPLE IDS LISTED ON CONTAINERS: WA04033-006/SFIF2STTC: S-FID21C; WA04033-007/SFIF2STDIII: S-FID2DIII

Report of Analysis

Arcadis U.S., Inc.
630 Plaza Drive
Suite 600
Highlands Ranch, CO 80129
Attention: Joseph Quinnan

Project Name: Eielson AFB

Project Number: 30030317

Lot Number:**WA20016**

Date Completed:01/26/2021

02/15/2021 11:39 AM
Approved and released by:
Project Manager II: **Marcia K. McGinnity**

The electronic signature above is the equivalent of a handwritten signature.
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Pace Analytical Services, LLC (*formerly Shealy Environmental Services, Inc.*)
106 Vantage Point Drive West Columbia, SC 29172
Tel: 803-791-9700 Fax: 803-791-9111 www.pacelabs.com

Case Narrative
Arcadis U.S., Inc.
Lot Number: WA20016

This Report of Analysis contains the analytical result(s) for the sample(s) listed on the Sample Summary following this Case Narrative. The sample receiving date is documented in the header information associated with each sample.

All results listed in this report relate only to the samples that are contained within this report.

Sample receipt, sample analysis, and data review have been performed in accordance with the most current approved The NELAC Institute (TNI) standards, the Pace Analytical Services, LLC ("Pace") Laboratory Quality Manual, standard operating procedures (SOPs), and Pace policies. Additionally, the DoD QSM version 5.3 has been followed for these samples, and specifically Table B-15 was followed for all PFAS samples. Any exceptions to the TNI standards, the Laboratory Quality Manual, SOPs, the DoD QSM, or policies are qualified on the results page or discussed below.

Where applicable, all soil sample analysis are reported on a dry weight basis unless flagged with a "W" qualifier

If you have any questions regarding this report please contact the Pace Project Manager listed on the cover page.

PFAS

Correction factors (CF) are used to calculate the original sample concentration. The CF is the inverse of the concentration factor (sample volume / extract final volume) times the dilution factor (DF). For undiluted analysis, the extract is prepared for injection by adding 182 uL of sample extract + 8 uL of reagent water + 10 uL of internal standard solution to a polypropylene autosampler vial. An extra correction factor of 0.91 (182 uL / 200 uL = 0.91) applies. The CF is calculated as follows:

For solid samples:

CF = DF * FV / Ws/S/1000

FV is volume of extract (mL)
Ws is initial sample weight (gram)
S is %Solids
DF is dilution factor. For undiluted analysis, DF = 1/0.91.

Concentration (ug/kg) = Cs*CF,

$$C_s = \frac{\left(\frac{(A_s x C_{is})}{A_{is}}\right) - B}{M1}$$

Where

C_s is on column concentration of target analyte in the sample (ng/L)
C_{is} is concentration of internal standard in the sample (ng/L)
A_s is peak response of target analyte in the sample
A_{is} is peak response of internal standard in the sample
M1 is the average RF from ICAL or the slope from linear regression ICAL
B is the y-intercept from the ICAL

For aqueous samples:

CF = DF * FV / Vo

FV is volume of extract (mL)
Vo is initial sample volume (mL)
DF is dilution factor.

Concentration (ng/L) = Cs*CF,

$$C_s = \frac{\left(\frac{(A_s x C_{is})}{A_{is}}\right) - B}{M1}$$

Where

C_s is on column concentration of target analyte in the sample (ng/L)
C_{is} is concentration of internal standard in the sample (ng/L)
A_s is peak response of target analyte in the sample
A_{is} is peak response of internal standard in the sample
M1 is the average RF from ICAL or the slope from linear regression ICAL
B is the y-intercept from the ICAL

Due to insufficient sample received, the initial sample amount used for the following sample(s) deviated from the standard procedure:WA20016-001, WA20016-002, WA20016-003, WA20016-004, WA20016-005, WA20016-006. The LOQ has been adjusted accordingly.

For samples WA20016-001, WA20016-002, WA20016-003, WA20016-004, WA20016-005, WA20016-006, the leaching solution generated from the SPLP leaching process and used for PFAS SPE sample prep was recieved in bottles with foam lined caps.

Recoveries and/or relative percent differences exceeded limits for the MS/MSD performed on sample WA20016-006. These exceedences are attributed to sample matrix.

Sample Summary
Arcadis U.S., Inc.
Lot Number: WA20016

Sample Number	Sample ID	Matrix	Date Sampled	Date Received
001	R4-HSDIHILIM	Solid	12/29/2020	01/20/2021
002	R4-SDSDICILIM	Solid	12/29/2020	01/20/2021
003	S-HSDIHILIM	Solid	12/29/2020	01/20/2021
004	S-SDSDICILIM	Solid	12/29/2020	01/20/2021
005	F-HSDIH505ILIM	Solid	12/29/2020	01/20/2021
006	S-F1F2-M	Solid	12/29/2020	01/20/2021

(6 samples)

Detection Summary

Arcadis U.S., Inc.

Lot Number: WA20016

Sample	Sample ID	Matrix	Parameter	Method	Result	Q	Units	Page
001	R4-HSDIHILIM	Solid	PFOSA	PFAS by ID	0.57	J	ug/kg	6
001	R4-HSDIHILIM	Solid	PFOS	PFAS by ID	8.8		ug/kg	6
001	R4-HSDIHILIM	Solid	6:2 FTS	PFAS by ID	74	HJ	ng/L	8
001	R4-HSDIHILIM	Solid	PFOS	PFAS by ID	120	H	ng/L	8
002	R4-SDSDICILIM	Solid	8:2 FTS	PFAS by ID	4.8		ug/kg	10
002	R4-SDSDICILIM	Solid	PFDS	PFAS by ID	1.4		ug/kg	10
002	R4-SDSDICILIM	Solid	PFNS	PFAS by ID	1.1	J	ug/kg	10
002	R4-SDSDICILIM	Solid	PFOSA	PFAS by ID	6.9		ug/kg	10
002	R4-SDSDICILIM	Solid	PFDoA	PFAS by ID	0.70	J	ug/kg	10
002	R4-SDSDICILIM	Solid	PFUdA	PFAS by ID	0.65	J	ug/kg	10
002	R4-SDSDICILIM	Solid	PFOS	PFAS by ID	61		ug/kg	10
002	R4-SDSDICILIM	Solid	6:2 FTS	PFAS by ID	100	H	ng/L	12
002	R4-SDSDICILIM	Solid	PFHxS	PFAS by ID	11	HJ	ng/L	12
002	R4-SDSDICILIM	Solid	PFOS	PFAS by ID	240	H	ng/L	12
003	S-HSDIHILIM	Solid	8:2 FTS	PFAS by ID	2.9		ug/kg	14
003	S-HSDIHILIM	Solid	6:2 FTS	PFAS by ID	0.59	J	ug/kg	14
003	S-HSDIHILIM	Solid	PFDS	PFAS by ID	1.1		ug/kg	14
003	S-HSDIHILIM	Solid	PFNS	PFAS by ID	0.97	J	ug/kg	14
003	S-HSDIHILIM	Solid	PFOSA	PFAS by ID	1.3		ug/kg	14
003	S-HSDIHILIM	Solid	PFHxS	PFAS by ID	0.27	J	ug/kg	14
003	S-HSDIHILIM	Solid	PFDoA	PFAS by ID	0.30	J	ug/kg	14
003	S-HSDIHILIM	Solid	PFHxA	PFAS by ID	0.48	J	ug/kg	14
003	S-HSDIHILIM	Solid	PFOS	PFAS by ID	28		ug/kg	14
003	S-HSDIHILIM	Solid	6:2 FTS	PFAS by ID	74	HJ	ng/L	16
003	S-HSDIHILIM	Solid	PFHxA	PFAS by ID	21	HJ	ng/L	16
003	S-HSDIHILIM	Solid	PFOS	PFAS by ID	160	H	ng/L	16
004	S-SDSDICILIM	Solid	8:2 FTS	PFAS by ID	3.7		ug/kg	18
004	S-SDSDICILIM	Solid	PFDS	PFAS by ID	1.7		ug/kg	18
004	S-SDSDICILIM	Solid	PFNS	PFAS by ID	1.3		ug/kg	18
004	S-SDSDICILIM	Solid	PFOSA	PFAS by ID	1.9		ug/kg	18
004	S-SDSDICILIM	Solid	PFHxS	PFAS by ID	0.61	J	ug/kg	18
004	S-SDSDICILIM	Solid	PFDoA	PFAS by ID	0.36	J	ug/kg	18
004	S-SDSDICILIM	Solid	PFUdA	PFAS by ID	0.28	J	ug/kg	18
004	S-SDSDICILIM	Solid	PFOS	PFAS by ID	38		ug/kg	18
004	S-SDSDICILIM	Solid	PFOSA	PFAS by ID	12	HJ	ng/L	20
004	S-SDSDICILIM	Solid	PFOS	PFAS by ID	250	H	ng/L	20
005	F-HSDIH505ILIM	Solid	8:2 FTS	PFAS by ID	32		ug/kg	22
005	F-HSDIH505ILIM	Solid	6:2 FTS	PFAS by ID	8.2	J	ug/kg	22
005	F-HSDIH505ILIM	Solid	PFDS	PFAS by ID	17		ug/kg	22
005	F-HSDIH505ILIM	Solid	PFNS	PFAS by ID	17		ug/kg	22
005	F-HSDIH505ILIM	Solid	PFOSA	PFAS by ID	59		ug/kg	22
005	F-HSDIH505ILIM	Solid	PFHxS	PFAS by ID	9.7	J	ug/kg	22
005	F-HSDIH505ILIM	Solid	PFDA	PFAS by ID	3.3	J	ug/kg	22
005	F-HSDIH505ILIM	Solid	PFDoA	PFAS by ID	5.2	J	ug/kg	22
005	F-HSDIH505ILIM	Solid	PFTeDA	PFAS by ID	3.4	J	ug/kg	22

Detection Summary (Continued)

Lot Number: WA20016

Sample	Sample ID	Matrix	Parameter	Method	Result	Q	Units	Page
005	F-HSDIH505ILIM	Solid	PFTrDA	PFAS by ID	3.1	J	ug/kg	22
005	F-HSDIH505ILIM	Solid	PFUdA	PFAS by ID	3.1	J	ug/kg	22
005	F-HSDIH505ILIM	Solid	PFOS	PFAS by ID	1400		ug/kg	22
005	F-HSDIH505ILIM	Solid	6:2 FTS	PFAS by ID	81	H	ng/L	24
005	F-HSDIH505ILIM	Solid	PFOSA	PFAS by ID	18	HJ	ng/L	24
005	F-HSDIH505ILIM	Solid	PFHxS	PFAS by ID	18	HJ	ng/L	24
005	F-HSDIH505ILIM	Solid	PFHxA	PFAS by ID	43	H	ng/L	24
005	F-HSDIH505ILIM	Solid	PFOS	PFAS by ID	380	H	ng/L	24
006	S-F1F2-M	Solid	8:2 FTS	PFAS by ID	8.6	S	ug/kg	26
006	S-F1F2-M	Solid	PFBS	PFAS by ID	1.6	JS	ug/kg	26
006	S-F1F2-M	Solid	PFDS	PFAS by ID	4.0	JS	ug/kg	26
006	S-F1F2-M	Solid	PFNS	PFAS by ID	2.5	JS	ug/kg	26
006	S-F1F2-M	Solid	PFOSA	PFAS by ID	9.0	S	ug/kg	26
006	S-F1F2-M	Solid	PFPeS	PFAS by ID	1.2	JS	ug/kg	26
006	S-F1F2-M	Solid	PFHxS	PFAS by ID	13	S	ug/kg	26
006	S-F1F2-M	Solid	PFDoA	PFAS by ID	1.1	J	ug/kg	26
006	S-F1F2-M	Solid	PFHxA	PFAS by ID	4.4		ug/kg	26
006	S-F1F2-M	Solid	PFOS	PFAS by ID	190	S	ug/kg	26
006	S-F1F2-M	Solid	8:2 FTS	PFAS by ID	99	H	ng/L	28
006	S-F1F2-M	Solid	6:2 FTS	PFAS by ID	160	H	ng/L	28
006	S-F1F2-M	Solid	PFBS	PFAS by ID	11	HJ	ng/L	28
006	S-F1F2-M	Solid	PFHpS	PFAS by ID	14	HJ	ng/L	28
006	S-F1F2-M	Solid	PFOSA	PFAS by ID	79	H	ng/L	28
006	S-F1F2-M	Solid	PFPeS	PFAS by ID	14	HJ	ng/L	28
006	S-F1F2-M	Solid	PFHxS	PFAS by ID	200	H	ng/L	28
006	S-F1F2-M	Solid	PFBA	PFAS by ID	20	HJ	ng/L	28
006	S-F1F2-M	Solid	PFHpA	PFAS by ID	15	HJ	ng/L	28
006	S-F1F2-M	Solid	PFHxA	PFAS by ID	200	H	ng/L	28
006	S-F1F2-M	Solid	PFOA	PFAS by ID	59	H	ng/L	28
006	S-F1F2-M	Solid	PFPeA	PFAS by ID	38	HJ	ng/L	28
006	S-F1F2-M	Solid	PFOS	PFAS by ID	1900	H	ng/L	28

(76 detections)

PFAS by LC/MS/MS

Client: **Arcadis U.S., Inc.** Laboratory ID: **WA20016-001**

Description: **R4-HSDIHILIM** Matrix: **Solid**

Date Sampled: **12/29/2020** % Solids: **84.6** **01/20/2021 2342**

Date Received: **01/20/2021**

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch
1	SOP SPE	PFAS by ID SOP QSM B-15	1	01/25/2021 1348	MMM	01/22/2021 1136	80346
2	SOP SPE	PFAS by ID SOP QSM B-15	1	01/26/2021 1110	MMM	01/22/2021 1136	80346

Parameter	CAS Number	Analytical Method	Result	Q	LOQ	LOD	DL	Units	Run
1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS)	39108-34-4	PFAS by ID SOP	1.1	U	2.2	1.1	0.55	ug/kg	1
1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS)	27619-97-2	PFAS by ID SOP	1.1	U	2.2	1.1	0.55	ug/kg	1
1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS)	757124-72-4	PFAS by ID SOP	1.1	U	2.2	1.1	0.55	ug/kg	1
N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA)	2991-50-6	PFAS by ID SOP	1.1	U	2.2	1.1	0.55	ug/kg	1
N-methylperfluoro-1-octanesulfonamide (MeFOSA)	31506-32-8	PFAS by ID SOP	1.1	U	2.2	1.1	0.55	ug/kg	2
N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA)	2355-31-9	PFAS by ID SOP	1.1	U	2.2	1.1	0.55	ug/kg	1
Perfluoro-1-butanesulfonic acid (PFBS)	375-73-5	PFAS by ID SOP	0.55	U	1.1	0.55	0.22	ug/kg	1
Perfluoro-1-decanesulfonic acid (PFDS)	335-77-3	PFAS by ID SOP	0.55	U	1.1	0.55	0.22	ug/kg	1
Perfluoro-1-heptanesulfonic acid (PFHpS)	375-92-8	PFAS by ID SOP	0.55	U	1.1	0.55	0.22	ug/kg	1
Perfluoro-1-nonanesulfonic acid (PFNS)	68259-12-1	PFAS by ID SOP	0.55	U	1.1	0.55	0.22	ug/kg	1
Perfluoro-1-octanesulfonamide (PFOSA)	**754-91-6**	**PFAS by ID SOP**	**0.57**	**J**	**1.1**	0.55	**0.22**	**ug/kg**	**1**
Perfluoro-1-pentanesulfonic acid (PFPeS)	2706-91-4	PFAS by ID SOP	0.55	U	1.1	0.55	0.22	ug/kg	1
Perfluorohexanesulfonic acid (PFHxS)	355-46-4	PFAS by ID SOP	0.55	U	1.1	0.55	0.22	ug/kg	1
Perfluoro-n-butanoic acid (PFBA)	375-22-4	PFAS by ID SOP	0.55	U	1.1	0.55	0.22	ug/kg	1
Perfluoro-n-decanoic acid (PFDA)	335-76-2	PFAS by ID SOP	0.55	U	1.1	0.55	0.22	ug/kg	1
Perfluoro-n-dodecanoic acid (PFDoA)	307-55-1	PFAS by ID SOP	0.55	U	1.1	0.55	0.22	ug/kg	1
Perfluoro-n-heptanoic acid (PFHpA)	375-85-9	PFAS by ID SOP	0.55	U	1.1	0.55	0.22	ug/kg	1
Perfluoro-n-hexanoic acid (PFHxA)	307-24-4	PFAS by ID SOP	0.55	U	1.1	0.55	0.22	ug/kg	1
Perfluoro-n-nonanoic acid (PFNA)	375-95-1	PFAS by ID SOP	0.55	U	1.1	0.55	0.22	ug/kg	1
Perfluoro-n-octanoic acid (PFOA)	335-67-1	PFAS by ID SOP	0.55	U	1.1	0.55	0.22	ug/kg	1
Perfluoro-n-pentanoic acid (PFPeA)	2706-90-3	PFAS by ID SOP	0.55	U	1.1	0.55	0.22	ug/kg	1
Perfluoro-n-tetradecanoic acid (PFTeDA)	376-06-7	PFAS by ID SOP	0.55	U	1.1	0.55	0.22	ug/kg	1
Perfluoro-n-tridecanoic acid (PFTrDA)	72629-94-8	PFAS by ID SOP	0.55	U	1.1	0.55	0.22	ug/kg	1
Perfluoro-n-undecanoic acid (PFUdA)	2058-94-8	PFAS by ID SOP	0.55	U	1.1	0.55	0.22	ug/kg	1
Perfluorooctanesulfonic acid (PFOS)	**1763-23-1**	**PFAS by ID SOP**	**8.8**		**1.1**	0.55	**0.22**	**ug/kg**	**1**

Surrogate	Run 1 Q	Run 1 % Recovery	Run 1 Acceptance Limits	Run 2 Q	Run 2 % Recovery	Run 2 Acceptance Limits
13C2_4:2FTS		97	50-150		84	50-150
13C2_6:2FTS		96	50-150		94	50-150
13C2_8:2FTS		97	50-150		115	50-150
13C2_PFDoA		104	50-150		96	50-150
13C2_PFTeDA		93	50-150		96	50-150
13C3_PFBS		86	50-150		91	50-150
13C3_PFHxS		91	50-150		89	50-150
13C4_PFBA		96	50-150		93	50-150
13C4_PFHpA		96	50-150		89	50-150
13C5_PFHxA		96	50-150		93	50-150
13C5_PFPeA		95	50-150		91	50-150
13C6_PFDA		98	50-150		99	50-150
13C7_PFUdA		96	50-150		90	50-150
13C8_PFOA		96	50-150		93	50-150
13C8_PFOS		93	50-150		79	50-150
13C8_PFOSA		93	50-150		97	50-150

LOQ = Limit of Quantitation
B = Detected in the method blank
E = Quantitation of compound exceeded the calibration range
DL = Detection Limit
Q = Surrogate failure
U = Not detected at or above the LOQ
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
J = Estimated result < LOQ and ≥ DL
L = LCS/LCSD failure
H = Out of holding time
W = Reported on wet weight basis
LOD = Limit of Detection
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

PFAS by LC/MS/MS

Client: **Arcadis U.S., Inc.**
Laboratory ID: **WA20016-001**
Description: **R4-HSDIHILIM**
Matrix: **Solid**
Date Sampled: **12/29/2020**
% Solids: **84.6** **01/20/2021 2342**
Date Received: **01/20/2021**

Surrogate	Q	Run 1 % Recovery	Acceptance Limits	Q	Run 2 % Recovery	Acceptance Limits
13C9_PFNA		94	50-150		98	50-150
d5-EtFOSAA		94	50-150		99	50-150
d-MeFOSA		96	50-150		93	50-150
d3-MeFOSAA		98	50-150		94	50-150

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

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SPLP PFAS (Australian)

Client: **Arcadis U.S., Inc.** Laboratory ID: **WA20016-001**

Description: **R4-HSDIHILIM** Matrix: **Solid**

Date Sampled: **12/29/2020** % Solids: **84.6** **01/20/2021 2342**

Date Received: **01/20/2021**

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch	Leachate Date
1	AS4439.3/PF	PFAS by ID SOP QSM B-15	1	01/25/2021 1825	MMM	01/22/2021 1119	80339	01/20/2021 2300

Parameter	CAS Number	Analytical Method	Result	Q	LOQ	LOD	DL	Units	Run
1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS)	39108-34-4	PFAS by ID SOP	40	UH	80	40	20	ng/L	1
1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS)	**27619-97-2**	**PFAS by ID SOP**	**74**	**HJ**	**80**	40	**20**	**ng/L**	**1**
1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS)	757124-72-4	PFAS by ID SOP	40	UH	80	40	20	ng/L	1
N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA)	2991-50-6	PFAS by ID SOP	40	UH	80	40	20	ng/L	1
N-methylperfluoro-1-octanesulfonamide (MeFOSA)	31506-32-8	PFAS by ID SOP	80	UH	160	80	40	ng/L	1
N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA)	2355-31-9	PFAS by ID SOP	40	UH	80	40	20	ng/L	1
Perfluoro-1-butanesulfonic acid (PFBS)	375-73-5	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-1-decanesulfonic acid (PFDS)	335-77-3	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-1-heptanesulfonic acid (PFHpS)	375-92-8	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-1-nonanesulfonic acid (PFNS)	68259-12-1	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-1-octanesulfonamide (PFOSA)	754-91-6	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-1-pentanesulfonic acid (PFPeS)	2706-91-4	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluorohexanesulfonic acid (PFHxS)	355-46-4	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-butanoic acid (PFBA)	375-22-4	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-decanoic acid (PFDA)	335-76-2	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-dodecanoic acid (PFDoA)	307-55-1	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-heptanoic acid (PFHpA)	375-85-9	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-hexanoic acid (PFHxA)	307-24-4	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-nonanoic acid (PFNA)	375-95-1	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-octanoic acid (PFOA)	335-67-1	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-pentanoic acid (PFPeA)	2706-90-3	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-tetradecanoic acid (PFTeDA)	376-06-7	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-tridecanoic acid (PFTrDA)	72629-94-8	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-undecanoic acid (PFUdA)	2058-94-8	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluorooctanesulfonic acid (PFOS)	**1763-23-1**	**PFAS by ID SOP**	**120**	**H**	**40**	20	**10**	**ng/L**	**1**

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
13C2_4:2FTS	H	100	50-150
13C2_6:2FTS	H	104	50-150
13C2_8:2FTS	H	97	50-150
13C2_PFDoA	H	89	50-150
13C2_PFTeDA	H	83	50-150
13C3_PFBS	H	91	50-150
13C3_PFHxS	H	90	50-150
13C4_PFBA	H	98	50-150
13C4_PFHpA	H	94	50-150
13C5_PFHxA	H	97	50-150
13C5_PFPeA	H	98	50-150
13C6_PFDA	H	93	50-150
13C7_PFUdA	H	91	50-150
13C8_PFOA	H	94	50-150
13C8_PFOS	H	92	50-150
13C8_PFOSA	H	94	50-150
13C9_PFNA	H	98	50-150

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

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SPLP PFAS (Australian)

Client: **Arcadis U.S., Inc.**
Laboratory ID: **WA20016-001**
Description: **R4-HSDIHILIM**
Matrix: **Solid**
Date Sampled: **12/29/2020**
% Solids: **84.6** **01/20/2021 2342**
Date Received: **01/20/2021**

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
d5-EtFOSAA	H	90	50-150
d-MeFOSA	H	82	50-150
d3-MeFOSAA	H	96	50-150

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
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PFAS by LC/MS/MS

Client: **Arcadis U.S., Inc.** Laboratory ID: **WA20016-002**

Description: **R4-SDSDICILIM** Matrix: **Solid**

Date Sampled: **12/29/2020** % Solids: **70.5** **01/20/2021 2342**

Date Received: **01/20/2021**

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch
1	SOP SPE	PFAS by ID SOP QSM B-15	1	01/25/2021 1359	MMM	01/22/2021 1136	80346
2	SOP SPE	PFAS by ID SOP QSM B-15	1	01/26/2021 1120	MMM	01/22/2021 1136	80346

Parameter	CAS Number	Analytical Method	Result	Q	LOQ	LOD	DL	Units	Run
1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS)	**39108-34-4**	**PFAS by ID SOP**	**4.8**		**2.7**	1.4	**0.66**	**ug/kg**	**1**
1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS)	27619-97-2	PFAS by ID SOP	1.4	U	2.7	1.4	0.66	ug/kg	1
1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS)	757124-72-4	PFAS by ID SOP	1.4	U	2.7	1.4	0.66	ug/kg	1
N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA)	2991-50-6	PFAS by ID SOP	1.4	U	2.7	1.4	0.66	ug/kg	1
N-methylperfluoro-1-octanesulfonamide (MeFOSA)	31506-32-8	PFAS by ID SOP	1.4	U	2.7	1.4	0.66	ug/kg	2
N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA)	2355-31-9	PFAS by ID SOP	1.4	U	2.7	1.4	0.66	ug/kg	1
Perfluoro-1-butanesulfonic acid (PFBS)	375-73-5	PFAS by ID SOP	0.65	U	1.3	0.65	0.27	ug/kg	1
Perfluoro-1-decanesulfonic acid (PFDS)	**335-77-3**	**PFAS by ID SOP**	**1.4**		**1.3**	0.65	**0.27**	**ug/kg**	**1**
Perfluoro-1-heptanesulfonic acid (PFHpS)	375-92-8	PFAS by ID SOP	0.65	U	1.3	0.65	0.27	ug/kg	1
Perfluoro-1-nonanesulfonic acid (PFNS)	**68259-12-1**	**PFAS by ID SOP**	**1.1**	**J**	**1.3**	0.65	**0.27**	**ug/kg**	**1**
Perfluoro-1-octanesulfonamide (PFOSA)	**754-91-6**	**PFAS by ID SOP**	**6.9**		**1.3**	0.65	**0.27**	**ug/kg**	**1**
Perfluoro-1-pentanesulfonic acid (PFPeS)	2706-91-4	PFAS by ID SOP	0.65	U	1.3	0.65	0.27	ug/kg	1
Perfluorohexanesulfonic acid (PFHxS)	355-46-4	PFAS by ID SOP	0.65	U	1.3	0.65	0.27	ug/kg	1
Perfluoro-n-butanoic acid (PFBA)	375-22-4	PFAS by ID SOP	0.65	U	1.3	0.65	0.27	ug/kg	1
Perfluoro-n-decanoic acid (PFDA)	335-76-2	PFAS by ID SOP	0.65	U	1.3	0.65	0.27	ug/kg	1
Perfluoro-n-dodecanoic acid (PFDoA)	**307-55-1**	**PFAS by ID SOP**	**0.70**	**J**	**1.3**	0.65	**0.27**	**ug/kg**	**1**
Perfluoro-n-heptanoic acid (PFHpA)	375-85-9	PFAS by ID SOP	0.65	U	1.3	0.65	0.27	ug/kg	1
Perfluoro-n-hexanoic acid (PFHxA)	307-24-4	PFAS by ID SOP	0.65	U	1.3	0.65	0.27	ug/kg	1
Perfluoro-n-nonanoic acid (PFNA)	375-95-1	PFAS by ID SOP	0.65	U	1.3	0.65	0.27	ug/kg	1
Perfluoro-n-octanoic acid (PFOA)	335-67-1	PFAS by ID SOP	0.65	U	1.3	0.65	0.27	ug/kg	1
Perfluoro-n-pentanoic acid (PFPeA)	2706-90-3	PFAS by ID SOP	0.65	U	1.3	0.65	0.27	ug/kg	1
Perfluoro-n-tetradecanoic acid (PFTeDA)	376-06-7	PFAS by ID SOP	0.65	U	1.3	0.65	0.27	ug/kg	1
Perfluoro-n-tridecanoic acid (PFTrDA)	72629-94-8	PFAS by ID SOP	0.65	U	1.3	0.65	0.27	ug/kg	1
Perfluoro-n-undecanoic acid (PFUdA)	**2058-94-8**	**PFAS by ID SOP**	**0.65**	**J**	**1.3**	0.65	**0.27**	**ug/kg**	**1**
Perfluorooctanesulfonic acid (PFOS)	**1763-23-1**	**PFAS by ID SOP**	**61**		**1.3**	0.65	**0.27**	**ug/kg**	**1**

Surrogate	Q	Run 1 % Recovery	Acceptance Limits	Q	Run 2 % Recovery	Acceptance Limits
13C2_4:2FTS		68	50-150		65	50-150
13C2_6:2FTS		76	50-150		69	50-150
13C2_8:2FTS		68	50-150		84	50-150
13C2_PFDoA		76	50-150		66	50-150
13C2_PFTeDA		69	50-150		71	50-150
13C3_PFBS		64	50-150		65	50-150
13C3_PFHxS		70	50-150		67	50-150
13C4_PFBA		71	50-150		69	50-150
13C4_PFHpA		69	50-150		67	50-150
13C5_PFHxA		70	50-150		64	50-150
13C5_PFPeA		70	50-150		64	50-150
13C6_PFDA		68	50-150		79	50-150
13C7_PFUdA		71	50-150		73	50-150
13C8_PFOA		71	50-150		77	50-150
13C8_PFOS		70	50-150		60	50-150
13C8_PFOSA		69	50-150		69	50-150

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

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PFAS by LC/MS/MS

Client: **Arcadis U.S., Inc.**
Laboratory ID: **WA20016-002**
Description: **R4-SDSDICILIM**
Matrix: **Solid**
Date Sampled: **12/29/2020**
% Solids: **70.5** **01/20/2021 2342**
Date Received: **01/20/2021**

Surrogate	Q	Run 1 % Recovery	Acceptance Limits	Q	Run 2 % Recovery	Acceptance Limits
13C9_PFNA		69	50-150		72	50-150
d5-EtFOSAA		70	50-150		68	50-150
d-MeFOSA		63	50-150		71	50-150
d3-MeFOSAA		71	50-150		76	50-150

LOQ = Limit of Quantitation
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SPLP PFAS (Australian)

Client: **Arcadis U.S., Inc.** Laboratory ID: **WA20016-002**

Description: **R4-SDSDICILIM** Matrix: **Solid**

Date Sampled: **12/29/2020** % Solids: **70.5** **01/20/2021 2342**

Date Received: **01/20/2021**

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch	Leachate Date
1	AS4439.3/PF	PFAS by ID SOP QSM B-15	1	01/25/2021 1835	MMM	01/22/2021 1119	80339	01/20/2021 2300

Parameter	CAS Number	Analytical Method	Result	Q	LOQ	LOD	DL	Units	Run
1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS)	39108-34-4	PFAS by ID SOP	40	UH	80	40	20	ng/L	1
1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS)	**27619-97-2**	**PFAS by ID SOP**	**100**	**H**	**80**	40	**20**	**ng/L**	**1**
1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS)	757124-72-4	PFAS by ID SOP	40	UH	80	40	20	ng/L	1
N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA)	2991-50-6	PFAS by ID SOP	40	UH	80	40	20	ng/L	1
N-methylperfluoro-1-octanesulfonamide (MeFOSA)	31506-32-8	PFAS by ID SOP	80	UH	160	80	40	ng/L	1
N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA)	2355-31-9	PFAS by ID SOP	40	UH	80	40	20	ng/L	1
Perfluoro-1-butanesulfonic acid (PFBS)	375-73-5	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-1-decanesulfonic acid (PFDS)	335-77-3	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-1-heptanesulfonic acid (PFHpS)	375-92-8	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-1-nonanesulfonic acid (PFNS)	68259-12-1	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-1-octanesulfonamide (PFOSA)	754-91-6	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-1-pentanesulfonic acid (PFPeS)	2706-91-4	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluorohexanesulfonic acid (PFHxS)	**355-46-4**	**PFAS by ID SOP**	**11**	**HJ**	**40**	20	**10**	**ng/L**	**1**
Perfluoro-n-butanoic acid (PFBA)	375-22-4	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-decanoic acid (PFDA)	335-76-2	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-dodecanoic acid (PFDoA)	307-55-1	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-heptanoic acid (PFHpA)	375-85-9	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-hexanoic acid (PFHxA)	307-24-4	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-nonanoic acid (PFNA)	375-95-1	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-octanoic acid (PFOA)	335-67-1	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-pentanoic acid (PFPeA)	2706-90-3	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-tetradecanoic acid (PFTeDA)	376-06-7	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-tridecanoic acid (PFTrDA)	72629-94-8	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-undecanoic acid (PFUdA)	2058-94-8	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluorooctanesulfonic acid (PFOS)	**1763-23-1**	**PFAS by ID SOP**	**240**	**H**	**40**	20	**10**	**ng/L**	**1**

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
13C2_4:2FTS	H	101	50-150
13C2_6:2FTS	H	96	50-150
13C2_8:2FTS	H	95	50-150
13C2_PFDoA	H	89	50-150
13C2_PFTeDA	H	87	50-150
13C3_PFBS	H	89	50-150
13C3_PFHxS	H	94	50-150
13C4_PFBA	H	97	50-150
13C4_PFHpA	H	92	50-150
13C5_PFHxA	H	94	50-150
13C5_PFPeA	H	94	50-150
13C6_PFDA	H	92	50-150
13C7_PFUdA	H	87	50-150
13C8_PFOA	H	95	50-150
13C8_PFOS	H	88	50-150
13C8_PFOSA	H	91	50-150
13C9_PFNA	H	98	50-150

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

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SPLP PFAS (Australian)

Client: **Arcadis U.S., Inc.**
Laboratory ID: **WA20016-002**
Description: **R4-SDSDICILIM**
Matrix: **Solid**
Date Sampled: **12/29/2020**
% Solids: **70.5** **01/20/2021 2342**
Date Received: **01/20/2021**

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
d5-EtFOSAA	H	88	50-150
d-MeFOSA	H	77	50-150
d3-MeFOSAA	H	94	50-150

LOQ = Limit of Quantitation	B = Detected in the method blank	E = Quantitation of compound exceeded the calibration range	DL = Detection Limit	Q = Surrogate failure
U = Not detected at or above the LOQ	N = Recovery is out of criteria	P = The RPD between two GC columns exceeds 40%	J = Estimated result < LOQ and ≥ DL	L = LCS/LCSD failure
H = Out of holding time	W = Reported on wet weight basis	LOD = Limit of Detection		S = MS/MSD failure

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PFAS by LC/MS/MS

Client: **Arcadis U.S., Inc.** Laboratory ID: **WA20016-003**

Description: **S-HSDIHILIM** Matrix: **Solid**

Date Sampled: **12/29/2020** % Solids: **80.3** **01/20/2021 2342**

Date Received: **01/20/2021**

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch
1	SOP SPE	PFAS by ID SOP QSM B-15	1	01/25/2021 1409	MMM	01/22/2021 1136	80346
2	SOP SPE	PFAS by ID SOP QSM B-15	1	01/26/2021 1131	MMM	01/22/2021 1136	80346

Parameter	CAS Number	Analytical Method	Result	Q	LOQ	LOD	DL	Units	Run
1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS)	**39108-34-4**	**PFAS by ID SOP**	**2.9**		**2.3**	1.2	**0.57**	**ug/kg**	**1**
1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS)	**27619-97-2**	**PFAS by ID SOP**	**0.59**	**J**	**2.3**	1.2	**0.57**	**ug/kg**	**1**
1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS)	757124-72-4	PFAS by ID SOP	1.2	U	2.3	1.2	0.57	ug/kg	1
N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA)	2991-50-6	PFAS by ID SOP	1.2	U	2.3	1.2	0.57	ug/kg	1
N-methylperfluoro-1-octanesulfonamide (MeFOSA)	31506-32-8	PFAS by ID SOP	1.2	U	2.3	1.2	0.57	ug/kg	2
N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA)	2355-31-9	PFAS by ID SOP	1.2	U	2.3	1.2	0.57	ug/kg	1
Perfluoro-1-butanesulfonic acid (PFBS)	375-73-5	PFAS by ID SOP	0.55	U	1.1	0.55	0.23	ug/kg	1
Perfluoro-1-decanesulfonic acid (PFDS)	**335-77-3**	**PFAS by ID SOP**	**1.1**		**1.1**	0.55	**0.23**	**ug/kg**	**1**
Perfluoro-1-heptanesulfonic acid (PFHpS)	375-92-8	PFAS by ID SOP	0.55	U	1.1	0.55	0.23	ug/kg	1
Perfluoro-1-nonanesulfonic acid (PFNS)	**68259-12-1**	**PFAS by ID SOP**	**0.97**	**J**	**1.1**	0.55	**0.23**	**ug/kg**	**1**
Perfluoro-1-octanesulfonamide (PFOSA)	**754-91-6**	**PFAS by ID SOP**	**1.3**		**1.1**	0.55	**0.23**	**ug/kg**	**1**
Perfluoro-1-pentanesulfonic acid (PFPeS)	2706-91-4	PFAS by ID SOP	0.55	U	1.1	0.55	0.23	ug/kg	1
Perfluorohexanesulfonic acid (PFHxS)	**355-46-4**	**PFAS by ID SOP**	**0.27**	**J**	**1.1**	0.55	**0.23**	**ug/kg**	**1**
Perfluoro-n-butanoic acid (PFBA)	375-22-4	PFAS by ID SOP	0.55	U	1.1	0.55	0.23	ug/kg	1
Perfluoro-n-decanoic acid (PFDA)	335-76-2	PFAS by ID SOP	0.55	U	1.1	0.55	0.23	ug/kg	1
Perfluoro-n-dodecanoic acid (PFDoA)	**307-55-1**	**PFAS by ID SOP**	**0.30**	**J**	**1.1**	0.55	**0.23**	**ug/kg**	**1**
Perfluoro-n-heptanoic acid (PFHpA)	375-85-9	PFAS by ID SOP	0.55	U	1.1	0.55	0.23	ug/kg	1
Perfluoro-n-hexanoic acid (PFHxA)	**307-24-4**	**PFAS by ID SOP**	**0.48**	**J**	**1.1**	0.55	**0.23**	**ug/kg**	**1**
Perfluoro-n-nonanoic acid (PFNA)	375-95-1	PFAS by ID SOP	0.55	U	1.1	0.55	0.23	ug/kg	1
Perfluoro-n-octanoic acid (PFOA)	335-67-1	PFAS by ID SOP	0.55	U	1.1	0.55	0.23	ug/kg	1
Perfluoro-n-pentanoic acid (PFPeA)	2706-90-3	PFAS by ID SOP	0.55	U	1.1	0.55	0.23	ug/kg	1
Perfluoro-n-tetradecanoic acid (PFTeDA)	376-06-7	PFAS by ID SOP	0.55	U	1.1	0.55	0.23	ug/kg	1
Perfluoro-n-tridecanoic acid (PFTrDA)	72629-94-8	PFAS by ID SOP	0.55	U	1.1	0.55	0.23	ug/kg	1
Perfluoro-n-undecanoic acid (PFUdA)	2058-94-8	PFAS by ID SOP	0.55	U	1.1	0.55	0.23	ug/kg	1
Perfluorooctanesulfonic acid (PFOS)	**1763-23-1**	**PFAS by ID SOP**	**28**		**1.1**	0.55	**0.23**	**ug/kg**	**1**

Surrogate	Run 1 Q	Run 1 % Recovery	Run 1 Acceptance Limits	Run 2 Q	Run 2 % Recovery	Run 2 Acceptance Limits
13C2_4:2FTS		108	50-150		92	50-150
13C2_6:2FTS		111	50-150		105	50-150
13C2_8:2FTS		107	50-150		116	50-150
13C2_PFDoA		116	50-150		97	50-150
13C2_PFTeDA		107	50-150		97	50-150
13C3_PFBS		94	50-150		95	50-150
13C3_PFHxS		103	50-150		99	50-150
13C4_PFBA		105	50-150		102	50-150
13C4_PFHpA		102	50-150		94	50-150
13C5_PFHxA		103	50-150		98	50-150
13C5_PFPeA		107	50-150		94	50-150
13C6_PFDA		105	50-150		100	50-150
13C7_PFUdA		109	50-150		93	50-150
13C8_PFOA		109	50-150		93	50-150
13C8_PFOS		104	50-150		95	50-150
13C8_PFOSA		106	50-150		101	50-150

LOQ = Limit of Quantitation
B = Detected in the method blank
E = Quantitation of compound exceeded the calibration range
DL = Detection Limit
Q = Surrogate failure
U = Not detected at or above the LOQ
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
J = Estimated result < LOQ and ≥ DL
L = LCS/LCSD failure
H = Out of holding time
W = Reported on wet weight basis
LOD = Limit of Detection
S = MS/MSD failure

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PFAS by LC/MS/MS

Client: **Arcadis U.S., Inc.**
Laboratory ID: **WA20016-003**
Description: **S-HSDIHILIM**
Matrix: **Solid**
Date Sampled: **12/29/2020**
% Solids: **80.3** **01/20/2021 2342**
Date Received: **01/20/2021**

Surrogate	Q	Run 1 % Recovery	Acceptance Limits	Q	Run 2 % Recovery	Acceptance Limits
13C9_PFNA		106	50-150		101	50-150
d5-EtFOSAA		105	50-150		104	50-150
d-MeFOSA		100	50-150		95	50-150
d3-MeFOSAA		106	50-150		103	50-150

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
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E = Quantitation of compound exceeded the calibration range
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SPLP PFAS (Australian)

Client: **Arcadis U.S., Inc.** Laboratory ID: **WA20016-003**

Description: **S-HSDIHILIM** Matrix: **Solid**

Date Sampled: **12/29/2020** % Solids: **80.3** **01/20/2021 2342**

Date Received: **01/20/2021**

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch	Leachate Date
1	AS4439.3/PF	PFAS by ID SOP QSM B-15	1	01/25/2021 1846	MMM	01/22/2021 1119	80339	01/20/2021 2300

Parameter	CAS Number	Analytical Method	Result	Q	LOQ	LOD	DL	Units	Run
1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS)	39108-34-4	PFAS by ID SOP	40	UH	80	40	20	ng/L	1
1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS)	**27619-97-2**	**PFAS by ID SOP**	**74**	**HJ**	**80**	40	**20**	**ng/L**	**1**
1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS)	757124-72-4	PFAS by ID SOP	40	UH	80	40	20	ng/L	1
N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA)	2991-50-6	PFAS by ID SOP	40	UH	80	40	20	ng/L	1
N-methylperfluoro-1-octanesulfonamide (MeFOSA)	31506-32-8	PFAS by ID SOP	80	UH	160	80	40	ng/L	1
N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA)	2355-31-9	PFAS by ID SOP	40	UH	80	40	20	ng/L	1
Perfluoro-1-butanesulfonic acid (PFBS)	375-73-5	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-1-decanesulfonic acid (PFDS)	335-77-3	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-1-heptanesulfonic acid (PFHpS)	375-92-8	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-1-nonanesulfonic acid (PFNS)	68259-12-1	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-1-octanesulfonamide (PFOSA)	754-91-6	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-1-pentanesulfonic acid (PFPeS)	2706-91-4	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluorohexanesulfonic acid (PFHxS)	355-46-4	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-butanoic acid (PFBA)	375-22-4	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-decanoic acid (PFDA)	335-76-2	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-dodecanoic acid (PFDoA)	307-55-1	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-heptanoic acid (PFHpA)	375-85-9	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-hexanoic acid (PFHxA)	**307-24-4**	**PFAS by ID SOP**	**21**	**HJ**	**40**	20	**10**	**ng/L**	**1**
Perfluoro-n-nonanoic acid (PFNA)	375-95-1	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-octanoic acid (PFOA)	335-67-1	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-pentanoic acid (PFPeA)	2706-90-3	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-tetradecanoic acid (PFTeDA)	376-06-7	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-tridecanoic acid (PFTrDA)	72629-94-8	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-undecanoic acid (PFUdA)	2058-94-8	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluorooctanesulfonic acid (PFOS)	**1763-23-1**	**PFAS by ID SOP**	**160**	**H**	**40**	20	**10**	**ng/L**	**1**

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
13C2_4:2FTS	H	90	50-150
13C2_6:2FTS	H	91	50-150
13C2_8:2FTS	H	78	50-150
13C2_PFDoA	H	84	50-150
13C2_PFTeDA	H	75	50-150
13C3_PFBS	H	80	50-150
13C3_PFHxS	H	81	50-150
13C4_PFBA	H	87	50-150
13C4_PFHpA	H	85	50-150
13C5_PFHxA	H	87	50-150
13C5_PFPeA	H	90	50-150
13C6_PFDA	H	79	50-150
13C7_PFUdA	H	75	50-150
13C8_PFOA	H	83	50-150
13C8_PFOS	H	84	50-150
13C8_PFOSA	H	82	50-150
13C9_PFNA	H	85	50-150

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

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SPLP PFAS (Australian)

Client: **Arcadis U.S., Inc.**
Laboratory ID: **WA20016-003**
Description: **S-HSDIHILIM**
Matrix: **Solid**
Date Sampled: **12/29/2020**
% Solids: **80.3** **01/20/2021 2342**
Date Received: **01/20/2021**

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
d5-EtFOSAA	H	81	50-150
d-MeFOSA	H	70	50-150
d3-MeFOSAA	H	85	50-150

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
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LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

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PFAS by LC/MS/MS

Client: **Arcadis U.S., Inc.** Laboratory ID: **WA20016-004**

Description: **S-SDSDICILIM** Matrix: **Solid**

Date Sampled: **12/29/2020** % Solids: **80.0** **01/20/2021 2342**

Date Received: **01/20/2021**

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch
1	SOP SPE	PFAS by ID SOP QSM B-15	1	01/25/2021 1420	MMM	01/22/2021 1136	80346
2	SOP SPE	PFAS by ID SOP QSM B-15	1	01/26/2021 1141	MMM	01/22/2021 1136	80346

Parameter	CAS Number	Analytical Method	Result	Q	LOQ	LOD	DL	Units	Run
1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS)	**39108-34-4**	**PFAS by ID SOP**	**3.7**		**2.4**	1.2	**0.61**	**ug/kg**	**1**
1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS)	27619-97-2	PFAS by ID SOP	1.2	U	2.4	1.2	0.61	ug/kg	1
1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS)	757124-72-4	PFAS by ID SOP	1.2	U	2.4	1.2	0.61	ug/kg	1
N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA)	2991-50-6	PFAS by ID SOP	1.2	U	2.4	1.2	0.61	ug/kg	1
N-methylperfluoro-1-octanesulfonamide (MeFOSA)	31506-32-8	PFAS by ID SOP	1.2	U	2.4	1.2	0.61	ug/kg	2
N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA)	2355-31-9	PFAS by ID SOP	1.2	U	2.4	1.2	0.61	ug/kg	1
Perfluoro-1-butanesulfonic acid (PFBS)	375-73-5	PFAS by ID SOP	0.60	U	1.2	0.60	0.24	ug/kg	1
Perfluoro-1-decanesulfonic acid (PFDS)	**335-77-3**	**PFAS by ID SOP**	**1.7**		**1.2**	0.60	**0.24**	**ug/kg**	**1**
Perfluoro-1-heptanesulfonic acid (PFHpS)	375-92-8	PFAS by ID SOP	0.60	U	1.2	0.60	0.24	ug/kg	1
Perfluoro-1-nonanesulfonic acid (PFNS)	**68259-12-1**	**PFAS by ID SOP**	**1.3**		**1.2**	0.60	**0.24**	**ug/kg**	**1**
Perfluoro-1-octanesulfonamide (PFOSA)	**754-91-6**	**PFAS by ID SOP**	**1.9**		**1.2**	0.60	**0.24**	**ug/kg**	**1**
Perfluoro-1-pentanesulfonic acid (PFPeS)	2706-91-4	PFAS by ID SOP	0.60	U	1.2	0.60	0.24	ug/kg	1
Perfluorohexanesulfonic acid (PFHxS)	**355-46-4**	**PFAS by ID SOP**	**0.61**	**J**	**1.2**	0.60	**0.24**	**ug/kg**	**1**
Perfluoro-n-butanoic acid (PFBA)	375-22-4	PFAS by ID SOP	0.60	U	1.2	0.60	0.24	ug/kg	1
Perfluoro-n-decanoic acid (PFDA)	335-76-2	PFAS by ID SOP	0.60	U	1.2	0.60	0.24	ug/kg	1
Perfluoro-n-dodecanoic acid (PFDoA)	**307-55-1**	**PFAS by ID SOP**	**0.36**	**J**	**1.2**	0.60	**0.24**	**ug/kg**	**1**
Perfluoro-n-heptanoic acid (PFHpA)	375-85-9	PFAS by ID SOP	0.60	U	1.2	0.60	0.24	ug/kg	1
Perfluoro-n-hexanoic acid (PFHxA)	307-24-4	PFAS by ID SOP	0.60	U	1.2	0.60	0.24	ug/kg	1
Perfluoro-n-nonanoic acid (PFNA)	375-95-1	PFAS by ID SOP	0.60	U	1.2	0.60	0.24	ug/kg	1
Perfluoro-n-octanoic acid (PFOA)	335-67-1	PFAS by ID SOP	0.60	U	1.2	0.60	0.24	ug/kg	1
Perfluoro-n-pentanoic acid (PFPeA)	2706-90-3	PFAS by ID SOP	0.60	U	1.2	0.60	0.24	ug/kg	1
Perfluoro-n-tetradecanoic acid (PFTeDA)	376-06-7	PFAS by ID SOP	0.60	U	1.2	0.60	0.24	ug/kg	1
Perfluoro-n-tridecanoic acid (PFTrDA)	72629-94-8	PFAS by ID SOP	0.60	U	1.2	0.60	0.24	ug/kg	1
Perfluoro-n-undecanoic acid (PFUdA)	**2058-94-8**	**PFAS by ID SOP**	**0.28**	**J**	**1.2**	0.60	**0.24**	**ug/kg**	**1**
Perfluorooctanesulfonic acid (PFOS)	**1763-23-1**	**PFAS by ID SOP**	**38**		**1.2**	0.60	**0.24**	**ug/kg**	**1**

Surrogate	Q	Run 1 % Recovery	Acceptance Limits	Q	Run 2 % Recovery	Acceptance Limits
13C2_4:2FTS		95	50-150		94	50-150
13C2_6:2FTS		111	50-150		95	50-150
13C2_8:2FTS		95	50-150		113	50-150
13C2_PFDoA		110	50-150		92	50-150
13C2_PFTeDA		96	50-150		92	50-150
13C3_PFBS		87	50-150		91	50-150
13C3_PFHxS		98	50-150		92	50-150
13C4_PFBA		97	50-150		98	50-150
13C4_PFHpA		97	50-150		85	50-150
13C5_PFHxA		99	50-150		99	50-150
13C5_PFPeA		98	50-150		94	50-150
13C6_PFDA		95	50-150		99	50-150
13C7_PFUdA		103	50-150		95	50-150
13C8_PFOA		96	50-150		103	50-150
13C8_PFOS		96	50-150		90	50-150
13C8_PFOSA		98	50-150		93	50-150

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
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PFAS by LC/MS/MS

Client: **Arcadis U.S., Inc.**
Laboratory ID: **WA20016-004**
Description: **S-SDSDICILIM**
Matrix: **Solid**
Date Sampled: **12/29/2020**
% Solids: **80.0** **01/20/2021 2342**
Date Received: **01/20/2021**

Surrogate	Q	Run 1 % Recovery	Acceptance Limits	Q	Run 2 % Recovery	Acceptance Limits
13C9_PFNA		99	50-150		98	50-150
d5-EtFOSAA		102	50-150		102	50-150
d-MeFOSA		91	50-150		114	50-150
d3-MeFOSAA		101	50-150		102	50-150

LOQ = Limit of Quantitation	B = Detected in the method blank	E = Quantitation of compound exceeded the calibration range	DL = Detection Limit	Q = Surrogate failure
U = Not detected at or above the LOQ	N = Recovery is out of criteria	P = The RPD between two GC columns exceeds 40%	J = Estimated result < LOQ and ≥ DL	L = LCS/LCSD failure
H = Out of holding time	W = Reported on wet weight basis	LOD = Limit of Detection		S = MS/MSD failure

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SPLP PFAS (Australian)

Client: **Arcadis U.S., Inc.**
Laboratory ID: **WA20016-004**
Description: **S-SDSDICILIM**
Matrix: **Solid**
Date Sampled: **12/29/2020**
% Solids: **80.0** **01/20/2021 2342**
Date Received: **01/20/2021**

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch	Leachate Date
1	AS4439.3/PF	PFAS by ID SOP QSM B-15	1	01/25/2021 1857	MMM	01/22/2021 1119	80339	01/20/2021 2300

Parameter	CAS Number	Analytical Method	Result	Q	LOQ	LOD	DL	Units	Run
1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS)	39108-34-4	PFAS by ID SOP	40	UH	80	40	20	ng/L	1
1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS)	27619-97-2	PFAS by ID SOP	40	UH	80	40	20	ng/L	1
1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS)	757124-72-4	PFAS by ID SOP	40	UH	80	40	20	ng/L	1
N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA)	2991-50-6	PFAS by ID SOP	40	UH	80	40	20	ng/L	1
N-methylperfluoro-1-octanesulfonamide (MeFOSA)	31506-32-8	PFAS by ID SOP	80	UH	160	80	40	ng/L	1
N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA)	2355-31-9	PFAS by ID SOP	40	UH	80	40	20	ng/L	1
Perfluoro-1-butanesulfonic acid (PFBS)	375-73-5	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-1-decanesulfonic acid (PFDS)	335-77-3	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-1-heptanesulfonic acid (PFHpS)	375-92-8	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-1-nonanesulfonic acid (PFNS)	68259-12-1	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-1-octanesulfonamide (PFOSA)	**754-91-6**	**PFAS by ID SOP**	**12**	**HJ**	**40**	20	**10**	**ng/L**	**1**
Perfluoro-1-pentanesulfonic acid (PFPeS)	2706-91-4	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluorohexanesulfonic acid (PFHxS)	355-46-4	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-butanoic acid (PFBA)	375-22-4	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-decanoic acid (PFDA)	335-76-2	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-dodecanoic acid (PFDoA)	307-55-1	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-heptanoic acid (PFHpA)	375-85-9	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-hexanoic acid (PFHxA)	307-24-4	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-nonanoic acid (PFNA)	375-95-1	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-octanoic acid (PFOA)	335-67-1	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-pentanoic acid (PFPeA)	2706-90-3	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-tetradecanoic acid (PFTeDA)	376-06-7	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-tridecanoic acid (PFTrDA)	72629-94-8	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-undecanoic acid (PFUdA)	2058-94-8	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluorooctanesulfonic acid (PFOS)	**1763-23-1**	**PFAS by ID SOP**	**250**	**H**	**40**	20	**10**	**ng/L**	**1**

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
13C2_4:2FTS	H	99	50-150
13C2_6:2FTS	H	101	50-150
13C2_8:2FTS	H	91	50-150
13C2_PFDoA	H	94	50-150
13C2_PFTeDA	H	85	50-150
13C3_PFBS	H	90	50-150
13C3_PFHxS	H	90	50-150
13C4_PFBA	H	100	50-150
13C4_PFHpA	H	100	50-150
13C5_PFHxA	H	98	50-150
13C5_PFPeA	H	97	50-150
13C6_PFDA	H	95	50-150
13C7_PFUdA	H	94	50-150
13C8_PFOA	H	97	50-150
13C8_PFOS	H	99	50-150
13C8_PFOSA	H	97	50-150
13C9_PFNA	H	98	50-150

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

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SPLP PFAS (Australian)

Client: **Arcadis U.S., Inc.**
Laboratory ID: **WA20016-004**
Description: **S-SDSDICILIM**
Matrix: **Solid**
Date Sampled: **12/29/2020**
% Solids: **80.0** **01/20/2021 2342**
Date Received: **01/20/2021**

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
d5-EtFOSAA	H	88	50-150
d-MeFOSA	H	92	50-150
d3-MeFOSAA	H	102	50-150

LOQ = Limit of Quantitation	B = Detected in the method blank	E = Quantitation of compound exceeded the calibration range	DL = Detection Limit	Q = Surrogate failure
U = Not detected at or above the LOQ	N = Recovery is out of criteria	P = The RPD between two GC columns exceeds 40%	J = Estimated result < LOQ and ≥ DL	L = LCS/LCSD failure
H = Out of holding time	W = Reported on wet weight basis	LOD = Limit of Detection		S = MS/MSD failure

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PFAS by LC/MS/MS

Client: **Arcadis U.S., Inc.** Laboratory ID: **WA20016-005**

Description: **F-HSDIH505ILIM** Matrix: **Solid**

Date Sampled: **12/29/2020** % Solids: **72.2** **01/20/2021 2342**

Date Received: **01/20/2021**

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch
1	SOP SPE	PFAS by ID SOP QSM B-15	10	01/25/2021 1431	MMM	01/22/2021 1136	80346
2	SOP SPE	PFAS by ID SOP QSM B-15	10	01/26/2021 1152	MMM	01/22/2021 1136	80346

Parameter	CAS Number	Analytical Method	Result	Q	LOQ	LOD	DL	Units	Run
1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS)	**39108-34-4**	**PFAS by ID SOP**	**32**		**27**	14	**6.8**	**ug/kg**	**1**
1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS)	**27619-97-2**	**PFAS by ID SOP**	**8.2**	**J**	**27**	14	**6.8**	**ug/kg**	**1**
1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS)	757124-72-4	PFAS by ID SOP	14	U	27	14	6.8	ug/kg	1
N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA)	2991-50-6	PFAS by ID SOP	14	U	27	14	6.8	ug/kg	1
N-methylperfluoro-1-octanesulfonamide (MeFOSA)	31506-32-8	PFAS by ID SOP	14	U	27	14	6.8	ug/kg	2
N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA)	2355-31-9	PFAS by ID SOP	14	U	27	14	6.8	ug/kg	1
Perfluoro-1-butanesulfonic acid (PFBS)	375-73-5	PFAS by ID SOP	7.0	U	14	7.0	2.7	ug/kg	1
Perfluoro-1-decanesulfonic acid (PFDS)	**335-77-3**	**PFAS by ID SOP**	**17**		**14**	7.0	**2.7**	**ug/kg**	**1**
Perfluoro-1-heptanesulfonic acid (PFHpS)	375-92-8	PFAS by ID SOP	7.0	U	14	7.0	2.7	ug/kg	1
Perfluoro-1-nonanesulfonic acid (PFNS)	**68259-12-1**	**PFAS by ID SOP**	**17**		**14**	7.0	**2.7**	**ug/kg**	**1**
Perfluoro-1-octanesulfonamide (PFOSA)	**754-91-6**	**PFAS by ID SOP**	**59**		**14**	7.0	**2.7**	**ug/kg**	**1**
Perfluoro-1-pentanesulfonic acid (PFPeS)	2706-91-4	PFAS by ID SOP	7.0	U	14	7.0	2.7	ug/kg	1
Perfluorohexanesulfonic acid (PFHxS)	**355-46-4**	**PFAS by ID SOP**	**9.7**	**J**	**14**	7.0	**2.7**	**ug/kg**	**1**
Perfluoro-n-butanoic acid (PFBA)	375-22-4	PFAS by ID SOP	7.0	U	14	7.0	2.7	ug/kg	1
Perfluoro-n-decanoic acid (PFDA)	**335-76-2**	**PFAS by ID SOP**	**3.3**	**J**	**14**	7.0	**2.7**	**ug/kg**	**1**
Perfluoro-n-dodecanoic acid (PFDoA)	**307-55-1**	**PFAS by ID SOP**	**5.2**	**J**	**14**	7.0	**2.7**	**ug/kg**	**1**
Perfluoro-n-heptanoic acid (PFHpA)	375-85-9	PFAS by ID SOP	7.0	U	14	7.0	2.7	ug/kg	1
Perfluoro-n-hexanoic acid (PFHxA)	307-24-4	PFAS by ID SOP	7.0	U	14	7.0	2.7	ug/kg	1
Perfluoro-n-nonanoic acid (PFNA)	375-95-1	PFAS by ID SOP	7.0	U	14	7.0	2.7	ug/kg	1
Perfluoro-n-octanoic acid (PFOA)	335-67-1	PFAS by ID SOP	7.0	U	14	7.0	2.7	ug/kg	1
Perfluoro-n-pentanoic acid (PFPeA)	2706-90-3	PFAS by ID SOP	7.0	U	14	7.0	2.7	ug/kg	1
Perfluoro-n-tetradecanoic acid (PFTeDA)	**376-06-7**	**PFAS by ID SOP**	**3.4**	**J**	**14**	7.0	**2.7**	**ug/kg**	**1**
Perfluoro-n-tridecanoic acid (PFTrDA)	**72629-94-8**	**PFAS by ID SOP**	**3.1**	**J**	**14**	7.0	**2.7**	**ug/kg**	**1**
Perfluoro-n-undecanoic acid (PFUdA)	**2058-94-8**	**PFAS by ID SOP**	**3.1**	**J**	**14**	7.0	**2.7**	**ug/kg**	**1**
Perfluorooctanesulfonic acid (PFOS)	**1763-23-1**	**PFAS by ID SOP**	**1400**		**14**	7.0	**2.7**	**ug/kg**	**1**

Surrogate	Q	Run 1 % Recovery	Acceptance Limits	Q	Run 2 % Recovery	Acceptance Limits
13C2_4:2FTS		120	50-150		105	50-150
13C2_6:2FTS		127	50-150		120	50-150
13C2_8:2FTS		108	50-150		141	50-150
13C2_PFDoA		122	50-150		108	50-150
13C2_PFTeDA		111	50-150		113	50-150
13C3_PFBS		114	50-150		124	50-150
13C3_PFHxS		117	50-150		114	50-150
13C4_PFBA		116	50-150		118	50-150
13C4_PFHpA		116	50-150		108	50-150
13C5_PFHxA		118	50-150		114	50-150
13C5_PFPeA		118	50-150		117	50-150
13C6_PFDA		114	50-150		121	50-150
13C7_PFUdA		121	50-150		109	50-150
13C8_PFOA		114	50-150		119	50-150
13C8_PFOS		118	50-150		106	50-150
13C8_PFOSA		118	50-150		107	50-150

LOQ = Limit of Quantitation
B = Detected in the method blank
E = Quantitation of compound exceeded the calibration range
DL = Detection Limit
Q = Surrogate failure
U = Not detected at or above the LOQ
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
J = Estimated result < LOQ and ≥ DL
L = LCS/LCSD failure
H = Out of holding time
W = Reported on wet weight basis
LOD = Limit of Detection
S = MS/MSD failure

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PFAS by LC/MS/MS

Client: **Arcadis U.S., Inc.**
Laboratory ID: **WA20016-005**
Description: **F-HSDIH505ILIM**
Matrix: **Solid**
Date Sampled: **12/29/2020**
% Solids: **72.2** **01/20/2021 2342**
Date Received: **01/20/2021**

Surrogate	Q	Run 1 % Recovery	Acceptance Limits	Q	Run 2 % Recovery	Acceptance Limits
13C9_PFNA		115	50-150		126	50-150
d5-EtFOSAA		118	50-150		122	50-150
d-MeFOSA		107	50-150		130	50-150
d3-MeFOSAA		113	50-150		127	50-150

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
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J = Estimated result < LOQ and ≥ DL
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SPLP PFAS (Australian)

Client: **Arcadis U.S., Inc.**
Laboratory ID: **WA20016-005**
Description: **F-HSDIH505ILIM**
Matrix: **Solid**
Date Sampled: **12/29/2020**
% Solids: **72.2** **01/20/2021 2342**
Date Received: **01/20/2021**

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch	Leachate Date
1	AS4439.3/PF	PFAS by ID SOP QSM B-15	1	01/25/2021 1908	MMM	01/22/2021 1119	80339	01/20/2021 2300

Parameter	CAS Number	Analytical Method	Result	Q	LOQ	LOD	DL	Units	Run
1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS)	39108-34-4	PFAS by ID SOP	40	UH	80	40	20	ng/L	1
1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS)	**27619-97-2**	**PFAS by ID SOP**	**81**	**H**	**80**	40	**20**	**ng/L**	**1**
1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS)	757124-72-4	PFAS by ID SOP	40	UH	80	40	20	ng/L	1
N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA)	2991-50-6	PFAS by ID SOP	40	UH	80	40	20	ng/L	1
N-methylperfluoro-1-octanesulfonamide (MeFOSA)	31506-32-8	PFAS by ID SOP	80	UH	160	80	40	ng/L	1
N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA)	2355-31-9	PFAS by ID SOP	40	UH	80	40	20	ng/L	1
Perfluoro-1-butanesulfonic acid (PFBS)	375-73-5	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-1-decanesulfonic acid (PFDS)	335-77-3	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-1-heptanesulfonic acid (PFHpS)	375-92-8	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-1-nonanesulfonic acid (PFNS)	68259-12-1	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-1-octanesulfonamide (PFOSA)	**754-91-6**	**PFAS by ID SOP**	**18**	**HJ**	**40**	20	**10**	**ng/L**	**1**
Perfluoro-1-pentanesulfonic acid (PFPeS)	2706-91-4	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluorohexanesulfonic acid (PFHxS)	**355-46-4**	**PFAS by ID SOP**	**18**	**HJ**	**40**	20	**10**	**ng/L**	**1**
Perfluoro-n-butanoic acid (PFBA)	375-22-4	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-decanoic acid (PFDA)	335-76-2	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-dodecanoic acid (PFDoA)	307-55-1	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-heptanoic acid (PFHpA)	375-85-9	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-hexanoic acid (PFHxA)	**307-24-4**	**PFAS by ID SOP**	**43**	**H**	**40**	20	**10**	**ng/L**	**1**
Perfluoro-n-nonanoic acid (PFNA)	375-95-1	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-octanoic acid (PFOA)	335-67-1	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-pentanoic acid (PFPeA)	2706-90-3	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-tetradecanoic acid (PFTeDA)	376-06-7	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-tridecanoic acid (PFTrDA)	72629-94-8	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-undecanoic acid (PFUdA)	2058-94-8	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluorooctanesulfonic acid (PFOS)	**1763-23-1**	**PFAS by ID SOP**	**380**	**H**	**40**	20	**10**	**ng/L**	**1**

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
13C2_4:2FTS	H	98	50-150
13C2_6:2FTS	H	100	50-150
13C2_8:2FTS	H	86	50-150
13C2_PFDoA	H	91	50-150
13C2_PFTeDA	H	79	50-150
13C3_PFBS	H	88	50-150
13C3_PFHxS	H	88	50-150
13C4_PFBA	H	95	50-150
13C4_PFHpA	H	92	50-150
13C5_PFHxA	H	92	50-150
13C5_PFPeA	H	94	50-150
13C6_PFDA	H	89	50-150
13C7_PFUdA	H	85	50-150
13C8_PFOA	H	90	50-150
13C8_PFOS	H	89	50-150
13C8_PFOSA	H	92	50-150
13C9_PFNA	H	92	50-150

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

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SPLP PFAS (Australian)

Client: **Arcadis U.S., Inc.**
Laboratory ID: **WA20016-005**
Description: **F-HSDIH505ILIM**
Matrix: **Solid**
Date Sampled: **12/29/2020**
% Solids: **72.2** **01/20/2021 2342**
Date Received: **01/20/2021**

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
d5-EtFOSAA	H	85	50-150
d-MeFOSA	H	72	50-150
d3-MeFOSAA	H	91	50-150

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

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PFAS by LC/MS/MS

Client: **Arcadis U.S., Inc.** Laboratory ID: **WA20016-006**

Description: **S-F1F2-M** Matrix: **Solid**

Date Sampled: **12/29/2020** % Solids: **99.8** **01/20/2021 2342**

Date Received: **01/20/2021**

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch
1	SOP SPE	PFAS by ID SOP QSM B-15	5	01/25/2021 1441	MMM	01/22/2021 1136	80346
2	SOP SPE	PFAS by ID SOP QSM B-15	5	01/26/2021 1202	MMM	01/22/2021 1136	80346

Parameter	CAS Number	Analytical Method	Result	Q	LOQ	LOD	DL	Units	Run
1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS)	**39108-34-4**	**PFAS by ID SOP**	**8.6**	**S**	**8.4**	4.2	**2.1**	**ug/kg**	**1**
1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS)	27619-97-2	PFAS by ID SOP	4.2	US	8.4	4.2	2.1	ug/kg	1
1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS)	757124-72-4	PFAS by ID SOP	4.2	US	8.4	4.2	2.1	ug/kg	1
N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA)	2991-50-6	PFAS by ID SOP	4.2	U	8.4	4.2	2.1	ug/kg	1
N-methylperfluoro-1-octanesulfonamide (MeFOSA)	31506-32-8	PFAS by ID SOP	4.2	U	8.4	4.2	2.1	ug/kg	2
N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA)	2355-31-9	PFAS by ID SOP	4.2	U	8.4	4.2	2.1	ug/kg	1
Perfluoro-1-butanesulfonic acid (PFBS)	**375-73-5**	**PFAS by ID SOP**	**1.6**	**JS**	**4.2**	2.1	**0.84**	**ug/kg**	**1**
Perfluoro-1-decanesulfonic acid (PFDS)	**335-77-3**	**PFAS by ID SOP**	**4.0**	**JS**	**4.2**	2.1	**0.84**	**ug/kg**	**1**
Perfluoro-1-heptanesulfonic acid (PFHpS)	375-92-8	PFAS by ID SOP	2.1	U	4.2	2.1	0.84	ug/kg	1
Perfluoro-1-nonanesulfonic acid (PFNS)	**68259-12-1**	**PFAS by ID SOP**	**2.5**	**JS**	**4.2**	2.1	**0.84**	**ug/kg**	**1**
Perfluoro-1-octanesulfonamide (PFOSA)	**754-91-6**	**PFAS by ID SOP**	**9.0**	**S**	**4.2**	2.1	**0.84**	**ug/kg**	**1**
Perfluoro-1-pentanesulfonic acid (PFPeS)	**2706-91-4**	**PFAS by ID SOP**	**1.2**	**JS**	**4.2**	2.1	**0.84**	**ug/kg**	**1**
Perfluorohexanesulfonic acid (PFHxS)	**355-46-4**	**PFAS by ID SOP**	**13**	**S**	**4.2**	2.1	**0.84**	**ug/kg**	**1**
Perfluoro-n-butanoic acid (PFBA)	375-22-4	PFAS by ID SOP	2.1	U	4.2	2.1	0.84	ug/kg	1
Perfluoro-n-decanoic acid (PFDA)	335-76-2	PFAS by ID SOP	2.1	US	4.2	2.1	0.84	ug/kg	1
Perfluoro-n-dodecanoic acid (PFDoA)	**307-55-1**	**PFAS by ID SOP**	**1.1**	**J**	**4.2**	2.1	**0.84**	**ug/kg**	**1**
Perfluoro-n-heptanoic acid (PFHpA)	375-85-9	PFAS by ID SOP	2.1	US	4.2	2.1	0.84	ug/kg	1
Perfluoro-n-hexanoic acid (PFHxA)	**307-24-4**	**PFAS by ID SOP**	**4.4**		**4.2**	2.1	**0.84**	**ug/kg**	**1**
Perfluoro-n-nonanoic acid (PFNA)	375-95-1	PFAS by ID SOP	2.1	U	4.2	2.1	0.84	ug/kg	1
Perfluoro-n-octanoic acid (PFOA)	335-67-1	PFAS by ID SOP	2.1	US	4.2	2.1	0.84	ug/kg	1
Perfluoro-n-pentanoic acid (PFPeA)	2706-90-3	PFAS by ID SOP	2.1	US	4.2	2.1	0.84	ug/kg	1
Perfluoro-n-tetradecanoic acid (PFTeDA)	376-06-7	PFAS by ID SOP	2.1	U	4.2	2.1	0.84	ug/kg	1
Perfluoro-n-tridecanoic acid (PFTrDA)	72629-94-8	PFAS by ID SOP	2.1	U	4.2	2.1	0.84	ug/kg	1
Perfluoro-n-undecanoic acid (PFUdA)	2058-94-8	PFAS by ID SOP	2.1	US	4.2	2.1	0.84	ug/kg	1
Perfluorooctanesulfonic acid (PFOS)	**1763-23-1**	**PFAS by ID SOP**	**190**	**S**	**4.2**	2.1	**0.84**	**ug/kg**	**1**

Surrogate	Q	Run 1 % Recovery	Acceptance Limits	Q	Run 2 % Recovery	Acceptance Limits
13C2_4:2FTS		95	50-150		90	50-150
13C2_6:2FTS		96	50-150		98	50-150
13C2_8:2FTS		87	50-150		116	50-150
13C2_PFDoA		105	50-150		88	50-150
13C2_PFTeDA		91	50-150		93	50-150
13C3_PFBS		92	50-150		95	50-150
13C3_PFHxS		97	50-150		94	50-150
13C4_PFBA		96	50-150		97	50-150
13C4_PFHpA		91	50-150		88	50-150
13C5_PFHxA		91	50-150		87	50-150
13C5_PFPeA		95	50-150		96	50-150
13C6_PFDA		93	50-150		107	50-150
13C7_PFUdA		95	50-150		91	50-150
13C8_PFOA		93	50-150		95	50-150
13C8_PFOS		93	50-150		90	50-150
13C8_PFOSA		91	50-150		95	50-150

LOQ = Limit of Quantitation
B = Detected in the method blank
E = Quantitation of compound exceeded the calibration range
DL = Detection Limit
Q = Surrogate failure
U = Not detected at or above the LOQ
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
J = Estimated result < LOQ and ≥ DL
L = LCS/LCSD failure
H = Out of holding time
W = Reported on wet weight basis
LOD = Limit of Detection
S = MS/MSD failure

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PFAS by LC/MS/MS

Client: **Arcadis U.S., Inc.**
Laboratory ID: **WA20016-006**
Description: **S-F1F2-M**
Matrix: **Solid**
Date Sampled: **12/29/2020**
% Solids: **99.8** **01/20/2021 2342**
Date Received: **01/20/2021**

Surrogate	Q	Run 1 % Recovery	Acceptance Limits	Q	Run 2 % Recovery	Acceptance Limits
13C9_PFNA		91	50-150		97	50-150
d5-EtFOSAA		93	50-150		97	50-150
d-MeFOSA		99	50-150		103	50-150
d3-MeFOSAA		95	50-150		101	50-150

LOQ = Limit of Quantitation	B = Detected in the method blank	E = Quantitation of compound exceeded the calibration range	DL = Detection Limit	Q = Surrogate failure
U = Not detected at or above the LOQ	N = Recovery is out of criteria	P = The RPD between two GC columns exceeds 40%	J = Estimated result < LOQ and ≥ DL	L = LCS/LCSD failure
H = Out of holding time	W = Reported on wet weight basis	LOD = Limit of Detection		S = MS/MSD failure

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SPLP PFAS (Australian)

Client: **Arcadis U.S., Inc.** Laboratory ID: **WA20016-006**

Description: **S-F1F2-M** Matrix: **Solid**

Date Sampled: **12/29/2020** % Solids: **99.8** **01/20/2021 2342**

Date Received: **01/20/2021**

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch	Leachate Date
1	AS4439.3/PF	PFAS by ID SOP QSM B-15	1	01/25/2021 1918	MMM	01/22/2021 1119	80339	01/20/2021 2300

Parameter	CAS Number	Analytical Method	Result	Q	LOQ	LOD	DL	Units	Run
1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS)	**39108-34-4**	**PFAS by ID SOP**	**99**	**H**	**80**	40	**20**	**ng/L**	**1**
1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS)	**27619-97-2**	**PFAS by ID SOP**	**160**	**H**	**80**	40	**20**	**ng/L**	**1**
1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS)	757124-72-4	PFAS by ID SOP	40	UH	80	40	20	ng/L	1
N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA)	2991-50-6	PFAS by ID SOP	40	UH	80	40	20	ng/L	1
N-methylperfluoro-1-octanesulfonamide (MeFOSA)	31506-32-8	PFAS by ID SOP	80	UH	160	80	40	ng/L	1
N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA)	2355-31-9	PFAS by ID SOP	40	UH	80	40	20	ng/L	1
Perfluoro-1-butanesulfonic acid (PFBS)	**375-73-5**	**PFAS by ID SOP**	**11**	**HJ**	**40**	20	**10**	**ng/L**	**1**
Perfluoro-1-decanesulfonic acid (PFDS)	335-77-3	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-1-heptanesulfonic acid (PFHpS)	**375-92-8**	**PFAS by ID SOP**	**14**	**HJ**	**40**	20	**10**	**ng/L**	**1**
Perfluoro-1-nonanesulfonic acid (PFNS)	68259-12-1	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-1-octanesulfonamide (PFOSA)	**754-91-6**	**PFAS by ID SOP**	**79**	**H**	**40**	20	**10**	**ng/L**	**1**
Perfluoro-1-pentanesulfonic acid (PFPeS)	**2706-91-4**	**PFAS by ID SOP**	**14**	**HJ**	**40**	20	**10**	**ng/L**	**1**
Perfluorohexanesulfonic acid (PFHxS)	**355-46-4**	**PFAS by ID SOP**	**200**	**H**	**40**	20	**10**	**ng/L**	**1**
Perfluoro-n-butanoic acid (PFBA)	**375-22-4**	**PFAS by ID SOP**	**20**	**HJ**	**40**	20	**10**	**ng/L**	**1**
Perfluoro-n-decanoic acid (PFDA)	335-76-2	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-dodecanoic acid (PFDoA)	307-55-1	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-heptanoic acid (PFHpA)	**375-85-9**	**PFAS by ID SOP**	**15**	**HJ**	**40**	20	**10**	**ng/L**	**1**
Perfluoro-n-hexanoic acid (PFHxA)	**307-24-4**	**PFAS by ID SOP**	**200**	**H**	**40**	20	**10**	**ng/L**	**1**
Perfluoro-n-nonanoic acid (PFNA)	375-95-1	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-octanoic acid (PFOA)	**335-67-1**	**PFAS by ID SOP**	**59**	**H**	**40**	20	**10**	**ng/L**	**1**
Perfluoro-n-pentanoic acid (PFPeA)	**2706-90-3**	**PFAS by ID SOP**	**38**	**HJ**	**40**	20	**10**	**ng/L**	**1**
Perfluoro-n-tetradecanoic acid (PFTeDA)	376-06-7	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-tridecanoic acid (PFTrDA)	72629-94-8	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-undecanoic acid (PFUdA)	2058-94-8	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluorooctanesulfonic acid (PFOS)	**1763-23-1**	**PFAS by ID SOP**	**1900**	**H**	**40**	20	**10**	**ng/L**	**1**

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
13C2_4:2FTS	H	94	50-150
13C2_6:2FTS	H	95	50-150
13C2_8:2FTS	H	91	50-150
13C2_PFDoA	H	89	50-150
13C2_PFTeDA	H	82	50-150
13C3_PFBS	H	87	50-150
13C3_PFHxS	H	92	50-150
13C4_PFBA	H	96	50-150
13C4_PFHpA	H	94	50-150
13C5_PFHxA	H	94	50-150
13C5_PFPeA	H	97	50-150
13C6_PFDA	H	89	50-150
13C7_PFUdA	H	84	50-150
13C8_PFOA	H	90	50-150
13C8_PFOS	H	92	50-150
13C8_PFOSA	H	90	50-150
13C9_PFNA	H	95	50-150

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

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SPLP PFAS (Australian)

Client: **Arcadis U.S., Inc.**
Laboratory ID: **WA20016-006**
Description: **S-F1F2-M**
Matrix: **Solid**
Date Sampled: **12/29/2020**
% Solids: **99.8** **01/20/2021 2342**
Date Received: **01/20/2021**

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
d5-EtFOSAA	H	86	50-150
d-MeFOSA	H	76	50-150
d3-MeFOSAA	H	90	50-150

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

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QC Summary

SPLP PFAS (Australian) - MB

Sample ID: WQ80339-001
Batch: 80339
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Solid
Prep Method: AS4439.3/PFAS
Prep Date: 01/22/2021 1119 **Leachate Date:** 01/20/2021 2300

Parameter	Result	Q	Dil	LOQ	LOD	DL	Units	Analysis Date
8:2 FTS	40	U	1	80	40	20	ng/L	01/25/2021 1524
6:2 FTS	40	U	1	80	40	20	ng/L	01/25/2021 1524
4:2 FTS	40	U	1	80	40	20	ng/L	01/25/2021 1524
EtFOSAA	40	U	1	80	40	20	ng/L	01/25/2021 1524
MeFOSA	80	U	1	160	80	40	ng/L	01/25/2021 1524
MeFOSAA	40	U	1	80	40	20	ng/L	01/25/2021 1524
PFBS	20	U	1	40	20	10	ng/L	01/25/2021 1524
PFDS	20	U	1	40	20	10	ng/L	01/25/2021 1524
PFHpS	20	U	1	40	20	10	ng/L	01/25/2021 1524
PFNS	20	U	1	40	20	10	ng/L	01/25/2021 1524
PFOSA	20	U	1	40	20	10	ng/L	01/25/2021 1524
PFPeS	20	U	1	40	20	10	ng/L	01/25/2021 1524
PFHxS	20	U	1	40	20	10	ng/L	01/25/2021 1524
PFBA	20	U	1	40	20	10	ng/L	01/25/2021 1524
PFDA	20	U	1	40	20	10	ng/L	01/25/2021 1524
PFDoA	20	U	1	40	20	10	ng/L	01/25/2021 1524
PFHpA	20	U	1	40	20	10	ng/L	01/25/2021 1524
PFHxA	20	U	1	40	20	10	ng/L	01/25/2021 1524
PFNA	20	U	1	40	20	10	ng/L	01/25/2021 1524
PFOA	20	U	1	40	20	10	ng/L	01/25/2021 1524
PFPeA	20	U	1	40	20	10	ng/L	01/25/2021 1524
PFTeDA	20	U	1	40	20	10	ng/L	01/25/2021 1524
PFTrDA	20	U	1	40	20	10	ng/L	01/25/2021 1524
PFUdA	20	U	1	40	20	10	ng/L	01/25/2021 1524
PFOS	20	U	1	40	20	10	ng/L	01/25/2021 1524

Surrogate	Q	% Rec	Acceptance Limit
13C2_4:2FTS		104	50-150
13C2_6:2FTS		109	50-150
13C2_8:2FTS		97	50-150
13C2_PFDoA		108	50-150
13C2_PFTeDA		93	50-150
13C3_PFBS		99	50-150
13C3_PFHxS		97	50-150
13C4_PFBA		109	50-150
13C4_PFHpA		105	50-150
13C5_PFHxA		104	50-150
13C5_PFPeA		106	50-150
13C6_PFDA		102	50-150
13C7_PFUdA		98	50-150
13C8_PFOA		108	50-150

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

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SPLP PFAS (Australian) - MB

Sample ID: WQ80339-001
Batch: 80339
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Solid
Prep Method: AS4439.3/PFAS
Prep Date: 01/22/2021 1119 **Leachate Date:** 01/20/2021 2300

Surrogate	Q	% Rec	Acceptance Limit
13C8_PFOS		95	50-150
13C8_PFOSA		104	50-150
13C9_PFNA		106	50-150
d5-EtFOSAA		97	50-150
d-MeFOSA		102	50-150
d3-MeFOSAA		106	50-150

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

SPLP PFAS (Australian) - LCS

Sample ID: WQ80339-002 **Matrix:** Solid
Batch: 80339 **Prep Method:** AS4439.3/PFAS
Analytical Method: PFAS by ID SOP QSM B-15 **Prep Date:** 01/22/2021 1119 **Leachate Date:** 01/20/2021 2300

Parameter	Spike Amount (ng/L)	Result (ng/L)	Q	Dil	% Rec	% Rec Limit	Analysis Date
8:2 FTS	150	190		1	124	67-138	01/25/2021 1545
6:2 FTS	150	180		1	117	64-140	01/25/2021 1545
4:2 FTS	150	160		1	109	63-143	01/25/2021 1545
EtFOSAA	160	180		1	111	61-135	01/25/2021 1545
MeFOSA	160	210		1	130	68-141	01/25/2021 1545
MeFOSAA	160	180		1	113	65-136	01/25/2021 1545
PFBS	140	150		1	108	72-130	01/25/2021 1545
PFDS	150	150		1	96	53-142	01/25/2021 1545
PFHpS	150	150		1	99	69-134	01/25/2021 1545
PFNS	150	170		1	110	69-127	01/25/2021 1545
PFOSA	160	180		1	115	67-137	01/25/2021 1545
PFPeS	150	160		1	106	71-127	01/25/2021 1545
PFHxS	150	170		1	116	68-131	01/25/2021 1545
PFBA	160	170		1	107	73-129	01/25/2021 1545
PFDA	160	170		1	105	71-129	01/25/2021 1545
PFDoA	160	190		1	117	72-134	01/25/2021 1545
PFHpA	160	170		1	105	72-130	01/25/2021 1545
PFHxA	160	180		1	114	72-129	01/25/2021 1545
PFNA	160	160		1	102	69-130	01/25/2021 1545
PFOA	160	170		1	107	71-133	01/25/2021 1545
PFPeA	160	170		1	108	72-129	01/25/2021 1545
PFTeDA	160	180		1	111	71-132	01/25/2021 1545
PFTrDA	160	180		1	112	65-144	01/25/2021 1545
PFUdA	160	170		1	108	69-133	01/25/2021 1545
PFOS	150	170		1	112	65-140	01/25/2021 1545

Surrogate	Q	% Rec	Acceptance Limit
13C2_4:2FTS		100	50-150
13C2_6:2FTS		95	50-150
13C2_8:2FTS		79	50-150
13C2_PFDoA		93	50-150
13C2_PFTeDA		87	50-150
13C3_PFBS		89	50-150
13C3_PFHxS		92	50-150
13C4_PFBA		97	50-150
13C4_PFHpA		95	50-150
13C5_PFHxA		92	50-150
13C5_PFPeA		94	50-150
13C6_PFDA		87	50-150
13C7_PFUdA		90	50-150
13C8_PFOA		93	50-150

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection
U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

SPLP PFAS (Australian) - LCS

Sample ID: WQ80339-002
Batch: 80339
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Solid
Prep Method: AS4439.3/PFAS
Prep Date: 01/22/2021 1119 **Leachate Date:** 01/20/2021 2300

Surrogate	Q	% Rec	Acceptance Limit
13C8_PFOS		90	50-150
13C8_PFOSA		95	50-150
13C9_PFNA		95	50-150
d5-EtFOSAA		84	50-150
d-MeFOSA		65	50-150
d3-MeFOSAA		89	50-150

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

PFAS by LC/MS/MS - MB

Sample ID: WQ80346-001
Batch: 80346
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Solid
Prep Method: SOP SPE
Prep Date: 01/22/2021 1136

Parameter	Result	Q	Dil	LOQ	LOD	DL	Units	Analysis Date
8:2 FTS	1.0	U	1	2.0	1.0	0.50	ug/kg	01/25/2021 1245
6:2 FTS	1.0	U	1	2.0	1.0	0.50	ug/kg	01/25/2021 1245
4:2 FTS	1.0	U	1	2.0	1.0	0.50	ug/kg	01/25/2021 1245
EtFOSAA	1.0	U	1	2.0	1.0	0.50	ug/kg	01/25/2021 1245
MeFOSA	1.0	U	1	2.0	1.0	0.50	ug/kg	01/25/2021 1245
MeFOSAA	1.0	U	1	2.0	1.0	0.50	ug/kg	01/25/2021 1245
PFBS	0.50	U	1	1.0	0.50	0.20	ug/kg	01/25/2021 1245
PFDS	0.50	U	1	1.0	0.50	0.20	ug/kg	01/25/2021 1245
PFHpS	0.50	U	1	1.0	0.50	0.20	ug/kg	01/25/2021 1245
PFNS	0.50	U	1	1.0	0.50	0.20	ug/kg	01/25/2021 1245
PFOSA	0.50	U	1	1.0	0.50	0.20	ug/kg	01/25/2021 1245
PFPeS	0.50	U	1	1.0	0.50	0.20	ug/kg	01/25/2021 1245
PFHxS	0.50	U	1	1.0	0.50	0.20	ug/kg	01/25/2021 1245
PFBA	0.50	U	1	1.0	0.50	0.20	ug/kg	01/25/2021 1245
PFDA	0.50	U	1	1.0	0.50	0.20	ug/kg	01/25/2021 1245
PFDoA	0.50	U	1	1.0	0.50	0.20	ug/kg	01/25/2021 1245
PFHpA	0.50	U	1	1.0	0.50	0.20	ug/kg	01/25/2021 1245
PFHxA	0.50	U	1	1.0	0.50	0.20	ug/kg	01/25/2021 1245
PFNA	0.50	U	1	1.0	0.50	0.20	ug/kg	01/25/2021 1245
PFOA	0.50	U	1	1.0	0.50	0.20	ug/kg	01/25/2021 1245
PFPeA	0.50	U	1	1.0	0.50	0.20	ug/kg	01/25/2021 1245
PFTeDA	0.50	U	1	1.0	0.50	0.20	ug/kg	01/25/2021 1245
PFTrDA	0.50	U	1	1.0	0.50	0.20	ug/kg	01/25/2021 1245
PFUdA	0.50	U	1	1.0	0.50	0.20	ug/kg	01/25/2021 1245
PFOS	0.50	U	1	1.0	0.50	0.20	ug/kg	01/25/2021 1245

Surrogate	Q	% Rec	Acceptance Limit
13C2_4:2FTS		98	50-150
13C2_6:2FTS		99	50-150
13C2_8:2FTS		98	50-150
13C2_PFDoA		102	50-150
13C2_PFTeDA		96	50-150
13C3_PFBS		85	50-150
13C3_PFHxS		91	50-150
13C4_PFBA		94	50-150
13C4_PFHpA		94	50-150
13C5_PFHxA		95	50-150
13C5_PFPeA		96	50-150
13C6_PFDA		93	50-150
13C7_PFUdA		94	50-150
13C8_PFOA		91	50-150

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

PFAS by LC/MS/MS - MB

Sample ID: WQ80346-001
Batch: 80346
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Solid
Prep Method: SOP SPE
Prep Date: 01/22/2021 1136

Surrogate	Q	% Rec	Acceptance Limit
13C8_PFOS		95	50-150
13C8_PFOSA		89	50-150
13C9_PFNA		98	50-150
d5-EtFOSAA		93	50-150
d-MeFOSA		100	50-150
d3-MeFOSAA		95	50-150

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

PFAS by LC/MS/MS - LCS

Sample ID: WQ80346-002
Batch: 80346
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Solid
Prep Method: SOP SPE
Prep Date: 01/22/2021 1136

Parameter	Spike Amount (ug/kg)	Result (ug/kg)	Q	Dil	% Rec	% Rec Limit	Analysis Date
8:2 FTS	1.9	2.6		1	136	65-137	01/25/2021 1255
6:2 FTS	1.9	2.3		1	122	64-140	01/25/2021 1255
4:2 FTS	1.9	1.8		1	96	62-145	01/25/2021 1255
EtFOSAA	2.0	1.9		1	97	61-139	01/25/2021 1255
MeFOSA	2.0	1.7		1	83	70-150	01/25/2021 1255
MeFOSAA	2.0	2.4		1	119	63-144	01/25/2021 1255
PFBS	1.8	1.9		1	110	72-128	01/25/2021 1255
PFDS	1.9	2.0		1	102	59-134	01/25/2021 1255
PFHpS	1.9	2.1		1	112	70-132	01/25/2021 1255
PFNS	1.9	1.8		1	93	69-125	01/25/2021 1255
PFOSA	2.0	2.3		1	116	67-137	01/25/2021 1255
PFPeS	1.9	1.9		1	102	73-123	01/25/2021 1255
PFHxS	1.8	1.8		1	97	67-130	01/25/2021 1255
PFBA	2.0	2.2		1	108	71-135	01/25/2021 1255
PFDA	2.0	2.2		1	108	69-133	01/25/2021 1255
PFDoA	2.0	2.1		1	105	69-135	01/25/2021 1255
PFHpA	2.0	2.4		1	118	71-131	01/25/2021 1255
PFHxA	2.0	2.3		1	115	70-132	01/25/2021 1255
PFNA	2.0	2.0		1	100	72-129	01/25/2021 1255
PFOA	2.0	2.2		1	110	69-133	01/25/2021 1255
PFPeA	2.0	2.2		1	108	69-132	01/25/2021 1255
PFTeDA	2.0	2.3		1	116	69-133	01/25/2021 1255
PFTrDA	2.0	2.2		1	111	66-139	01/25/2021 1255
PFUdA	2.0	2.4		1	120	64-136	01/25/2021 1255
PFOS	1.9	2.0		1	105	68-136	01/25/2021 1255

Surrogate	Q	% Rec	Acceptance Limit
13C2_4:2FTS		103	50-150
13C2_6:2FTS		102	50-150
13C2_8:2FTS		91	50-150
13C2_PFDoA		105	50-150
13C2_PFTeDA		93	50-150
13C3_PFBS		89	50-150
13C3_PFHxS		99	50-150
13C4_PFBA		97	50-150
13C4_PFHpA		98	50-150
13C5_PFHxA		97	50-150
13C5_PFPeA		97	50-150
13C6_PFDA		98	50-150
13C7_PFUdA		97	50-150
13C8_PFOA		100	50-150

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

PFAS by LC/MS/MS - LCS

Sample ID: WQ80346-002
Batch: 80346
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Solid
Prep Method: SOP SPE
Prep Date: 01/22/2021 1136

Surrogate	Q	% Rec	Acceptance Limit
13C8_PFOS		100	50-150
13C8_PFOSA		93	50-150
13C9_PFNA		102	50-150
d5-EtFOSAA		101	50-150
d-MeFOSA		92	50-150
d3-MeFOSAA		102	50-150

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

PFAS by LC/MS/MS - MS

Sample ID: WA20016-006MS
Batch: 80346
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Solid
Prep Method: SOP SPE
Prep Date: 01/22/2021 1136

Parameter	Sample Amount (ug/kg)	Spike Amount (ug/kg)	Result (ug/kg)	Q	Dil	% Rec	% Rec Limit	Analysis Date
8:2 FTS	8.6	1.9	11		5	116	65-137	01/25/2021 1452
6:2 FTS	ND	1.9	8.9	N	5	473	64-140	01/25/2021 1452
4:2 FTS	ND	1.8	1.4		5	78	62-145	01/25/2021 1452
EtFOSAA	ND	2.0	1.9		5	96	61-139	01/25/2021 1452
MeFOSA	ND	2.0	1.8		5	93	70-150	01/25/2021 1452
MeFOSAA	ND	2.0	2.8		5	139	63-144	01/25/2021 1452
PFBS	1.6	1.8	2.7	N	5	64	72-128	01/25/2021 1452
PFDS	4.0	1.9	7.4	N	5	178	59-134	01/25/2021 1452
PFHpS	ND	1.9	2.0		5	109	70-132	01/25/2021 1452
PFNS	2.5	1.9	5.8	N	5	172	69-125	01/25/2021 1452
PFOSA	9.0	2.0	13	N	5	179	67-137	01/25/2021 1452
PFPeS	1.2	1.9	2.5	N	5	69	73-123	01/25/2021 1452
PFHxS	13	1.8	10	N	5	-137	67-130	01/25/2021 1452
PFBA	ND	2.0	2.9		5	115	71-135	01/25/2021 1452
PFDA	ND	2.0	3.4	N	5	170	69-133	01/25/2021 1452
PFDoA	1.1	2.0	3.6		5	124	69-135	01/25/2021 1452
PFHpA	ND	2.0	2.5		5	124	71-131	01/25/2021 1452
PFHxA	4.4	2.0	5.9		5	73	70-132	01/25/2021 1452
PFNA	ND	2.0	2.1		5	108	72-129	01/25/2021 1452
PFOA	ND	2.0	4.0	N	5	202	69-133	01/25/2021 1452
PFPeA	ND	2.0	3.0	N	5	152	69-132	01/25/2021 1452
PFTeDA	ND	2.0	2.9		5	119	69-133	01/25/2021 1452
PFTrDA	ND	2.0	2.8		5	115	66-139	01/25/2021 1452
PFUdA	ND	2.0	2.8	N	5	142	64-136	01/25/2021 1452
PFOS	190	1.8	190	N	5	256	68-136	01/25/2021 1452

Surrogate	Q	% Rec	Acceptance Limit
13C2_4:2FTS		92	50-150
13C2_6:2FTS		101	50-150
13C2_8:2FTS		98	50-150
13C2_PFDoA		99	50-150
13C2_PFTeDA		91	50-150
13C3_PFBS		90	50-150
13C3_PFHxS		97	50-150
13C4_PFBA		94	50-150
13C4_PFHpA		95	50-150
13C5_PFHxA		93	50-150
13C5_PFPeA		93	50-150
13C6_PFDA		89	50-150
13C7_PFUdA		93	50-150
13C8_PFOA		94	50-150

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

PFAS by LC/MS/MS - MS

Sample ID: WA20016-006MS
Batch: 80346
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Solid
Prep Method: SOP SPE
Prep Date: 01/22/2021 1136

Surrogate	Q	% Rec	Acceptance Limit
13C8_PFOS		94	50-150
13C8_PFOSA		87	50-150
13C9_PFNA		95	50-150
d5-EtFOSAA		94	50-150
d-MeFOSA		89	50-150
d3-MeFOSAA		96	50-150

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

PFAS by LC/MS/MS - MSD

Sample ID: WA20016-006MD
Batch: 80346
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Solid
Prep Method: SOP SPE
Prep Date: 01/22/2021 1136

Parameter	Sample Amount (ug/kg)	Spike Amount (ug/kg)	Result (ug/kg)	Q	Dil	% Rec	% RPD	% Rec Limit	% RPD Limit	Analysis Date
8:2 FTS	8.6	1.9	11	N	5	155	6.3	65-137	30	01/25/2021 1503
6:2 FTS	ND	1.9	7.8	N	5	422	12	64-140	30	01/25/2021 1503
4:2 FTS	ND	1.8	2.9	N,+	5	157	67	62-145	30	01/25/2021 1503
EtFOSAA	ND	2.0	2.3		5	119	20	61-139	30	01/25/2021 1503
MeFOSA	ND	2.0	2.6	+	5	132	34	70-150	30	01/25/2021 1503
MeFOSAA	ND	2.0	2.7		5	139	0.87	63-144	30	01/25/2021 1503
PFBS	1.6	1.7	2.4	N	5	50	10	72-128	30	01/25/2021 1503
PFDS	4.0	1.9	5.9		5	98	23	59-134	30	01/25/2021 1503
PFHpS	ND	1.9	2.2		5	118	7.5	70-132	30	01/25/2021 1503
PFNS	2.5	1.9	4.3		5	96	29	69-125	30	01/25/2021 1503
PFOSA	9.0	2.0	11		5	122	9.7	67-137	30	01/25/2021 1503
PFPeS	1.2	1.8	2.4	N	5	63	5.8	73-123	30	01/25/2021 1503
PFHxS	13	1.8	9.5	N	5	-178	7.1	67-130	30	01/25/2021 1503
PFBA	ND	2.0	2.6		5	100	12	71-135	30	01/25/2021 1503
PFDA	ND	2.0	2.6		5	131	27	69-133	30	01/25/2021 1503
PFDoA	1.1	2.0	3.1		5	98	16	69-135	30	01/25/2021 1503
PFHpA	ND	2.0	2.7	N	5	136	8.1	71-131	30	01/25/2021 1503
PFHxA	4.4	2.0	5.8		5	71	1.1	70-132	30	01/25/2021 1503
PFNA	ND	2.0	2.1		5	107	2.0	72-129	30	01/25/2021 1503
PFOA	ND	2.0	3.0	N	5	151	30	69-133	30	01/25/2021 1503
PFPeA	ND	2.0	2.5		5	128	19	69-132	30	01/25/2021 1503
PFTeDA	ND	2.0	2.6		5	105	11	69-133	30	01/25/2021 1503
PFTrDA	ND	2.0	2.9		5	119	1.6	66-139	30	01/25/2021 1503
PFUdA	ND	2.0	2.8	N	5	145	1.1	64-136	30	01/25/2021 1503
PFOS	190	1.8	140	N	5	-2470	30	68-136	30	01/25/2021 1503

Surrogate	Q	% Rec	Acceptance Limit
13C2_4:2FTS		105	50-150
13C2_6:2FTS		105	50-150
13C2_8:2FTS		105	50-150
13C2_PFDoA		105	50-150
13C2_PFTeDA		98	50-150
13C3_PFBS		102	50-150
13C3_PFHxS		106	50-150
13C4_PFBA		104	50-150
13C4_PFHpA		101	50-150
13C5_PFHxA		103	50-150
13C5_PFPeA		102	50-150
13C6_PFDA		104	50-150
13C7_PFUdA		105	50-150
13C8_PFOA		102	50-150

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

PFAS by LC/MS/MS - MSD

Sample ID: WA20016-006MD
Batch: 80346
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Solid
Prep Method: SOP SPE
Prep Date: 01/22/2021 1136

Surrogate	Q	% Rec	Acceptance Limit
13C8_PFOS		104	50-150
13C8_PFOSA		103	50-150
13C9_PFNA		103	50-150
d5-EtFOSAA		104	50-150
d-MeFOSA		99	50-150
d3-MeFOSAA		104	50-150

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

Chain of Custody
and
Miscellaneous Documents

Shealy Environmental Services, Inc.
106 Vantage Point Drive
West Columbia, South Carolina 29172
Telephone No. (803) 791-9700 Fax No. (803) 791-9111
www.shealylab.com

Chain of Custody Record

Number

Report to Contact: Colin Merrell
Telephone No. / E-mail: 902.209.9476 / colin@leisanitechnologies.ca
Quote No.: Mike McFadden
Sampler's Signature
Analysis (Attach list if more space is needed): PFAS DoD QSM 5.3 ELAP Table B-15
Page 1 of 1
WA20017
WA20016
Project Name
P.O No.
Project Number: 000-EI
Matrix
No of Containers by Preservative Type
Remarks / Cooler ID.

Sample ID / Description (Containers for each sample may be combined on one line)	Date	Time	Comp	Grab	Aqueous	Non-Aqueous	Solid	Unpres	H2SO4	HNO3	HCl	NaOH	5035 kit	PFAS DoD QSM 5.3 ELAP Table B-15	Remarks / Cooler ID.
R4-HSDIHILIM	Dec 29/20		C				x							PFAS	
R4-HSDIH505LIM	Dec 29/20		C				x							PFAS	
R4-SDSDICILIM	Dec 28/20		C				x							PFAS	
S-HSDIHILIM	Dec 28/20		C				x							PFAS	
S-SDSDICILIM	Dec 29/20		C				x							PFAS	
S-HSDIH505LIM	Dec 29/20		C				x							PFAS	
F-HSDIH505LIM	Dec 29/20		C				x							PFAS	
S-F1F2-M	Dec 29/20		C												
	Dec 29/20		C												

Sample Disposal: Return to Client / Disposal by Lab
Possible Hazard Identification: Non-Hazardous / Flammable / Skin Irritant / Poison / Unknown
QC Requirements
Turn Around Time Required (Prior lab approval required for expedited TAT): Standard / Rush (Please Specify)

	Date	Time
1. Relinquished by: Colin Merrell	Dec 29/20	
1. Received by		
2. Relinquished by	Date	Time
2. Received by		
3. Relinquished by	Date	Time
3. Received by		
4. Relinquished by	Date 1/12/21	Time 0935
4. Laboratory Received by	Date 1/12/21	Time 0935

Note: All samples are retained for four weeks from receipt unless other arrangements are made.
LAB USE ONLY
Received on Ice (Check): Y / N
Ice Pack
Receipt Temp. 5.3 °C
Document Number: ME000W-01

PaceAnalytical

Samples Receipt Checklist (SRC) (ME0018C-15)
Issuing Authority: Pace ENV - WCOL

Revised:9/29/2020
Page 1 of 1

Sample Receipt Checklist (SRC)

Client: Arcadis Cooler Inspected by/date: JSH / 01/20/2021 Lot #: WA20916/WA20917

Means of receipt: ☐ Pace ☐ Client ☐ UPS ☑ FedEx ☐ Other:

☐ Yes	☑ No		1. Were custody seals present on the cooler?
☐ Yes	☐ No	☑ NA	2. If custody seals were present, were they intact and unbroken?

pH Strip ID: NA Chlorine Strip ID: NA Tested by: NA

Original temperature upon receipt / Derived (Corrected) temperature upon receipt %Solid Snap-Cup ID: 20-875

5.3 / 5.3 °C NA / NA °C NA / NA °C NA / NA °C

Method: ☐ Temperature Blank ☑ Against Bottles IR Gun ID: 5 IR Gun Correction Factor: 0 °C

Method of coolant: ☑ Wet Ice ☐ Ice Packs ☐ Dry Ice ☐ None

☐ Yes	☐ No	☑ NA	3. If temperature of any cooler exceeded 6.0°C, was Project Manager Notified? PM was Notified by: phone / email / face-to-face (circle one).
☑ Yes	☐ No	☐ NA	4. Is the commercial courier's packing slip attached to this form?
☑ Yes	☐ No		5. Were proper custody procedures (relinquished/received) followed?
☑ Yes	☐ No		6. Were sample IDs listed on the COC?
☑ Yes	☐ No		7. Were sample IDs listed on all sample containers?
☐ Yes	☑ No		8. Was collection date & time listed on the COC?
☐ Yes	☑ No		9. Was collection date & time listed on all sample containers?
☐ Yes	☑ No		10. Did all container label information (ID, date, time) agree with the COC?
☑ Yes	☐ No		11. Were tests to be performed listed on the COC?
☑ Yes	☐ No		12. Did all samples arrive in the proper containers for each test and/or in good condition (unbroken, lids on, etc.)?
☑ Yes	☐ No		13. Was adequate sample volume available?
☐ Yes	☑ No		14. Were all samples received within ½ the holding time or 48 hours, whichever comes first?
☐ Yes	☑ No		15. Were any samples containers missing/excess (circle one) samples Not listed on COC?
☐ Yes	☐ No	☑ NA	16. For VOA and RSK-175 samples, were bubbles present >"pea-size" (¼"or 6mm in diameter) in any of the VOA vials?
☐ Yes	☐ No	☑ NA	17. Were all DRO/metals/nutrient samples received at a pH of < 2?
☐ Yes	☐ No	☑ NA	18. Were all cyanide samples received at a pH > 12 and sulfide samples received at a pH > 9?
☐ Yes	☐ No	☑ NA	19. Were all applicable NH_3/TKN/cyanide/phenol/625.1/608.3 (< 0.5mg/L) samples free of residual chlorine?
☐ Yes	☐ No	☑ NA	20. Were client remarks/requests (i.e. requested dilutions, MS/MSD designations, etc…) correctly transcribed from the COC into the comment section in LIMS?
☐ Yes	☑ No		21. Was the quote number listed on the container label? If yes, Quote #

Sample Preservation (Must be completed for any sample(s) incorrectly preserved or with headspace.)

Sample(s) NA were received incorrectly preserved and were adjusted accordingly in sample receiving with NA mL of circle one: H2SO4, HNO3, HCl, NaOH using SR # NA.

Time of preservation NA. If more than one preservative is needed, please note in the comments below.

Sample(s) NA were received with bubbles >6 mm in diameter.

Samples(s) NA were received with TRC > 0.5 mg/L (If #19 is ***no***) and were adjusted accordingly in sample receiving with sodium thiosulfate ($Na_2S_2O_3$) with Shealy ID: NA.

SR barcode labels applied by: MEH Date: 01/20/2021

Comments: Dates on containers are Jan 15/20 and Jan 15/21

Report of Analysis

Arcadis U.S., Inc.
630 Plaza Drive
Suite 600
Highlands Ranch, CO 80129
Attention: Colin Morrell

Project Name: Eielson AFB - Soil Washing

Project Number: 30030317.00001

Lot Number:**WF02026**

Date Completed:06/15/2021

06/18/2021 4:07 PM
Approved and released by:
Project Manager II: **Kathy E. Smith**

The electronic signature above is the equivalent of a handwritten signature.
This report shall not be reproduced, except in its entirety, without the written approval of Pace Analytical Services, LLC.

Pace Analytical Services, LLC (*formerly Shealy Environmental Services, Inc.*)
106 Vantage Point Drive West Columbia, SC 29172
Tel: 803-791-9700 Fax: 803-791-9111 www.pacelabs.com

Case Narrative
Arcadis U.S., Inc.
Lot Number: WF02026

This Report of Analysis contains the analytical result(s) for the sample(s) listed on the Sample Summary following this Case Narrative. The sample receiving date is documented in the header information associated with each sample.

All results listed in this report relate only to the samples that are contained within this report.

Sample receipt, sample analysis, and data review have been performed in accordance with the Pace Quality Assurance Management Plan (QAMP), applicable Shealy standard operating procedures (SOPs), the 2003 NELAC standard, and Shealy policies. Additionally, the DoD QSM version 5.3 has been followed for these samples, and specifically Table B-15 was followed for all PFAS samples. Any exceptions to the QAMP, SOPs, NELAC standards, the DoD QSM, or policies are qualified on the results page or discussed below.

All QC associated with these samples was in compliance with DOD QSM 5.3 table B-15 and our PFAS SOP.

Correction factors (CF) are used to calculate the original sample concentration. The CF is the inverse of the concentration factor (sample volume / extract final volume) times the dilution factor (DF). For undiluted analysis. For undiluted analysis, the extract is prepared for injection by adding 182 uL of sample extract + 8 uL of reagent water + 10 uL of internal standard solution to a polypropylene autosampler vial. An extra correction factor of 0.91 (182 uL / 200 uL = 0.91) applies. The CF is calculated as follows:

CF = DF * FV / Vo

FV is volume of extract (mL)
Vo is initial sample volume (mL)
DF is dilution factor. For undiluted analysis, DF = 1/0.91.

Sample concentration for aqueous samples:
Concentration (ng/L) = Cs*CF,

$$C_s = \frac{\left(\frac{(A_s x C_{is})}{A_{is}}\right) - B}{M1}$$

Where

C_s is on column concentration of target analyte in the sample (ng/L)
C_{is} is concentration of internal standard in the sample (ng/L)
A_s is peak response of target analyte in the sample
A_{is} is peak response of internal standard in the sample
M1 is the average RF from ICAL or the slope from linear regression ICAL
B is the y-intercept from the ICAL

The laboratory control sample (LCS) and / or laboratory control sample duplicate (LCSD) for analytical batch 94425 exceeded acceptance criteria for the following analytes: PFNS. These analytes were biased high and were not detected in the samples affected: WF02026-001, WF02026-002, WF02026-003, WF02026-004, WF02026-005, WF02026-006, WF02026-007, WF02026-009, WF02026-010, WF02026-011, WF02026-012, WF02026-013, WF02026-014, WF02026-015, WF02026-016.

The MS/MSD associated with sample WF02026-007 had PFOS recovered outside of the acceptance limits. The LCS was recovered within the required acceptance limits; therefore, this demonstrates a matrix effect and data quality is not impacted.

Sample Summary
Arcadis U.S., Inc.
Lot Number: WF02026

Sample Number	Sample ID	Matrix	Date Sampled	Date Received
001	377-UT-1	Solid	05/30/2021	06/02/2021
002	377-R-1	Solid	05/30/2021	06/02/2021
003	377-R-2	Solid	05/30/2021	06/02/2021
004	377-S-1	Solid	05/30/2021	06/02/2021
005	377-S-2	Solid	05/30/2021	06/02/2021
006	377-S-3	Solid	05/30/2021	06/02/2021
007	377-F-1	Solid	05/30/2021	06/02/2021
008	379-UT-2	Solid	05/30/2021	
009	379-R-1	Solid	05/30/2021	06/02/2021
010	379-R-2	Solid	05/30/2021	06/02/2021
011	379-UT-1	Solid	05/30/2021	06/02/2021
012	379-S-1	Solid	05/30/2021	06/02/2021
013	379-S-2	Solid	05/30/2021	06/02/2021
014	379-S-3	Solid	05/30/2021	06/02/2021
015	379-F-1	Solid	05/30/2021	06/02/2021
016	379-F-2	Solid	05/30/2021	06/02/2021

(16 samples)

Detection Summary

Arcadis U.S., Inc.

Lot Number: WF02026

Sample	Sample ID	Matrix	Parameter	Method	Result	Q	Units	Page
001	377-UT-1	Solid	PFHxS	PFAS by ID	3.7		ug/kg	6
001	377-UT-1	Solid	PFHxA	PFAS by ID	0.53	J	ug/kg	6
001	377-UT-1	Solid	PFNA	PFAS by ID	0.23	J	ug/kg	6
001	377-UT-1	Solid	PFOA	PFAS by ID	0.78	J	ug/kg	6
001	377-UT-1	Solid	PFOS	PFAS by ID	15		ug/kg	6
002	377-R-1	Solid	PFOS	PFAS by ID	0.32	J	ug/kg	8
003	377-R-2	Solid	PFOS	PFAS by ID	0.35	J	ug/kg	10
004	377-S-1	Solid	PFHxS	PFAS by ID	0.79	J	ug/kg	12
004	377-S-1	Solid	PFOS	PFAS by ID	1.3		ug/kg	12
005	377-S-2	Solid	PFOS	PFAS by ID	0.62	J	ug/kg	14
006	377-S-3	Solid	PFOS	PFAS by ID	0.50	J	ug/kg	16
007	377-F-1	Solid	PFOS	PFAS by ID	5.4	S	ug/kg	18
010	379-R-2	Solid	PFOS	PFAS by ID	0.50	J	ug/kg	22
011	379-UT-1	Solid	PFBS	PFAS by ID	0.28	J	ug/kg	24
011	379-UT-1	Solid	PFHpS	PFAS by ID	0.27	J	ug/kg	24
011	379-UT-1	Solid	PFPeS	PFAS by ID	0.34	J	ug/kg	24
011	379-UT-1	Solid	PFHxS	PFAS by ID	4.6		ug/kg	24
011	379-UT-1	Solid	PFHpA	PFAS by ID	0.27	J	ug/kg	24
011	379-UT-1	Solid	PFHxA	PFAS by ID	0.81	J	ug/kg	24
011	379-UT-1	Solid	PFNA	PFAS by ID	0.26	J	ug/kg	24
011	379-UT-1	Solid	PFOA	PFAS by ID	0.45	J	ug/kg	24
011	379-UT-1	Solid	PFPeA	PFAS by ID	0.71	J	ug/kg	24
011	379-UT-1	Solid	PFOS	PFAS by ID	59		ug/kg	24
012	379-S-1	Solid	PFOS	PFAS by ID	1.3		ug/kg	26
013	379-S-2	Solid	6:2 FTS	PFAS by ID	0.99	J	ug/kg	28
013	379-S-2	Solid	PFOS	PFAS by ID	1.4		ug/kg	28
014	379-S-3	Solid	PFOS	PFAS by ID	0.42	J	ug/kg	30
015	379-F-1	Solid	PFHxS	PFAS by ID	1.2	J	ug/kg	32
015	379-F-1	Solid	PFOS	PFAS by ID	12		ug/kg	32
016	379-F-2	Solid	PFHxS	PFAS by ID	1.3	J	ug/kg	34
016	379-F-2	Solid	PFOS	PFAS by ID	9.6		ug/kg	34

(31 detections)

PFAS by LC/MS/MS

Client: **Arcadis U.S., Inc.** Laboratory ID: **WF02026-001**

Description: **377-UT-1** Matrix: **Solid**

Date Sampled: **05/30/2021** % Solids: **78.1** **06/03/2021 0023**

Date Received: **06/02/2021**

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch
1	SOP SPE	PFAS by ID SOP QSM B-15	1	06/04/2021 1423	JJG	06/03/2021 1117	94181

Parameter	CAS Number	Analytical Method	Result	Q	LOQ	LOD	DL	Units	Run
1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS)	39108-34-4	PFAS by ID SOP	1.1	U	2.2	1.1	0.56	ug/kg	1
1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS)	27619-97-2	PFAS by ID SOP	1.1	U	2.2	1.1	0.56	ug/kg	1
1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS)	757124-72-4	PFAS by ID SOP	1.1	U	2.2	1.1	0.56	ug/kg	1
N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA)	2991-50-6	PFAS by ID SOP	1.1	U	2.2	1.1	0.56	ug/kg	1
N-methylperfluoro-1-octanesulfonamide (MeFOSA)	31506-32-8	PFAS by ID SOP	1.1	U	2.2	1.1	0.56	ug/kg	1
N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA)	2355-31-9	PFAS by ID SOP	1.1	U	2.2	1.1	0.56	ug/kg	1
Perfluoro-1-butanesulfonic acid (PFBS)	375-73-5	PFAS by ID SOP	0.55	U	1.1	0.55	0.22	ug/kg	1
Perfluoro-1-decanesulfonic acid (PFDS)	335-77-3	PFAS by ID SOP	0.55	U	1.1	0.55	0.22	ug/kg	1
Perfluoro-1-heptanesulfonic acid (PFHpS)	375-92-8	PFAS by ID SOP	0.55	U	1.1	0.55	0.22	ug/kg	1
Perfluoro-1-nonanesulfonic acid (PFNS)	68259-12-1	PFAS by ID SOP	0.55	UL	1.1	0.55	0.22	ug/kg	1
Perfluoro-1-octanesulfonamide (PFOSA)	754-91-6	PFAS by ID SOP	0.55	U	1.1	0.55	0.22	ug/kg	1
Perfluoro-1-pentanesulfonic acid (PFPeS)	2706-91-4	PFAS by ID SOP	0.55	U	1.1	0.55	0.22	ug/kg	1
Perfluorohexanesulfonic acid (PFHxS)	**355-46-4**	**PFAS by ID SOP**	**3.7**		**1.1**	0.55	**0.22**	**ug/kg**	**1**
Perfluoro-n-butanoic acid (PFBA)	375-22-4	PFAS by ID SOP	0.55	U	1.1	0.55	0.22	ug/kg	1
Perfluoro-n-decanoic acid (PFDA)	335-76-2	PFAS by ID SOP	0.55	U	1.1	0.55	0.22	ug/kg	1
Perfluoro-n-dodecanoic acid (PFDoA)	307-55-1	PFAS by ID SOP	0.55	U	1.1	0.55	0.22	ug/kg	1
Perfluoro-n-heptanoic acid (PFHpA)	375-85-9	PFAS by ID SOP	0.55	U	1.1	0.55	0.22	ug/kg	1
Perfluoro-n-hexanoic acid (PFHxA)	**307-24-4**	**PFAS by ID SOP**	**0.53**	**J**	**1.1**	0.55	**0.22**	**ug/kg**	**1**
Perfluoro-n-nonanoic acid (PFNA)	**375-95-1**	**PFAS by ID SOP**	**0.23**	**J**	**1.1**	0.55	**0.22**	**ug/kg**	**1**
Perfluoro-n-octanoic acid (PFOA)	**335-67-1**	**PFAS by ID SOP**	**0.78**	**J**	**1.1**	0.55	**0.22**	**ug/kg**	**1**
Perfluoro-n-pentanoic acid (PFPeA)	2706-90-3	PFAS by ID SOP	0.55	U	1.1	0.55	0.22	ug/kg	1
Perfluoro-n-tetradecanoic acid (PFTeDA)	376-06-7	PFAS by ID SOP	0.55	U	1.1	0.55	0.22	ug/kg	1
Perfluoro-n-tridecanoic acid (PFTrDA)	72629-94-8	PFAS by ID SOP	0.55	U	1.1	0.55	0.22	ug/kg	1
Perfluoro-n-undecanoic acid (PFUdA)	2058-94-8	PFAS by ID SOP	0.55	U	1.1	0.55	0.22	ug/kg	1
Perfluorooctanesulfonic acid (PFOS)	**1763-23-1**	**PFAS by ID SOP**	**15**		**1.1**	0.55	**0.22**	**ug/kg**	**1**

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
13C2_4:2FTS		90	50-150
13C2_6:2FTS		87	50-150
13C2_8:2FTS		106	50-150
13C2_PFDoA		88	50-150
13C2_PFTeDA		85	50-150
13C3_PFBS		89	50-150
13C3_PFHxS		87	50-150
13C4_PFBA		88	50-150
13C4_PFHpA		93	50-150
13C5_PFHxA		85	50-150
13C5_PFPeA		87	50-150
13C6_PFDA		83	50-150
13C7_PFUdA		90	50-150
13C8_PFOA		88	50-150
13C8_PFOS		89	50-150
13C8_PFOSA		86	50-150
13C9_PFNA		88	50-150

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

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PFAS by LC/MS/MS

Client: **Arcadis U.S., Inc.**
Laboratory ID: **WF02026-001**
Description: **377-UT-1**
Matrix: **Solid**
Date Sampled: **05/30/2021**
% Solids: **78.1** **06/03/2021 0023**
Date Received: **06/02/2021**

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
d5-EtFOSAA		89	50-150
d-MeFOSA		85	50-150
d3-MeFOSAA		85	50-150

LOQ = Limit of Quantitation	B = Detected in the method blank	E = Quantitation of compound exceeded the calibration range	DL = Detection Limit	Q = Surrogate failure
U = Not detected at or above the LOQ	N = Recovery is out of criteria	P = The RPD between two GC columns exceeds 40%	J = Estimated result < LOQ and ≥ DL	L = LCS/LCSD failure
H = Out of holding time	W = Reported on wet weight basis	LOD = Limit of Detection		S = MS/MSD failure

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PFAS by LC/MS/MS

Client: **Arcadis U.S., Inc.** Laboratory ID: **WF02026-002**

Description: **377-R-1** Matrix: **Solid**

Date Sampled: **05/30/2021** % Solids: **99.1** **06/03/2021 0023**

Date Received: **06/02/2021**

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch
1	SOP SPE	PFAS by ID SOP QSM B-15	1	06/04/2021 1433	JJG	06/03/2021 1117	94181

Parameter	CAS Number	Analytical Method	Result	Q	LOQ	LOD	DL	Units	Run
1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS)	39108-34-4	PFAS by ID SOP	0.90	U	1.8	0.90	0.44	ug/kg	1
1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS)	27619-97-2	PFAS by ID SOP	0.90	U	1.8	0.90	0.44	ug/kg	1
1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS)	757124-72-4	PFAS by ID SOP	0.90	U	1.8	0.90	0.44	ug/kg	1
N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA)	2991-50-6	PFAS by ID SOP	0.90	U	1.8	0.90	0.44	ug/kg	1
N-methylperfluoro-1-octanesulfonamide (MeFOSA)	31506-32-8	PFAS by ID SOP	0.90	U	1.8	0.90	0.44	ug/kg	1
N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA)	2355-31-9	PFAS by ID SOP	0.90	U	1.8	0.90	0.44	ug/kg	1
Perfluoro-1-butanesulfonic acid (PFBS)	375-73-5	PFAS by ID SOP	0.44	U	0.88	0.44	0.18	ug/kg	1
Perfluoro-1-decanesulfonic acid (PFDS)	335-77-3	PFAS by ID SOP	0.44	U	0.88	0.44	0.18	ug/kg	1
Perfluoro-1-heptanesulfonic acid (PFHpS)	375-92-8	PFAS by ID SOP	0.44	U	0.88	0.44	0.18	ug/kg	1
Perfluoro-1-nonanesulfonic acid (PFNS)	68259-12-1	PFAS by ID SOP	0.44	UL	0.88	0.44	0.18	ug/kg	1
Perfluoro-1-octanesulfonamide (PFOSA)	754-91-6	PFAS by ID SOP	0.44	U	0.88	0.44	0.18	ug/kg	1
Perfluoro-1-pentanesulfonic acid (PFPeS)	2706-91-4	PFAS by ID SOP	0.44	U	0.88	0.44	0.18	ug/kg	1
Perfluorohexanesulfonic acid (PFHxS)	355-46-4	PFAS by ID SOP	0.44	U	0.88	0.44	0.18	ug/kg	1
Perfluoro-n-butanoic acid (PFBA)	375-22-4	PFAS by ID SOP	0.44	U	0.88	0.44	0.18	ug/kg	1
Perfluoro-n-decanoic acid (PFDA)	335-76-2	PFAS by ID SOP	0.44	U	0.88	0.44	0.18	ug/kg	1
Perfluoro-n-dodecanoic acid (PFDoA)	307-55-1	PFAS by ID SOP	0.44	U	0.88	0.44	0.18	ug/kg	1
Perfluoro-n-heptanoic acid (PFHpA)	375-85-9	PFAS by ID SOP	0.44	U	0.88	0.44	0.18	ug/kg	1
Perfluoro-n-hexanoic acid (PFHxA)	307-24-4	PFAS by ID SOP	0.44	U	0.88	0.44	0.18	ug/kg	1
Perfluoro-n-nonanoic acid (PFNA)	375-95-1	PFAS by ID SOP	0.44	U	0.88	0.44	0.18	ug/kg	1
Perfluoro-n-octanoic acid (PFOA)	335-67-1	PFAS by ID SOP	0.44	U	0.88	0.44	0.18	ug/kg	1
Perfluoro-n-pentanoic acid (PFPeA)	2706-90-3	PFAS by ID SOP	0.44	U	0.88	0.44	0.18	ug/kg	1
Perfluoro-n-tetradecanoic acid (PFTeDA)	376-06-7	PFAS by ID SOP	0.44	U	0.88	0.44	0.18	ug/kg	1
Perfluoro-n-tridecanoic acid (PFTrDA)	72629-94-8	PFAS by ID SOP	0.44	U	0.88	0.44	0.18	ug/kg	1
Perfluoro-n-undecanoic acid (PFUdA)	2058-94-8	PFAS by ID SOP	0.44	U	0.88	0.44	0.18	ug/kg	1
Perfluorooctanesulfonic acid (PFOS)	**1763-23-1**	**PFAS by ID SOP**	**0.32**	**J**	**0.88**	0.44	**0.18**	**ug/kg**	**1**

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
13C2_4:2FTS		103	50-150
13C2_6:2FTS		95	50-150
13C2_8:2FTS		102	50-150
13C2_PFDoA		96	50-150
13C2_PFTeDA		94	50-150
13C3_PFBS		87	50-150
13C3_PFHxS		91	50-150
13C4_PFBA		92	50-150
13C4_PFHpA		95	50-150
13C5_PFHxA		92	50-150
13C5_PFPeA		93	50-150
13C6_PFDA		90	50-150
13C7_PFUdA		97	50-150
13C8_PFOA		90	50-150
13C8_PFOS		87	50-150
13C8_PFOSA		93	50-150
13C9_PFNA		96	50-150

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

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PFAS by LC/MS/MS

Client: **Arcadis U.S., Inc.**
Laboratory ID: **WF02026-002**
Description: **377-R-1**
Matrix: **Solid**
Date Sampled: **05/30/2021**
% Solids: **99.1** **06/03/2021 0023**
Date Received: **06/02/2021**

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
d5-EtFOSAA		100	50-150
d-MeFOSA		105	50-150
d3-MeFOSAA		93	50-150

LOQ = Limit of Quantitation	B = Detected in the method blank	E = Quantitation of compound exceeded the calibration range	DL = Detection Limit	Q = Surrogate failure
U = Not detected at or above the LOQ	N = Recovery is out of criteria	P = The RPD between two GC columns exceeds 40%	J = Estimated result < LOQ and ≥ DL	L = LCS/LCSD failure
H = Out of holding time	W = Reported on wet weight basis	LOD = Limit of Detection		S = MS/MSD failure

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PFAS by LC/MS/MS

Client: **Arcadis U.S., Inc.** Laboratory ID: **WF02026-003**

Description: **377-R-2** Matrix: **Solid**

Date Sampled: **05/30/2021** % Solids: **98.8** **06/03/2021 0023**

Date Received: **06/02/2021**

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch
1	SOP SPE	PFAS by ID SOP QSM B-15	1	06/04/2021 1444	JJG	06/03/2021 1117	94181

Parameter	CAS Number	Analytical Method	Result	Q	LOQ	LOD	DL	Units	Run
1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS)	39108-34-4	PFAS by ID SOP	0.85	U	1.7	0.85	0.43	ug/kg	1
1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS)	27619-97-2	PFAS by ID SOP	0.85	U	1.7	0.85	0.43	ug/kg	1
1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS)	757124-72-4	PFAS by ID SOP	0.85	U	1.7	0.85	0.43	ug/kg	1
N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA)	2991-50-6	PFAS by ID SOP	0.85	U	1.7	0.85	0.43	ug/kg	1
N-methylperfluoro-1-octanesulfonamide (MeFOSA)	31506-32-8	PFAS by ID SOP	0.85	U	1.7	0.85	0.43	ug/kg	1
N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA)	2355-31-9	PFAS by ID SOP	0.85	U	1.7	0.85	0.43	ug/kg	1
Perfluoro-1-butanesulfonic acid (PFBS)	375-73-5	PFAS by ID SOP	0.44	U	0.87	0.44	0.17	ug/kg	1
Perfluoro-1-decanesulfonic acid (PFDS)	335-77-3	PFAS by ID SOP	0.44	U	0.87	0.44	0.17	ug/kg	1
Perfluoro-1-heptanesulfonic acid (PFHpS)	375-92-8	PFAS by ID SOP	0.44	U	0.87	0.44	0.17	ug/kg	1
Perfluoro-1-nonanesulfonic acid (PFNS)	68259-12-1	PFAS by ID SOP	0.44	UL	0.87	0.44	0.17	ug/kg	1
Perfluoro-1-octanesulfonamide (PFOSA)	754-91-6	PFAS by ID SOP	0.44	U	0.87	0.44	0.17	ug/kg	1
Perfluoro-1-pentanesulfonic acid (PFPeS)	2706-91-4	PFAS by ID SOP	0.44	U	0.87	0.44	0.17	ug/kg	1
Perfluorohexanesulfonic acid (PFHxS)	355-46-4	PFAS by ID SOP	0.44	U	0.87	0.44	0.17	ug/kg	1
Perfluoro-n-butanoic acid (PFBA)	375-22-4	PFAS by ID SOP	0.44	U	0.87	0.44	0.17	ug/kg	1
Perfluoro-n-decanoic acid (PFDA)	335-76-2	PFAS by ID SOP	0.44	U	0.87	0.44	0.17	ug/kg	1
Perfluoro-n-dodecanoic acid (PFDoA)	307-55-1	PFAS by ID SOP	0.44	U	0.87	0.44	0.17	ug/kg	1
Perfluoro-n-heptanoic acid (PFHpA)	375-85-9	PFAS by ID SOP	0.44	U	0.87	0.44	0.17	ug/kg	1
Perfluoro-n-hexanoic acid (PFHxA)	307-24-4	PFAS by ID SOP	0.44	U	0.87	0.44	0.17	ug/kg	1
Perfluoro-n-nonanoic acid (PFNA)	375-95-1	PFAS by ID SOP	0.44	U	0.87	0.44	0.17	ug/kg	1
Perfluoro-n-octanoic acid (PFOA)	335-67-1	PFAS by ID SOP	0.44	U	0.87	0.44	0.17	ug/kg	1
Perfluoro-n-pentanoic acid (PFPeA)	2706-90-3	PFAS by ID SOP	0.44	U	0.87	0.44	0.17	ug/kg	1
Perfluoro-n-tetradecanoic acid (PFTeDA)	376-06-7	PFAS by ID SOP	0.44	U	0.87	0.44	0.17	ug/kg	1
Perfluoro-n-tridecanoic acid (PFTrDA)	72629-94-8	PFAS by ID SOP	0.44	U	0.87	0.44	0.17	ug/kg	1
Perfluoro-n-undecanoic acid (PFUdA)	2058-94-8	PFAS by ID SOP	0.44	U	0.87	0.44	0.17	ug/kg	1
Perfluorooctanesulfonic acid (PFOS)	**1763-23-1**	**PFAS by ID SOP**	**0.35**	**J**	**0.87**	0.44	**0.17**	**ug/kg**	**1**

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
13C2_4:2FTS		99	50-150
13C2_6:2FTS		93	50-150
13C2_8:2FTS		103	50-150
13C2_PFDoA		101	50-150
13C2_PFTeDA		94	50-150
13C3_PFBS		84	50-150
13C3_PFHxS		90	50-150
13C4_PFBA		91	50-150
13C4_PFHpA		97	50-150
13C5_PFHxA		92	50-150
13C5_PFPeA		90	50-150
13C6_PFDA		83	50-150
13C7_PFUdA		75	50-150
13C8_PFOA		94	50-150
13C8_PFOS		89	50-150
13C8_PFOSA		88	50-150
13C9_PFNA		94	50-150

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

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PFAS by LC/MS/MS

Client: **Arcadis U.S., Inc.**
Laboratory ID: **WF02026-003**
Description: **377-R-2**
Matrix: **Solid**
Date Sampled: **05/30/2021**
% Solids: **98.8** **06/03/2021 0023**
Date Received: **06/02/2021**

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
d5-EtFOSAA		70	50-150
d-MeFOSA		74	50-150
d3-MeFOSAA		91	50-150

LOQ = Limit of Quantitation	B = Detected in the method blank	E = Quantitation of compound exceeded the calibration range	DL = Detection Limit	Q = Surrogate failure
U = Not detected at or above the LOQ	N = Recovery is out of criteria	P = The RPD between two GC columns exceeds 40%	J = Estimated result < LOQ and ≥ DL	L = LCS/LCSD failure
H = Out of holding time	W = Reported on wet weight basis	LOD = Limit of Detection		S = MS/MSD failure

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PFAS by LC/MS/MS

Client: **Arcadis U.S., Inc.** Laboratory ID: **WF02026-004**

Description: **377-S-1** Matrix: **Solid**

Date Sampled: **05/30/2021** % Solids: **76.1** **06/03/2021 0023**

Date Received: **06/02/2021**

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch
1	SOP SPE	PFAS by ID SOP QSM B-15	1	06/04/2021 1455	JJG	06/03/2021 1117	94181

Parameter	CAS Number	Analytical Method	Result	Q	LOQ	LOD	DL	Units	Run
1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS)	39108-34-4	PFAS by ID SOP	1.2	U	2.4	1.2	0.60	ug/kg	1
1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS)	27619-97-2	PFAS by ID SOP	1.2	U	2.4	1.2	0.60	ug/kg	1
1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS)	757124-72-4	PFAS by ID SOP	1.2	U	2.4	1.2	0.60	ug/kg	1
N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA)	2991-50-6	PFAS by ID SOP	1.2	U	2.4	1.2	0.60	ug/kg	1
N-methylperfluoro-1-octanesulfonamide (MeFOSA)	31506-32-8	PFAS by ID SOP	1.2	U	2.4	1.2	0.60	ug/kg	1
N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA)	2355-31-9	PFAS by ID SOP	1.2	U	2.4	1.2	0.60	ug/kg	1
Perfluoro-1-butanesulfonic acid (PFBS)	375-73-5	PFAS by ID SOP	0.60	U	1.2	0.60	0.24	ug/kg	1
Perfluoro-1-decanesulfonic acid (PFDS)	335-77-3	PFAS by ID SOP	0.60	U	1.2	0.60	0.24	ug/kg	1
Perfluoro-1-heptanesulfonic acid (PFHpS)	375-92-8	PFAS by ID SOP	0.60	U	1.2	0.60	0.24	ug/kg	1
Perfluoro-1-nonanesulfonic acid (PFNS)	68259-12-1	PFAS by ID SOP	0.60	UL	1.2	0.60	0.24	ug/kg	1
Perfluoro-1-octanesulfonamide (PFOSA)	754-91-6	PFAS by ID SOP	0.60	U	1.2	0.60	0.24	ug/kg	1
Perfluoro-1-pentanesulfonic acid (PFPeS)	2706-91-4	PFAS by ID SOP	0.60	U	1.2	0.60	0.24	ug/kg	1
Perfluorohexanesulfonic acid (PFHxS)	**355-46-4**	**PFAS by ID SOP**	**0.79**	**J**	**1.2**	0.60	**0.24**	**ug/kg**	**1**
Perfluoro-n-butanoic acid (PFBA)	375-22-4	PFAS by ID SOP	0.60	U	1.2	0.60	0.24	ug/kg	1
Perfluoro-n-decanoic acid (PFDA)	335-76-2	PFAS by ID SOP	0.60	U	1.2	0.60	0.24	ug/kg	1
Perfluoro-n-dodecanoic acid (PFDoA)	307-55-1	PFAS by ID SOP	0.60	U	1.2	0.60	0.24	ug/kg	1
Perfluoro-n-heptanoic acid (PFHpA)	375-85-9	PFAS by ID SOP	0.60	U	1.2	0.60	0.24	ug/kg	1
Perfluoro-n-hexanoic acid (PFHxA)	307-24-4	PFAS by ID SOP	0.60	U	1.2	0.60	0.24	ug/kg	1
Perfluoro-n-nonanoic acid (PFNA)	375-95-1	PFAS by ID SOP	0.60	U	1.2	0.60	0.24	ug/kg	1
Perfluoro-n-octanoic acid (PFOA)	335-67-1	PFAS by ID SOP	0.60	U	1.2	0.60	0.24	ug/kg	1
Perfluoro-n-pentanoic acid (PFPeA)	2706-90-3	PFAS by ID SOP	0.60	U	1.2	0.60	0.24	ug/kg	1
Perfluoro-n-tetradecanoic acid (PFTeDA)	376-06-7	PFAS by ID SOP	0.60	U	1.2	0.60	0.24	ug/kg	1
Perfluoro-n-tridecanoic acid (PFTrDA)	72629-94-8	PFAS by ID SOP	0.60	U	1.2	0.60	0.24	ug/kg	1
Perfluoro-n-undecanoic acid (PFUdA)	2058-94-8	PFAS by ID SOP	0.60	U	1.2	0.60	0.24	ug/kg	1
Perfluorooctanesulfonic acid (PFOS)	**1763-23-1**	**PFAS by ID SOP**	**1.3**		**1.2**	0.60	**0.24**	**ug/kg**	**1**

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
13C2_4:2FTS		98	50-150
13C2_6:2FTS		89	50-150
13C2_8:2FTS		98	50-150
13C2_PFDoA		99	50-150
13C2_PFTeDA		92	50-150
13C3_PFBS		81	50-150
13C3_PFHxS		88	50-150
13C4_PFBA		89	50-150
13C4_PFHpA		91	50-150
13C5_PFHxA		88	50-150
13C5_PFPeA		90	50-150
13C6_PFDA		83	50-150
13C7_PFUdA		87	50-150
13C8_PFOA		86	50-150
13C8_PFOS		90	50-150
13C8_PFOSA		85	50-150
13C9_PFNA		92	50-150

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

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PFAS by LC/MS/MS

Client: **Arcadis U.S., Inc.**
Laboratory ID: **WF02026-004**
Description: **377-S-1**
Matrix: **Solid**
Date Sampled: **05/30/2021**
% Solids: **76.1** **06/03/2021 0023**
Date Received: **06/02/2021**

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
d5-EtFOSAA		91	50-150
d-MeFOSA		103	50-150
d3-MeFOSAA		88	50-150

LOQ = Limit of Quantitation	B = Detected in the method blank	E = Quantitation of compound exceeded the calibration range	DL = Detection Limit	Q = Surrogate failure
U = Not detected at or above the LOQ	N = Recovery is out of criteria	P = The RPD between two GC columns exceeds 40%	J = Estimated result < LOQ and ≥ DL	L = LCS/LCSD failure
H = Out of holding time	W = Reported on wet weight basis	LOD = Limit of Detection		S = MS/MSD failure

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PFAS by LC/MS/MS

Client: **Arcadis U.S., Inc.** Laboratory ID: **WF02026-005**

Description: **377-S-2** Matrix: **Solid**

Date Sampled: **05/30/2021** % Solids: **77.9** **06/03/2021 0023**

Date Received: **06/02/2021**

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch
1	SOP SPE	PFAS by ID SOP QSM B-15	1	06/04/2021 1505	JJG	06/03/2021 1117	94181

Parameter	CAS Number	Analytical Method	Result	Q	LOQ	LOD	DL	Units	Run
1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS)	39108-34-4	PFAS by ID SOP	1.2	U	2.3	1.2	0.57	ug/kg	1
1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS)	27619-97-2	PFAS by ID SOP	1.2	U	2.3	1.2	0.57	ug/kg	1
1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS)	757124-72-4	PFAS by ID SOP	1.2	U	2.3	1.2	0.57	ug/kg	1
N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA)	2991-50-6	PFAS by ID SOP	1.2	U	2.3	1.2	0.57	ug/kg	1
N-methylperfluoro-1-octanesulfonamide (MeFOSA)	31506-32-8	PFAS by ID SOP	1.2	U	2.3	1.2	0.57	ug/kg	1
N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA)	2355-31-9	PFAS by ID SOP	1.2	U	2.3	1.2	0.57	ug/kg	1
Perfluoro-1-butanesulfonic acid (PFBS)	375-73-5	PFAS by ID SOP	0.55	U	1.1	0.55	0.23	ug/kg	1
Perfluoro-1-decanesulfonic acid (PFDS)	335-77-3	PFAS by ID SOP	0.55	U	1.1	0.55	0.23	ug/kg	1
Perfluoro-1-heptanesulfonic acid (PFHpS)	375-92-8	PFAS by ID SOP	0.55	U	1.1	0.55	0.23	ug/kg	1
Perfluoro-1-nonanesulfonic acid (PFNS)	68259-12-1	PFAS by ID SOP	0.55	UL	1.1	0.55	0.23	ug/kg	1
Perfluoro-1-octanesulfonamide (PFOSA)	754-91-6	PFAS by ID SOP	0.55	U	1.1	0.55	0.23	ug/kg	1
Perfluoro-1-pentanesulfonic acid (PFPeS)	2706-91-4	PFAS by ID SOP	0.55	U	1.1	0.55	0.23	ug/kg	1
Perfluorohexanesulfonic acid (PFHxS)	355-46-4	PFAS by ID SOP	0.55	U	1.1	0.55	0.23	ug/kg	1
Perfluoro-n-butanoic acid (PFBA)	375-22-4	PFAS by ID SOP	0.55	U	1.1	0.55	0.23	ug/kg	1
Perfluoro-n-decanoic acid (PFDA)	335-76-2	PFAS by ID SOP	0.55	U	1.1	0.55	0.23	ug/kg	1
Perfluoro-n-dodecanoic acid (PFDoA)	307-55-1	PFAS by ID SOP	0.55	U	1.1	0.55	0.23	ug/kg	1
Perfluoro-n-heptanoic acid (PFHpA)	375-85-9	PFAS by ID SOP	0.55	U	1.1	0.55	0.23	ug/kg	1
Perfluoro-n-hexanoic acid (PFHxA)	307-24-4	PFAS by ID SOP	0.55	U	1.1	0.55	0.23	ug/kg	1
Perfluoro-n-nonanoic acid (PFNA)	375-95-1	PFAS by ID SOP	0.55	U	1.1	0.55	0.23	ug/kg	1
Perfluoro-n-octanoic acid (PFOA)	335-67-1	PFAS by ID SOP	0.55	U	1.1	0.55	0.23	ug/kg	1
Perfluoro-n-pentanoic acid (PFPeA)	2706-90-3	PFAS by ID SOP	0.55	U	1.1	0.55	0.23	ug/kg	1
Perfluoro-n-tetradecanoic acid (PFTeDA)	376-06-7	PFAS by ID SOP	0.55	U	1.1	0.55	0.23	ug/kg	1
Perfluoro-n-tridecanoic acid (PFTrDA)	72629-94-8	PFAS by ID SOP	0.55	U	1.1	0.55	0.23	ug/kg	1
Perfluoro-n-undecanoic acid (PFUdA)	2058-94-8	PFAS by ID SOP	0.55	U	1.1	0.55	0.23	ug/kg	1
Perfluorooctanesulfonic acid (PFOS)	**1763-23-1**	**PFAS by ID SOP**	**0.62**	**J**	**1.1**	0.55	**0.23**	**ug/kg**	**1**

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
13C2_4:2FTS		93	50-150
13C2_6:2FTS		89	50-150
13C2_8:2FTS		94	50-150
13C2_PFDoA		94	50-150
13C2_PFTeDA		89	50-150
13C3_PFBS		81	50-150
13C3_PFHxS		82	50-150
13C4_PFBA		88	50-150
13C4_PFHpA		90	50-150
13C5_PFHxA		89	50-150
13C5_PFPeA		89	50-150
13C6_PFDA		81	50-150
13C7_PFUdA		84	50-150
13C8_PFOA		86	50-150
13C8_PFOS		84	50-150
13C8_PFOSA		83	50-150
13C9_PFNA		90	50-150

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

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PFAS by LC/MS/MS

Client: **Arcadis U.S., Inc.**
Laboratory ID: **WF02026-005**
Description: **377-S-2**
Matrix: **Solid**
Date Sampled: **05/30/2021**
% Solids: **77.9** **06/03/2021 0023**
Date Received: **06/02/2021**

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
d5-EtFOSAA		90	50-150
d-MeFOSA		90	50-150
d3-MeFOSAA		83	50-150

LOQ = Limit of Quantitation	B = Detected in the method blank	E = Quantitation of compound exceeded the calibration range	DL = Detection Limit	Q = Surrogate failure
U = Not detected at or above the LOQ	N = Recovery is out of criteria	P = The RPD between two GC columns exceeds 40%	J = Estimated result < LOQ and ≥ DL	L = LCS/LCSD failure
H = Out of holding time	W = Reported on wet weight basis	LOD = Limit of Detection		S = MS/MSD failure

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PFAS by LC/MS/MS

Client: **Arcadis U.S., Inc.** Laboratory ID: **WF02026-006**

Description: **377-S-3** Matrix: **Solid**

Date Sampled: **05/30/2021** % Solids: **76.5** **06/03/2021 0023**

Date Received: **06/02/2021**

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch
1	SOP SPE	PFAS by ID SOP QSM B-15	1	06/04/2021 1516	JJG	06/03/2021 1117	94181

Parameter	CAS Number	Analytical Method	Result	Q	LOQ	LOD	DL	Units	Run
1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS)	39108-34-4	PFAS by ID SOP	1.2	U	2.4	1.2	0.61	ug/kg	1
1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS)	27619-97-2	PFAS by ID SOP	1.2	U	2.4	1.2	0.61	ug/kg	1
1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS)	757124-72-4	PFAS by ID SOP	1.2	U	2.4	1.2	0.61	ug/kg	1
N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA)	2991-50-6	PFAS by ID SOP	1.2	U	2.4	1.2	0.61	ug/kg	1
N-methylperfluoro-1-octanesulfonamide (MeFOSA)	31506-32-8	PFAS by ID SOP	1.2	U	2.4	1.2	0.61	ug/kg	1
N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA)	2355-31-9	PFAS by ID SOP	1.2	U	2.4	1.2	0.61	ug/kg	1
Perfluoro-1-butanesulfonic acid (PFBS)	375-73-5	PFAS by ID SOP	0.60	U	1.2	0.60	0.24	ug/kg	1
Perfluoro-1-decanesulfonic acid (PFDS)	335-77-3	PFAS by ID SOP	0.60	U	1.2	0.60	0.24	ug/kg	1
Perfluoro-1-heptanesulfonic acid (PFHpS)	375-92-8	PFAS by ID SOP	0.60	U	1.2	0.60	0.24	ug/kg	1
Perfluoro-1-nonanesulfonic acid (PFNS)	68259-12-1	PFAS by ID SOP	0.60	UL	1.2	0.60	0.24	ug/kg	1
Perfluoro-1-octanesulfonamide (PFOSA)	754-91-6	PFAS by ID SOP	0.60	U	1.2	0.60	0.24	ug/kg	1
Perfluoro-1-pentanesulfonic acid (PFPeS)	2706-91-4	PFAS by ID SOP	0.60	U	1.2	0.60	0.24	ug/kg	1
Perfluorohexanesulfonic acid (PFHxS)	355-46-4	PFAS by ID SOP	0.60	U	1.2	0.60	0.24	ug/kg	1
Perfluoro-n-butanoic acid (PFBA)	375-22-4	PFAS by ID SOP	0.60	U	1.2	0.60	0.24	ug/kg	1
Perfluoro-n-decanoic acid (PFDA)	335-76-2	PFAS by ID SOP	0.60	U	1.2	0.60	0.24	ug/kg	1
Perfluoro-n-dodecanoic acid (PFDoA)	307-55-1	PFAS by ID SOP	0.60	U	1.2	0.60	0.24	ug/kg	1
Perfluoro-n-heptanoic acid (PFHpA)	375-85-9	PFAS by ID SOP	0.60	U	1.2	0.60	0.24	ug/kg	1
Perfluoro-n-hexanoic acid (PFHxA)	307-24-4	PFAS by ID SOP	0.60	U	1.2	0.60	0.24	ug/kg	1
Perfluoro-n-nonanoic acid (PFNA)	375-95-1	PFAS by ID SOP	0.60	U	1.2	0.60	0.24	ug/kg	1
Perfluoro-n-octanoic acid (PFOA)	335-67-1	PFAS by ID SOP	0.60	U	1.2	0.60	0.24	ug/kg	1
Perfluoro-n-pentanoic acid (PFPeA)	2706-90-3	PFAS by ID SOP	0.60	U	1.2	0.60	0.24	ug/kg	1
Perfluoro-n-tetradecanoic acid (PFTeDA)	376-06-7	PFAS by ID SOP	0.60	U	1.2	0.60	0.24	ug/kg	1
Perfluoro-n-tridecanoic acid (PFTrDA)	72629-94-8	PFAS by ID SOP	0.60	U	1.2	0.60	0.24	ug/kg	1
Perfluoro-n-undecanoic acid (PFUdA)	2058-94-8	PFAS by ID SOP	0.60	U	1.2	0.60	0.24	ug/kg	1
Perfluorooctanesulfonic acid (PFOS)	**1763-23-1**	**PFAS by ID SOP**	**0.50**	**J**	**1.2**	0.60	**0.24**	**ug/kg**	**1**

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
13C2_4:2FTS		96	50-150
13C2_6:2FTS		100	50-150
13C2_8:2FTS		108	50-150
13C2_PFDoA		104	50-150
13C2_PFTeDA		99	50-150
13C3_PFBS		82	50-150
13C3_PFHxS		88	50-150
13C4_PFBA		94	50-150
13C4_PFHpA		98	50-150
13C5_PFHxA		96	50-150
13C5_PFPeA		98	50-150
13C6_PFDA		92	50-150
13C7_PFUdA		102	50-150
13C8_PFOA		92	50-150
13C8_PFOS		93	50-150
13C8_PFOSA		96	50-150
13C9_PFNA		94	50-150

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

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PFAS by LC/MS/MS

Client: **Arcadis U.S., Inc.**
Laboratory ID: **WF02026-006**
Description: **377-S-3**
Matrix: **Solid**
Date Sampled: **05/30/2021**
% Solids: **76.5** **06/03/2021 0023**
Date Received: **06/02/2021**

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
d5-EtFOSAA		100	50-150
d-MeFOSA		107	50-150
d3-MeFOSAA		93	50-150

LOQ = Limit of Quantitation	B = Detected in the method blank	E = Quantitation of compound exceeded the calibration range	DL = Detection Limit	Q = Surrogate failure
U = Not detected at or above the LOQ	N = Recovery is out of criteria	P = The RPD between two GC columns exceeds 40%	J = Estimated result < LOQ and ≥ DL	L = LCS/LCSD failure
H = Out of holding time	W = Reported on wet weight basis	LOD = Limit of Detection		S = MS/MSD failure

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PFAS by LC/MS/MS

Client: **Arcadis U.S., Inc.** Laboratory ID: **WF02026-007**

Description: **377-F-1** Matrix: **Solid**

Date Sampled: **05/30/2021** % Solids: **61.0** **06/03/2021 0023**

Date Received: **06/02/2021**

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch
1	SOP SPE	PFAS by ID SOP QSM B-15	1	06/04/2021 1527	JJG	06/03/2021 1117	94181

Parameter	CAS Number	Analytical Method	Result	Q	LOQ	LOD	DL	Units	Run
1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS)	39108-34-4	PFAS by ID SOP	1.5	U	2.9	1.5	0.73	ug/kg	1
1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS)	27619-97-2	PFAS by ID SOP	1.5	U	2.9	1.5	0.73	ug/kg	1
1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS)	757124-72-4	PFAS by ID SOP	1.5	U	2.9	1.5	0.73	ug/kg	1
N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA)	2991-50-6	PFAS by ID SOP	1.5	U	2.9	1.5	0.73	ug/kg	1
N-methylperfluoro-1-octanesulfonamide (MeFOSA)	31506-32-8	PFAS by ID SOP	1.5	U	2.9	1.5	0.73	ug/kg	1
N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA)	2355-31-9	PFAS by ID SOP	1.5	U	2.9	1.5	0.73	ug/kg	1
Perfluoro-1-butanesulfonic acid (PFBS)	375-73-5	PFAS by ID SOP	0.75	U	1.5	0.75	0.29	ug/kg	1
Perfluoro-1-decanesulfonic acid (PFDS)	335-77-3	PFAS by ID SOP	0.75	U	1.5	0.75	0.29	ug/kg	1
Perfluoro-1-heptanesulfonic acid (PFHpS)	375-92-8	PFAS by ID SOP	0.75	U	1.5	0.75	0.29	ug/kg	1
Perfluoro-1-nonanesulfonic acid (PFNS)	68259-12-1	PFAS by ID SOP	0.75	UL	1.5	0.75	0.29	ug/kg	1
Perfluoro-1-octanesulfonamide (PFOSA)	754-91-6	PFAS by ID SOP	0.75	U	1.5	0.75	0.29	ug/kg	1
Perfluoro-1-pentanesulfonic acid (PFPeS)	2706-91-4	PFAS by ID SOP	0.75	U	1.5	0.75	0.29	ug/kg	1
Perfluorohexanesulfonic acid (PFHxS)	355-46-4	PFAS by ID SOP	0.75	U	1.5	0.75	0.29	ug/kg	1
Perfluoro-n-butanoic acid (PFBA)	375-22-4	PFAS by ID SOP	0.75	U	1.5	0.75	0.29	ug/kg	1
Perfluoro-n-decanoic acid (PFDA)	335-76-2	PFAS by ID SOP	0.75	U	1.5	0.75	0.29	ug/kg	1
Perfluoro-n-dodecanoic acid (PFDoA)	307-55-1	PFAS by ID SOP	0.75	U	1.5	0.75	0.29	ug/kg	1
Perfluoro-n-heptanoic acid (PFHpA)	375-85-9	PFAS by ID SOP	0.75	U	1.5	0.75	0.29	ug/kg	1
Perfluoro-n-hexanoic acid (PFHxA)	307-24-4	PFAS by ID SOP	0.75	U	1.5	0.75	0.29	ug/kg	1
Perfluoro-n-nonanoic acid (PFNA)	375-95-1	PFAS by ID SOP	0.75	U	1.5	0.75	0.29	ug/kg	1
Perfluoro-n-octanoic acid (PFOA)	335-67-1	PFAS by ID SOP	0.75	U	1.5	0.75	0.29	ug/kg	1
Perfluoro-n-pentanoic acid (PFPeA)	2706-90-3	PFAS by ID SOP	0.75	U	1.5	0.75	0.29	ug/kg	1
Perfluoro-n-tetradecanoic acid (PFTeDA)	376-06-7	PFAS by ID SOP	0.75	U	1.5	0.75	0.29	ug/kg	1
Perfluoro-n-tridecanoic acid (PFTrDA)	72629-94-8	PFAS by ID SOP	0.75	U	1.5	0.75	0.29	ug/kg	1
Perfluoro-n-undecanoic acid (PFUdA)	2058-94-8	PFAS by ID SOP	0.75	U	1.5	0.75	0.29	ug/kg	1
Perfluorooctanesulfonic acid (PFOS)	**1763-23-1**	**PFAS by ID SOP**	**5.4**	**S**	**1.5**	0.75	**0.29**	**ug/kg**	**1**

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
13C2_4:2FTS		90	50-150
13C2_6:2FTS		84	50-150
13C2_8:2FTS		107	50-150
13C2_PFDoA		114	50-150
13C2_PFTeDA		94	50-150
13C3_PFBS		82	50-150
13C3_PFHxS		80	50-150
13C4_PFBA		87	50-150
13C4_PFHpA		94	50-150
13C5_PFHxA		91	50-150
13C5_PFPeA		91	50-150
13C6_PFDA		84	50-150
13C7_PFUdA		95	50-150
13C8_PFOA		89	50-150
13C8_PFOS		85	50-150
13C8_PFOSA		87	50-150
13C9_PFNA		91	50-150

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

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PFAS by LC/MS/MS

Client: **Arcadis U.S., Inc.**
Laboratory ID: **WF02026-007**
Description: **377-F-1**
Matrix: **Solid**
Date Sampled: **05/30/2021**
% Solids: **61.0** **06/03/2021 0023**
Date Received: **06/02/2021**

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
d5-EtFOSAA		102	50-150
d-MeFOSA		100	50-150
d3-MeFOSAA		89	50-150

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

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PFAS by LC/MS/MS

Client: **Arcadis U.S., Inc.** Laboratory ID: **WF02026-009**

Description: **379-R-1** Matrix: **Solid**

Date Sampled: **05/30/2021** % Solids: **98.6** **06/03/2021 0023**

Date Received: **06/02/2021**

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch
1	SOP SPE	PFAS by ID SOP QSM B-15	1	06/04/2021 1559	JJG	06/03/2021 1117	94181

Parameter	CAS Number	Analytical Method	Result	Q	LOQ	LOD	DL	Units	Run
1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS)	39108-34-4	PFAS by ID SOP	0.95	U	1.9	0.95	0.48	ug/kg	1
1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS)	27619-97-2	PFAS by ID SOP	0.95	U	1.9	0.95	0.48	ug/kg	1
1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS)	757124-72-4	PFAS by ID SOP	0.95	U	1.9	0.95	0.48	ug/kg	1
N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA)	2991-50-6	PFAS by ID SOP	0.95	U	1.9	0.95	0.48	ug/kg	1
N-methylperfluoro-1-octanesulfonamide (MeFOSA)	31506-32-8	PFAS by ID SOP	0.95	U	1.9	0.95	0.48	ug/kg	1
N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA)	2355-31-9	PFAS by ID SOP	0.95	U	1.9	0.95	0.48	ug/kg	1
Perfluoro-1-butanesulfonic acid (PFBS)	375-73-5	PFAS by ID SOP	0.48	U	0.96	0.48	0.19	ug/kg	1
Perfluoro-1-decanesulfonic acid (PFDS)	335-77-3	PFAS by ID SOP	0.48	U	0.96	0.48	0.19	ug/kg	1
Perfluoro-1-heptanesulfonic acid (PFHpS)	375-92-8	PFAS by ID SOP	0.48	U	0.96	0.48	0.19	ug/kg	1
Perfluoro-1-nonanesulfonic acid (PFNS)	68259-12-1	PFAS by ID SOP	0.48	UL	0.96	0.48	0.19	ug/kg	1
Perfluoro-1-octanesulfonamide (PFOSA)	754-91-6	PFAS by ID SOP	0.48	U	0.96	0.48	0.19	ug/kg	1
Perfluoro-1-pentanesulfonic acid (PFPeS)	2706-91-4	PFAS by ID SOP	0.48	U	0.96	0.48	0.19	ug/kg	1
Perfluorohexanesulfonic acid (PFHxS)	355-46-4	PFAS by ID SOP	0.48	U	0.96	0.48	0.19	ug/kg	1
Perfluoro-n-butanoic acid (PFBA)	375-22-4	PFAS by ID SOP	0.48	U	0.96	0.48	0.19	ug/kg	1
Perfluoro-n-decanoic acid (PFDA)	335-76-2	PFAS by ID SOP	0.48	U	0.96	0.48	0.19	ug/kg	1
Perfluoro-n-dodecanoic acid (PFDoA)	307-55-1	PFAS by ID SOP	0.48	U	0.96	0.48	0.19	ug/kg	1
Perfluoro-n-heptanoic acid (PFHpA)	375-85-9	PFAS by ID SOP	0.48	U	0.96	0.48	0.19	ug/kg	1
Perfluoro-n-hexanoic acid (PFHxA)	307-24-4	PFAS by ID SOP	0.48	U	0.96	0.48	0.19	ug/kg	1
Perfluoro-n-nonanoic acid (PFNA)	375-95-1	PFAS by ID SOP	0.48	U	0.96	0.48	0.19	ug/kg	1
Perfluoro-n-octanoic acid (PFOA)	335-67-1	PFAS by ID SOP	0.48	U	0.96	0.48	0.19	ug/kg	1
Perfluoro-n-pentanoic acid (PFPeA)	2706-90-3	PFAS by ID SOP	0.48	U	0.96	0.48	0.19	ug/kg	1
Perfluoro-n-tetradecanoic acid (PFTeDA)	376-06-7	PFAS by ID SOP	0.48	U	0.96	0.48	0.19	ug/kg	1
Perfluoro-n-tridecanoic acid (PFTrDA)	72629-94-8	PFAS by ID SOP	0.48	U	0.96	0.48	0.19	ug/kg	1
Perfluoro-n-undecanoic acid (PFUdA)	2058-94-8	PFAS by ID SOP	0.48	U	0.96	0.48	0.19	ug/kg	1
Perfluorooctanesulfonic acid (PFOS)	1763-23-1	PFAS by ID SOP	0.48	U	0.96	0.48	0.19	ug/kg	1

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
13C2_4:2FTS		91	50-150
13C2_6:2FTS		91	50-150
13C2_8:2FTS		98	50-150
13C2_PFDoA		93	50-150
13C2_PFTeDA		91	50-150
13C3_PFBS		83	50-150
13C3_PFHxS		87	50-150
13C4_PFBA		88	50-150
13C4_PFHpA		91	50-150
13C5_PFHxA		90	50-150
13C5_PFPeA		90	50-150
13C6_PFDA		83	50-150
13C7_PFUdA		89	50-150
13C8_PFOA		87	50-150
13C8_PFOS		85	50-150
13C8_PFOSA		91	50-150
13C9_PFNA		86	50-150

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

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PFAS by LC/MS/MS

Client: **Arcadis U.S., Inc.**
Laboratory ID: **WF02026-009**
Description: **379-R-1**
Matrix: **Solid**
Date Sampled: **05/30/2021**
% Solids: **98.6** **06/03/2021 0023**
Date Received: **06/02/2021**

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
d5-EtFOSAA		92	50-150
d-MeFOSA		92	50-150
d3-MeFOSAA		88	50-150

LOQ = Limit of Quantitation	B = Detected in the method blank	E = Quantitation of compound exceeded the calibration range	DL = Detection Limit	Q = Surrogate failure
U = Not detected at or above the LOQ	N = Recovery is out of criteria	P = The RPD between two GC columns exceeds 40%	J = Estimated result < LOQ and ≥ DL	L = LCS/LCSD failure
H = Out of holding time	W = Reported on wet weight basis	LOD = Limit of Detection		S = MS/MSD failure

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PFAS by LC/MS/MS

Client: **Arcadis U.S., Inc.** Laboratory ID: **WF02026-010**

Description: **379-R-2** Matrix: **Solid**

Date Sampled: **05/30/2021** % Solids: **98.2** **06/03/2021 0023**

Date Received: **06/02/2021**

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch
1	SOP SPE	PFAS by ID SOP QSM B-15	1	06/04/2021 1609	JJG	06/03/2021 1117	94181

Parameter	CAS Number	Analytical Method	Result	Q	LOQ	LOD	DL	Units	Run
1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS)	39108-34-4	PFAS by ID SOP	1.0	U	2.0	1.0	0.49	ug/kg	1
1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS)	27619-97-2	PFAS by ID SOP	1.0	U	2.0	1.0	0.49	ug/kg	1
1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS)	757124-72-4	PFAS by ID SOP	1.0	U	2.0	1.0	0.49	ug/kg	1
N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA)	2991-50-6	PFAS by ID SOP	1.0	U	2.0	1.0	0.49	ug/kg	1
N-methylperfluoro-1-octanesulfonamide (MeFOSA)	31506-32-8	PFAS by ID SOP	1.0	U	2.0	1.0	0.49	ug/kg	1
N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA)	2355-31-9	PFAS by ID SOP	1.0	U	2.0	1.0	0.49	ug/kg	1
Perfluoro-1-butanesulfonic acid (PFBS)	375-73-5	PFAS by ID SOP	0.49	U	0.98	0.49	0.20	ug/kg	1
Perfluoro-1-decanesulfonic acid (PFDS)	335-77-3	PFAS by ID SOP	0.49	U	0.98	0.49	0.20	ug/kg	1
Perfluoro-1-heptanesulfonic acid (PFHpS)	375-92-8	PFAS by ID SOP	0.49	U	0.98	0.49	0.20	ug/kg	1
Perfluoro-1-nonanesulfonic acid (PFNS)	68259-12-1	PFAS by ID SOP	0.49	UL	0.98	0.49	0.20	ug/kg	1
Perfluoro-1-octanesulfonamide (PFOSA)	754-91-6	PFAS by ID SOP	0.49	U	0.98	0.49	0.20	ug/kg	1
Perfluoro-1-pentanesulfonic acid (PFPeS)	2706-91-4	PFAS by ID SOP	0.49	U	0.98	0.49	0.20	ug/kg	1
Perfluorohexanesulfonic acid (PFHxS)	355-46-4	PFAS by ID SOP	0.49	U	0.98	0.49	0.20	ug/kg	1
Perfluoro-n-butanoic acid (PFBA)	375-22-4	PFAS by ID SOP	0.49	U	0.98	0.49	0.20	ug/kg	1
Perfluoro-n-decanoic acid (PFDA)	335-76-2	PFAS by ID SOP	0.49	U	0.98	0.49	0.20	ug/kg	1
Perfluoro-n-dodecanoic acid (PFDoA)	307-55-1	PFAS by ID SOP	0.49	U	0.98	0.49	0.20	ug/kg	1
Perfluoro-n-heptanoic acid (PFHpA)	375-85-9	PFAS by ID SOP	0.49	U	0.98	0.49	0.20	ug/kg	1
Perfluoro-n-hexanoic acid (PFHxA)	307-24-4	PFAS by ID SOP	0.49	U	0.98	0.49	0.20	ug/kg	1
Perfluoro-n-nonanoic acid (PFNA)	375-95-1	PFAS by ID SOP	0.49	U	0.98	0.49	0.20	ug/kg	1
Perfluoro-n-octanoic acid (PFOA)	335-67-1	PFAS by ID SOP	0.49	U	0.98	0.49	0.20	ug/kg	1
Perfluoro-n-pentanoic acid (PFPeA)	2706-90-3	PFAS by ID SOP	0.49	U	0.98	0.49	0.20	ug/kg	1
Perfluoro-n-tetradecanoic acid (PFTeDA)	376-06-7	PFAS by ID SOP	0.49	U	0.98	0.49	0.20	ug/kg	1
Perfluoro-n-tridecanoic acid (PFTrDA)	72629-94-8	PFAS by ID SOP	0.49	U	0.98	0.49	0.20	ug/kg	1
Perfluoro-n-undecanoic acid (PFUdA)	2058-94-8	PFAS by ID SOP	0.49	U	0.98	0.49	0.20	ug/kg	1
Perfluorooctanesulfonic acid (PFOS)	**1763-23-1**	**PFAS by ID SOP**	**0.50**	**J**	**0.98**	0.49	**0.20**	**ug/kg**	**1**

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
13C2_4:2FTS		90	50-150
13C2_6:2FTS		88	50-150
13C2_8:2FTS		95	50-150
13C2_PFDoA		84	50-150
13C2_PFTeDA		89	50-150
13C3_PFBS		77	50-150
13C3_PFHxS		81	50-150
13C4_PFBA		85	50-150
13C4_PFHpA		92	50-150
13C5_PFHxA		86	50-150
13C5_PFPeA		88	50-150
13C6_PFDA		82	50-150
13C7_PFUdA		87	50-150
13C8_PFOA		83	50-150
13C8_PFOS		84	50-150
13C8_PFOSA		83	50-150
13C9_PFNA		89	50-150

LOQ = Limit of Quantitation
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E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

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PFAS by LC/MS/MS

Client: **Arcadis U.S., Inc.**
Laboratory ID: **WF02026-010**
Description: **379-R-2**
Matrix: **Solid**
Date Sampled: **05/30/2021**
% Solids: **98.2** **06/03/2021 0023**
Date Received: **06/02/2021**

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
d5-EtFOSAA		93	50-150
d-MeFOSA		84	50-150
d3-MeFOSAA		86	50-150

LOQ = Limit of Quantitation	B = Detected in the method blank	E = Quantitation of compound exceeded the calibration range	DL = Detection Limit	Q = Surrogate failure
U = Not detected at or above the LOQ	N = Recovery is out of criteria	P = The RPD between two GC columns exceeds 40%	J = Estimated result < LOQ and ≥ DL	L = LCS/LCSD failure
H = Out of holding time	W = Reported on wet weight basis	LOD = Limit of Detection		S = MS/MSD failure

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PFAS by LC/MS/MS

Client: **Arcadis U.S., Inc.** Laboratory ID: **WF02026-011**

Description: **379-UT-1** Matrix: **Solid**

Date Sampled: **05/30/2021** % Solids: **79.6** **06/03/2021 0023**

Date Received: **06/02/2021**

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch
1	SOP SPE	PFAS by ID SOP QSM B-15	1	06/04/2021 1641	JJG	06/03/2021 1117	94181

Parameter	CAS Number	Analytical Method	Result	Q	LOQ	LOD	DL	Units	Run
1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS)	39108-34-4	PFAS by ID SOP	1.2	U	2.4	1.2	0.61	ug/kg	1
1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS)	27619-97-2	PFAS by ID SOP	1.2	U	2.4	1.2	0.61	ug/kg	1
1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS)	757124-72-4	PFAS by ID SOP	1.2	U	2.4	1.2	0.61	ug/kg	1
N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA)	2991-50-6	PFAS by ID SOP	1.2	U	2.4	1.2	0.61	ug/kg	1
N-methylperfluoro-1-octanesulfonamide (MeFOSA)	31506-32-8	PFAS by ID SOP	1.2	U	2.4	1.2	0.61	ug/kg	1
N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA)	2355-31-9	PFAS by ID SOP	1.2	U	2.4	1.2	0.61	ug/kg	1
Perfluoro-1-butanesulfonic acid (PFBS)	**375-73-5**	**PFAS by ID SOP**	**0.28**	**J**	**1.2**	0.60	**0.24**	**ug/kg**	**1**
Perfluoro-1-decanesulfonic acid (PFDS)	335-77-3	PFAS by ID SOP	0.60	U	1.2	0.60	0.24	ug/kg	1
Perfluoro-1-heptanesulfonic acid (PFHpS)	**375-92-8**	**PFAS by ID SOP**	**0.27**	**J**	**1.2**	0.60	**0.24**	**ug/kg**	**1**
Perfluoro-1-nonanesulfonic acid (PFNS)	68259-12-1	PFAS by ID SOP	0.60	UL	1.2	0.60	0.24	ug/kg	1
Perfluoro-1-octanesulfonamide (PFOSA)	754-91-6	PFAS by ID SOP	0.60	U	1.2	0.60	0.24	ug/kg	1
Perfluoro-1-pentanesulfonic acid (PFPeS)	**2706-91-4**	**PFAS by ID SOP**	**0.34**	**J**	**1.2**	0.60	**0.24**	**ug/kg**	**1**
Perfluorohexanesulfonic acid (PFHxS)	**355-46-4**	**PFAS by ID SOP**	**4.6**		**1.2**	0.60	**0.24**	**ug/kg**	**1**
Perfluoro-n-butanoic acid (PFBA)	375-22-4	PFAS by ID SOP	0.60	U	1.2	0.60	0.24	ug/kg	1
Perfluoro-n-decanoic acid (PFDA)	335-76-2	PFAS by ID SOP	0.60	U	1.2	0.60	0.24	ug/kg	1
Perfluoro-n-dodecanoic acid (PFDoA)	307-55-1	PFAS by ID SOP	0.60	U	1.2	0.60	0.24	ug/kg	1
Perfluoro-n-heptanoic acid (PFHpA)	**375-85-9**	**PFAS by ID SOP**	**0.27**	**J**	**1.2**	0.60	**0.24**	**ug/kg**	**1**
Perfluoro-n-hexanoic acid (PFHxA)	**307-24-4**	**PFAS by ID SOP**	**0.81**	**J**	**1.2**	0.60	**0.24**	**ug/kg**	**1**
Perfluoro-n-nonanoic acid (PFNA)	**375-95-1**	**PFAS by ID SOP**	**0.26**	**J**	**1.2**	0.60	**0.24**	**ug/kg**	**1**
Perfluoro-n-octanoic acid (PFOA)	**335-67-1**	**PFAS by ID SOP**	**0.45**	**J**	**1.2**	0.60	**0.24**	**ug/kg**	**1**
Perfluoro-n-pentanoic acid (PFPeA)	**2706-90-3**	**PFAS by ID SOP**	**0.71**	**J**	**1.2**	0.60	**0.24**	**ug/kg**	**1**
Perfluoro-n-tetradecanoic acid (PFTeDA)	376-06-7	PFAS by ID SOP	0.60	U	1.2	0.60	0.24	ug/kg	1
Perfluoro-n-tridecanoic acid (PFTrDA)	72629-94-8	PFAS by ID SOP	0.60	U	1.2	0.60	0.24	ug/kg	1
Perfluoro-n-undecanoic acid (PFUdA)	2058-94-8	PFAS by ID SOP	0.60	U	1.2	0.60	0.24	ug/kg	1
Perfluorooctanesulfonic acid (PFOS)	**1763-23-1**	**PFAS by ID SOP**	**59**		**1.2**	0.60	**0.24**	**ug/kg**	**1**

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
13C2_4:2FTS		96	50-150
13C2_6:2FTS		92	50-150
13C2_8:2FTS		97	50-150
13C2_PFDoA		91	50-150
13C2_PFTeDA		97	50-150
13C3_PFBS		85	50-150
13C3_PFHxS		90	50-150
13C4_PFBA		87	50-150
13C4_PFHpA		92	50-150
13C5_PFHxA		94	50-150
13C5_PFPeA		91	50-150
13C6_PFDA		86	50-150
13C7_PFUdA		94	50-150
13C8_PFOA		90	50-150
13C8_PFOS		90	50-150
13C8_PFOSA		91	50-150
13C9_PFNA		88	50-150

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

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PFAS by LC/MS/MS

Client: **Arcadis U.S., Inc.**
Laboratory ID: **WF02026-011**
Description: **379-UT-1**
Matrix: **Solid**
Date Sampled: **05/30/2021**
% Solids: **79.6** **06/03/2021 0023**
Date Received: **06/02/2021**

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
d5-EtFOSAA		99	50-150
d-MeFOSA		106	50-150
d3-MeFOSAA		93	50-150

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
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PFAS by LC/MS/MS

Client: **Arcadis U.S., Inc.** Laboratory ID: **WF02026-012**

Description: **379-S-1** Matrix: **Solid**

Date Sampled: **05/30/2021** % Solids: **73.8** **06/03/2021 0023**

Date Received: **06/02/2021**

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch
1	SOP SPE	PFAS by ID SOP QSM B-15	1	06/04/2021 1652	JJG	06/03/2021 1117	94181

Parameter	CAS Number	Analytical Method	Result	Q	LOQ	LOD	DL	Units	Run
1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS)	39108-34-4	PFAS by ID SOP	1.2	U	2.4	1.2	0.59	ug/kg	1
1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS)	27619-97-2	PFAS by ID SOP	1.2	U	2.4	1.2	0.59	ug/kg	1
1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS)	757124-72-4	PFAS by ID SOP	1.2	U	2.4	1.2	0.59	ug/kg	1
N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA)	2991-50-6	PFAS by ID SOP	1.2	U	2.4	1.2	0.59	ug/kg	1
N-methylperfluoro-1-octanesulfonamide (MeFOSA)	31506-32-8	PFAS by ID SOP	1.2	U	2.4	1.2	0.59	ug/kg	1
N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA)	2355-31-9	PFAS by ID SOP	1.2	U	2.4	1.2	0.59	ug/kg	1
Perfluoro-1-butanesulfonic acid (PFBS)	375-73-5	PFAS by ID SOP	0.60	U	1.2	0.60	0.24	ug/kg	1
Perfluoro-1-decanesulfonic acid (PFDS)	335-77-3	PFAS by ID SOP	0.60	U	1.2	0.60	0.24	ug/kg	1
Perfluoro-1-heptanesulfonic acid (PFHpS)	375-92-8	PFAS by ID SOP	0.60	U	1.2	0.60	0.24	ug/kg	1
Perfluoro-1-nonanesulfonic acid (PFNS)	68259-12-1	PFAS by ID SOP	0.60	UL	1.2	0.60	0.24	ug/kg	1
Perfluoro-1-octanesulfonamide (PFOSA)	754-91-6	PFAS by ID SOP	0.60	U	1.2	0.60	0.24	ug/kg	1
Perfluoro-1-pentanesulfonic acid (PFPeS)	2706-91-4	PFAS by ID SOP	0.60	U	1.2	0.60	0.24	ug/kg	1
Perfluorohexanesulfonic acid (PFHxS)	355-46-4	PFAS by ID SOP	0.60	U	1.2	0.60	0.24	ug/kg	1
Perfluoro-n-butanoic acid (PFBA)	375-22-4	PFAS by ID SOP	0.60	U	1.2	0.60	0.24	ug/kg	1
Perfluoro-n-decanoic acid (PFDA)	335-76-2	PFAS by ID SOP	0.60	U	1.2	0.60	0.24	ug/kg	1
Perfluoro-n-dodecanoic acid (PFDoA)	307-55-1	PFAS by ID SOP	0.60	U	1.2	0.60	0.24	ug/kg	1
Perfluoro-n-heptanoic acid (PFHpA)	375-85-9	PFAS by ID SOP	0.60	U	1.2	0.60	0.24	ug/kg	1
Perfluoro-n-hexanoic acid (PFHxA)	307-24-4	PFAS by ID SOP	0.60	U	1.2	0.60	0.24	ug/kg	1
Perfluoro-n-nonanoic acid (PFNA)	375-95-1	PFAS by ID SOP	0.60	U	1.2	0.60	0.24	ug/kg	1
Perfluoro-n-octanoic acid (PFOA)	335-67-1	PFAS by ID SOP	0.60	U	1.2	0.60	0.24	ug/kg	1
Perfluoro-n-pentanoic acid (PFPeA)	2706-90-3	PFAS by ID SOP	0.60	U	1.2	0.60	0.24	ug/kg	1
Perfluoro-n-tetradecanoic acid (PFTeDA)	376-06-7	PFAS by ID SOP	0.60	U	1.2	0.60	0.24	ug/kg	1
Perfluoro-n-tridecanoic acid (PFTrDA)	72629-94-8	PFAS by ID SOP	0.60	U	1.2	0.60	0.24	ug/kg	1
Perfluoro-n-undecanoic acid (PFUdA)	2058-94-8	PFAS by ID SOP	0.60	U	1.2	0.60	0.24	ug/kg	1
Perfluorooctanesulfonic acid (PFOS)	**1763-23-1**	**PFAS by ID SOP**	**1.3**		**1.2**	0.60	**0.24**	**ug/kg**	**1**

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
13C2_4:2FTS		90	50-150
13C2_6:2FTS		88	50-150
13C2_8:2FTS		92	50-150
13C2_PFDoA		94	50-150
13C2_PFTeDA		94	50-150
13C3_PFBS		80	50-150
13C3_PFHxS		80	50-150
13C4_PFBA		87	50-150
13C4_PFHpA		94	50-150
13C5_PFHxA		87	50-150
13C5_PFPeA		88	50-150
13C6_PFDA		80	50-150
13C7_PFUdA		89	50-150
13C8_PFOA		88	50-150
13C8_PFOS		91	50-150
13C8_PFOSA		85	50-150
13C9_PFNA		90	50-150

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

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PFAS by LC/MS/MS

Client: **Arcadis U.S., Inc.**
Laboratory ID: **WF02026-012**
Description: **379-S-1**
Matrix: **Solid**
Date Sampled: **05/30/2021**
% Solids: **73.8** **06/03/2021 0023**
Date Received: **06/02/2021**

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
d5-EtFOSAA		90	50-150
d-MeFOSA		87	50-150
d3-MeFOSAA		84	50-150

LOQ = Limit of Quantitation	B = Detected in the method blank	E = Quantitation of compound exceeded the calibration range	DL = Detection Limit	Q = Surrogate failure
U = Not detected at or above the LOQ	N = Recovery is out of criteria	P = The RPD between two GC columns exceeds 40%	J = Estimated result < LOQ and ≥ DL	L = LCS/LCSD failure
H = Out of holding time	W = Reported on wet weight basis	LOD = Limit of Detection		S = MS/MSD failure

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PFAS by LC/MS/MS

Client: **Arcadis U.S., Inc.** Laboratory ID: **WF02026-013**

Description: **379-S-2** Matrix: **Solid**

Date Sampled: **05/30/2021** % Solids: **74.2** **06/03/2021 0023**

Date Received: **06/02/2021**

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch
1	SOP SPE	PFAS by ID SOP QSM B-15	1	06/04/2021 1702	JJG	06/03/2021 1117	94181

Parameter	CAS Number	Analytical Method	Result	Q	LOQ	LOD	DL	Units	Run
1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS)	39108-34-4	PFAS by ID SOP	1.3	U	2.5	1.3	0.61	ug/kg	1
1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS)	**27619-97-2**	**PFAS by ID SOP**	**0.99**	**J**	**2.5**	1.3	**0.61**	**ug/kg**	**1**
1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS)	757124-72-4	PFAS by ID SOP	1.3	U	2.5	1.3	0.61	ug/kg	1
N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA)	2991-50-6	PFAS by ID SOP	1.3	U	2.5	1.3	0.61	ug/kg	1
N-methylperfluoro-1-octanesulfonamide (MeFOSA)	31506-32-8	PFAS by ID SOP	1.3	U	2.5	1.3	0.61	ug/kg	1
N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA)	2355-31-9	PFAS by ID SOP	1.3	U	2.5	1.3	0.61	ug/kg	1
Perfluoro-1-butanesulfonic acid (PFBS)	375-73-5	PFAS by ID SOP	0.60	U	1.2	0.60	0.25	ug/kg	1
Perfluoro-1-decanesulfonic acid (PFDS)	335-77-3	PFAS by ID SOP	0.60	U	1.2	0.60	0.25	ug/kg	1
Perfluoro-1-heptanesulfonic acid (PFHpS)	375-92-8	PFAS by ID SOP	0.60	U	1.2	0.60	0.25	ug/kg	1
Perfluoro-1-nonanesulfonic acid (PFNS)	68259-12-1	PFAS by ID SOP	0.60	UL	1.2	0.60	0.25	ug/kg	1
Perfluoro-1-octanesulfonamide (PFOSA)	754-91-6	PFAS by ID SOP	0.60	U	1.2	0.60	0.25	ug/kg	1
Perfluoro-1-pentanesulfonic acid (PFPeS)	2706-91-4	PFAS by ID SOP	0.60	U	1.2	0.60	0.25	ug/kg	1
Perfluorohexanesulfonic acid (PFHxS)	355-46-4	PFAS by ID SOP	0.60	U	1.2	0.60	0.25	ug/kg	1
Perfluoro-n-butanoic acid (PFBA)	375-22-4	PFAS by ID SOP	0.60	U	1.2	0.60	0.25	ug/kg	1
Perfluoro-n-decanoic acid (PFDA)	335-76-2	PFAS by ID SOP	0.60	U	1.2	0.60	0.25	ug/kg	1
Perfluoro-n-dodecanoic acid (PFDoA)	307-55-1	PFAS by ID SOP	0.60	U	1.2	0.60	0.25	ug/kg	1
Perfluoro-n-heptanoic acid (PFHpA)	375-85-9	PFAS by ID SOP	0.60	U	1.2	0.60	0.25	ug/kg	1
Perfluoro-n-hexanoic acid (PFHxA)	307-24-4	PFAS by ID SOP	0.60	U	1.2	0.60	0.25	ug/kg	1
Perfluoro-n-nonanoic acid (PFNA)	375-95-1	PFAS by ID SOP	0.60	U	1.2	0.60	0.25	ug/kg	1
Perfluoro-n-octanoic acid (PFOA)	335-67-1	PFAS by ID SOP	0.60	U	1.2	0.60	0.25	ug/kg	1
Perfluoro-n-pentanoic acid (PFPeA)	2706-90-3	PFAS by ID SOP	0.60	U	1.2	0.60	0.25	ug/kg	1
Perfluoro-n-tetradecanoic acid (PFTeDA)	376-06-7	PFAS by ID SOP	0.60	U	1.2	0.60	0.25	ug/kg	1
Perfluoro-n-tridecanoic acid (PFTrDA)	72629-94-8	PFAS by ID SOP	0.60	U	1.2	0.60	0.25	ug/kg	1
Perfluoro-n-undecanoic acid (PFUdA)	2058-94-8	PFAS by ID SOP	0.60	U	1.2	0.60	0.25	ug/kg	1
Perfluorooctanesulfonic acid (PFOS)	**1763-23-1**	**PFAS by ID SOP**	**1.4**		**1.2**	0.60	**0.25**	**ug/kg**	**1**

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
13C2_4:2FTS		95	50-150
13C2_6:2FTS		97	50-150
13C2_8:2FTS		97	50-150
13C2_PFDoA		92	50-150
13C2_PFTeDA		95	50-150
13C3_PFBS		85	50-150
13C3_PFHxS		87	50-150
13C4_PFBA		91	50-150
13C4_PFHpA		95	50-150
13C5_PFHxA		91	50-150
13C5_PFPeA		92	50-150
13C6_PFDA		85	50-150
13C7_PFUdA		89	50-150
13C8_PFOA		88	50-150
13C8_PFOS		91	50-150
13C8_PFOSA		94	50-150
13C9_PFNA		91	50-150

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

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PFAS by LC/MS/MS

Client: **Arcadis U.S., Inc.**
Laboratory ID: **WF02026-013**
Description: **379-S-2**
Matrix: **Solid**
Date Sampled: **05/30/2021**
% Solids: **74.2** **06/03/2021 0023**
Date Received: **06/02/2021**

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
d5-EtFOSAA		97	50-150
d-MeFOSA		92	50-150
d3-MeFOSAA		94	50-150

LOQ = Limit of Quantitation	B = Detected in the method blank	E = Quantitation of compound exceeded the calibration range	DL = Detection Limit	Q = Surrogate failure
U = Not detected at or above the LOQ	N = Recovery is out of criteria	P = The RPD between two GC columns exceeds 40%	J = Estimated result < LOQ and ≥ DL	L = LCS/LCSD failure
H = Out of holding time	W = Reported on wet weight basis	LOD = Limit of Detection		S = MS/MSD failure

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PFAS by LC/MS/MS

Client: **Arcadis U.S., Inc.** Laboratory ID: **WF02026-014**

Description: **379-S-3** Matrix: **Solid**

Date Sampled: **05/30/2021** % Solids: **80.1** **06/03/2021 0023**

Date Received: **06/02/2021**

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch
1	SOP SPE	PFAS by ID SOP QSM B-15	1	06/04/2021 1713	JJG	06/03/2021 1117	94181

Parameter	CAS Number	Analytical Method	Result	Q	LOQ	LOD	DL	Units	Run
1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS)	39108-34-4	PFAS by ID SOP	1.1	U	2.2	1.1	0.56	ug/kg	1
1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS)	27619-97-2	PFAS by ID SOP	1.1	U	2.2	1.1	0.56	ug/kg	1
1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS)	757124-72-4	PFAS by ID SOP	1.1	U	2.2	1.1	0.56	ug/kg	1
N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA)	2991-50-6	PFAS by ID SOP	1.1	U	2.2	1.1	0.56	ug/kg	1
N-methylperfluoro-1-octanesulfonamide (MeFOSA)	31506-32-8	PFAS by ID SOP	1.1	U	2.2	1.1	0.56	ug/kg	1
N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA)	2355-31-9	PFAS by ID SOP	1.1	U	2.2	1.1	0.56	ug/kg	1
Perfluoro-1-butanesulfonic acid (PFBS)	375-73-5	PFAS by ID SOP	0.55	U	1.1	0.55	0.22	ug/kg	1
Perfluoro-1-decanesulfonic acid (PFDS)	335-77-3	PFAS by ID SOP	0.55	U	1.1	0.55	0.22	ug/kg	1
Perfluoro-1-heptanesulfonic acid (PFHpS)	375-92-8	PFAS by ID SOP	0.55	U	1.1	0.55	0.22	ug/kg	1
Perfluoro-1-nonanesulfonic acid (PFNS)	68259-12-1	PFAS by ID SOP	0.55	UL	1.1	0.55	0.22	ug/kg	1
Perfluoro-1-octanesulfonamide (PFOSA)	754-91-6	PFAS by ID SOP	0.55	U	1.1	0.55	0.22	ug/kg	1
Perfluoro-1-pentanesulfonic acid (PFPeS)	2706-91-4	PFAS by ID SOP	0.55	U	1.1	0.55	0.22	ug/kg	1
Perfluorohexanesulfonic acid (PFHxS)	355-46-4	PFAS by ID SOP	0.55	U	1.1	0.55	0.22	ug/kg	1
Perfluoro-n-butanoic acid (PFBA)	375-22-4	PFAS by ID SOP	0.55	U	1.1	0.55	0.22	ug/kg	1
Perfluoro-n-decanoic acid (PFDA)	335-76-2	PFAS by ID SOP	0.55	U	1.1	0.55	0.22	ug/kg	1
Perfluoro-n-dodecanoic acid (PFDoA)	307-55-1	PFAS by ID SOP	0.55	U	1.1	0.55	0.22	ug/kg	1
Perfluoro-n-heptanoic acid (PFHpA)	375-85-9	PFAS by ID SOP	0.55	U	1.1	0.55	0.22	ug/kg	1
Perfluoro-n-hexanoic acid (PFHxA)	307-24-4	PFAS by ID SOP	0.55	U	1.1	0.55	0.22	ug/kg	1
Perfluoro-n-nonanoic acid (PFNA)	375-95-1	PFAS by ID SOP	0.55	U	1.1	0.55	0.22	ug/kg	1
Perfluoro-n-octanoic acid (PFOA)	335-67-1	PFAS by ID SOP	0.55	U	1.1	0.55	0.22	ug/kg	1
Perfluoro-n-pentanoic acid (PFPeA)	2706-90-3	PFAS by ID SOP	0.55	U	1.1	0.55	0.22	ug/kg	1
Perfluoro-n-tetradecanoic acid (PFTeDA)	376-06-7	PFAS by ID SOP	0.55	U	1.1	0.55	0.22	ug/kg	1
Perfluoro-n-tridecanoic acid (PFTrDA)	72629-94-8	PFAS by ID SOP	0.55	U	1.1	0.55	0.22	ug/kg	1
Perfluoro-n-undecanoic acid (PFUdA)	2058-94-8	PFAS by ID SOP	0.55	U	1.1	0.55	0.22	ug/kg	1
Perfluorooctanesulfonic acid (PFOS)	**1763-23-1**	**PFAS by ID SOP**	**0.42**	**J**	**1.1**	0.55	**0.22**	**ug/kg**	**1**

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
13C2_4:2FTS		93	50-150
13C2_6:2FTS		97	50-150
13C2_8:2FTS		95	50-150
13C2_PFDoA		94	50-150
13C2_PFTeDA		92	50-150
13C3_PFBS		83	50-150
13C3_PFHxS		85	50-150
13C4_PFBA		89	50-150
13C4_PFHpA		96	50-150
13C5_PFHxA		92	50-150
13C5_PFPeA		90	50-150
13C6_PFDA		86	50-150
13C7_PFUdA		89	50-150
13C8_PFOA		91	50-150
13C8_PFOS		90	50-150
13C8_PFOSA		87	50-150
13C9_PFNA		89	50-150

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

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PFAS by LC/MS/MS

Client: **Arcadis U.S., Inc.**
Laboratory ID: **WF02026-014**
Description: **379-S-3**
Matrix: **Solid**
Date Sampled: **05/30/2021**
% Solids: **80.1** **06/03/2021 0023**
Date Received: **06/02/2021**

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
d5-EtFOSAA		98	50-150
d-MeFOSA		93	50-150
d3-MeFOSAA		89	50-150

LOQ = Limit of Quantitation	B = Detected in the method blank	E = Quantitation of compound exceeded the calibration range	DL = Detection Limit	Q = Surrogate failure
U = Not detected at or above the LOQ	N = Recovery is out of criteria	P = The RPD between two GC columns exceeds 40%	J = Estimated result < LOQ and ≥ DL	L = LCS/LCSD failure
H = Out of holding time	W = Reported on wet weight basis	LOD = Limit of Detection		S = MS/MSD failure

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PFAS by LC/MS/MS

Client: **Arcadis U.S., Inc.** Laboratory ID: **WF02026-015**

Description: **379-F-1** Matrix: **Solid**

Date Sampled: **05/30/2021** % Solids: **63.8** **06/03/2021 0023**

Date Received: **06/02/2021**

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch
2	SOP SPE	PFAS by ID SOP QSM B-15	1	06/12/2021 1934	JJG	06/10/2021 1837	95164

Parameter	CAS Number	Analytical Method	Result	Q	LOQ	LOD	DL	Units	Run
1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS)	39108-34-4	PFAS by ID SOP	1.4	U	2.7	1.4	0.67	ug/kg	2
1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS)	27619-97-2	PFAS by ID SOP	1.4	U	2.7	1.4	0.67	ug/kg	2
1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS)	757124-72-4	PFAS by ID SOP	1.4	U	2.7	1.4	0.67	ug/kg	2
N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA)	2991-50-6	PFAS by ID SOP	1.4	U	2.7	1.4	0.67	ug/kg	2
N-methylperfluoro-1-octanesulfonamide (MeFOSA)	31506-32-8	PFAS by ID SOP	1.4	U	2.7	1.4	0.67	ug/kg	2
N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA)	2355-31-9	PFAS by ID SOP	1.4	U	2.7	1.4	0.67	ug/kg	2
Perfluoro-1-butanesulfonic acid (PFBS)	375-73-5	PFAS by ID SOP	0.65	U	1.3	0.65	0.27	ug/kg	2
Perfluoro-1-decanesulfonic acid (PFDS)	335-77-3	PFAS by ID SOP	0.65	U	1.3	0.65	0.27	ug/kg	2
Perfluoro-1-heptanesulfonic acid (PFHpS)	375-92-8	PFAS by ID SOP	0.65	U	1.3	0.65	0.27	ug/kg	2
Perfluoro-1-nonanesulfonic acid (PFNS)	68259-12-1	PFAS by ID SOP	0.65	U	1.3	0.65	0.27	ug/kg	2
Perfluoro-1-octanesulfonamide (PFOSA)	754-91-6	PFAS by ID SOP	0.65	U	1.3	0.65	0.27	ug/kg	2
Perfluoro-1-pentanesulfonic acid (PFPeS)	2706-91-4	PFAS by ID SOP	0.65	U	1.3	0.65	0.27	ug/kg	2
Perfluorohexanesulfonic acid (PFHxS)	**355-46-4**	**PFAS by ID SOP**	**1.2**	**J**	**1.3**	0.65	**0.27**	**ug/kg**	**2**
Perfluoro-n-butanoic acid (PFBA)	375-22-4	PFAS by ID SOP	0.65	U	1.3	0.65	0.27	ug/kg	2
Perfluoro-n-decanoic acid (PFDA)	335-76-2	PFAS by ID SOP	0.65	U	1.3	0.65	0.27	ug/kg	2
Perfluoro-n-dodecanoic acid (PFDoA)	307-55-1	PFAS by ID SOP	0.65	U	1.3	0.65	0.27	ug/kg	2
Perfluoro-n-heptanoic acid (PFHpA)	375-85-9	PFAS by ID SOP	0.65	U	1.3	0.65	0.27	ug/kg	2
Perfluoro-n-hexanoic acid (PFHxA)	307-24-4	PFAS by ID SOP	0.65	U	1.3	0.65	0.27	ug/kg	2
Perfluoro-n-nonanoic acid (PFNA)	375-95-1	PFAS by ID SOP	0.65	U	1.3	0.65	0.27	ug/kg	2
Perfluoro-n-octanoic acid (PFOA)	335-67-1	PFAS by ID SOP	0.65	U	1.3	0.65	0.27	ug/kg	2
Perfluoro-n-pentanoic acid (PFPeA)	2706-90-3	PFAS by ID SOP	0.65	U	1.3	0.65	0.27	ug/kg	2
Perfluoro-n-tetradecanoic acid (PFTeDA)	376-06-7	PFAS by ID SOP	0.65	U	1.3	0.65	0.27	ug/kg	2
Perfluoro-n-tridecanoic acid (PFTrDA)	72629-94-8	PFAS by ID SOP	0.65	U	1.3	0.65	0.27	ug/kg	2
Perfluoro-n-undecanoic acid (PFUdA)	2058-94-8	PFAS by ID SOP	0.65	U	1.3	0.65	0.27	ug/kg	2
Perfluorooctanesulfonic acid (PFOS)	**1763-23-1**	**PFAS by ID SOP**	**12**		**1.3**	0.65	**0.27**	**ug/kg**	**2**

Surrogate	Q	Run 2 % Recovery	Acceptance Limits
13C2_4:2FTS		85	50-150
13C2_6:2FTS		106	50-150
13C2_8:2FTS		100	50-150
13C2_PFDoA		69	50-150
13C2_PFTeDA		87	50-150
13C3_PFBS		90	50-150
13C3_PFHxS		85	50-150
13C4_PFBA		90	50-150
13C4_PFHpA		95	50-150
13C5_PFHxA		89	50-150
13C5_PFPeA		85	50-150
13C6_PFDA		92	50-150
13C7_PFUdA		109	50-150
13C8_PFOA		91	50-150
13C8_PFOS		87	50-150
13C8_PFOSA		100	50-150
13C9_PFNA		86	50-150

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

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PFAS by LC/MS/MS

Client: **Arcadis U.S., Inc.**
Laboratory ID: **WF02026-015**
Description: **379-F-1**
Matrix: **Solid**
Date Sampled: **05/30/2021**
% Solids: **63.8** **06/03/2021 0023**
Date Received: **06/02/2021**

Surrogate	Q	Run 2 % Recovery	Acceptance Limits
d5-EtFOSAA		131	50-150
d-MeFOSA		82	50-150
d3-MeFOSAA		107	50-150

LOQ = Limit of Quantitation	B = Detected in the method blank	E = Quantitation of compound exceeded the calibration range	DL = Detection Limit	Q = Surrogate failure
U = Not detected at or above the LOQ	N = Recovery is out of criteria	P = The RPD between two GC columns exceeds 40%	J = Estimated result < LOQ and ≥ DL	L = LCS/LCSD failure
H = Out of holding time	W = Reported on wet weight basis	LOD = Limit of Detection		S = MS/MSD failure

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PFAS by LC/MS/MS

Client: **Arcadis U.S., Inc.** Laboratory ID: **WF02026-016**

Description: **379-F-2** Matrix: **Solid**

Date Sampled: **05/30/2021** % Solids: **59.2** **06/03/2021 0023**

Date Received: **06/02/2021**

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch
1	SOP SPE	PFAS by ID SOP QSM B-15	1	06/04/2021 1735	JJG	06/03/2021 1117	94181

Parameter	CAS Number	Analytical Method	Result	Q	LOQ	LOD	DL	Units	Run
1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS)	39108-34-4	PFAS by ID SOP	1.5	U	2.9	1.5	0.73	ug/kg	1
1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS)	27619-97-2	PFAS by ID SOP	1.5	U	2.9	1.5	0.73	ug/kg	1
1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS)	757124-72-4	PFAS by ID SOP	1.5	U	2.9	1.5	0.73	ug/kg	1
N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA)	2991-50-6	PFAS by ID SOP	1.5	U	2.9	1.5	0.73	ug/kg	1
N-methylperfluoro-1-octanesulfonamide (MeFOSA)	31506-32-8	PFAS by ID SOP	1.5	U	2.9	1.5	0.73	ug/kg	1
N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA)	2355-31-9	PFAS by ID SOP	1.5	U	2.9	1.5	0.73	ug/kg	1
Perfluoro-1-butanesulfonic acid (PFBS)	375-73-5	PFAS by ID SOP	0.75	U	1.5	0.75	0.29	ug/kg	1
Perfluoro-1-decanesulfonic acid (PFDS)	335-77-3	PFAS by ID SOP	0.75	U	1.5	0.75	0.29	ug/kg	1
Perfluoro-1-heptanesulfonic acid (PFHpS)	375-92-8	PFAS by ID SOP	0.75	U	1.5	0.75	0.29	ug/kg	1
Perfluoro-1-nonanesulfonic acid (PFNS)	68259-12-1	PFAS by ID SOP	0.75	UL	1.5	0.75	0.29	ug/kg	1
Perfluoro-1-octanesulfonamide (PFOSA)	754-91-6	PFAS by ID SOP	0.75	U	1.5	0.75	0.29	ug/kg	1
Perfluoro-1-pentanesulfonic acid (PFPeS)	2706-91-4	PFAS by ID SOP	0.75	U	1.5	0.75	0.29	ug/kg	1
Perfluorohexanesulfonic acid (PFHxS)	**355-46-4**	**PFAS by ID SOP**	**1.3**	**J**	**1.5**	0.75	**0.29**	**ug/kg**	**1**
Perfluoro-n-butanoic acid (PFBA)	375-22-4	PFAS by ID SOP	0.75	U	1.5	0.75	0.29	ug/kg	1
Perfluoro-n-decanoic acid (PFDA)	335-76-2	PFAS by ID SOP	0.75	U	1.5	0.75	0.29	ug/kg	1
Perfluoro-n-dodecanoic acid (PFDoA)	307-55-1	PFAS by ID SOP	0.75	U	1.5	0.75	0.29	ug/kg	1
Perfluoro-n-heptanoic acid (PFHpA)	375-85-9	PFAS by ID SOP	0.75	U	1.5	0.75	0.29	ug/kg	1
Perfluoro-n-hexanoic acid (PFHxA)	307-24-4	PFAS by ID SOP	0.75	U	1.5	0.75	0.29	ug/kg	1
Perfluoro-n-nonanoic acid (PFNA)	375-95-1	PFAS by ID SOP	0.75	U	1.5	0.75	0.29	ug/kg	1
Perfluoro-n-octanoic acid (PFOA)	335-67-1	PFAS by ID SOP	0.75	U	1.5	0.75	0.29	ug/kg	1
Perfluoro-n-pentanoic acid (PFPeA)	2706-90-3	PFAS by ID SOP	0.75	U	1.5	0.75	0.29	ug/kg	1
Perfluoro-n-tetradecanoic acid (PFTeDA)	376-06-7	PFAS by ID SOP	0.75	U	1.5	0.75	0.29	ug/kg	1
Perfluoro-n-tridecanoic acid (PFTrDA)	72629-94-8	PFAS by ID SOP	0.75	U	1.5	0.75	0.29	ug/kg	1
Perfluoro-n-undecanoic acid (PFUdA)	2058-94-8	PFAS by ID SOP	0.75	U	1.5	0.75	0.29	ug/kg	1
Perfluorooctanesulfonic acid (PFOS)	**1763-23-1**	**PFAS by ID SOP**	**9.6**		**1.5**	0.75	**0.29**	**ug/kg**	**1**

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
13C2_4:2FTS		95	50-150
13C2_6:2FTS		96	50-150
13C2_8:2FTS		102	50-150
13C2_PFDoA		61	50-150
13C2_PFTeDA		90	50-150
13C3_PFBS		89	50-150
13C3_PFHxS		85	50-150
13C4_PFBA		87	50-150
13C4_PFHpA		96	50-150
13C5_PFHxA		87	50-150
13C5_PFPeA		87	50-150
13C6_PFDA		84	50-150
13C7_PFUdA		101	50-150
13C8_PFOA		86	50-150
13C8_PFOS		96	50-150
13C8_PFOSA		92	50-150
13C9_PFNA		92	50-150

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

PFAS by LC/MS/MS

Client: **Arcadis U.S., Inc.**
Laboratory ID: **WF02026-016**
Description: **379-F-2**
Matrix: **Solid**
Date Sampled: **05/30/2021**
% Solids: **59.2** **06/03/2021 0023**
Date Received: **06/02/2021**

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
d5-EtFOSAA		125	50-150
d-MeFOSA		91	50-150
d3-MeFOSAA		104	50-150

LOQ = Limit of Quantitation	B = Detected in the method blank	E = Quantitation of compound exceeded the calibration range	DL = Detection Limit	Q = Surrogate failure
U = Not detected at or above the LOQ	N = Recovery is out of criteria	P = The RPD between two GC columns exceeds 40%	J = Estimated result < LOQ and ≥ DL	L = LCS/LCSD failure
H = Out of holding time	W = Reported on wet weight basis	LOD = Limit of Detection		S = MS/MSD failure

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QC Summary

PFAS by LC/MS/MS - MB

Sample ID: WQ94181-001
Batch: 94181
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Solid
Prep Method: SOP SPE
Prep Date: 06/03/2021 1117

Parameter	Result	Q	Dil	LOQ	LOD	DL	Units	Analysis Date
8:2 FTS	1.0	U	1	2.0	1.0	0.50	ug/kg	06/04/2021 1351
6:2 FTS	1.0	U	1	2.0	1.0	0.50	ug/kg	06/04/2021 1351
4:2 FTS	1.0	U	1	2.0	1.0	0.50	ug/kg	06/04/2021 1351
EtFOSAA	1.0	U	1	2.0	1.0	0.50	ug/kg	06/04/2021 1351
MeFOSA	1.0	U	1	2.0	1.0	0.50	ug/kg	06/04/2021 1351
MeFOSAA	1.0	U	1	2.0	1.0	0.50	ug/kg	06/04/2021 1351
PFBS	0.50	U	1	1.0	0.50	0.20	ug/kg	06/04/2021 1351
PFDS	0.50	U	1	1.0	0.50	0.20	ug/kg	06/04/2021 1351
PFHpS	0.50	U	1	1.0	0.50	0.20	ug/kg	06/04/2021 1351
PFNS	0.50	U	1	1.0	0.50	0.20	ug/kg	06/04/2021 1351
PFOSA	0.50	U	1	1.0	0.50	0.20	ug/kg	06/04/2021 1351
PFPeS	0.50	U	1	1.0	0.50	0.20	ug/kg	06/04/2021 1351
PFHxS	0.50	U	1	1.0	0.50	0.20	ug/kg	06/04/2021 1351
PFBA	0.50	U	1	1.0	0.50	0.20	ug/kg	06/04/2021 1351
PFDA	0.50	U	1	1.0	0.50	0.20	ug/kg	06/04/2021 1351
PFDoA	0.50	U	1	1.0	0.50	0.20	ug/kg	06/04/2021 1351
PFHpA	0.50	U	1	1.0	0.50	0.20	ug/kg	06/04/2021 1351
PFHxA	0.50	U	1	1.0	0.50	0.20	ug/kg	06/04/2021 1351
PFNA	0.50	U	1	1.0	0.50	0.20	ug/kg	06/04/2021 1351
PFOA	0.50	U	1	1.0	0.50	0.20	ug/kg	06/04/2021 1351
PFPeA	0.50	U	1	1.0	0.50	0.20	ug/kg	06/04/2021 1351
PFTeDA	0.50	U	1	1.0	0.50	0.20	ug/kg	06/04/2021 1351
PFTrDA	0.50	U	1	1.0	0.50	0.20	ug/kg	06/04/2021 1351
PFUdA	0.50	U	1	1.0	0.50	0.20	ug/kg	06/04/2021 1351
PFOS	0.50	U	1	1.0	0.50	0.20	ug/kg	06/04/2021 1351

Surrogate	Q	% Rec	Acceptance Limit
13C2_4:2FTS		103	50-150
13C2_6:2FTS		97	50-150
13C2_8:2FTS		95	50-150
13C2_PFDoA		92	50-150
13C2_PFTeDA		89	50-150
13C3_PFBS		84	50-150
13C3_PFHxS		91	50-150
13C4_PFBA		90	50-150
13C4_PFHpA		93	50-150
13C5_PFHxA		92	50-150
13C5_PFPeA		90	50-150
13C6_PFDA		89	50-150
13C7_PFUdA		92	50-150
13C8_PFOA		88	50-150

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

PFAS by LC/MS/MS - MB

Sample ID: WQ94181-001
Batch: 94181
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Solid
Prep Method: SOP SPE
Prep Date: 06/03/2021 1117

Surrogate	Q	% Rec	Acceptance Limit
13C8_PFOS		92	50-150
13C8_PFOSA		90	50-150
13C9_PFNA		93	50-150
d5-EtFOSAA		88	50-150
d-MeFOSA		96	50-150
d3-MeFOSAA		85	50-150

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

PFAS by LC/MS/MS - LCS

Sample ID: WQ94181-002 **Matrix:** Solid
Batch: 94181 **Prep Method:** SOP SPE
Analytical Method: PFAS by ID SOP QSM B-15 **Prep Date:** 06/03/2021 1117

Parameter	Spike Amount (ug/kg)	Result (ug/kg)	Q	Dil	% Rec	%Rec Limit	Analysis Date
8:2 FTS	1.9	1.5		1	80	65-137	06/04/2021 1401
6:2 FTS	1.9	2.0		1	105	64-140	06/04/2021 1401
4:2 FTS	1.9	1.9		1	105	62-145	06/04/2021 1401
EtFOSAA	2.0	2.0		1	101	61-139	06/04/2021 1401
MeFOSA	2.0	1.8		1	88	70-150	06/04/2021 1401
MeFOSAA	2.0	1.8		1	91	63-144	06/04/2021 1401
PFBS	1.8	1.6		1	91	72-128	06/04/2021 1401
PFDS	1.9	2.1		1	108	59-134	06/04/2021 1401
PFHpS	1.9	2.2		1	116	70-132	06/04/2021 1401
PFNS	1.9	2.5	N	1	131	69-125	06/04/2021 1401
PFOSA	2.0	1.9		1	96	67-137	06/04/2021 1401
PFPeS	1.9	1.9		1	104	73-123	06/04/2021 1401
PFHxS	1.8	1.9		1	102	67-130	06/04/2021 1401
PFBA	2.0	2.0		1	98	71-135	06/04/2021 1401
PFDA	2.0	1.9		1	95	69-133	06/04/2021 1401
PFDoA	2.0	1.9		1	97	69-135	06/04/2021 1401
PFHpA	2.0	2.0		1	101	71-131	06/04/2021 1401
PFHxA	2.0	2.0		1	102	70-132	06/04/2021 1401
PFNA	2.0	2.0		1	102	72-129	06/04/2021 1401
PFOA	2.0	2.0		1	100	69-133	06/04/2021 1401
PFPeA	2.0	2.1		1	103	69-132	06/04/2021 1401
PFTeDA	2.0	2.0		1	100	69-133	06/04/2021 1401
PFTrDA	2.0	2.1		1	107	66-139	06/04/2021 1401
PFUdA	2.0	2.0		1	102	64-136	06/04/2021 1401
PFOS	1.9	2.1		1	111	68-136	06/04/2021 1401

Surrogate	Q	% Rec	Acceptance Limit
13C2_4:2FTS		86	50-150
13C2_6:2FTS		91	50-150
13C2_8:2FTS		91	50-150
13C2_PFDoA		85	50-150
13C2_PFTeDA		89	50-150
13C3_PFBS		85	50-150
13C3_PFHxS		84	50-150
13C4_PFBA		86	50-150
13C4_PFHpA		87	50-150
13C5_PFHxA		87	50-150
13C5_PFPeA		86	50-150
13C6_PFDA		83	50-150
13C7_PFUdA		91	50-150
13C8_PFOA		87	50-150

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
N = Recovery is out of criteria
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
* = RSD is out of criteria
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

PFAS by LC/MS/MS - LCS

Sample ID: WQ94181-002
Batch: 94181
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Solid
Prep Method: SOP SPE
Prep Date: 06/03/2021 1117

Surrogate	Q	% Rec	Acceptance Limit
13C8_PFOS		84	50-150
13C8_PFOSA		85	50-150
13C9_PFNA		90	50-150
d5-EtFOSAA		92	50-150
d-MeFOSA		97	50-150
d3-MeFOSAA		83	50-150

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

PFAS by LC/MS/MS - MS

Sample ID: WF02026-007MS
Batch: 94181
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Solid
Prep Method: SOP SPE
Prep Date: 06/03/2021 1117

Parameter	Sample Amount (ug/kg)	Spike Amount (ug/kg)	Result (ug/kg)	Q	Dil	% Rec	%Rec Limit	Analysis Date
8:2 FTS	ND	2.8	2.7		1	99	65-137	06/04/2021 1537
6:2 FTS	ND	2.7	2.6		1	96	64-140	06/04/2021 1537
4:2 FTS	ND	2.7	2.5		1	92	62-145	06/04/2021 1537
EtFOSAA	ND	2.9	2.9		1	101	61-139	06/04/2021 1537
MeFOSA	ND	2.9	2.1		1	74	70-150	06/04/2021 1537
MeFOSAA	ND	2.9	3.0		1	105	63-144	06/04/2021 1537
PFBS	ND	2.6	2.4		1	94	72-128	06/04/2021 1537
PFDS	ND	2.8	3.0		1	108	59-134	06/04/2021 1537
PFHpS	ND	2.8	2.7		1	97	70-132	06/04/2021 1537
PFNS	ND	2.8	2.3		1	85	69-125	06/04/2021 1537
PFOSA	ND	2.9	2.8		1	96	67-137	06/04/2021 1537
PFPeS	ND	2.7	2.9		1	107	73-123	06/04/2021 1537
PFHxS	ND	2.6	3.0		1	112	67-130	06/04/2021 1537
PFBA	ND	2.9	2.8		1	99	71-135	06/04/2021 1537
PFDA	ND	2.9	2.5		1	85	69-133	06/04/2021 1537
PFDoA	ND	2.9	2.9		1	101	69-135	06/04/2021 1537
PFHpA	ND	2.9	3.1		1	107	71-131	06/04/2021 1537
PFHxA	ND	2.9	2.7		1	95	70-132	06/04/2021 1537
PFNA	ND	2.9	2.8		1	98	72-129	06/04/2021 1537
PFOA	ND	2.9	2.8		1	96	69-133	06/04/2021 1537
PFPeA	ND	2.9	2.8		1	96	69-132	06/04/2021 1537
PFTeDA	ND	2.9	3.0		1	104	69-133	06/04/2021 1537
PFTrDA	ND	2.9	2.6		1	90	66-139	06/04/2021 1537
PFUdA	ND	2.9	2.7		1	93	64-136	06/04/2021 1537
PFOS	5.4	2.7	6.5	N	1	40	68-136	06/04/2021 1537

Surrogate	Q	% Rec	Acceptance Limit
13C2_4:2FTS		99	50-150
13C2_6:2FTS		98	50-150
13C2_8:2FTS		103	50-150
13C2_PFDoA		111	50-150
13C2_PFTeDA		99	50-150
13C3_PFBS		91	50-150
13C3_PFHxS		91	50-150
13C4_PFBA		90	50-150
13C4_PFHpA		95	50-150
13C5_PFHxA		96	50-150
13C5_PFPeA		93	50-150
13C6_PFDA		92	50-150
13C7_PFUdA		99	50-150
13C8_PFOA		92	50-150

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

PFAS by LC/MS/MS - MS

Sample ID: WF02026-007MS
Batch: 94181
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Solid
Prep Method: SOP SPE
Prep Date: 06/03/2021 1117

Surrogate	Q	% Rec	Acceptance Limit
13C8_PFOS		94	50-150
13C8_PFOSA		90	50-150
13C9_PFNA		97	50-150
d5-EtFOSAA		106	50-150
d-MeFOSA		106	50-150
d3-MeFOSAA		90	50-150

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

PFAS by LC/MS/MS - MSD

Sample ID: WF02026-007MD
Batch: 94181
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Solid
Prep Method: SOP SPE
Prep Date: 06/03/2021 1117

Parameter	Sample Amount (ug/kg)	Spike Amount (ug/kg)	Result (ug/kg)	Q	Dil	% Rec	% RPD	%Rec Limit	% RPD Limit	Analysis Date
8:2 FTS	ND	3.0	2.8		1	95	2.0	65-137	30	06/04/2021 1548
6:2 FTS	ND	2.9	3.0		1	101	12	64-140	30	06/04/2021 1548
4:2 FTS	ND	2.9	2.8		1	96	9.9	62-145	30	06/04/2021 1548
EtFOSAA	ND	3.1	2.9		1	93	1.7	61-139	30	06/04/2021 1548
MeFOSA	ND	3.1	3.1	+	1	102	38	70-150	30	06/04/2021 1548
MeFOSAA	ND	3.1	2.7		1	89	10	63-144	30	06/04/2021 1548
PFBS	ND	2.7	2.5		1	90	2.2	72-128	30	06/04/2021 1548
PFDS	ND	3.0	2.6		1	86	16	59-134	30	06/04/2021 1548
PFHpS	ND	2.9	3.4		1	116	24	70-132	30	06/04/2021 1548
PFNS	ND	3.0	3.0		1	99	23	69-125	30	06/04/2021 1548
PFOSA	ND	3.1	3.2		1	104	15	67-137	30	06/04/2021 1548
PFPeS	ND	2.9	2.8		1	98	3.0	73-123	30	06/04/2021 1548
PFHxS	ND	2.8	3.0		1	107	1.9	67-130	30	06/04/2021 1548
PFBA	ND	3.1	3.0		1	97	5.1	71-135	30	06/04/2021 1548
PFDA	ND	3.1	3.3		1	108	30	69-133	30	06/04/2021 1548
PFDoA	ND	3.1	3.0		1	98	3.6	69-135	30	06/04/2021 1548
PFHpA	ND	3.1	3.0		1	97	3.3	71-131	30	06/04/2021 1548
PFHxA	ND	3.1	3.2		1	105	17	70-132	30	06/04/2021 1548
PFNA	ND	3.1	3.0		1	96	4.9	72-129	30	06/04/2021 1548
PFOA	ND	3.1	3.1		1	100	11	69-133	30	06/04/2021 1548
PFPeA	ND	3.1	3.1		1	99	9.6	69-132	30	06/04/2021 1548
PFTeDA	ND	3.1	3.0		1	96	0.45	69-133	30	06/04/2021 1548
PFTrDA	ND	3.1	2.7		1	86	2.6	66-139	30	06/04/2021 1548
PFUdA	ND	3.1	3.1		1	101	15	64-136	30	06/04/2021 1548
PFOS	5.4	2.9	7.6		1	74	15	68-136	30	06/04/2021 1548

Surrogate	Q	% Rec	Acceptance Limit
13C2_4:2FTS		88	50-150
13C2_6:2FTS		89	50-150
13C2_8:2FTS		90	50-150
13C2_PFDoA		108	50-150
13C2_PFTeDA		95	50-150
13C3_PFBS		84	50-150
13C3_PFHxS		83	50-150
13C4_PFBA		83	50-150
13C4_PFHpA		91	50-150
13C5_PFHxA		85	50-150
13C5_PFPeA		87	50-150
13C6_PFDA		77	50-150
13C7_PFUdA		94	50-150
13C8_PFOA		86	50-150

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

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PFAS by LC/MS/MS - MSD

Sample ID: WF02026-007MD
Batch: 94181
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Solid
Prep Method: SOP SPE
Prep Date: 06/03/2021 1117

Surrogate	Q	% Rec	Acceptance Limit
13C8_PFOS		88	50-150
13C8_PFOSA		84	50-150
13C9_PFNA		89	50-150
d5-EtFOSAA		100	50-150
d-MeFOSA		85	50-150
d3-MeFOSAA		86	50-150

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

PFAS by LC/MS/MS - MB

Sample ID: WQ95164-001
Batch: 95164
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Solid
Prep Method: SOP SPE
Prep Date: 06/10/2021 1837

Parameter	Result	Q	Dil	LOQ	LOD	DL	Units	Analysis Date
8:2 FTS	1.0	U	1	2.0	1.0	0.50	ug/kg	06/11/2021 2140
6:2 FTS	1.0	U	1	2.0	1.0	0.50	ug/kg	06/11/2021 2140
4:2 FTS	1.0	U	1	2.0	1.0	0.50	ug/kg	06/11/2021 2140
EtFOSAA	1.0	U	1	2.0	1.0	0.50	ug/kg	06/11/2021 2140
MeFOSA	1.0	U	1	2.0	1.0	0.50	ug/kg	06/11/2021 2140
MeFOSAA	1.0	U	1	2.0	1.0	0.50	ug/kg	06/11/2021 2140
PFBS	0.50	U	1	1.0	0.50	0.20	ug/kg	06/11/2021 2140
PFDS	0.50	U	1	1.0	0.50	0.20	ug/kg	06/11/2021 2140
PFHpS	0.50	U	1	1.0	0.50	0.20	ug/kg	06/11/2021 2140
PFNS	0.50	U	1	1.0	0.50	0.20	ug/kg	06/11/2021 2140
PFOSA	0.50	U	1	1.0	0.50	0.20	ug/kg	06/11/2021 2140
PFPeS	0.50	U	1	1.0	0.50	0.20	ug/kg	06/11/2021 2140
PFHxS	0.50	U	1	1.0	0.50	0.20	ug/kg	06/11/2021 2140
PFBA	0.50	U	1	1.0	0.50	0.20	ug/kg	06/11/2021 2140
PFDA	0.50	U	1	1.0	0.50	0.20	ug/kg	06/11/2021 2140
PFDoA	0.50	U	1	1.0	0.50	0.20	ug/kg	06/11/2021 2140
PFHpA	0.50	U	1	1.0	0.50	0.20	ug/kg	06/11/2021 2140
PFHxA	0.50	U	1	1.0	0.50	0.20	ug/kg	06/11/2021 2140
PFNA	0.50	U	1	1.0	0.50	0.20	ug/kg	06/11/2021 2140
PFOA	0.50	U	1	1.0	0.50	0.20	ug/kg	06/11/2021 2140
PFPeA	0.50	U	1	1.0	0.50	0.20	ug/kg	06/11/2021 2140
PFTeDA	0.50	U	1	1.0	0.50	0.20	ug/kg	06/11/2021 2140
PFTrDA	0.50	U	1	1.0	0.50	0.20	ug/kg	06/11/2021 2140
PFUdA	0.50	U	1	1.0	0.50	0.20	ug/kg	06/11/2021 2140
PFOS	0.50	U	1	1.0	0.50	0.20	ug/kg	06/11/2021 2140

Surrogate	Q	% Rec	Acceptance Limit
13C2_4:2FTS		72	50-150
13C2_6:2FTS		78	50-150
13C2_8:2FTS		81	50-150
13C2_PFDoA		76	50-150
13C2_PFTeDA		73	50-150
13C3_PFBS		71	50-150
13C3_PFHxS		73	50-150
13C4_PFBA		75	50-150
13C4_PFHpA		78	50-150
13C5_PFHxA		75	50-150
13C5_PFPeA		76	50-150
13C6_PFDA		72	50-150
13C7_PFUdA		77	50-150
13C8_PFOA		74	50-150

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

PFAS by LC/MS/MS - MB

Sample ID: WQ95164-001
Batch: 95164
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Solid
Prep Method: SOP SPE
Prep Date: 06/10/2021 1837

Surrogate	Q	% Rec	Acceptance Limit
13C8_PFOS		78	50-150
13C8_PFOSA		80	50-150
13C9_PFNA		78	50-150
d5-EtFOSAA		83	50-150
d-MeFOSA		75	50-150
d3-MeFOSAA		76	50-150

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

PFAS by LC/MS/MS - LCS

Sample ID: WQ95164-002
Batch: 95164
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Solid
Prep Method: SOP SPE
Prep Date: 06/10/2021 1837

Parameter	Spike Amount (ug/kg)	Result (ug/kg)	Q	Dil	% Rec	%Rec Limit	Analysis Date
8:2 FTS	1.9	1.8		1	94	65-137	06/11/2021 2151
6:2 FTS	1.9	1.6		1	86	64-140	06/11/2021 2151
4:2 FTS	1.9	2.1		1	113	62-145	06/11/2021 2151
EtFOSAA	2.0	1.9		1	97	61-139	06/11/2021 2151
MeFOSA	2.0	2.3		1	115	70-150	06/11/2021 2151
MeFOSAA	2.0	2.2		1	111	63-144	06/11/2021 2151
PFBS	1.8	1.6		1	94	72-128	06/11/2021 2151
PFDS	1.9	1.6		1	83	59-134	06/11/2021 2151
PFHpS	1.9	2.0		1	105	70-132	06/11/2021 2151
PFNS	1.9	1.6		1	84	69-125	06/11/2021 2151
PFOSA	2.0	2.3		1	114	67-137	06/11/2021 2151
PFPeS	1.9	2.0		1	109	73-123	06/11/2021 2151
PFHxS	1.8	1.9		1	106	67-130	06/11/2021 2151
PFBA	2.0	2.0		1	100	71-135	06/11/2021 2151
PFDA	2.0	2.1		1	107	69-133	06/11/2021 2151
PFDoA	2.0	2.2		1	110	69-135	06/11/2021 2151
PFHpA	2.0	2.1		1	107	71-131	06/11/2021 2151
PFHxA	2.0	2.0		1	100	70-132	06/11/2021 2151
PFNA	2.0	1.9		1	96	72-129	06/11/2021 2151
PFOA	2.0	2.0		1	98	69-133	06/11/2021 2151
PFPeA	2.0	2.0		1	102	69-132	06/11/2021 2151
PFTeDA	2.0	2.0		1	102	69-133	06/11/2021 2151
PFTrDA	2.0	2.1		1	106	66-139	06/11/2021 2151
PFUdA	2.0	2.2		1	110	64-136	06/11/2021 2151
PFOS	1.9	1.6		1	86	68-136	06/11/2021 2151

Surrogate	Q	% Rec	Acceptance Limit
13C2_4:2FTS		83	50-150
13C2_6:2FTS		95	50-150
13C2_8:2FTS		97	50-150
13C2_PFDoA		82	50-150
13C2_PFTeDA		88	50-150
13C3_PFBS		79	50-150
13C3_PFHxS		81	50-150
13C4_PFBA		86	50-150
13C4_PFHpA		89	50-150
13C5_PFHxA		87	50-150
13C5_PFPeA		85	50-150
13C6_PFDA		86	50-150
13C7_PFUdA		84	50-150
13C8_PFOA		82	50-150

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

PFAS by LC/MS/MS - LCS

Sample ID: WQ95164-002
Batch: 95164
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Solid
Prep Method: SOP SPE
Prep Date: 06/10/2021 1837

Surrogate	Q	% Rec	Acceptance Limit
13C8_PFOS		92	50-150
13C8_PFOSA		83	50-150
13C9_PFNA		86	50-150
d5-EtFOSAA		92	50-150
d-MeFOSA		88	50-150
d3-MeFOSAA		89	50-150

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

Chain of Custody
and
Miscellaneous Documents

Shealy Environmental Services, Inc.
106 Vantage Point Drive
West Columbia, South Carolina 29172
Telephone No. (803) 791-9700 Fax No. (803) 791-9111
www.shealylab.com

SHEALY

Chain of Custody Record

Number

Client	Report to Contact	Telephone No. / E-mail	Quote No.
Wardis	Colin Morrell	902.209.3476 / colin@cleanearthtechnologies.ca	Mike McFadden
Address	Sampler's Signature	Analysis (Attach list if more space is needed)	Page
	x	PFAS-DoD QSM 5.3 ELAP Table B.15 cmpds and SPLP	1 of 1
City / State / Zip Code	Printed Name		
Project Name			

WF02026

KBS2

Project Number	P.O No.		Matrix				No of Containers by Preservative Type							Total PFAS	SPLP Circum Neutral							
1000-EI			G=Grab C=Composite	Aqueous	Solid	Non-Aqueous	Unpres.	H2SO4	HNO3	HCl	NaOH	5035 K1										
Sample ID / Description (Containers for each sample may be combined on one line)	Date	Time																				Remarks / Cooler I.D.
377-UT-1	May 30/21		C		x									x	x							PFAS
377-R-1	May 30/21		C		x									x	x							PFAS
377-R-2	May 30/21		C		x									x	x							PFAS
377-S-1	May 30/21		C		x									x	x							PFAS
377-S-2	May 30/21		C		x									x	x							PFAS
377-S-3	May 30/21		C		x									x	x							PFAS
377-F-1	May 30/21		C		x									x	x							PFAS
379-UT-2	May 30/21		C		x									x	x							PFAS
379-R-1	May 30/21		C		x									x	x							PFAS
379-R-2	May 30/21		C		x									x	x							PFAS

Turn Around Time Required (Prior lab approval required for expedited TAT)
☐ Standard ☒ Rush (Please Specify)

Sample Disposal
☐ Return to Client ☐ Disposal by Lab

Possible Hazard Identification (List any known hazards in the remarks)
☐ Non-Hazardous ☐ Flammable ☐ Skin Irritant ☐ SDS provided ☐ Unknown

QC Requirements

	Date	Time		Date	Time
1. Relinquished by Ken Maynard	May 31/2021	11:00 Am	1. Received by		
2. Relinquished by			2. Received by		
3. Relinquished by			3. Received by		
4. Relinquished by Fed Ex	6/1/21	1025	4. Laboratory Received by	6/2/21	1025

Note: All samples are retained for four weeks from receipt unless other arrangements are made.

LAB USE ONLY
Received on Ice (Check) ☒Y ☐N ☐Ice Pack

Receipt Temp. 3.1 °C

Document Number: ME002OW-01

PACE ANALYTICAL SERVICES, LLC

Shealy Environmental Services, Inc.
106 Vantage Point Drive
West Columbia, South Carolina 29172
Telephone No. (803) 791-9700 Fax No. (803) 791-9111
www.shealylab.com

Chain of Custody Record

Number

Client	Report to Contact	Telephone No. / E-mail	Quote No.
Arcadis	Colin Morrell	902 209.3470 / colin@cleanearthtechnologies.ca	Mike McFadden
Address	Sampler's Signature	Analysis (Attach list if more space is needed)	Page
		PFAS DoD QSM 5.3 ELAP Table B-15 cmpds and SPLP	2 of 2
City / State / Zip Code	Printed Name		
Project Name			

WF02026

KB92

Project Number	P.O No.			Matrix				No of Containers by Preservative Type							Total PFAS	SPLP Circum Neutral							
1000-Et																							
Sample ID / Description (Containers for each sample may be combined on one line)	Date	Time	G=Grab C=Composite	Aqueous	Solid	Non-Aqueous		Unpres	H2SO4	HNO3	HCl	NaOH	5035 Kit										Remarks / Cooler I.D.
379-UT-1	May 30/21		C		x										x	x							PFAS
379-R-1	May 30/21		C		x										x	x							PFAS
379-R-2	May 30/21		C		x										x	x							PFAS
379-S-1	May 30/21		C		x										x	x							PFAS
379-S-2	May 30/21		C		x										x	x							PFAS
379-S-3	May 30/21		C		x										x	x							PFAS
379-F-1	May 30/21		C		x										x	x							PFAS
379-F-2	May 30/21		C		x										x	x							PFAS

Turn Around Time Required (Prior lab approval required for expedited TAT)
☐ Standard ☒ Rush (Please Specify)

Sample Disposal
☐ Return to Client ☐ Disposal by Lab

Possible Hazard Identification (List any known hazards in the remarks)
☐ Non-Hazardous ☐ Flammable ☐ Skin Irritant ☐ SDS provided ☐ Unknown

QC Requirements

	Date	Time		Date	Time
1. Relinquished by Ken Maynard	May 31/2021	11:00 Am	1. Received by		
2. Relinquished by	Date	Time	2. Received by	Date	Time
3. Relinquished by	Date	Time	3. Received by	Date	Time
4. Relinquished by FedEx	Date 6/2/21	Time 1025	4. Laboratory Received by	Date 6/2/21	Time 1025

Note: All samples are retained for four weeks from receipt unless other arrangements are made.

LAB USE ONLY
Received on Ice (Check) ☑ Y ☐ N ☐ Ice Pack

Receipt Temp. 3.1 °C

Document Number: ME002OW-01

PACE ANALYTICAL SERVICES, LLC

Pace Analytical Services, LLC (formerly Shealy Environmental Services, Inc.)
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

Pace Analytical

Samples Receipt Checklist (SRC) (ME0018C-15)
Issuing Authority: Pace ENV - WCOI

Revised:9/29/2020
Page 1 of 1

Sample Receipt Checklist (SRC)

Client: Arcadis Cooler Inspected by/date: JRG2 / 06/02/2021 Lot #: WF02026

Means of receipt: ☐ Pace ☐ Client ☐ UPS ☑ FedEx ☐ Other:

☐ Yes	☑ No		1. Were custody seals present on the cooler?
☐ Yes	☐ No	☑ NA	2. If custody seals were present, were they intact and unbroken?

pH Strip ID: NA Chlorine Strip ID: NA Tested by: NA

Original temperature upon receipt / Derived (Corrected) temperature upon receipt %Solid Snap-Cup ID: 21-238

3.1 / 3.1 °C NA / NA °C NA / NA °C NA / NA °C

Method: ☐ Temperature Blank ☑ Against Bottles IR Gun ID: 5 IR Gun Correction Factor: 0 °C

Method of coolant: ☑ Wet Ice ☐ Ice Packs ☐ Dry Ice ☐ None

☐ Yes	☐ No	☑ NA	3. If temperature of any cooler exceeded 6.0°C, was Project Manager Notified? PM was Notified by: phone / email / face-to-face (circle one).
☐ Yes	☐ No	☑ NA	4. Is the commercial courier's packing slip attached to this form?
☑ Yes	☐ No		5. Were proper custody procedures (relinquished/received) followed?
☑ Yes	☐ No		6. Were sample IDs listed on the COC?
☐ Yes	☑ No		7. Were sample IDs listed on all sample containers?
☐ Yes	☑ No		8. Was collection date & time listed on the COC?
☐ Yes	☑ No		9. Was collection date & time listed on all sample containers?
☑ Yes	☐ No		10. Did all container label information (ID, date, time) agree with the COC?
☑ Yes	☐ No		11. Were tests to be performed listed on the COC?
☑ Yes	☐ No		12. Did all samples arrive in the proper containers for each test and/or in good condition (unbroken, lids on, etc.)?
☐ Yes	☑ No		13. Was adequate sample volume available?
☑ Yes	☐ No		14. Were all samples received within ½ the holding time or 48 hours, whichever comes first?
☐ Yes	☑ No		15. Were any samples containers missing/excess (circle one) samples Not listed on COC?
☐ Yes	☐ No	☑ NA	16. For VOA and RSK-175 samples, were bubbles present >"pea-size" (¼"or 6mm in diameter) in any of the VOA vials?
☐ Yes	☐ No	☑ NA	17. Were all DRO/metals/nutrient samples received at a pH of < 2?
☐ Yes	☐ No	☑ NA	18. Were all cyanide samples received at a pH > 12 and sulfide samples received at a pH > 9?
☐ Yes	☐ No	☑ NA	19. Were all applicable NH_3/TKN/cyanide/phenol/625.1/608.3 (< 0.5mg/L) samples free of residual chlorine?
☐ Yes	☐ No	☑ NA	20. Were client remarks/requests (i.e. requested dilutions, MS/MSD designations, etc…) correctly transcribed from the COC into the comment section in LIMS?
☐ Yes	☑ No		21. Was the quote number listed on the container label? If yes, Quote #

Sample Preservation (Must be completed for any sample(s) incorrectly preserved or with headspace.)

Sample(s) NA were received incorrectly preserved and were adjusted accordingly in sample receiving with NA mL of circle one: H_2SO_4, HNO_3, HCl, NaOH using SR # NA.
Time of preservation NA. If more than one preservative is needed, please note in the comments below.

Sample(s) NA were received with bubbles >6 mm in diameter.

Samples(s) NA were received with TRC > 0.5 mg/L (If #19 is ***no***) and were adjusted accordingly in sample receiving with sodium thiosulfate ($Na_2S_2O_3$) with Shealy ID: NA.

SR barcode labels applied by: JRG2 Date: 06/02/2021

Comments: One container missing label. No dates or times listed on containers. No times listed on COC.

Samples 379-R-1, 379-R-2 were listed twice on COCs.

Report of Analysis

Arcadis U.S., Inc.
630 Plaza Drive
Suite 600
Highlands Ranch, CO 80129
Attention: Colin Morrell

Project Name: Eielson AFB - Soil Washing

Project Number: 30030317.00001

Lot Number:**WF04011**

Date Completed:06/23/2021

06/24/2021 9:00 AM
Approved and released by:
Project Manager II: **Kathy E. Smith**

The electronic signature above is the equivalent of a handwritten signature.
This report shall not be reproduced, except in its entirety, without the written approval of Pace Analytical Services, LLC.

Pace Analytical Services, LLC (*formerly Shealy Environmental Services, Inc.*)
106 Vantage Point Drive West Columbia, SC 29172
Tel: 803-791-9700 Fax: 803-791-9111 www.pacelabs.com

Case Narrative
Arcadis U.S., Inc.
Lot Number: WF04011

This Report of Analysis contains the analytical result(s) for the sample(s) listed on the Sample Summary following this Case Narrative. The sample receiving date is documented in the header information associated with each sample.

All results listed in this report relate only to the samples that are contained within this report.

Sample receipt, sample analysis, and data review have been performed in accordance with the Pace Quality Assurance Management Plan (QAMP), applicable Shealy standard operating procedures (SOPs), the 2003 NELAC standard, and Shealy policies. Additionally, the DoD QSM version 5.3 has been followed for these samples, and specifically Table B-15 was followed for all PFAS samples. Any exceptions to the QAMP, SOPs, NELAC standards, the DoD QSM, or policies are qualified on the results page or discussed below.

All QC associated with these samples was in compliance with DOD QSM 5.3 table B-15 and our PFAS SOP.

Correction factors (CF) are used to calculate the original sample concentration. The CF is the inverse of the concentration factor (sample volume / extract final volume) times the dilution factor (DF). For undiluted analysis. For undiluted analysis, the extract is prepared for injection by adding 182 uL of sample extract + 8 uL of reagent water + 10 uL of internal standard solution to a polypropylene autosampler vial. An extra correction factor of 0.91 (182 uL / 200 uL = 0.91) applies. The CF is calculated as follows:

CF = DF * FV / Vo

FV is volume of extract (mL)
Vo is initial sample volume (mL)
DF is dilution factor. For undiluted analysis, DF = 1/0.91.

Sample concentration for aqueous samples:
Concentration (ng/L) = Cs*CF,

$$C_s = \frac{\left(\frac{(A_s x C_{is})}{A_{is}}\right) - B}{M1}$$

Where

C_s is on column concentration of target analyte in the sample (ng/L)
C_{is} is concentration of internal standard in the sample (ng/L)
A_s is peak response of target analyte in the sample
A_{is} is peak response of internal standard in the sample
M1 is the average RF from ICAL or the slope from linear regression ICAL
B is the y-intercept from the ICAL

Surrogate recovery for the following sample(s) was outside of acceptance limits: WF04011-015. There was insufficient sample to perform a re-extraction; therefore, the data have been reported.

The MS/MSD associated with sample WF04011-002 had 6:2 FTS recovered outside of the acceptance limits. The LCS was recovered within the required acceptance limits; therefore, this demonstrates a matrix effect and data quality is not impacted.

Sample Summary
Arcadis U.S., Inc.
Lot Number: WF04011

Sample Number	Sample ID	Matrix	Date Sampled	Date Received
001	377-UT-1	Solid	05/30/2021	06/02/2021
002	377-R-1	Solid	05/30/2021	06/02/2021
003	377-R-2	Solid	05/30/2021	06/02/2021
004	377-S-1	Solid	05/30/2021	06/02/2021
005	377-S-2	Solid	05/30/2021	06/02/2021
006	377-S-3	Solid	05/30/2021	06/02/2021
007	377-F-1	Solid	05/30/2021	06/02/2021
008	379-UT-2	Solid	05/30/2021	
009	379-R-1	Solid	05/30/2021	06/02/2021
010	379-R-2	Solid	05/30/2021	06/02/2021
011	379-UT-1	Solid	05/30/2021	06/02/2021
012	379-S-1	Solid	05/30/2021	06/02/2021
013	379-S-2	Solid	05/30/2021	06/02/2021
014	379-S-3	Solid	05/30/2021	06/02/2021
015	379-F-1	Solid	05/30/2021	06/02/2021
016	379-F-2	Solid	05/30/2021	06/04/2021

(16 samples)

Detection Summary

Arcadis U.S., Inc.

Lot Number: WF04011

Sample	Sample ID	Matrix	Parameter	Method	Result	Q	Units	Page
001	377-UT-1	Solid	PFBS	PFAS by ID	3.4	J	ng/L	7
001	377-UT-1	Solid	PFHpS	PFAS by ID	3.5	J	ng/L	7
001	377-UT-1	Solid	PFPeS	PFAS by ID	4.4		ng/L	7
001	377-UT-1	Solid	PFHxS	PFAS by ID	130		ng/L	7
001	377-UT-1	Solid	PFBA	PFAS by ID	4.0		ng/L	7
001	377-UT-1	Solid	PFDA	PFAS by ID	1.4	J	ng/L	7
001	377-UT-1	Solid	PFHpA	PFAS by ID	9.1		ng/L	7
001	377-UT-1	Solid	PFHxA	PFAS by ID	20		ng/L	7
001	377-UT-1	Solid	PFNA	PFAS by ID	7.2		ng/L	7
001	377-UT-1	Solid	PFOA	PFAS by ID	20		ng/L	7
001	377-UT-1	Solid	PFPeA	PFAS by ID	7.3		ng/L	7
001	377-UT-1	Solid	PFOS	PFAS by ID	450		ng/L	7
004	377-S-1	Solid	PFHxS	PFAS by ID	1.4	J	ng/L	13
004	377-S-1	Solid	PFOS	PFAS by ID	6.8		ng/L	13
005	377-S-2	Solid	PFOS	PFAS by ID	1.5	J	ng/L	15
006	377-S-3	Solid	6:2 FTS	PFAS by ID	21		ng/L	17
007	377-F-1	Solid	6:2 FTS	PFAS by ID	100		ng/L	19
007	377-F-1	Solid	PFBS	PFAS by ID	1.2	J	ng/L	19
007	377-F-1	Solid	PFHxS	PFAS by ID	3.1	J	ng/L	19
007	377-F-1	Solid	PFOS	PFAS by ID	47		ng/L	19
009	379-R-1	Solid	6:2 FTS	PFAS by ID	95		ng/L	21
009	379-R-1	Solid	PFHxS	PFAS by ID	12		ng/L	21
009	379-R-1	Solid	PFBA	PFAS by ID	1.5	J	ng/L	21
009	379-R-1	Solid	PFHpA	PFAS by ID	1.5	J	ng/L	21
009	379-R-1	Solid	PFHxA	PFAS by ID	3.4	J	ng/L	21
009	379-R-1	Solid	PFOA	PFAS by ID	1.1	J	ng/L	21
009	379-R-1	Solid	PFPeA	PFAS by ID	4.3		ng/L	21
009	379-R-1	Solid	PFOS	PFAS by ID	29		ng/L	21
010	379-R-2	Solid	6:2 FTS	PFAS by ID	99		ng/L	23
010	379-R-2	Solid	PFPeS	PFAS by ID	1.4	J	ng/L	23
010	379-R-2	Solid	PFHxS	PFAS by ID	19		ng/L	23
010	379-R-2	Solid	PFBA	PFAS by ID	1.1	J	ng/L	23
010	379-R-2	Solid	PFHpA	PFAS by ID	1.6	J	ng/L	23
010	379-R-2	Solid	PFHxA	PFAS by ID	4.3		ng/L	23
010	379-R-2	Solid	PFOA	PFAS by ID	1.4	J	ng/L	23
010	379-R-2	Solid	PFPeA	PFAS by ID	3.2	J	ng/L	23
010	379-R-2	Solid	PFOS	PFAS by ID	62		ng/L	23
011	379-UT-1	Solid	8:2 FTS	PFAS by ID	4.8	J	ng/L	25
011	379-UT-1	Solid	6:2 FTS	PFAS by ID	100		ng/L	25
011	379-UT-1	Solid	PFBS	PFAS by ID	13		ng/L	25
011	379-UT-1	Solid	PFDS	PFAS by ID	1.5	J	ng/L	25
011	379-UT-1	Solid	PFHpS	PFAS by ID	17		ng/L	25
011	379-UT-1	Solid	PFNS	PFAS by ID	5.0		ng/L	25
011	379-UT-1	Solid	PFOSA	PFAS by ID	8.7		ng/L	25
011	379-UT-1	Solid	PFPeS	PFAS by ID	24		ng/L	25

Detection Summary (Continued)

Lot Number: WF04011

Sample	Sample ID	Matrix	Parameter	Method	Result	Q	Units	Page
011	379-UT-1	Solid	PFHxS	PFAS by ID	320		ng/L	25
011	379-UT-1	Solid	PFBA	PFAS by ID	17		ng/L	25
011	379-UT-1	Solid	PFDA	PFAS by ID	6.9		ng/L	25
011	379-UT-1	Solid	PFHpA	PFAS by ID	26		ng/L	25
011	379-UT-1	Solid	PFHxA	PFAS by ID	76		ng/L	25
011	379-UT-1	Solid	PFNA	PFAS by ID	14		ng/L	25
011	379-UT-1	Solid	PFOA	PFAS by ID	29		ng/L	25
011	379-UT-1	Solid	PFPeA	PFAS by ID	83		ng/L	25
011	379-UT-1	Solid	PFOS	PFAS by ID	2800		ng/L	27
012	379-S-1	Solid	6:2 FTS	PFAS by ID	73		ng/L	29
012	379-S-1	Solid	PFOS	PFAS by ID	1.9	J	ng/L	29
013	379-S-2	Solid	6:2 FTS	PFAS by ID	120		ng/L	31
013	379-S-2	Solid	PFOS	PFAS by ID	1.4	J	ng/L	31
014	379-S-3	Solid	6:2 FTS	PFAS by ID	64		ng/L	33
014	379-S-3	Solid	PFOS	PFAS by ID	2.2	J	ng/L	33
015	379-F-1	Solid	8:2 FTS	PFAS by ID	2.7	JQ	ng/L	35
015	379-F-1	Solid	6:2 FTS	PFAS by ID	110		ng/L	35
015	379-F-1	Solid	PFOSA	PFAS by ID	2.1	J	ng/L	35
015	379-F-1	Solid	PFHxS	PFAS by ID	13		ng/L	35
015	379-F-1	Solid	PFHxA	PFAS by ID	1.5	J	ng/L	35
015	379-F-1	Solid	PFOA	PFAS by ID	1.2	J	ng/L	35
015	379-F-1	Solid	PFOS	PFAS by ID	83		ng/L	35
016	379-F-2	Solid	8:2 FTS	PFAS by ID	4.0	J	ng/L	37
016	379-F-2	Solid	6:2 FTS	PFAS by ID	100		ng/L	37
016	379-F-2	Solid	PFHxS	PFAS by ID	3.0	J	ng/L	37
016	379-F-2	Solid	PFHxA	PFAS by ID	1.9	J	ng/L	37
016	379-F-2	Solid	PFOS	PFAS by ID	7.8		ng/L	37

(72 detections)

SPLP PFAS

Client: **Arcadis U.S., Inc.** Laboratory ID: **WF04011-001**

Description: **377-UT-1** Matrix: **Solid**

Date Sampled: **05/30/2021**

Date Received: **06/02/2021**

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch	Leachate Date
1	1312/PFAS	PFAS by ID SOP QSM B-15	1	06/21/2021 1754	MMM	06/19/2021 1119	96072	06/10/2021 0230

Parameter	CAS Number	Analytical Method	Result	Q	LOQ	LOD	DL	Units	Run
1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS)	39108-34-4	PFAS by ID SOP	3.8	U	7.6	3.8	1.9	ng/L	1
1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS)	27619-97-2	PFAS by ID SOP	3.8	U	7.6	3.8	1.9	ng/L	1
1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS)	757124-72-4	PFAS by ID SOP	3.8	U	7.6	3.8	1.9	ng/L	1
N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA)	2991-50-6	PFAS by ID SOP	3.8	U	7.6	3.8	1.9	ng/L	1
N-methylperfluoro-1-octanesulfonamide (MeFOSA)	31506-32-8	PFAS by ID SOP	7.5	U	15	7.5	3.8	ng/L	1
N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA)	2355-31-9	PFAS by ID SOP	3.8	U	7.6	3.8	1.9	ng/L	1
Perfluoro-1-butanesulfonic acid (PFBS)	**375-73-5**	**PFAS by ID SOP**	**3.4**	**J**	**3.8**	1.9	**0.95**	**ng/L**	**1**
Perfluoro-1-decanesulfonic acid (PFDS)	335-77-3	PFAS by ID SOP	1.9	U	3.8	1.9	0.95	ng/L	1
Perfluoro-1-heptanesulfonic acid (PFHpS)	**375-92-8**	**PFAS by ID SOP**	**3.5**	**J**	**3.8**	1.9	**0.95**	**ng/L**	**1**
Perfluoro-1-nonanesulfonic acid (PFNS)	68259-12-1	PFAS by ID SOP	1.9	U	3.8	1.9	0.95	ng/L	1
Perfluoro-1-octanesulfonamide (PFOSA)	754-91-6	PFAS by ID SOP	1.9	U	3.8	1.9	0.95	ng/L	1
Perfluoro-1-pentanesulfonic acid (PFPeS)	**2706-91-4**	**PFAS by ID SOP**	**4.4**		**3.8**	1.9	**0.95**	**ng/L**	**1**
Perfluorohexanesulfonic acid (PFHxS)	**355-46-4**	**PFAS by ID SOP**	**130**		**3.8**	1.9	**0.95**	**ng/L**	**1**
Perfluoro-n-butanoic acid (PFBA)	**375-22-4**	**PFAS by ID SOP**	**4.0**		**3.8**	1.9	**0.95**	**ng/L**	**1**
Perfluoro-n-decanoic acid (PFDA)	**335-76-2**	**PFAS by ID SOP**	**1.4**	**J**	**3.8**	1.9	**0.95**	**ng/L**	**1**
Perfluoro-n-dodecanoic acid (PFDoA)	307-55-1	PFAS by ID SOP	1.9	U	3.8	1.9	0.95	ng/L	1
Perfluoro-n-heptanoic acid (PFHpA)	**375-85-9**	**PFAS by ID SOP**	**9.1**		**3.8**	1.9	**0.95**	**ng/L**	**1**
Perfluoro-n-hexanoic acid (PFHxA)	**307-24-4**	**PFAS by ID SOP**	**20**		**3.8**	1.9	**0.95**	**ng/L**	**1**
Perfluoro-n-nonanoic acid (PFNA)	**375-95-1**	**PFAS by ID SOP**	**7.2**		**3.8**	1.9	**0.95**	**ng/L**	**1**
Perfluoro-n-octanoic acid (PFOA)	**335-67-1**	**PFAS by ID SOP**	**20**		**3.8**	1.9	**0.95**	**ng/L**	**1**
Perfluoro-n-pentanoic acid (PFPeA)	**2706-90-3**	**PFAS by ID SOP**	**7.3**		**3.8**	1.9	**0.95**	**ng/L**	**1**
Perfluoro-n-tetradecanoic acid (PFTeDA)	376-06-7	PFAS by ID SOP	1.9	U	3.8	1.9	0.95	ng/L	1
Perfluoro-n-tridecanoic acid (PFTrDA)	72629-94-8	PFAS by ID SOP	1.9	U	3.8	1.9	0.95	ng/L	1
Perfluoro-n-undecanoic acid (PFUdA)	2058-94-8	PFAS by ID SOP	1.9	U	3.8	1.9	0.95	ng/L	1
Perfluorooctanesulfonic acid (PFOS)	**1763-23-1**	**PFAS by ID SOP**	**450**		**3.8**	1.9	**0.95**	**ng/L**	**1**

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
13C2_4:2FTS		91	50-150
13C2_6:2FTS		87	50-150
13C2_8:2FTS		90	50-150
13C2_PFDoA		69	50-150
13C2_PFTeDA		56	50-150
13C3_PFBS		76	50-150
13C3_PFHxS		76	50-150
13C4_PFBA		87	50-150
13C4_PFHpA		85	50-150
13C5_PFHxA		78	50-150
13C5_PFPeA		87	50-150
13C6_PFDA		79	50-150
13C7_PFUdA		75	50-150
13C8_PFOA		82	50-150
13C8_PFOS		61	50-150
13C8_PFOSA		86	50-150
13C9_PFNA		81	50-150

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

SPLP PFAS

Client: **Arcadis U.S., Inc.**
Laboratory ID: **WF04011-001**
Description: **377-UT-1**
Matrix: **Solid**
Date Sampled: **05/30/2021**
Date Received: **06/02/2021**

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
d5-EtFOSAA		79	50-150
d-MeFOSA		78	50-150
d3-MeFOSAA		83	50-150

LOQ = Limit of Quantitation	B = Detected in the method blank	E = Quantitation of compound exceeded the calibration range	DL = Detection Limit	Q = Surrogate failure
U = Not detected at or above the LOQ	N = Recovery is out of criteria	P = The RPD between two GC columns exceeds 40%	J = Estimated result < LOQ and ≥ DL	L = LCS/LCSD failure
H = Out of holding time	W = Reported on wet weight basis	LOD = Limit of Detection		S = MS/MSD failure

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SPLP PFAS

Client: **Arcadis U.S., Inc.** Laboratory ID: **WF04011-002**

Description: **377-R-1** Matrix: **Solid**

Date Sampled: **05/30/2021**

Date Received: **06/02/2021**

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch	Leachate Date
1	1312/PFAS	PFAS by ID SOP QSM B-15	1	06/21/2021 1805	MMM	06/19/2021 1119	96072	06/10/2021 0230

Parameter	CAS Number	Analytical Method	Result	Q	LOQ	LOD	DL	Units	Run
1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS)	39108-34-4	PFAS by ID SOP	3.8	U	7.5	3.8	1.9	ng/L	1
1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS)	27619-97-2	PFAS by ID SOP	3.8	US	7.5	3.8	1.9	ng/L	1
1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS)	757124-72-4	PFAS by ID SOP	3.8	U	7.5	3.8	1.9	ng/L	1
N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA)	2991-50-6	PFAS by ID SOP	3.8	U	7.5	3.8	1.9	ng/L	1
N-methylperfluoro-1-octanesulfonamide (MeFOSA)	31506-32-8	PFAS by ID SOP	7.5	U	15	7.5	3.7	ng/L	1
N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA)	2355-31-9	PFAS by ID SOP	3.8	U	7.5	3.8	1.9	ng/L	1
Perfluoro-1-butanesulfonic acid (PFBS)	375-73-5	PFAS by ID SOP	1.9	U	3.7	1.9	0.94	ng/L	1
Perfluoro-1-decanesulfonic acid (PFDS)	335-77-3	PFAS by ID SOP	1.9	U	3.7	1.9	0.94	ng/L	1
Perfluoro-1-heptanesulfonic acid (PFHpS)	375-92-8	PFAS by ID SOP	1.9	U	3.7	1.9	0.94	ng/L	1
Perfluoro-1-nonanesulfonic acid (PFNS)	68259-12-1	PFAS by ID SOP	1.9	U	3.7	1.9	0.94	ng/L	1
Perfluoro-1-octanesulfonamide (PFOSA)	754-91-6	PFAS by ID SOP	1.9	U	3.7	1.9	0.94	ng/L	1
Perfluoro-1-pentanesulfonic acid (PFPeS)	2706-91-4	PFAS by ID SOP	1.9	U	3.7	1.9	0.94	ng/L	1
Perfluorohexanesulfonic acid (PFHxS)	355-46-4	PFAS by ID SOP	1.9	U	3.7	1.9	0.94	ng/L	1
Perfluoro-n-butanoic acid (PFBA)	375-22-4	PFAS by ID SOP	1.9	U	3.7	1.9	0.94	ng/L	1
Perfluoro-n-decanoic acid (PFDA)	335-76-2	PFAS by ID SOP	1.9	U	3.7	1.9	0.94	ng/L	1
Perfluoro-n-dodecanoic acid (PFDoA)	307-55-1	PFAS by ID SOP	1.9	U	3.7	1.9	0.94	ng/L	1
Perfluoro-n-heptanoic acid (PFHpA)	375-85-9	PFAS by ID SOP	1.9	U	3.7	1.9	0.94	ng/L	1
Perfluoro-n-hexanoic acid (PFHxA)	307-24-4	PFAS by ID SOP	1.9	U	3.7	1.9	0.94	ng/L	1
Perfluoro-n-nonanoic acid (PFNA)	375-95-1	PFAS by ID SOP	1.9	U	3.7	1.9	0.94	ng/L	1
Perfluoro-n-octanoic acid (PFOA)	335-67-1	PFAS by ID SOP	1.9	U	3.7	1.9	0.94	ng/L	1
Perfluoro-n-pentanoic acid (PFPeA)	2706-90-3	PFAS by ID SOP	1.9	U	3.7	1.9	0.94	ng/L	1
Perfluoro-n-tetradecanoic acid (PFTeDA)	376-06-7	PFAS by ID SOP	1.9	U	3.7	1.9	0.94	ng/L	1
Perfluoro-n-tridecanoic acid (PFTrDA)	72629-94-8	PFAS by ID SOP	1.9	U	3.7	1.9	0.94	ng/L	1
Perfluoro-n-undecanoic acid (PFUdA)	2058-94-8	PFAS by ID SOP	1.9	U	3.7	1.9	0.94	ng/L	1
Perfluorooctanesulfonic acid (PFOS)	1763-23-1	PFAS by ID SOP	1.9	U	3.7	1.9	0.94	ng/L	1

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
13C2_4:2FTS		101	50-150
13C2_6:2FTS		103	50-150
13C2_8:2FTS		88	50-150
13C2_PFDoA		87	50-150
13C2_PFTeDA		79	50-150
13C3_PFBS		87	50-150
13C3_PFHxS		87	50-150
13C4_PFBA		94	50-150
13C4_PFHpA		93	50-150
13C5_PFHxA		88	50-150
13C5_PFPeA		88	50-150
13C6_PFDA		75	50-150
13C7_PFUdA		96	50-150
13C8_PFOA		81	50-150
13C8_PFOS		83	50-150
13C8_PFOSA		92	50-150
13C9_PFNA		91	50-150

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

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SPLP PFAS

Client: **Arcadis U.S., Inc.**
Laboratory ID: **WF04011-002**
Description: **377-R-1**
Matrix: **Solid**
Date Sampled: **05/30/2021**
Date Received: **06/02/2021**

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
d5-EtFOSAA		94	50-150
d-MeFOSA		87	50-150
d3-MeFOSAA		105	50-150

LOQ = Limit of Quantitation	B = Detected in the method blank	E = Quantitation of compound exceeded the calibration range	DL = Detection Limit	Q = Surrogate failure
U = Not detected at or above the LOQ	N = Recovery is out of criteria	P = The RPD between two GC columns exceeds 40%	J = Estimated result < LOQ and ≥ DL	L = LCS/LCSD failure
H = Out of holding time	W = Reported on wet weight basis	LOD = Limit of Detection		S = MS/MSD failure

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SPLP PFAS

Client: **Arcadis U.S., Inc.** Laboratory ID: **WF04011-003**

Description: **377-R-2** Matrix: **Solid**

Date Sampled: **05/30/2021**

Date Received: **06/02/2021**

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch	Leachate Date
1	1312/PFAS	PFAS by ID SOP QSM B-15	1	06/21/2021 1837	MMM	06/19/2021 1119	96072	06/10/2021 0230

Parameter	CAS Number	Analytical Method	Result	Q	LOQ	LOD	DL	Units	Run
1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS)	39108-34-4	PFAS by ID SOP	3.7	U	7.4	3.7	1.9	ng/L	1
1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS)	27619-97-2	PFAS by ID SOP	3.7	U	7.4	3.7	1.9	ng/L	1
1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS)	757124-72-4	PFAS by ID SOP	3.7	U	7.4	3.7	1.9	ng/L	1
N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA)	2991-50-6	PFAS by ID SOP	3.7	U	7.4	3.7	1.9	ng/L	1
N-methylperfluoro-1-octanesulfonamide (MeFOSA)	31506-32-8	PFAS by ID SOP	7.5	U	15	7.5	3.7	ng/L	1
N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA)	2355-31-9	PFAS by ID SOP	3.7	U	7.4	3.7	1.9	ng/L	1
Perfluoro-1-butanesulfonic acid (PFBS)	375-73-5	PFAS by ID SOP	1.9	U	3.7	1.9	0.93	ng/L	1
Perfluoro-1-decanesulfonic acid (PFDS)	335-77-3	PFAS by ID SOP	1.9	U	3.7	1.9	0.93	ng/L	1
Perfluoro-1-heptanesulfonic acid (PFHpS)	375-92-8	PFAS by ID SOP	1.9	U	3.7	1.9	0.93	ng/L	1
Perfluoro-1-nonanesulfonic acid (PFNS)	68259-12-1	PFAS by ID SOP	1.9	U	3.7	1.9	0.93	ng/L	1
Perfluoro-1-octanesulfonamide (PFOSA)	754-91-6	PFAS by ID SOP	1.9	U	3.7	1.9	0.93	ng/L	1
Perfluoro-1-pentanesulfonic acid (PFPeS)	2706-91-4	PFAS by ID SOP	1.9	U	3.7	1.9	0.93	ng/L	1
Perfluorohexanesulfonic acid (PFHxS)	355-46-4	PFAS by ID SOP	1.9	U	3.7	1.9	0.93	ng/L	1
Perfluoro-n-butanoic acid (PFBA)	375-22-4	PFAS by ID SOP	1.9	U	3.7	1.9	0.93	ng/L	1
Perfluoro-n-decanoic acid (PFDA)	335-76-2	PFAS by ID SOP	1.9	U	3.7	1.9	0.93	ng/L	1
Perfluoro-n-dodecanoic acid (PFDoA)	307-55-1	PFAS by ID SOP	1.9	U	3.7	1.9	0.93	ng/L	1
Perfluoro-n-heptanoic acid (PFHpA)	375-85-9	PFAS by ID SOP	1.9	U	3.7	1.9	0.93	ng/L	1
Perfluoro-n-hexanoic acid (PFHxA)	307-24-4	PFAS by ID SOP	1.9	U	3.7	1.9	0.93	ng/L	1
Perfluoro-n-nonanoic acid (PFNA)	375-95-1	PFAS by ID SOP	1.9	U	3.7	1.9	0.93	ng/L	1
Perfluoro-n-octanoic acid (PFOA)	335-67-1	PFAS by ID SOP	1.9	U	3.7	1.9	0.93	ng/L	1
Perfluoro-n-pentanoic acid (PFPeA)	2706-90-3	PFAS by ID SOP	1.9	U	3.7	1.9	0.93	ng/L	1
Perfluoro-n-tetradecanoic acid (PFTeDA)	376-06-7	PFAS by ID SOP	1.9	U	3.7	1.9	0.93	ng/L	1
Perfluoro-n-tridecanoic acid (PFTrDA)	72629-94-8	PFAS by ID SOP	1.9	U	3.7	1.9	0.93	ng/L	1
Perfluoro-n-undecanoic acid (PFUdA)	2058-94-8	PFAS by ID SOP	1.9	U	3.7	1.9	0.93	ng/L	1
Perfluorooctanesulfonic acid (PFOS)	1763-23-1	PFAS by ID SOP	1.9	U	3.7	1.9	0.93	ng/L	1

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
13C2_4:2FTS		99	50-150
13C2_6:2FTS		98	50-150
13C2_8:2FTS		91	50-150
13C2_PFDoA		82	50-150
13C2_PFTeDA		83	50-150
13C3_PFBS		94	50-150
13C3_PFHxS		85	50-150
13C4_PFBA		98	50-150
13C4_PFHpA		113	50-150
13C5_PFHxA		89	50-150
13C5_PFPeA		88	50-150
13C6_PFDA		81	50-150
13C7_PFUdA		80	50-150
13C8_PFOA		85	50-150
13C8_PFOS		71	50-150
13C8_PFOSA		88	50-150
13C9_PFNA		85	50-150

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

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SPLP PFAS

Client: **Arcadis U.S., Inc.**
Laboratory ID: **WF04011-003**
Description: **377-R-2**
Matrix: **Solid**
Date Sampled: **05/30/2021**
Date Received: **06/02/2021**

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
d5-EtFOSAA		86	50-150
d-MeFOSA		90	50-150
d3-MeFOSAA		95	50-150

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
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SPLP PFAS

Client: **Arcadis U.S., Inc.** Laboratory ID: **WF04011-004**

Description: **377-S-1** Matrix: **Solid**

Date Sampled: **05/30/2021**

Date Received: **06/02/2021**

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch	Leachate Date
1	1312/PFAS	PFAS by ID SOP QSM B-15	1	06/21/2021 1847	MMM	06/19/2021 1119	96072	06/10/2021 0230

Parameter	CAS Number	Analytical Method	Result	Q	LOQ	LOD	DL	Units	Run
1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS)	39108-34-4	PFAS by ID SOP	3.9	U	7.7	3.9	1.9	ng/L	1
1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS)	27619-97-2	PFAS by ID SOP	3.9	U	7.7	3.9	1.9	ng/L	1
1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS)	757124-72-4	PFAS by ID SOP	3.9	U	7.7	3.9	1.9	ng/L	1
N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA)	2991-50-6	PFAS by ID SOP	3.9	U	7.7	3.9	1.9	ng/L	1
N-methylperfluoro-1-octanesulfonamide (MeFOSA)	31506-32-8	PFAS by ID SOP	7.5	U	15	7.5	3.8	ng/L	1
N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA)	2355-31-9	PFAS by ID SOP	3.9	U	7.7	3.9	1.9	ng/L	1
Perfluoro-1-butanesulfonic acid (PFBS)	375-73-5	PFAS by ID SOP	1.9	U	3.8	1.9	0.96	ng/L	1
Perfluoro-1-decanesulfonic acid (PFDS)	335-77-3	PFAS by ID SOP	1.9	U	3.8	1.9	0.96	ng/L	1
Perfluoro-1-heptanesulfonic acid (PFHpS)	375-92-8	PFAS by ID SOP	1.9	U	3.8	1.9	0.96	ng/L	1
Perfluoro-1-nonanesulfonic acid (PFNS)	68259-12-1	PFAS by ID SOP	1.9	U	3.8	1.9	0.96	ng/L	1
Perfluoro-1-octanesulfonamide (PFOSA)	754-91-6	PFAS by ID SOP	1.9	U	3.8	1.9	0.96	ng/L	1
Perfluoro-1-pentanesulfonic acid (PFPeS)	2706-91-4	PFAS by ID SOP	1.9	U	3.8	1.9	0.96	ng/L	1
Perfluorohexanesulfonic acid (PFHxS)	**355-46-4**	**PFAS by ID SOP**	**1.4**	**J**	**3.8**	1.9	**0.96**	**ng/L**	**1**
Perfluoro-n-butanoic acid (PFBA)	375-22-4	PFAS by ID SOP	1.9	U	3.8	1.9	0.96	ng/L	1
Perfluoro-n-decanoic acid (PFDA)	335-76-2	PFAS by ID SOP	1.9	U	3.8	1.9	0.96	ng/L	1
Perfluoro-n-dodecanoic acid (PFDoA)	307-55-1	PFAS by ID SOP	1.9	U	3.8	1.9	0.96	ng/L	1
Perfluoro-n-heptanoic acid (PFHpA)	375-85-9	PFAS by ID SOP	1.9	U	3.8	1.9	0.96	ng/L	1
Perfluoro-n-hexanoic acid (PFHxA)	307-24-4	PFAS by ID SOP	1.9	U	3.8	1.9	0.96	ng/L	1
Perfluoro-n-nonanoic acid (PFNA)	375-95-1	PFAS by ID SOP	1.9	U	3.8	1.9	0.96	ng/L	1
Perfluoro-n-octanoic acid (PFOA)	335-67-1	PFAS by ID SOP	1.9	U	3.8	1.9	0.96	ng/L	1
Perfluoro-n-pentanoic acid (PFPeA)	2706-90-3	PFAS by ID SOP	1.9	U	3.8	1.9	0.96	ng/L	1
Perfluoro-n-tetradecanoic acid (PFTeDA)	376-06-7	PFAS by ID SOP	1.9	U	3.8	1.9	0.96	ng/L	1
Perfluoro-n-tridecanoic acid (PFTrDA)	72629-94-8	PFAS by ID SOP	1.9	U	3.8	1.9	0.96	ng/L	1
Perfluoro-n-undecanoic acid (PFUdA)	2058-94-8	PFAS by ID SOP	1.9	U	3.8	1.9	0.96	ng/L	1
Perfluorooctanesulfonic acid (PFOS)	**1763-23-1**	**PFAS by ID SOP**	**6.8**		**3.8**	1.9	**0.96**	**ng/L**	**1**

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
13C2_4:2FTS		99	50-150
13C2_6:2FTS		98	50-150
13C2_8:2FTS		89	50-150
13C2_PFDoA		74	50-150
13C2_PFTeDA		72	50-150
13C3_PFBS		83	50-150
13C3_PFHxS		86	50-150
13C4_PFBA		91	50-150
13C4_PFHpA		93	50-150
13C5_PFHxA		91	50-150
13C5_PFPeA		89	50-150
13C6_PFDA		83	50-150
13C7_PFUdA		79	50-150
13C8_PFOA		82	50-150
13C8_PFOS		76	50-150
13C8_PFOSA		94	50-150
13C9_PFNA		85	50-150

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

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SPLP PFAS

Client: **Arcadis U.S., Inc.**
Laboratory ID: **WF04011-004**
Description: **377-S-1**
Matrix: **Solid**
Date Sampled: **05/30/2021**
Date Received: **06/02/2021**

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
d5-EtFOSAA		86	50-150
d-MeFOSA		87	50-150
d3-MeFOSAA		85	50-150

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

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SPLP PFAS

Client: **Arcadis U.S., Inc.** Laboratory ID: **WF04011-005**

Description: **377-S-2** Matrix: **Solid**

Date Sampled: **05/30/2021**

Date Received: **06/02/2021**

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch	Leachate Date
1	1312/PFAS	PFAS by ID SOP QSM B-15	1	06/21/2021 1858	MMM	06/19/2021 1119	96072	06/10/2021 0230

Parameter	CAS Number	Analytical Method	Result	Q	LOQ	LOD	DL	Units	Run
1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS)	39108-34-4	PFAS by ID SOP	3.7	U	7.3	3.7	1.8	ng/L	1
1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS)	27619-97-2	PFAS by ID SOP	3.7	U	7.3	3.7	1.8	ng/L	1
1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS)	757124-72-4	PFAS by ID SOP	3.7	U	7.3	3.7	1.8	ng/L	1
N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA)	2991-50-6	PFAS by ID SOP	3.7	U	7.3	3.7	1.8	ng/L	1
N-methylperfluoro-1-octanesulfonamide (MeFOSA)	31506-32-8	PFAS by ID SOP	7.5	U	15	7.5	3.7	ng/L	1
N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA)	2355-31-9	PFAS by ID SOP	3.7	U	7.3	3.7	1.8	ng/L	1
Perfluoro-1-butanesulfonic acid (PFBS)	375-73-5	PFAS by ID SOP	1.9	U	3.7	1.9	0.92	ng/L	1
Perfluoro-1-decanesulfonic acid (PFDS)	335-77-3	PFAS by ID SOP	1.9	U	3.7	1.9	0.92	ng/L	1
Perfluoro-1-heptanesulfonic acid (PFHpS)	375-92-8	PFAS by ID SOP	1.9	U	3.7	1.9	0.92	ng/L	1
Perfluoro-1-nonanesulfonic acid (PFNS)	68259-12-1	PFAS by ID SOP	1.9	U	3.7	1.9	0.92	ng/L	1
Perfluoro-1-octanesulfonamide (PFOSA)	754-91-6	PFAS by ID SOP	1.9	U	3.7	1.9	0.92	ng/L	1
Perfluoro-1-pentanesulfonic acid (PFPeS)	2706-91-4	PFAS by ID SOP	1.9	U	3.7	1.9	0.92	ng/L	1
Perfluorohexanesulfonic acid (PFHxS)	355-46-4	PFAS by ID SOP	1.9	U	3.7	1.9	0.92	ng/L	1
Perfluoro-n-butanoic acid (PFBA)	375-22-4	PFAS by ID SOP	1.9	U	3.7	1.9	0.92	ng/L	1
Perfluoro-n-decanoic acid (PFDA)	335-76-2	PFAS by ID SOP	1.9	U	3.7	1.9	0.92	ng/L	1
Perfluoro-n-dodecanoic acid (PFDoA)	307-55-1	PFAS by ID SOP	1.9	U	3.7	1.9	0.92	ng/L	1
Perfluoro-n-heptanoic acid (PFHpA)	375-85-9	PFAS by ID SOP	1.9	U	3.7	1.9	0.92	ng/L	1
Perfluoro-n-hexanoic acid (PFHxA)	307-24-4	PFAS by ID SOP	1.9	U	3.7	1.9	0.92	ng/L	1
Perfluoro-n-nonanoic acid (PFNA)	375-95-1	PFAS by ID SOP	1.9	U	3.7	1.9	0.92	ng/L	1
Perfluoro-n-octanoic acid (PFOA)	335-67-1	PFAS by ID SOP	1.9	U	3.7	1.9	0.92	ng/L	1
Perfluoro-n-pentanoic acid (PFPeA)	2706-90-3	PFAS by ID SOP	1.9	U	3.7	1.9	0.92	ng/L	1
Perfluoro-n-tetradecanoic acid (PFTeDA)	376-06-7	PFAS by ID SOP	1.9	U	3.7	1.9	0.92	ng/L	1
Perfluoro-n-tridecanoic acid (PFTrDA)	72629-94-8	PFAS by ID SOP	1.9	U	3.7	1.9	0.92	ng/L	1
Perfluoro-n-undecanoic acid (PFUdA)	2058-94-8	PFAS by ID SOP	1.9	U	3.7	1.9	0.92	ng/L	1
Perfluorooctanesulfonic acid (PFOS)	**1763-23-1**	**PFAS by ID SOP**	**1.5**	**J**	**3.7**	1.9	**0.92**	**ng/L**	**1**

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
13C2_4:2FTS		109	50-150
13C2_6:2FTS		110	50-150
13C2_8:2FTS		98	50-150
13C2_PFDoA		90	50-150
13C2_PFTeDA		91	50-150
13C3_PFBS		96	50-150
13C3_PFHxS		103	50-150
13C4_PFBA		100	50-150
13C4_PFHpA		107	50-150
13C5_PFHxA		96	50-150
13C5_PFPeA		95	50-150
13C6_PFDA		92	50-150
13C7_PFUdA		87	50-150
13C8_PFOA		95	50-150
13C8_PFOS		86	50-150
13C8_PFOSA		101	50-150
13C9_PFNA		103	50-150

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

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SPLP PFAS

Client: **Arcadis U.S., Inc.**
Laboratory ID: **WF04011-005**
Description: **377-S-2**
Matrix: **Solid**
Date Sampled: **05/30/2021**
Date Received: **06/02/2021**

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
d5-EtFOSAA		99	50-150
d-MeFOSA		94	50-150
d3-MeFOSAA		103	50-150

LOQ = Limit of Quantitation	B = Detected in the method blank	E = Quantitation of compound exceeded the calibration range	DL = Detection Limit	Q = Surrogate failure
U = Not detected at or above the LOQ	N = Recovery is out of criteria	P = The RPD between two GC columns exceeds 40%	J = Estimated result < LOQ and ≥ DL	L = LCS/LCSD failure
H = Out of holding time	W = Reported on wet weight basis	LOD = Limit of Detection		S = MS/MSD failure

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SPLP PFAS

Client: **Arcadis U.S., Inc.** Laboratory ID: **WF04011-006**

Description: **377-S-3** Matrix: **Solid**

Date Sampled: **05/30/2021**

Date Received: **06/02/2021**

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch	Leachate Date
1	1312/PFAS	PFAS by ID SOP QSM B-15	1	06/21/2021 1908	MMM	06/19/2021 1119	96072	06/10/2021 0230

Parameter	CAS Number	Analytical Method	Result	Q	LOQ	LOD	DL	Units	Run
1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS)	39108-34-4	PFAS by ID SOP	4.0	U	8.0	4.0	2.0	ng/L	1
1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS)	**27619-97-2**	**PFAS by ID SOP**	**21**		**8.0**	4.0	**2.0**	**ng/L**	**1**
1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS)	757124-72-4	PFAS by ID SOP	4.0	U	8.0	4.0	2.0	ng/L	1
N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA)	2991-50-6	PFAS by ID SOP	4.0	U	8.0	4.0	2.0	ng/L	1
N-methylperfluoro-1-octanesulfonamide (MeFOSA)	31506-32-8	PFAS by ID SOP	8.0	U	16	8.0	4.0	ng/L	1
N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA)	2355-31-9	PFAS by ID SOP	4.0	U	8.0	4.0	2.0	ng/L	1
Perfluoro-1-butanesulfonic acid (PFBS)	375-73-5	PFAS by ID SOP	2.0	U	4.0	2.0	1.0	ng/L	1
Perfluoro-1-decanesulfonic acid (PFDS)	335-77-3	PFAS by ID SOP	2.0	U	4.0	2.0	1.0	ng/L	1
Perfluoro-1-heptanesulfonic acid (PFHpS)	375-92-8	PFAS by ID SOP	2.0	U	4.0	2.0	1.0	ng/L	1
Perfluoro-1-nonanesulfonic acid (PFNS)	68259-12-1	PFAS by ID SOP	2.0	U	4.0	2.0	1.0	ng/L	1
Perfluoro-1-octanesulfonamide (PFOSA)	754-91-6	PFAS by ID SOP	2.0	U	4.0	2.0	1.0	ng/L	1
Perfluoro-1-pentanesulfonic acid (PFPeS)	2706-91-4	PFAS by ID SOP	2.0	U	4.0	2.0	1.0	ng/L	1
Perfluorohexanesulfonic acid (PFHxS)	355-46-4	PFAS by ID SOP	2.0	U	4.0	2.0	1.0	ng/L	1
Perfluoro-n-butanoic acid (PFBA)	375-22-4	PFAS by ID SOP	2.0	U	4.0	2.0	1.0	ng/L	1
Perfluoro-n-decanoic acid (PFDA)	335-76-2	PFAS by ID SOP	2.0	U	4.0	2.0	1.0	ng/L	1
Perfluoro-n-dodecanoic acid (PFDoA)	307-55-1	PFAS by ID SOP	2.0	U	4.0	2.0	1.0	ng/L	1
Perfluoro-n-heptanoic acid (PFHpA)	375-85-9	PFAS by ID SOP	2.0	U	4.0	2.0	1.0	ng/L	1
Perfluoro-n-hexanoic acid (PFHxA)	307-24-4	PFAS by ID SOP	2.0	U	4.0	2.0	1.0	ng/L	1
Perfluoro-n-nonanoic acid (PFNA)	375-95-1	PFAS by ID SOP	2.0	U	4.0	2.0	1.0	ng/L	1
Perfluoro-n-octanoic acid (PFOA)	335-67-1	PFAS by ID SOP	2.0	U	4.0	2.0	1.0	ng/L	1
Perfluoro-n-pentanoic acid (PFPeA)	2706-90-3	PFAS by ID SOP	2.0	U	4.0	2.0	1.0	ng/L	1
Perfluoro-n-tetradecanoic acid (PFTeDA)	376-06-7	PFAS by ID SOP	2.0	U	4.0	2.0	1.0	ng/L	1
Perfluoro-n-tridecanoic acid (PFTrDA)	72629-94-8	PFAS by ID SOP	2.0	U	4.0	2.0	1.0	ng/L	1
Perfluoro-n-undecanoic acid (PFUdA)	2058-94-8	PFAS by ID SOP	2.0	U	4.0	2.0	1.0	ng/L	1
Perfluorooctanesulfonic acid (PFOS)	1763-23-1	PFAS by ID SOP	2.0	U	4.0	2.0	1.0	ng/L	1

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
13C2_4:2FTS		105	50-150
13C2_6:2FTS		101	50-150
13C2_8:2FTS		94	50-150
13C2_PFDoA		93	50-150
13C2_PFTeDA		80	50-150
13C3_PFBS		93	50-150
13C3_PFHxS		91	50-150
13C4_PFBA		96	50-150
13C4_PFHpA		99	50-150
13C5_PFHxA		92	50-150
13C5_PFPeA		92	50-150
13C6_PFDA		93	50-150
13C7_PFUdA		96	50-150
13C8_PFOA		91	50-150
13C8_PFOS		89	50-150
13C8_PFOSA		101	50-150
13C9_PFNA		93	50-150

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

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SPLP PFAS

Client: **Arcadis U.S., Inc.**
Laboratory ID: **WF04011-006**
Description: **377-S-3**
Matrix: **Solid**
Date Sampled: **05/30/2021**
Date Received: **06/02/2021**

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
d5-EtFOSAA		106	50-150
d-MeFOSA		99	50-150
d3-MeFOSAA		96	50-150

LOQ = Limit of Quantitation	B = Detected in the method blank	E = Quantitation of compound exceeded the calibration range	DL = Detection Limit	Q = Surrogate failure
U = Not detected at or above the LOQ	N = Recovery is out of criteria	P = The RPD between two GC columns exceeds 40%	J = Estimated result < LOQ and ≥ DL	L = LCS/LCSD failure
H = Out of holding time	W = Reported on wet weight basis	LOD = Limit of Detection		S = MS/MSD failure

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SPLP PFAS

Client: **Arcadis U.S., Inc.** Laboratory ID: **WF04011-007**

Description: **377-F-1** Matrix: **Solid**

Date Sampled: **05/30/2021**

Date Received: **06/02/2021**

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch	Leachate Date
1	1312/PFAS	PFAS by ID SOP QSM B-15	1	06/21/2021 1919	MMM	06/19/2021 1119	96072	06/10/2021 0230

Parameter	CAS Number	Analytical Method	Result	Q	LOQ	LOD	DL	Units	Run
1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS)	39108-34-4	PFAS by ID SOP	4.1	U	8.1	4.1	2.0	ng/L	1
1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS)	**27619-97-2**	**PFAS by ID SOP**	**100**		**8.1**	4.1	**2.0**	**ng/L**	**1**
1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS)	757124-72-4	PFAS by ID SOP	4.1	U	8.1	4.1	2.0	ng/L	1
N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA)	2991-50-6	PFAS by ID SOP	4.1	U	8.1	4.1	2.0	ng/L	1
N-methylperfluoro-1-octanesulfonamide (MeFOSA)	31506-32-8	PFAS by ID SOP	8.0	U	16	8.0	4.0	ng/L	1
N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA)	2355-31-9	PFAS by ID SOP	4.1	U	8.1	4.1	2.0	ng/L	1
Perfluoro-1-butanesulfonic acid (PFBS)	**375-73-5**	**PFAS by ID SOP**	**1.2**	**J**	**4.0**	2.0	**1.0**	**ng/L**	**1**
Perfluoro-1-decanesulfonic acid (PFDS)	335-77-3	PFAS by ID SOP	2.0	U	4.0	2.0	1.0	ng/L	1
Perfluoro-1-heptanesulfonic acid (PFHpS)	375-92-8	PFAS by ID SOP	2.0	U	4.0	2.0	1.0	ng/L	1
Perfluoro-1-nonanesulfonic acid (PFNS)	68259-12-1	PFAS by ID SOP	2.0	U	4.0	2.0	1.0	ng/L	1
Perfluoro-1-octanesulfonamide (PFOSA)	754-91-6	PFAS by ID SOP	2.0	U	4.0	2.0	1.0	ng/L	1
Perfluoro-1-pentanesulfonic acid (PFPeS)	2706-91-4	PFAS by ID SOP	2.0	U	4.0	2.0	1.0	ng/L	1
Perfluorohexanesulfonic acid (PFHxS)	**355-46-4**	**PFAS by ID SOP**	**3.1**	**J**	**4.0**	2.0	**1.0**	**ng/L**	**1**
Perfluoro-n-butanoic acid (PFBA)	375-22-4	PFAS by ID SOP	2.0	U	4.0	2.0	1.0	ng/L	1
Perfluoro-n-decanoic acid (PFDA)	335-76-2	PFAS by ID SOP	2.0	U	4.0	2.0	1.0	ng/L	1
Perfluoro-n-dodecanoic acid (PFDoA)	307-55-1	PFAS by ID SOP	2.0	U	4.0	2.0	1.0	ng/L	1
Perfluoro-n-heptanoic acid (PFHpA)	375-85-9	PFAS by ID SOP	2.0	U	4.0	2.0	1.0	ng/L	1
Perfluoro-n-hexanoic acid (PFHxA)	307-24-4	PFAS by ID SOP	2.0	U	4.0	2.0	1.0	ng/L	1
Perfluoro-n-nonanoic acid (PFNA)	375-95-1	PFAS by ID SOP	2.0	U	4.0	2.0	1.0	ng/L	1
Perfluoro-n-octanoic acid (PFOA)	335-67-1	PFAS by ID SOP	2.0	U	4.0	2.0	1.0	ng/L	1
Perfluoro-n-pentanoic acid (PFPeA)	2706-90-3	PFAS by ID SOP	2.0	U	4.0	2.0	1.0	ng/L	1
Perfluoro-n-tetradecanoic acid (PFTeDA)	376-06-7	PFAS by ID SOP	2.0	U	4.0	2.0	1.0	ng/L	1
Perfluoro-n-tridecanoic acid (PFTrDA)	72629-94-8	PFAS by ID SOP	2.0	U	4.0	2.0	1.0	ng/L	1
Perfluoro-n-undecanoic acid (PFUdA)	2058-94-8	PFAS by ID SOP	2.0	U	4.0	2.0	1.0	ng/L	1
Perfluorooctanesulfonic acid (PFOS)	**1763-23-1**	**PFAS by ID SOP**	**47**		**4.0**	2.0	**1.0**	**ng/L**	**1**

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
13C2_4:2FTS		121	50-150
13C2_6:2FTS		106	50-150
13C2_8:2FTS		110	50-150
13C2_PFDoA		80	50-150
13C2_PFTeDA		67	50-150
13C3_PFBS		94	50-150
13C3_PFHxS		94	50-150
13C4_PFBA		97	50-150
13C4_PFHpA		104	50-150
13C5_PFHxA		92	50-150
13C5_PFPeA		93	50-150
13C6_PFDA		95	50-150
13C7_PFUdA		97	50-150
13C8_PFOA		92	50-150
13C8_PFOS		95	50-150
13C8_PFOSA		104	50-150
13C9_PFNA		94	50-150

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

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SPLP PFAS

Client: **Arcadis U.S., Inc.**
Laboratory ID: **WF04011-007**
Description: **377-F-1**
Matrix: **Solid**
Date Sampled: **05/30/2021**
Date Received: **06/02/2021**

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
d5-EtFOSAA		127	50-150
d-MeFOSA		101	50-150
d3-MeFOSAA		113	50-150

LOQ = Limit of Quantitation	B = Detected in the method blank	E = Quantitation of compound exceeded the calibration range	DL = Detection Limit	Q = Surrogate failure
U = Not detected at or above the LOQ	N = Recovery is out of criteria	P = The RPD between two GC columns exceeds 40%	J = Estimated result < LOQ and ≥ DL	L = LCS/LCSD failure
H = Out of holding time	W = Reported on wet weight basis	LOD = Limit of Detection		S = MS/MSD failure

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SPLP PFAS

Client: **Arcadis U.S., Inc.** Laboratory ID: **WF04011-009**

Description: **379-R-1** Matrix: **Solid**

Date Sampled: **05/30/2021**

Date Received: **06/02/2021**

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch	Leachate Date
1	1312/PFAS	PFAS by ID SOP QSM B-15	1	06/21/2021 1951	MMM	06/19/2021 1119	96072	06/10/2021 0230

Parameter	CAS Number	Analytical Method	Result	Q	LOQ	LOD	DL	Units	Run
1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS)	39108-34-4	PFAS by ID SOP	4.0	U	7.9	4.0	2.0	ng/L	1
1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS)	**27619-97-2**	**PFAS by ID SOP**	**95**		**7.9**	4.0	**2.0**	**ng/L**	**1**
1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS)	757124-72-4	PFAS by ID SOP	4.0	U	7.9	4.0	2.0	ng/L	1
N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA)	2991-50-6	PFAS by ID SOP	4.0	U	7.9	4.0	2.0	ng/L	1
N-methylperfluoro-1-octanesulfonamide (MeFOSA)	31506-32-8	PFAS by ID SOP	8.0	U	16	8.0	4.0	ng/L	1
N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA)	2355-31-9	PFAS by ID SOP	4.0	U	7.9	4.0	2.0	ng/L	1
Perfluoro-1-butanesulfonic acid (PFBS)	375-73-5	PFAS by ID SOP	2.0	U	4.0	2.0	0.99	ng/L	1
Perfluoro-1-decanesulfonic acid (PFDS)	335-77-3	PFAS by ID SOP	2.0	U	4.0	2.0	0.99	ng/L	1
Perfluoro-1-heptanesulfonic acid (PFHpS)	375-92-8	PFAS by ID SOP	2.0	U	4.0	2.0	0.99	ng/L	1
Perfluoro-1-nonanesulfonic acid (PFNS)	68259-12-1	PFAS by ID SOP	2.0	U	4.0	2.0	0.99	ng/L	1
Perfluoro-1-octanesulfonamide (PFOSA)	754-91-6	PFAS by ID SOP	2.0	U	4.0	2.0	0.99	ng/L	1
Perfluoro-1-pentanesulfonic acid (PFPeS)	2706-91-4	PFAS by ID SOP	2.0	U	4.0	2.0	0.99	ng/L	1
Perfluorohexanesulfonic acid (PFHxS)	**355-46-4**	**PFAS by ID SOP**	**12**		**4.0**	2.0	**0.99**	**ng/L**	**1**
Perfluoro-n-butanoic acid (PFBA)	**375-22-4**	**PFAS by ID SOP**	**1.5**	**J**	**4.0**	2.0	**0.99**	**ng/L**	**1**
Perfluoro-n-decanoic acid (PFDA)	335-76-2	PFAS by ID SOP	2.0	U	4.0	2.0	0.99	ng/L	1
Perfluoro-n-dodecanoic acid (PFDoA)	307-55-1	PFAS by ID SOP	2.0	U	4.0	2.0	0.99	ng/L	1
Perfluoro-n-heptanoic acid (PFHpA)	**375-85-9**	**PFAS by ID SOP**	**1.5**	**J**	**4.0**	2.0	**0.99**	**ng/L**	**1**
Perfluoro-n-hexanoic acid (PFHxA)	**307-24-4**	**PFAS by ID SOP**	**3.4**	**J**	**4.0**	2.0	**0.99**	**ng/L**	**1**
Perfluoro-n-nonanoic acid (PFNA)	375-95-1	PFAS by ID SOP	2.0	U	4.0	2.0	0.99	ng/L	1
Perfluoro-n-octanoic acid (PFOA)	**335-67-1**	**PFAS by ID SOP**	**1.1**	**J**	**4.0**	2.0	**0.99**	**ng/L**	**1**
Perfluoro-n-pentanoic acid (PFPeA)	**2706-90-3**	**PFAS by ID SOP**	**4.3**		**4.0**	2.0	**0.99**	**ng/L**	**1**
Perfluoro-n-tetradecanoic acid (PFTeDA)	376-06-7	PFAS by ID SOP	2.0	U	4.0	2.0	0.99	ng/L	1
Perfluoro-n-tridecanoic acid (PFTrDA)	72629-94-8	PFAS by ID SOP	2.0	U	4.0	2.0	0.99	ng/L	1
Perfluoro-n-undecanoic acid (PFUdA)	2058-94-8	PFAS by ID SOP	2.0	U	4.0	2.0	0.99	ng/L	1
Perfluorooctanesulfonic acid (PFOS)	**1763-23-1**	**PFAS by ID SOP**	**29**		**4.0**	2.0	**0.99**	**ng/L**	**1**

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
13C2_4:2FTS		99	50-150
13C2_6:2FTS		106	50-150
13C2_8:2FTS		99	50-150
13C2_PFDoA		97	50-150
13C2_PFTeDA		86	50-150
13C3_PFBS		95	50-150
13C3_PFHxS		102	50-150
13C4_PFBA		96	50-150
13C4_PFHpA		102	50-150
13C5_PFHxA		95	50-150
13C5_PFPeA		94	50-150
13C6_PFDA		91	50-150
13C7_PFUdA		94	50-150
13C8_PFOA		92	50-150
13C8_PFOS		91	50-150
13C8_PFOSA		104	50-150
13C9_PFNA		97	50-150

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
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SPLP PFAS

Client: **Arcadis U.S., Inc.**
Laboratory ID: **WF04011-009**
Description: **379-R-1**
Matrix: **Solid**
Date Sampled: **05/30/2021**
Date Received: **06/02/2021**

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
d5-EtFOSAA		102	50-150
d-MeFOSA		98	50-150
d3-MeFOSAA		103	50-150

LOQ = Limit of Quantitation	B = Detected in the method blank	E = Quantitation of compound exceeded the calibration range	DL = Detection Limit	Q = Surrogate failure
U = Not detected at or above the LOQ	N = Recovery is out of criteria	P = The RPD between two GC columns exceeds 40%	J = Estimated result < LOQ and ≥ DL	L = LCS/LCSD failure
H = Out of holding time	W = Reported on wet weight basis	LOD = Limit of Detection		S = MS/MSD failure

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SPLP PFAS

Client: **Arcadis U.S., Inc.** Laboratory ID: **WF04011-010**

Description: **379-R-2** Matrix: **Solid**

Date Sampled: **05/30/2021**

Date Received: **06/02/2021**

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch	Leachate Date
1	1312/PFAS	PFAS by ID SOP QSM B-15	1	06/21/2021 2001	MMM	06/19/2021 1119	96072	06/10/2021 0230

Parameter	CAS Number	Analytical Method	Result	Q	LOQ	LOD	DL	Units	Run
1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS)	39108-34-4	PFAS by ID SOP	3.9	U	7.8	3.9	1.9	ng/L	1
1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS)	**27619-97-2**	**PFAS by ID SOP**	**99**		**7.8**	3.9	**1.9**	**ng/L**	**1**
1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS)	757124-72-4	PFAS by ID SOP	3.9	U	7.8	3.9	1.9	ng/L	1
N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA)	2991-50-6	PFAS by ID SOP	3.9	U	7.8	3.9	1.9	ng/L	1
N-methylperfluoro-1-octanesulfonamide (MeFOSA)	31506-32-8	PFAS by ID SOP	8.0	U	16	8.0	3.9	ng/L	1
N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA)	2355-31-9	PFAS by ID SOP	3.9	U	7.8	3.9	1.9	ng/L	1
Perfluoro-1-butanesulfonic acid (PFBS)	375-73-5	PFAS by ID SOP	2.0	U	3.9	2.0	0.97	ng/L	1
Perfluoro-1-decanesulfonic acid (PFDS)	335-77-3	PFAS by ID SOP	2.0	U	3.9	2.0	0.97	ng/L	1
Perfluoro-1-heptanesulfonic acid (PFHpS)	375-92-8	PFAS by ID SOP	2.0	U	3.9	2.0	0.97	ng/L	1
Perfluoro-1-nonanesulfonic acid (PFNS)	68259-12-1	PFAS by ID SOP	2.0	U	3.9	2.0	0.97	ng/L	1
Perfluoro-1-octanesulfonamide (PFOSA)	754-91-6	PFAS by ID SOP	2.0	U	3.9	2.0	0.97	ng/L	1
Perfluoro-1-pentanesulfonic acid (PFPeS)	**2706-91-4**	**PFAS by ID SOP**	**1.4**	**J**	**3.9**	2.0	**0.97**	**ng/L**	**1**
Perfluorohexanesulfonic acid (PFHxS)	**355-46-4**	**PFAS by ID SOP**	**19**		**3.9**	2.0	**0.97**	**ng/L**	**1**
Perfluoro-n-butanoic acid (PFBA)	**375-22-4**	**PFAS by ID SOP**	**1.1**	**J**	**3.9**	2.0	**0.97**	**ng/L**	**1**
Perfluoro-n-decanoic acid (PFDA)	335-76-2	PFAS by ID SOP	2.0	U	3.9	2.0	0.97	ng/L	1
Perfluoro-n-dodecanoic acid (PFDoA)	307-55-1	PFAS by ID SOP	2.0	U	3.9	2.0	0.97	ng/L	1
Perfluoro-n-heptanoic acid (PFHpA)	**375-85-9**	**PFAS by ID SOP**	**1.6**	**J**	**3.9**	2.0	**0.97**	**ng/L**	**1**
Perfluoro-n-hexanoic acid (PFHxA)	**307-24-4**	**PFAS by ID SOP**	**4.3**		**3.9**	2.0	**0.97**	**ng/L**	**1**
Perfluoro-n-nonanoic acid (PFNA)	375-95-1	PFAS by ID SOP	2.0	U	3.9	2.0	0.97	ng/L	1
Perfluoro-n-octanoic acid (PFOA)	**335-67-1**	**PFAS by ID SOP**	**1.4**	**J**	**3.9**	2.0	**0.97**	**ng/L**	**1**
Perfluoro-n-pentanoic acid (PFPeA)	**2706-90-3**	**PFAS by ID SOP**	**3.2**	**J**	**3.9**	2.0	**0.97**	**ng/L**	**1**
Perfluoro-n-tetradecanoic acid (PFTeDA)	376-06-7	PFAS by ID SOP	2.0	U	3.9	2.0	0.97	ng/L	1
Perfluoro-n-tridecanoic acid (PFTrDA)	72629-94-8	PFAS by ID SOP	2.0	U	3.9	2.0	0.97	ng/L	1
Perfluoro-n-undecanoic acid (PFUdA)	2058-94-8	PFAS by ID SOP	2.0	U	3.9	2.0	0.97	ng/L	1
Perfluorooctanesulfonic acid (PFOS)	**1763-23-1**	**PFAS by ID SOP**	**62**		**3.9**	2.0	**0.97**	**ng/L**	**1**

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
13C2_4:2FTS		108	50-150
13C2_6:2FTS		111	50-150
13C2_8:2FTS		117	50-150
13C2_PFDoA		100	50-150
13C2_PFTeDA		93	50-150
13C3_PFBS		94	50-150
13C3_PFHxS		97	50-150
13C4_PFBA		103	50-150
13C4_PFHpA		110	50-150
13C5_PFHxA		92	50-150
13C5_PFPeA		96	50-150
13C6_PFDA		101	50-150
13C7_PFUdA		92	50-150
13C8_PFOA		98	50-150
13C8_PFOS		88	50-150
13C8_PFOSA		108	50-150
13C9_PFNA		99	50-150

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

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SPLP PFAS

Client: **Arcadis U.S., Inc.**
Laboratory ID: **WF04011-010**
Description: **379-R-2**
Matrix: **Solid**
Date Sampled: **05/30/2021**
Date Received: **06/02/2021**

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
d5-EtFOSAA		111	50-150
d-MeFOSA		103	50-150
d3-MeFOSAA		106	50-150

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
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SPLP PFAS

Client: **Arcadis U.S., Inc.** Laboratory ID: **WF04011-011**

Description: **379-UT-1** Matrix: **Solid**

Date Sampled: **05/30/2021**

Date Received: **06/02/2021**

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch	Leachate Date
1	1312/PFAS	PFAS by ID SOP QSM B-15	1	06/21/2021 2012	MMM	06/19/2021 1119	96072	06/10/2021 0230
2	1312/PFAS	PFAS by ID SOP QSM B-15	10	06/23/2021 1110	MMM	06/19/2021 1119	96072	06/10/2021 0230

Parameter	CAS Number	Analytical Method	Result	Q	LOQ	LOD	DL	Units	Run
1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS)	**39108-34-4**	**PFAS by ID SOP**	**4.8**	**J**	**8.0**	4.0	**2.0**	**ng/L**	**1**
1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS)	**27619-97-2**	**PFAS by ID SOP**	**100**		**8.0**	4.0	**2.0**	**ng/L**	**1**
1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS)	757124-72-4	PFAS by ID SOP	4.0	U	8.0	4.0	2.0	ng/L	1
N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA)	2991-50-6	PFAS by ID SOP	4.0	U	8.0	4.0	2.0	ng/L	1
N-methylperfluoro-1-octanesulfonamide (MeFOSA)	31506-32-8	PFAS by ID SOP	8.0	U	16	8.0	4.0	ng/L	1
N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA)	2355-31-9	PFAS by ID SOP	4.0	U	8.0	4.0	2.0	ng/L	1
Perfluoro-1-butanesulfonic acid (PFBS)	**375-73-5**	**PFAS by ID SOP**	**13**		**4.0**	2.0	**1.0**	**ng/L**	**1**
Perfluoro-1-decanesulfonic acid (PFDS)	**335-77-3**	**PFAS by ID SOP**	**1.5**	**J**	**4.0**	2.0	**1.0**	**ng/L**	**1**
Perfluoro-1-heptanesulfonic acid (PFHpS)	**375-92-8**	**PFAS by ID SOP**	**17**		**4.0**	2.0	**1.0**	**ng/L**	**1**
Perfluoro-1-nonanesulfonic acid (PFNS)	**68259-12-1**	**PFAS by ID SOP**	**5.0**		**4.0**	2.0	**1.0**	**ng/L**	**1**
Perfluoro-1-octanesulfonamide (PFOSA)	**754-91-6**	**PFAS by ID SOP**	**8.7**		**4.0**	2.0	**1.0**	**ng/L**	**1**
Perfluoro-1-pentanesulfonic acid (PFPeS)	**2706-91-4**	**PFAS by ID SOP**	**24**		**4.0**	2.0	**1.0**	**ng/L**	**1**
Perfluorohexanesulfonic acid (PFHxS)	**355-46-4**	**PFAS by ID SOP**	**320**		**4.0**	2.0	**1.0**	**ng/L**	**1**
Perfluoro-n-butanoic acid (PFBA)	**375-22-4**	**PFAS by ID SOP**	**17**		**4.0**	2.0	**1.0**	**ng/L**	**1**
Perfluoro-n-decanoic acid (PFDA)	**335-76-2**	**PFAS by ID SOP**	**6.9**		**4.0**	2.0	**1.0**	**ng/L**	**1**
Perfluoro-n-dodecanoic acid (PFDoA)	307-55-1	PFAS by ID SOP	2.0	U	4.0	2.0	1.0	ng/L	1
Perfluoro-n-heptanoic acid (PFHpA)	**375-85-9**	**PFAS by ID SOP**	**26**		**4.0**	2.0	**1.0**	**ng/L**	**1**
Perfluoro-n-hexanoic acid (PFHxA)	**307-24-4**	**PFAS by ID SOP**	**76**		**4.0**	2.0	**1.0**	**ng/L**	**1**
Perfluoro-n-nonanoic acid (PFNA)	**375-95-1**	**PFAS by ID SOP**	**14**		**4.0**	2.0	**1.0**	**ng/L**	**1**
Perfluoro-n-octanoic acid (PFOA)	**335-67-1**	**PFAS by ID SOP**	**29**		**4.0**	2.0	**1.0**	**ng/L**	**1**
Perfluoro-n-pentanoic acid (PFPeA)	**2706-90-3**	**PFAS by ID SOP**	**83**		**4.0**	2.0	**1.0**	**ng/L**	**1**
Perfluoro-n-tetradecanoic acid (PFTeDA)	376-06-7	PFAS by ID SOP	2.0	U	4.0	2.0	1.0	ng/L	1
Perfluoro-n-tridecanoic acid (PFTrDA)	72629-94-8	PFAS by ID SOP	2.0	U	4.0	2.0	1.0	ng/L	1
Perfluoro-n-undecanoic acid (PFUdA)	2058-94-8	PFAS by ID SOP	2.0	U	4.0	2.0	1.0	ng/L	1
Perfluorooctanesulfonic acid (PFOS)	**1763-23-1**	**PFAS by ID SOP**	**3300**	**E**	**4.0**	2.0	**1.0**	**ng/L**	**1**

Surrogate	Run 1 Q	Run 1 % Recovery	Run 1 Acceptance Limits	Run 2 Q	Run 2 % Recovery	Run 2 Acceptance Limits
13C2_4:2FTS		109	50-150		97	50-150
13C2_6:2FTS		106	50-150		87	50-150
13C2_8:2FTS		97	50-150		108	50-150
13C2_PFDoA		86	50-150		103	50-150
13C2_PFTeDA		70	50-150		102	50-150
13C3_PFBS		91	50-150		100	50-150
13C3_PFHxS		93	50-150		107	50-150
13C4_PFBA		101	50-150		105	50-150
13C4_PFHpA		103	50-150		112	50-150
13C5_PFHxA		101	50-150		107	50-150
13C5_PFPeA		93	50-150		107	50-150
13C6_PFDA		86	50-150		112	50-150
13C7_PFUdA		113	50-150		98	50-150
13C8_PFOA		96	50-150		107	50-150
13C8_PFOS		70	50-150		105	50-150
13C8_PFOSA		106	50-150		112	50-150

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
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N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
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J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
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SPLP PFAS

Client: **Arcadis U.S., Inc.**
Laboratory ID: **WF04011-011**
Description: **379-UT-1**
Matrix: **Solid**
Date Sampled: **05/30/2021**
Date Received: **06/02/2021**

Surrogate	Q	Run 1 % Recovery	Acceptance Limits	Q	Run 2 % Recovery	Acceptance Limits
13C9_PFNA		78	50-150		100	50-150
d5-EtFOSAA		102	50-150		104	50-150
d-MeFOSA		99	50-150		111	50-150
d3-MeFOSAA		98	50-150		109	50-150

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
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S = MS/MSD failure

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SPLP PFAS

Client: **Arcadis U.S., Inc.** Laboratory ID: **WF04011-011**

Description: **379-UT-1** Matrix: **Solid**

Date Sampled: **05/30/2021**

Date Received: **06/02/2021**

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch	Leachate Date
1	1312/PFAS	PFAS by ID SOP QSM B-15	1	06/21/2021 2012	MMM	06/19/2021 1119	96072	06/10/2021 0230
2	1312/PFAS	PFAS by ID SOP QSM B-15	10	06/23/2021 1110	MMM	06/19/2021 1119	96072	06/10/2021 0230

Parameter	CAS Number	Analytical Method	Result	Q	LOQ	LOD	DL	Units	Run
1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS)	39108-34-4	PFAS by ID SOP	40	U	80	40	20	ng/L	2
1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS)	**27619-97-2**	**PFAS by ID SOP**	**92**		**80**	40	**20**	**ng/L**	**2**
1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS)	757124-72-4	PFAS by ID SOP	40	U	80	40	20	ng/L	2
N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA)	2991-50-6	PFAS by ID SOP	40	U	80	40	20	ng/L	2
N-methylperfluoro-1-octanesulfonamide (MeFOSA)	31506-32-8	PFAS by ID SOP	80	U	160	80	40	ng/L	2
N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA)	2355-31-9	PFAS by ID SOP	40	U	80	40	20	ng/L	2
Perfluoro-1-butanesulfonic acid (PFBS)	**375-73-5**	**PFAS by ID SOP**	**12**	**J**	**40**	20	**10**	**ng/L**	**2**
Perfluoro-1-decanesulfonic acid (PFDS)	335-77-3	PFAS by ID SOP	20	U	40	20	10	ng/L	2
Perfluoro-1-heptanesulfonic acid (PFHpS)	**375-92-8**	**PFAS by ID SOP**	**19**	**J**	**40**	20	**10**	**ng/L**	**2**
Perfluoro-1-nonanesulfonic acid (PFNS)	68259-12-1	PFAS by ID SOP	20	U	40	20	10	ng/L	2
Perfluoro-1-octanesulfonamide (PFOSA)	754-91-6	PFAS by ID SOP	20	U	40	20	10	ng/L	2
Perfluoro-1-pentanesulfonic acid (PFPeS)	**2706-91-4**	**PFAS by ID SOP**	**22**	**J**	**40**	20	**10**	**ng/L**	**2**
Perfluorohexanesulfonic acid (PFHxS)	**355-46-4**	**PFAS by ID SOP**	**320**		**40**	20	**10**	**ng/L**	**2**
Perfluoro-n-butanoic acid (PFBA)	**375-22-4**	**PFAS by ID SOP**	**17**	**J**	**40**	20	**10**	**ng/L**	**2**
Perfluoro-n-decanoic acid (PFDA)	335-76-2	PFAS by ID SOP	20	U	40	20	10	ng/L	2
Perfluoro-n-dodecanoic acid (PFDoA)	307-55-1	PFAS by ID SOP	20	U	40	20	10	ng/L	2
Perfluoro-n-heptanoic acid (PFHpA)	**375-85-9**	**PFAS by ID SOP**	**27**	**J**	**40**	20	**10**	**ng/L**	**2**
Perfluoro-n-hexanoic acid (PFHxA)	**307-24-4**	**PFAS by ID SOP**	**78**		**40**	20	**10**	**ng/L**	**2**
Perfluoro-n-nonanoic acid (PFNA)	**375-95-1**	**PFAS by ID SOP**	**13**	**J**	**40**	20	**10**	**ng/L**	**2**
Perfluoro-n-octanoic acid (PFOA)	**335-67-1**	**PFAS by ID SOP**	**25**	**J**	**40**	20	**10**	**ng/L**	**2**
Perfluoro-n-pentanoic acid (PFPeA)	**2706-90-3**	**PFAS by ID SOP**	**83**		**40**	20	**10**	**ng/L**	**2**
Perfluoro-n-tetradecanoic acid (PFTeDA)	376-06-7	PFAS by ID SOP	20	U	40	20	10	ng/L	2
Perfluoro-n-tridecanoic acid (PFTrDA)	72629-94-8	PFAS by ID SOP	20	U	40	20	10	ng/L	2
Perfluoro-n-undecanoic acid (PFUdA)	2058-94-8	PFAS by ID SOP	20	U	40	20	10	ng/L	2
Perfluorooctanesulfonic acid (PFOS)	**1763-23-1**	**PFAS by ID SOP**	**2800**		**40**	20	**10**	**ng/L**	**2**

Surrogate	Run 1 Q	Run 1 % Recovery	Run 1 Acceptance Limits	Run 2 Q	Run 2 % Recovery	Run 2 Acceptance Limits
13C2_4:2FTS		109	50-150		97	50-150
13C2_6:2FTS		106	50-150		87	50-150
13C2_8:2FTS		97	50-150		108	50-150
13C2_PFDoA		86	50-150		103	50-150
13C2_PFTeDA		70	50-150		102	50-150
13C3_PFBS		91	50-150		100	50-150
13C3_PFHxS		93	50-150		107	50-150
13C4_PFBA		101	50-150		105	50-150
13C4_PFHpA		103	50-150		112	50-150
13C5_PFHxA		101	50-150		107	50-150
13C5_PFPeA		93	50-150		107	50-150
13C6_PFDA		86	50-150		112	50-150
13C7_PFUdA		113	50-150		98	50-150
13C8_PFOA		96	50-150		107	50-150
13C8_PFOS		70	50-150		105	50-150
13C8_PFOSA		106	50-150		112	50-150

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

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SPLP PFAS

Client: **Arcadis U.S., Inc.**
Laboratory ID: **WF04011-011**
Description: **379-UT-1**
Matrix: **Solid**
Date Sampled: **05/30/2021**
Date Received: **06/02/2021**

Surrogate	Q	Run 1 % Recovery	Acceptance Limits	Q	Run 2 % Recovery	Acceptance Limits
13C9_PFNA		78	50-150		100	50-150
d5-EtFOSAA		102	50-150		104	50-150
d-MeFOSA		99	50-150		111	50-150
d3-MeFOSAA		98	50-150		109	50-150

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
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SPLP PFAS

Client: **Arcadis U.S., Inc.** Laboratory ID: **WF04011-012**

Description: **379-S-1** Matrix: **Solid**

Date Sampled: **05/30/2021**

Date Received: **06/02/2021**

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch	Leachate Date
1	1312/PFAS	PFAS by ID SOP QSM B-15	1	06/21/2021 2022	MMM	06/19/2021 1119	96072	06/10/2021 0230

Parameter	CAS Number	Analytical Method	Result	Q	LOQ	LOD	DL	Units	Run
1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS)	39108-34-4	PFAS by ID SOP	4.0	U	7.9	4.0	2.0	ng/L	1
1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS)	**27619-97-2**	**PFAS by ID SOP**	**73**		**7.9**	4.0	**2.0**	**ng/L**	**1**
1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS)	757124-72-4	PFAS by ID SOP	4.0	U	7.9	4.0	2.0	ng/L	1
N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA)	2991-50-6	PFAS by ID SOP	4.0	U	7.9	4.0	2.0	ng/L	1
N-methylperfluoro-1-octanesulfonamide (MeFOSA)	31506-32-8	PFAS by ID SOP	8.0	U	16	8.0	3.9	ng/L	1
N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA)	2355-31-9	PFAS by ID SOP	4.0	U	7.9	4.0	2.0	ng/L	1
Perfluoro-1-butanesulfonic acid (PFBS)	375-73-5	PFAS by ID SOP	2.0	U	3.9	2.0	0.98	ng/L	1
Perfluoro-1-decanesulfonic acid (PFDS)	335-77-3	PFAS by ID SOP	2.0	U	3.9	2.0	0.98	ng/L	1
Perfluoro-1-heptanesulfonic acid (PFHpS)	375-92-8	PFAS by ID SOP	2.0	U	3.9	2.0	0.98	ng/L	1
Perfluoro-1-nonanesulfonic acid (PFNS)	68259-12-1	PFAS by ID SOP	2.0	U	3.9	2.0	0.98	ng/L	1
Perfluoro-1-octanesulfonamide (PFOSA)	754-91-6	PFAS by ID SOP	2.0	U	3.9	2.0	0.98	ng/L	1
Perfluoro-1-pentanesulfonic acid (PFPeS)	2706-91-4	PFAS by ID SOP	2.0	U	3.9	2.0	0.98	ng/L	1
Perfluorohexanesulfonic acid (PFHxS)	355-46-4	PFAS by ID SOP	2.0	U	3.9	2.0	0.98	ng/L	1
Perfluoro-n-butanoic acid (PFBA)	375-22-4	PFAS by ID SOP	2.0	U	3.9	2.0	0.98	ng/L	1
Perfluoro-n-decanoic acid (PFDA)	335-76-2	PFAS by ID SOP	2.0	U	3.9	2.0	0.98	ng/L	1
Perfluoro-n-dodecanoic acid (PFDoA)	307-55-1	PFAS by ID SOP	2.0	U	3.9	2.0	0.98	ng/L	1
Perfluoro-n-heptanoic acid (PFHpA)	375-85-9	PFAS by ID SOP	2.0	U	3.9	2.0	0.98	ng/L	1
Perfluoro-n-hexanoic acid (PFHxA)	307-24-4	PFAS by ID SOP	2.0	U	3.9	2.0	0.98	ng/L	1
Perfluoro-n-nonanoic acid (PFNA)	375-95-1	PFAS by ID SOP	2.0	U	3.9	2.0	0.98	ng/L	1
Perfluoro-n-octanoic acid (PFOA)	335-67-1	PFAS by ID SOP	2.0	U	3.9	2.0	0.98	ng/L	1
Perfluoro-n-pentanoic acid (PFPeA)	2706-90-3	PFAS by ID SOP	2.0	U	3.9	2.0	0.98	ng/L	1
Perfluoro-n-tetradecanoic acid (PFTeDA)	376-06-7	PFAS by ID SOP	2.0	U	3.9	2.0	0.98	ng/L	1
Perfluoro-n-tridecanoic acid (PFTrDA)	72629-94-8	PFAS by ID SOP	2.0	U	3.9	2.0	0.98	ng/L	1
Perfluoro-n-undecanoic acid (PFUdA)	2058-94-8	PFAS by ID SOP	2.0	U	3.9	2.0	0.98	ng/L	1
Perfluorooctanesulfonic acid (PFOS)	**1763-23-1**	**PFAS by ID SOP**	**1.9**	**J**	**3.9**	2.0	**0.98**	**ng/L**	**1**

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
13C2_4:2FTS		110	50-150
13C2_6:2FTS		113	50-150
13C2_8:2FTS		95	50-150
13C2_PFDoA		97	50-150
13C2_PFTeDA		83	50-150
13C3_PFBS		93	50-150
13C3_PFHxS		97	50-150
13C4_PFBA		102	50-150
13C4_PFHpA		99	50-150
13C5_PFHxA		98	50-150
13C5_PFPeA		99	50-150
13C6_PFDA		103	50-150
13C7_PFUdA		94	50-150
13C8_PFOA		93	50-150
13C8_PFOS		92	50-150
13C8_PFOSA		101	50-150
13C9_PFNA		96	50-150

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

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SPLP PFAS

Client: **Arcadis U.S., Inc.**
Laboratory ID: **WF04011-012**
Description: **379-S-1**
Matrix: **Solid**
Date Sampled: **05/30/2021**
Date Received: **06/02/2021**

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
d5-EtFOSAA		105	50-150
d-MeFOSA		100	50-150
d3-MeFOSAA		101	50-150

LOQ = Limit of Quantitation	B = Detected in the method blank	E = Quantitation of compound exceeded the calibration range	DL = Detection Limit	Q = Surrogate failure
U = Not detected at or above the LOQ	N = Recovery is out of criteria	P = The RPD between two GC columns exceeds 40%	J = Estimated result < LOQ and ≥ DL	L = LCS/LCSD failure
H = Out of holding time	W = Reported on wet weight basis	LOD = Limit of Detection		S = MS/MSD failure

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SPLP PFAS

Client: **Arcadis U.S., Inc.** Laboratory ID: **WF04011-013**

Description: **379-S-2** Matrix: **Solid**

Date Sampled: **05/30/2021**

Date Received: **06/02/2021**

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch	Leachate Date
1	1312/PFAS	PFAS by ID SOP QSM B-15	1	06/21/2021 2033	MMM	06/19/2021 1119	96072	06/10/2021 0230

Parameter	CAS Number	Analytical Method	Result	Q	LOQ	LOD	DL	Units	Run
1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS)	39108-34-4	PFAS by ID SOP	3.8	U	7.5	3.8	1.9	ng/L	1
1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS)	**27619-97-2**	**PFAS by ID SOP**	**120**		**7.5**	3.8	**1.9**	**ng/L**	**1**
1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS)	757124-72-4	PFAS by ID SOP	3.8	U	7.5	3.8	1.9	ng/L	1
N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA)	2991-50-6	PFAS by ID SOP	3.8	U	7.5	3.8	1.9	ng/L	1
N-methylperfluoro-1-octanesulfonamide (MeFOSA)	31506-32-8	PFAS by ID SOP	7.5	U	15	7.5	3.7	ng/L	1
N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA)	2355-31-9	PFAS by ID SOP	3.8	U	7.5	3.8	1.9	ng/L	1
Perfluoro-1-butanesulfonic acid (PFBS)	375-73-5	PFAS by ID SOP	1.9	U	3.7	1.9	0.94	ng/L	1
Perfluoro-1-decanesulfonic acid (PFDS)	335-77-3	PFAS by ID SOP	1.9	U	3.7	1.9	0.94	ng/L	1
Perfluoro-1-heptanesulfonic acid (PFHpS)	375-92-8	PFAS by ID SOP	1.9	U	3.7	1.9	0.94	ng/L	1
Perfluoro-1-nonanesulfonic acid (PFNS)	68259-12-1	PFAS by ID SOP	1.9	U	3.7	1.9	0.94	ng/L	1
Perfluoro-1-octanesulfonamide (PFOSA)	754-91-6	PFAS by ID SOP	1.9	U	3.7	1.9	0.94	ng/L	1
Perfluoro-1-pentanesulfonic acid (PFPeS)	2706-91-4	PFAS by ID SOP	1.9	U	3.7	1.9	0.94	ng/L	1
Perfluorohexanesulfonic acid (PFHxS)	355-46-4	PFAS by ID SOP	1.9	U	3.7	1.9	0.94	ng/L	1
Perfluoro-n-butanoic acid (PFBA)	375-22-4	PFAS by ID SOP	1.9	U	3.7	1.9	0.94	ng/L	1
Perfluoro-n-decanoic acid (PFDA)	335-76-2	PFAS by ID SOP	1.9	U	3.7	1.9	0.94	ng/L	1
Perfluoro-n-dodecanoic acid (PFDoA)	307-55-1	PFAS by ID SOP	1.9	U	3.7	1.9	0.94	ng/L	1
Perfluoro-n-heptanoic acid (PFHpA)	375-85-9	PFAS by ID SOP	1.9	U	3.7	1.9	0.94	ng/L	1
Perfluoro-n-hexanoic acid (PFHxA)	307-24-4	PFAS by ID SOP	1.9	U	3.7	1.9	0.94	ng/L	1
Perfluoro-n-nonanoic acid (PFNA)	375-95-1	PFAS by ID SOP	1.9	U	3.7	1.9	0.94	ng/L	1
Perfluoro-n-octanoic acid (PFOA)	335-67-1	PFAS by ID SOP	1.9	U	3.7	1.9	0.94	ng/L	1
Perfluoro-n-pentanoic acid (PFPeA)	2706-90-3	PFAS by ID SOP	1.9	U	3.7	1.9	0.94	ng/L	1
Perfluoro-n-tetradecanoic acid (PFTeDA)	376-06-7	PFAS by ID SOP	1.9	U	3.7	1.9	0.94	ng/L	1
Perfluoro-n-tridecanoic acid (PFTrDA)	72629-94-8	PFAS by ID SOP	1.9	U	3.7	1.9	0.94	ng/L	1
Perfluoro-n-undecanoic acid (PFUdA)	2058-94-8	PFAS by ID SOP	1.9	U	3.7	1.9	0.94	ng/L	1
Perfluorooctanesulfonic acid (PFOS)	**1763-23-1**	**PFAS by ID SOP**	**1.4**	**J**	**3.7**	1.9	**0.94**	**ng/L**	**1**

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
13C2_4:2FTS		121	50-150
13C2_6:2FTS		108	50-150
13C2_8:2FTS		91	50-150
13C2_PFDoA		87	50-150
13C2_PFTeDA		83	50-150
13C3_PFBS		94	50-150
13C3_PFHxS		89	50-150
13C4_PFBA		102	50-150
13C4_PFHpA		111	50-150
13C5_PFHxA		100	50-150
13C5_PFPeA		101	50-150
13C6_PFDA		102	50-150
13C7_PFUdA		91	50-150
13C8_PFOA		100	50-150
13C8_PFOS		88	50-150
13C8_PFOSA		106	50-150
13C9_PFNA		97	50-150

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

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SPLP PFAS

Client: **Arcadis U.S., Inc.**
Laboratory ID: **WF04011-013**
Description: **379-S-2**
Matrix: **Solid**
Date Sampled: **05/30/2021**
Date Received: **06/02/2021**

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
d5-EtFOSAA		97	50-150
d-MeFOSA		93	50-150
d3-MeFOSAA		99	50-150

LOQ = Limit of Quantitation	B = Detected in the method blank	E = Quantitation of compound exceeded the calibration range	DL = Detection Limit	Q = Surrogate failure
U = Not detected at or above the LOQ	N = Recovery is out of criteria	P = The RPD between two GC columns exceeds 40%	J = Estimated result < LOQ and ≥ DL	L = LCS/LCSD failure
H = Out of holding time	W = Reported on wet weight basis	LOD = Limit of Detection		S = MS/MSD failure

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SPLP PFAS

Client: **Arcadis U.S., Inc.** Laboratory ID: **WF04011-014**

Description: **379-S-3** Matrix: **Solid**

Date Sampled: **05/30/2021**

Date Received: **06/02/2021**

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch	Leachate Date
1	1312/PFAS	PFAS by ID SOP QSM B-15	1	06/21/2021 2044	MMM	06/19/2021 1119	96072	06/10/2021 0230

Parameter	CAS Number	Analytical Method	Result	Q	LOQ	LOD	DL	Units	Run
1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS)	39108-34-4	PFAS by ID SOP	3.9	U	7.7	3.9	1.9	ng/L	1
1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS)	**27619-97-2**	**PFAS by ID SOP**	**64**		**7.7**	3.9	**1.9**	**ng/L**	**1**
1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS)	757124-72-4	PFAS by ID SOP	3.9	U	7.7	3.9	1.9	ng/L	1
N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA)	2991-50-6	PFAS by ID SOP	3.9	U	7.7	3.9	1.9	ng/L	1
N-methylperfluoro-1-octanesulfonamide (MeFOSA)	31506-32-8	PFAS by ID SOP	7.5	U	15	7.5	3.9	ng/L	1
N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA)	2355-31-9	PFAS by ID SOP	3.9	U	7.7	3.9	1.9	ng/L	1
Perfluoro-1-butanesulfonic acid (PFBS)	375-73-5	PFAS by ID SOP	2.0	U	3.9	2.0	0.97	ng/L	1
Perfluoro-1-decanesulfonic acid (PFDS)	335-77-3	PFAS by ID SOP	2.0	U	3.9	2.0	0.97	ng/L	1
Perfluoro-1-heptanesulfonic acid (PFHpS)	375-92-8	PFAS by ID SOP	2.0	U	3.9	2.0	0.97	ng/L	1
Perfluoro-1-nonanesulfonic acid (PFNS)	68259-12-1	PFAS by ID SOP	2.0	U	3.9	2.0	0.97	ng/L	1
Perfluoro-1-octanesulfonamide (PFOSA)	754-91-6	PFAS by ID SOP	2.0	U	3.9	2.0	0.97	ng/L	1
Perfluoro-1-pentanesulfonic acid (PFPeS)	2706-91-4	PFAS by ID SOP	2.0	U	3.9	2.0	0.97	ng/L	1
Perfluorohexanesulfonic acid (PFHxS)	355-46-4	PFAS by ID SOP	2.0	U	3.9	2.0	0.97	ng/L	1
Perfluoro-n-butanoic acid (PFBA)	375-22-4	PFAS by ID SOP	2.0	U	3.9	2.0	0.97	ng/L	1
Perfluoro-n-decanoic acid (PFDA)	335-76-2	PFAS by ID SOP	2.0	U	3.9	2.0	0.97	ng/L	1
Perfluoro-n-dodecanoic acid (PFDoA)	307-55-1	PFAS by ID SOP	2.0	U	3.9	2.0	0.97	ng/L	1
Perfluoro-n-heptanoic acid (PFHpA)	375-85-9	PFAS by ID SOP	2.0	U	3.9	2.0	0.97	ng/L	1
Perfluoro-n-hexanoic acid (PFHxA)	307-24-4	PFAS by ID SOP	2.0	U	3.9	2.0	0.97	ng/L	1
Perfluoro-n-nonanoic acid (PFNA)	375-95-1	PFAS by ID SOP	2.0	U	3.9	2.0	0.97	ng/L	1
Perfluoro-n-octanoic acid (PFOA)	335-67-1	PFAS by ID SOP	2.0	U	3.9	2.0	0.97	ng/L	1
Perfluoro-n-pentanoic acid (PFPeA)	2706-90-3	PFAS by ID SOP	2.0	U	3.9	2.0	0.97	ng/L	1
Perfluoro-n-tetradecanoic acid (PFTeDA)	376-06-7	PFAS by ID SOP	2.0	U	3.9	2.0	0.97	ng/L	1
Perfluoro-n-tridecanoic acid (PFTrDA)	72629-94-8	PFAS by ID SOP	2.0	U	3.9	2.0	0.97	ng/L	1
Perfluoro-n-undecanoic acid (PFUdA)	2058-94-8	PFAS by ID SOP	2.0	U	3.9	2.0	0.97	ng/L	1
Perfluorooctanesulfonic acid (PFOS)	**1763-23-1**	**PFAS by ID SOP**	**2.2**	**J**	**3.9**	2.0	**0.97**	**ng/L**	**1**

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
13C2_4:2FTS		110	50-150
13C2_6:2FTS		112	50-150
13C2_8:2FTS		108	50-150
13C2_PFDoA		94	50-150
13C2_PFTeDA		90	50-150
13C3_PFBS		96	50-150
13C3_PFHxS		105	50-150
13C4_PFBA		107	50-150
13C4_PFHpA		112	50-150
13C5_PFHxA		103	50-150
13C5_PFPeA		103	50-150
13C6_PFDA		102	50-150
13C7_PFUdA		97	50-150
13C8_PFOA		94	50-150
13C8_PFOS		93	50-150
13C8_PFOSA		107	50-150
13C9_PFNA		102	50-150

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
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W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

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SPLP PFAS

Client: **Arcadis U.S., Inc.**
Laboratory ID: **WF04011-014**
Description: **379-S-3**
Matrix: **Solid**
Date Sampled: **05/30/2021**
Date Received: **06/02/2021**

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
d5-EtFOSAA		105	50-150
d-MeFOSA		99	50-150
d3-MeFOSAA		110	50-150

LOQ = Limit of Quantitation	B = Detected in the method blank	E = Quantitation of compound exceeded the calibration range	DL = Detection Limit	Q = Surrogate failure
U = Not detected at or above the LOQ	N = Recovery is out of criteria	P = The RPD between two GC columns exceeds 40%	J = Estimated result < LOQ and ≥ DL	L = LCS/LCSD failure
H = Out of holding time	W = Reported on wet weight basis	LOD = Limit of Detection		S = MS/MSD failure

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SPLP PFAS

Client: **Arcadis U.S., Inc.** Laboratory ID: **WF04011-015**

Description: **379-F-1** Matrix: **Solid**

Date Sampled: **05/30/2021**

Date Received: **06/02/2021**

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch	Leachate Date
1	1312/PFAS	PFAS by ID SOP QSM B-15	1	06/21/2021 2054	MMM	06/19/2021 1119	96072	06/10/2021 0230

Parameter	CAS Number	Analytical Method	Result	Q	LOQ	LOD	DL	Units	Run
1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS)	**39108-34-4**	**PFAS by ID SOP**	**2.7**	**JQ**	**7.6**	3.8	**1.9**	**ng/L**	**1**
1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS)	**27619-97-2**	**PFAS by ID SOP**	**110**		**7.6**	3.8	**1.9**	**ng/L**	**1**
1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS)	757124-72-4	PFAS by ID SOP	3.8	U	7.6	3.8	1.9	ng/L	1
N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA)	2991-50-6	PFAS by ID SOP	3.8	U	7.6	3.8	1.9	ng/L	1
N-methylperfluoro-1-octanesulfonamide (MeFOSA)	31506-32-8	PFAS by ID SOP	7.5	U	15	7.5	3.8	ng/L	1
N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA)	2355-31-9	PFAS by ID SOP	3.8	U	7.6	3.8	1.9	ng/L	1
Perfluoro-1-butanesulfonic acid (PFBS)	375-73-5	PFAS by ID SOP	1.9	U	3.8	1.9	0.95	ng/L	1
Perfluoro-1-decanesulfonic acid (PFDS)	335-77-3	PFAS by ID SOP	1.9	U	3.8	1.9	0.95	ng/L	1
Perfluoro-1-heptanesulfonic acid (PFHpS)	375-92-8	PFAS by ID SOP	1.9	U	3.8	1.9	0.95	ng/L	1
Perfluoro-1-nonanesulfonic acid (PFNS)	68259-12-1	PFAS by ID SOP	1.9	U	3.8	1.9	0.95	ng/L	1
Perfluoro-1-octanesulfonamide (PFOSA)	**754-91-6**	**PFAS by ID SOP**	**2.1**	**J**	**3.8**	1.9	**0.95**	**ng/L**	**1**
Perfluoro-1-pentanesulfonic acid (PFPeS)	2706-91-4	PFAS by ID SOP	1.9	U	3.8	1.9	0.95	ng/L	1
Perfluorohexanesulfonic acid (PFHxS)	**355-46-4**	**PFAS by ID SOP**	**13**		**3.8**	1.9	**0.95**	**ng/L**	**1**
Perfluoro-n-butanoic acid (PFBA)	375-22-4	PFAS by ID SOP	1.9	U	3.8	1.9	0.95	ng/L	1
Perfluoro-n-decanoic acid (PFDA)	335-76-2	PFAS by ID SOP	1.9	U	3.8	1.9	0.95	ng/L	1
Perfluoro-n-dodecanoic acid (PFDoA)	307-55-1	PFAS by ID SOP	1.9	UQ	3.8	1.9	0.95	ng/L	1
Perfluoro-n-heptanoic acid (PFHpA)	375-85-9	PFAS by ID SOP	1.9	U	3.8	1.9	0.95	ng/L	1
Perfluoro-n-hexanoic acid (PFHxA)	**307-24-4**	**PFAS by ID SOP**	**1.5**	**J**	**3.8**	1.9	**0.95**	**ng/L**	**1**
Perfluoro-n-nonanoic acid (PFNA)	375-95-1	PFAS by ID SOP	1.9	U	3.8	1.9	0.95	ng/L	1
Perfluoro-n-octanoic acid (PFOA)	**335-67-1**	**PFAS by ID SOP**	**1.2**	**J**	**3.8**	1.9	**0.95**	**ng/L**	**1**
Perfluoro-n-pentanoic acid (PFPeA)	2706-90-3	PFAS by ID SOP	1.9	U	3.8	1.9	0.95	ng/L	1
Perfluoro-n-tetradecanoic acid (PFTeDA)	376-06-7	PFAS by ID SOP	1.9	U	3.8	1.9	0.95	ng/L	1
Perfluoro-n-tridecanoic acid (PFTrDA)	72629-94-8	PFAS by ID SOP	1.9	UQ	3.8	1.9	0.95	ng/L	1
Perfluoro-n-undecanoic acid (PFUdA)	2058-94-8	PFAS by ID SOP	1.9	U	3.8	1.9	0.95	ng/L	1
Perfluorooctanesulfonic acid (PFOS)	**1763-23-1**	**PFAS by ID SOP**	**83**		**3.8**	1.9	**0.95**	**ng/L**	**1**

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
13C2_4:2FTS		147	50-150
13C2_6:2FTS		144	50-150
13C2_8:2FTS	N	167	50-150
13C2_PFDoA	N	40	50-150
13C2_PFTeDA		51	50-150
13C3_PFBS		104	50-150
13C3_PFHxS		106	50-150
13C4_PFBA		100	50-150
13C4_PFHpA		112	50-150
13C5_PFHxA		102	50-150
13C5_PFPeA		107	50-150
13C6_PFDA		111	50-150
13C7_PFUdA		75	50-150
13C8_PFOA		109	50-150
13C8_PFOS		103	50-150
13C8_PFOSA		120	50-150
13C9_PFNA		103	50-150

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

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SPLP PFAS

Client: **Arcadis U.S., Inc.**
Laboratory ID: **WF04011-015**
Description: **379-F-1**
Matrix: **Solid**
Date Sampled: **05/30/2021**
Date Received: **06/02/2021**

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
d5-EtFOSAA		77	50-150
d-MeFOSA		56	50-150
d3-MeFOSAA		112	50-150

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
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SPLP PFAS

Client: **Arcadis U.S., Inc.** Laboratory ID: **WF04011-016**

Description: **379-F-2** Matrix: **Solid**

Date Sampled: **05/30/2021**

Date Received: **06/04/2021**

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch	Leachate Date
1	1312/PFAS	PFAS by ID SOP QSM B-15	1	06/21/2021 2105	MMM	06/19/2021 1119	96072	06/10/2021 0230

Parameter	CAS Number	Analytical Method	Result	Q	LOQ	LOD	DL	Units	Run
1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS)	**39108-34-4**	**PFAS by ID SOP**	**4.0**	**J**	**7.5**	3.8	**1.9**	**ng/L**	**1**
1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS)	**27619-97-2**	**PFAS by ID SOP**	**100**		**7.5**	3.8	**1.9**	**ng/L**	**1**
1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS)	757124-72-4	PFAS by ID SOP	3.8	U	7.5	3.8	1.9	ng/L	1
N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA)	2991-50-6	PFAS by ID SOP	3.8	U	7.5	3.8	1.9	ng/L	1
N-methylperfluoro-1-octanesulfonamide (MeFOSA)	31506-32-8	PFAS by ID SOP	7.5	U	15	7.5	3.8	ng/L	1
N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA)	2355-31-9	PFAS by ID SOP	3.8	U	7.5	3.8	1.9	ng/L	1
Perfluoro-1-butanesulfonic acid (PFBS)	375-73-5	PFAS by ID SOP	1.9	U	3.8	1.9	0.94	ng/L	1
Perfluoro-1-decanesulfonic acid (PFDS)	335-77-3	PFAS by ID SOP	1.9	U	3.8	1.9	0.94	ng/L	1
Perfluoro-1-heptanesulfonic acid (PFHpS)	375-92-8	PFAS by ID SOP	1.9	U	3.8	1.9	0.94	ng/L	1
Perfluoro-1-nonanesulfonic acid (PFNS)	68259-12-1	PFAS by ID SOP	1.9	U	3.8	1.9	0.94	ng/L	1
Perfluoro-1-octanesulfonamide (PFOSA)	754-91-6	PFAS by ID SOP	1.9	U	3.8	1.9	0.94	ng/L	1
Perfluoro-1-pentanesulfonic acid (PFPeS)	2706-91-4	PFAS by ID SOP	1.9	U	3.8	1.9	0.94	ng/L	1
Perfluorohexanesulfonic acid (PFHxS)	**355-46-4**	**PFAS by ID SOP**	**3.0**	**J**	**3.8**	1.9	**0.94**	**ng/L**	**1**
Perfluoro-n-butanoic acid (PFBA)	375-22-4	PFAS by ID SOP	1.9	U	3.8	1.9	0.94	ng/L	1
Perfluoro-n-decanoic acid (PFDA)	335-76-2	PFAS by ID SOP	1.9	U	3.8	1.9	0.94	ng/L	1
Perfluoro-n-dodecanoic acid (PFDoA)	307-55-1	PFAS by ID SOP	1.9	U	3.8	1.9	0.94	ng/L	1
Perfluoro-n-heptanoic acid (PFHpA)	375-85-9	PFAS by ID SOP	1.9	U	3.8	1.9	0.94	ng/L	1
Perfluoro-n-hexanoic acid (PFHxA)	**307-24-4**	**PFAS by ID SOP**	**1.9**	**J**	**3.8**	1.9	**0.94**	**ng/L**	**1**
Perfluoro-n-nonanoic acid (PFNA)	375-95-1	PFAS by ID SOP	1.9	U	3.8	1.9	0.94	ng/L	1
Perfluoro-n-octanoic acid (PFOA)	335-67-1	PFAS by ID SOP	1.9	U	3.8	1.9	0.94	ng/L	1
Perfluoro-n-pentanoic acid (PFPeA)	2706-90-3	PFAS by ID SOP	1.9	U	3.8	1.9	0.94	ng/L	1
Perfluoro-n-tetradecanoic acid (PFTeDA)	376-06-7	PFAS by ID SOP	1.9	U	3.8	1.9	0.94	ng/L	1
Perfluoro-n-tridecanoic acid (PFTrDA)	72629-94-8	PFAS by ID SOP	1.9	U	3.8	1.9	0.94	ng/L	1
Perfluoro-n-undecanoic acid (PFUdA)	2058-94-8	PFAS by ID SOP	1.9	U	3.8	1.9	0.94	ng/L	1
Perfluorooctanesulfonic acid (PFOS)	**1763-23-1**	**PFAS by ID SOP**	**7.8**		**3.8**	1.9	**0.94**	**ng/L**	**1**

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
13C2_4:2FTS		117	50-150
13C2_6:2FTS		108	50-150
13C2_8:2FTS		102	50-150
13C2_PFDoA		102	50-150
13C2_PFTeDA		90	50-150
13C3_PFBS		97	50-150
13C3_PFHxS		99	50-150
13C4_PFBA		106	50-150
13C4_PFHpA		101	50-150
13C5_PFHxA		97	50-150
13C5_PFPeA		99	50-150
13C6_PFDA		98	50-150
13C7_PFUdA		100	50-150
13C8_PFOA		96	50-150
13C8_PFOS		97	50-150
13C8_PFOSA		105	50-150
13C9_PFNA		95	50-150

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

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SPLP PFAS

Client: **Arcadis U.S., Inc.**
Laboratory ID: **WF04011-016**
Description: **379-F-2**
Matrix: **Solid**
Date Sampled: **05/30/2021**
Date Received: **06/04/2021**

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
d5-EtFOSAA		116	50-150
d-MeFOSA		102	50-150
d3-MeFOSAA		106	50-150

LOQ = Limit of Quantitation	B = Detected in the method blank	E = Quantitation of compound exceeded the calibration range	DL = Detection Limit	Q = Surrogate failure
U = Not detected at or above the LOQ	N = Recovery is out of criteria	P = The RPD between two GC columns exceeds 40%	J = Estimated result < LOQ and ≥ DL	L = LCS/LCSD failure
H = Out of holding time	W = Reported on wet weight basis	LOD = Limit of Detection		S = MS/MSD failure

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QC Summary

SPLP PFAS - MB

Sample ID: WQ96072-001
Batch: 96072
Analytical Method: PFAS by ID SOP QSM B-15
Matrix: Solid
Prep Method: 1312/PFAS
Prep Date: 06/19/2021 1119 **Leachate Date:** 06/10/2021 0230

Parameter	Result	Q	Dil	LOQ	LOD	DL	Units	Analysis Date
8:2 FTS	40	U	1	80	40	20	ng/L	06/21/2021 1722
6:2 FTS	40	U	1	80	40	20	ng/L	06/21/2021 1722
4:2 FTS	40	U	1	80	40	20	ng/L	06/21/2021 1722
EtFOSAA	40	U	1	80	40	20	ng/L	06/21/2021 1722
MeFOSA	80	U	1	160	80	40	ng/L	06/21/2021 1722
MeFOSAA	40	U	1	80	40	20	ng/L	06/21/2021 1722
PFBS	20	U	1	40	20	10	ng/L	06/21/2021 1722
PFDS	20	U	1	40	20	10	ng/L	06/21/2021 1722
PFHpS	20	U	1	40	20	10	ng/L	06/21/2021 1722
PFNS	20	U	1	40	20	10	ng/L	06/21/2021 1722
PFOSA	20	U	1	40	20	10	ng/L	06/21/2021 1722
PFPeS	20	U	1	40	20	10	ng/L	06/21/2021 1722
PFHxS	20	U	1	40	20	10	ng/L	06/21/2021 1722
PFBA	20	U	1	40	20	10	ng/L	06/21/2021 1722
PFDA	20	U	1	40	20	10	ng/L	06/21/2021 1722
PFDoA	20	U	1	40	20	10	ng/L	06/21/2021 1722
PFHpA	20	U	1	40	20	10	ng/L	06/21/2021 1722
PFHxA	20	U	1	40	20	10	ng/L	06/21/2021 1722
PFNA	20	U	1	40	20	10	ng/L	06/21/2021 1722
PFOA	20	U	1	40	20	10	ng/L	06/21/2021 1722
PFPeA	20	U	1	40	20	10	ng/L	06/21/2021 1722
PFTeDA	20	U	1	40	20	10	ng/L	06/21/2021 1722
PFTrDA	20	U	1	40	20	10	ng/L	06/21/2021 1722
PFUdA	20	U	1	40	20	10	ng/L	06/21/2021 1722
PFOS	20	U	1	40	20	10	ng/L	06/21/2021 1722

Surrogate	Q	% Rec	Acceptance Limit
13C2_4:2FTS		117	50-150
13C2_6:2FTS		120	50-150
13C2_8:2FTS		106	50-150
13C2_PFDoA		113	50-150
13C2_PFTeDA		102	50-150
13C3_PFBS		98	50-150
13C3_PFHxS		98	50-150
13C4_PFBA		109	50-150
13C4_PFHpA		114	50-150
13C5_PFHxA		112	50-150
13C5_PFPeA		108	50-150
13C6_PFDA		98	50-150
13C7_PFUdA		106	50-150
13C8_PFOA		100	50-150

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection
U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

SPLP PFAS - MB

Sample ID: WQ96072-001
Batch: 96072
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Solid
Prep Method: 1312/PFAS
Prep Date: 06/19/2021 1119 **Leachate Date:** 06/10/2021 0230

Surrogate	Q	% Rec	Acceptance Limit
13C8_PFOS		96	50-150
13C8_PFOSA		112	50-150
13C9_PFNA		115	50-150
d5-EtFOSAA		110	50-150
d-MeFOSA		108	50-150
d3-MeFOSAA		115	50-150

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

SPLP PFAS - LCS

Sample ID: WQ96072-002
Batch: 96072
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Solid
Prep Method: 1312/PFAS
Prep Date: 06/19/2021 1119 **Leachate Date:** 06/10/2021 0230

Parameter	Spike Amount (ng/L)	Result (ng/L)	Q	Dil	% Rec	%Rec Limit	Analysis Date
8:2 FTS	15	16		1	102	67-138	06/21/2021 1733
6:2 FTS	15	12		1	80	64-140	06/21/2021 1733
4:2 FTS	15	18		1	121	63-143	06/21/2021 1733
EtFOSAA	16	15		1	94	61-135	06/21/2021 1733
MeFOSA	16	17		1	107	68-141	06/21/2021 1733
MeFOSAA	16	18		1	113	65-136	06/21/2021 1733
PFBS	14	17		1	118	72-130	06/21/2021 1733
PFDS	15	17		1	112	53-142	06/21/2021 1733
PFHpS	15	17		1	111	69-134	06/21/2021 1733
PFNS	15	19		1	123	69-127	06/21/2021 1733
PFOSA	16	17		1	109	67-137	06/21/2021 1733
PFPeS	15	17		1	116	71-127	06/21/2021 1733
PFHxS	15	15		1	101	68-131	06/21/2021 1733
PFBA	16	19		1	117	73-129	06/21/2021 1733
PFDA	16	18		1	110	71-129	06/21/2021 1733
PFDoA	16	18		1	115	72-134	06/21/2021 1733
PFHpA	16	18		1	114	72-130	06/21/2021 1733
PFHxA	16	20		1	126	72-129	06/21/2021 1733
PFNA	16	18		1	115	69-130	06/21/2021 1733
PFOA	16	18		1	115	71-133	06/21/2021 1733
PFPeA	16	19		1	120	72-129	06/21/2021 1733
PFTeDA	16	18		1	112	71-132	06/21/2021 1733
PFTrDA	16	17		1	104	65-144	06/21/2021 1733
PFUdA	16	18		1	113	69-133	06/21/2021 1733
PFOS	15	16		1	109	65-140	06/21/2021 1733

Surrogate	Q	% Rec	Acceptance Limit
13C2_4:2FTS		103	50-150
13C2_6:2FTS		106	50-150
13C2_8:2FTS		105	50-150
13C2_PFDoA		94	50-150
13C2_PFTeDA		93	50-150
13C3_PFBS		90	50-150
13C3_PFHxS		99	50-150
13C4_PFBA		100	50-150
13C4_PFHpA		106	50-150
13C5_PFHxA		86	50-150
13C5_PFPeA		93	50-150
13C6_PFDA		95	50-150
13C7_PFUdA		99	50-150
13C8_PFOA		85	50-150

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

SPLP PFAS - LCS

Sample ID: WQ96072-002
Batch: 96072
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Solid
Prep Method: 1312/PFAS
Prep Date: 06/19/2021 1119 **Leachate Date:** 06/10/2021 0230

Surrogate	Q	% Rec	Acceptance Limit
13C8_PFOS		93	50-150
13C8_PFOSA		108	50-150
13C9_PFNA		96	50-150
d5-EtFOSAA		107	50-150
d-MeFOSA		93	50-150
d3-MeFOSAA		110	50-150

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

SPLP PFAS - MS

Sample ID: WF04011-002MS
Batch: 96072
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Solid
Prep Method: 1312/PFAS
Prep Date: 06/19/2021 1119 **Leachate Date:** 06/10/2021 0230

Parameter	Sample Amount (ng/L)	Spike Amount (ng/L)	Result (ng/L)	Q	Dil	% Rec	%Rec Limit	Analysis Date
8:2 FTS	ND	15	15		1	104	67-138	06/21/2021 1815
6:2 FTS	ND	14	93	N	1	643	64-140	06/21/2021 1815
4:2 FTS	ND	14	17		1	116	63-143	06/21/2021 1815
EtFOSAA	ND	15	17		1	109	61-135	06/21/2021 1815
MeFOSA	ND	15	15		1	98	68-141	06/21/2021 1815
MeFOSAA	ND	15	18		1	117	65-136	06/21/2021 1815
PFBS	ND	13	15		1	113	72-130	06/21/2021 1815
PFDS	ND	15	14		1	93	53-142	06/21/2021 1815
PFHpS	ND	15	15		1	102	69-134	06/21/2021 1815
PFNS	ND	15	15		1	102	69-127	06/21/2021 1815
PFOSA	ND	15	17		1	111	67-137	06/21/2021 1815
PFPeS	ND	14	16		1	111	71-127	06/21/2021 1815
PFHxS	ND	14	15		1	108	68-131	06/21/2021 1815
PFBA	ND	15	18		1	118	73-129	06/21/2021 1815
PFDA	ND	15	17		1	111	71-129	06/21/2021 1815
PFDoA	ND	15	18		1	116	72-134	06/21/2021 1815
PFHpA	ND	15	18		1	120	72-130	06/21/2021 1815
PFHxA	ND	15	17		1	110	72-129	06/21/2021 1815
PFNA	ND	15	17		1	115	69-130	06/21/2021 1815
PFOA	ND	15	20		1	131	71-133	06/21/2021 1815
PFPeA	ND	15	18		1	115	72-129	06/21/2021 1815
PFTeDA	ND	15	17		1	112	71-132	06/21/2021 1815
PFTrDA	ND	15	15		1	99	65-144	06/21/2021 1815
PFUdA	ND	15	16		1	104	69-133	06/21/2021 1815
PFOS	ND	14	16		1	116	65-140	06/21/2021 1815

Surrogate	Q	% Rec	Acceptance Limit
13C2_4:2FTS		109	50-150
13C2_6:2FTS		100	50-150
13C2_8:2FTS		87	50-150
13C2_PFDoA		82	50-150
13C2_PFTeDA		77	50-150
13C3_PFBS		92	50-150
13C3_PFHxS		88	50-150
13C4_PFBA		94	50-150
13C4_PFHpA		92	50-150
13C5_PFHxA		91	50-150
13C5_PFPeA		94	50-150
13C6_PFDA		86	50-150
13C7_PFUdA		84	50-150
13C8_PFOA		81	50-150

LOQ = Limit of Quantitation
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N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

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SPLP PFAS - MS

Sample ID: WF04011-002MS
Batch: 96072
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Solid
Prep Method: 1312/PFAS
Prep Date: 06/19/2021 1119 **Leachate Date:** 06/10/2021 0230

Surrogate	Q	% Rec	Acceptance Limit
13C8_PFOS		83	50-150
13C8_PFOSA		102	50-150
13C9_PFNA		94	50-150
d5-EtFOSAA		92	50-150
d-MeFOSA		93	50-150
d3-MeFOSAA		93	50-150

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

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J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

SPLP PFAS - MSD

Sample ID: WF04011-002MD
Batch: 96072
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Solid
Prep Method: 1312/PFAS
Prep Date: 06/19/2021 1119 **Leachate Date:** 06/10/2021 0230

Parameter	Sample Amount (ng/L)	Spike Amount (ng/L)	Result (ng/L)	Q	Dil	% Rec	% RPD	%Rec Limit	% RPD Limit	Analysis Date
8:2 FTS	ND	15	17		1	114	9.0	67-138	30	06/21/2021 1826
6:2 FTS	ND	15	84	N	1	582	9.7	64-140	30	06/21/2021 1826
4:2 FTS	ND	14	16		1	114	1.1	63-143	30	06/21/2021 1826
EtFOSAA	ND	15	16		1	104	3.6	61-135	30	06/21/2021 1826
MeFOSA	ND	15	17		1	112	14	68-141	30	06/21/2021 1826
MeFOSAA	ND	15	16		1	101	14	65-136	30	06/21/2021 1826
PFBS	ND	14	15		1	107	4.3	72-130	30	06/21/2021 1826
PFDS	ND	15	12		1	84	9.7	53-142	30	06/21/2021 1826
PFHpS	ND	15	17		1	118	15	69-134	30	06/21/2021 1826
PFNS	ND	15	15		1	99	2.5	69-127	30	06/21/2021 1826
PFOSA	ND	15	17		1	109	1.1	67-137	30	06/21/2021 1826
PFPeS	ND	14	17		1	116	5.2	71-127	30	06/21/2021 1826
PFHxS	ND	14	17		1	125	15	68-131	30	06/21/2021 1826
PFBA	ND	15	18		1	121	2.4	73-129	30	06/21/2021 1826
PFDA	ND	15	20		1	129	15	71-129	30	06/21/2021 1826
PFDoA	ND	15	18		1	119	2.8	72-134	30	06/21/2021 1826
PFHpA	ND	15	19		1	122	2.6	72-130	30	06/21/2021 1826
PFHxA	ND	15	17		1	112	1.8	72-129	30	06/21/2021 1826
PFNA	ND	15	18		1	115	0.57	69-130	30	06/21/2021 1826
PFOA	ND	15	17		1	109	18	71-133	30	06/21/2021 1826
PFPeA	ND	15	17		1	114	1.1	72-129	30	06/21/2021 1826
PFTeDA	ND	15	17		1	109	2.1	71-132	30	06/21/2021 1826
PFTrDA	ND	15	16		1	102	2.9	65-144	30	06/21/2021 1826
PFUdA	ND	15	16		1	107	4.0	69-133	30	06/21/2021 1826
PFOS	ND	14	16		1	110	4.6	65-140	30	06/21/2021 1826

Surrogate	Q	% Rec	Acceptance Limit
13C2_4:2FTS		103	50-150
13C2_6:2FTS		104	50-150
13C2_8:2FTS		92	50-150
13C2_PFDoA		80	50-150
13C2_PFTeDA		77	50-150
13C3_PFBS		89	50-150
13C3_PFHxS		84	50-150
13C4_PFBA		97	50-150
13C4_PFHpA		99	50-150
13C5_PFHxA		88	50-150
13C5_PFPeA		97	50-150
13C6_PFDA		84	50-150
13C7_PFUdA		88	50-150
13C8_PFOA		95	50-150

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SPLP PFAS - MSD

Sample ID: WF04011-002MD
Batch: 96072
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Solid
Prep Method: 1312/PFAS
Prep Date: 06/19/2021 1119 **Leachate Date:** 06/10/2021 0230

Surrogate	Q	% Rec	Acceptance Limit
13C8_PFOS		83	50-150
13C8_PFOSA		97	50-150
13C9_PFNA		88	50-150
d5-EtFOSAA		87	50-150
d-MeFOSA		98	50-150
d3-MeFOSAA		95	50-150

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

Chain of Custody
and
Miscellaneous Documents

Appendix B
ASLP Method

Australian Standard®

Wastes, sediments and contaminated soils

Part 3: Preparation of leachates—Bottle leaching procedure

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This Australian Standard was prepared by Committee CH/35, Examination of Wastes. It was approved on behalf of the Council of Standards Australia on 30 October 1996 and published on 5 January 1997.

The following interests are represented on Committee CH/35:

Australian Aluminium Council

Australian Government Analytical Laboratories

Australian Lead Development Association

Brisbane City Council

Bureau of Steel Manufacturers of Australia

Department of Environment and Natural Resources, S.A.

Division of Coal and Energy Technology, CSIRO

Environment Protection Authority of Victoria

Environment Protection Authority of N.S.W.

Government Chemical Laboratory, Queensland

Griffith University

National Association of Testing Authorities

Plastics and Chemicals Industry Association

Sydney Water Corporation

Victorian University of Technology

Victorian Waste Management Association

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Full details of all Australian Standards and related publications will be found in the Standards Australia Catalogue of Publications; this information is supplemented each month by the magazine 'The Australian Standard', which subscribing members receive, and which gives details of new publications, new editions and amendments, and of withdrawn Standards.

Suggestions for improvements to Australian Standards, addressed to the head office of Standards Australia, are welcomed. Notification of any inaccuracy or ambiguity found in an Australian Standard should be made without delay in order that the matter may be investigated and appropriate action taken.

This Standard was issued in draft form for comment as DR 95140.

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Australian Standard®

Wastes, sediments and contaminated soils

Part 3: Preparation of leachates—Bottle leaching procedure

PUBLISHED BY STANDARDS AUSTRALIA
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1 THE CRESCENT, HOMEBUSH, NSW 2140

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PREFACE

This Standard was prepared by the Standards Australia Committee CH/35 on the Examination of Wastes and forms part of a series of Standards prepared to provide a standardized method to determine the contamination potential of groundwater with inorganic and semivolatile organic materials from liquid and solid wastes, soils, sediments and sludges.

The terms 'normative' and 'informative' have been used in this Standard to define the application of the appendices to which they apply. An 'informative' appendix is only for information and guidance whilst a 'normative' appendix is an integral part of the Standard.

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CONTENTS

Page

1 SCOPE 4
2 REFERENCED DOCUMENTS 4
3 DEFINITIONS 5
4 PRINCIPLE 5
5 REAGENTS 5
6 APPARATUS 6
7 SAMPLING AND SAMPLE PREPARATION 8
8 PROCEDURE 10
9 ANALYSIS AND REPORTING 12
10 PRECISION AND EFFECT OF PARTICLE SIZE 13
11 TEST REPORT 15

APPENDICES
A SEMI-VOLATILE ORGANIC COMPOUNDS 16
B LEACHING PROCEDURE FLOWSHEET 18
C LEACHATE STORAGE AND PRESERVATION 19

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First published as AS 4439.3—1997.

STANDARDS AUSTRALIA

Australian Standard

Wastes, sediments and contaminated soils

Part 3: Preparation of leachates—Bottle leaching procedure

1 SCOPE This Standard provides a method for the preparation of leachates from liquid and solid wastes, sediments, sludges and soils for assessing the potential of inorganic and semivolatile organic contamination of groundwater, in a variety of disposal-to-land scenarios. It deals only with the preparation of the leachate and does not describe procedures prior to submitting samples to the laboratory for analysis or sub-sampling. The range of analyte compounds includes, but is not limited to, those compounds with a vapour pressure in the range 10^{-1} mm Hg to 10^{-7} mm Hg and with a boiling point greater than 150°C.

NOTE: A list of analyte compounds is given in Appendix A.

The procedure is not applicable to encapsulated wastes which cannot be reduced to the specified maximum particle size without breaking the integrity of encapsulation.

The pH and the oxidation-reduction (redox) potential, or E_h, of a leaching fluid may vary with each disposal environment and is known to affect the leaching of metals and possibly some organic species. No provision is made in this procedure, however, to control pH and E_h during leaching. As an aid to interpretation of results, it is recommended that the E_h of the extracted sample liquid and the solids leachate be measured and reported.

2 REFERENCED DOCUMENTS The following documents are referred to in this Standard:

AS
1152 Specification for test sieves
2162 Verification and use of volumetric apparatus
2162.1 Part 1: General—Volumetric glassware
2163 Laboratory glassware—Measuring cylinders
2243 Safety in laboratories
2243.1 Part 1: General
2243.2 Part 2: Chemical aspects
4439 Wastes sediments and contaminated soils
4439.2 Part 2: Preparation of leachates—Zero headspace procedure

AS/NZS
2243 Safety in laboratories
2243.3 Part 3: Microbiology

ISO
3696 Water for analytical laboratory use—Specification and test methods

ASTM
D1498 Practice for oxidation-reduction potential of water

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3 DEFINITIONS For the purpose of this Standard, the definitions below apply.

3.1 Laboratory sample—a sample as received by the laboratory from the field and intended for inspection or testing.

3.2 Leaching fluid—the solution produced in the laboratory to be used for the leaching of the test sample.

3.3 Percentage solids—that amount of a test portion remaining after all liquids have been expelled by pressure filtration under a pressure of 350 kPa, expressed as a percentage.

3.4 Sample—one or more items taken from a lot and intended to provide information about the lot and, possibly, to serve as the basis for a decision on the lot or on the process which has produced it.

3.5 Sample liquid—the liquid which is separated from a test sample by pressure filtration as described in Clause 8.3.

3.6 Solids leachate—the liquid produced by treatment of the solids with the leaching fluid and subsequent filtration.

3.7 Test portion—the quantity of material taken from the test sample (or, if both are the same, from the laboratory sample) and on which the test or observation is actually carried out.

3.8 Test sample—a sample prepared from the laboratory sample and from which test portions will be taken.

4 PRINCIPLE The percentage solids is determined by pressure filtering a weighed portion and weighing the extracted sample liquid. A second test portion is subjected to pressure filtration and the sample liquid collected and stored. The solids remaining are reduced in particle size if necessary and leached by agitation with a selected leaching fluid. The solids leachate is recovered by pressure filtration through a glass fibre filter with 0.6 μm to 0.8 μm effective pore size. The sample liquid and solids leachate thus obtained are then analysed by appropriate test methods.

A detailed Flowsheet outlining the leaching procedure is shown in Appendix B.

5 REAGENTS

5.1 General requirement Unless otherwise specified, all reagents shall be of analytical reagent grade. All containers should meet requirements of Clause 6.1.

5.2 Reagent water Water of laboratory Grade 1 as defined in ISO 3696 shall be used.

5.3 Leaching fluid

5.3.1 *General* The leaching fluid shall be tested immediately before use to ensure conformity to the specified pH value. Leaching fluids not prepared immediately prior to use shall also be examined for indication of contamination or deterioration. In the presence of microbial growth, colouration, solid or suspended matter, the solution shall be discarded and fresh leaching fluid prepared.

5.3.2 *Leaching fluid pH 2.9* Add 5.7 mL of glacial acetic acid (ρ_{20} = 1.01 g/mL) to 900 mL of water. Dilute to 1 L with water. The pH of this fluid should be 2.8 to 3.0 and adjustment of pH is not permitted.

5.3.3 *Leaching fluid pH 5.0* Add 5.7 mL of glacial acetic acid (ρ_{20} = 1.01 g/mL) to approximately 900 mL of water. Add 64.3 mL of 1 mole/L sodium hydroxide solution, dilute to 1 L with water and mix well. If the pH is not 4.9 to 5.1, adjust by dropwise addition of 1 mol/L acetic acid or 1 mol/L sodium hydroxide solution as appropriate. Store in an airtight container.

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5.3.4 *Leaching fluid pH 9.2* Dissolve 38.2 g of sodium tetraborate decahydrate (borax, $Na_2B_4O_7.10H_2O$) in approximately 900 mL of water, dilute to 1 L and mix well. The pH of this fluid shall be 9.1 to 9.3, otherwise it should be discarded. Adjustment of pH is not permitted. Store in an airtight container.

5.4 Compressed gas Pressure controllable up to 350 kPa, free of particulate and organic contaminants.

6 APPARATUS

6.1 General All devices with which the sample or leaching fluids come into contact shall be made of a material(s) which will not leach or adsorb analytes such as—

(a) glass;

(b) polytetrafluoroethylene (PTFE);

(c) stainless steel Type 316; or

(d) polyethylene, polypropylene or polyvinyl chloride when only inorganic analytes will be determined.

These components shall be cleaned so that they do not contribute significantly to the level of analyte being determined.

6.2 Glassware Graduated measuring cylinders shall comply with AS 2163. The use of volumetric glassware shall comply with AS 2162.1.

6.3 pH Meter Accurate to ±0.05 pH units at 25°C.

6.4 Laboratory balance Accurate to ±0.1 g.

6.5 Filters Filter disks to suit devices specified in Clause 6.6 and made of borosilicate glass fibres, not containing binder materials and with an effective pore size of 0.6 µm to 0.8 µm or equivalent, are suitable.

6.6 Pressure filtration device Any filter holder capable of supporting a 0.6 µm to 0.8 µm glass fibre filter membrane with a minimum of 47 mm in diameter, with the ability to withstand a pressure of 350 kPa or more and a capacity of at least 300 mL is suitable. An example of a suitable pressure filtration device is shown in Figure 1.

NOTE: The recommended device has a capacity of 1.5 L and 142 mm diameter.

6.7 Liquid collection vessels Containers for collection and storage of sample liquid and solids leachate prior to analysis must be composed of any of those materials listed in Clause 6.1.

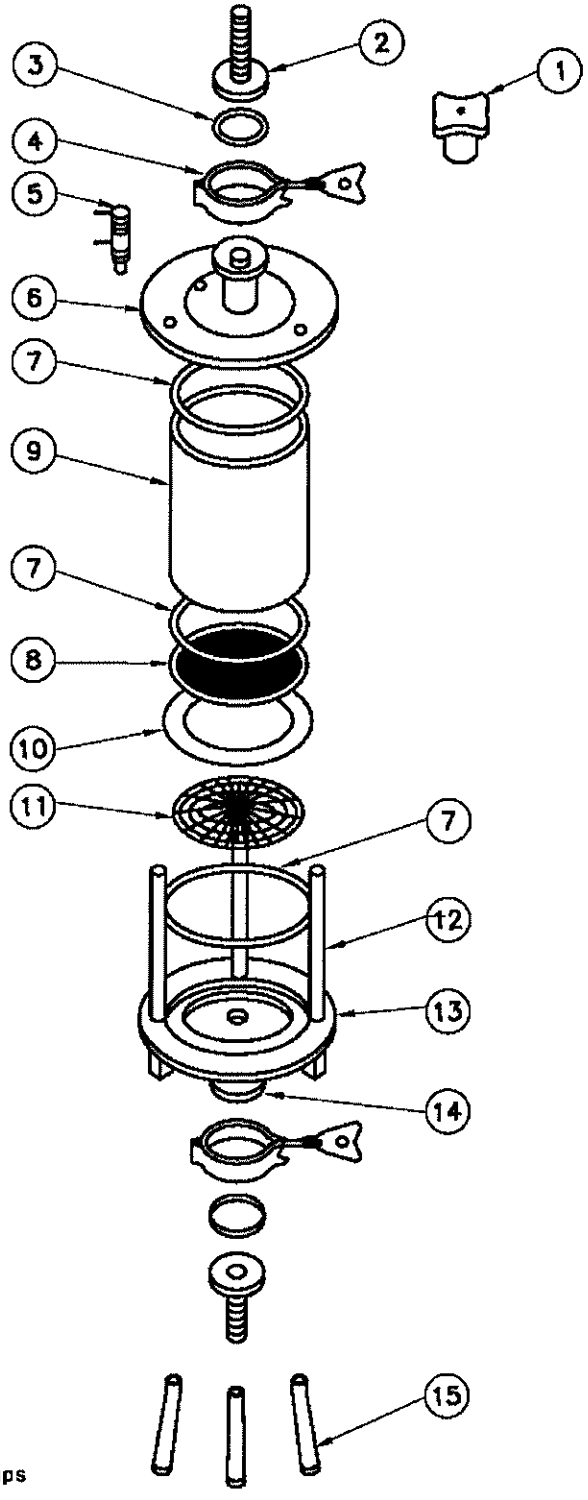
6.8 Agitation apparatus Capable of rotating extraction bottles in an end-over-end fashion at 30 ±2 revolutions per minute.

6.9 Extraction bottles Capable of containing up to 100 g of sample and up to 2000 g of leaching fluid, with at least 100 mL of headspace.

6.10 Sieve Plate or mesh sieve with an aperture dimension of approximately 2.4 mm and complying with AS 1152.

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LEGEND:

1 Handwheel knob (three)
2 Adaptor (two)
3 Gasket, silicone
4 Clamp (two)
5 Vent/relief valve
6 Top plate
7 O-ring, silicone (three)
8 Filter
9 Stainless steel cylinder
10 Support screen
11 Underdrain screen
12 Cylinder extension posts
13 Bottom plate
14 Outlet plate
15 Three legs with rubber caps

FIGURE 1 EXAMPLE OF A PRESSURE FILTRATION DEVICE

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7 SAMPLING AND SAMPLE PREPARATION

7.1 Collection Samples shall be large enough to support all the requirements of this method. There shall be sufficient sample to perform, where required, the following—

(a) preliminary determination of total analytes, if necessary;

(b) preliminary evaluation of the solids content (Clause 7.3);

(c) preliminary screening of waste pH (Clause 7.5);

(d) leaching of solids for determination of metals;

(e) leaching of solids for determination of semi-volatile compounds;

(f) leaching of solids for determination of volatile organic compounds; and

(g) any repeat analyses.

WARNING: APPROPRIATE SAFETY PRECAUTIONS AS DEFINED IN AS 2243, PARTS 1, 2 AND 3 SHOULD BE TAKEN.

7.2 Storage Samples shall be stored at 2°C to 6°C, in a manner to prevent change in content or leachability of analytes, in vessels specified in Appendix C. Sample vessels should be filled to capacity and only opened immediately prior to leaching. Leaching of samples shall be carried out as soon as possible, but within the maximum holding times specified in Table 1. They should be stored in accordance with Appendix C.

TABLE 1

MAXIMUM SAMPLE HOLDING TIMES (DAYS)

Analyte	Maximum sample holding time prior to bottle leaching days
Inorganics	
Metals (all)	28
Anions (Cl^-, F^-, I^-, SO_4^{2-}, S^{2-}, CN^-, NO_2^-, NO_3^-, PO_4^{3-})	7
Nitrogen (total Kjeldahl, NH_3/NH_4^+)	7
Phosphorus (all forms)	7
Organics	
Hydrocarbons (including total petroleum hydrocarbons, PAHs)	7
Pesticides, organochlorine (OCs)	28
Pesticides, other	7
Phenolics	7
Polychlorinated biphenyls (PCBs)	28
Other	14

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7.3 Determination of percentage solids The percentage solids in the sample shall be determined as follows:

(a) Weigh the vessel that is to receive the filtrate (m_1).

(b) Weigh approximately 100 g of the test sample into a beaker and record the combined weight. Transfer as much as possible to the pressure filtration device (6.6), fitted with a filter (6.5). Spread the waste sample evenly over the surface of the filter. Reweigh the beaker and calculate the mass of waste transferred (m_2) by difference.

WARNING: SUITABLE CONTAINMENT PROCEDURES SHALL BE IN PLACE TO ISOLATE FLYING PARTS IN THE EVENT OF OVER PRESSURE EXPLODING THE DEVICE.

(c) Apply a pressure of 50 kPa to the pressure filtration device, and maintain it until liquid ceases to pass through the filter. Gradually increase the pressure, in 50 kPa increments, to 350 kPa.

(d) When filtration is complete (i.e. when no liquid has passed during the previous 1 min period). Weigh the receiving vessel plus filtrate (m_3).

NOTE: If the sample liquid contains volatile solvents, then either the receiving vessel is designed to prevent loss of volatiles (e.g. narrow neck flask) or the pressure filtration device is weighed before and after to determine the mass of liquid collected.

(e) Calculate the percentage solids from the following equation:

$$\text{Percentage solids} = 100 - \left(\frac{(m_3 - m_1)}{m_2} \times 100 \right) \quad \ldots 7(1)$$

where

m_3 = mass of the receiving vessel plus filtrate, in grams

m_1 = mass of the empty receiving vessel, in grams

m_2 = mass of sample transferred, in grams

NOTE: For testing metals and semi-volatile organic compounds, it is allowable to use the solid portion from this preliminary evaluation for subsequent leaching as described in Clause 8, provided that no particle size reduction is required (see Clause 7.4), and the sample liquid is collected and stored as described in Appendix C. It may be necessary, however, to filter more than 100 g of waste, as some solids may be used for other preliminary tests.

7.4 Reduction of sample particle size

7.4.1 *General* To ensure that test portions adequately represent the laboratory sample, all particles in a test sample of at least 250 g mass shall be reduced if necessary to pass through a 2.4 mm aperture sieve (6.10). The sample shall be chilled to 1°C–4°C prior to particle size reduction and care taken during the process to prevent the generation of heat.

NOTE: Percentage solids are to be determined before particle size reduction.

7.4.2 *Large particles* If the sample is predominantly greater than 2.4 mm particle size, or if the larger particles are not significantly different from the bulk of the material, then the whole test sample should be reduced to pass through a sieve (6.10) in such a way as to minimize any loss of analytes of interest.

If a relatively small proportion of material is greater than 2.4 mm maximum particle size, and is significantly different in type from the bulk of the material, then this fraction should be removed from any test sample, discarded and this noted in the report.

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7.5 Selection of leaching fluid The leaching fluid selected shall be appropriate to the landfill category and selected from Table 2. If the proposed landfill category is such that an acidic leaching fluid is specified, the following preliminary procedure shall be performed:

(a) Weigh out a small subsample of the solid phase of the waste, reduce the solid, if necessary, to a particle size of approximately 1 mm in diameter or less. Transfer 5.0 g of this solid phase of the waste to a 500 mL beaker or erlenmeyer flask.

(b) Add 100 mL of water to the beaker, cover with a watchglass, and stir vigorously for 5 min using a magnetic stirrer. Measure and record the pH.

(c) If the pH is less than 5.0, then use leaching fluid (5.3.3) and proceed to Clause 8.

(d) If the pH is greater than 5.0, add 3.5 mL of 1 mol/L HC1, slurry briefly, cover with a watchglass, heat to 50°C to 60°C and hold at this temperature for 10 min.

(e) Let the solution cool to room temperature and record the pH. If the pH is less than 5.0, use leaching fluid (5.3.3); if the pH is greater than 5.0, use leaching fluid (5.3.2).

TABLE 2

SUGGESTED LEACHING FLUIDS

Class	Landfill category	Leaching fluid
CLASS 1	In situ—to be left undisturbed at the site	Reagent water
CLASS 2	Monofilled 2a Putrescible material 2b Non-putrescible material	 Acetate buffer pH 5.0 Reagent water
CLASS 3	Co-disposed with 3a Putrescible material 3b Non-putrescible material	 Acetate buffer pH 5.0 or pH 2.9 Acetate buffer pH 5.0 or pH 2.9 and Tetraborate buffer pH 9.2 (i.e. two leaches)
CLASS 4	Disposed of without confinement e.g. dispersed over land	Reagent water

NOTES:

1 Subject to regulatory approval for a specific site assessment, other appropriate leaching fluids, such as local groundwater or seawater, may be used in place of those above. Use of groundwater as a leaching fluid may prove difficult as it would need to be maintained in the same chemical, physical and biological environment from which it was obtained up to and during the extraction process. It may also be difficult to interpret data unless the complete chemical composition of the groundwater is known due to analytical interferences and chemical speciation/precipitation reactions.

2 Some losses of cyanide, fluoride, iodide and sulfide may be experienced where non-alkaline leach fluids are used. If these leach fluids must be used, see AS 4439.2 for requirements for the zero headspace procedure.

8 PROCEDURE

8.1 Number of determinations Using the procedure described in Clause 8.3, a single test portion from each test sample shall be leached. In addition, duplicate test portions shall be leached from selected test samples at a rate not less than one duplicate leach in every 10 test portions or one duplicate leach for each batch of samples, whichever is the greater rate.

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8.2 Blank test A blank test shall be run in parallel with the test samples using the same procedure and reagents in the same quantity but omitting the sample. A blank test shall be run with each batch or at a rate of at least one in every 10 samples processed.

Should the level of analyte determined in the blank be greater than 20% of the appropriate regulatory limit, the source of contaminants shall be determined and rectified before any further samples are processed.

8.3 Preparation of sample liquid The procedure for preparing sample liquid and solids leachate as shown in Appendix B shall be as follows:

(a) Weigh out the mass of test portion, as determined from the following equation into a beaker or similar vessel and record the weight:

$$\text{Mass of test portion, (grams)} = \frac{100 \times 100}{\text{percentage solids}} \quad \ldots 8(1)$$

NOTES:

1 The purpose in using the amount of sample calculated as above is to provide a mass of approximately 100 g of solids for leaching. For samples with low solids content, the mass calculated above may exceed the amount of sample available or the volume of the pressure filtration unit. In this case, a smaller sample may be filtered, provided it is derived by filtration of at least 100 g of sample, not less than 5 g of solids are obtained and the leachate derived is sufficient to support all of the analyses required. Should this not be possible, additional sample must be obtained or multiple filtrations must be performed.

2 For samples of high percentage solids content, the amount of liquid obtainable by filtration of 100 g may not be sufficient to support its separate analysis. In this case, a larger sample, up to 500 g, should be filtered. Should this still produce insufficient liquid for separate analysis, the liquid derived may be combined with the solids leachate obtained in Clause 8.4(a) to (f) for analysis.

3 If particle size reduction is required, at least 250 g of sample is to be filtered (see Clause 7.4.1).

(b) Weigh an empty liquid collection vessel (6.7) for collection of sample liquid. Record this mass (m_4) and place the vessel beneath a pressure filtration device (6.6).

(c) Quantitatively transfer the test portion to the pressure filtration device (6.6) with a filter (6.5) installed. Reweigh the beaker and calculate the mass transferred (m_5) by difference. Spread the waste evenly over the surface of the filter.

(d) Seal the pressure filtration device and then apply gentle pressure of up to 50 KPa. Maintain this pressure for 2 min, then increase the pressure in 50 kPa increments, holding at each pressure for 2 min, up to 350 KPa. Collect the filtered sample in a preweighed liquid collection vessel (6.7).

NOTE: Instantaneous application of high pressure can degrade the glass fibre filter or may cause premature plugging or rupture.

(e) Hold the pressure at 350 kPa until no further liquid flow is detected during any 1 min period; then shut off the gas pressure and reweigh the liquid collection vessel. Calculate the mass of liquid collected (m_6) by difference.

NOTE: If the sample liquid contains volatile solvents, then either the receiving vessel is designed to prevent loss of volatiles (e.g. narrow neck flask) or the pressure filtration device is weighed before and after to determine the mass of liquid collected.

(f) Remove a small portion of the collected sample liquid and measure and record its pH. Store the remaining liquid prior to analysis as described in Appendix C.

NOTE: If redox potential is to be measured using ASTM D1498, a small portion of the leachate should be removed for this purpose at this stage and the measurement made within 5 min of the portion being withdrawn.

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(g) Remove the filter and the material remaining ('the solids') from the pressure filtration device. Clean the filtration device before re-use.

8.4 Leaching of solids The procedure shall be as follows:

(a) Reduce the particle size of the solids (see Clause 7.4) if necessary.

(b) Place the solids, derived from Clause 8.3(a) to (g), together with the filter used, into an extraction bottle. Calculate the mass of leaching fluid required to be added to the solids from the following equation:

$$\text{Mass of leaching fluid, (grams)} = 20 \times (m_5 - m_6) \quad \ldots 8(2)$$

where

20 = ratio of leaching solution to solids

m_5 = mass of test sample transferred, in grams

m_6 = mass of sample liquid collected, in grams

(c) Slowly add the amount of appropriate leaching fluid selected in Clause 7.5 to the extraction bottle and seal tightly.

CAUTION: AT INTERVALS, SUCH AS 15 MIN, 30 MIN AND 60 MIN AFTER COMMENCING THE AGITATION, ANY PRESSURE BUILT UP SHALL BE VENTED INTO A FUMEHOOD.

(d) Place the extraction bottle on the rotator, suitably counterbalanced and rotate the extraction bottle for 18 ±2 h at 30 ±2 revolutions per minute at an ambient temperature in the range of 22 ±5°C.

CAUTION: UNLESS CORRECTLY COUNTERBALANCED, THE ROTATION APPARATUS WILL BE SUBJECT TO SEVERE VIBRATIONS WHICH WILL CAUSE WEAR OF THE BEARING, OVERHEATING OF THE MOTOR, AND MAY CAUSE THE APPARATUS TO MOVE ALONG THE BENCH. IF A SECOND EXTRACTION BOTTLE IS USED AS A COUNTERBALANCE, IT MAY CONTAIN WATER OR LEACHING FLUID, WITH OR WITHOUT ANOTHER SAMPLE. HOWEVER, IT IS DESIRABLE TO MATCH THE WEIGHTS AS CLOSELY AS POSSIBLE.

(e) Remove the extraction bottle from the agitator. Place a fresh glass fibre filter into the cleaned, dry, pressure filtration device and filter the solids leachate using the method described in Clause 8.3(e).

NOTE: If the filtered liquid contains multiple phases, it is most convenient to collect the whole of the filtrate in a single container.

(f) Remove a small portion of the filtered solids leachate and measure and record its pH. Store the remaining liquid prior to analysis as described in Appendix C.

NOTE: If redox potential is to be measured using ASTM D1498, a small portion of the leachate should be removed for this purpose at this stage and the measurement made within 5 min of the portion being withdrawn.

9 ANALYSIS AND REPORTING All sample liquid and leachate phases should be analysed separately using appropriate analytical methods for the required analytes. The results should be reported separately.

With multiphasic samples, more than one phase may result from either the sample liquid(s) or leachate. A mass averaged value shall also be reported with the separate phase results. For each analyte, this is calculated from the general equation:

$$c_{calc} = \frac{\Sigma(c_i \times m_i)}{\Sigma m_i} \quad \ldots 9(1)$$

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where

c_{calc} = calculated mass averaged value for the analyte in sample liquid(s) and leachate, in milligrams per kilogram

c_i = concentration of analyte measured in the sample liquid or leachate phase i, in milligrams per kilogram

m_i = mass of sample liquid or leachate phase i, in grams

10 PRECISION AND EFFECT OF PARTICLE SIZE

10.1 Precision The interlaboratory precision of the test procedure by leaching three metal-containing wastes in several laboratories has been assessed as follows:

Waste Type	Leach Fluid pH	Metal contaminants	No. of Laboratories
Electric arc furnace Dust (EAFD)	5.0	Cu, Pb, Zn	8
Mine tailings (MT)	5.0	Cu, Pb, Zn, Cd, Mn	7
Aluminium sludge (AS)	2.9	Cr, Sb	5

Samples were assessed prior to dispatch to confirm homogeneity. Analysis of all extracts was performed in a single laboratory. Interlaboratory precision for the various metals, expressed as percent relative standard deviations are shown in Table 3.

10.2 Effect of particle size An attempt was made to evaluate the degree to which concentrations of analyte in solids leachates may vary when particle size is reduced to 2.4 mm, from that produced if particle size is 9.5 mm as prescribed in USEPA method 1311. A sample of cement-fixed waste containing copper and iron was leached by three laboratories at two particle sizes—

(a) 2.4 mm as prescribed in this standard; and

(b) 9.5 mm as prescribed in USEPA method 1311.

For many waste types, the variation in leachate concentrations will be small, (see Table 4 for particle size comparative results). Waste generators may need to investigate the degree of variation which applies to their particular waste type.

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TABLE 3

INTERLABORATORY AND LITERATURE REPORTED PRECISION

Study	Sample	Cu	Pb	Zn	Cd	Mn	Cr	Sb	As	Ba
CH/35	EAFD	9 (0.3)	55 (135)	10 (4)						
CH/35	MT	43 (0.9)	38 (4)	13 (77)	6 (0.3)	10 (16)				
CH/35	AS						63 (15)	17 (0.2)		
Precision (see Note 2)	Still bottoms		90 (0.003)		60 (0.05)		94 (0.02)			
"	Mixed		100 (0.003)		61 (0.01)		40 (0.06)			
"	Fly ash		85 (0.01)		86 (0.08)		85 (0.02)			
EPRI (see Note 2)	Alkaline fly ash	67 (0.2)		79 (0.2)	25 (0.02)	10 (5)	15 (0.5)		52 (0.4)	45 (0.3)
"	Acidic fly ash			6 (53)	16 (0.2)	4 (38)	44 (0.9)			43 (0.1)
"	Alkaline bottom ash			101 (0.2)	360 (0.004)	11 (0.6)	68 (0.01)			41 (0.8)
"	Neutral bottom ash			87 (0.2)	17 (0.03)	17 (0.03)	55 (0.004)			105 (0.3)
"	Desulfur-ization sludge			23 (1.5)	38 (0.004)	8 (1.5)	86 (0.04)			57 (0.12)
"	Desulfur-ization sludge			56 (0.3)	32 (0.006)	8 (2)	116 (0.013)			54 (0.2)
"	Neutral fly ash			59 (0.3)		6 (0.2)	30 (0.06)			31 (0.4)

NOTES:

1 The values in brackets are the mean concentrations, in mg/L, of the metals in the leachates.

2 Precision data from ten waste samples leached in similar precision trials of USEPA method 1311 (TCLP) reported in Newcomer, L R Blackburn, W B and Hansen, G A 'Performance of the Toxicity Characteristics Leaching Procedure', in 'Waste Testing and Quality Assurance: Second Volume, ASTM STP 1062, D Friedman Ed., American Society for Testing and Materials, Philadelphia, 1990.

3 An unknown proportion of the variation in these studies was probably attributable to non-homogeneous wastes.

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TABLE 4

INTERLABORATORY PARTICLE SIZE COMPARATIVE RESULTS

Laboratory		Copper			Iron		
Mean Concentration mg/L		2.4 mm	9.5 mm	Ratio	2.4 mm	9.5 mm	Ratio
1 (n=4)	Mean	1.347	1.087	1.24	0.015	0.013	1.15
	%RSD	6.8	13.7		13	38	
2 (n=5)	Mean	1.283	1.294	0.99	0.011	0.007	1.57
	%RSD	6.1	2.2		18	27	
3 (n=4)	Mean	1.353	1.264	1.07	0.017	0.016	1.06
	%RSD	3.0	5.5		52	31	

Ratio = Mean concentration for 2.4 mm/Mean concentration for 9.5 mm.

11 TEST REPORT The following information shall be reported:

(a) Identification of the laboratory sample as received.

(b) Date of receipt.

(c) Details of storage of the laboratory sample.

(d) Details of any sample preparation carried out.

(e) Percentage solids in the laboratory sample.

(f) Date of leachate preparation and date of analysis.

(g) Mass of test sample.

(h) Mass of sample liquid expelled.

(i) Leaching fluid used.

(j) Mass of leaching fluid added.

(k) Mass of solids leachate collected.

(l) E_h if measured, of the leaching fluid, sample liquid and solids leachate.

(m) pH of the sample liquid and solids leachate.

(n) Concentration of analytes in the sample liquid and solids leachate.

(o) A reference to this test method, i.e. AS 4439.3.

(p) Any observation, in relation to the sample or the performance of the method, which may affect the correct interpretation of the ensuing analytical results.

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APPENDIX A
SEMI-VOLATILE ORGANIC COMPOUNDS
(Informative)

A1 SCOPE This Appendix lists those semi-volatile organic compounds considered to be significant pollutants by regulatory authorities. It does not preclude other semi-volatile organic compounds from being termed the same but is a list that requires assessment in consultation with the appropriate regulatory authority at the time of implementation of this Standard.

A2 LIST OF POLLUTANTS The following is a list of analytes that are considered pollutant analytes by the Australian regulatory authorities:

Phenols

2-sec-Butyl-4,6-dinitrophenol
4-Chloro-3-methylphenol
2-Chlorophenol
Cresols
2-Cyclohexyl-4,6-dinitrophenol
2,4-Dichlorophenol
2,6-Dichlorophenol
2,4-Dimethylphenol
2,4-Dinitrophenol
2-Methyl-4,6-dinitrophenol
2-Nitrophenol
4-Nitrophenol
Pentachlorophenol
Phenol
Tetrachlorophenols
Trichlorophenols
2,4,6-Trichlorophenol

Polynuclear aromatic hydrocarbons (PAHs)

Acenaphthene
Acenaphthylene
Anthracene
Benzo(a)anthracene
Benzo(a)pyrene
Benzo(b)fluoranthene
Benzo(j)fluoranthene
Benzo(k)fluoranthene
Benzo(ghi)perylene
Chrysene
Dibenzo(a,h)acridine
Dibenzo(a,j)acridine
Dibenzo(a,h)anthracene
7H-Dibenzo(c,g)carbazole
Dibenzo(a,e)pyrene
Dibenzo(a,h)pyrene
Dibenzo(a,i)pyrene
Fluoranthene
Indeno(1,2,3-cd)pyrene
3-Methylchloanthrene
Naphthalene
Phenanthrene
Pyrene

Polychlorinated Biphenyls

Aroclor 1016
Aroclor 1221
Aroclor 1232
Aroclor 1242
Aroclor 1248
Aroclor 1254
Aroclor 1260

Phthalate Esters

Benzyl butyl phthalate
Bis(2-ethylhexyl)phthalate
Di-n-butyl phthalate
Diethyl phthalate
Dimethyl phthalate
Di-n-octyl phthalate

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Chlorinated Hydrocarbons
Benzai chloride
Benzotrichloride
Benzyl chloride
2-Chloronaphthalene
1,2-Dichlorobenzene
1,3-Dichlorobenzene
1,4-Dichlorobenzene
Hexachlorobenzene
Hexachlorobutadiene
Hexachlorocyclohexane
Hexachlorocyclopentadiene
Hexachloroethane
Tetrachlorobenzenes
1,2,4-Trichlorobenzene
Pentachlorohexane

Chlorinated Herbicides
2,4-D
2,4-DB
2,4,5-T
2,4,5-TP (Silvex)
Dalapon
Dichoroprop
Dinoseb
MCPA
MCPP

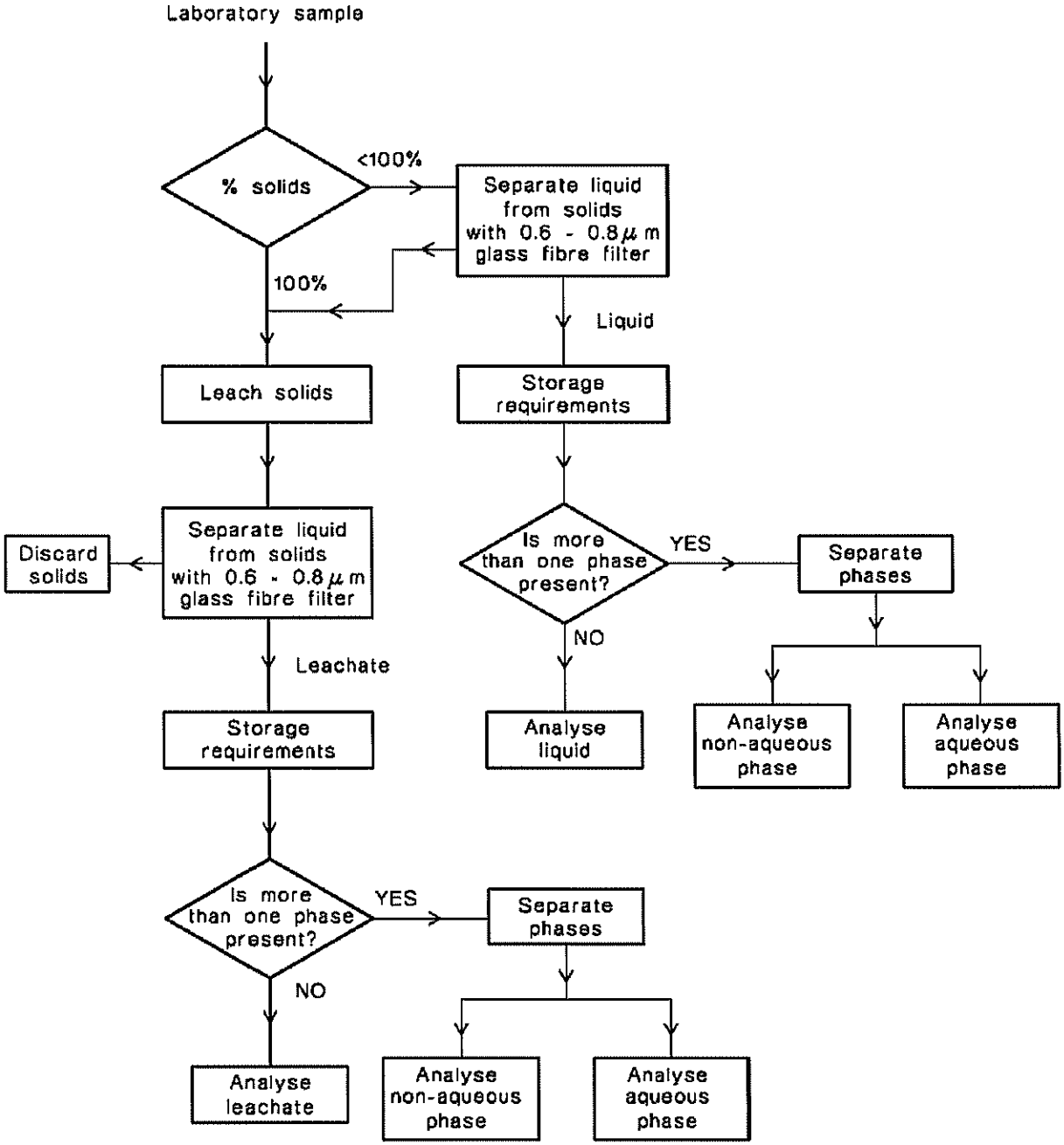
Nitroaromatics and Cyclic Ketones
Isophorone
Nitrobenzene
2,4-Dinitrotoluene
2,6-Dinitrotoluene
Dinitrobenzene
Naphthoquinone

Pesticides
Gamma-BHC
Delta-BHC
Hexachlorobenzene
Alpha-BHC
Beta-BHC
Heptachlor
Aldrin
Heptachlorepoxide
DDE
Dieldrin
Endrin Ketone
DDD
DDT
Alpha-Endosulphan
Beta-Endosulphan
Endosulphan Sulphate
Endrin Aldehyde
Methoxychlor
Azinphos methyl
Bolstar
Chlorpyrifos
Coumaphos
Demeton-O
Demeton-S
Diazinon
Dichlorvos
Disulfoton
Ethoprop
Fensulfothion
Fenthion
Merphos
Mevinphos
Naled
Parathion methyl
Phorate
Ronnel
Stirophos (Tetrachlorvinphos)
Tokuthion (Prothiosfos)
Trichloronate

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APPENDIX B
LEACHING PROCEDURE FLOWSHEET
(Normative)



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APPENDIX C
LEACHATE STORAGE AND PRESERVATION
(Normative)

Analyte	Vessel	Preservation	Maximum holding period	
			Bottle leaching to preparative extraction (or analysis*)	Preparative extraction to analysis
Ammonia	P or G	(a) None (b) Store 1°C to 4°C (c) Freeze (d) pH 1-2 with sulfuric acid. Store 1°C to 4°C	(a) Analyse immediately (b 6 h (c) 7 d (d) 7 d	N/A 4 h
Anionic surfactant	G	Store 1°C to 4°C	48 h	28 d (if by MBAS)
Boron	P	None required	28 d	N/A
Bromide	P or G	Store 1°C to 4°C in the dark	28 d	N/A
Chloride	P or G	None required	6 m	
Cyanide (total)	P or G	NaOH to pH >12 Store 1°C to 4°C in dark. (a) Add cadmium nitrate to remove sulfide. (b) Add ascorbic acid to remove oxidizing agents.	24 h	7 d
Cyanide (amenable to chlorination)	P or G	Add 100 mg $Na_2S_2O_3$/L	7 d	7 d
Fluoride	P	None required	28 d	
Hydrocarbons-total#	G(SW)	(a) None (b) pH to < 2 using sulfuric acid. Store 1°C to 4°C	(a) Extract immediately (b) 24 h	28 d
Iodide	P or G	Store 1°C to 4°C in the dark.	7 d	N/A
Metals (except Mg, Hg, Ca,Cr(VI), K)	P(AW)	pH 1-2 using nitric acid	28 d	28 d
— Calcium	P	Exclude air pH 1-2 using nitric acid	7 d	28 d
— Chromium(VI)	P(AW)	Store 1°C to 4°C	24 h	N/A
— Magnesium	P	Exclude air pH 1-2 using nitric acid	28 d	28 d
— Mercury	GB(AW)	pH 1-2 using nitric acid potassium dichromate 0.05%	3 d	28 d
— Potassium		None required	28 d	28 d
Nitrogen — Total Kjeldahl	P or G	pH 1-2 with sulfuric acid Store 1°C to 4°C	7 d	N/A

(*continued*)

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Analyte	Vessel	Preservation	Maximum holding period	
			Bottle leaching to preparative extraction (or analysis*)	Preparative extraction to analysis
Nitrate	P or G	(a) None (b) Store 1°C to 4°C (c) freeze (d) pH 1-2 with sulfuric acid Store 1°C to 4°C	Analyse immediately 6 d 7 d 7 d	N/A
Nitrite	P or G	Freeze immediately	7 d	N/A
Oil and grease†	G(SW)	(a) None (b) pH to < 2 using sulfuric acid Store 1°C to 4°C	(a) Extract immediately (b) 24 h	28 d
Pesticides† — organochlorine	G(SW)	(a) None (b) Store 1°C to 4°C	(a) Extract immediately (b) 24 h	6 months
Pesticides† organophosphorus, carbamate, herbicides and similar	G(SW)	(a) None (b) Store 1°C to 4°C	(a) Extract immediately (b) 24 h	28 d
Phenolics	G(SW)	(a) None (b) pH to 4 with H_3PO_4, H_2SO_4 or HCl and add 1 g of copper sulfate ($CuSO_4.5H_2O$) per L of extract	(a) Extract immediately (b) 28 d	28 d
Phosphate (total)	G(AW)	Add 1 mL of HCl per L of extract.	6 d	N/A
Phosphorus (all forms)	P	(a) Store 1°C to 4°C (b) Freeze immediately upon collection (c) Store 1°C to 4°C in bottles impregnated with iodine	(a) 6 h (b) 28 d (c) 28 d	
Polychlorinated Biphenyls (PCBs)†	G(SW)	(a) None (b) Store 1°C to 4°C	(a) Extract immediately (b) 24 h	6 months
Polyaromatic hydrocarbons (PAHs)†	G(SW)	(a) None (b) pH to < 2 using sulfuric acid. Store 1°C to 4°C	(a) Extract immediately (b) 24 h	28 d
Sulfate	P(AW)	Store 1°C to 4°C	7 d	N/A
Sulfide	P		Determine immediately	N/A
Other semi-volatile organics not specified above	G(SW)	Store 1 °C to 4°C	7 d	

* If no preliminary extraction or digestion is required.
† Entire leachate sample and container should be extracted.

LEGEND:
P = Polyethylene
B = Borosilicate
G = Glass
SW = Solvent washed
AW = Acid washed
N/A = Not applicable

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APPENDIX C FIELD DEMONSTRATION LABORATORY REPORTS AND SUMMARY TABLES

Appendix C

Table C-1 EIE382-5 Soil PFAS Results

Analyte	CAS	ADEC Screening Level	Category	Untreated		Untreated		Untreated		Gravel		Gravel		Gravel		Sand		Sand		Sand		Sand	
			Location	382-5		382-5		382-5		382-5		382-5		382-5		382-5		382-5		382-5		382-5	
			Sample ID	382-5-UT-1(08302021)		382-5-UT-2(09012021)		382-5-UT-3(09082021)		382-5-G-1(09012021)		382-5-G-2(09082021)		382-5-G-3(09082021)		382-5-S-1(09072021)		382-5-S-2(09072021)		382-5-S-3(09072021)		382-5-SAND(09022021)	
			Sample Date	08/30/2021		09/01/2021		09/08/2021		09/01/2021		09/08/2021		09/08/2021		09/07/2021		09/07/2021		09/07/2021		09/02/2021	
			Sample Type	Batch		Batch		Batch		Batch		Batch		Batch		Batch		Batch		Batch		Batch	
			Matrix	Soil		Soil		Soil		Soil		Soil		Soil		Soil		Soil		Soil		Soil	
			Units	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual
PFAS																							
4:2 Fluorotelomer sulfonate	757124-72-4		µg/kg	2.2	U	2.2	U	2.3	U	0.23	U	1.1	U	0.92	U	2.1	U	2	U	2.2	U	2.6	U
6:2 Fluorotelomer sulfonic acid (6:2 FTSA)	27619-97-2		µg/kg	2.2	U	2.2	U	2.3	U	0.23	U	1.1	U	0.92	U	2.1	U	**1**	J	**0.79**	J	2.3	U
8:2 Fluorotelomer sulfonic acid (8:2 FTSA)	39108-34-4		µg/kg	2.2	U	2.2	U	2.3	U	0.23	U	1.1	U	0.92	U	2.1	U	2	U	2.2	U	2.6	U
N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6		µg/kg	2.2	U	2.2	U	2.3	U	0.23	U	1.1	U	0.92	U	2.1	U	2	U	2.2	U	2.6	U
N-Methyl perfluorooctane sulfonamide (N-MeFOSA)	31506-32-8		µg/kg	2.2	U	2.2	U	2.3	U	0.23	U	1.1	U	0.92	U	2.1	U	2	U	2.2	U	2.6	U
N-Methylperfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9		µg/kg	2.2	U	2.2	U	2.3	U	0.23	U	1.1	U	0.92	U	2.1	U	2	U	2.2	U	2.6	U
Perfluorobutane sulfonic acid (PFBS)	375-73-5		µg/kg	1.1	U	1.1	U	1.1	U	0.11	U	0.56	U	0.46	U	1.1	U	1	U	1.1	U	1.3	U
Perfluorobutanoic acid (PFBA)	375-22-4		µg/kg	1.1	U	1.1	U	1.1	U	**0.054**	J	0.56	U	0.46	U	1.1	U	1	U	1.1	U	1.3	U
Perfluorodecane sulfonic acid (PFDS)	335-77-3		µg/kg	1.1	U	1.1	U	1.1	U	0.11	U	0.56	U	0.46	U	1.1	U	1	U	1.1	U	1.3	U
Perfluorodecanoic acid (PFDA)	335-76-2		µg/kg	1.1	U	1.1	U	1.1	U	0.11	U	0.56	U	0.46	U	1.1	U	1	U	1.1	U	1.3	U
Perfluorododecanoic acid (PFDoA)	307-55-1		µg/kg	1.1	U	1.1	U	1.1	U	0.11	U	0.56	U	0.46	U	1.1	U	1	U	1.1	U	1.3	U
Perfluoroheptane sulfonic acid (PFHpS)	375-92-8		µg/kg	1.1	U	1.1	U	1.1	U	0.11	U	0.56	U	0.46	U	1.1	U	1	U	1.1	U	1.3	U
Perfluoroheptanoic acid (PFHpA)	375-85-9		µg/kg	1.1	U	1.1	U	1.1	U	0.11	U	0.56	U	0.46	U	1.1	U	1	U	1.1	U	1.3	U
Perfluorohexane sulfonic acid (PFHxS)	355-46-4		µg/kg	**2.2**		**1.7**		**1.7**		0.11	U	0.56	U	0.46	U	1.1	U	**0.23**	J	1.1	U	**0.56**	J
Perfluorohexanoic acid (PFHxA)	307-24-4		µg/kg	1.1	U	1.1	U	1.1	U	0.11	U	0.56	U	0.46	U	1.1	U	1	U	1.1	U	1.3	U
Perfluorononane sulfonic acid (PFNS)	68259-12-1		µg/kg	1.1	U	1.1	U	1.1	U	0.11	U	0.56	U	0.46	U	1.1	U	1	U	1.1	U	1.3	U
Perfluorononanoic acid (PFNA)	375-95-1		µg/kg	1.1	U	1.1	U	1.1	U	0.11	U	0.56	U	0.46	U	1.1	U	1	U	1.1	U	1.3	U
Perfluorooctane sulfonamide (PFOSA)	754-91-6		µg/kg	1.1	U	1.1	U	1.1	U	0.11	U	0.56	U	0.46	U	1.1	U	1	U	1.1	U	1.3	U
Perfluorooctane sulfonic acid (PFOS)	1763-23-1	3	µg/kg	**5.2**		**4.6**		**5.3**		0.11	U	0.56	U	0.46	U	**0.25**	J	**0.25**	J	**0.25**	J	**1.2**	J
Perfluorooctanoic acid (PFOA)	335-67-1	1.7	µg/kg	1.1	U	1.1	U	**0.32**	J	0.11	U	0.56	U	0.46	U	1.1	U	1	U	1.1	U	1.3	U
Perfluoropentane sulfonate (PFPeS)	138495-42-8		µg/kg	1.1	U	1.1	U	1.1	U	0.11	U	0.56	U	0.46	U	1.1	U	1	U	1.1	U	1.3	U
Perfluoropentanoic acid (PFPeA)	2706-90-3		µg/kg	1.1	U	1.1	U	1.1	U	0.11	U	0.56	U	0.46	U	1.1	U	1	U	1.1	U	1.3	U
Perfluorotetradecanoic acid (PFTeDA)	376-06-7		µg/kg	1.1	U	1.1	U	1.1	U	0.11	U	0.56	U	0.46	U	1.1	U	1	U	1.1	U	1.3	U
Perfluorotridecanoic acid (PFTrDA)	72629-94-8		µg/kg	1.1	U	1.1	U	1.1	U	0.11	U	0.56	U	0.46	U	1.1	U	1	U	1.1	U	1.3	U
Perfluoroundecanoic acid (PFUdA)	2058-94-8		µg/kg	1.1	U	1.1	U	1.1	U	0.11	U	0.56	U	0.46	U	1.1	U	1	U	1.1	U	1.3	U

Notes:

1. Bolded values indicate the result was detected greater than the limit of detection
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Laboratory Qualifiers
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U = The analyte was analyzed for but the result was not detected above the limit of quantitation (LOQ).
H = Sample analyzed out of holding time

Table C-1 EIE382-5 Soil PFAS Results

Analyte	CAS	ADEC Screening Level	Category	Fines		Fines		Fines		Untreated		Untreated		Untreated		Gravel		Gravel		Gravel		Sand	
			Location	382-5		382-5		382-5		382-5		382-5		382-5		382-5		382-5		382-5		382-5	
			Sample ID	382-5-F-1(09082021)		382-5-F-2(09082021)		382-5-F-3(09082021)		ISM-382-5-UTA(09082021)		ISM-382-5-UTB(09082021)		ISM-382-5-UTC(09082021)		ISM-382-5-GA(09082021)		ISM-382-5-GB(09082021)		ISM-382-5-GC(09082021)		ISM-382-5-SA(09072021)	
			Sample Date	09/08/2021		09/08/2021		09/08/2021		09/08/2021		09/08/2021		09/08/2021		09/08/2021		09/08/2021		09/08/2021		09/07/2021	
			Sample Type	Batch		Batch		Batch		ISM		ISM		ISM		ISM		ISM		ISM		ISM	
			Matrix	Soil		Soil		Soil		Soil		Soil		Soil		Soil		Soil		Soil		Soil	
			Units	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual
PFAS																							
4:2 Fluorotelomer sulfonate	757124-72-4		µg/kg	2.7	U	3.2	U	3.1	U	1.9	U	2.2	U	1.9	U	1.7	U	1.7	U	1.9	U	2.3	U
6:2 Fluorotelomer sulfonic acid (6:2 FTSA)	27619-97-2		µg/kg	2.7	U	2.8	U	**0.98**	J	1.9	U	2.1	U	2.2	U	1.7	U	2	U	1.8	U	2	U
8:2 Fluorotelomer sulfonic acid (8:2 FTSA)	39108-34-4		µg/kg	2.7	U	3.2	U	3.1	U	1.9	U	2.2	U	1.9	U	1.7	U	1.7	U	1.9	U	2.3	U
N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6		µg/kg	2.7	U	3.2	U	3.1	U	1.9	U	2.2	U	1.9	U	1.7	U	1.7	U	1.9	U	2.3	U
N-Methyl perfluorooctane sulfonamide (N-MeFOSA)	31506-32-8		µg/kg	2.7	U	2.8	U	3.1	U	1.9	U	2.2	U	1.9	U	1.7	U	1.7	U	1.9	U	2.3	U
N-Methylperfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9		µg/kg	2.7	U	3.2	U	3.1	U	1.9	U	2.2	U	1.9	U	1.7	U	1.7	U	1.9	U	2.3	U
Perfluorobutane sulfonic acid (PFBS)	375-73-5		µg/kg	1.4	U	1.6	U	1.5	U	0.97	U	1.1	U	0.96	U	0.86	U	0.85	U	0.95	U	1.1	U
Perfluorobutanoic acid (PFBA)	375-22-4		µg/kg	1.4	U	1.6	U	1.5	U	0.97	U	1.1	U	0.96	U	**0.76**	J	0.85	U	0.95	U	1.1	U
Perfluorodecane sulfonic acid (PFDS)	335-77-3		µg/kg	1.4	U	1.6	U	1.5	U	0.97	U	1.1	U	0.96	U	0.86	U	0.85	U	0.95	U	1.1	U
Perfluorodecanoic acid (PFDA)	335-76-2		µg/kg	1.4	U	1.6	U	1.5	U	0.97	U	1.1	U	0.96	U	0.86	U	0.85	U	0.95	U	1.1	U
Perfluorododecanoic acid (PFDoA)	307-55-1		µg/kg	1.4	U	1.6	U	1.5	U	0.97	U	1.1	U	0.96	U	0.86	U	0.85	U	0.95	U	1.1	U
Perfluoroheptane sulfonic acid (PFHpS)	375-92-8		µg/kg	1.4	U	1.6	U	1.5	U	0.97	U	1.1	U	0.96	U	0.86	U	0.85	U	0.95	U	1.1	U
Perfluoroheptanoic acid (PFHpA)	375-85-9		µg/kg	1.4	U	1.6	U	1.5	U	0.97	U	1.1	U	0.96	U	0.86	U	0.85	U	0.95	U	1.1	U
Perfluorohexane sulfonic acid (PFHxS)	355-46-4		µg/kg	**0.4**	J	**0.96**	J	**0.44**	J	**1.7**		**1.5**		**1.2**		0.86	U	0.85	U	0.95	U	1.1	U
Perfluorohexanoic acid (PFHxA)	307-24-4		µg/kg	1.4	U	1.6	U	1.5	U	0.97	U	1.1	U	0.96	U	0.86	U	0.85	U	0.95	U	1.1	U
Perfluorononane sulfonic acid (PFNS)	68259-12-1		µg/kg	1.4	U	1.6	U	1.5	U	0.97	U	1.1	U	0.96	U	0.86	U	0.85	U	0.95	U	1.1	U
Perfluorononanoic acid (PFNA)	375-95-1		µg/kg	1.4	U	1.6	U	1.5	U	0.97	U	1.1	U	0.96	U	0.86	U	0.85	U	0.95	U	1.1	U
Perfluorooctane sulfonamide (PFOSA)	754-91-6		µg/kg	1.4	U	1.6	U	1.5	U	0.97	U	1.1	U	0.96	U	0.86	U	0.85	U	0.95	U	1.1	U
Perfluorooctane sulfonic acid (PFOS)	1763-23-1	3	µg/kg	**1.6**		**3.1**		**2.1**		**5.1**		**4.6**		**3.9**		0.86	U	0.85	U	0.95	U	**0.29**	J
Perfluorooctanoic acid (PFOA)	335-67-1	1.7	µg/kg	1.4	U	1.6	U	1.5	U	**0.23**	J	1.1	U	**0.28**	J	0.86	U	0.85	U	0.95	U	1.1	U
Perfluoropentane sulfonate (PFPeS)	138495-42-8		µg/kg	1.4	U	1.6	U	1.5	U	0.97	U	1.1	U	0.96	U	0.86	U	0.85	U	0.95	U	1.1	U
Perfluoropentanoic acid (PFPeA)	2706-90-3		µg/kg	1.4	U	1.4	U	1.5	U	0.97	U	1.1	U	0.96	U	0.86	U	0.85	U	0.95	U	1.1	U
Perfluorotetradecanoic acid (PFTeDA)	376-06-7		µg/kg	1.4	U	1.6	U	1.5	U	0.97	U	1.1	U	0.96	U	0.86	U	0.85	U	0.95	U	1.1	U
Perfluorotridecanoic acid (PFTrDA)	72629-94-8		µg/kg	1.4	U	1.6	U	1.5	U	0.97	U	1.1	U	0.96	U	0.86	U	0.85	U	0.95	U	1.1	U
Perfluoroundecanoic acid (PFUdA)	2058-94-8		µg/kg	1.4	U	1.6	U	1.5	U	0.97	U	1.1	U	0.96	U	0.86	U	0.85	U	0.95	U	1.1	U

Notes:

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H = Sample analyzed out of holding time

Table C-1 EIE382-5 Soil PFAS Results

Analyte	CAS	ADEC Screening Level	Category	Sand		Sand		Fines		Fines		Fines		Fines	
			Location	382-5		382-5		382-5		382-5		382-5		382-5	
			Sample ID	ISM-382-5-SB(09072021)		ISM-382-5-SC(09072021)		ISM-382-5-FA(09082021)		ISM-382-5-FB(09082021)		ISM-382-5-FC(09082021)		DUP-01(09082021)	
			Sample Date	09/07/2021		09/07/2021		09/08/2021		09/08/2021		09/08/2021		09/08/2021	
			Sample Type	ISM		ISM		ISM		ISM		ISM		FD	
			Matrix	Soil		Soil		Soil		Soil		Soil		Soil	
			Units	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual
PFAS															
4:2 Fluorotelomer sulfonate	757124-72-4		µg/kg	1.9	U	1.8	U	1.8	U	1.9	U	2.5	U	3.6	U
6:2 Fluorotelomer sulfonic acid (6:2 FTSA)	27619-97-2		µg/kg	2.1	U	1.7	U	1.7	U	2	U	2.5	U	**0.94**	J
8:2 Fluorotelomer sulfonic acid (8:2 FTSA)	39108-34-4		µg/kg	1.9	U	1.8	U	1.8	U	1.9	U	2.5	U	3.6	U
N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6		µg/kg	1.9	U	1.8	U	1.8	U	1.9	U	2.5	U	3.6	U
N-Methyl perfluorooctane sulfonamide (N-MeFOSA)	31506-32-8		µg/kg	1.9	U	1.8	U	1.8	U	1.9	U	2.5	U	3.6	U
N-Methylperfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9		µg/kg	1.9	U	1.8	U	1.8	U	1.9	U	2.5	U	3.6	U
Perfluorobutane sulfonic acid (PFBS)	375-73-5		µg/kg	0.97	U	0.9	U	0.91	U	0.94	U	1.3	U	1.8	U
Perfluorobutanoic acid (PFBA)	375-22-4		µg/kg	0.97	U	0.9	U	0.91	U	0.94	U	1.3	U	1.8	U
Perfluorodecane sulfonic acid (PFDS)	335-77-3		µg/kg	0.97	U	0.9	U	0.91	U	0.94	U	1.3	U	1.8	U
Perfluorodecanoic acid (PFDA)	335-76-2		µg/kg	0.97	U	0.9	U	0.91	U	0.94	U	1.3	U	1.8	U
Perfluorododecanoic acid (PFDoA)	307-55-1		µg/kg	0.97	U	0.9	U	0.91	U	0.94	U	1.3	U	1.8	U
Perfluoroheptane sulfonic acid (PFHpS)	375-92-8		µg/kg	0.97	U	0.9	U	0.91	U	0.94	U	1.3	U	1.8	U
Perfluoroheptanoic acid (PFHpA)	375-85-9		µg/kg	0.97	U	0.9	U	0.91	U	0.94	U	1.3	U	1.8	U
Perfluorohexane sulfonic acid (PFHxS)	355-46-4		µg/kg	0.97	U	0.9	U	**0.45**	J	**0.45**	J	**0.55**	J	**0.52**	J
Perfluorohexanoic acid (PFHxA)	307-24-4		µg/kg	0.97	U	0.9	U	0.91	U	0.94	U	1.3	U	1.8	U
Perfluorononane sulfonic acid (PFNS)	68259-12-1		µg/kg	0.97	U	0.9	U	0.91	U	0.94	U	1.3	U	1.8	U
Perfluorononanoic acid (PFNA)	375-95-1		µg/kg	0.97	U	0.9	U	0.91	U	0.94	U	1.3	U	1.8	U
Perfluorooctane sulfonamide (PFOSA)	754-91-6		µg/kg	0.97	U	0.9	U	0.91	U	0.94	U	1.3	U	1.8	U
Perfluorooctane sulfonic acid (PFOS)	1763-23-1	3	µg/kg	0.97	U	0.9	U	**1.4**		**1.9**		**1.9**		**2.3**	
Perfluorooctanoic acid (PFOA)	335-67-1	1.7	µg/kg	0.97	U	0.9	U	0.91	U	0.94	U	1.3	U	1.8	U
Perfluoropentane sulfonate (PFPeS)	138495-42-8		µg/kg	0.97	U	0.9	U	0.91	U	0.94	U	1.3	U	1.8	U
Perfluoropentanoic acid (PFPeA)	2706-90-3		µg/kg	0.97	U	0.9	U	0.91	U	0.94	U	1.3	U	1.8	U
Perfluorotetradecanoic acid (PFTeDA)	376-06-7		µg/kg	0.97	U	0.9	U	0.91	U	0.94	U	1.3	U	1.8	U
Perfluorotridecanoic acid (PFTrDA)	72629-94-8		µg/kg	0.97	U	0.9	U	0.91	U	0.94	U	1.3	U	1.8	U
Perfluoroundecanoic acid (PFUdA)	2058-94-8		µg/kg	0.97	U	0.9	U	0.91	U	0.94	U	1.3	U	1.8	U

Notes:

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H = Sample analyzed out of holding time

Table C-2 EIE382-5 SPLP PFAS Results

Analyte	CAS	ADEC Screening Level	Units	Category	Location	Sample ID	Sample Date	Sample Type	Matrix	Leachate Type	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual
				Untreated	382-5	382-5-UT-1(08302021)	08/30/2021	Batch	Soil	SPLP																					
				Untreated	382-5	382-5-UT-2(09012021)	09/01/2021	Batch	Soil	SPLP																					
				Untreated	382-5	382-5-UT-3(09082021)	09/08/2021	Batch	Soil	SPLP																					
				Gravel	382-5	382-5-G-1(09012021)	09/01/2021	Batch	Soil	SPLP																					
				Gravel	382-5	382-5-G-2(09082021)	09/08/2021	Batch	Soil	SPLP																					
				Gravel	382-5	382-5-G-3(09082021)	09/08/2021	Batch	Soil	SPLP																					
				Sand	382-5	382-5-S-1(09072021)	09/07/2021	Batch	Soil	SPLP																					
				Sand	382-5	382-5-S-2(09072021)	09/07/2021	Batch	Soil	SPLP																					
				Sand	382-5	382-5-S-3(09072021)	09/07/2021	Batch	Soil	SPLP																					
				Sand	382-5	382-5-SAND(09022021)	09/02/2021	Batch	Soil	SPLP																					
				Fines	382-5	382-5-F-1(09082021)	09/08/2021	Batch	Soil	SPLP																					
PFAS																														
4:2 Fluorotelomer sulfonate	757124-72-4		ng/L								200	U	200	U	80	U	200	U	80	U	80	U	80	U	80	U	80	U	200	U	80	U
6:2 Fluorotelomer sulfonic acid (6:2 FTSA)	27619-97-2		ng/L								200	U	200	U	80	U	200	U	80	U	80	U	80	U	80	U	80	U	200	U	80	U
8:2 Fluorotelomer sulfonic acid (8:2 FTSA)	39108-34-4		ng/L								200	U	200	U	80	U	200	U	80	U	80	U	80	U	80	U	80	U	200	U	80	U
N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6		ng/L								200	U	200	U	80	U	200	U	80	U	80	U	80	U	80	U	80	U	200	U	80	U
N-Methyl perfluorooctane sulfonamide (N-MeFOSA)	31506-32-8		ng/L								400	U	400	U	160	U	400	U	160	U	160	U	160	U	160	U	160	U	400	U	160	U
N-Methylperfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9		ng/L								200	U	200	U	80	U	200	U	80	U	80	U	80	U	80	U	80	U	200	U	80	U
Perfluorobutane sulfonic acid (PFBS)	375-73-5		ng/L								100	U	100	U	40	U	100	U	40	U	40	U	40	U	40	U	40	U	100	U	40	U
Perfluorobutanoic acid (PFBA)	375-22-4		ng/L								100	U	100	U	40	U	100	U	40	U	40	U	40	U	40	U	40	U	100	U	40	U
Perfluorodecane sulfonic acid (PFDS)	335-77-3		ng/L								100	U	100	U	40	U	100	U	40	U	40	U	40	U	40	U	40	U	100	U	40	U
Perfluorodecanoic acid (PFDA)	335-76-2		ng/L								100	U	100	U	40	U	100	U	40	U	40	U	40	U	40	U	40	U	100	U	40	U
Perfluorododecanoic acid (PFDoA)	307-55-1		ng/L								100	U	100	U	40	U	100	U	40	U	40	U	40	U	40	U	40	U	100	U	40	U
Perfluoroheptane sulfonic acid (PFHpS)	375-92-8		ng/L								100	U	100	U	40	U	100	U	40	U	40	U	40	U	40	U	40	U	100	U	40	U
Perfluoroheptanoic acid (PFHpA)	375-85-9		ng/L								100	U	100	U	40	U	100	U	40	U	40	U	40	U	40	U	40	U	100	U	40	U
Perfluorohexane sulfonic acid (PFHxS)	355-46-4		ng/L								**82**	J	**65**	J	40	U	100	U	40	U	40	U	40	U	40	U	40	U	100	U	40	U
Perfluorohexanoic acid (PFHxA)	307-24-4		ng/L								100	U	100	U	40	U	100	U	40	U	40	U	40	U	40	U	40	U	100	U	40	U
Perfluorononane sulfonic acid (PFNS)	68259-12-1		ng/L								100	U	100	U	40	U	100	U	40	U	40	U	40	U	40	U	40	U	100	U	40	U
Perfluorononanoic acid (PFNA)	375-95-1		ng/L								100	U	100	U	40	U	100	U	40	U	40	U	40	U	40	U	40	U	100	U	40	U
Perfluorooctane sulfonamide (PFOSA)	754-91-6		ng/L								100	U	100	U	40	U	100	U	40	U	40	U	40	U	40	U	40	U	100	U	40	U
Perfluorooctane sulfonic acid (PFOS)	1763-23-1	40	ng/L								**160**		**120**		**13**	J	100	U	40	U	40	U	40	U	40	U	40	U	100	U	40	U
Perfluorooctanoic acid (PFOA)	335-67-1	40	ng/L								100	U	100	U	40	U	100	U	40	U	40	U	40	U	40	U	40	U	100	U	40	U
Perfluoropentane sulfonate (PFPeS)	138495-42-8		ng/L								100	U	100	U	40	U	100	U	40	U	40	U	40	U	40	U	40	U	100	U	40	U
Perfluoropentanoic acid (PFPeA)	2706-90-3		ng/L								100	U	100	U	40	U	100	U	40	U	40	U	40	U	40	U	40	U	100	U	40	U
Perfluorotetradecanoic acid (PFTeDA)	376-06-7		ng/L								100	U	100	U	40	U	100	U	40	U	40	U	40	U	40	U	40	U	100	U	40	U
Perfluorotridecanoic acid (PFTrDA)	72629-94-8		ng/L								100	U	100	U	40	U	100	U	40	U	40	U	40	U	40	U	40	U	100	U	40	U
Perfluoroundecanoic acid (PFUdA)	2058-94-8		ng/L								100	U	100	U	40	U	100	U	40	U	40	U	40	U	40	U	40	U	100	U	40	U

Notes:

1. Bolded values indicate the result was detected greater than the limit of detection
2. Data are compared to the Regional screening levels for the Project are adopted from Alaska Department of Environmental Conservation (ADEC) (2016), ADEC (2019) and OSD (2019).
3. Grey shaded values indicate the result was detected greater than or equal to the ADEC screening level for the residential scenario.

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CAS = Chemical Abstracts Service number
ID = identification
ng/L = nanograms per liter (parts per trillion)
PFAS = per- and polyfluoroalkyl substances

Laboratory Qualifiers
E = The reported result is above the limit of the calibration range.
J = The analyte was positively identified; however the associated numerical value is an estimated concentration only
U = The analyte was analyzed for but the result was not detected above the limit of quantitation (LOQ).
H = Sample analyzed out of holding time

Table C-2 EIE382-5 SPLP PFAS Results

Analyte	CAS	ADEC Screening Level	Units	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual
Category				Fines		Fines		Fines		Untreated		Untreated		Untreated		Gravel		Gravel		Gravel		Sand		Sand	
Location				382-5		382-5		382-5		382-5		382-5		382-5		382-5		382-5		382-5		382-5		382-5	
Sample ID				382-5-F-2(09082021)		382-5-F-3(09082021)		DUP-01(09082021)		[redacted]		[redacted]		[redacted]		ISM-382-5-GA(09082021)		ISM-382-5-GB(09082021)		ISM-382-5-GC(09082021)		ISM-382-5-SA(09072021)		ISM-382-5-SB(09072021)	
Sample Date				09/08/2021		09/08/2021		09/08/2021		09/08/2021		09/08/2021		09/08/2021		09/08/2021		09/08/2021		09/08/2021		09/07/2021		09/07/2021	
Sample Type				Batch		Batch		Batch		ISM		ISM		ISM		ISM		ISM		ISM		ISM		ISM	
Matrix				Soil		Soil		Soil		Soil		Soil		Soil		Soil		Soil		Soil		Soil		Soil	
Leachate Type				SPLP		SPLP		SPLP		SPLP		SPLP		SPLP		SPLP		SPLP		SPLP		SPLP		SPLP	
PFAS																									
4:2 Fluorotelomer sulfonate	757124-72-4		ng/L	80	U	80	U	80	U	80	HU	80	HU	80	HU	80	HU	80	HU	80	HU	80	HU	80	HU
6:2 Fluorotelomer sulfonic acid (6:2 FTSA)	27619-97-2		ng/L	80	U	80	U	80	U	**27**	HJ	80	HU	**28**	HJ	80	HU	80	HU	80	HU	**110**	H	**29**	HJ
8:2 Fluorotelomer sulfonic acid (8:2 FTSA)	39108-34-4		ng/L	80	U	80	U	80	U	80	HU	80	HU	80	HU	80	HU	80	HU	80	HU	80	HU	80	HU
N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6		ng/L	80	U	80	U	80	U	80	HU	80	HU	80	HU	80	HU	80	HU	80	HU	80	HU	80	HU
N-Methyl perfluorooctane sulfonamide (N-MeFOSA)	31506-32-8		ng/L	160	U	160	U	160	U	160	HU	160	HU	160	HU	160	HU	160	HU	160	HU	160	HU	160	HU
N-Methylperfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9		ng/L	80	U	80	U	80	U	80	HU	80	HU	80	HU	80	HU	80	HU	80	HU	80	HU	80	HU
Perfluorobutane sulfonic acid (PFBS)	375-73-5		ng/L	40	U	40	U	40	U	40	HU	40	HU	40	HU	40	HU	40	HU	40	HU	40	HU	40	HU
Perfluorobutanoic acid (PFBA)	375-22-4		ng/L	40	U	40	U	40	U	40	HU	40	HU	40	HU	40	HU	40	HU	40	HU	40	HU	40	HU
Perfluorodecane sulfonic acid (PFDS)	335-77-3		ng/L	40	U	40	U	40	U	40	HU	40	HU	40	HU	40	HU	40	HU	40	HU	40	HU	40	HU
Perfluorodecanoic acid (PFDA)	335-76-2		ng/L	40	U	40	U	40	U	40	HU	40	HU	40	HU	40	HU	40	HU	40	HU	40	HU	40	HU
Perfluorododecanoic acid (PFDoA)	307-55-1		ng/L	40	U	40	U	40	U	40	HU	40	HU	40	HU	40	HU	40	HU	40	HU	40	HU	40	HU
Perfluoroheptane sulfonic acid (PFHpS)	375-92-8		ng/L	40	U	40	U	40	U	40	HU	40	HU	40	HU	40	HU	40	HU	40	HU	40	HU	40	HU
Perfluoroheptanoic acid (PFHpA)	375-85-9		ng/L	40	U	40	U	40	U	40	HU	40	HU	40	HU	40	HU	40	HU	40	HU	40	HU	40	HU
Perfluorohexane sulfonic acid (PFHxS)	355-46-4		ng/L	40	U	40	U	40	U	**86**	H	**100**	H	**87**	H	40	HU	40	HU	40	HU	40	HU	40	HU
Perfluorohexanoic acid (PFHxA)	307-24-4		ng/L	40	U	40	U	40	U	40	HU	40	HU	40	HU	40	HU	40	HU	40	HU	40	HU	40	HU
Perfluorononane sulfonic acid (PFNS)	68259-12-1		ng/L	40	U	40	U	40	U	40	HU	40	HU	40	HU	40	HU	40	HU	40	HU	40	HU	40	HU
Perfluorononanoic acid (PFNA)	375-95-1		ng/L	40	U	40	U	40	U	40	HU	40	HU	40	HU	40	HU	40	HU	40	HU	40	HU	40	HU
Perfluorooctane sulfonamide (PFOSA)	754-91-6		ng/L	40	U	40	U	40	U	40	HU	40	HU	40	HU	40	HU	40	HU	40	HU	40	HU	40	HU
Perfluorooctane sulfonic acid (PFOS)	1763-23-1	40	ng/L	40	U	40	U	40	U	**200**	H	**190**	H	**190**	H	40	HU	40	HU	40	HU	40	HU	40	HU
Perfluorooctanoic acid (PFOA)	335-67-1	40	ng/L	40	U	40	U	40	U	**14**	HJ	**11**	HJ	40	HU	40	HU	40	HU	40	HU	40	HU	40	HU
Perfluoropentane sulfonate (PFPeS)	138495-42-8		ng/L	40	U	40	U	40	U	40	HU	40	HU	40	HU	40	HU	40	HU	40	HU	40	HU	40	HU
Perfluoropentanoic acid (PFPeA)	2706-90-3		ng/L	40	U	40	U	40	U	40	HU	40	HU	40	HU	40	HU	40	HU	40	HU	40	HU	40	HU
Perfluorotetradecanoic acid (PFTeDA)	376-06-7		ng/L	40	U	40	U	40	U	40	HU	40	HU	40	HU	40	HU	40	HU	40	HU	40	HU	40	HU
Perfluorotridecanoic acid (PFTrDA)	72629-94-8		ng/L	40	U	40	U	40	U	40	HU	40	HU	40	HU	40	HU	40	HU	40	HU	40	HU	40	HU
Perfluoroundecanoic acid (PFUdA)	2058-94-8		ng/L	40	U	40	U	40	U	40	HU	40	HU	40	HU	40	HU	40	HU	40	HU	40	HU	40	HU

Notes:

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H = Sample analyzed out of holding time

Table C-2 EIE382-5 SPLP PFAS Results

Analyte	CAS	ADEC Screening Level	Category	Sand		Fines		Fines		Fines	
			Location	382-5		382-5		382-5		382-5	
			Sample ID	ISM-382-5-SC(09072021)		ISM-382-5-FA(09082021)		ISM-382-5-FB(09082021)		ISM-382-5-FC(09082021)	
			Sample Date	09/07/2021		09/08/2021		09/08/2021		09/08/2021	
			Sample Type	ISM		ISM		ISM		ISM	
			Matrix	Soil		Soil		Soil		Soil	
			Leachate Type	SPLP		SPLP		SPLP		SPLP	
			Units	Result	Qual	Result	Qual	Result	Qual	Result	Qual
PFAS											
4:2 Fluorotelomer sulfonate	757124-72-4		ng/L	80	HU	80	HU	80	HU	80	HU
6:2 Fluorotelomer sulfonic acid (6:2 FTSA)	27619-97-2		ng/L	80	HU	**32**	HJ	**51**	HJ	80	HU
8:2 Fluorotelomer sulfonic acid (8:2 FTSA)	39108-34-4		ng/L	80	HU	80	HU	80	HU	80	HU
N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6		ng/L	80	HU	80	HU	80	HU	80	HU
N-Methyl perfluorooctane sulfonamide (N-MeFOSA)	31506-32-8		ng/L	160	HU	160	HU	160	HU	160	HU
N-Methylperfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9		ng/L	80	HU	80	HU	80	HU	80	HU
Perfluorobutane sulfonic acid (PFBS)	375-73-5		ng/L	40	HU	40	HU	40	HU	40	HU
Perfluorobutanoic acid (PFBA)	375-22-4		ng/L	40	HU	40	HU	40	HU	40	HU
Perfluorodecane sulfonic acid (PFDS)	335-77-3		ng/L	40	HU	40	HU	40	HU	40	HU
Perfluorodecanoic acid (PFDA)	335-76-2		ng/L	40	HU	40	HU	40	HU	40	HU
Perfluorododecanoic acid (PFDoA)	307-55-1		ng/L	40	HU	40	HU	40	HU	40	HU
Perfluoroheptane sulfonic acid (PFHpS)	375-92-8		ng/L	40	HU	40	HU	40	HU	40	HU
Perfluoroheptanoic acid (PFHpA)	375-85-9		ng/L	40	HU	40	HU	40	HU	40	HU
Perfluorohexane sulfonic acid (PFHxS)	355-46-4		ng/L	40	HU	**29**	HJ	**21**	HJ	**15**	HJ
Perfluorohexanoic acid (PFHxA)	307-24-4		ng/L	40	HU	40	HU	40	HU	40	HU
Perfluorononane sulfonic acid (PFNS)	68259-12-1		ng/L	40	HU	40	HU	40	HU	40	HU
Perfluorononanoic acid (PFNA)	375-95-1		ng/L	40	HU	40	HU	40	HU	40	HU
Perfluorooctane sulfonamide (PFOSA)	754-91-6		ng/L	40	HU	40	HU	40	HU	40	HU
Perfluorooctane sulfonic acid (PFOS)	1763-23-1	40	ng/L	40	HU	**58**	H	**66**	H	**44**	H
Perfluorooctanoic acid (PFOA)	335-67-1	40	ng/L	40	HU	40	HU	40	HU	40	HU
Perfluoropentane sulfonate (PFPeS)	138495-42-8		ng/L	40	HU	40	HU	40	HU	40	HU
Perfluoropentanoic acid (PFPeA)	2706-90-3		ng/L	40	HU	40	HU	40	HU	40	HU
Perfluorotetradecanoic acid (PFTeDA)	376-06-7		ng/L	40	HU	40	HU	40	HU	40	HU
Perfluorotridecanoic acid (PFTrDA)	72629-94-8		ng/L	40	HU	40	HU	40	HU	40	HU
Perfluoroundecanoic acid (PFUdA)	2058-94-8		ng/L	40	HU	40	HU	40	HU	40	HU

Notes:

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Table C-3 EIE385-4 Soil PFAS Results

Analyte	CAS	ADEC Screening Level	Category	Untreated		Untreated		Untreated		Untreated		Untreated		Gravel		Gravel		Gravel		Sand		Sand		Sand	
			Location	385-4		385-4		385-4		385-4		385-4		385-4		385-4		385-4		385-4		385-4		385-4	
			Sample ID	385-4-UT-1(09132021)		385-4-UT-2(09172021)		385-4-UT-3(09172021)		385-4-UT-4(09182021)		385-4-UT-5(09182021)		385-4-G-1(09152021)		385-4-G-2(09172021)		385-4-G-3(09182021)		385-4-S-1(09152021)		385-4-S-2(09172021)		385-4-S-3(09182021)	
			Sample Date	09/13/2021		09/17/2021		09/17/2021		09/18/2021		09/18/2021		09/15/2021		09/17/2021		09/18/2021		09/15/2021		09/17/2021		09/18/2021	
			Sample Type	N		N		N		N		N		N		N		N		N		N		N	
			Matrix	Soil		Soil		Soil		Soil		Soil		Soil		Soil		Soil		Soil		Soil		Soil	
			Units	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual
PFAS																									
4:2 Fluorotelomer sulfonate	757124-72-4		µg/kg	2	U	2.2	U	2.2	U	2	U	2.1	U	1.1	U	1.7	U	1.8	U	2.1	U	2	U	1.9	U
6:2 Fluorotelomer sulfonic acid (6:2 FTSA)	27619-97-2		µg/kg	2.1	U	2.2	U	2.2	U	2	U	2.1	U	1.1	U	1.7	U	1.8	U	2.1	U	2	U	1.9	U
8:2 Fluorotelomer sulfonic acid (8:2 FTSA)	39108-34-4		µg/kg	2	U	2.2	U	2.2	U	2	U	2.1	U	1.1	U	1.7	U	1.8	U	2.1	U	2	U	1.9	U
N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6		µg/kg	2	U	2.2	U	2.2	U	2	U	2.1	U	1.1	U	1.7	U	1.8	U	2.1	U	2	U	1.9	U
N-Methyl perfluorooctane sulfonamide (N-MeFOSA)	31506-32-8		µg/kg	2	U	2.2	U	2.2	U	2	U	2.1	U	1.1	U	1.7	U	1.8	U	2.1	U	2	U	1.9	U
N-Methylperfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9		µg/kg	2	U	2.2	U	2.2	U	2	U	2.1	U	1.1	U	1.7	U	1.8	U	2.1	U	2	U	1.9	U
Perfluorobutane sulfonic acid (PFBS)	375-73-5		µg/kg	**0.22**	J	1.1	U	**0.31**	J	0.98	U	**0.22**	J	0.55	U	0.87	U	0.91	U	1	U	1	U	0.97	U
Perfluorobutanoic acid (PFBA)	375-22-4		µg/kg	**0.21**	J	**0.22**	JB	**0.33**	JB	**0.26**	JB	**0.31**	JB	0.55	U	0.87	U	0.91	U	1	U	1	U	0.97	U
Perfluorodecane sulfonic acid (PFDS)	335-77-3		µg/kg	0.98	U	1.1	U	1.1	U	0.98	U	1	U	0.55	U	0.87	U	0.91	U	1	U	1	U	0.97	U
Perfluorodecanoic acid (PFDA)	335-76-2		µg/kg	**0.21**	J	**0.22**	J	**0.31**	J	**0.25**	J	1	U	0.55	U	0.87	U	0.91	U	1	U	1	U	0.97	U
Perfluorododecanoic acid (PFDoA)	307-55-1		µg/kg	0.98	U	1.1	U	1.1	U	0.98	U	1	U	0.55	U	0.87	U	0.91	U	1	U	1	U	0.97	U
Perfluoroheptane sulfonic acid (PFHpS)	375-92-8		µg/kg	0.98	U	1.1	U	1.1	U	0.98	U	1	U	0.55	U	0.87	U	0.91	U	1	U	1	U	0.97	U
Perfluoroheptanoic acid (PFHpA)	375-85-9		µg/kg	**0.45**	J	**0.64**	J	**0.92**	J	**0.73**	J	**0.7**	J	0.55	U	0.87	U	0.91	U	1	U	1	U	0.97	U
Perfluorohexane sulfonic acid (PFHxS)	355-46-4		µg/kg	**4.8**		**7**		**7.5**		**6.8**		**6.5**		0.55	U	0.87	U	0.91	U	**0.4**	J	**0.31**	J	**0.59**	J
Perfluorohexanoic acid (PFHxA)	307-24-4		µg/kg	**0.71**	J	**0.98**	J	**1.2**		**0.96**	J	**1.1**		0.55	U	0.87	U	0.91	U	1	U	1	U	0.97	U
Perfluorononane sulfonic acid (PFNS)	68259-12-1		µg/kg	0.98	U	1.1	U	1.1	U	0.98	U	1	U	0.55	U	0.87	U	0.91	U	1	U	1	U	0.97	U
Perfluorononanoic acid (PFNA)	375-95-1		µg/kg	**0.2**	J	**0.26**	J	**0.27**	J	**0.22**	J	1	U	0.55	U	0.87	U	0.91	U	1	U	1	U	0.97	U
Perfluorooctane sulfonamide (PFOSA)	754-91-6		µg/kg	0.98	U	**0.37**	J	**0.31**	J	**0.36**	J	**0.24**	J	0.55	U	0.87	U	0.91	U	1	U	1	U	0.97	U
Perfluorooctane sulfonic acid (PFOS)	1763-23-1	3	µg/kg	**9.2**		**13**		**14**		**12**		**11**		**0.28**	J	0.87	U	0.91	U	**0.8**	J	**0.87**	J	**1.1**	
Perfluorooctanoic acid (PFOA)	335-67-1	1.7	µg/kg	**0.78**	J	**1.8**		**1.4**		**1.4**		**1.1**		0.55	U	0.87	U	0.91	U	1	U	1	U	0.97	U
Perfluoropentane sulfonate (PFPeS)	138495-42-8		µg/kg	0.98	U	**0.29**	J	**0.42**	J	**0.35**	J	**0.33**	J	0.55	U	0.87	U	0.91	U	1	U	1	U	0.97	U
Perfluoropentanoic acid (PFPeA)	2706-90-3		µg/kg	**0.37**	J	**0.48**	J	**0.62**	J	**0.49**	J	**0.56**	J	0.55	U	0.87	U	0.91	U	1	U	1	U	0.97	U
Perfluorotetradecanoic acid (PFTeDA)	376-06-7		µg/kg	0.98	U	1.1	U	1.1	U	0.98	U	1	U	0.55	U	0.87	U	0.91	U	1	U	1	U	0.97	U
Perfluorotridecanoic acid (PFTrDA)	72629-94-8		µg/kg	0.98	U	1.1	U	1.1	U	0.98	U	1	U	0.55	U	0.87	U	0.91	U	1	U	1	U	0.97	U
Perfluoroundecanoic acid (PFUdA)	2058-94-8		µg/kg	0.98	U	1.1	U	1.1	U	0.98	U	1	U	0.55	U	0.87	U	0.91	U	1	U	1	U	0.97	U

Notes:

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3. Grey shaded values indicate the result was detected greater than or equal to the ADEC screening level for the residential scenario.

Acronyms/Abbreviations:
-- = not applicable/not analyzed
ADEC = Alaska Department of Environmental Conservation
CAS = Chemical Abstracts Service number
ID = identification
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PFAS = per- and polyfluoroalkyl substances

Laboratory Qualifiers
E = The reported result is above the limit of the calibration range.
J = The analyte was positively identified; however the associated numerical value is an estimated concentration only
U = The analyte was analyzed for but the result was not detected above the limit of quantitation (LOQ).
H = Sample analyzed out of holding time

Table C-3 EIE385-4 Soil PFAS Results

Analyte	CAS	ADEC Screening Level	Units	Category	Location	Sample ID	Sample Date	Sample Type	Matrix	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual
PFAS																													
4:2 Fluorotelomer sulfonate	757124-72-4		µg/kg	Fines	385-4	385-4-F-1(09222021)	09/22/2021	N	Soil	1.3	U	2.6	U	2.6	U	1.8	U	1.8	U	1.9	U	2	U	1.7	U	2	U	1.4	U	2	U
6:2 Fluorotelomer sulfonic acid (6:2 FTSA)	27619-97-2		µg/kg	Fines	385-4	385-4-F-2(09222021)	09/22/2021	N	Soil	1.3	U	2.6	U	2.6	U	1.8	U	1.8	U	1.9	U	2	U	1.7	U	2	U	1	U	2	U
8:2 Fluorotelomer sulfonic acid (8:2 FTSA)	39108-34-4		µg/kg	Fines	385-4	385-4-F-3(09222021)	09/22/2021	N	Soil	1.3	U	2.6	U	2.6	U	1.8	U	1.8	U	1.9	U	2	U	1.7	U	2	U	1.4	U	2	U
N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6		µg/kg	Untreated	385-4	385-4-UTA(09182021)	09/18/2021	N	Soil	1.3	U	2.6	U	2.6	U	1.8	U	1.8	U	1.9	U	2	U	1.7	U	2	U	1.4	U	2	U
N-Methyl perfluorooctane sulfonamide (N-MeFOSA)	31506-32-8		µg/kg	Untreated	385-4	385-4-UTB(09182021)	09/18/2021	N	Soil	1.3	U	2.6	U	2.6	U	1.8	U	1.8	U	1.9	U	2	U	1.7	U	2	U	1.4	U	2	U
N-Methylperfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9		µg/kg	Untreated	385-4	385-4-UTC(09182021)	09/18/2021	N	Soil	1.3	U	2.6	U	2.6	U	1.8	U	1.8	U	1.9	U	2	U	1.7	U	2	U	1.4	U	2	U
Perfluorobutane sulfonic acid (PFBS)	375-73-5		µg/kg	Gravel	385-4	385-4-GA(09182021)	09/18/2021	N	Soil	0.6	U	1.3	U	1.3	U	0.91	U	**0.22**	J	**0.22**	J	0.99	U	0.84	U	0.99	U	0.71	U	0.98	U
Perfluorobutanoic acid (PFBA)	375-22-4		µg/kg	Gravel	385-4	385-4-GB(09182021)	09/18/2021	N	Soil	0.6	U	1.3	U	1.3	U	0.91	U	**0.18**	J	0.95	U	0.99	U	0.84	U	0.99	U	0.71	U	0.98	U
Perfluorodecane sulfonic acid (PFDS)	335-77-3		µg/kg	Gravel	385-4	385-4-GC(09182021)	09/18/2021	N	Soil	0.6	U	1.3	U	1.3	U	**0.28**	J	0.9	U	0.95	U	0.99	U	0.84	U	0.99	U	0.71	U	0.98	U
Perfluorodecanoic acid (PFDA)	335-76-2		µg/kg	Gravel	385-4	DUP-02(09152021)	09/15/2021	FD	Soil	0.6	U	1.3	U	1.3	U	0.91	U	**0.19**	J	0.95	U	0.99	U	0.84	U	0.99	U	0.71	U	0.98	U
Perfluorododecanoic acid (PFDoA)	307-55-1		µg/kg	Sand	385-4	385-4-SA(09182021)	09/18/2021	N	Soil	0.6	U	1.3	U	1.3	U	0.91	U	0.9	U	0.95	U	0.99	U	0.84	U	0.99	U	0.71	U	0.98	U
Perfluoroheptane sulfonic acid (PFHpS)	375-92-8		µg/kg							0.6	U	1.3	U	1.3	U	0.91	U	0.9	U	0.95	U	0.99	U	0.84	U	0.99	U	0.71	U	0.98	U
Perfluoroheptanoic acid (PFHpA)	375-85-9		µg/kg							0.6	U	1.3	U	1.3	U	**0.35**	J	**0.5**	J	**0.58**	J	0.99	U	0.84	U	0.99	U	0.71	U	0.98	U
Perfluorohexane sulfonic acid (PFHxS)	355-46-4		µg/kg							**1.6**		**2.5**		1.3	U	**3.5**		**4.5**		**5**		0.99	U	0.84	U	0.99	U	**0.71**	J	**0.37**	J
Perfluorohexanoic acid (PFHxA)	307-24-4		µg/kg							0.6	U	1.3	U	1.3	U	**0.46**	J	**0.74**	J	**0.71**	J	0.99	U	0.84	U	0.99	U	0.71	U	0.98	U
Perfluorononane sulfonic acid (PFNS)	68259-12-1		µg/kg							0.6	U	1.3	U	1.3	U	0.91	U	0.9	U	0.95	U	0.99	U	0.84	U	0.99	U	0.71	U	0.98	U
Perfluorononanoic acid (PFNA)	375-95-1		µg/kg							0.6	U	1.3	U	1.3	U	0.91	U	0.9	U	**0.19**	J	0.99	U	0.84	U	0.99	U	0.71	U	0.98	U
Perfluorooctane sulfonamide (PFOSA)	754-91-6		µg/kg							0.6	U	1.3	U	1.3	U	0.91	U	0.9	U	**0.2**	J	0.99	U	0.84	U	0.99	U	0.71	U	0.98	U
Perfluorooctane sulfonic acid (PFOS)	1763-23-1	3	µg/kg							**5.4**		**8.5**		**6.2**		**6.7**		**8.9**		**9.1**		0.99	U	**0.23**	J	0.99	U	**0.75**		**1.1**	
Perfluorooctanoic acid (PFOA)	335-67-1	1.7	µg/kg							0.6	U	**0.27**	J	1.3	U	**0.61**	J	**0.81**	J	**0.94**	J	0.99	U	0.84	U	0.99	U	**0.71**	J	0.98	U
Perfluoropentane sulfonate (PFPeS)	138495-42-8		µg/kg							0.6	U	1.3	U	1.3	U	0.91	U	**0.19**	J	**0.2**	J	0.99	U	0.84	U	0.99	U	0.71	U	0.98	U
Perfluoropentanoic acid (PFPeA)	2706-90-3		µg/kg							0.6	U	1.3	U	1.3	U	**0.22**	J	**0.33**	J	**0.34**	J	0.99	U	0.84	U	0.99	U	0.71	U	0.98	U
Perfluorotetradecanoic acid (PFTeDA)	376-06-7		µg/kg							0.6	U	1.3	U	1.3	U	0.91	U	0.9	U	0.95	U	0.99	U	0.84	U	0.99	U	0.71	U	0.98	U
Perfluorotridecanoic acid (PFTrDA)	72629-94-8		µg/kg							0.6	U	1.3	U	1.3	U	0.91	U	0.9	U	0.95	U	0.99	U	0.84	U	0.99	U	0.71	U	0.98	U
Perfluoroundecanoic acid (PFUdA)	2058-94-8		µg/kg							0.6	U	1.3	U	1.3	U	0.91	U	0.9	U	0.95	U	0.99	U	0.84	U	0.99	U	0.71	U	0.98	U

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Table C-3 EIE385-4 Soil PFAS Results

Analyte	CAS	ADEC Screening Level	Units	Category	Location	Sample ID	Sample Date	Sample Type	Matrix	Result	Qual
PFAS											
4:2 Fluorotelomer sulfonate	757124-72-4		µg/kg	Sand	385-4	385-4-SB(09182021)	09/18/2021	N	Soil	1.8	U
6:2 Fluorotelomer sulfonic acid (6:2 FTSA)	27619-97-2		µg/kg	Sand	385-4	385-4-SB(09182021)	09/18/2021	N	Soil	1.8	U
8:2 Fluorotelomer sulfonic acid (8:2 FTSA)	39108-34-4		µg/kg	Sand	385-4	385-4-SB(09182021)	09/18/2021	N	Soil	1.8	U
N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6		µg/kg	Sand	385-4	385-4-SB(09182021)	09/18/2021	N	Soil	1.8	U
N-Methyl perfluorooctane sulfonamide (N-MeFOSA)	31506-32-8		µg/kg	Sand	385-4	385-4-SB(09182021)	09/18/2021	N	Soil	1.8	U
N-Methylperfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9		µg/kg	Sand	385-4	385-4-SB(09182021)	09/18/2021	N	Soil	1.8	U
Perfluorobutane sulfonic acid (PFBS)	375-73-5		µg/kg	Sand	385-4	385-4-SB(09182021)	09/18/2021	N	Soil	0.88	U
Perfluorobutanoic acid (PFBA)	375-22-4		µg/kg	Sand	385-4	385-4-SB(09182021)	09/18/2021	N	Soil	0.88	U
Perfluorodecane sulfonic acid (PFDS)	335-77-3		µg/kg	Sand	385-4	385-4-SB(09182021)	09/18/2021	N	Soil	0.88	U
Perfluorodecanoic acid (PFDA)	335-76-2		µg/kg	Sand	385-4	385-4-SB(09182021)	09/18/2021	N	Soil	0.88	U
Perfluorododecanoic acid (PFDoA)	307-55-1		µg/kg	Sand	385-4	385-4-SB(09182021)	09/18/2021	N	Soil	0.88	U
Perfluoroheptane sulfonic acid (PFHpS)	375-92-8		µg/kg	Sand	385-4	385-4-SB(09182021)	09/18/2021	N	Soil	0.88	U
Perfluoroheptanoic acid (PFHpA)	375-85-9		µg/kg	Sand	385-4	385-4-SB(09182021)	09/18/2021	N	Soil	0.88	U
Perfluorohexane sulfonic acid (PFHxS)	355-46-4		µg/kg	Sand	385-4	385-4-SB(09182021)	09/18/2021	N	Soil	**0.41**	J
Perfluorohexanoic acid (PFHxA)	307-24-4		µg/kg	Sand	385-4	385-4-SB(09182021)	09/18/2021	N	Soil	0.88	U
Perfluorononane sulfonic acid (PFNS)	68259-12-1		µg/kg	Sand	385-4	385-4-SB(09182021)	09/18/2021	N	Soil	0.88	U
Perfluorononanoic acid (PFNA)	375-95-1		µg/kg	Sand	385-4	385-4-SB(09182021)	09/18/2021	N	Soil	0.88	U
Perfluorooctane sulfonamide (PFOSA)	754-91-6		µg/kg	Sand	385-4	385-4-SB(09182021)	09/18/2021	N	Soil	0.88	U
Perfluorooctane sulfonic acid (PFOS)	1763-23-1	3	µg/kg	Sand	385-4	385-4-SB(09182021)	09/18/2021	N	Soil	**0.85**	J
Perfluorooctanoic acid (PFOA)	335-67-1	1.7	µg/kg	Sand	385-4	385-4-SB(09182021)	09/18/2021	N	Soil	0.88	U
Perfluoropentane sulfonate (PFPeS)	138495-42-8		µg/kg	Sand	385-4	385-4-SB(09182021)	09/18/2021	N	Soil	0.88	U
Perfluoropentanoic acid (PFPeA)	2706-90-3		µg/kg	Sand	385-4	385-4-SB(09182021)	09/18/2021	N	Soil	0.88	U
Perfluorotetradecanoic acid (PFTeDA)	376-06-7		µg/kg	Sand	385-4	385-4-SB(09182021)	09/18/2021	N	Soil	0.88	U
Perfluorotridecanoic acid (PFTrDA)	72629-94-8		µg/kg	Sand	385-4	385-4-SB(09182021)	09/18/2021	N	Soil	0.88	U
Perfluoroundecanoic acid (PFUdA)	2058-94-8		µg/kg	Sand	385-4	385-4-SB(09182021)	09/18/2021	N	Soil	0.88	U

Analyte	CAS	ADEC Screening Level	Units	Category	Location	Sample ID	Sample Date	Sample Type	Matrix	Result	Qual
PFAS											
4:2 Fluorotelomer sulfonate	757124-72-4		µg/kg	Sand	385-4	385-4-SC(09182021)	09/18/2021	N	Soil	1.8	U
6:2 Fluorotelomer sulfonic acid (6:2 FTSA)	27619-97-2		µg/kg	Sand	385-4	385-4-SC(09182021)	09/18/2021	N	Soil	1.8	U
8:2 Fluorotelomer sulfonic acid (8:2 FTSA)	39108-34-4		µg/kg	Sand	385-4	385-4-SC(09182021)	09/18/2021	N	Soil	1.8	U
N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6		µg/kg	Sand	385-4	385-4-SC(09182021)	09/18/2021	N	Soil	1.8	U
N-Methyl perfluorooctane sulfonamide (N-MeFOSA)	31506-32-8		µg/kg	Sand	385-4	385-4-SC(09182021)	09/18/2021	N	Soil	1.8	U
N-Methylperfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9		µg/kg	Sand	385-4	385-4-SC(09182021)	09/18/2021	N	Soil	1.8	U
Perfluorobutane sulfonic acid (PFBS)	375-73-5		µg/kg	Sand	385-4	385-4-SC(09182021)	09/18/2021	N	Soil	0.9	U
Perfluorobutanoic acid (PFBA)	375-22-4		µg/kg	Sand	385-4	385-4-SC(09182021)	09/18/2021	N	Soil	0.9	U
Perfluorodecane sulfonic acid (PFDS)	335-77-3		µg/kg	Sand	385-4	385-4-SC(09182021)	09/18/2021	N	Soil	0.9	U
Perfluorodecanoic acid (PFDA)	335-76-2		µg/kg	Sand	385-4	385-4-SC(09182021)	09/18/2021	N	Soil	0.9	U
Perfluorododecanoic acid (PFDoA)	307-55-1		µg/kg	Sand	385-4	385-4-SC(09182021)	09/18/2021	N	Soil	0.9	U
Perfluoroheptane sulfonic acid (PFHpS)	375-92-8		µg/kg	Sand	385-4	385-4-SC(09182021)	09/18/2021	N	Soil	0.9	U
Perfluoroheptanoic acid (PFHpA)	375-85-9		µg/kg	Sand	385-4	385-4-SC(09182021)	09/18/2021	N	Soil	0.9	U
Perfluorohexane sulfonic acid (PFHxS)	355-46-4		µg/kg	Sand	385-4	385-4-SC(09182021)	09/18/2021	N	Soil	**0.35**	J
Perfluorohexanoic acid (PFHxA)	307-24-4		µg/kg	Sand	385-4	385-4-SC(09182021)	09/18/2021	N	Soil	0.9	U
Perfluorononane sulfonic acid (PFNS)	68259-12-1		µg/kg	Sand	385-4	385-4-SC(09182021)	09/18/2021	N	Soil	0.9	U
Perfluorononanoic acid (PFNA)	375-95-1		µg/kg	Sand	385-4	385-4-SC(09182021)	09/18/2021	N	Soil	0.9	U
Perfluorooctane sulfonamide (PFOSA)	754-91-6		µg/kg	Sand	385-4	385-4-SC(09182021)	09/18/2021	N	Soil	0.9	U
Perfluorooctane sulfonic acid (PFOS)	1763-23-1	3	µg/kg	Sand	385-4	385-4-SC(09182021)	09/18/2021	N	Soil	**0.87**	J
Perfluorooctanoic acid (PFOA)	335-67-1	1.7	µg/kg	Sand	385-4	385-4-SC(09182021)	09/18/2021	N	Soil	0.9	U
Perfluoropentane sulfonate (PFPeS)	138495-42-8		µg/kg	Sand	385-4	385-4-SC(09182021)	09/18/2021	N	Soil	0.9	U
Perfluoropentanoic acid (PFPeA)	2706-90-3		µg/kg	Sand	385-4	385-4-SC(09182021)	09/18/2021	N	Soil	0.9	U
Perfluorotetradecanoic acid (PFTeDA)	376-06-7		µg/kg	Sand	385-4	385-4-SC(09182021)	09/18/2021	N	Soil	0.9	U
Perfluorotridecanoic acid (PFTrDA)	72629-94-8		µg/kg	Sand	385-4	385-4-SC(09182021)	09/18/2021	N	Soil	0.9	U
Perfluoroundecanoic acid (PFUdA)	2058-94-8		µg/kg	Sand	385-4	385-4-SC(09182021)	09/18/2021	N	Soil	0.9	U

Analyte	CAS	ADEC Screening Level	Units	Category	Location	Sample ID	Sample Date	Sample Type	Matrix	Result	Qual
PFAS											
4:2 Fluorotelomer sulfonate	757124-72-4		µg/kg	Fines	385-4	385-4-FA(09222021)	09/22/2021	N	Soil	2.1	U
6:2 Fluorotelomer sulfonic acid (6:2 FTSA)	27619-97-2		µg/kg	Fines	385-4	385-4-FA(09222021)	09/22/2021	N	Soil	2.1	U
8:2 Fluorotelomer sulfonic acid (8:2 FTSA)	39108-34-4		µg/kg	Fines	385-4	385-4-FA(09222021)	09/22/2021	N	Soil	2.1	U
N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6		µg/kg	Fines	385-4	385-4-FA(09222021)	09/22/2021	N	Soil	2.1	U
N-Methyl perfluorooctane sulfonamide (N-MeFOSA)	31506-32-8		µg/kg	Fines	385-4	385-4-FA(09222021)	09/22/2021	N	Soil	2.1	U
N-Methylperfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9		µg/kg	Fines	385-4	385-4-FA(09222021)	09/22/2021	N	Soil	2.1	U
Perfluorobutane sulfonic acid (PFBS)	375-73-5		µg/kg	Fines	385-4	385-4-FA(09222021)	09/22/2021	N	Soil	1	U
Perfluorobutanoic acid (PFBA)	375-22-4		µg/kg	Fines	385-4	385-4-FA(09222021)	09/22/2021	N	Soil	1	U
Perfluorodecane sulfonic acid (PFDS)	335-77-3		µg/kg	Fines	385-4	385-4-FA(09222021)	09/22/2021	N	Soil	1	U
Perfluorodecanoic acid (PFDA)	335-76-2		µg/kg	Fines	385-4	385-4-FA(09222021)	09/22/2021	N	Soil	1	U
Perfluorododecanoic acid (PFDoA)	307-55-1		µg/kg	Fines	385-4	385-4-FA(09222021)	09/22/2021	N	Soil	1	U
Perfluoroheptane sulfonic acid (PFHpS)	375-92-8		µg/kg	Fines	385-4	385-4-FA(09222021)	09/22/2021	N	Soil	1	U
Perfluoroheptanoic acid (PFHpA)	375-85-9		µg/kg	Fines	385-4	385-4-FA(09222021)	09/22/2021	N	Soil	1	U
Perfluorohexane sulfonic acid (PFHxS)	355-46-4		µg/kg	Fines	385-4	385-4-FA(09222021)	09/22/2021	N	Soil	**2.3**	
Perfluorohexanoic acid (PFHxA)	307-24-4		µg/kg	Fines	385-4	385-4-FA(09222021)	09/22/2021	N	Soil	1	U
Perfluorononane sulfonic acid (PFNS)	68259-12-1		µg/kg	Fines	385-4	385-4-FA(09222021)	09/22/2021	N	Soil	1	U
Perfluorononanoic acid (PFNA)	375-95-1		µg/kg	Fines	385-4	385-4-FA(09222021)	09/22/2021	N	Soil	1	U
Perfluorooctane sulfonamide (PFOSA)	754-91-6		µg/kg	Fines	385-4	385-4-FA(09222021)	09/22/2021	N	Soil	**0.31**	J
Perfluorooctane sulfonic acid (PFOS)	1763-23-1	3	µg/kg	Fines	385-4	385-4-FA(09222021)	09/22/2021	N	Soil	**7.6**	
Perfluorooctanoic acid (PFOA)	335-67-1	1.7	µg/kg	Fines	385-4	385-4-FA(09222021)	09/22/2021	N	Soil	1	U
Perfluoropentane sulfonate (PFPeS)	138495-42-8		µg/kg	Fines	385-4	385-4-FA(09222021)	09/22/2021	N	Soil	1	U
Perfluoropentanoic acid (PFPeA)	2706-90-3		µg/kg	Fines	385-4	385-4-FA(09222021)	09/22/2021	N	Soil	1	U
Perfluorotetradecanoic acid (PFTeDA)	376-06-7		µg/kg	Fines	385-4	385-4-FA(09222021)	09/22/2021	N	Soil	1	U
Perfluorotridecanoic acid (PFTrDA)	72629-94-8		µg/kg	Fines	385-4	385-4-FA(09222021)	09/22/2021	N	Soil	1	U
Perfluoroundecanoic acid (PFUdA)	2058-94-8		µg/kg	Fines	385-4	385-4-FA(09222021)	09/22/2021	N	Soil	1	U

Analyte	CAS	ADEC Screening Level	Units	Category	Location	Sample ID	Sample Date	Sample Type	Matrix	Result	Qual
PFAS											
4:2 Fluorotelomer sulfonate	757124-72-4		µg/kg	Fines	385-4	385-4-FB(09222021)	09/22/2021	N	Soil	2	U
6:2 Fluorotelomer sulfonic acid (6:2 FTSA)	27619-97-2		µg/kg	Fines	385-4	385-4-FB(09222021)	09/22/2021	N	Soil	2	U
8:2 Fluorotelomer sulfonic acid (8:2 FTSA)	39108-34-4		µg/kg	Fines	385-4	385-4-FB(09222021)	09/22/2021	N	Soil	2	U
N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6		µg/kg	Fines	385-4	385-4-FB(09222021)	09/22/2021	N	Soil	2	U
N-Methyl perfluorooctane sulfonamide (N-MeFOSA)	31506-32-8		µg/kg	Fines	385-4	385-4-FB(09222021)	09/22/2021	N	Soil	2	U
N-Methylperfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9		µg/kg	Fines	385-4	385-4-FB(09222021)	09/22/2021	N	Soil	2	U
Perfluorobutane sulfonic acid (PFBS)	375-73-5		µg/kg	Fines	385-4	385-4-FB(09222021)	09/22/2021	N	Soil	1	U
Perfluorobutanoic acid (PFBA)	375-22-4		µg/kg	Fines	385-4	385-4-FB(09222021)	09/22/2021	N	Soil	1	U
Perfluorodecane sulfonic acid (PFDS)	335-77-3		µg/kg	Fines	385-4	385-4-FB(09222021)	09/22/2021	N	Soil	**0.21**	J
Perfluorodecanoic acid (PFDA)	335-76-2		µg/kg	Fines	385-4	385-4-FB(09222021)	09/22/2021	N	Soil	1	U
Perfluorododecanoic acid (PFDoA)	307-55-1		µg/kg	Fines	385-4	385-4-FB(09222021)	09/22/2021	N	Soil	1	U
Perfluoroheptane sulfonic acid (PFHpS)	375-92-8		µg/kg	Fines	385-4	385-4-FB(09222021)	09/22/2021	N	Soil	1	U
Perfluoroheptanoic acid (PFHpA)	375-85-9		µg/kg	Fines	385-4	385-4-FB(09222021)	09/22/2021	N	Soil	1	U
Perfluorohexane sulfonic acid (PFHxS)	355-46-4		µg/kg	Fines	385-4	385-4-FB(09222021)	09/22/2021	N	Soil	**2.2**	
Perfluorohexanoic acid (PFHxA)	307-24-4		µg/kg	Fines	385-4	385-4-FB(09222021)	09/22/2021	N	Soil	**0.2**	J
Perfluorononane sulfonic acid (PFNS)	68259-12-1		µg/kg	Fines	385-4	385-4-FB(09222021)	09/22/2021	N	Soil	1	U
Perfluorononanoic acid (PFNA)	375-95-1		µg/kg	Fines	385-4	385-4-FB(09222021)	09/22/2021	N	Soil	1	U
Perfluorooctane sulfonamide (PFOSA)	754-91-6		µg/kg	Fines	385-4	385-4-FB(09222021)	09/22/2021	N	Soil	**0.36**	J
Perfluorooctane sulfonic acid (PFOS)	1763-23-1	3	µg/kg	Fines	385-4	385-4-FB(09222021)	09/22/2021	N	Soil	**11**	
Perfluorooctanoic acid (PFOA)	335-67-1	1.7	µg/kg	Fines	385-4	385-4-FB(09222021)	09/22/2021	N	Soil	**0.2**	J
Perfluoropentane sulfonate (PFPeS)	138495-42-8		µg/kg	Fines	385-4	385-4-FB(09222021)	09/22/2021	N	Soil	1	U
Perfluoropentanoic acid (PFPeA)	2706-90-3		µg/kg	Fines	385-4	385-4-FB(09222021)	09/22/2021	N	Soil	1	U
Perfluorotetradecanoic acid (PFTeDA)	376-06-7		µg/kg	Fines	385-4	385-4-FB(09222021)	09/22/2021	N	Soil	1	U
Perfluorotridecanoic acid (PFTrDA)	72629-94-8		µg/kg	Fines	385-4	385-4-FB(09222021)	09/22/2021	N	Soil	1	U
Perfluoroundecanoic acid (PFUdA)	2058-94-8		µg/kg	Fines	385-4	385-4-FB(09222021)	09/22/2021	N	Soil	1	U

Analyte	CAS	ADEC Screening Level	Units	Category	Location	Sample ID	Sample Date	Sample Type	Matrix	Result	Qual
PFAS											
4:2 Fluorotelomer sulfonate	757124-72-4		µg/kg	Fines	385-4	385-4-FC(09222021)	09/22/2021	N	Soil	1.8	U
6:2 Fluorotelomer sulfonic acid (6:2 FTSA)	27619-97-2		µg/kg	Fines	385-4	385-4-FC(09222021)	09/22/2021	N	Soil	1.8	U
8:2 Fluorotelomer sulfonic acid (8:2 FTSA)	39108-34-4		µg/kg	Fines	385-4	385-4-FC(09222021)	09/22/2021	N	Soil	1.8	U
N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6		µg/kg	Fines	385-4	385-4-FC(09222021)	09/22/2021	N	Soil	1.8	U
N-Methyl perfluorooctane sulfonamide (N-MeFOSA)	31506-32-8		µg/kg	Fines	385-4	385-4-FC(09222021)	09/22/2021	N	Soil	1.8	U
N-Methylperfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9		µg/kg	Fines	385-4	385-4-FC(09222021)	09/22/2021	N	Soil	1.8	U
Perfluorobutane sulfonic acid (PFBS)	375-73-5		µg/kg	Fines	385-4	385-4-FC(09222021)	09/22/2021	N	Soil	0.89	U
Perfluorobutanoic acid (PFBA)	375-22-4		µg/kg	Fines	385-4	385-4-FC(09222021)	09/22/2021	N	Soil	0.89	U
Perfluorodecane sulfonic acid (PFDS)	335-77-3		µg/kg	Fines	385-4	385-4-FC(09222021)	09/22/2021	N	Soil	0.89	U
Perfluorodecanoic acid (PFDA)	335-76-2		µg/kg	Fines	385-4	385-4-FC(09222021)	09/22/2021	N	Soil	0.89	U
Perfluorododecanoic acid (PFDoA)	307-55-1		µg/kg	Fines	385-4	385-4-FC(09222021)	09/22/2021	N	Soil	0.89	U
Perfluoroheptane sulfonic acid (PFHpS)	375-92-8		µg/kg	Fines	385-4	385-4-FC(09222021)	09/22/2021	N	Soil	0.89	U
Perfluoroheptanoic acid (PFHpA)	375-85-9		µg/kg	Fines	385-4	385-4-FC(09222021)	09/22/2021	N	Soil	0.89	U
Perfluorohexane sulfonic acid (PFHxS)	355-46-4		µg/kg	Fines	385-4	385-4-FC(09222021)	09/22/2021	N	Soil	**2.2**	
Perfluorohexanoic acid (PFHxA)	307-24-4		µg/kg	Fines	385-4	385-4-FC(09222021)	09/22/2021	N	Soil	0.89	U
Perfluorononane sulfonic acid (PFNS)	68259-12-1		µg/kg	Fines	385-4	385-4-FC(09222021)	09/22/2021	N	Soil	0.89	U
Perfluorononanoic acid (PFNA)	375-95-1		µg/kg	Fines	385-4	385-4-FC(09222021)	09/22/2021	N	Soil	0.89	U
Perfluorooctane sulfonamide (PFOSA)	754-91-6		µg/kg	Fines	385-4	385-4-FC(09222021)	09/22/2021	N	Soil	**0.37**	J
Perfluorooctane sulfonic acid (PFOS)	1763-23-1	3	µg/kg	Fines	385-4	385-4-FC(09222021)	09/22/2021	N	Soil	**8**	
Perfluorooctanoic acid (PFOA)	335-67-1	1.7	µg/kg	Fines	385-4	385-4-FC(09222021)	09/22/2021	N	Soil	**0.28**	J
Perfluoropentane sulfonate (PFPeS)	138495-42-8		µg/kg	Fines	385-4	385-4-FC(09222021)	09/22/2021	N	Soil	0.89	U
Perfluoropentanoic acid (PFPeA)	2706-90-3		µg/kg	Fines	385-4	385-4-FC(09222021)	09/22/2021	N	Soil	0.89	U
Perfluorotetradecanoic acid (PFTeDA)	376-06-7		µg/kg	Fines	385-4	385-4-FC(09222021)	09/22/2021	N	Soil	0.89	U
Perfluorotridecanoic acid (PFTrDA)	72629-94-8		µg/kg	Fines	385-4	385-4-FC(09222021)	09/22/2021	N	Soil	0.89	U
Perfluoroundecanoic acid (PFUdA)	2058-94-8		µg/kg	Fines	385-4	385-4-FC(09222021)	09/22/2021	N	Soil	0.89	U

Notes:

1. Bolded values indicate the result was detected greater than the limit of detection
2. Data are compared to the Regional screening levels for the Project are adopted from Alaska Department of Environmental Conservation (ADEC) (2016), ADEC (2019) and OSD (2019).
3. Grey shaded values indicate the result was detected greater than or equal to the ADEC screening level for the residential scenario.

Acronyms/Abbreviations:
-- = not applicable/not analyzed
ADEC = Alaska Department of Environmental Conservation
CAS = Chemical Abstracts Service number
ID = identification
µg/kg = micrograms per kilogram (parts per billion)
PFAS = per- and polyfluoroalkyl substances

Laboratory Qualifiers
E = The reported result is above the limit of the calibration range.
J = The analyte was positively identified; however the associated numerical value is an estimated concentration only
U = The analyte was analyzed for but the result was not detected above the limit of quantitation (LOQ).
H = Sample analyzed out of holding time

Table C-4 EIE385-4 SPLP PFAS Results

			Category	Untreated		Untreated		Untreated		Untreated		Untreated		Gravel		Gravel		Gravel		Gravel		Sand		Sand	
			Location	385-4		385-4		385-4		385-4		385-4		385-4		385-4		385-4		385-4		385-4		385-4	
			Sample ID	385-4-UT-1(09132021)		385-4-UT-2(09172021)		385-4-UT-3(09172021)		385-4-UT-4(09182021)		385-4-UT-5(09182021)		385-4-G-1(09152021)		385-4-G-2(09172021)		385-4-G-3(09182021)		DUP-02(09152021)		385-4-S-1(09152021)		385-4-S-2(09172021)	
			Sample Date	09/13/2021		09/17/2021		09/17/2021		09/18/2021		09/18/2021		09/15/2021		09/17/2021		09/18/2021		09/15/2021		09/15/2021		09/17/2021	
			Sample Type	N		N		N		N		N		N		N		N		FD		N		N	
			Matrix	Soil		Soil		Soil		Soil		Soil		Soil		Soil		Soil		Soil		Soil		Soil	
			Leachate Type	SPLP		SPLP		SPLP		SPLP		SPLP		SPLP		SPLP		SPLP		SPLP		SPLP		SPLP	
Analyte	**CAS**	**ADECScreening Level**	**Units**	**Result**	**Qual**	**Result**	**Qual**	**Result**	**Qual**	**Result**	**Qual**	**Result**	**Qual**	**Result**	**Qual**	**Result**	**Qual**	**Result**	**Qual**	**Result**	**Qual**	**Result**	**Qual**	**Result**	**Qual**
PFAS																									
4:2 Fluorotelomer sulfonate	757124-72-4		ng/L	80	U	80	U	80	U	80	U	80	U	80	U	80	U	80	U	80	U	80	U	80	U
6:2 Fluorotelomer sulfonic acid (6:2 FTSA)	27619-97-2		ng/L	80	U	80	U	80	U	80	U	80	U	**37**	J	80	U	80	U	80	U	80	U	80	U
8:2 Fluorotelomer sulfonic acid (8:2 FTSA)	39108-34-4		ng/L	80	U	80	U	80	U	80	U	80	U	80	U	80	U	80	U	80	U	80	U	80	U
N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6		ng/L	80	U	80	U	80	U	80	U	80	U	80	U	80	U	80	U	80	U	80	U	80	U
N-Methyl perfluorooctane sulfonamide (N-MeFOSA)	31506-32-8		ng/L	160	U	160	U	160	U	160	U	160	U	160	U	160	U	160	U	160	U	160	U	160	U
N-Methylperfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9		ng/L	80	U	80	U	80	U	80	U	80	U	80	U	80	U	80	U	80	U	80	U	80	U
Perfluorobutane sulfonic acid (PFBS)	375-73-5		ng/L	40	U	**13**	J	**11**	J	**11**	J	**12**	J	40	U	40	U	40	U	40	U	40	U	40	U
Perfluorobutanoic acid (PFBA)	375-22-4		ng/L	40	U	40	U	40	U	40	U	40	U	40	U	40	U	40	U	40	U	40	U	40	U
Perfluorodecane sulfonic acid (PFDS)	335-77-3		ng/L	40	U	40	U	40	U	40	U	40	U	40	U	40	U	40	U	40	U	40	U	40	U
Perfluorodecanoic acid (PFDA)	335-76-2		ng/L	40	U	40	U	40	U	40	U	40	U	40	U	40	U	40	U	40	U	40	U	40	U
Perfluorododecanoic acid (PFDoA)	307-55-1		ng/L	40	U	40	U	40	U	40	U	40	U	40	U	40	U	40	U	40	U	40	U	40	U
Perfluoroheptane sulfonic acid (PFHpS)	375-92-8		ng/L	40	U	40	U	40	U	40	U	40	U	40	U	40	U	40	U	40	U	40	U	40	U
Perfluoroheptanoic acid (PFHpA)	375-85-9		ng/L	40	U	**32**	J	**28**	J	**25**	J	**24**	J	40	U	40	U	40	U	40	U	40	U	40	U
Perfluorohexane sulfonic acid (PFHxS)	355-46-4		ng/L	**96**		**230**		**210**		**200**		**190**		40	U	40	U	40	U	40	U	40	U	40	U
Perfluorohexanoic acid (PFHxA)	307-24-4		ng/L	**15**	J	**40**		**35**	J	**29**	J	**33**	J	40	U	40	U	40	U	40	U	40	U	40	U
Perfluorononane sulfonic acid (PFNS)	68259-12-1		ng/L	40	U	40	U	40	U	40	U	40	U	40	U	40	U	40	U	40	U	40	U	40	U
Perfluorononanoic acid (PFNA)	375-95-1		ng/L	40	U	40	U	40	U	40	U	40	U	40	U	40	U	40	U	40	U	40	U	40	U
Perfluorooctane sulfonamide (PFOSA)	754-91-6		ng/L	40	U	40	U	40	U	40	U	40	U	40	U	40	U	40	U	40	U	40	U	40	U
Perfluorooctane sulfonic acid (PFOS)	1763-23-1	40	ng/L	**180**		**400**		**300**		**290**		**270**		40	U	40	U	40	U	40	U	40	U	40	U
Perfluorooctanoic acid (PFOA)	335-67-1	40	ng/L	**18**	J	**51**		**48**		**34**	J	**39**	J	40	U	40	U	40	U	40	U	40	U	40	U
Perfluoropentane sulfonate (PFPeS)	138495-42-8		ng/L	40	U	**12**	J	**11**	J	40	U	40	U	40	U	40	U	40	U	40	U	40	U	40	U
Perfluoropentanoic acid (PFPeA)	2706-90-3		ng/L	40	U	**20**	J	**17**	J	**15**	J	**17**	J	40	U	40	U	40	U	40	U	40	U	40	U
Perfluorotetradecanoic acid (PFTeDA)	376-06-7		ng/L	40	U	40	U	40	U	40	U	40	U	40	U	40	U	40	U	40	U	40	U	40	U
Perfluorotridecanoic acid (PFTrDA)	72629-94-8		ng/L	40	U	40	U	40	U	40	U	40	U	40	U	40	U	40	U	40	U	40	U	40	U
Perfluoroundecanoic acid (PFUdA)	2058-94-8		ng/L	40	U	40	U	40	U	40	U	40	U	40	U	40	U	40	U	40	U	40	U	40	U

Notes:

1. Bolded values indicate the result was detected greater than the limit of detection
2. Data are compared to the Regional screening levels for the Project are adopted from Alaska Department of Environmental Conservation (ADEC) (2016), ADEC (2019) and OSD (2019).
3. Grey shaded values indicate the result was detected greater than or equal to the ADEC screening level for the residential scenario.

Acronyms/Abbreviations:
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ADEC = Alaska Department of Environmental Conservation
CAS = Chemical Abstracts Service number
ID = identification
ng/L = nanograms per liter (parts per trillion)
PFAS = per- and polyfluoroalkyl substances

Laboratory Qualifiers
E = The reported result is above the limit of the calibration range.
J = The analyte was positively identified; however the associated numerical value is an estimated concentration only
U = The analyte was analyzed for but the result was not detected above the limit of quantitation (LOQ).
H = Sample analyzed out of holding time

Table C-4 EIE385-4 SPLP PFAS Results

			Category	Sand		Fines		Fines		Fines		Untreated		Untreated		Untreated		Gravel		Gravel		Gravel		Sand	
			Location	385-4		385-4		385-4		385-4		385-4		385-4		385-4		385-4		385-4		385-4		385-4	
			Sample ID	385-4-S-3(09182021)		385-4-F-1(09222021)		385-4-F-2(09222021)		385-4-F-3(09222021)		385-4-UTa(09182021)		385-4-UTb(09182021)		385-4-UTc(09182021)		385-4-Ga(09182021)		385-4-Gb(09182021)		385-4-Gc(09182021)		385-4-Sa(09182021)	
			Sample Date	09/18/2021		09/22/2021		09/22/2021		09/22/2021		09/18/2021		09/18/2021		09/18/2021		09/18/2021		09/18/2021		09/18/2021		09/18/2021	
			Sample Type	N		N		N		N		N		N		N		N		N		N		N	
			Matrix	Soil		Soil		Soil		Soil		Soil		Soil		Soil		Soil		Soil		Soil		Soil	
			Leachate Type	SPLP		SPLP		SPLP		SPLP		SPLP		SPLP		SPLP		SPLP		SPLP		SPLP		SPLP	
Analyte	**CAS**	**ADECScreening Level**	**Units**	**Result**	**Qual**	**Result**	**Qual**	**Result**	**Qual**	**Result**	**Qual**	**Result**	**Qual**	**Result**	**Qual**	**Result**	**Qual**	**Result**	**Qual**	**Result**	**Qual**	**Result**	**Qual**	**Result**	**Qual**
PFAS																									
4:2 Fluorotelomer sulfonate	757124-72-4		ng/L	80	U	80	U	80	U	80	U	80	HU	80	HU	80	HU	80	HU	80	HU	80	HU	80	HU
6:2 Fluorotelomer sulfonic acid (6:2 FTSA)	27619-97-2		ng/L	80	U	80	U	80	U	80	U	80	HU	80	HU	80	HU	80	HU	**32**	HJ	80	HU	**100**	H
8:2 Fluorotelomer sulfonic acid (8:2 FTSA)	39108-34-4		ng/L	80	U	80	U	80	U	80	U	80	HU	80	HU	80	HU	80	HU	80	HU	80	HU	80	HU
N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6		ng/L	80	U	80	U	80	U	80	U	80	HU	80	HU	80	HU	80	HU	80	HU	80	HU	80	HU
N-Methyl perfluorooctane sulfonamide (N-MeFOSA)	31506-32-8		ng/L	160	U	160	U	160	U	160	U	160	HU	160	HU	160	HU	160	HU	160	HU	160	HU	160	HU
N-Methylperfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9		ng/L	80	U	80	U	80	U	80	U	80	HU	80	HU	80	HU	80	HU	80	HU	80	HU	80	HU
Perfluorobutane sulfonic acid (PFBS)	375-73-5		ng/L	40	U	40	U	40	U	40	U	**12**	HJ	**11**	HJ	**12**	HJ	40	HU	40	HU	40	HU	40	HU
Perfluorobutanoic acid (PFBA)	375-22-4		ng/L	40	U	40	U	40	U	40	U	**13**	HJ	**11**	HJ	**11**	HJ	40	HU	40	HU	40	HU	40	HU
Perfluorodecane sulfonic acid (PFDS)	335-77-3		ng/L	40	U	40	U	40	U	40	U	40	HU	40	HU	40	HU	40	HU	40	HU	40	HU	40	HU
Perfluorodecanoic acid (PFDA)	335-76-2		ng/L	40	U	40	U	40	U	40	U	40	HU	40	HU	40	HU	40	HU	40	HU	40	HU	40	HU
Perfluorododecanoic acid (PFDoA)	307-55-1		ng/L	40	U	40	U	40	U	40	U	40	HU	40	HU	40	HU	40	HU	40	HU	40	HU	40	HU
Perfluoroheptane sulfonic acid (PFHpS)	375-92-8		ng/L	40	U	40	U	40	U	40	U	40	HU	40	HU	40	HU	40	HU	40	HU	40	HU	40	HU
Perfluoroheptanoic acid (PFHpA)	375-85-9		ng/L	40	U	40	U	40	U	40	U	**31**	HJ	**31**	HJ	**32**	HJ	40	HU	40	HU	40	HU	40	HU
Perfluorohexane sulfonic acid (PFHxS)	355-46-4		ng/L	40	U	**25**	J	**22**	J	**27**	J	**270**	H	**260**	H	**230**	H	40	HU	40	HU	40	HU	**12**	HJ
Perfluorohexanoic acid (PFHxA)	307-24-4		ng/L	40	U	40	U	40	U	40	U	**42**	H	**38**	HJ	**35**	HJ	40	HU	40	HU	40	HU	40	HU
Perfluorononane sulfonic acid (PFNS)	68259-12-1		ng/L	40	U	40	U	40	U	40	U	40	HU	40	HU	40	HU	40	HU	40	HU	40	HU	40	HU
Perfluorononanoic acid (PFNA)	375-95-1		ng/L	40	U	40	U	40	U	40	U	40	HU	40	HU	40	HU	40	HU	40	HU	40	HU	40	HU
Perfluorooctane sulfonamide (PFOSA)	754-91-6		ng/L	40	U	40	U	40	U	40	U	40	HU	40	HU	40	HU	40	HU	40	HU	40	HU	40	HU
Perfluorooctane sulfonic acid (PFOS)	1763-23-1	40	ng/L	**11**	J	**67**		**65**		**68**		**430**	H	**440**	H	**420**	H	40	HU	40	HU	40	HU	**11**	HJ
Perfluorooctanoic acid (PFOA)	335-67-1	40	ng/L	40	U	40	U	40	U	40	U	**51**	H	**50**	H	**48**	H	40	HU	40	HU	40	HU	40	HU
Perfluoropentane sulfonate (PFPeS)	138495-42-8		ng/L	40	U	40	U	40	U	40	U	40	HU	40	HU	40	HU	40	HU	40	HU	40	HU	40	HU
Perfluoropentanoic acid (PFPeA)	2706-90-3		ng/L	40	U	40	U	40	U	40	U	**24**	HJ	**22**	HJ	**21**	HJ	40	HU	40	HU	40	HU	40	HU
Perfluorotetradecanoic acid (PFTeDA)	376-06-7		ng/L	40	U	40	U	40	U	40	U	40	HU	40	HU	40	HU	40	HU	40	HU	40	HU	40	HU
Perfluorotridecanoic acid (PFTrDA)	72629-94-8		ng/L	40	U	40	U	40	U	40	U	40	HU	40	HU	40	HU	40	HU	40	HU	40	HU	40	HU
Perfluoroundecanoic acid (PFUdA)	2058-94-8		ng/L	40	U	40	U	40	U	40	U	40	HU	40	HU	40	HU	40	HU	40	HU	40	HU	40	HU

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Table C-4 EIE385-4 SPLP PFAS Results

			Category	Sand		Sand		Fines		Fines		Fines	
			Location	385-4		385-4		385-4		385-4		385-4	
			Sample ID	385-4-Sb(09182021)		385-4-Sc(09182021)		385-4-FA(09222021)		385-4-FB(09222021)		385-4-FC(09222021)	
			Sample Date	09/18/2021		09/18/2021		09/22/2021		09/22/2021		09/22/2021	
			Sample Type	N		N		N		N		N	
			Matrix	Soil		Soil		Soil		Soil		Soil	
			Leachate Type	SPLP		SPLP		SPLP		SPLP		SPLP	
Analyte	**CAS**	**ADECScreening Level**	**Units**	**Result**	**Qual**	**Result**	**Qual**	**Result**	**Qual**	**Result**	**Qual**	**Result**	**Qual**
PFAS													
4:2 Fluorotelomer sulfonate	757124-72-4		ng/L	80	HU	80	HU	80	HU	80	HU	80	HU
6:2 Fluorotelomer sulfonic acid (6:2 FTSA)	27619-97-2		ng/L	80	HU	80	HU	80	HU	80	HU	80	HU
8:2 Fluorotelomer sulfonic acid (8:2 FTSA)	39108-34-4		ng/L	80	HU	80	HU	80	HU	80	HU	80	HU
N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6		ng/L	80	HU	80	HU	80	HU	80	HU	80	HU
N-Methyl perfluorooctane sulfonamide (N-MeFOSA)	31506-32-8		ng/L	160	HU	160	HU	160	HU	160	HU	160	HU
N-Methylperfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9		ng/L	80	HU	80	HU	80	HU	80	HU	80	HU
Perfluorobutane sulfonic acid (PFBS)	375-73-5		ng/L	40	HU	40	HU	40	HU	40	HU	40	HU
Perfluorobutanoic acid (PFBA)	375-22-4		ng/L	40	HU	40	HU	**10**	BHJ	40	HU	40	HU
Perfluorodecane sulfonic acid (PFDS)	335-77-3		ng/L	40	HU	40	HU	40	HU	40	HU	40	HU
Perfluorodecanoic acid (PFDA)	335-76-2		ng/L	40	HU	40	HU	40	HU	40	HU	40	HU
Perfluorododecanoic acid (PFDoA)	307-55-1		ng/L	40	HU	40	HU	40	HU	40	HU	40	HU
Perfluoroheptane sulfonic acid (PFHpS)	375-92-8		ng/L	40	HU	40	HU	40	HU	40	HU	40	HU
Perfluoroheptanoic acid (PFHpA)	375-85-9		ng/L	40	HU	40	HU	40	HU	40	HU	40	HU
Perfluorohexane sulfonic acid (PFHxS)	355-46-4		ng/L	**15**	HJ	**11**	HJ	**60**	BH	**71**	BH	**56**	BH
Perfluorohexanoic acid (PFHxA)	307-24-4		ng/L	40	HU	40	HU	40	HU	**15**	BHJ	**10**	BHJ
Perfluorononane sulfonic acid (PFNS)	68259-12-1		ng/L	40	HU	40	HU	40	HU	40	HU	40	HU
Perfluorononanoic acid (PFNA)	375-95-1		ng/L	40	HU	40	HU	40	HU	40	HU	40	HU
Perfluorooctane sulfonamide (PFOSA)	754-91-6		ng/L	40	HU	40	HU	40	HU	**11**	BHJ	40	HU
Perfluorooctane sulfonic acid (PFOS)	1763-23-1	40	ng/L	**15**	HJ	**14**	HJ	**150**	BH	**390**	BH	**190**	BH
Perfluorooctanoic acid (PFOA)	335-67-1	40	ng/L	40	HU	40	HU	**15**	BHJ	**16**	BHJ	**17**	BHJ
Perfluoropentane sulfonate (PFPeS)	138495-42-8		ng/L	40	HU	40	HU	40	HU	40	HU	40	HU
Perfluoropentanoic acid (PFPeA)	2706-90-3		ng/L	40	HU	40	HU	40	HU	40	HU	40	HU
Perfluorotetradecanoic acid (PFTeDA)	376-06-7		ng/L	40	HU	40	HU	40	HU	40	HU	40	HU
Perfluorotridecanoic acid (PFTrDA)	72629-94-8		ng/L	40	HU	40	HU	40	HU	40	HU	40	HU
Perfluoroundecanoic acid (PFUdA)	2058-94-8		ng/L	40	HU	40	HU	40	HU	40	HU	40	HU

Notes:

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Table C-5 EIE385-4 Soil PAH Results

Analyte	CAS	ADEC Screening Level	Category	Untreat		Untreat		Untreat		Untreat		Untreat		Gravel		Gravel		Gravel		Gravel		Sand		Sand		Sand	
			Location	385-4		385-4		385-4		385-4		385-4		385-4		385-4		385-4		385-4		385-4		385-4		385-4	
			Sample ID	385-4-UT-1(09132021)		385-4-UT-2(09172021)		385-4-UT-3(09172021)		385-4-UT-4(09182021)		385-4-UT-5(09182021)		385-4-G-1(09152021)		385-4-G-2(09172021)		385-4-G-3(09182021)		DUP-02(09152021)		385-4-S-1(09152021)		385-4-S-2(09172021)		385-4-S-3(09182021)	
			Sample Date	09/13/2021		09/17/2021		09/17/2021		09/18/2021		09/18/2021		09/15/2021		09/17/2021		09/18/2021		09/15/2021		09/15/2021		09/17/2021		09/18/2021	
			Sample Type	N		N		N		N		N		N		N		N		FD		N		N		N	
			Matrix	Soil		Soil		Soil		Soil		Soil		Soil		Soil		Soil		Soil		Soil		Soil		Soil	
			Units	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual
1-Methylnaphthalene	90-12-0	410	µg/kg	**27**	J	110	U	110	U	110	U	110	U	2.1	U	2	U	1.9	U	2	U	**38**		**49**	J	**140**	
2-Methylnaphthalene	91-57-6	1300	µg/kg	**33**		110	U	110	U	110	U	110	U	2.1	U	2	U	1.9	U	2	U	**36**		**53**	J	**170**	
Acenaphthene	83-32-9	37000	µg/kg	**54**		**96**	J	**83**	J	**78**	J	**170**		2.1	U	2	U	1.9	U	2	U	**220**		**190**		**600**	
Acenaphthylene	208-96-8	18000	µg/kg	**38**		110	U	110	U	110	U	110	U	2.1	U	2	U	1.9	U	2	U	**37**		**52**	J	**92**	
Anthracene	120-12-7	390000	µg/kg	**130**		**280**		**300**		**260**		**550**		**1**	J	2	U	1.9	U	**0.6**	J	**590**		**460**		**1300**	
Benz(a)anthracene	56-55-3	700	µg/kg	**500**		**910**		**910**		**810**		**1400**		**2.8**		**2.6**	J	**2.1**	J	**1.6**	J	**1400**		**1600**		**2600**	
Benzo(a)pyrene	50-32-8	1900	µg/kg	**820**		**1500**		**1400**		**1100**		**1900**		**2.8**		**3.9**		**2.5**	J	**1.2**	J	**1400**		**2100**		**3100**	
Benzo(b)fluoranthene	205-99-2	20000	µg/kg	**970**		**1700**		**1500**		**1300**		**2400**		**2.4**	J	**4**		**3**		**0.93**	J	**1500**		**2300**		**3600**	
Benzo(g,h,i)perylene	191-24-2	15000000	µg/kg	**390**		**810**		**700**		**600**		**870**		**1.4**	J	**3.3**		**2**	J	2	U	**460**		**1100**		**1400**	
Benzo(k)fluoranthene	207-08-9	190000	µg/kg	**420**		**740**		**630**		**550**		**830**		**1.6**	J	**1.6**	J	**1.1**	J	**1**	J	**700**		**900**		**1400**	
Chrysene	218-01-9	600000	µg/kg	**750**		**1300**		**1200**		**1100**		**1500**		1.6	U	**2.1**	J	**1.9**	J	1.5	U	**1800**		**1800**		**2800**	
Dibenz(a,h)anthracene	53-70-3	6300	µg/kg	23	U	110	U	110	U	110	U	110	U	2.1	U	2	U	1.9	U	2	U	22	U	44	U	43	U
Fluoranthene	206-44-0	590000	µg/kg	**1300**		**2200**		**2100**		**1900**		**3300**		**2.4**	J	**2.8**		**2.6**		**1.1**	J	**3700**		**3700**		**6800**	
Fluorene	86-73-7	36000	µg/kg	**60**		**110**	J	**92**	J	**90**	J	**220**		2.1	U	2	U	1.9	U	2	U	**290**		**230**		**720**	
Indeno(1,2,3-cd)pyrene	193-39-5	65000	µg/kg	**380**		**720**		**590**		**580**		**750**		**1.3**	J	**2.6**	J	**1.3**	J	2	U	**470**		**980**		**1300**	
Naphthalene	91-20-3	38	µg/kg	**26**	J	110	U	110	U	110	U	110	U	2.1	U	2	U	1.9	U	2	U	**27**	J	**44**	J	**160**	
Phenanthrene	85-01-8	39000	µg/kg	**650**		**1400**		**1300**		**1200**		**2500**		2.1	U	**1.6**	J	**1.5**	J	2	U	**2600**		**2800**		**6700**	
Pyrene	129-00-0	87000	µg/kg	**1000**		**2100**		**2000**		**1700**		**3000**		**2.5**	J	**3.4**		**3**		**1.1**	J	**2900**		**3400**		**6000**	

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Analyte	CAS	ADEC Screening Level	Category	Fines		Fines		Fines	
			Location	385-4		385-4		385-4	
			Sample ID	385-4-F-1(09222021)		385-4-F-2(09222021)		385-4-F-3(09222021)	
			Sample Date	09/22/2021		09/22/2021		09/22/2021	
			Sample Type	N		N		N	
			Matrix	Soil		Soil		Soil	
			Units	Result	Qual	Result	Qual	Result	Qual
1-Methylnaphthalene	90-12-0	410	µg/kg	50	U	52	U	52	U
2-Methylnaphthalene	91-57-6	1300	µg/kg	50	U	52	U	52	U
Acenaphthene	83-32-9	37000	µg/kg	50	U	**70**		52	U
Acenaphthylene	208-96-8	18000	µg/kg	50	U	**29**	J	52	U
Anthracene	120-12-7	390000	µg/kg	**140**		**230**		**160**	
Benz(a)anthracene	56-55-3	700	µg/kg	**430**		**640**		**540**	
Benzo(a)pyrene	50-32-8	1900	µg/kg	**730**		**1100**		**900**	
Benzo(b)fluoranthene	205-99-2	20000	µg/kg	**890**		**1300**		**1300**	
Benzo(g,h,i)perylene	191-24-2	15000000	µg/kg	**390**		**410**		**300**	
Benzo(k)fluoranthene	207-08-9	190000	µg/kg	**330**		**450**		**480**	
Chrysene	218-01-9	600000	µg/kg	**650**		**860**		**780**	
Dibenz(a,h)anthracene	53-70-3	6300	µg/kg	50	U	52	U	52	U
Fluoranthene	206-44-0	590000	µg/kg	**1200**		**1900**		**1500**	
Fluorene	86-73-7	36000	µg/kg	**31**	J	**65**	J	**47**	J
Indeno(1,2,3-cd)pyrene	193-39-5	65000	µg/kg	**330**		**330**		**310**	
Naphthalene	91-20-3	38	µg/kg	50	U	52	U	52	U
Phenanthrene	85-01-8	39000	µg/kg	**490**		**920**		**620**	
Pyrene	129-00-0	87000	µg/kg	**930**		**1300**		**1100**	

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Table C-7 EIE393-1 SPLP PFAS Results

Analyte	CAS	ADEC Screening Level	Units	Category	Location	Sample ID	Sample Date	Sample Type	Matrix	Leachate Type	Result	Qual
PFAS												
4:2 Fluorotelomer sulfonate	757124-72-4		ng/L	Untreated	393-1	393-1-UT-1(09222021)	09/22/2021	Batch	Soil	SPLP	80	U
6:2 Fluorotelomer sulfonic acid (6:2 FTSA)	27619-97-2		ng/L	Untreated	393-1	393-1-UT-1(09222021)	09/22/2021	Batch	Soil	SPLP	**300**	
8:2 Fluorotelomer sulfonic acid (8:2 FTSA)	39108-34-4		ng/L	Untreated	393-1	393-1-UT-1(09222021)	09/22/2021	Batch	Soil	SPLP	**540**	
N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6		ng/L	Untreated	393-1	393-1-UT-1(09222021)	09/22/2021	Batch	Soil	SPLP	80	U
N-Methyl perfluorooctane sulfonamide (N-MeFOSA)	31506-32-8		ng/L	Untreated	393-1	393-1-UT-1(09222021)	09/22/2021	Batch	Soil	SPLP	160	U
N-Methylperfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9		ng/L	Untreated	393-1	393-1-UT-1(09222021)	09/22/2021	Batch	Soil	SPLP	80	U
Perfluorobutane sulfonic acid (PFBS)	375-73-5		ng/L	Untreated	393-1	393-1-UT-1(09222021)	09/22/2021	Batch	Soil	SPLP	**40**	
Perfluorobutanoic acid (PFBA)	375-22-4		ng/L	Untreated	393-1	393-1-UT-1(09222021)	09/22/2021	Batch	Soil	SPLP	**27**	J
Perfluorodecane sulfonic acid (PFDS)	335-77-3		ng/L	Untreated	393-1	393-1-UT-1(09222021)	09/22/2021	Batch	Soil	SPLP	40	U
Perfluorodecanoic acid (PFDA)	335-76-2		ng/L	Untreated	393-1	393-1-UT-1(09222021)	09/22/2021	Batch	Soil	SPLP	**46**	
Perfluorododecanoic acid (PFDoA)	307-55-1		ng/L	Untreated	393-1	393-1-UT-1(09222021)	09/22/2021	Batch	Soil	SPLP	40	U
Perfluoroheptane sulfonic acid (PFHpS)	375-92-8		ng/L	Untreated	393-1	393-1-UT-1(09222021)	09/22/2021	Batch	Soil	SPLP	**16**	J
Perfluoroheptanoic acid (PFHpA)	375-85-9		ng/L	Untreated	393-1	393-1-UT-1(09222021)	09/22/2021	Batch	Soil	SPLP	**46**	
Perfluorohexane sulfonic acid (PFHxS)	355-46-4		ng/L	Untreated	393-1	393-1-UT-1(09222021)	09/22/2021	Batch	Soil	SPLP	**780**	
Perfluorohexanoic acid (PFHxA)	307-24-4		ng/L	Untreated	393-1	393-1-UT-1(09222021)	09/22/2021	Batch	Soil	SPLP	**220**	
Perfluorononane sulfonic acid (PFNS)	68259-12-1		ng/L	Untreated	393-1	393-1-UT-1(09222021)	09/22/2021	Batch	Soil	SPLP	**58**	J
Perfluorononanoic acid (PFNA)	375-95-1		ng/L	Untreated	393-1	393-1-UT-1(09222021)	09/22/2021	Batch	Soil	SPLP	**21**	J
Perfluorooctane sulfonamide (PFOSA)	754-91-6		ng/L	Untreated	393-1	393-1-UT-1(09222021)	09/22/2021	Batch	Soil	SPLP	**480**	
Perfluorooctane sulfonic acid (PFOS)	1763-23-1	40	ng/L	Untreated	393-1	393-1-UT-1(09222021)	09/22/2021	Batch	Soil	SPLP	**15000**	
Perfluorooctanoic acid (PFOA)	335-67-1	40	ng/L	Untreated	393-1	393-1-UT-1(09222021)	09/22/2021	Batch	Soil	SPLP	**180**	
Perfluoropentane sulfonate (PFPeS)	138495-42-8		ng/L	Untreated	393-1	393-1-UT-1(09222021)	09/22/2021	Batch	Soil	SPLP	**52**	
Perfluoropentanoic acid (PFPeA)	2706-90-3		ng/L	Untreated	393-1	393-1-UT-1(09222021)	09/22/2021	Batch	Soil	SPLP	**90**	
Perfluorotetradecanoic acid (PFTeDA)	376-06-7		ng/L	Untreated	393-1	393-1-UT-1(09222021)	09/22/2021	Batch	Soil	SPLP	40	U
Perfluorotridecanoic acid (PFTrDA)	72629-94-8		ng/L	Untreated	393-1	393-1-UT-1(09222021)	09/22/2021	Batch	Soil	SPLP	40	U
Perfluoroundecanoic acid (PFUdA)	2058-94-8		ng/L	Untreated	393-1	393-1-UT-1(09222021)	09/22/2021	Batch	Soil	SPLP	40	U
4:2 Fluorotelomer sulfonate	757124-72-4		ng/L	Untreated	393-1	393-1-UT-2(09222021)	09/22/2021	Batch	Soil	SPLP	80	U
6:2 Fluorotelomer sulfonic acid (6:2 FTSA)	27619-97-2		ng/L	Untreated	393-1	393-1-UT-2(09222021)	09/22/2021	Batch	Soil	SPLP	**410**	
8:2 Fluorotelomer sulfonic acid (8:2 FTSA)	39108-34-4		ng/L	Untreated	393-1	393-1-UT-2(09222021)	09/22/2021	Batch	Soil	SPLP	**840**	
N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6		ng/L	Untreated	393-1	393-1-UT-2(09222021)	09/22/2021	Batch	Soil	SPLP	80	U
N-Methyl perfluorooctane sulfonamide (N-MeFOSA)	31506-32-8		ng/L	Untreated	393-1	393-1-UT-2(09222021)	09/22/2021	Batch	Soil	SPLP	160	U
N-Methylperfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9		ng/L	Untreated	393-1	393-1-UT-2(09222021)	09/22/2021	Batch	Soil	SPLP	80	U
Perfluorobutane sulfonic acid (PFBS)	375-73-5		ng/L	Untreated	393-1	393-1-UT-2(09222021)	09/22/2021	Batch	Soil	SPLP	**48**	
Perfluorobutanoic acid (PFBA)	375-22-4		ng/L	Untreated	393-1	393-1-UT-2(09222021)	09/22/2021	Batch	Soil	SPLP	**29**	J
Perfluorodecane sulfonic acid (PFDS)	335-77-3		ng/L	Untreated	393-1	393-1-UT-2(09222021)	09/22/2021	Batch	Soil	SPLP	400	U
Perfluorodecanoic acid (PFDA)	335-76-2		ng/L	Untreated	393-1	393-1-UT-2(09222021)	09/22/2021	Batch	Soil	SPLP	**66**	
Perfluorododecanoic acid (PFDoA)	307-55-1		ng/L	Untreated	393-1	393-1-UT-2(09222021)	09/22/2021	Batch	Soil	SPLP	40	U
Perfluoroheptane sulfonic acid (PFHpS)	375-92-8		ng/L	Untreated	393-1	393-1-UT-2(09222021)	09/22/2021	Batch	Soil	SPLP	**23**	J
Perfluoroheptanoic acid (PFHpA)	375-85-9		ng/L	Untreated	393-1	393-1-UT-2(09222021)	09/22/2021	Batch	Soil	SPLP	**51**	
Perfluorohexane sulfonic acid (PFHxS)	355-46-4		ng/L	Untreated	393-1	393-1-UT-2(09222021)	09/22/2021	Batch	Soil	SPLP	**1100**	
Perfluorohexanoic acid (PFHxA)	307-24-4		ng/L	Untreated	393-1	393-1-UT-2(09222021)	09/22/2021	Batch	Soil	SPLP	**250**	
Perfluorononane sulfonic acid (PFNS)	68259-12-1		ng/L	Untreated	393-1	393-1-UT-2(09222021)	09/22/2021	Batch	Soil	SPLP	**90**	
Perfluorononanoic acid (PFNA)	375-95-1		ng/L	Untreated	393-1	393-1-UT-2(09222021)	09/22/2021	Batch	Soil	SPLP	**27**	J
Perfluorooctane sulfonamide (PFOSA)	754-91-6		ng/L	Untreated	393-1	393-1-UT-2(09222021)	09/22/2021	Batch	Soil	SPLP	**660**	
Perfluorooctane sulfonic acid (PFOS)	1763-23-1	40	ng/L	Untreated	393-1	393-1-UT-2(09222021)	09/22/2021	Batch	Soil	SPLP	**21000**	
Perfluorooctanoic acid (PFOA)	335-67-1	40	ng/L	Untreated	393-1	393-1-UT-2(09222021)	09/22/2021	Batch	Soil	SPLP	**240**	
Perfluoropentane sulfonate (PFPeS)	138495-42-8		ng/L	Untreated	393-1	393-1-UT-2(09222021)	09/22/2021	Batch	Soil	SPLP	**69**	
Perfluoropentanoic acid (PFPeA)	2706-90-3		ng/L	Untreated	393-1	393-1-UT-2(09222021)	09/22/2021	Batch	Soil	SPLP	**100**	
Perfluorotetradecanoic acid (PFTeDA)	376-06-7		ng/L	Untreated	393-1	393-1-UT-2(09222021)	09/22/2021	Batch	Soil	SPLP	40	U
Perfluorotridecanoic acid (PFTrDA)	72629-94-8		ng/L	Untreated	393-1	393-1-UT-2(09222021)	09/22/2021	Batch	Soil	SPLP	40	U
Perfluoroundecanoic acid (PFUdA)	2058-94-8		ng/L	Untreated	393-1	393-1-UT-2(09222021)	09/22/2021	Batch	Soil	SPLP	40	U
4:2 Fluorotelomer sulfonate	757124-72-4		ng/L	Untreated	393-1	393-1-UT-3(09232021)	09/23/2021	Batch	Soil	SPLP	80	U
6:2 Fluorotelomer sulfonic acid (6:2 FTSA)	27619-97-2		ng/L	Untreated	393-1	393-1-UT-3(09232021)	09/23/2021	Batch	Soil	SPLP	**580**	
8:2 Fluorotelomer sulfonic acid (8:2 FTSA)	39108-34-4		ng/L	Untreated	393-1	393-1-UT-3(09232021)	09/23/2021	Batch	Soil	SPLP	**1500**	
N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6		ng/L	Untreated	393-1	393-1-UT-3(09232021)	09/23/2021	Batch	Soil	SPLP	80	U
N-Methyl perfluorooctane sulfonamide (N-MeFOSA)	31506-32-8		ng/L	Untreated	393-1	393-1-UT-3(09232021)	09/23/2021	Batch	Soil	SPLP	160	U
N-Methylperfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9		ng/L	Untreated	393-1	393-1-UT-3(09232021)	09/23/2021	Batch	Soil	SPLP	80	U
Perfluorobutane sulfonic acid (PFBS)	375-73-5		ng/L	Untreated	393-1	393-1-UT-3(09232021)	09/23/2021	Batch	Soil	SPLP	**140**	
Perfluorobutanoic acid (PFBA)	375-22-4		ng/L	Untreated	393-1	393-1-UT-3(09232021)	09/23/2021	Batch	Soil	SPLP	**82**	
Perfluorodecane sulfonic acid (PFDS)	335-77-3		ng/L	Untreated	393-1	393-1-UT-3(09232021)	09/23/2021	Batch	Soil	SPLP	40	U
Perfluorodecanoic acid (PFDA)	335-76-2		ng/L	Untreated	393-1	393-1-UT-3(09232021)	09/23/2021	Batch	Soil	SPLP	**130**	
Perfluorododecanoic acid (PFDoA)	307-55-1		ng/L	Untreated	393-1	393-1-UT-3(09232021)	09/23/2021	Batch	Soil	SPLP	40	U
Perfluoroheptane sulfonic acid (PFHpS)	375-92-8		ng/L	Untreated	393-1	393-1-UT-3(09232021)	09/23/2021	Batch	Soil	SPLP	**35**	J
Perfluoroheptanoic acid (PFHpA)	375-85-9		ng/L	Untreated	393-1	393-1-UT-3(09232021)	09/23/2021	Batch	Soil	SPLP	**100**	
Perfluorohexane sulfonic acid (PFHxS)	355-46-4		ng/L	Untreated	393-1	393-1-UT-3(09232021)	09/23/2021	Batch	Soil	SPLP	**2200**	
Perfluorohexanoic acid (PFHxA)	307-24-4		ng/L	Untreated	393-1	393-1-UT-3(09232021)	09/23/2021	Batch	Soil	SPLP	**720**	
Perfluorononane sulfonic acid (PFNS)	68259-12-1		ng/L	Untreated	393-1	393-1-UT-3(09232021)	09/23/2021	Batch	Soil	SPLP	**120**	
Perfluorononanoic acid (PFNA)	375-95-1		ng/L	Untreated	393-1	393-1-UT-3(09232021)	09/23/2021	Batch	Soil	SPLP	**62**	
Perfluorooctane sulfonamide (PFOSA)	754-91-6		ng/L	Untreated	393-1	393-1-UT-3(09232021)	09/23/2021	Batch	Soil	SPLP	**1100**	
Perfluorooctane sulfonic acid (PFOS)	1763-23-1	40	ng/L	Untreated	393-1	393-1-UT-3(09232021)	09/23/2021	Batch	Soil	SPLP	**44000**	
Perfluorooctanoic acid (PFOA)	335-67-1	40	ng/L	Untreated	393-1	393-1-UT-3(09232021)	09/23/2021	Batch	Soil	SPLP	**310**	
Perfluoropentane sulfonate (PFPeS)	138495-42-8		ng/L	Untreated	393-1	393-1-UT-3(09232021)	09/23/2021	Batch	Soil	SPLP	**160**	
Perfluoropentanoic acid (PFPeA)	2706-90-3		ng/L	Untreated	393-1	393-1-UT-3(09232021)	09/23/2021	Batch	Soil	SPLP	**270**	
Perfluorotetradecanoic acid (PFTeDA)	376-06-7		ng/L	Untreated	393-1	393-1-UT-3(09232021)	09/23/2021	Batch	Soil	SPLP	40	U
Perfluorotridecanoic acid (PFTrDA)	72629-94-8		ng/L	Untreated	393-1	393-1-UT-3(09232021)	09/23/2021	Batch	Soil	SPLP	40	U
Perfluoroundecanoic acid (PFUdA)	2058-94-8		ng/L	Untreated	393-1	393-1-UT-3(09232021)	09/23/2021	Batch	Soil	SPLP	40	U
4:2 Fluorotelomer sulfonate	757124-72-4		ng/L	Gravel	393-1	393-1-G-1(09222021)	09/22/2021	Batch	Soil	SPLP	80	U
6:2 Fluorotelomer sulfonic acid (6:2 FTSA)	27619-97-2		ng/L	Gravel	393-1	393-1-G-1(09222021)	09/22/2021	Batch	Soil	SPLP	**29**	J
8:2 Fluorotelomer sulfonic acid (8:2 FTSA)	39108-34-4		ng/L	Gravel	393-1	393-1-G-1(09222021)	09/22/2021	Batch	Soil	SPLP	80	U
N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6		ng/L	Gravel	393-1	393-1-G-1(09222021)	09/22/2021	Batch	Soil	SPLP	80	U
N-Methyl perfluorooctane sulfonamide (N-MeFOSA)	31506-32-8		ng/L	Gravel	393-1	393-1-G-1(09222021)	09/22/2021	Batch	Soil	SPLP	160	U
N-Methylperfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9		ng/L	Gravel	393-1	393-1-G-1(09222021)	09/22/2021	Batch	Soil	SPLP	80	U
Perfluorobutane sulfonic acid (PFBS)	375-73-5		ng/L	Gravel	393-1	393-1-G-1(09222021)	09/22/2021	Batch	Soil	SPLP	40	U
Perfluorobutanoic acid (PFBA)	375-22-4		ng/L	Gravel	393-1	393-1-G-1(09222021)	09/22/2021	Batch	Soil	SPLP	40	U
Perfluorodecane sulfonic acid (PFDS)	335-77-3		ng/L	Gravel	393-1	393-1-G-1(09222021)	09/22/2021	Batch	Soil	SPLP	40	U
Perfluorodecanoic acid (PFDA)	335-76-2		ng/L	Gravel	393-1	393-1-G-1(09222021)	09/22/2021	Batch	Soil	SPLP	40	U
Perfluorododecanoic acid (PFDoA)	307-55-1		ng/L	Gravel	393-1	393-1-G-1(09222021)	09/22/2021	Batch	Soil	SPLP	40	U
Perfluoroheptane sulfonic acid (PFHpS)	375-92-8		ng/L	Gravel	393-1	393-1-G-1(09222021)	09/22/2021	Batch	Soil	SPLP	40	U
Perfluoroheptanoic acid (PFHpA)	375-85-9		ng/L	Gravel	393-1	393-1-G-1(09222021)	09/22/2021	Batch	Soil	SPLP	40	U
Perfluorohexane sulfonic acid (PFHxS)	355-46-4		ng/L	Gravel	393-1	393-1-G-1(09222021)	09/22/2021	Batch	Soil	SPLP	**77**	
Perfluorohexanoic acid (PFHxA)	307-24-4		ng/L	Gravel	393-1	393-1-G-1(09222021)	09/22/2021	Batch	Soil	SPLP	**39**	J
Perfluorononane sulfonic acid (PFNS)	68259-12-1		ng/L	Gravel	393-1	393-1-G-1(09222021)	09/22/2021	Batch	Soil	SPLP	40	U
Perfluorononanoic acid (PFNA)	375-95-1		ng/L	Gravel	393-1	393-1-G-1(09222021)	09/22/2021	Batch	Soil	SPLP	40	U
Perfluorooctane sulfonamide (PFOSA)	754-91-6		ng/L	Gravel	393-1	393-1-G-1(09222021)	09/22/2021	Batch	Soil	SPLP	40	U
Perfluorooctane sulfonic acid (PFOS)	1763-23-1	40	ng/L	Gravel	393-1	393-1-G-1(09222021)	09/22/2021	Batch	Soil	SPLP	**450**	
Perfluorooctanoic acid (PFOA)	335-67-1	40	ng/L	Gravel	393-1	393-1-G-1(09222021)	09/22/2021	Batch	Soil	SPLP	**14**	J
Perfluoropentane sulfonate (PFPeS)	138495-42-8		ng/L	Gravel	393-1	393-1-G-1(09222021)	09/22/2021	Batch	Soil	SPLP	40	U
Perfluoropentanoic acid (PFPeA)	2706-90-3		ng/L	Gravel	393-1	393-1-G-1(09222021)	09/22/2021	Batch	Soil	SPLP	**14**	J
Perfluorotetradecanoic acid (PFTeDA)	376-06-7		ng/L	Gravel	393-1	393-1-G-1(09222021)	09/22/2021	Batch	Soil	SPLP	40	U
Perfluorotridecanoic acid (PFTrDA)	72629-94-8		ng/L	Gravel	393-1	393-1-G-1(09222021)	09/22/2021	Batch	Soil	SPLP	40	U
Perfluoroundecanoic acid (PFUdA)	2058-94-8		ng/L	Gravel	393-1	393-1-G-1(09222021)	09/22/2021	Batch	Soil	SPLP	40	U
4:2 Fluorotelomer sulfonate	757124-72-4		ng/L	Gravel	393-1	393-1-G-2(09222021)	09/22/2021	Batch	Soil	SPLP	80	U
6:2 Fluorotelomer sulfonic acid (6:2 FTSA)	27619-97-2		ng/L	Gravel	393-1	393-1-G-2(09222021)	09/22/2021	Batch	Soil	SPLP	**23**	J
8:2 Fluorotelomer sulfonic acid (8:2 FTSA)	39108-34-4		ng/L	Gravel	393-1	393-1-G-2(09222021)	09/22/2021	Batch	Soil	SPLP	80	U
N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6		ng/L	Gravel	393-1	393-1-G-2(09222021)	09/22/2021	Batch	Soil	SPLP	80	U
N-Methyl perfluorooctane sulfonamide (N-MeFOSA)	31506-32-8		ng/L	Gravel	393-1	393-1-G-2(09222021)	09/22/2021	Batch	Soil	SPLP	160	U
N-Methylperfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9		ng/L	Gravel	393-1	393-1-G-2(09222021)	09/22/2021	Batch	Soil	SPLP	80	U
Perfluorobutane sulfonic acid (PFBS)	375-73-5		ng/L	Gravel	393-1	393-1-G-2(09222021)	09/22/2021	Batch	Soil	SPLP	40	U
Perfluorobutanoic acid (PFBA)	375-22-4		ng/L	Gravel	393-1	393-1-G-2(09222021)	09/22/2021	Batch	Soil	SPLP	40	U
Perfluorodecane sulfonic acid (PFDS)	335-77-3		ng/L	Gravel	393-1	393-1-G-2(09222021)	09/22/2021	Batch	Soil	SPLP	40	U
Perfluorodecanoic acid (PFDA)	335-76-2		ng/L	Gravel	393-1	393-1-G-2(09222021)	09/22/2021	Batch	Soil	SPLP	40	U
Perfluorododecanoic acid (PFDoA)	307-55-1		ng/L	Gravel	393-1	393-1-G-2(09222021)	09/22/2021	Batch	Soil	SPLP	40	U
Perfluoroheptane sulfonic acid (PFHpS)	375-92-8		ng/L	Gravel	393-1	393-1-G-2(09222021)	09/22/2021	Batch	Soil	SPLP	40	U
Perfluoroheptanoic acid (PFHpA)	375-85-9		ng/L	Gravel	393-1	393-1-G-2(09222021)	09/22/2021	Batch	Soil	SPLP	40	U
Perfluorohexane sulfonic acid (PFHxS)	355-46-4		ng/L	Gravel	393-1	393-1-G-2(09222021)	09/22/2021	Batch	Soil	SPLP	**24**	J
Perfluorohexanoic acid (PFHxA)	307-24-4		ng/L	Gravel	393-1	393-1-G-2(09222021)	09/22/2021	Batch	Soil	SPLP	**15**	J
Perfluorononane sulfonic acid (PFNS)	68259-12-1		ng/L	Gravel	393-1	393-1-G-2(09222021)	09/22/2021	Batch	Soil	SPLP	40	U
Perfluorononanoic acid (PFNA)	375-95-1		ng/L	Gravel	393-1	393-1-G-2(09222021)	09/22/2021	Batch	Soil	SPLP	40	U
Perfluorooctane sulfonamide (PFOSA)	754-91-6		ng/L	Gravel	393-1	393-1-G-2(09222021)	09/22/2021	Batch	Soil	SPLP	40	U
Perfluorooctane sulfonic acid (PFOS)	1763-23-1	40	ng/L	Gravel	393-1	393-1-G-2(09222021)	09/22/2021	Batch	Soil	SPLP	**470**	
Perfluorooctanoic acid (PFOA)	335-67-1	40	ng/L	Gravel	393-1	393-1-G-2(09222021)	09/22/2021	Batch	Soil	SPLP	**17**	J
Perfluoropentane sulfonate (PFPeS)	138495-42-8		ng/L	Gravel	393-1	393-1-G-2(09222021)	09/22/2021	Batch	Soil	SPLP	40	U
Perfluoropentanoic acid (PFPeA)	2706-90-3		ng/L	Gravel	393-1	393-1-G-2(09222021)	09/22/2021	Batch	Soil	SPLP	40	U
Perfluorotetradecanoic acid (PFTeDA)	376-06-7		ng/L	Gravel	393-1	393-1-G-2(09222021)	09/22/2021	Batch	Soil	SPLP	40	U
Perfluorotridecanoic acid (PFTrDA)	72629-94-8		ng/L	Gravel	393-1	393-1-G-2(09222021)	09/22/2021	Batch	Soil	SPLP	40	U
Perfluoroundecanoic acid (PFUdA)	2058-94-8		ng/L	Gravel	393-1	393-1-G-2(09222021)	09/22/2021	Batch	Soil	SPLP	40	U
4:2 Fluorotelomer sulfonate	757124-72-4		ng/L	Gravel	393-1	393-1-G-3(09232021)	09/23/2021	Batch	Soil	SPLP	80	U
6:2 Fluorotelomer sulfonic acid (6:2 FTSA)	27619-97-2		ng/L	Gravel	393-1	393-1-G-3(09232021)	09/23/2021	Batch	Soil	SPLP	80	U
8:2 Fluorotelomer sulfonic acid (8:2 FTSA)	39108-34-4		ng/L	Gravel	393-1	393-1-G-3(09232021)	09/23/2021	Batch	Soil	SPLP	80	U
N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6		ng/L	Gravel	393-1	393-1-G-3(09232021)	09/23/2021	Batch	Soil	SPLP	80	U
N-Methyl perfluorooctane sulfonamide (N-MeFOSA)	31506-32-8		ng/L	Gravel	393-1	393-1-G-3(09232021)	09/23/2021	Batch	Soil	SPLP	160	U
N-Methylperfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9		ng/L	Gravel	393-1	393-1-G-3(09232021)	09/23/2021	Batch	Soil	SPLP	80	U
Perfluorobutane sulfonic acid (PFBS)	375-73-5		ng/L	Gravel	393-1	393-1-G-3(09232021)	09/23/2021	Batch	Soil	SPLP	40	U
Perfluorobutanoic acid (PFBA)	375-22-4		ng/L	Gravel	393-1	393-1-G-3(09232021)	09/23/2021	Batch	Soil	SPLP	40	U
Perfluorodecane sulfonic acid (PFDS)	335-77-3		ng/L	Gravel	393-1	393-1-G-3(09232021)	09/23/2021	Batch	Soil	SPLP	40	U
Perfluorodecanoic acid (PFDA)	335-76-2		ng/L	Gravel	393-1	393-1-G-3(09232021)	09/23/2021	Batch	Soil	SPLP	40	U
Perfluorododecanoic acid (PFDoA)	307-55-1		ng/L	Gravel	393-1	393-1-G-3(09232021)	09/23/2021	Batch	Soil	SPLP	40	U
Perfluoroheptane sulfonic acid (PFHpS)	375-92-8		ng/L	Gravel	393-1	393-1-G-3(09232021)	09/23/2021	Batch	Soil	SPLP	40	U
Perfluoroheptanoic acid (PFHpA)	375-85-9		ng/L	Gravel	393-1	393-1-G-3(09232021)	09/23/2021	Batch	Soil	SPLP	40	U
Perfluorohexane sulfonic acid (PFHxS)	355-46-4		ng/L	Gravel	393-1	393-1-G-3(09232021)	09/23/2021	Batch	Soil	SPLP	**40**	
Perfluorohexanoic acid (PFHxA)	307-24-4		ng/L	Gravel	393-1	393-1-G-3(09232021)	09/23/2021	Batch	Soil	SPLP	**15**	J
Perfluorononane sulfonic acid (PFNS)	68259-12-1		ng/L	Gravel	393-1	393-1-G-3(09232021)	09/23/2021	Batch	Soil	SPLP	40	U
Perfluorononanoic acid (PFNA)	375-95-1		ng/L	Gravel	393-1	393-1-G-3(09232021)	09/23/2021	Batch	Soil	SPLP	40	U
Perfluorooctane sulfonamide (PFOSA)	754-91-6		ng/L	Gravel	393-1	393-1-G-3(09232021)	09/23/2021	Batch	Soil	SPLP	40	U
Perfluorooctane sulfonic acid (PFOS)	1763-23-1	40	ng/L	Gravel	393-1	393-1-G-3(09232021)	09/23/2021	Batch	Soil	SPLP	**190**	
Perfluorooctanoic acid (PFOA)	335-67-1	40	ng/L	Gravel	393-1	393-1-G-3(09232021)	09/23/2021	Batch	Soil	SPLP	40	U
Perfluoropentane sulfonate (PFPeS)	138495-42-8		ng/L	Gravel	393-1	393-1-G-3(09232021)	09/23/2021	Batch	Soil	SPLP	40	U
Perfluoropentanoic acid (PFPeA)	2706-90-3		ng/L	Gravel	393-1	393-1-G-3(09232021)	09/23/2021	Batch	Soil	SPLP	40	U
Perfluorotetradecanoic acid (PFTeDA)	376-06-7		ng/L	Gravel	393-1	393-1-G-3(09232021)	09/23/2021	Batch	Soil	SPLP	40	U
Perfluorotridecanoic acid (PFTrDA)	72629-94-8		ng/L	Gravel	393-1	393-1-G-3(09232021)	09/23/2021	Batch	Soil	SPLP	40	U
Perfluoroundecanoic acid (PFUdA)	2058-94-8		ng/L	Gravel	393-1	393-1-G-3(09232021)	09/23/2021	Batch	Soil	SPLP	40	U
4:2 Fluorotelomer sulfonate	757124-72-4		ng/L	Sand	393-1	393-1-S-1(09222021)	09/22/2021	Batch	Soil	SPLP	80	U
6:2 Fluorotelomer sulfonic acid (6:2 FTSA)	27619-97-2		ng/L	Sand	393-1	393-1-S-1(09222021)	09/22/2021	Batch	Soil	SPLP	80	U
8:2 Fluorotelomer sulfonic acid (8:2 FTSA)	39108-34-4		ng/L	Sand	393-1	393-1-S-1(09222021)	09/22/2021	Batch	Soil	SPLP	**28**	J
N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6		ng/L	Sand	393-1	393-1-S-1(09222021)	09/22/2021	Batch	Soil	SPLP	80	U
N-Methyl perfluorooctane sulfonamide (N-MeFOSA)	31506-32-8		ng/L	Sand	393-1	393-1-S-1(09222021)	09/22/2021	Batch	Soil	SPLP	160	U
N-Methylperfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9		ng/L	Sand	393-1	393-1-S-1(09222021)	09/22/2021	Batch	Soil	SPLP	80	U
Perfluorobutane sulfonic acid (PFBS)	375-73-5		ng/L	Sand	393-1	393-1-S-1(09222021)	09/22/2021	Batch	Soil	SPLP	40	U
Perfluorobutanoic acid (PFBA)	375-22-4		ng/L	Sand	393-1	393-1-S-1(09222021)	09/22/2021	Batch	Soil	SPLP	40	U
Perfluorodecane sulfonic acid (PFDS)	335-77-3		ng/L	Sand	393-1	393-1-S-1(09222021)	09/22/2021	Batch	Soil	SPLP	40	U
Perfluorodecanoic acid (PFDA)	335-76-2		ng/L	Sand	393-1	393-1-S-1(09222021)	09/22/2021	Batch	Soil	SPLP	40	U
Perfluorododecanoic acid (PFDoA)	307-55-1		ng/L	Sand	393-1	393-1-S-1(09222021)	09/22/2021	Batch	Soil	SPLP	40	U
Perfluoroheptane sulfonic acid (PFHpS)	375-92-8		ng/L	Sand	393-1	393-1-S-1(09222021)	09/22/2021	Batch	Soil	SPLP	40	U
Perfluoroheptanoic acid (PFHpA)	375-85-9		ng/L	Sand	393-1	393-1-S-1(09222021)	09/22/2021	Batch	Soil	SPLP	40	U
Perfluorohexane sulfonic acid (PFHxS)	355-46-4		ng/L	Sand	393-1	393-1-S-1(09222021)	09/22/2021	Batch	Soil	SPLP	**53**	
Perfluorohexanoic acid (PFHxA)	307-24-4		ng/L	Sand	393-1	393-1-S-1(09222021)	09/22/2021	Batch	Soil	SPLP	**13**	J
Perfluorononane sulfonic acid (PFNS)	68259-12-1		ng/L	Sand	393-1	393-1-S-1(09222021)	09/22/2021	Batch	Soil	SPLP	40	U
Perfluorononanoic acid (PFNA)	375-95-1		ng/L	Sand	393-1	393-1-S-1(09222021)	09/22/2021	Batch	Soil	SPLP	40	U
Perfluorooctane sulfonamide (PFOSA)	754-91-6		ng/L	Sand	393-1	393-1-S-1(09222021)	09/22/2021	Batch	Soil	SPLP	**30**	J
Perfluorooctane sulfonic acid (PFOS)	1763-23-1	40	ng/L	Sand	393-1	393-1-S-1(09222021)	09/22/2021	Batch	Soil	SPLP	**470**	
Perfluorooctanoic acid (PFOA)	335-67-1	40	ng/L	Sand	393-1	393-1-S-1(09222021)	09/22/2021	Batch	Soil	SPLP	**17**	J
Perfluoropentane sulfonate (PFPeS)	138495-42-

Table C-7 EIE393-1 SPLP PFAS Results

Analyte	CAS	ADEC Screening Level	Category	Fines		Fines		Fines		Untreated		Untreated		Untreated		Gravel		Gravel		Gravel		Sand		Sand	
			Location	393-1		393-1		393-1		393-1		393-1		393-1		393-1		393-1		393-1		393-1		393-1	
			Sample ID	393-1-F-1(09292021)		393-1-F-2(09292021)		393-1-F-3(09292021)		ISM-393-1-UTA(09232021)		ISM-393-1-UTB(09232021)		ISM-393-1-UTC(09232021)		ISM-393-1-GA(09232021)		ISM-393-1-GB(09232021)		ISM-393-1-GC(09232021)		ISM-393-1-SA(09232021)		ISM-393-1-SB(09232021)	
			Sample Date	09/29/2021		09/29/2021		09/29/2021		09/23/2021		09/23/2021		09/23/2021		09/23/2021		09/23/2021		09/23/2021		09/23/2021		09/23/2021	
			Sample Type	Batch		Batch		Batch		ISM		ISM		ISM		ISM		ISM		ISM		ISM		ISM	
			Matrix	Soil		Soil		Soil		Soil		Soil		Soil		Soil		Soil		Soil		Soil		Soil	
			Leachate Type	SPLP		SPLP		SPLP		SPLP		SPLP		SPLP		SPLP		SPLP		SPLP		SPLP		SPLP	
			Units	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual
PFAS																									
4:2 Fluorotelomer sulfonate	757124-72-4		ng/L	80	U	80	U	80	U	80	HU	80	HU	80	HU	80	HU	80	HU	80	HU	80	HU	80	HU
6:2 Fluorotelomer sulfonic acid (6:2 FTSA)	27619-97-2		ng/L	**50**	J	**53**	J	**41**	J	**340**	H	**400**	H	**180**	H	**210**	H	**39**	HJ	**24**	HJ	80	HU	**36**	HJ
8:2 Fluorotelomer sulfonic acid (8:2 FTSA)	39108-34-4		ng/L	**630**		**620**		**600**		**570**	H	**900**	H	**540**	H	**530**	H	**56**	HJ	**42**	HJ	**52**	HJ	**35**	HJ
N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6		ng/L	80	U	80	U	80	U	80	HU	80	HU	80	HU	80	HU	80	HU	80	HU	80	HU	80	HU
N-Methyl perfluorooctane sulfonamide (N-MeFOSA)	31506-32-8		ng/L	160	U	160	U	160	U	160	HU	160	HU	160	HU	160	HU	160	HU	160	HU	160	HU	160	HU
N-Methylperfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9		ng/L	80	U	80	U	80	U	80	HU	80	HU	80	HU	80	HU	80	HU	80	HU	80	HU	80	HU
Perfluorobutane sulfonic acid (PFBS)	375-73-5		ng/L	40	U	40	U	40	U	**52**	H	**63**	H	**32**	HJ	**38**	HJ	40	HU	40	HU	40	HU	40	HU
Perfluorobutanoic acid (PFBA)	375-22-4		ng/L	40	U	40	U	40	U	**39**	HJ	**44**	H	**25**	HJ	**27**	HJ	40	HU	40	HU	**11**	HJ	40	HU
Perfluorodecane sulfonic acid (PFDS)	335-77-3		ng/L	40	U	40	U	40	U	40	HU	40	HU	40	HU	40	HU	40	HU	40	HU	40	HU	40	HU
Perfluorodecanoic acid (PFDA)	335-76-2		ng/L	**42**		**39**	J	**39**	J	**59**	H	**83**	H	**45**	H	**41**	H	40	HU	40	HU	40	HU	40	HU
Perfluorododecanoic acid (PFDoA)	307-55-1		ng/L	40	U	40	U	40	U	40	HU	**11**	HJ	40	HU	40	HU	40	HU	40	HU	40	HU	40	HU
Perfluoroheptane sulfonic acid (PFHpS)	375-92-8		ng/L	40	U	40	U	40	U	**26**	HJ	**32**	HJ	**16**	HJ	**16**	HJ	40	HU	40	HU	40	HU	40	HU
Perfluoroheptanoic acid (PFHpA)	375-85-9		ng/L	40	U	40	U	40	U	**65**	H	**74**	H	**41**	H	**41**	H	40	HU	40	HU	40	HU	40	HU
Perfluorohexane sulfonic acid (PFHxS)	355-46-4		ng/L	**290**		**300**		**290**		**1100**	H	**1300**	H	**670**	H	**640**	H	**72**	H	**61**	H	**67**	H	**67**	H
Perfluorohexanoic acid (PFHxA)	307-24-4		ng/L	**41**		**43**		**41**		**370**	H	**430**	H	**250**	H	**240**	H	**53**	H	**51**	H	**46**	H	**49**	H
Perfluorononane sulfonic acid (PFNS)	68259-12-1		ng/L	**140**	J	**160**	J	**120**	J	**75**	H	**82**	H	**44**	H	**52**	H	**10**	HJ	40	HU	40	HU	40	HU
Perfluorononanoic acid (PFNA)	375-95-1		ng/L	40	U	40	U	40	U	**32**	HJ	**38**	HJ	**20**	HJ	**18**	HJ	40	HU	40	HU	40	HU	40	HU
Perfluorooctane sulfonamide (PFOSA)	754-91-6		ng/L	**270**		**270**		**260**		**600**	H	**710**	H	**450**	H	**410**	H	**60**	H	**48**	H	40	HU	**45**	H
Perfluorooctane sulfonic acid (PFOS)	1763-23-1	40	ng/L	**9900**		**11000**		**8900**		**21000**		**28000**		**17000**		**15000**		**1700**	H	**1300**	H	**800**	H	**920**	H
Perfluorooctanoic acid (PFOA)	335-67-1	40	ng/L	**57**		**56**		**58**		**280**	H	**300**	H	**150**	H	**160**	H	**14**	HJ	**23**	HJ	**31**	HJ	**34**	HJ
Perfluoropentane sulfonate (PFPeS)	138495-42-8		ng/L	**18**	J	**17**	J	**15**	J	**68**	H	**88**	H	**49**	H	**51**	H	40	HU	40	HU	40	HU	40	HU
Perfluoropentanoic acid (PFPeA)	2706-90-3		ng/L	40	U	40	U	40	U	**130**	H	**150**	H	**85**	H	**89**	H	**16**	HJ	**18**	HJ	40	HU	40	HU
Perfluorotetradecanoic acid (PFTeDA)	376-06-7		ng/L	40	U	40	U	40	U	40	HU	40	HU	40	HU	40	HU	40	HU	40	HU	40	HU	40	HU
Perfluorotridecanoic acid (PFTrDA)	72629-94-8		ng/L	40	U	40	U	40	U	40	HU	40	HU	40	HU	40	HU	40	HU	40	HU	40	HU	40	HU
Perfluoroundecanoic acid (PFUdA)	2058-94-8		ng/L	**24**	J	**21**	J	**20**	J	**14**	HJ	**21**	HJ	**11**	HJ	**11**	HJ	40	HU	40	HU	40	HU	40	HU

Notes:

1. Bolded values indicate the result was detected greater than the limit of detection
2. Data are compared to the Regional screening levels for the Project are adopted from Alaska Department of Environmental Conservation (ADEC) (2016), ADEC (2019) and OSD (2019).
3. Grey shaded values indicate the result was detected greater than or equal to the ADEC screening level for the residential scenario.

Acronyms/Abbreviations:
-- = not applicable/not analyzed
ADEC = Alaska Department of Environmental Conservation
CAS = Chemical Abstracts Service number
ID = identification
ng/L = nanograms per liter (parts per trillion)
PFAS = per- and polyfluoroalkyl substances

Laboratory Qualifiers
E = The reported result is above the limit of the calibration range.
J = The analyte was positively identified; however the associated numerical value is an estimated concentration only
U = The analyte was analyzed for but the result was not detected above the limit of quantitation (LOQ).
H = Sample analyzed out of holding time

Table C-7 EIE393-1 SPLP PFAS Results

Analyte	CAS	ADEC Screening Level	Category	Sand		Fines		Fines		Fines	
			Location	393-1		393-1		393-1		393-1	
			Sample ID	ISM-393-1-SC(09232021)		ISM-393-FA		ISM-393-FB		ISM-393-FC	
			Sample Date	09/23/2021		09/29/2021		09/29/2021		09/29/2021	
			Sample Type	ISM		ISM		ISM		ISM	
			Matrix	Soil		Soil		Soil		Soil	
			Leachate Type	SPLP		SPLP		SPLP		SPLP	
			Units	Result	Qual	Result	Qual	Result	Qual	Result	Qual
PFAS											
4:2 Fluorotelomer sulfonate	757124-72-4		ng/L	80	HU	80	HU	80	HU	80	HU
6:2 Fluorotelomer sulfonic acid (6:2 FTSA)	27619-97-2		ng/L	**35**	HJ	**140**	H	**110**	H	**150**	H
8:2 Fluorotelomer sulfonic acid (8:2 FTSA)	39108-34-4		ng/L	**41**	HJ	**660**	H	**600**	H	**770**	H
N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6		ng/L	80	HU	80	HU	80	HU	80	HU
N-Methyl perfluorooctane sulfonamide (N-MeFOSA)	31506-32-8		ng/L	160	HU	160	HU	160	HU	160	HU
N-Methylperfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9		ng/L	80	HU	80	HU	80	HU	80	HU
Perfluorobutane sulfonic acid (PFBS)	375-73-5		ng/L	40	HU	**13**	HJ	**11**	HJ	**13**	HJ
Perfluorobutanoic acid (PFBA)	375-22-4		ng/L	40	HU	40	HU	40	HU	**13**	HJ
Perfluorodecane sulfonic acid (PFDS)	335-77-3		ng/L	40	HU	**19**	HJ	**25**	HJ	**27**	HJ
Perfluorodecanoic acid (PFDA)	335-76-2		ng/L	40	HU	**39**	HJ	**40**	H	**64**	H
Perfluorododecanoic acid (PFDoA)	307-55-1		ng/L	40	HU	40	HU	**15**	HJ	40	HU
Perfluoroheptane sulfonic acid (PFHpS)	375-92-8		ng/L	40	HU	**10**	HJ	**11**	HJ	**11**	HJ
Perfluoroheptanoic acid (PFHpA)	375-85-9		ng/L	40	HU	**16**	HJ	**14**	HJ	**19**	HJ
Perfluorohexane sulfonic acid (PFHxS)	355-46-4		ng/L	**67**	H	**420**	H	**380**	H	**460**	H
Perfluorohexanoic acid (PFHxA)	307-24-4		ng/L	**51**	H	**140**	H	**120**	H	**150**	H
Perfluorononane sulfonic acid (PFNS)	68259-12-1		ng/L	40	HU	**110**	H	**120**	H	**160**	H
Perfluorononanoic acid (PFNA)	375-95-1		ng/L	40	HU	**11**	HJ	40	HU	**15**	HJ
Perfluorooctane sulfonamide (PFOSA)	754-91-6		ng/L	**48**	H	**290**	H	**290**	H	**400**	H
Perfluorooctane sulfonic acid (PFOS)	1763-23-1	40	ng/L	**800**	H	**12000**		**11000**		**15000**	
Perfluorooctanoic acid (PFOA)	335-67-1	40	ng/L	**30**	HJ	**84**	H	**79**	H	**100**	H
Perfluoropentane sulfonate (PFPeS)	138495-42-8		ng/L	40	HU	**28**	HJ	**23**	HJ	**28**	HJ
Perfluoropentanoic acid (PFPeA)	2706-90-3		ng/L	**10**	HJ	**21**	HJ	**19**	HJ	**22**	HJ
Perfluorotetradecanoic acid (PFTeDA)	376-06-7		ng/L	40	HU	40	HU	40	HU	40	HU
Perfluorotridecanoic acid (PFTrDA)	72629-94-8		ng/L	40	HU	40	HU	40	HU	40	HU
Perfluoroundecanoic acid (PFUdA)	2058-94-8		ng/L	40	HU	**24**	HJ	**26**	HJ	**28**	HJ

Notes:

1. Bolded values indicate the result was detected greater than the limit of detection
2. Data are compared to the Regional screening levels for the Project are adopted from Alaska Department of Environmental Conservation (ADEC) (2016), ADEC (2019) and OSD (2019).
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Table C-6 EIE393-1 Soil PFAS Results

Analyte	CAS	ADEC Screening Level	Units	Category	Location	Sample ID	Sample Date	Sample Type	Matrix	Result	Qual
PFAS											
4:2 Fluorotelomer sulfonate	757124-72-4		µg/kg	Untreated	393-1	393-1-UT-1(09222021)	09/22/2021	Batch	Soil	1.9	U
6:2 Fluorotelomer sulfonic acid (6:2 FTSA)	27619-97-2		µg/kg							**6.5**	
8:2 Fluorotelomer sulfonic acid (8:2 FTSA)	39108-34-4		µg/kg							**31**	
N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6		µg/kg							1.9	U
N-Methyl perfluorooctane sulfonamide (N-MeFOSA)	31506-32-8		µg/kg							1.9	U
N-Methylperfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9		µg/kg							1.9	U
Perfluorobutane sulfonic acid (PFBS)	375-73-5		µg/kg							**1.4**	
Perfluorobutanoic acid (PFBA)	375-22-4		µg/kg							**0.7**	J
Perfluorodecane sulfonic acid (PFDS)	335-77-3		µg/kg							**3.2**	
Perfluorodecanoic acid (PFDA)	335-76-2		µg/kg							**2.6**	
Perfluorododecanoic acid (PFDoA)	307-55-1		µg/kg							**0.86**	J
Perfluoroheptane sulfonic acid (PFHpS)	375-92-8		µg/kg							**0.85**	J
Perfluoroheptanoic acid (PFHpA)	375-85-9		µg/kg							**1.4**	
Perfluorohexane sulfonic acid (PFHxS)	355-46-4		µg/kg							**30**	
Perfluorohexanoic acid (PFHxA)	307-24-4		µg/kg							**6.6**	
Perfluorononane sulfonic acid (PFNS)	68259-12-1		µg/kg							**4.5**	
Perfluorononanoic acid (PFNA)	375-95-1		µg/kg							**0.71**	J
Perfluorooctane sulfonamide (PFOSA)	754-91-6		µg/kg							**20**	
Perfluorooctane sulfonic acid (PFOS)	1763-23-1	3	µg/kg							**640**	
Perfluorooctanoic acid (PFOA)	335-67-1	1.7	µg/kg							**12**	
Perfluoropentane sulfonate (PFPeS)	138495-42-8		µg/kg							**1.7**	
Perfluoropentanoic acid (PFPeA)	2706-90-3		µg/kg							**2.6**	
Perfluorotetradecanoic acid (PFTeDA)	376-06-7		µg/kg							0.95	U
Perfluorotridecanoic acid (PFTrDA)	72629-94-8		µg/kg							**0.24**	J
Perfluoroundecanoic acid (PFUdA)	2058-94-8		µg/kg							**1.3**	

Analyte	CAS	ADEC Screening Level	Units	Category	Location	Sample ID	Sample Date	Sample Type	Matrix	Result	Qual
PFAS											
4:2 Fluorotelomer sulfonate	757124-72-4		µg/kg	Untreated	393-1	393-1-UT-2(09222021)	09/22/2021	Batch	Soil	1.9	U
6:2 Fluorotelomer sulfonic acid (6:2 FTSA)	27619-97-2		µg/kg							**6.7**	
8:2 Fluorotelomer sulfonic acid (8:2 FTSA)	39108-34-4		µg/kg							**25**	
N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6		µg/kg							1.9	U
N-Methyl perfluorooctane sulfonamide (N-MeFOSA)	31506-32-8		µg/kg							1.9	U
N-Methylperfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9		µg/kg							1.9	U
Perfluorobutane sulfonic acid (PFBS)	375-73-5		µg/kg							**1.6**	
Perfluorobutanoic acid (PFBA)	375-22-4		µg/kg							**0.77**	J
Perfluorodecane sulfonic acid (PFDS)	335-77-3		µg/kg							**2.1**	
Perfluorodecanoic acid (PFDA)	335-76-2		µg/kg							**2.1**	
Perfluorododecanoic acid (PFDoA)	307-55-1		µg/kg							**0.64**	J
Perfluoroheptane sulfonic acid (PFHpS)	375-92-8		µg/kg							**0.68**	J
Perfluoroheptanoic acid (PFHpA)	375-85-9		µg/kg							**1.4**	
Perfluorohexane sulfonic acid (PFHxS)	355-46-4		µg/kg							**27**	
Perfluorohexanoic acid (PFHxA)	307-24-4		µg/kg							**7.5**	
Perfluorononane sulfonic acid (PFNS)	68259-12-1		µg/kg							**2.9**	
Perfluorononanoic acid (PFNA)	375-95-1		µg/kg							**0.58**	J
Perfluorooctane sulfonamide (PFOSA)	754-91-6		µg/kg							**18**	
Perfluorooctane sulfonic acid (PFOS)	1763-23-1	3	µg/kg							**480**	
Perfluorooctanoic acid (PFOA)	335-67-1	1.7	µg/kg							**6.3**	
Perfluoropentane sulfonate (PFPeS)	138495-42-8		µg/kg							**1.8**	
Perfluoropentanoic acid (PFPeA)	2706-90-3		µg/kg							**3.2**	
Perfluorotetradecanoic acid (PFTeDA)	376-06-7		µg/kg							0.97	U
Perfluorotridecanoic acid (PFTrDA)	72629-94-8		µg/kg							**0.21**	J
Perfluoroundecanoic acid (PFUdA)	2058-94-8		µg/kg							**1**	

Analyte	CAS	ADEC Screening Level	Units	Category	Location	Sample ID	Sample Date	Sample Type	Matrix	Result	Qual
PFAS											
4:2 Fluorotelomer sulfonate	757124-72-4		µg/kg	Untreated	393-1	393-1-UT-3(09232021)	09/23/2021	Batch	Soil	1.8	U
6:2 Fluorotelomer sulfonic acid (6:2 FTSA)	27619-97-2		µg/kg							**14**	
8:2 Fluorotelomer sulfonic acid (8:2 FTSA)	39108-34-4		µg/kg							**65**	
N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6		µg/kg							**0.58**	J
N-Methyl perfluorooctane sulfonamide (N-MeFOSA)	31506-32-8		µg/kg							1.8	U
N-Methylperfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9		µg/kg							1.8	U
Perfluorobutane sulfonic acid (PFBS)	375-73-5		µg/kg							**4.3**	
Perfluorobutanoic acid (PFBA)	375-22-4		µg/kg							**2.1**	
Perfluorodecane sulfonic acid (PFDS)	335-77-3		µg/kg							**11**	
Perfluorodecanoic acid (PFDA)	335-76-2		µg/kg							**5.8**	
Perfluorododecanoic acid (PFDoA)	307-55-1		µg/kg							**2.1**	
Perfluoroheptane sulfonic acid (PFHpS)	375-92-8		µg/kg							**1.5**	
Perfluoroheptanoic acid (PFHpA)	375-85-9		µg/kg							**2.7**	
Perfluorohexane sulfonic acid (PFHxS)	355-46-4		µg/kg							**61**	
Perfluorohexanoic acid (PFHxA)	307-24-4		µg/kg							**17**	
Perfluorononane sulfonic acid (PFNS)	68259-12-1		µg/kg							**13**	
Perfluorononanoic acid (PFNA)	375-95-1		µg/kg							**1.9**	
Perfluorooctane sulfonamide (PFOSA)	754-91-6		µg/kg							**47**	
Perfluorooctane sulfonic acid (PFOS)	1763-23-1	3	µg/kg							**1200**	
Perfluorooctanoic acid (PFOA)	335-67-1	1.7	µg/kg							**9.3**	
Perfluoropentane sulfonate (PFPeS)	138495-42-8		µg/kg							**4.5**	
Perfluoropentanoic acid (PFPeA)	2706-90-3		µg/kg							**7**	
Perfluorotetradecanoic acid (PFTeDA)	376-06-7		µg/kg							**0.43**	J
Perfluorotridecanoic acid (PFTrDA)	72629-94-8		µg/kg							**0.72**	J
Perfluoroundecanoic acid (PFUdA)	2058-94-8		µg/kg							**2.9**	

Analyte	CAS	ADEC Screening Level	Units	Category	Location	Sample ID	Sample Date	Sample Type	Matrix	Result	Qual
PFAS											
4:2 Fluorotelomer sulfonate	757124-72-4		µg/kg	Gravel	393-1	393-1-G-1(09222021)	09/22/2021	Batch	Soil	1.6	U
6:2 Fluorotelomer sulfonic acid (6:2 FTSA)	27619-97-2		µg/kg							1.6	U
8:2 Fluorotelomer sulfonic acid (8:2 FTSA)	39108-34-4		µg/kg							1.6	U
N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6		µg/kg							1.6	U
N-Methyl perfluorooctane sulfonamide (N-MeFOSA)	31506-32-8		µg/kg							1.6	U
N-Methylperfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9		µg/kg							1.6	U
Perfluorobutane sulfonic acid (PFBS)	375-73-5		µg/kg							0.78	U
Perfluorobutanoic acid (PFBA)	375-22-4		µg/kg							0.78	U
Perfluorodecane sulfonic acid (PFDS)	335-77-3		µg/kg							0.78	U
Perfluorodecanoic acid (PFDA)	335-76-2		µg/kg							0.78	U
Perfluorododecanoic acid (PFDoA)	307-55-1		µg/kg							0.78	U
Perfluoroheptane sulfonic acid (PFHpS)	375-92-8		µg/kg							0.78	U
Perfluoroheptanoic acid (PFHpA)	375-85-9		µg/kg							0.78	U
Perfluorohexane sulfonic acid (PFHxS)	355-46-4		µg/kg							**0.35**	J
Perfluorohexanoic acid (PFHxA)	307-24-4		µg/kg							0.78	U
Perfluorononane sulfonic acid (PFNS)	68259-12-1		µg/kg							0.78	U
Perfluorononanoic acid (PFNA)	375-95-1		µg/kg							0.78	U
Perfluorooctane sulfonamide (PFOSA)	754-91-6		µg/kg							0.78	U
Perfluorooctane sulfonic acid (PFOS)	1763-23-1	3	µg/kg							**1.5**	
Perfluorooctanoic acid (PFOA)	335-67-1	1.7	µg/kg							0.78	U
Perfluoropentane sulfonate (PFPeS)	138495-42-8		µg/kg							0.78	U
Perfluoropentanoic acid (PFPeA)	2706-90-3		µg/kg							0.78	U
Perfluorotetradecanoic acid (PFTeDA)	376-06-7		µg/kg							0.78	U
Perfluorotridecanoic acid (PFTrDA)	72629-94-8		µg/kg							0.78	U
Perfluoroundecanoic acid (PFUdA)	2058-94-8		µg/kg							0.78	U

Analyte	CAS	ADEC Screening Level	Units	Category	Location	Sample ID	Sample Date	Sample Type	Matrix	Result	Qual
PFAS											
4:2 Fluorotelomer sulfonate	757124-72-4		µg/kg	Gravel	393-1	393-1-G-2(09222021)	09/22/2021	Batch	Soil	1.9	U
6:2 Fluorotelomer sulfonic acid (6:2 FTSA)	27619-97-2		µg/kg							1.9	U
8:2 Fluorotelomer sulfonic acid (8:2 FTSA)	39108-34-4		µg/kg							1.9	U
N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6		µg/kg							1.9	U
N-Methyl perfluorooctane sulfonamide (N-MeFOSA)	31506-32-8		µg/kg							1.9	U
N-Methylperfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9		µg/kg							1.9	U
Perfluorobutane sulfonic acid (PFBS)	375-73-5		µg/kg							0.97	U
Perfluorobutanoic acid (PFBA)	375-22-4		µg/kg							**2.9**	
Perfluorodecane sulfonic acid (PFDS)	335-77-3		µg/kg							0.97	U
Perfluorodecanoic acid (PFDA)	335-76-2		µg/kg							0.97	U
Perfluorododecanoic acid (PFDoA)	307-55-1		µg/kg							0.97	U
Perfluoroheptane sulfonic acid (PFHpS)	375-92-8		µg/kg							0.97	U
Perfluoroheptanoic acid (PFHpA)	375-85-9		µg/kg							0.97	U
Perfluorohexane sulfonic acid (PFHxS)	355-46-4		µg/kg							0.97	U
Perfluorohexanoic acid (PFHxA)	307-24-4		µg/kg							0.97	U
Perfluorononane sulfonic acid (PFNS)	68259-12-1		µg/kg							0.97	U
Perfluorononanoic acid (PFNA)	375-95-1		µg/kg							0.97	U
Perfluorooctane sulfonamide (PFOSA)	754-91-6		µg/kg							0.97	U
Perfluorooctane sulfonic acid (PFOS)	1763-23-1	3	µg/kg							0.97	U
Perfluorooctanoic acid (PFOA)	335-67-1	1.7	µg/kg							0.97	U
Perfluoropentane sulfonate (PFPeS)	138495-42-8		µg/kg							0.97	U
Perfluoropentanoic acid (PFPeA)	2706-90-3		µg/kg							0.97	U
Perfluorotetradecanoic acid (PFTeDA)	376-06-7		µg/kg							0.97	U
Perfluorotridecanoic acid (PFTrDA)	72629-94-8		µg/kg							0.97	U
Perfluoroundecanoic acid (PFUdA)	2058-94-8		µg/kg							0.97	U

Analyte	CAS	ADEC Screening Level	Units	Category	Location	Sample ID	Sample Date	Sample Type	Matrix	Result	Qual
PFAS											
4:2 Fluorotelomer sulfonate	757124-72-4		µg/kg	Gravel	393-1	393-1-G-3(09232021)	09/23/2021	Batch	Soil	1.5	U
6:2 Fluorotelomer sulfonic acid (6:2 FTSA)	27619-97-2		µg/kg							1.5	U
8:2 Fluorotelomer sulfonic acid (8:2 FTSA)	39108-34-4		µg/kg							1.5	U
N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6		µg/kg							1.5	U
N-Methyl perfluorooctane sulfonamide (N-MeFOSA)	31506-32-8		µg/kg							1.5	U
N-Methylperfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9		µg/kg							1.5	U
Perfluorobutane sulfonic acid (PFBS)	375-73-5		µg/kg							0.77	U
Perfluorobutanoic acid (PFBA)	375-22-4		µg/kg							0.77	U
Perfluorodecane sulfonic acid (PFDS)	335-77-3		µg/kg							0.77	U
Perfluorodecanoic acid (PFDA)	335-76-2		µg/kg							0.77	U
Perfluorododecanoic acid (PFDoA)	307-55-1		µg/kg							0.77	U
Perfluoroheptane sulfonic acid (PFHpS)	375-92-8		µg/kg							0.77	U
Perfluoroheptanoic acid (PFHpA)	375-85-9		µg/kg							0.77	U
Perfluorohexane sulfonic acid (PFHxS)	355-46-4		µg/kg							**0.7**	J
Perfluorohexanoic acid (PFHxA)	307-24-4		µg/kg							**0.26**	J
Perfluorononane sulfonic acid (PFNS)	68259-12-1		µg/kg							0.77	U
Perfluorononanoic acid (PFNA)	375-95-1		µg/kg							0.77	U
Perfluorooctane sulfonamide (PFOSA)	754-91-6		µg/kg							0.77	U
Perfluorooctane sulfonic acid (PFOS)	1763-23-1	3	µg/kg							**5.3**	
Perfluorooctanoic acid (PFOA)	335-67-1	1.7	µg/kg							0.77	U
Perfluoropentane sulfonate (PFPeS)	138495-42-8		µg/kg							0.77	U
Perfluoropentanoic acid (PFPeA)	2706-90-3		µg/kg							0.77	U
Perfluorotetradecanoic acid (PFTeDA)	376-06-7		µg/kg							0.77	U
Perfluorotridecanoic acid (PFTrDA)	72629-94-8		µg/kg							0.77	U
Perfluoroundecanoic acid (PFUdA)	2058-94-8		µg/kg							0.77	U

Analyte	CAS	ADEC Screening Level	Units	Category	Location	Sample ID	Sample Date	Sample Type	Matrix	Result	Qual
PFAS											
4:2 Fluorotelomer sulfonate	757124-72-4		µg/kg	Sand	393-1	393-1-S-1(09222021)	09/22/2021	Batch	Soil	2	U
6:2 Fluorotelomer sulfonic acid (6:2 FTSA)	27619-97-2		µg/kg							**1.1**	J
8:2 Fluorotelomer sulfonic acid (8:2 FTSA)	39108-34-4		µg/kg							**2.4**	
N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6		µg/kg							2	U
N-Methyl perfluorooctane sulfonamide (N-MeFOSA)	31506-32-8		µg/kg							2	U
N-Methylperfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9		µg/kg							2	U
Perfluorobutane sulfonic acid (PFBS)	375-73-5		µg/kg							**0.25**	J
Perfluorobutanoic acid (PFBA)	375-22-4		µg/kg							1	U
Perfluorodecane sulfonic acid (PFDS)	335-77-3		µg/kg							**0.5**	J
Perfluorodecanoic acid (PFDA)	335-76-2		µg/kg							1	U
Perfluorododecanoic acid (PFDoA)	307-55-1		µg/kg							1	U
Perfluoroheptane sulfonic acid (PFHpS)	375-92-8		µg/kg							**0.24**	J
Perfluoroheptanoic acid (PFHpA)	375-85-9		µg/kg							1	U
Perfluorohexane sulfonic acid (PFHxS)	355-46-4		µg/kg							**4.4**	
Perfluorohexanoic acid (PFHxA)	307-24-4		µg/kg							**0.37**	J
Perfluorononane sulfonic acid (PFNS)	68259-12-1		µg/kg							**0.51**	J
Perfluorononanoic acid (PFNA)	375-95-1		µg/kg							1	U
Perfluorooctane sulfonamide (PFOSA)	754-91-6		µg/kg							**1.6**	
Perfluorooctane sulfonic acid (PFOS)	1763-23-1	3	µg/kg							**48**	
Perfluorooctanoic acid (PFOA)	335-67-1	1.7	µg/kg							**0.73**	J
Perfluoropentane sulfonate (PFPeS)	138495-42-8		µg/kg							**0.25**	J
Perfluoropentanoic acid (PFPeA)	2706-90-3		µg/kg							1	U
Perfluorotetradecanoic acid (PFTeDA)	376-06-7		µg/kg							1	U
Perfluorotridecanoic acid (PFTrDA)	72629-94-8		µg/kg							1	U
Perfluoroundecanoic acid (PFUdA)	2058-94-8		µg/kg							1	U

Analyte	CAS	ADEC Screening Level	Units	Category	Location	Sample ID	Sample Date	Sample Type	Matrix	Result	Qual
PFAS											
4:2 Fluorotelomer sulfonate	757124-72-4		µg/kg	Sand	393-1	393-1-S-2(09222021)	09/22/2021	Batch	Soil	1.8	U
6:2 Fluorotelomer sulfonic acid (6:2 FTSA)	27619-97-2		µg/kg							1.8	U
8:2 Fluorotelomer sulfonic acid (8:2 FTSA)	39108-34-4		µg/kg							**5**	
N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6		µg/kg							1.8	U
N-Methyl perfluorooctane sulfonamide (N-MeFOSA)	31506-32-8		µg/kg							1.8	U
N-Methylperfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9		µg/kg							1.8	U
Perfluorobutane sulfonic acid (PFBS)	375-73-5		µg/kg							**0.63**	J
Perfluorobutanoic acid (PFBA)	375-22-4		µg/kg							0.91	U
Perfluorodecane sulfonic acid (PFDS)	335-77-3		µg/kg							**1.2**	
Perfluorodecanoic acid (PFDA)	335-76-2		µg/kg							**0.19**	J
Perfluorododecanoic acid (PFDoA)	307-55-1		µg/kg							**0.39**	J
Perfluoroheptane sulfonic acid (PFHpS)	375-92-8		µg/kg							**0.28**	J
Perfluoroheptanoic acid (PFHpA)	375-85-9		µg/kg							0.91	U
Perfluorohexane sulfonic acid (PFHxS)	355-46-4		µg/kg							**4.2**	
Perfluorohexanoic acid (PFHxA)	307-24-4		µg/kg							**0.4**	J
Perfluorononane sulfonic acid (PFNS)	68259-12-1		µg/kg							**1**	
Perfluorononanoic acid (PFNA)	375-95-1		µg/kg							0.91	U
Perfluorooctane sulfonamide (PFOSA)	754-91-6		µg/kg							**2.2**	
Perfluorooctane sulfonic acid (PFOS)	1763-23-1	3	µg/kg							**62**	
Perfluorooctanoic acid (PFOA)	335-67-1	1.7	µg/kg							**0.37**	J
Perfluoropentane sulfonate (PFPeS)	138495-42-8		µg/kg							**0.43**	J
Perfluoropentanoic acid (PFPeA)	2706-90-3		µg/kg							0.91	U
Perfluorotetradecanoic acid (PFTeDA)	376-06-7		µg/kg							0.91	U
Perfluorotridecanoic acid (PFTrDA)	72629-94-8		µg/kg							0.91	U
Perfluoroundecanoic acid (PFUdA)	2058-94-8		µg/kg							**0.59**	J

Analyte	CAS	ADEC Screening Level	Units	Category	Location	Sample ID	Sample Date	Sample Type	Matrix	Result	Qual
PFAS											
4:2 Fluorotelomer sulfonate	757124-72-4		µg/kg	Sand	393-1	393-1-S-3(09232021)	09/23/2021	Batch	Soil	2.1	U
6:2 Fluorotelomer sulfonic acid (6:2 FTSA)	27619-97-2		µg/kg							2.1	U
8:2 Fluorotelomer sulfonic acid (8:2 FTSA)	39108-34-4		µg/kg							**1.1**	J
N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6		µg/kg							2.1	U
N-Methyl perfluorooctane sulfonamide (N-MeFOSA)	31506-32-8		µg/kg							2.1	U
N-Methylperfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9		µg/kg							2.1	U
Perfluorobutane sulfonic acid (PFBS)	375-73-5		µg/kg							**0.26**	J
Perfluorobutanoic acid (PFBA)	375-22-4		µg/kg							1.1	U
Perfluorodecane sulfonic acid (PFDS)	335-77-3		µg/kg							**0.29**	J
Perfluorodecanoic acid (PFDA)	335-76-2		µg/kg							1.1	U
Perfluorododecanoic acid (PFDoA)	307-55-1		µg/kg							1.1	U
Perfluoroheptane sulfonic acid (PFHpS)	375-92-8		µg/kg							1.1	U
Perfluoroheptanoic acid (PFHpA)	375-85-9		µg/kg							1.1	U
Perfluorohexane sulfonic acid (PFHxS)	355-46-4		µg/kg							**3**	
Perfluorohexanoic acid (PFHxA)	307-24-4		µg/kg							**0.33**	J
Perfluorononane sulfonic acid (PFNS)	68259-12-1		µg/kg							1.1	U
Perfluorononanoic acid (PFNA)	375-95-1		µg/kg							1.1	U
Perfluorooctane sulfonamide (PFOSA)	754-91-6		µg/kg							**1.1**	
Perfluorooctane sulfonic acid (PFOS)	1763-23-1	3	µg/kg							**32**	
Perfluorooctanoic acid (PFOA)	335-67-1	1.7	µg/kg							**0.53**	J
Perfluoropentane sulfonate (PFPeS)	138495-42-8		µg/kg							**0.24**	J
Perfluoropentanoic acid (PFPeA)	2706-90-3		µg/kg							1.1	U
Perfluorotetradecanoic acid (PFTeDA)	376-06-7		µg/kg							1.1	U
Perfluorotridecanoic acid (PFTrDA)	72629-94-8		µg/kg							1.1	U
Perfluoroundecanoic acid (PFUdA)	2058-94-8		µg/kg							1.1	U

Analyte	CAS	ADEC Screening Level	Units	Category	Location	Sample ID	Sample Date	Sample Type	Matrix	Result	Qual
PFAS											
4:2 Fluorotelomer sulfonate	757124-72-4		µg/kg	Sand	393-1	DUP-04(09222021)	09/22/2021	Batch	Soil	2.1	U
6:2 Fluorotelomer sulfonic acid (6:2 FTSA)	27619-97-2		µg/kg							2.1	U
8:2 Fluorotelomer sulfonic acid (8:2 FTSA)	39108-34-4		µg/kg							2.1	U
N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6		µg/kg							2.1	U
N-Methyl perfluorooctane sulfonamide (N-MeFOSA)	31506-32-8		µg/kg							2.1	U
N-Methylperfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9		µg/kg							2.1	U
Perfluorobutane sulfonic acid (PFBS)	375-73-5		µg/kg							1.1	U
Perfluorobutanoic acid (PFBA)	375-22-4		µg/kg							1.1	U
Perfluorodecane sulfonic acid (PFDS)	335-77-3		µg/kg							1.1	U
Perfluorodecanoic acid (PFDA)	335-76-2		µg/kg							1.1	U
Perfluorododecanoic acid (PFDoA)	307-55-1		µg/kg							1.1	U
Perfluoroheptane sulfonic acid (PFHpS)	375-92-8		µg/kg							1.1	U
Perfluoroheptanoic acid (PFHpA)	375-85-9		µg/kg							1.1	U
Perfluorohexane sulfonic acid (PFHxS)	355-46-4		µg/kg							**1.7**	J
Perfluorohexanoic acid (PFHxA)	307-24-4		µg/kg							**1.1**	J
Perfluorononane sulfonic acid (PFNS)	68259-12-1		µg/kg							1.1	U
Perfluorononanoic acid (PFNA)	375-95-1		µg/kg							1.1	U
Perfluorooctane sulfonamide (PFOSA)	754-91-6		µg/kg							**1.4**	J
Perfluorooctane sulfonic acid (PFOS)	1763-23-1	3	µg/kg							**26**	
Perfluorooctanoic acid (PFOA)	335-67-1	1.7	µg/kg							**1.1**	J
Perfluoropentane sulfonate (PFPeS)	138495-42-8		µg/kg							1.1	U
Perfluoropentanoic acid (PFPeA)	2706-90-3		µg/kg							1.1	U
Perfluorotetradecanoic acid (PFTeDA)	376-06-7		µg/kg							1.1	U
Perfluorotridecanoic acid (PFTrDA)	72629-94-8		µg/kg							1.1	U
Perfluoroundecanoic acid (PFUdA)	2058-94-8		µg/kg							1.1	U

Notes:

1. Bolded values indicate the result was detected greater than the limit of detection
2. Data are compared to the Regional screening levels for the Project are adopted from Alaska Department of Environmental Conservation (ADEC) (2016), ADEC (2019) and OSD (2019).
3. Grey shaded values indicate the result was detected greater than or equal to the ADEC screening level for the residential scenario.

Acronyms/Abbreviations:
-- = not applicable/not analyzed
ADEC = Alaska Department of Environmental Conservation
CAS = Chemical Abstracts Service number
ID = identification
µg/kg = micrograms per kilogram (parts per billion)
PFAS = per- and polyfluoroalkyl substances

Laboratory Qualifiers
E = The reported result is above the limit of the calibration range.
J = The analyte was positively identified; however the associated numerical value is an estimated concentration only
U = The analyte was analyzed for but the result was not detected above the limit of quantitation (LOQ).
H = Sample analyzed out of holding time

Table C-6 EIE393-1 Soil PFAS Results

Analyte	CAS	ADEC Screening Level	Units	Category	Location	Sample ID	Sample Date	Sample Type	Matrix	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual
PFAS																													
4:2 Fluorotelomer sulfonate	757124-72-4		µg/kg	Fines	393-1	393-1-F-1(09292021)	09/29/2021	Batch	Soil	3.3	U	3.3	U	3.5	U	1.9	U	1.9	U	1.9	U	1.9	U	1.9	U	2	U	2	U	2	U
6:2 Fluorotelomer sulfonic acid (6:2 FTSA)	27619-97-2		µg/kg	Fines	393-1	393-1-F-1(09292021)	09/29/2021	Batch	Soil	**2.8**	J	**2.6**	J	**2.4**	J	**6.2**	B	**7**	B	**8.6**	B	1.9	U	1.9	U	2	U	2	U	**0.6**	JB
8:2 Fluorotelomer sulfonic acid (8:2 FTSA)	39108-34-4		µg/kg	Fines	393-1	393-1-F-1(09292021)	09/29/2021	Batch	Soil	**31**		**31**		**31**		**23**		**28**		**32**		**0.72**	J	**0.56**	J	**0.88**	J	**1**	J	**1.1**	J
N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6		µg/kg	Fines	393-1	393-1-F-1(09292021)	09/29/2021	Batch	Soil	3.3	U	3.3	U	3.5	U	1.9	U	1.9	U	1.9	U	1.9	U	1.9	U	2	U	2	U	2	U
N-Methyl perfluorooctane sulfonamide (N-MeFOSA)	31506-32-8		µg/kg	Fines	393-1	393-1-F-1(09292021)	09/29/2021	Batch	Soil	3.3	U	3.3	U	3.5	U	1.9	U	1.9	U	1.9	U	1.9	U	1.9	U	2	U	2	U	2	U
N-Methylperfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9		µg/kg	Fines	393-1	393-1-F-1(09292021)	09/29/2021	Batch	Soil	3.3	U	3.3	U	3.5	U	1.9	U	1.9	U	1.9	U	1.9	U	1.9	U	2	U	2	U	2	U
Perfluorobutane sulfonic acid (PFBS)	375-73-5		µg/kg	Fines	393-1	393-1-F-1(09292021)	09/29/2021	Batch	Soil	**0.84**	J	**0.79**	J	**0.75**	J	**1.1**		**1.4**		**1.6**		0.93	U	0.93	U	1	U	0.98	U	0.99	U
Perfluorobutanoic acid (PFBA)	375-22-4		µg/kg	Fines	393-1	393-1-F-1(09292021)	09/29/2021	Batch	Soil	1.7	U	1.6	U	1.8	U	**0.69**	J	**0.75**	J	**0.91**	J	0.93	U	0.93	U	1	U	0.98	U	0.99	U
Perfluorodecane sulfonic acid (PFDS)	335-77-3		µg/kg	Fines	393-1	393-1-F-1(09292021)	09/29/2021	Batch	Soil	**11**		**10**		**12**		**2.7**		**3.3**		**3.5**		**0.19**	J	0.93	U	**0.28**	J	**0.42**	J	**0.33**	J
Perfluorodecanoic acid (PFDA)	335-76-2		µg/kg	Fines	393-1	393-1-F-1(09292021)	09/29/2021	Batch	Soil	**2.2**		**2**		**2.2**		**1.7**		**2.3**		**2.4**		0.93	U	0.93	U	1	U	0.98	U	0.99	U
Perfluorododecanoic acid (PFDoA)	307-55-1		µg/kg	Fines	393-1	393-1-F-1(09292021)	09/29/2021	Batch	Soil	**2.5**		**2.1**		**2.5**		**0.63**	J	**0.74**	J	**0.88**	J	0.93	U	0.93	U	1	U	0.98	U	0.99	U
Perfluoroheptane sulfonic acid (PFHpS)	375-92-8		µg/kg	Fines	393-1	393-1-F-1(09292021)	09/29/2021	Batch	Soil	**0.77**	J	**0.83**	J	**0.79**	J	**0.48**	J	**0.66**	J	**0.96**		0.93	U	0.93	U	1	U	0.98	U	0.99	U
Perfluoroheptanoic acid (PFHpA)	375-85-9		µg/kg	Fines	393-1	393-1-F-1(09292021)	09/29/2021	Batch	Soil	**0.52**	J	**0.45**	J	**0.54**	J	**1.2**		**1.4**		**1.6**		0.93	U	0.93	U	1	U	0.98	U	0.99	U
Perfluorohexane sulfonic acid (PFHxS)	355-46-4		µg/kg	Fines	393-1	393-1-F-1(09292021)	09/29/2021	Batch	Soil	**21**		**16**		**18**		**21**		**27**		**32**		**1**		**1.3**		**1.6**		**2.2**		**2.2**	
Perfluorohexanoic acid (PFHxA)	307-24-4		µg/kg	Fines	393-1	393-1-F-1(09292021)	09/29/2021	Batch	Soil	**2**		**2.3**		**1.9**		**5.9**		**7.1**		**8.6**		**0.62**	J	**0.55**	J	**0.75**	J	**0.72**	J	**0.73**	J
Perfluorononane sulfonic acid (PFNS)	68259-12-1		µg/kg	Fines	393-1	393-1-F-1(09292021)	09/29/2021	Batch	Soil	**11**		**10**		**11**		**3.8**		**4.7**		**5.2**		0.93	U	0.93	U	**0.2**	J	0.98	U	0.99	U
Perfluorononanoic acid (PFNA)	375-95-1		µg/kg	Fines	393-1	393-1-F-1(09292021)	09/29/2021	Batch	Soil	**0.43**	J	**0.35**	J	**0.4**	J	**0.63**	J	**0.84**	J	**0.88**	J	0.93	U	0.93	U	1	U	0.98	U	0.99	U
Perfluorooctane sulfonamide (PFOSA)	754-91-6		µg/kg	Fines	393-1	393-1-F-1(09292021)	09/29/2021	Batch	Soil	**15**		**14**		**14**		**16**		**19**		**21**		**0.67**	J	**0.83**	J	**1.1**		**1.3**		**1.2**	
Perfluorooctane sulfonic acid (PFOS)	1763-23-1	3	µg/kg	Fines	393-1	393-1-F-1(09292021)	09/29/2021	Batch	Soil	**500**		**430**		**480**		**420**		**520**		**740**		**30**		**29**		**32**		**30**		**32**	
Perfluorooctanoic acid (PFOA)	335-67-1	1.7	µg/kg	Fines	393-1	393-1-F-1(09292021)	09/29/2021	Batch	Soil	**3.1**		**2.5**		**3.1**		**4.8**		**6.1**		**7.1**		**0.2**	J	**0.22**	J	**0.74**	J	**0.4**	J	**0.44**	J
Perfluoropentane sulfonate (PFPeS)	138495-42-8		µg/kg	Fines	393-1	393-1-F-1(09292021)	09/29/2021	Batch	Soil	**1.2**	J	**1.2**	J	**1.2**	J	**1.4**		**1.8**		**2.2**		0.93	U	0.93	U	1	U	0.98	U	0.99	U
Perfluoropentanoic acid (PFPeA)	2706-90-3		µg/kg	Fines	393-1	393-1-F-1(09292021)	09/29/2021	Batch	Soil	**0.33**	J	**0.33**	J	**0.4**	J	**2.2**		**2.7**		**3.2**		**0.19**	J	**0.2**	J	**0.26**	J	0.98	U	0.99	U
Perfluorotetradecanoic acid (PFTeDA)	376-06-7		µg/kg	Fines	393-1	393-1-F-1(09292021)	09/29/2021	Batch	Soil	**0.59**	J	**0.56**	J	**0.52**	J	0.96	U	**0.19**	J	0.95	U	0.93	U	0.93	U	1	U	0.98	U	0.99	U
Perfluorotridecanoic acid (PFTrDA)	72629-94-8		µg/kg	Fines	393-1	393-1-F-1(09292021)	09/29/2021	Batch	Soil	**0.76**	J	**0.69**	J	**0.77**	J	0.96	U	**0.21**	J	**0.24**	J	0.93	U	0.93	U	1	U	0.98	U	0.99	U
Perfluoroundecanoic acid (PFUdA)	2058-94-8		µg/kg	Fines	393-1	393-1-F-1(09292021)	09/29/2021	Batch	Soil	**2.8**		**2.7**		**3**		**0.75**	J	**1.1**		**1.3**		0.93	U	0.93	U	1	U	0.98	U	0.99	U

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Table C-6 EIE393-1 Soil PFAS Results

Analyte	CAS	ADEC Screening Level	Units	Category	Location	Sample ID	Sample Date	Sample Type	Matrix	Result	Qual
				Sand	393-1	ISM-393-1-SC(09232021)	09/23/2021	ISM	Soil		
PFAS											
4:2 Fluorotelomer sulfonate	757124-72-4		µg/kg							1.7	U
6:2 Fluorotelomer sulfonic acid (6:2 FTSA)	27619-97-2		µg/kg							**0.88**	JB
8:2 Fluorotelomer sulfonic acid (8:2 FTSA)	39108-34-4		µg/kg							**1.4**	J
N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6		µg/kg							1.7	U
N-Methyl perfluorooctane sulfonamide (N-MeFOSA)	31506-32-8		µg/kg							1.7	U
N-Methylperfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9		µg/kg							1.7	U
Perfluorobutane sulfonic acid (PFBS)	375-73-5		µg/kg							0.86	U
Perfluorobutanoic acid (PFBA)	375-22-4		µg/kg							0.86	U
Perfluorodecane sulfonic acid (PFDS)	335-77-3		µg/kg							**0.52**	J
Perfluorodecanoic acid (PFDA)	335-76-2		µg/kg							0.86	U
Perfluorododecanoic acid (PFDoA)	307-55-1		µg/kg							0.86	U
Perfluoroheptane sulfonic acid (PFHpS)	375-92-8		µg/kg							0.86	U
Perfluoroheptanoic acid (PFHpA)	375-85-9		µg/kg							0.86	U
Perfluorohexane sulfonic acid (PFHxS)	355-46-4		µg/kg							**2.2**	
Perfluorohexanoic acid (PFHxA)	307-24-4		µg/kg							**0.93**	
Perfluorononane sulfonic acid (PFNS)	68259-12-1		µg/kg							0.86	U
Perfluorononanoic acid (PFNA)	375-95-1		µg/kg							0.86	U
Perfluorooctane sulfonamide (PFOSA)	754-91-6		µg/kg							**1.3**	
Perfluorooctane sulfonic acid (PFOS)	1763-23-1	3	µg/kg							**32**	
Perfluorooctanoic acid (PFOA)	335-67-1	1.7	µg/kg							**0.4**	J
Perfluoropentane sulfonate (PFPeS)	138495-42-8		µg/kg							0.86	U
Perfluoropentanoic acid (PFPeA)	2706-90-3		µg/kg							0.86	U
Perfluorotetradecanoic acid (PFTeDA)	376-06-7		µg/kg							0.86	U
Perfluorotridecanoic acid (PFTrDA)	72629-94-8		µg/kg							0.86	U
Perfluoroundecanoic acid (PFUdA)	2058-94-8		µg/kg							0.86	U

Analyte	CAS	ADEC Screening Level	Units	Category	Location	Sample ID	Sample Date	Sample Type	Matrix	Result	Qual
				Fines	393-1	ISM-393-FA	09/29/2021	ISM	Soil		
PFAS											
4:2 Fluorotelomer sulfonate	757124-72-4		µg/kg							1	HU
6:2 Fluorotelomer sulfonic acid (6:2 FTSA)	27619-97-2		µg/kg							**3.1**	H
8:2 Fluorotelomer sulfonic acid (8:2 FTSA)	39108-34-4		µg/kg							**16**	H
N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6		µg/kg							1	HU
N-Methyl perfluorooctane sulfonamide (N-MeFOSA)	31506-32-8		µg/kg							1	HU
N-Methylperfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9		µg/kg							1	HU
Perfluorobutane sulfonic acid (PFBS)	375-73-5		µg/kg							**0.72**	HJ
Perfluorobutanoic acid (PFBA)	375-22-4		µg/kg							0.5	HU
Perfluorodecane sulfonic acid (PFDS)	335-77-3		µg/kg							**7**	H
Perfluorodecanoic acid (PFDA)	335-76-2		µg/kg							**1.3**	H
Perfluorododecanoic acid (PFDoA)	307-55-1		µg/kg							**1.6**	H
Perfluoroheptane sulfonic acid (PFHpS)	375-92-8		µg/kg							**0.79**	HJ
Perfluoroheptanoic acid (PFHpA)	375-85-9		µg/kg							**0.36**	HJ
Perfluorohexane sulfonic acid (PFHxS)	355-46-4		µg/kg							**14**	H
Perfluorohexanoic acid (PFHxA)	307-24-4		µg/kg							**2.7**	H
Perfluorononane sulfonic acid (PFNS)	68259-12-1		µg/kg							**7.1**	H
Perfluorononanoic acid (PFNA)	375-95-1		µg/kg							**0.23**	HJ
Perfluorooctane sulfonamide (PFOSA)	754-91-6		µg/kg							**8.5**	H
Perfluorooctane sulfonic acid (PFOS)	1763-23-1	3	µg/kg							**300**	
Perfluorooctanoic acid (PFOA)	335-67-1	1.7	µg/kg							**1.9**	H
Perfluoropentane sulfonate (PFPeS)	138495-42-8		µg/kg							**0.98**	HJ
Perfluoropentanoic acid (PFPeA)	2706-90-3		µg/kg							**0.44**	HJ
Perfluorotetradecanoic acid (PFTeDA)	376-06-7		µg/kg							**0.39**	HJ
Perfluorotridecanoic acid (PFTrDA)	72629-94-8		µg/kg							**0.57**	HJ
Perfluoroundecanoic acid (PFUdA)	2058-94-8		µg/kg							**2**	H

Analyte	CAS	ADEC Screening Level	Units	Category	Location	Sample ID	Sample Date	Sample Type	Matrix	Result	Qual
				Fines	393-1	ISM-393-FB	09/29/2021	ISM	Soil		
PFAS											
4:2 Fluorotelomer sulfonate	757124-72-4		µg/kg							1	HU
6:2 Fluorotelomer sulfonic acid (6:2 FTSA)	27619-97-2		µg/kg							**2.4**	H
8:2 Fluorotelomer sulfonic acid (8:2 FTSA)	39108-34-4		µg/kg							**15**	H
N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6		µg/kg							1	HU
N-Methyl perfluorooctane sulfonamide (N-MeFOSA)	31506-32-8		µg/kg							1	HU
N-Methylperfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9		µg/kg							1	HU
Perfluorobutane sulfonic acid (PFBS)	375-73-5		µg/kg							**0.64**	HJ
Perfluorobutanoic acid (PFBA)	375-22-4		µg/kg							0.5	HU
Perfluorodecane sulfonic acid (PFDS)	335-77-3		µg/kg							**6.7**	H
Perfluorodecanoic acid (PFDA)	335-76-2		µg/kg							**1.2**	H
Perfluorododecanoic acid (PFDoA)	307-55-1		µg/kg							**1.6**	H
Perfluoroheptane sulfonic acid (PFHpS)	375-92-8		µg/kg							**0.57**	HJ
Perfluoroheptanoic acid (PFHpA)	375-85-9		µg/kg							**0.35**	HJ
Perfluorohexane sulfonic acid (PFHxS)	355-46-4		µg/kg							**13**	H
Perfluorohexanoic acid (PFHxA)	307-24-4		µg/kg							**2.6**	H
Perfluorononane sulfonic acid (PFNS)	68259-12-1		µg/kg							**6.5**	H
Perfluorononanoic acid (PFNA)	375-95-1		µg/kg							**0.24**	HJ
Perfluorooctane sulfonamide (PFOSA)	754-91-6		µg/kg							**8.3**	H
Perfluorooctane sulfonic acid (PFOS)	1763-23-1	3	µg/kg							**260**	
Perfluorooctanoic acid (PFOA)	335-67-1	1.7	µg/kg							**1.9**	H
Perfluoropentane sulfonate (PFPeS)	138495-42-8		µg/kg							**0.95**	HJ
Perfluoropentanoic acid (PFPeA)	2706-90-3		µg/kg							**0.43**	HJ
Perfluorotetradecanoic acid (PFTeDA)	376-06-7		µg/kg							**0.36**	HJ
Perfluorotridecanoic acid (PFTrDA)	72629-94-8		µg/kg							**0.47**	HJ
Perfluoroundecanoic acid (PFUdA)	2058-94-8		µg/kg							**1.9**	H

Analyte	CAS	ADEC Screening Level	Units	Category	Location	Sample ID	Sample Date	Sample Type	Matrix	Result	Qual
				Fines	393-1	ISM-393-FC	09/29/2021	ISM	Soil		
PFAS											
4:2 Fluorotelomer sulfonate	757124-72-4		µg/kg							1	HU
6:2 Fluorotelomer sulfonic acid (6:2 FTSA)	27619-97-2		µg/kg							**3.6**	H
8:2 Fluorotelomer sulfonic acid (8:2 FTSA)	39108-34-4		µg/kg							**26**	H
N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6		µg/kg							**0.62**	HJ
N-Methyl perfluorooctane sulfonamide (N-MeFOSA)	31506-32-8		µg/kg							1	HU
N-Methylperfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9		µg/kg							1	HU
Perfluorobutane sulfonic acid (PFBS)	375-73-5		µg/kg							**0.8**	HJ
Perfluorobutanoic acid (PFBA)	375-22-4		µg/kg							**0.23**	HJ
Perfluorodecane sulfonic acid (PFDS)	335-77-3		µg/kg							**11**	H
Perfluorodecanoic acid (PFDA)	335-76-2		µg/kg							**1.9**	H
Perfluorododecanoic acid (PFDoA)	307-55-1		µg/kg							**2.5**	H
Perfluoroheptane sulfonic acid (PFHpS)	375-92-8		µg/kg							**0.79**	HJ
Perfluoroheptanoic acid (PFHpA)	375-85-9		µg/kg							**0.45**	HJ
Perfluorohexane sulfonic acid (PFHxS)	355-46-4		µg/kg							**18**	H
Perfluorohexanoic acid (PFHxA)	307-24-4		µg/kg							**3.6**	H
Perfluorononane sulfonic acid (PFNS)	68259-12-1		µg/kg							**11**	H
Perfluorononanoic acid (PFNA)	375-95-1		µg/kg							**0.35**	HJ
Perfluorooctane sulfonamide (PFOSA)	754-91-6		µg/kg							**12**	H
Perfluorooctane sulfonic acid (PFOS)	1763-23-1	3	µg/kg							**430**	
Perfluorooctanoic acid (PFOA)	335-67-1	1.7	µg/kg							**2.7**	H
Perfluoropentane sulfonate (PFPeS)	138495-42-8		µg/kg							**1.3**	H
Perfluoropentanoic acid (PFPeA)	2706-90-3		µg/kg							**0.57**	HJ
Perfluorotetradecanoic acid (PFTeDA)	376-06-7		µg/kg							**0.52**	HJ
Perfluorotridecanoic acid (PFTrDA)	72629-94-8		µg/kg							**0.75**	HJ
Perfluoroundecanoic acid (PFUdA)	2058-94-8		µg/kg							**2.5**	H

Notes:

1. Bolded values indicate the result was detected greater than the limit of detection
2. Data are compared to the Regional screening levels for the Project are adopted from Alaska Department of Environmental Conservation (ADEC) (2016), ADEC (2019) and OSD (2019).
3. Grey shaded values indicate the result was detected greater than or equal to the ADEC screening level for the residential scenario.

Acronyms/Abbreviations:
-- = not applicable/not analyzed
ADEC = Alaska Department of Environmental Conservation
CAS = Chemical Abstracts Service number
ID = identification
µg/kg = micrograms per kilogram (parts per billion)
PFAS = per- and polyfluoroalkyl substances

Laboratory Qualifiers
E = The reported result is above the limit of the calibration range.
J = The analyte was positively identified; however the associated numerical value is an estimated concentration only
U = The analyte was analyzed for but the result was not detected above the limit of quantitation (LOQ).
H = Sample analyzed out of holding time

Table C-8 Water PFAS Results

Analyte	CAS	ADEC Screening Level	Category	Untreated		Treated		Untreated		Treated		Treated		Untreated		Treated		Treated	
			Location	382-5		382-5		385-4		385-4		385-4		393-1		393-1		393-1	
			Sample ID	382-5-W-UT-1(09072021)		382-5-W-T-1(09072021)		385-4-W-UT-1(09152021)		385-4-W-T-1(09152021)		DUP-03(09152021)		393-1-UT-W(09232021)		393-1-T-W(09232021)		DUP-05(09232021)	
			Sample Date	09/07/2021		09/07/2021		09/15/2021		09/15/2021		09/15/2021		09/23/2021		09/23/2021		09/23/2021	
			Matrix	Water		Water		Water		Water		Water		Water		Water		Water	
			Units	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual
PFAS																			
4:2 Fluorotelomer sulfonate	757124-72-4		ng/L	7.8	U	7.6	U	8	U	7.8	U	7.7	U	7.1	U	6.8	U	7.2	U
6:2 Fluorotelomer sulfonic acid (6:2 FTSA)	27619-97-2		ng/L	**6.2**	J	7.6	U	8	U	7.8	U	7.7	U	**320**		6.8	U	7.2	U
8:2 Fluorotelomer sulfonic acid (8:2 FTSA)	39108-34-4		ng/L	**3.2**	J	7.6	U	8	U	7.8	U	7.7	U	**1100**		6.8	U	**2**	J
N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6		ng/L	7.8	U	7.6	U	8	U	7.8	U	7.7	U	**6.9**	J	6.8	U	7.2	U
N-Methyl perfluorooctane sulfonamide (N-MeFOSA)	31506-32-8		ng/L	16	U	15	U	16	U	16	U	15	U	14	U	14	U	14	U
N-Methylperfluoroocatane sulfonamidoacetic acid (MeFOSAA)	2355-31-9		ng/L	7.8	U	7.6	U	8	U	7.8	U	7.7	U	**6.4**	J	6.8	U	7.2	U
Perfluorobutane sulfonic acid (PFBS)	375-73-5		ng/L	**2.2**	J	3.8	U	**7.8**		3.9	U	3.9	U	**86**		3.4	U	3.6	U
Perfluorobutanoic acid (PFBA)	375-22-4		ng/L	**3.4**	J	3.8	U	**5.9**		3.9	U	3.9	U	**51**		3.4	U	3.6	U
Perfluorodecane sulfonic acid (PFDS)	335-77-3		ng/L	3.9	U	3.8	U	4	U	3.9	U	3.9	U	**120**		**1.4**	J	**1.2**	J
Perfluorodecanoic acid (PFDA)	335-76-2		ng/L	3.9	U	3.8	U	**3.4**	J	3.9	U	3.9	U	**120**		3.4	U	3.6	U
Perfluorododecanoic acid (PFDoA)	307-55-1		ng/L	3.9	U	3.8	U	4	U	3.9	U	3.9	U	**15**		3.4	U	3.6	U
Perfluoroheptane sulfonic acid (PFHpS)	375-92-8		ng/L	**1.9**	J	3.8	U	**2.4**	J	3.9	U	3.9	U	**23**		3.4	U	3.6	U
Perfluoroheptanoic acid (PFHpA)	375-85-9		ng/L	**3.2**	J	3.8	U	**18**		3.9	U	3.9	U	**67**		3.4	U	3.6	U
Perfluorohexane sulfonic acid (PFHxS)	355-46-4		ng/L	**46**		3.8	U	**160**		3.9	U	3.9	U	**1200**		**1.6**	J	**1.9**	J
Perfluorohexanoic acid (PFHxA)	307-24-4		ng/L	**10**		3.8	U	**24**		3.9	U	3.9	U	**430**		3.4	U	3.6	U
Perfluorononane sulfonic acid (PFNS)	68259-12-1		ng/L	3.9	U	3.8	U	4	U	3.9	U	3.9	U	**320**		3.4	U	3.6	U
Perfluorononanoic acid (PFNA)	375-95-1		ng/L	3.9	U	3.8	U	**4.4**		3.9	U	3.9	U	**38**		3.4	U	3.6	U
Perfluorooctane sulfonamide (PFOSA)	754-91-6		ng/L	3.9	U	3.8	U	**2.2**	J	3.9	U	3.9	U	**680**		3.4	U	3.6	U
Perfluorooctane sulfonic acid (PFOS)	1763-23-1	400	ng/L	**72**		**1.6**	J	**190**		3.9	U	3.9	U	**26000**		**25**		**26**	
Perfluorooctanoic acid (PFOA)	335-67-1	400	ng/L	**4.6**		3.8	U	**25**		3.9	U	3.9	U	**200**		3.4	U	3.6	U
Perfluoropentane sulfonate (PFPeS)	138495-42-8		ng/L	**3.8**	J	3.8	U	**5.9**		3.9	U	3.9	U	**110**		3.4	U	3.6	U
Perfluoropentanoic acid (PFPeA)	2706-90-3		ng/L	**10**		3.8	U	**12**		3.9	U	3.9	U	**180**		3.4	U	3.6	U
Perfluorotetradecanoic acid (PFTeDA)	376-06-7		ng/L	3.9	U	3.8	U	4	U	3.9	U	3.9	U	**2.3**	J	3.4	U	3.6	U
Perfluorotridecanoic acid (PFTrDA)	72629-94-8		ng/L	3.9	U	3.8	U	4	U	3.9	U	3.9	U	**3.3**	J	3.4	U	3.6	U
Perfluoroundecanoic acid (PFUdA)	2058-94-8		ng/L	3.9	U	3.8	U	4	U	3.9	U	3.9	U	**34**		3.4	U	3.6	U

Notes:

1. Bolded values indicate the result was detected greater than the limit of detection
2. Data are compared to the Regional screening levels for the Project are adopted from Alaska Department of Environmental Conservation (ADEC) (2016), ADEC (2019) and OSD (2019).
3. Grey shaded values indicate the result was detected greater than or equal to the ADEC screening level for the residential scenario.

Acronyms/Abbreviations:
-- = not applicable/not analyzed
ADEC = Alaska Department of Environmental Conservation
CAS = Chemical Abstracts Service number
ID = identification
ng/L = nanograms per liter (parts per trillion)
PFAS = per- and polyfluoroalkyl substances

Laboratory Qualifiers
E = The reported result is above the limit of the calibration range.
J = The analyte was positively identified; however the associated numerical value is an estimated concentration only
U = The analyte was analyzed for but the result was not detected above the limit of quantitation (LOQ).
H = Sample analyzed out of holding time

Report of Analysis

Arcadis U.S., Inc.
630 Plaza Drive
Suite 600
Highlands Ranch, CO 80129
Attention: Joseph Quinnan

Project Name: Eielson AFB

Project Number: 30030317

Lot Number:**WJ01060**

Date Completed:10/27/2021

Kathy Smith

10/28/2021 1:12 PM
Approved and released by:
Project Manager II: **Kathy E. Smith**

The electronic signature above is the equivalent of a handwritten signature.
This report shall not be reproduced, except in its entirety, without the written approval of Pace Analytical Services, LLC.

Pace Analytical Services, LLC (*formerly Shealy Environmental Services, Inc.*)
106 Vantage Point Drive West Columbia, SC 29172
Tel: 803-791-9700 Fax: 803-791-9111 www.pacelabs.com

Case Narrative
Arcadis U.S., Inc.
Lot Number: WJ01060

This Report of Analysis contains the analytical result(s) for the sample(s) listed on the Sample Summary following this Case Narrative. The sample receiving date is documented in the header information associated with each sample.

All results listed in this report relate only to the samples that are contained within this report.

Sample receipt, sample analysis, and data review have been performed in accordance with the Pace Quality Assurance Management Plan (QAMP), applicable Shealy standard operating procedures (SOPs), the 2003 NELAC standard, and Shealy policies. Additionally, the DoD QSM version 5.3 has been followed for these samples, and specifically Table B-15 was followed for all PFAS samples. Any exceptions to the QAMP, SOPs, NELAC standards, the DoD QSM, or policies are qualified on the results page or discussed below.

All QC associated with these samples was in compliance with DOD QSM 5.3 table B-15 and our PFAS SOP.

Correction factors (CF) are used to calculate the original sample concentration. The CF is the inverse of the concentration factor (sample volume / extract final volume) times the dilution factor (DF). For undiluted analysis. For undiluted analysis, the extract is prepared for injection by adding 182 uL of sample extract + 8 uL of reagent water + 10 uL of internal standard solution to a polypropylene autosampler vial. An extra correction factor of 0.91 (182 uL / 200 uL = 0.91) applies. The CF is calculated as follows:

CF = DF * FV / Vo

FV is volume of extract (mL)
Vo is initial sample volume (mL)
DF is dilution factor. For undiluted analysis, DF = 1/0.91.

Sample concentration for aqueous samples:
Concentration (ng/L) = Cs*CF,

$$C_s = \frac{\left(\frac{(A_s x C_{is})}{A_{is}}\right) - B}{M1}$$

Where

C_s is on column concentration of target analyte in the sample (ng/L)
C_{is} is concentration of internal standard in the sample (ng/L)
A_s is peak response of target analyte in the sample
A_{is} is peak response of internal standard in the sample
M1 is the average RF from ICAL or the slope from linear regression ICAL
B is the y-intercept from the ICAL

Pace is a TNI accredited laboratory; however, the following analyses are currently not listed on our TNI scope of accreditation:

Biological Tissue: All, Non-Potable Water: SGT-HEM EPA 1664B, Silica EPA 200.7, Boron, Calcium, Silicon, Strontium EPA 200.8, Bicarbonate, Carbonate, and Hydroxide Alkalinity SM 2320 B-2011, Fecal Coliform SM 9221 C E-2006 & SM 9222D-2006, Strontium SW-846 6010D, VOC SM 6200 B-2011, Drinking Water: VOC (excluding BTEX, MTBE, Naphthalene, & 1,2-dichloroethane) EPA 524.2, Solid Chemical Material: TOC Walkley-Black.

Where applicable, all soil sample results (including LOQ and DL if requested) are corrected for dry weight unless flagged with a "W" qualifier.

If you have any questions regarding this report please contact the Pace Project Manager listed on the cover page.

Sample Summary
Arcadis U.S., Inc.
Lot Number: WJ01060
Project Name: Eielson AFB
Project Number: 30030317

Sample Number	Sample ID	Matrix	Date Sampled	Date Received
001	393-1-F-1	Solid	09/29/2021 1600	10/01/2021
002	393-1-F-2	Solid	09/29/2021 1630	10/01/2021
003	393-1-F-3	Solid	09/29/2021 1700	10/01/2021

(3 samples)

Detection Summary
Arcadis U.S., Inc.
Lot Number: WJ01060
Project Name: Eielson AFB
Project Number: 30030317

Sample	Sample ID	Matrix	Parameter	Method	Result	Q	Units	Page
001	393-1-F-1	Solid	8:2 FTS	PFAS by ID	31		ug/kg	7
001	393-1-F-1	Solid	6:2 FTS	PFAS by ID	2.8	J	ug/kg	7
001	393-1-F-1	Solid	PFBS	PFAS by ID	0.84	J	ug/kg	7
001	393-1-F-1	Solid	PFDS	PFAS by ID	11		ug/kg	7
001	393-1-F-1	Solid	PFHpS	PFAS by ID	0.77	J	ug/kg	7
001	393-1-F-1	Solid	PFNS	PFAS by ID	11		ug/kg	7
001	393-1-F-1	Solid	PFOSA	PFAS by ID	15		ug/kg	7
001	393-1-F-1	Solid	PFPeS	PFAS by ID	1.2	J	ug/kg	7
001	393-1-F-1	Solid	PFHxS	PFAS by ID	21		ug/kg	7
001	393-1-F-1	Solid	PFDA	PFAS by ID	2.2		ug/kg	7
001	393-1-F-1	Solid	PFDoA	PFAS by ID	2.5		ug/kg	7
001	393-1-F-1	Solid	PFHpA	PFAS by ID	0.52	J	ug/kg	7
001	393-1-F-1	Solid	PFHxA	PFAS by ID	2.0		ug/kg	7
001	393-1-F-1	Solid	PFNA	PFAS by ID	0.43	J	ug/kg	7
001	393-1-F-1	Solid	PFOA	PFAS by ID	3.1		ug/kg	7
001	393-1-F-1	Solid	PFPeA	PFAS by ID	0.33	J	ug/kg	7
001	393-1-F-1	Solid	PFTeDA	PFAS by ID	0.59	J	ug/kg	7
001	393-1-F-1	Solid	PFTrDA	PFAS by ID	0.76	J	ug/kg	7
001	393-1-F-1	Solid	PFUdA	PFAS by ID	2.8		ug/kg	7
001	393-1-F-1	Solid	PFOS	PFAS by ID	500		ug/kg	7
001	393-1-F-1	Solid	8:2 FTS	PFAS by ID	630		ng/L	9
001	393-1-F-1	Solid	6:2 FTS	PFAS by ID	50	J	ng/L	9
001	393-1-F-1	Solid	PFNS	PFAS by ID	140	J	ng/L	9
001	393-1-F-1	Solid	PFOSA	PFAS by ID	270		ng/L	9
001	393-1-F-1	Solid	PFPeS	PFAS by ID	18	J	ng/L	9
001	393-1-F-1	Solid	PFHxS	PFAS by ID	290		ng/L	9
001	393-1-F-1	Solid	PFDA	PFAS by ID	42		ng/L	9
001	393-1-F-1	Solid	PFHxA	PFAS by ID	41		ng/L	9
001	393-1-F-1	Solid	PFOA	PFAS by ID	57		ng/L	9
001	393-1-F-1	Solid	PFUdA	PFAS by ID	24	J	ng/L	9
001	393-1-F-1	Solid	PFOS	PFAS by ID	9900		ng/L	9
002	393-1-F-2	Solid	8:2 FTS	PFAS by ID	31		ug/kg	11
002	393-1-F-2	Solid	6:2 FTS	PFAS by ID	2.6	J	ug/kg	11
002	393-1-F-2	Solid	PFBS	PFAS by ID	0.79	J	ug/kg	11
002	393-1-F-2	Solid	PFDS	PFAS by ID	10		ug/kg	11
002	393-1-F-2	Solid	PFHpS	PFAS by ID	0.83	J	ug/kg	11
002	393-1-F-2	Solid	PFNS	PFAS by ID	10		ug/kg	11
002	393-1-F-2	Solid	PFOSA	PFAS by ID	14		ug/kg	11
002	393-1-F-2	Solid	PFPeS	PFAS by ID	1.2	J	ug/kg	11
002	393-1-F-2	Solid	PFHxS	PFAS by ID	16		ug/kg	11
002	393-1-F-2	Solid	PFDA	PFAS by ID	2.0		ug/kg	11
002	393-1-F-2	Solid	PFDoA	PFAS by ID	2.1		ug/kg	11
002	393-1-F-2	Solid	PFHpA	PFAS by ID	0.45	J	ug/kg	11

Detection Summary (Continued)

Lot Number: WJ01060

Sample	Sample ID	Matrix	Parameter	Method	Result	Q	Units	Page
002	393-1-F-2	Solid	PFHxA	PFAS by ID	2.3		ug/kg	11
002	393-1-F-2	Solid	PFNA	PFAS by ID	0.35	J	ug/kg	11
002	393-1-F-2	Solid	PFOA	PFAS by ID	2.5		ug/kg	11
002	393-1-F-2	Solid	PFPeA	PFAS by ID	0.33	J	ug/kg	11
002	393-1-F-2	Solid	PFTeDA	PFAS by ID	0.56	J	ug/kg	11
002	393-1-F-2	Solid	PFTrDA	PFAS by ID	0.69	J	ug/kg	11
002	393-1-F-2	Solid	PFUdA	PFAS by ID	2.7		ug/kg	11
002	393-1-F-2	Solid	PFOS	PFAS by ID	430		ug/kg	11
002	393-1-F-2	Solid	8:2 FTS	PFAS by ID	620		ng/L	13
002	393-1-F-2	Solid	6:2 FTS	PFAS by ID	53	J	ng/L	13
002	393-1-F-2	Solid	PFNS	PFAS by ID	160	J	ng/L	13
002	393-1-F-2	Solid	PFOSA	PFAS by ID	270		ng/L	13
002	393-1-F-2	Solid	PFPeS	PFAS by ID	17	J	ng/L	13
002	393-1-F-2	Solid	PFHxS	PFAS by ID	300		ng/L	13
002	393-1-F-2	Solid	PFDA	PFAS by ID	39	J	ng/L	13
002	393-1-F-2	Solid	PFHxA	PFAS by ID	43		ng/L	13
002	393-1-F-2	Solid	PFOA	PFAS by ID	56		ng/L	13
002	393-1-F-2	Solid	PFUdA	PFAS by ID	21	J	ng/L	13
002	393-1-F-2	Solid	PFOS	PFAS by ID	11000		ng/L	13
003	393-1-F-3	Solid	8:2 FTS	PFAS by ID	31		ug/kg	15
003	393-1-F-3	Solid	6:2 FTS	PFAS by ID	2.4	J	ug/kg	15
003	393-1-F-3	Solid	PFBS	PFAS by ID	0.75	J	ug/kg	15
003	393-1-F-3	Solid	PFDS	PFAS by ID	12		ug/kg	15
003	393-1-F-3	Solid	PFHpS	PFAS by ID	0.79	J	ug/kg	15
003	393-1-F-3	Solid	PFNS	PFAS by ID	11		ug/kg	15
003	393-1-F-3	Solid	PFOSA	PFAS by ID	14		ug/kg	15
003	393-1-F-3	Solid	PFPeS	PFAS by ID	1.2	J	ug/kg	15
003	393-1-F-3	Solid	PFHxS	PFAS by ID	18		ug/kg	15
003	393-1-F-3	Solid	PFDA	PFAS by ID	2.2		ug/kg	15
003	393-1-F-3	Solid	PFDoA	PFAS by ID	2.5		ug/kg	15
003	393-1-F-3	Solid	PFHpA	PFAS by ID	0.54	J	ug/kg	15
003	393-1-F-3	Solid	PFHxA	PFAS by ID	1.9		ug/kg	15
003	393-1-F-3	Solid	PFNA	PFAS by ID	0.40	J	ug/kg	15
003	393-1-F-3	Solid	PFOA	PFAS by ID	3.1		ug/kg	15
003	393-1-F-3	Solid	PFPeA	PFAS by ID	0.40	J	ug/kg	15
003	393-1-F-3	Solid	PFTeDA	PFAS by ID	0.52	J	ug/kg	15
003	393-1-F-3	Solid	PFTrDA	PFAS by ID	0.77	J	ug/kg	15
003	393-1-F-3	Solid	PFUdA	PFAS by ID	3.0		ug/kg	15
003	393-1-F-3	Solid	PFOS	PFAS by ID	480		ug/kg	15
003	393-1-F-3	Solid	8:2 FTS	PFAS by ID	600		ng/L	17
003	393-1-F-3	Solid	6:2 FTS	PFAS by ID	41	J	ng/L	17
003	393-1-F-3	Solid	PFNS	PFAS by ID	120	J	ng/L	17
003	393-1-F-3	Solid	PFOSA	PFAS by ID	260		ng/L	17
003	393-1-F-3	Solid	PFPeS	PFAS by ID	15	J	ng/L	17
003	393-1-F-3	Solid	PFHxS	PFAS by ID	290		ng/L	17
003	393-1-F-3	Solid	PFDA	PFAS by ID	39	J	ng/L	17
003	393-1-F-3	Solid	PFHxA	PFAS by ID	41		ng/L	17
003	393-1-F-3	Solid	PFOA	PFAS by ID	58		ng/L	17

Detection Summary (Continued)

Lot Number: WJ01060

Sample	Sample ID	Matrix	Parameter	Method	Result	Q	Units	Page
003	393-1-F-3	Solid	PFUdA	PFAS by ID	20	J	ng/L	17
003	393-1-F-3	Solid	PFOS	PFAS by ID	8900		ng/L	17

(93 detections)

PFAS by LC/MS/MS

Client: **Arcadis U.S., Inc.**		Laboratory ID: **WJ01060-001**	
Description: **393-1-F-1**		Matrix: **Solid**	
Date Sampled: **09/29/2021 1600**	Project Name: **Eielson AFB**	% Solids: **57.7**	**10/02/2021 1447**
Date Received: **10/01/2021**	Project Number: **30030317**		

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch
1	SOP SPE	PFAS by ID SOP QSM B-15	1	10/04/2021 1457	JJG	10/03/2021 1401	17485
2	SOP SPE	PFAS by ID SOP QSM B-15	5	10/05/2021 1533	JJG	10/03/2021 1401	17485

Parameter	CAS Number	Analytical Method	Result	Q	LOQ	LOD	DL	Units	Run
1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS)	**39108-34-4**	**PFAS by ID SOP**	**31**		**3.3**	1.7	**0.83**	**ug/kg**	**1**
1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS)	**27619-97-2**	**PFAS by ID SOP**	**2.8**	**J**	**3.3**	1.7	**0.83**	**ug/kg**	**1**
1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS)	757124-72-4	PFAS by ID SOP	1.7	U	3.3	1.7	0.83	ug/kg	1
N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA)	2991-50-6	PFAS by ID SOP	1.7	U	3.3	1.7	0.83	ug/kg	1
N-methylperfluoro-1-octanesulfonamide (MeFOSA)	31506-32-8	PFAS by ID SOP	1.7	U	3.3	1.7	0.83	ug/kg	1
N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA)	2355-31-9	PFAS by ID SOP	1.7	U	3.3	1.7	0.83	ug/kg	1
Perfluoro-1-butanesulfonic acid (PFBS)	**375-73-5**	**PFAS by ID SOP**	**0.84**	**J**	**1.7**	0.85	**0.33**	**ug/kg**	**1**
Perfluoro-1-decanesulfonic acid (PFDS)	**335-77-3**	**PFAS by ID SOP**	**11**		**1.7**	0.85	**0.33**	**ug/kg**	**1**
Perfluoro-1-heptanesulfonic acid (PFHpS)	**375-92-8**	**PFAS by ID SOP**	**0.77**	**J**	**1.7**	0.85	**0.33**	**ug/kg**	**1**
Perfluoro-1-nonanesulfonic acid (PFNS)	**68259-12-1**	**PFAS by ID SOP**	**11**		**1.7**	0.85	**0.33**	**ug/kg**	**1**
Perfluoro-1-octanesulfonamide (PFOSA)	**754-91-6**	**PFAS by ID SOP**	**15**		**1.7**	0.85	**0.33**	**ug/kg**	**1**
Perfluoro-1-pentanesulfonic acid (PFPeS)	**2706-91-4**	**PFAS by ID SOP**	**1.2**	**J**	**1.7**	0.85	**0.33**	**ug/kg**	**1**
Perfluorohexanesulfonic acid (PFHxS)	**355-46-4**	**PFAS by ID SOP**	**21**		**1.7**	0.85	**0.33**	**ug/kg**	**1**
Perfluoro-n-butanoic acid (PFBA)	375-22-4	PFAS by ID SOP	0.85	U	1.7	0.85	0.33	ug/kg	1
Perfluoro-n-decanoic acid (PFDA)	**335-76-2**	**PFAS by ID SOP**	**2.2**		**1.7**	0.85	**0.33**	**ug/kg**	**1**
Perfluoro-n-dodecanoic acid (PFDoA)	**307-55-1**	**PFAS by ID SOP**	**2.5**		**1.7**	0.85	**0.33**	**ug/kg**	**1**
Perfluoro-n-heptanoic acid (PFHpA)	**375-85-9**	**PFAS by ID SOP**	**0.52**	**J**	**1.7**	0.85	**0.33**	**ug/kg**	**1**
Perfluoro-n-hexanoic acid (PFHxA)	**307-24-4**	**PFAS by ID SOP**	**2.0**		**1.7**	0.85	**0.33**	**ug/kg**	**1**
Perfluoro-n-nonanoic acid (PFNA)	**375-95-1**	**PFAS by ID SOP**	**0.43**	**J**	**1.7**	0.85	**0.33**	**ug/kg**	**1**
Perfluoro-n-octanoic acid (PFOA)	**335-67-1**	**PFAS by ID SOP**	**3.1**		**1.7**	0.85	**0.33**	**ug/kg**	**1**
Perfluoro-n-pentanoic acid (PFPeA)	**2706-90-3**	**PFAS by ID SOP**	**0.33**	**J**	**1.7**	0.85	**0.33**	**ug/kg**	**1**
Perfluoro-n-tetradecanoic acid (PFTeDA)	**376-06-7**	**PFAS by ID SOP**	**0.59**	**J**	**1.7**	0.85	**0.33**	**ug/kg**	**1**
Perfluoro-n-tridecanoic acid (PFTrDA)	**72629-94-8**	**PFAS by ID SOP**	**0.76**	**J**	**1.7**	0.85	**0.33**	**ug/kg**	**1**
Perfluoro-n-undecanoic acid (PFUdA)	**2058-94-8**	**PFAS by ID SOP**	**2.8**		**1.7**	0.85	**0.33**	**ug/kg**	**1**
Perfluorooctanesulfonic acid (PFOS)	**1763-23-1**	**PFAS by ID SOP**	**500**		**8.3**	4.2	**1.7**	**ug/kg**	**2**

Surrogate	Q	Run 1 % Recovery	Acceptance Limits	Q	Run 2 % Recovery	Acceptance Limits
13C2_4:2FTS		103	50-150		143	50-150
13C2_6:2FTS		101	50-150		105	50-150
13C2_8:2FTS		109	50-150		95	50-150
13C2_PFDoA		87	50-150		91	50-150
13C2_PFTeDA		91	50-150		86	50-150
13C3_PFBS		93	50-150		98	50-150
13C3_PFHxS		90	50-150		101	50-150
13C4_PFBA		94	50-150		96	50-150
13C4_PFHpA		92	50-150		100	50-150
13C5_PFHxA		87	50-150		100	50-150
13C5_PFPeA		95	50-150		100	50-150
13C6_PFDA		92	50-150		97	50-150
13C7_PFUdA		93	50-150		101	50-150
13C8_PFOA		89	50-150		90	50-150
13C8_PFOS		86	50-150		93	50-150
13C8_PFOSA		105	50-150		105	50-150

LOQ = Limit of Quantitation	B = Detected in the method blank	E = Quantitation of compound exceeded the calibration range	DL = Detection Limit	Q = Surrogate failure
U = Not detected at or above the LOQ	N = Recovery is out of criteria	P = The RPD between two GC columns exceeds 40%	J = Estimated result < LOQ and ≥ DL	L = LCS/LCSD failure
H = Out of holding time	W = Reported on wet weight basis	LOD = Limit of Detection		S = MS/MSD failure

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PFAS by LC/MS/MS

Client: **Arcadis U.S., Inc.**		Laboratory ID: **WJ01060-001**	
Description: **393-1-F-1**		Matrix: **Solid**	
Date Sampled: **09/29/2021 1600**	Project Name: **Eielson AFB**	% Solids: **57.7**	**10/02/2021 1447**
Date Received: **10/01/2021**	Project Number: **30030317**		

Surrogate	Q	Run 1 % Recovery	Acceptance Limits	Q	Run 2 % Recovery	Acceptance Limits
13C9_PFNA		87	50-150		94	50-150
d5-EtFOSAA		107	50-150		90	50-150
d-MeFOSA		109	50-150		98	50-150
d3-MeFOSAA		97	50-150		93	50-150

LOQ = Limit of Quantitation	B = Detected in the method blank	E = Quantitation of compound exceeded the calibration range	DL = Detection Limit	Q = Surrogate failure
U = Not detected at or above the LOQ	N = Recovery is out of criteria	P = The RPD between two GC columns exceeds 40%	J = Estimated result < LOQ and ≥ DL	L = LCS/LCSD failure
H = Out of holding time	W = Reported on wet weight basis	LOD = Limit of Detection		S = MS/MSD failure

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SPLP PFAS

Client: **Arcadis U.S., Inc.**		Laboratory ID: **WJ01060-001**	
Description: **393-1-F-1**		Matrix: **Solid**	
Date Sampled: **09/29/2021 1600**	Project Name: **Eielson AFB**	% Solids: **57.7**	**10/02/2021 1447**
Date Received: **10/01/2021**	Project Number: **30030317**		

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch	Leachate Date
1	1312/PFAS	PFAS by ID SOP QSM B-15	1	10/21/2021 1620	JJG	10/20/2021 1345	19466	10/16/2021 0006
2	1312/PFAS	PFAS by ID SOP QSM B-15	5	10/24/2021 1556	JJG	10/20/2021 1345	19466	10/16/2021 0006

Parameter	CAS Number	Analytical Method	Result	Q	LOQ	LOD	DL	Units	Run
1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS)	**39108-34-4**	**PFAS by ID SOP**	**630**		**80**	40	**20**	**ng/L**	**1**
1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS)	**27619-97-2**	**PFAS by ID SOP**	**50**	**J**	**80**	40	**20**	**ng/L**	**1**
1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS)	757124-72-4	PFAS by ID SOP	40	U	80	40	20	ng/L	1
N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA)	2991-50-6	PFAS by ID SOP	40	U	80	40	20	ng/L	1
N-methylperfluoro-1-octanesulfonamide (MeFOSA)	31506-32-8	PFAS by ID SOP	80	U	160	80	40	ng/L	1
N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA)	2355-31-9	PFAS by ID SOP	40	U	80	40	20	ng/L	1
Perfluoro-1-butanesulfonic acid (PFBS)	375-73-5	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-1-decanesulfonic acid (PFDS)	335-77-3	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-1-heptanesulfonic acid (PFHpS)	375-92-8	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-1-nonanesulfonic acid (PFNS)	**68259-12-1**	**PFAS by ID SOP**	**140**	**J**	**200**	100	**50**	**ng/L**	**2**
Perfluoro-1-octanesulfonamide (PFOSA)	**754-91-6**	**PFAS by ID SOP**	**270**		**40**	20	**10**	**ng/L**	**1**
Perfluoro-1-pentanesulfonic acid (PFPeS)	**2706-91-4**	**PFAS by ID SOP**	**18**	**J**	**40**	20	**10**	**ng/L**	**1**
Perfluorohexanesulfonic acid (PFHxS)	**355-46-4**	**PFAS by ID SOP**	**290**		**40**	20	**10**	**ng/L**	**1**
Perfluoro-n-butanoic acid (PFBA)	375-22-4	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-n-decanoic acid (PFDA)	**335-76-2**	**PFAS by ID SOP**	**42**		**40**	20	**10**	**ng/L**	**1**
Perfluoro-n-dodecanoic acid (PFDoA)	307-55-1	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-n-heptanoic acid (PFHpA)	375-85-9	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-n-hexanoic acid (PFHxA)	**307-24-4**	**PFAS by ID SOP**	**41**		**40**	20	**10**	**ng/L**	**1**
Perfluoro-n-nonanoic acid (PFNA)	375-95-1	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-n-octanoic acid (PFOA)	**335-67-1**	**PFAS by ID SOP**	**57**		**40**	20	**10**	**ng/L**	**1**
Perfluoro-n-pentanoic acid (PFPeA)	2706-90-3	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-n-tetradecanoic acid (PFTeDA)	376-06-7	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-n-tridecanoic acid (PFTrDA)	72629-94-8	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-n-undecanoic acid (PFUdA)	**2058-94-8**	**PFAS by ID SOP**	**24**	**J**	**40**	20	**10**	**ng/L**	**1**
Perfluorooctanesulfonic acid (PFOS)	**1763-23-1**	**PFAS by ID SOP**	**9900**		**200**	100	**50**	**ng/L**	**2**

Surrogate	Q	Run 1 % Recovery	Run 1 Acceptance Limits	Q	Run 2 % Recovery	Run 2 Acceptance Limits
13C2_4:2FTS		101	50-150		84	50-150
13C2_6:2FTS		104	50-150		92	50-150
13C2_8:2FTS		92	50-150		87	50-150
13C2_PFDoA		86	50-150		90	50-150
13C2_PFTeDA		91	50-150		92	50-150
13C3_PFBS		92	50-150		96	50-150
13C3_PFHxS		100	50-150		92	50-150
13C4_PFBA		91	50-150		93	50-150
13C4_PFHpA		86	50-150		97	50-150
13C5_PFHxA		94	50-150		91	50-150
13C5_PFPeA		90	50-150		88	50-150
13C6_PFDA		83	50-150		96	50-150
13C7_PFUdA		87	50-150		91	50-150
13C8_PFOA		90	50-150		92	50-150
13C8_PFOS		93	50-150		84	50-150
13C8_PFOSA		97	50-150		91	50-150

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

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SPLP PFAS

Client: **Arcadis U.S., Inc.**		Laboratory ID: **WJ01060-001**	
Description: **393-1-F-1**		Matrix: **Solid**	
Date Sampled: **09/29/2021 1600**	Project Name: **Eielson AFB**	% Solids: **57.7**	**10/02/2021 1447**
Date Received: **10/01/2021**	Project Number: **30030317**		

Surrogate	Q	Run 1 % Recovery	Acceptance Limits	Q	Run 2 % Recovery	Acceptance Limits
13C9_PFNA		87	50-150		87	50-150
d5-EtFOSAA		105	50-150		87	50-150
d-MeFOSA		91	50-150		98	50-150
d3-MeFOSAA		92	50-150		84	50-150

LOQ = Limit of Quantitation	B = Detected in the method blank	E = Quantitation of compound exceeded the calibration range	DL = Detection Limit	Q = Surrogate failure
U = Not detected at or above the LOQ	N = Recovery is out of criteria	P = The RPD between two GC columns exceeds 40%	J = Estimated result < LOQ and ≥ DL	L = LCS/LCSD failure
H = Out of holding time	W = Reported on wet weight basis	LOD = Limit of Detection		S = MS/MSD failure

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PFAS by LC/MS/MS

Client: **Arcadis U.S., Inc.** Laboratory ID: **WJ01060-002**

Description: **393-1-F-2** Matrix: **Solid**

Date Sampled: **09/29/2021 1630** Project Name: **Eielson AFB** % Solids: **58.5** **10/02/2021 1447**

Date Received: **10/01/2021** Project Number: **30030317**

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch
1	SOP SPE	PFAS by ID SOP QSM B-15	1	10/04/2021 1507	JJG	10/03/2021 1401	17485
2	SOP SPE	PFAS by ID SOP QSM B-15	5	10/05/2021 1544	JJG	10/03/2021 1401	17485

Parameter	CAS Number	Analytical Method	Result	Q	LOQ	LOD	DL	Units	Run
1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS)	**39108-34-4**	**PFAS by ID SOP**	**31**		**3.3**	1.7	**0.82**	**ug/kg**	**1**
1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS)	**27619-97-2**	**PFAS by ID SOP**	**2.6**	**J**	**3.3**	1.7	**0.82**	**ug/kg**	**1**
1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS)	757124-72-4	PFAS by ID SOP	1.7	U	3.3	1.7	0.82	ug/kg	1
N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA)	2991-50-6	PFAS by ID SOP	1.7	U	3.3	1.7	0.82	ug/kg	1
N-methylperfluoro-1-octanesulfonamide (MeFOSA)	31506-32-8	PFAS by ID SOP	1.7	U	3.3	1.7	0.82	ug/kg	1
N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA)	2355-31-9	PFAS by ID SOP	1.7	U	3.3	1.7	0.82	ug/kg	1
Perfluoro-1-butanesulfonic acid (PFBS)	**375-73-5**	**PFAS by ID SOP**	**0.79**	**J**	**1.6**	0.80	**0.33**	**ug/kg**	**1**
Perfluoro-1-decanesulfonic acid (PFDS)	**335-77-3**	**PFAS by ID SOP**	**10**		**1.6**	0.80	**0.33**	**ug/kg**	**1**
Perfluoro-1-heptanesulfonic acid (PFHpS)	**375-92-8**	**PFAS by ID SOP**	**0.83**	**J**	**1.6**	0.80	**0.33**	**ug/kg**	**1**
Perfluoro-1-nonanesulfonic acid (PFNS)	**68259-12-1**	**PFAS by ID SOP**	**10**		**1.6**	0.80	**0.33**	**ug/kg**	**1**
Perfluoro-1-octanesulfonamide (PFOSA)	**754-91-6**	**PFAS by ID SOP**	**14**		**1.6**	0.80	**0.33**	**ug/kg**	**1**
Perfluoro-1-pentanesulfonic acid (PFPeS)	**2706-91-4**	**PFAS by ID SOP**	**1.2**	**J**	**1.6**	0.80	**0.33**	**ug/kg**	**1**
Perfluorohexanesulfonic acid (PFHxS)	**355-46-4**	**PFAS by ID SOP**	**16**		**1.6**	0.80	**0.33**	**ug/kg**	**1**
Perfluoro-n-butanoic acid (PFBA)	375-22-4	PFAS by ID SOP	0.80	U	1.6	0.80	0.33	ug/kg	1
Perfluoro-n-decanoic acid (PFDA)	**335-76-2**	**PFAS by ID SOP**	**2.0**		**1.6**	0.80	**0.33**	**ug/kg**	**1**
Perfluoro-n-dodecanoic acid (PFDoA)	**307-55-1**	**PFAS by ID SOP**	**2.1**		**1.6**	0.80	**0.33**	**ug/kg**	**1**
Perfluoro-n-heptanoic acid (PFHpA)	**375-85-9**	**PFAS by ID SOP**	**0.45**	**J**	**1.6**	0.80	**0.33**	**ug/kg**	**1**
Perfluoro-n-hexanoic acid (PFHxA)	**307-24-4**	**PFAS by ID SOP**	**2.3**		**1.6**	0.80	**0.33**	**ug/kg**	**1**
Perfluoro-n-nonanoic acid (PFNA)	**375-95-1**	**PFAS by ID SOP**	**0.35**	**J**	**1.6**	0.80	**0.33**	**ug/kg**	**1**
Perfluoro-n-octanoic acid (PFOA)	**335-67-1**	**PFAS by ID SOP**	**2.5**		**1.6**	0.80	**0.33**	**ug/kg**	**1**
Perfluoro-n-pentanoic acid (PFPeA)	**2706-90-3**	**PFAS by ID SOP**	**0.33**	**J**	**1.6**	0.80	**0.33**	**ug/kg**	**1**
Perfluoro-n-tetradecanoic acid (PFTeDA)	**376-06-7**	**PFAS by ID SOP**	**0.56**	**J**	**1.6**	0.80	**0.33**	**ug/kg**	**1**
Perfluoro-n-tridecanoic acid (PFTrDA)	**72629-94-8**	**PFAS by ID SOP**	**0.69**	**J**	**1.6**	0.80	**0.33**	**ug/kg**	**1**
Perfluoro-n-undecanoic acid (PFUdA)	**2058-94-8**	**PFAS by ID SOP**	**2.7**		**1.6**	0.80	**0.33**	**ug/kg**	**1**
Perfluorooctanesulfonic acid (PFOS)	**1763-23-1**	**PFAS by ID SOP**	**430**		**8.2**	4.1	**1.6**	**ug/kg**	**2**

Surrogate	Run 1 Q	Run 1 % Recovery	Run 1 Acceptance Limits	Run 2 Q	Run 2 % Recovery	Run 2 Acceptance Limits
13C2_4:2FTS		91	50-150		92	50-150
13C2_6:2FTS		99	50-150		95	50-150
13C2_8:2FTS		91	50-150		91	50-150
13C2_PFDoA		82	50-150		93	50-150
13C2_PFTeDA		81	50-150		91	50-150
13C3_PFBS		82	50-150		94	50-150
13C3_PFHxS		81	50-150		96	50-150
13C4_PFBA		85	50-150		94	50-150
13C4_PFHpA		82	50-150		93	50-150
13C5_PFHxA		78	50-150		90	50-150
13C5_PFPeA		85	50-150		94	50-150
13C6_PFDA		83	50-150		91	50-150
13C7_PFUdA		84	50-150		100	50-150
13C8_PFOA		85	50-150		87	50-150
13C8_PFOS		77	50-150		98	50-150
13C8_PFOSA		96	50-150		99	50-150

LOQ = Limit of Quantitation
B = Detected in the method blank
E = Quantitation of compound exceeded the calibration range
DL = Detection Limit
Q = Surrogate failure
U = Not detected at or above the LOQ
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
J = Estimated result < LOQ and ≥ DL
L = LCS/LCSD failure
H = Out of holding time
W = Reported on wet weight basis
LOD = Limit of Detection
S = MS/MSD failure

PFAS by LC/MS/MS

Client: **Arcadis U.S., Inc.**		Laboratory ID: **WJ01060-002**	
Description: **393-1-F-2**		Matrix: **Solid**	
Date Sampled: **09/29/2021 1630**	Project Name: **Eielson AFB**	% Solids: **58.5**	**10/02/2021 1447**
Date Received: **10/01/2021**	Project Number: **30030317**		

Surrogate	Q	Run 1 % Recovery	Acceptance Limits	Q	Run 2 % Recovery	Acceptance Limits
13C9_PFNA		84	50-150		89	50-150
d5-EtFOSAA		97	50-150		97	50-150
d-MeFOSA		101	50-150		100	50-150
d3-MeFOSAA		88	50-150		92	50-150

LOQ = Limit of Quantitation	B = Detected in the method blank	E = Quantitation of compound exceeded the calibration range	DL = Detection Limit	Q = Surrogate failure
U = Not detected at or above the LOQ	N = Recovery is out of criteria	P = The RPD between two GC columns exceeds 40%	J = Estimated result < LOQ and ≥ DL	L = LCS/LCSD failure
H = Out of holding time	W = Reported on wet weight basis	LOD = Limit of Detection		S = MS/MSD failure

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SPLP PFAS

Client: **Arcadis U.S., Inc.** Laboratory ID: **WJ01060-002**

Description: **393-1-F-2** Matrix: **Solid**

Date Sampled: **09/29/2021 1630** Project Name: **Eielson AFB** % Solids: **58.5** **10/02/2021 1447**

Date Received: **10/01/2021** Project Number: **30030317**

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch	Leachate Date
1	1312/PFAS	PFAS by ID SOP QSM B-15	1	10/21/2021 1631	JJG	10/20/2021 1345	19466	10/16/2021 0006
2	1312/PFAS	PFAS by ID SOP QSM B-15	5	10/24/2021 1607	JJG	10/20/2021 1345	19466	10/16/2021 0006

Parameter	CAS Number	Analytical Method	Result	Q	LOQ	LOD	DL	Units	Run
1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS)	**39108-34-4**	**PFAS by ID SOP**	**620**		**80**	40	**20**	**ng/L**	**1**
1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS)	**27619-97-2**	**PFAS by ID SOP**	**53**	**J**	**80**	40	**20**	**ng/L**	**1**
1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS)	757124-72-4	PFAS by ID SOP	40	U	80	40	20	ng/L	1
N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA)	2991-50-6	PFAS by ID SOP	40	U	80	40	20	ng/L	1
N-methylperfluoro-1-octanesulfonamide (MeFOSA)	31506-32-8	PFAS by ID SOP	80	U	160	80	40	ng/L	1
N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA)	2355-31-9	PFAS by ID SOP	40	U	80	40	20	ng/L	1
Perfluoro-1-butanesulfonic acid (PFBS)	375-73-5	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-1-decanesulfonic acid (PFDS)	335-77-3	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-1-heptanesulfonic acid (PFHpS)	375-92-8	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-1-nonanesulfonic acid (PFNS)	**68259-12-1**	**PFAS by ID SOP**	**160**	**J**	**200**	100	**50**	**ng/L**	**2**
Perfluoro-1-octanesulfonamide (PFOSA)	**754-91-6**	**PFAS by ID SOP**	**270**		**40**	20	**10**	**ng/L**	**1**
Perfluoro-1-pentanesulfonic acid (PFPeS)	**2706-91-4**	**PFAS by ID SOP**	**17**	**J**	**40**	20	**10**	**ng/L**	**1**
Perfluorohexanesulfonic acid (PFHxS)	**355-46-4**	**PFAS by ID SOP**	**300**		**40**	20	**10**	**ng/L**	**1**
Perfluoro-n-butanoic acid (PFBA)	375-22-4	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-n-decanoic acid (PFDA)	**335-76-2**	**PFAS by ID SOP**	**39**	**J**	**40**	20	**10**	**ng/L**	**1**
Perfluoro-n-dodecanoic acid (PFDoA)	307-55-1	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-n-heptanoic acid (PFHpA)	375-85-9	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-n-hexanoic acid (PFHxA)	**307-24-4**	**PFAS by ID SOP**	**43**		**40**	20	**10**	**ng/L**	**1**
Perfluoro-n-nonanoic acid (PFNA)	375-95-1	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-n-octanoic acid (PFOA)	**335-67-1**	**PFAS by ID SOP**	**56**		**40**	20	**10**	**ng/L**	**1**
Perfluoro-n-pentanoic acid (PFPeA)	2706-90-3	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-n-tetradecanoic acid (PFTeDA)	376-06-7	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-n-tridecanoic acid (PFTrDA)	72629-94-8	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-n-undecanoic acid (PFUdA)	**2058-94-8**	**PFAS by ID SOP**	**21**	**J**	**40**	20	**10**	**ng/L**	**1**
Perfluorooctanesulfonic acid (PFOS)	**1763-23-1**	**PFAS by ID SOP**	**11000**		**200**	100	**50**	**ng/L**	**2**

Surrogate	Q	Run 1 % Recovery	Acceptance Limits	Q	Run 2 % Recovery	Acceptance Limits
13C2_4:2FTS		107	50-150		87	50-150
13C2_6:2FTS		109	50-150		84	50-150
13C2_8:2FTS		94	50-150		88	50-150
13C2_PFDoA		89	50-150		86	50-150
13C2_PFTeDA		94	50-150		91	50-150
13C3_PFBS		95	50-150		96	50-150
13C3_PFHxS		99	50-150		91	50-150
13C4_PFBA		93	50-150		92	50-150
13C4_PFHpA		92	50-150		95	50-150
13C5_PFHxA		96	50-150		91	50-150
13C5_PFPeA		95	50-150		88	50-150
13C6_PFDA		91	50-150		93	50-150
13C7_PFUdA		89	50-150		95	50-150
13C8_PFOA		93	50-150		90	50-150
13C8_PFOS		92	50-150		80	50-150
13C8_PFOSA		105	50-150		88	50-150

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

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SPLP PFAS

Client: **Arcadis U.S., Inc.**		Laboratory ID: **WJ01060-002**	
Description: **393-1-F-2**		Matrix: **Solid**	
Date Sampled: **09/29/2021 1630**	Project Name: **Eielson AFB**	% Solids: **58.5**	**10/02/2021 1447**
Date Received: **10/01/2021**	Project Number: **30030317**		

Surrogate	Q	Run 1 % Recovery	Acceptance Limits	Q	Run 2 % Recovery	Acceptance Limits
13C9_PFNA		91	50-150		88	50-150
d5-EtFOSAA		104	50-150		84	50-150
d-MeFOSA		85	50-150		88	50-150
d3-MeFOSAA		101	50-150		87	50-150

LOQ = Limit of Quantitation	B = Detected in the method blank	E = Quantitation of compound exceeded the calibration range	DL = Detection Limit	Q = Surrogate failure
U = Not detected at or above the LOQ	N = Recovery is out of criteria	P = The RPD between two GC columns exceeds 40%	J = Estimated result < LOQ and ≥ DL	L = LCS/LCSD failure
H = Out of holding time	W = Reported on wet weight basis	LOD = Limit of Detection		S = MS/MSD failure

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PFAS by LC/MS/MS

Client: **Arcadis U.S., Inc.**		Laboratory ID: **WJ01060-003**	
Description: **393-1-F-3**		Matrix: **Solid**	
Date Sampled: **09/29/2021 1700**	Project Name: **Eielson AFB**	% Solids: **54.3**	**10/02/2021 1447**
Date Received: **10/01/2021**	Project Number: **30030317**		

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch
1	SOP SPE	PFAS by ID SOP QSM B-15	1	10/04/2021 1518	JJG	10/03/2021 1401	17485
2	SOP SPE	PFAS by ID SOP QSM B-15	5	10/05/2021 1554	JJG	10/03/2021 1401	17485

Parameter	CAS Number	Analytical Method	Result	Q	LOQ	LOD	DL	Units	Run
1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS)	**39108-34-4**	**PFAS by ID SOP**	**31**		**3.5**	1.8	**0.88**	**ug/kg**	**1**
1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS)	**27619-97-2**	**PFAS by ID SOP**	**2.4**	**J**	**3.5**	1.8	**0.88**	**ug/kg**	**1**
1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS)	757124-72-4	PFAS by ID SOP	1.8	U	3.5	1.8	0.88	ug/kg	1
N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA)	2991-50-6	PFAS by ID SOP	1.8	U	3.5	1.8	0.88	ug/kg	1
N-methylperfluoro-1-octanesulfonamide (MeFOSA)	31506-32-8	PFAS by ID SOP	1.8	U	3.5	1.8	0.88	ug/kg	1
N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA)	2355-31-9	PFAS by ID SOP	1.8	U	3.5	1.8	0.88	ug/kg	1
Perfluoro-1-butanesulfonic acid (PFBS)	**375-73-5**	**PFAS by ID SOP**	**0.75**	**J**	**1.8**	0.90	**0.35**	**ug/kg**	**1**
Perfluoro-1-decanesulfonic acid (PFDS)	**335-77-3**	**PFAS by ID SOP**	**12**		**1.8**	0.90	**0.35**	**ug/kg**	**1**
Perfluoro-1-heptanesulfonic acid (PFHpS)	**375-92-8**	**PFAS by ID SOP**	**0.79**	**J**	**1.8**	0.90	**0.35**	**ug/kg**	**1**
Perfluoro-1-nonanesulfonic acid (PFNS)	**68259-12-1**	**PFAS by ID SOP**	**11**		**1.8**	0.90	**0.35**	**ug/kg**	**1**
Perfluoro-1-octanesulfonamide (PFOSA)	**754-91-6**	**PFAS by ID SOP**	**14**		**1.8**	0.90	**0.35**	**ug/kg**	**1**
Perfluoro-1-pentanesulfonic acid (PFPeS)	**2706-91-4**	**PFAS by ID SOP**	**1.2**	**J**	**1.8**	0.90	**0.35**	**ug/kg**	**1**
Perfluorohexanesulfonic acid (PFHxS)	**355-46-4**	**PFAS by ID SOP**	**18**		**1.8**	0.90	**0.35**	**ug/kg**	**1**
Perfluoro-n-butanoic acid (PFBA)	375-22-4	PFAS by ID SOP	0.90	U	1.8	0.90	0.35	ug/kg	1
Perfluoro-n-decanoic acid (PFDA)	**335-76-2**	**PFAS by ID SOP**	**2.2**		**1.8**	0.90	**0.35**	**ug/kg**	**1**
Perfluoro-n-dodecanoic acid (PFDoA)	**307-55-1**	**PFAS by ID SOP**	**2.5**		**1.8**	0.90	**0.35**	**ug/kg**	**1**
Perfluoro-n-heptanoic acid (PFHpA)	**375-85-9**	**PFAS by ID SOP**	**0.54**	**J**	**1.8**	0.90	**0.35**	**ug/kg**	**1**
Perfluoro-n-hexanoic acid (PFHxA)	**307-24-4**	**PFAS by ID SOP**	**1.9**		**1.8**	0.90	**0.35**	**ug/kg**	**1**
Perfluoro-n-nonanoic acid (PFNA)	**375-95-1**	**PFAS by ID SOP**	**0.40**	**J**	**1.8**	0.90	**0.35**	**ug/kg**	**1**
Perfluoro-n-octanoic acid (PFOA)	**335-67-1**	**PFAS by ID SOP**	**3.1**		**1.8**	0.90	**0.35**	**ug/kg**	**1**
Perfluoro-n-pentanoic acid (PFPeA)	**2706-90-3**	**PFAS by ID SOP**	**0.40**	**J**	**1.8**	0.90	**0.35**	**ug/kg**	**1**
Perfluoro-n-tetradecanoic acid (PFTeDA)	**376-06-7**	**PFAS by ID SOP**	**0.52**	**J**	**1.8**	0.90	**0.35**	**ug/kg**	**1**
Perfluoro-n-tridecanoic acid (PFTrDA)	**72629-94-8**	**PFAS by ID SOP**	**0.77**	**J**	**1.8**	0.90	**0.35**	**ug/kg**	**1**
Perfluoro-n-undecanoic acid (PFUdA)	**2058-94-8**	**PFAS by ID SOP**	**3.0**		**1.8**	0.90	**0.35**	**ug/kg**	**1**
Perfluorooctanesulfonic acid (PFOS)	**1763-23-1**	**PFAS by ID SOP**	**480**		**8.8**	4.4	**1.8**	**ug/kg**	**2**

Surrogate	Run 1 Q	Run 1 % Recovery	Run 1 Acceptance Limits	Run 2 Q	Run 2 % Recovery	Run 2 Acceptance Limits
13C2_4:2FTS		100	50-150		93	50-150
13C2_6:2FTS		101	50-150		112	50-150
13C2_8:2FTS		101	50-150		92	50-150
13C2_PFDoA		84	50-150		101	50-150
13C2_PFTeDA		85	50-150		95	50-150
13C3_PFBS		87	50-150		101	50-150
13C3_PFHxS		87	50-150		104	50-150
13C4_PFBA		90	50-150		101	50-150
13C4_PFHpA		85	50-150		99	50-150
13C5_PFHxA		84	50-150		100	50-150
13C5_PFPeA		89	50-150		105	50-150
13C6_PFDA		88	50-150		95	50-150
13C7_PFUdA		88	50-150		105	50-150
13C8_PFOA		88	50-150		96	50-150
13C8_PFOS		82	50-150		105	50-150
13C8_PFOSA		107	50-150		108	50-150

LOQ = Limit of Quantitation	B = Detected in the method blank	E = Quantitation of compound exceeded the calibration range	DL = Detection Limit	Q = Surrogate failure
U = Not detected at or above the LOQ	N = Recovery is out of criteria	P = The RPD between two GC columns exceeds 40%	J = Estimated result < LOQ and ≥ DL	L = LCS/LCSD failure
H = Out of holding time	W = Reported on wet weight basis	LOD = Limit of Detection		S = MS/MSD failure

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PFAS by LC/MS/MS

Client: **Arcadis U.S., Inc.**		Laboratory ID: **WJ01060-003**	
Description: **393-1-F-3**		Matrix: **Solid**	
Date Sampled: **09/29/2021 1700**	Project Name: **Eielson AFB**	% Solids: **54.3**	**10/02/2021 1447**
Date Received: **10/01/2021**	Project Number: **30030317**		

Surrogate	Q	Run 1 % Recovery	Acceptance Limits	Q	Run 2 % Recovery	Acceptance Limits
13C9_PFNA		88	50-150		96	50-150
d5-EtFOSAA		100	50-150		102	50-150
d-MeFOSA		100	50-150		103	50-150
d3-MeFOSAA		92	50-150		97	50-150

LOQ = Limit of Quantitation	B = Detected in the method blank	E = Quantitation of compound exceeded the calibration range	DL = Detection Limit	Q = Surrogate failure
U = Not detected at or above the LOQ	N = Recovery is out of criteria	P = The RPD between two GC columns exceeds 40%	J = Estimated result < LOQ and ≥ DL	L = LCS/LCSD failure
H = Out of holding time	W = Reported on wet weight basis	LOD = Limit of Detection		S = MS/MSD failure

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SPLP PFAS

Client: **Arcadis U.S., Inc.**		Laboratory ID: **WJ01060-003**	
Description: **393-1-F-3**		Matrix: **Solid**	
Date Sampled: **09/29/2021 1700**	Project Name: **Eielson AFB**	% Solids: **54.3**	**10/02/2021 1447**
Date Received: **10/01/2021**	Project Number: **30030317**		

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch	Leachate Date
1	1312/PFAS	PFAS by ID SOP QSM B-15	1	10/21/2021 1641	JJG	10/20/2021 1345	19466	10/16/2021 0006
2	1312/PFAS	PFAS by ID SOP QSM B-15	5	10/24/2021 1617	JJG	10/20/2021 1345	19466	10/16/2021 0006

Parameter	CAS Number	Analytical Method	Result	Q	LOQ	LOD	DL	Units	Run
1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS)	**39108-34-4**	**PFAS by ID SOP**	**600**		**80**	40	**20**	**ng/L**	**1**
1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS)	**27619-97-2**	**PFAS by ID SOP**	**41**	**J**	**80**	40	**20**	**ng/L**	**1**
1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS)	757124-72-4	PFAS by ID SOP	40	U	80	40	20	ng/L	1
N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA)	2991-50-6	PFAS by ID SOP	40	U	80	40	20	ng/L	1
N-methylperfluoro-1-octanesulfonamide (MeFOSA)	31506-32-8	PFAS by ID SOP	80	U	160	80	40	ng/L	1
N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA)	2355-31-9	PFAS by ID SOP	40	U	80	40	20	ng/L	1
Perfluoro-1-butanesulfonic acid (PFBS)	375-73-5	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-1-decanesulfonic acid (PFDS)	335-77-3	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-1-heptanesulfonic acid (PFHpS)	375-92-8	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-1-nonanesulfonic acid (PFNS)	**68259-12-1**	**PFAS by ID SOP**	**120**	**J**	**200**	100	**50**	**ng/L**	**2**
Perfluoro-1-octanesulfonamide (PFOSA)	**754-91-6**	**PFAS by ID SOP**	**260**		**40**	20	**10**	**ng/L**	**1**
Perfluoro-1-pentanesulfonic acid (PFPeS)	**2706-91-4**	**PFAS by ID SOP**	**15**	**J**	**40**	20	**10**	**ng/L**	**1**
Perfluorohexanesulfonic acid (PFHxS)	**355-46-4**	**PFAS by ID SOP**	**290**		**40**	20	**10**	**ng/L**	**1**
Perfluoro-n-butanoic acid (PFBA)	375-22-4	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-n-decanoic acid (PFDA)	**335-76-2**	**PFAS by ID SOP**	**39**	**J**	**40**	20	**10**	**ng/L**	**1**
Perfluoro-n-dodecanoic acid (PFDoA)	307-55-1	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-n-heptanoic acid (PFHpA)	375-85-9	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-n-hexanoic acid (PFHxA)	**307-24-4**	**PFAS by ID SOP**	**41**		**40**	20	**10**	**ng/L**	**1**
Perfluoro-n-nonanoic acid (PFNA)	375-95-1	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-n-octanoic acid (PFOA)	**335-67-1**	**PFAS by ID SOP**	**58**		**40**	20	**10**	**ng/L**	**1**
Perfluoro-n-pentanoic acid (PFPeA)	2706-90-3	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-n-tetradecanoic acid (PFTeDA)	376-06-7	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-n-tridecanoic acid (PFTrDA)	72629-94-8	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-n-undecanoic acid (PFUdA)	**2058-94-8**	**PFAS by ID SOP**	**20**	**J**	**40**	20	**10**	**ng/L**	**1**
Perfluorooctanesulfonic acid (PFOS)	**1763-23-1**	**PFAS by ID SOP**	**8900**		**200**	100	**50**	**ng/L**	**2**

Surrogate	Run 1 Q	Run 1 % Recovery	Run 1 Acceptance Limits	Run 2 Q	Run 2 % Recovery	Run 2 Acceptance Limits
13C2_4:2FTS		100	50-150		88	50-150
13C2_6:2FTS		99	50-150		86	50-150
13C2_8:2FTS		100	50-150		92	50-150
13C2_PFDoA		90	50-150		97	50-150
13C2_PFTeDA		90	50-150		92	50-150
13C3_PFBS		88	50-150		93	50-150
13C3_PFHxS		92	50-150		93	50-150
13C4_PFBA		88	50-150		94	50-150
13C4_PFHpA		89	50-150		93	50-150
13C5_PFHxA		92	50-150		95	50-150
13C5_PFPeA		93	50-150		92	50-150
13C6_PFDA		89	50-150		95	50-150
13C7_PFUdA		86	50-150		92	50-150
13C8_PFOA		87	50-150		94	50-150
13C8_PFOS		88	50-150		84	50-150
13C8_PFOSA		96	50-150		88	50-150

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

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SPLP PFAS

Client: **Arcadis U.S., Inc.**		Laboratory ID: **WJ01060-003**	
Description: **393-1-F-3**		Matrix: **Solid**	
Date Sampled: **09/29/2021 1700**	Project Name: **Eielson AFB**	% Solids: **54.3**	**10/02/2021 1447**
Date Received: **10/01/2021**	Project Number: **30030317**		

Surrogate	Q	Run 1 % Recovery	Acceptance Limits	Q	Run 2 % Recovery	Acceptance Limits
13C9_PFNA		88	50-150		89	50-150
d5-EtFOSAA		101	50-150		85	50-150
d-MeFOSA		94	50-150		97	50-150
d3-MeFOSAA		93	50-150		87	50-150

LOQ = Limit of Quantitation	B = Detected in the method blank	E = Quantitation of compound exceeded the calibration range	DL = Detection Limit	Q = Surrogate failure
U = Not detected at or above the LOQ	N = Recovery is out of criteria	P = The RPD between two GC columns exceeds 40%	J = Estimated result < LOQ and ≥ DL	L = LCS/LCSD failure
H = Out of holding time	W = Reported on wet weight basis	LOD = Limit of Detection		S = MS/MSD failure

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QC Summary

PFAS by LC/MS/MS - MB

Sample ID: WQ17485-001
Batch: 17485
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Solid
Prep Method: SOP SPE
Prep Date: 10/03/2021 1401

Parameter	Result	Q	Dil	LOQ	LOD	DL	Units	Analysis Date
8:2 FTS	1.0	U	1	2.0	1.0	0.50	ug/kg	10/04/2021 1436
6:2 FTS	1.0	U	1	2.0	1.0	0.50	ug/kg	10/04/2021 1436
4:2 FTS	1.0	U	1	2.0	1.0	0.50	ug/kg	10/04/2021 1436
EtFOSAA	1.0	U	1	2.0	1.0	0.50	ug/kg	10/04/2021 1436
MeFOSA	1.0	U	1	2.0	1.0	0.50	ug/kg	10/04/2021 1436
MeFOSAA	1.0	U	1	2.0	1.0	0.50	ug/kg	10/04/2021 1436
PFBS	0.50	U	1	1.0	0.50	0.20	ug/kg	10/04/2021 1436
PFDS	0.50	U	1	1.0	0.50	0.20	ug/kg	10/04/2021 1436
PFHpS	0.50	U	1	1.0	0.50	0.20	ug/kg	10/04/2021 1436
PFNS	0.50	U	1	1.0	0.50	0.20	ug/kg	10/04/2021 1436
PFOSA	0.50	U	1	1.0	0.50	0.20	ug/kg	10/04/2021 1436
PFPeS	0.50	U	1	1.0	0.50	0.20	ug/kg	10/04/2021 1436
PFHxS	0.50	U	1	1.0	0.50	0.20	ug/kg	10/04/2021 1436
PFBA	0.50	U	1	1.0	0.50	0.20	ug/kg	10/04/2021 1436
PFDA	0.50	U	1	1.0	0.50	0.20	ug/kg	10/04/2021 1436
PFDoA	0.50	U	1	1.0	0.50	0.20	ug/kg	10/04/2021 1436
PFHpA	0.50	U	1	1.0	0.50	0.20	ug/kg	10/04/2021 1436
PFHxA	0.50	U	1	1.0	0.50	0.20	ug/kg	10/04/2021 1436
PFNA	0.50	U	1	1.0	0.50	0.20	ug/kg	10/04/2021 1436
PFOA	0.50	U	1	1.0	0.50	0.20	ug/kg	10/04/2021 1436
PFPeA	0.50	U	1	1.0	0.50	0.20	ug/kg	10/04/2021 1436
PFTeDA	0.50	U	1	1.0	0.50	0.20	ug/kg	10/04/2021 1436
PFTrDA	0.50	U	1	1.0	0.50	0.20	ug/kg	10/04/2021 1436
PFUdA	0.50	U	1	1.0	0.50	0.20	ug/kg	10/04/2021 1436
PFOS	0.50	U	1	1.0	0.50	0.20	ug/kg	10/04/2021 1436

Surrogate	Q	% Rec	Acceptance Limit
13C2_4:2FTS		97	50-150
13C2_6:2FTS		119	50-150
13C2_8:2FTS		86	50-150
13C2_PFDoA		87	50-150
13C2_PFTeDA		90	50-150
13C3_PFBS		91	50-150
13C3_PFHxS		88	50-150
13C4_PFBA		92	50-150
13C4_PFHpA		88	50-150
13C5_PFHxA		88	50-150
13C5_PFPeA		89	50-150
13C6_PFDA		98	50-150
13C7_PFUdA		90	50-150
13C8_PFOA		93	50-150

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

PFAS by LC/MS/MS - MB

Sample ID: WQ17485-001
Batch: 17485
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Solid
Prep Method: SOP SPE
Prep Date: 10/03/2021 1401

Surrogate	Q	% Rec	Acceptance Limit
13C8_PFOS		91	50-150
13C8_PFOSA		106	50-150
13C9_PFNA		94	50-150
d5-EtFOSAA		102	50-150
d-MeFOSA		109	50-150
d3-MeFOSAA		98	50-150

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

PFAS by LC/MS/MS - LCS

Sample ID: WQ17485-002
Batch: 17485
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Solid
Prep Method: SOP SPE
Prep Date: 10/03/2021 1401

Parameter	Spike Amount (ug/kg)	Result (ug/kg)	Q	Dil	% Rec	%Rec Limit	Analysis Date
8:2 FTS	1.9	2.4		1	125	65-137	10/04/2021 1446
6:2 FTS	1.9	2.6		1	140	64-140	10/04/2021 1446
4:2 FTS	1.9	1.8		1	99	62-145	10/04/2021 1446
EtFOSAA	2.0	1.9		1	93	61-139	10/04/2021 1446
MeFOSA	2.0	2.0		1	99	70-150	10/04/2021 1446
MeFOSAA	2.0	1.9		1	93	63-144	10/04/2021 1446
PFBS	1.8	1.6		1	91	72-128	10/04/2021 1446
PFDS	1.9	2.1		1	110	59-134	10/04/2021 1446
PFHpS	1.9	2.0		1	105	70-132	10/04/2021 1446
PFNS	1.9	2.4		1	123	69-125	10/04/2021 1446
PFOSA	2.0	1.8		1	88	67-137	10/04/2021 1446
PFPeS	1.9	1.8		1	99	73-123	10/04/2021 1446
PFHxS	1.8	1.6		1	89	67-130	10/04/2021 1446
PFBA	2.0	2.0		1	100	71-135	10/04/2021 1446
PFDA	2.0	2.2		1	111	69-133	10/04/2021 1446
PFDoA	2.0	1.9		1	95	69-135	10/04/2021 1446
PFHpA	2.0	1.9		1	96	71-131	10/04/2021 1446
PFHxA	2.0	2.0		1	100	70-132	10/04/2021 1446
PFNA	2.0	2.0		1	99	72-129	10/04/2021 1446
PFOA	2.0	2.0		1	102	69-133	10/04/2021 1446
PFPeA	2.0	1.9		1	95	69-132	10/04/2021 1446
PFTeDA	2.0	2.1		1	104	69-133	10/04/2021 1446
PFTrDA	2.0	1.9		1	96	66-139	10/04/2021 1446
PFUdA	2.0	1.9		1	97	64-136	10/04/2021 1446
PFOS	1.9	1.9		1	101	68-136	10/04/2021 1446

Surrogate	Q	% Rec	Acceptance Limit
13C2_4:2FTS		95	50-150
13C2_6:2FTS		103	50-150
13C2_8:2FTS		93	50-150
13C2_PFDoA		87	50-150
13C2_PFTeDA		89	50-150
13C3_PFBS		95	50-150
13C3_PFHxS		91	50-150
13C4_PFBA		93	50-150
13C4_PFHpA		87	50-150
13C5_PFHxA		85	50-150
13C5_PFPeA		94	50-150
13C6_PFDA		92	50-150
13C7_PFUdA		92	50-150
13C8_PFOA		92	50-150

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

PFAS by LC/MS/MS - LCS

Sample ID: WQ17485-002
Batch: 17485
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Solid
Prep Method: SOP SPE
Prep Date: 10/03/2021 1401

Surrogate	Q	% Rec	Acceptance Limit
13C8_PFOS		91	50-150
13C8_PFOSA		107	50-150
13C9_PFNA		97	50-150
d5-EtFOSAA		103	50-150
d-MeFOSA		101	50-150
d3-MeFOSAA		93	50-150

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

SPLP PFAS - MB

Sample ID: WQ19466-001
Batch: 19466
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Solid
Prep Method: 1312/PFAS
Prep Date: 10/20/2021 1345 **Leachate Date:** 10/16/2021 0006

Parameter	Result	Q	Dil	LOQ	LOD	DL	Units	Analysis Date
8:2 FTS	40	U	1	80	40	20	ng/L	10/21/2021 1343
6:2 FTS	40	U	1	80	40	20	ng/L	10/21/2021 1343
4:2 FTS	40	U	1	80	40	20	ng/L	10/21/2021 1343
EtFOSAA	40	U	1	80	40	20	ng/L	10/21/2021 1343
MeFOSA	80	U	1	160	80	40	ng/L	10/21/2021 1343
MeFOSAA	40	U	1	80	40	20	ng/L	10/21/2021 1343
PFBS	20	U	1	40	20	10	ng/L	10/21/2021 1343
PFDS	20	U	1	40	20	10	ng/L	10/21/2021 1343
PFHpS	20	U	1	40	20	10	ng/L	10/21/2021 1343
PFNS	20	U	1	40	20	10	ng/L	10/21/2021 1343
PFOSA	20	U	1	40	20	10	ng/L	10/21/2021 1343
PFPeS	20	U	1	40	20	10	ng/L	10/21/2021 1343
PFHxS	20	U	1	40	20	10	ng/L	10/21/2021 1343
PFBA	20	U	1	40	20	10	ng/L	10/21/2021 1343
PFDA	20	U	1	40	20	10	ng/L	10/21/2021 1343
PFDoA	20	U	1	40	20	10	ng/L	10/21/2021 1343
PFHpA	20	U	1	40	20	10	ng/L	10/21/2021 1343
PFHxA	20	U	1	40	20	10	ng/L	10/21/2021 1343
PFNA	20	U	1	40	20	10	ng/L	10/21/2021 1343
PFOA	20	U	1	40	20	10	ng/L	10/21/2021 1343
PFPeA	20	U	1	40	20	10	ng/L	10/21/2021 1343
PFTeDA	20	U	1	40	20	10	ng/L	10/21/2021 1343
PFTrDA	20	U	1	40	20	10	ng/L	10/21/2021 1343
PFUdA	20	U	1	40	20	10	ng/L	10/21/2021 1343
PFOS	20	U	1	40	20	10	ng/L	10/21/2021 1343

Surrogate	Q	% Rec	Acceptance Limit
13C2_4:2FTS		106	50-150
13C2_6:2FTS		102	50-150
13C2_8:2FTS		92	50-150
13C2_PFDoA		89	50-150
13C2_PFTeDA		89	50-150
13C3_PFBS		90	50-150
13C3_PFHxS		97	50-150
13C4_PFBA		94	50-150
13C4_PFHpA		88	50-150
13C5_PFHxA		94	50-150
13C5_PFPeA		92	50-150
13C6_PFDA		89	50-150
13C7_PFUdA		93	50-150
13C8_PFOA		93	50-150

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

SPLP PFAS - MB

Sample ID: WQ19466-001
Batch: 19466
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Solid
Prep Method: 1312/PFAS
Prep Date: 10/20/2021 1345 **Leachate Date:** 10/16/2021 0006

Surrogate	Q	% Rec	Acceptance Limit
13C8_PFOS		95	50-150
13C8_PFOSA		104	50-150
13C9_PFNA		97	50-150
d5-EtFOSAA		93	50-150
d-MeFOSA		96	50-150
d3-MeFOSAA		92	50-150

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

SPLP PFAS - LCS

Sample ID: WQ19466-002 **Matrix:** Solid
Batch: 19466 **Prep Method:** 1312/PFAS
Analytical Method: PFAS by ID SOP QSM B-15 **Prep Date:** 10/20/2021 1345 **Leachate Date:** 10/16/2021 0006

Parameter	Spike Amount (ng/L)	Result (ng/L)	Q	Dil	% Rec	%Rec Limit	Analysis Date
8:2 FTS	150	170		1	111	67-138	10/21/2021 1404
6:2 FTS	150	150		1	98	64-140	10/21/2021 1404
4:2 FTS	150	150		1	98	63-143	10/21/2021 1404
EtFOSAA	160	170		1	109	61-135	10/21/2021 1404
MeFOSA	160	130		1	78	68-141	10/21/2021 1404
MeFOSAA	160	160		1	103	65-136	10/21/2021 1404
PFBS	140	140		1	98	72-130	10/21/2021 1404
PFDS	150	150		1	99	53-142	10/21/2021 1404
PFHpS	150	140		1	94	69-134	10/21/2021 1404
PFNS	150	150		1	98	69-127	10/21/2021 1404
PFOSA	160	150		1	93	67-137	10/21/2021 1404
PFPeS	150	150		1	97	71-127	10/21/2021 1404
PFHxS	150	140		1	98	68-131	10/21/2021 1404
PFBA	160	150		1	95	73-129	10/21/2021 1404
PFDA	160	170		1	103	71-129	10/21/2021 1404
PFDoA	160	170		1	105	72-134	10/21/2021 1404
PFHpA	160	160		1	100	72-130	10/21/2021 1404
PFHxA	160	160		1	100	72-129	10/21/2021 1404
PFNA	160	160		1	99	69-130	10/21/2021 1404
PFOA	160	150		1	94	71-133	10/21/2021 1404
PFPeA	160	160		1	102	72-129	10/21/2021 1404
PFTeDA	160	170		1	104	71-132	10/21/2021 1404
PFTrDA	160	150		1	96	65-144	10/21/2021 1404
PFUdA	160	160		1	100	69-133	10/21/2021 1404
PFOS	150	140		1	97	65-140	10/21/2021 1404

Surrogate	Q	% Rec	Acceptance Limit
13C2_4:2FTS		105	50-150
13C2_6:2FTS		99	50-150
13C2_8:2FTS		100	50-150
13C2_PFDoA		92	50-150
13C2_PFTeDA		92	50-150
13C3_PFBS		96	50-150
13C3_PFHxS		96	50-150
13C4_PFBA		93	50-150
13C4_PFHpA		89	50-150
13C5_PFHxA		98	50-150
13C5_PFPeA		93	50-150
13C6_PFDA		90	50-150
13C7_PFUdA		90	50-150
13C8_PFOA		94	50-150

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
N = Recovery is out of criteria
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
* = RSD is out of criteria
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

SPLP PFAS - LCS

Sample ID: WQ19466-002
Batch: 19466
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Solid
Prep Method: 1312/PFAS
Prep Date: 10/20/2021 1345 **Leachate Date:** 10/16/2021 0006

Surrogate	Q	% Rec	Acceptance Limit
13C8_PFOS		103	50-150
13C8_PFOSA		97	50-150
13C9_PFNA		99	50-150
d5-EtFOSAA		99	50-150
d-MeFOSA		105	50-150
d3-MeFOSAA		91	50-150

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

Chain of Custody
and
Miscellaneous Documents

Pace Analytical®

PACE ANALYTICAL SERVICES, LLC
106 Vantage Point Drive • West Columbia, SC 29172
Telephone No. 803-791-9700 Fax No. 803-791-9111
www.pacelabs.com

Number 122684

Client: Arcadis	Report to Contact: Nathan Nagle	Telephone No. / E-mail: Nathan.Nagle@arcadis.com	Quote No.
Address: 10 Friends Lane, Ste 100	Sampler's Signature: X	Analysis (Attach list if more space is needed)	Page 1 of 1
City: Newtown / State: PA / Zip Code: 18940	Printed Name: Jacob Schenk		
Project Name: Eielson Soil Washing			

WJ01060

| Project No. | P.O. No. | | | Matrix | | | No of Containers by Preservative Type | | |

PaceAnalytical

Samples Receipt Checklist (SRC) (MED018C-15)
Issuing Authority: Pace ENV - WCOL

Revised:9/29/2020
Page 1 of 1

Sample Receipt Checklist (SRC)

Client: Arcadis Cooler Inspected by/date: KDRW / 10/01/2021 Lot #: WJ01050

Means of receipt: ☐ Pace ☐ Client: ☑ UPS ☐ FedEx ☐ Other:			
☐ Yes	☑ No		1. Were custody seals present on the cooler?
☐ Yes	☐ No	☑ NA	2. If custody seals were present, were they intact and unbroken?

pH Strip ID: NA Chlorine Strip ID: NA Tested by: NA

Original temperature upon receipt / Derived (Corrected) temperature upon receipt %Solid Snap-Cup ID: 21-1928

2.3 / 2.3 °C NA / NA °C NA / NA °C NA / NA °C

Method: ☑ Temperature Blank ☐ Against Bottles IR Gun ID: 5 IR Gun Correction Factor: 0 °C

Method of coolant: ☑ Wet Ice ☐ Ice Packs ☐ Dry Ice ☐ None

☐ Yes	☐ No	☑ NA	3. If temperature of any cooler exceeded 6.0°C, was Project Manager Notified? PM was Notified by: phone / email / face-to-face (circle one).
☑ Yes	☐ No	☐ NA	4. Is the commercial courier's packing slip attached to this form?
☑ Yes	☐ No		5. Were proper custody procedures (relinquished/received) followed?
☑ Yes	☐ No		6. Were sample IDs listed on the COC?
☑ Yes	☐ No		7. Were sample IDs listed on all sample containers?
☑ Yes	☐ No		8. Was collection date & time listed on the COC?
☑ Yes	☐ No		9. Was collection date & time listed on all sample containers?
☑ Yes	☐ No		10. Did all container label information (ID, date, time) agree with the COC?
☑ Yes	☐ No		11. Were tests to be performed listed on the COC?
☑ Yes	☐ No		12. Did all samples arrive in the proper containers for each test and/or in good condition (unbroken, lids on, etc.)?
☑ Yes	☐ No		13. Was adequate sample volume available?
☑ Yes	☐ No		14. Were all samples received within ½ the holding time or 48 hours, whichever comes first?
☐ Yes	☑ No		15. Were any samples containers missing/excess (circle one) samples Not listed on COC?
☐ Yes	☐ No	☑ NA	16. For VOA and RSK-175 samples, were bubbles present >"pea-size" (¼"or 6mm in diameter) in any of the VOA vials?
☐ Yes	☐ No	☑ NA	17. Were all DRO/metals/nutrient samples received at a pH of < 2?
☐ Yes	☐ No	☑ NA	18. Were all cyanide samples received at a pH > 12 and sulfide samples received at a pH > 9?
☐ Yes	☐ No	☑ NA	19. Were all applicable NH_3/TKN/cyanide/phenol/625.1/608.3 (< 0.5mg/L) samples free of residual chlorine?
☐ Yes	☐ No	☑ NA	20. Were client remarks/requests (i.e. requested dilutions, MS/MSD designations, etc…) correctly transcribed from the COC into the comment section in LIMS?
☑ Yes	☐ No		21. Was the quote number listed on the container label? If yes, Quote # 35048

Sample Preservation (Must be completed for any sample(s) incorrectly preserved or with headspace.)

Sample(s) NA were received incorrectly preserved and were adjusted accordingly in sample receiving with NA mL of circle one: H2SO4, HNO3, HCl, NaOH using SR # NA.
Time of preservation NA. If more than one preservative is needed, please note in the comments below.

Sample(s) NA were received with bubbles >6 mm in diameter.

Samples(s) NA were received with TRC > 0.5 mg/L (If #19 is ***no***) and were adjusted accordingly in sample receiving with sodium thiosulfate ($Na_2S_2O_3$) with Shealy ID: NA.

SR barcode labels applied by: KDRW Date: 10/01/2021

Comments:

Report of Analysis

Arcadis U.S., Inc.
630 Plaza Drive
Suite 600
Highlands Ranch, CO 80129
Attention: Joseph Quinnan

Project Name: Eielson AFB

Lot Number:**WI03029**

Date Completed:09/14/2021

09/15/2021 4:41 PM
Approved and released by:
Project Manager II: **Kathy E. Smith**

The electronic signature above is the equivalent of a handwritten signature.
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Pace Analytical Services, LLC (*formerly Shealy Environmental Services, Inc.*)
106 Vantage Point Drive West Columbia, SC 29172
Tel: 803-791-9700 Fax: 803-791-9111 www.pacelabs.com

Case Narrative
Arcadis U.S., Inc.
Lot Number: WI03029

All results listed in this report relate only to the samples that are contained within this report.

Sample receipt, sample analysis, and data review have been performed in accordance with the Pace Quality Assurance Management Plan (QAMP), applicable Shealy standard operating procedures (SOPs), the 2003 NELAC standard, and Shealy policies. Additionally, the DoD QSM version 5.3 has been followed for these samples, and specifically Table B-15 was followed for all PFAS samples. Any exceptions to the QAMP, SOPs, NELAC standards, the DoD QSM, or policies are qualified on the results page or discussed below.

All QC associated with these samples was in compliance with DOD QSM 5.3 table B-15 and our PFAS SOP.

Correction factors (CF) are used to calculate the original sample concentration. The CF is the inverse of the concentration factor (sample volume / extract final volume) times the dilution factor (DF). For undiluted analysis. For undiluted analysis, the extract is prepared for injection by adding 182 uL of sample extract + 8 uL of reagent water + 10 uL of internal standard solution to a polypropylene autosampler vial. An extra correction factor of 0.91 (182 uL / 200 uL = 0.91) applies. The CF is calculated as follows:

CF = DF * FV / Vo

FV is volume of extract (mL)
Vo is initial sample volume (mL)
DF is dilution factor. For undiluted analysis, DF = 1/0.91.

Sample concentration for aqueous samples:
Concentration (ng/L) = Cs*CF,

$$C_s = \frac{\left(\frac{(A_s x C_{is})}{A_{is}}\right) - B}{M1}$$

Where

C_s is on column concentration of target analyte in the sample (ng/L)
C_{is} is concentration of internal standard in the sample (ng/L)
A_s is peak response of target analyte in the sample
A_{is} is peak response of internal standard in the sample
M1 is the average RF from ICAL or the slope from linear regression ICAL
B is the y-intercept from the ICAL

Sample Summary

Arcadis U.S., Inc.

Lot Number: WI03029

Project Name: Eielson AFB

Project Number:

Sample Number	Sample ID	Matrix	Date Sampled	Date Received
001	382-5-UT-1	Solid	08/30/2021 0830	09/03/2021
002	382-5-UT-2	Solid	09/01/2021 1245	09/03/2021
003	382-5-G-1	Solid	09/01/2021 1245	09/03/2021

(3 samples)

Detection Summary

Arcadis U.S., Inc.

Lot Number: WI03029

Project Name: Eielson AFB

Project Number:

Sample	Sample ID	Matrix	Parameter	Method	Result	Q	Units	Page
001	382-5-UT-1	Solid	PFHxS	PFAS by ID	2.2		ug/kg	5
001	382-5-UT-1	Solid	PFOS	PFAS by ID	5.2		ug/kg	5
001	382-5-UT-1	Solid	PFHxS	PFAS by ID	82	J	ng/L	7
001	382-5-UT-1	Solid	PFOS	PFAS by ID	160		ng/L	7
002	382-5-UT-2	Solid	PFHxS	PFAS by ID	1.7		ug/kg	9
002	382-5-UT-2	Solid	PFOS	PFAS by ID	4.6		ug/kg	9
002	382-5-UT-2	Solid	PFHxS	PFAS by ID	65	J	ng/L	11
002	382-5-UT-2	Solid	PFOS	PFAS by ID	120		ng/L	11
003	382-5-G-1	Solid	PFBA	PFAS by ID	0.054	J	ug/kg	13

(9 detections)

PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: WI03029-001
Description: 382-5-UT-1 | Matrix: Solid
Date Sampled: 08/30/2021 0830 | Project Name: Eielson AFB | % Solids: 82.3 09/04/2021 2059
Date Received: 09/03/2021 | Project Number:

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch
1	SOP SPE	PFAS by ID SOP QSM B-15	1	09/05/2021 1530	MMM	09/03/2021 1900	14455

Parameter	CAS Number	Analytical Method	Result	Q	LOQ	LOD	DL	Units	Run
1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS)	39108-34-4	PFAS by ID SOP	1.1	U	2.2	1.1	0.55	ug/kg	1
1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS)	27619-97-2	PFAS by ID SOP	1.1	U	2.2	1.1	0.55	ug/kg	1
1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS)	757124-72-4	PFAS by ID SOP	1.1	U	2.2	1.1	0.55	ug/kg	1
N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA)	2991-50-6	PFAS by ID SOP	1.1	U	2.2	1.1	0.55	ug/kg	1
N-methylperfluoro-1-octanesulfonamide (MeFOSA)	31506-32-8	PFAS by ID SOP	1.1	U	2.2	1.1	0.55	ug/kg	1
N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA)	2355-31-9	PFAS by ID SOP	1.1	U	2.2	1.1	0.55	ug/kg	1
Perfluoro-1-butanesulfonic acid (PFBS)	375-73-5	PFAS by ID SOP	0.55	U	1.1	0.55	0.22	ug/kg	1
Perfluoro-1-decanesulfonic acid (PFDS)	335-77-3	PFAS by ID SOP	0.55	U	1.1	0.55	0.22	ug/kg	1
Perfluoro-1-heptanesulfonic acid (PFHpS)	375-92-8	PFAS by ID SOP	0.55	U	1.1	0.55	0.22	ug/kg	1
Perfluoro-1-nonanesulfonic acid (PFNS)	68259-12-1	PFAS by ID SOP	0.55	U	1.1	0.55	0.22	ug/kg	1
Perfluoro-1-octanesulfonamide (PFOSA)	754-91-6	PFAS by ID SOP	0.55	U	1.1	0.55	0.22	ug/kg	1
Perfluoro-1-pentanesulfonic acid (PFPeS)	2706-91-4	PFAS by ID SOP	0.55	U	1.1	0.55	0.22	ug/kg	1
Perfluorohexanesulfonic acid (PFHxS)	355-46-4	PFAS by ID SOP	2.2		1.1	0.55	0.22	ug/kg	1
Perfluoro-n-butanoic acid (PFBA)	375-22-4	PFAS by ID SOP	0.55	U	1.1	0.55	0.22	ug/kg	1
Perfluoro-n-decanoic acid (PFDA)	335-76-2	PFAS by ID SOP	0.55	U	1.1	0.55	0.22	ug/kg	1
Perfluoro-n-dodecanoic acid (PFDoA)	307-55-1	PFAS by ID SOP	0.55	U	1.1	0.55	0.22	ug/kg	1
Perfluoro-n-heptanoic acid (PFHpA)	375-85-9	PFAS by ID SOP	0.55	U	1.1	0.55	0.22	ug/kg	1
Perfluoro-n-hexanoic acid (PFHxA)	307-24-4	PFAS by ID SOP	0.55	U	1.1	0.55	0.22	ug/kg	1
Perfluoro-n-nonanoic acid (PFNA)	375-95-1	PFAS by ID SOP	0.55	U	1.1	0.55	0.22	ug/kg	1
Perfluoro-n-octanoic acid (PFOA)	335-67-1	PFAS by ID SOP	0.55	U	1.1	0.55	0.22	ug/kg	1
Perfluoro-n-pentanoic acid (PFPeA)	2706-90-3	PFAS by ID SOP	0.55	U	1.1	0.55	0.22	ug/kg	1
Perfluoro-n-tetradecanoic acid (PFTeDA)	376-06-7	PFAS by ID SOP	0.55	U	1.1	0.55	0.22	ug/kg	1
Perfluoro-n-tridecanoic acid (PFTrDA)	72629-94-8	PFAS by ID SOP	0.55	U	1.1	0.55	0.22	ug/kg	1
Perfluoro-n-undecanoic acid (PFUdA)	2058-94-8	PFAS by ID SOP	0.55	U	1.1	0.55	0.22	ug/kg	1
Perfluorooctanesulfonic acid (PFOS)	1763-23-1	PFAS by ID SOP	5.2		1.1	0.55	0.22	ug/kg	1

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
13C2_4:2FTS		91	50-150
13C2_6:2FTS		88	50-150
13C2_8:2FTS		79	50-150
13C2_PFDoA		94	50-150
13C2_PFTeDA		95	50-150
13C3_PFBS		87	50-150
13C3_PFHxS		90	50-150
13C4_PFBA		91	50-150
13C4_PFHpA		89	50-150
13C5_PFHxA		92	50-150
13C5_PFPeA		78	50-150
13C6_PFDA		86	50-150
13C7_PFUdA		86	50-150
13C8_PFOA		100	50-150
13C8_PFOS		89	50-150
13C8_PFOSA		103	50-150
13C9_PFNA		94	50-150

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

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PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.		Laboratory ID: WI03029-001	
Description: 382-5-UT-1		Matrix: Solid	
Date Sampled: 08/30/2021 0830	Project Name: Eielson AFB	% Solids: 82.3	09/04/2021 2059
Date Received: 09/03/2021	Project Number:		

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
d5-EtFOSAA		104	50-150
d-MeFOSA		94	50-150
d3-MeFOSAA		107	50-150

LOQ = Limit of Quantitation	B = Detected in the method blank	E = Quantitation of compound exceeded the calibration range	DL = Detection Limit	Q = Surrogate failure
U = Not detected at or above the LOQ	N = Recovery is out of criteria	P = The RPD between two GC columns exceeds 40%	J = Estimated result < LOQ and ≥ DL	L = LCS/LCSD failure
H = Out of holding time	W = Reported on wet weight basis	LOD = Limit of Detection		S = MS/MSD failure

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SPLP PFAS

Client: Arcadis U.S., Inc. | Laboratory ID: WI03029-001
Description: 382-5-UT-1 | Matrix: Solid
Date Sampled: 08/30/2021 0830 | Project Name: Eielson AFB | % Solids: 82.3 09/04/2021 2059
Date Received: 09/03/2021 | Project Number:

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch	Leachate Date
1	1312/PFAS	PFAS by ID SOP QSM B-15	1	09/12/2021 1904	JJG	09/10/2021 1856	15024	09/09/2021 2338

Parameter	CAS Number	Analytical Method	Result	Q	LOQ	LOD	DL	Units	Run
1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS)	39108-34-4	PFAS by ID SOP	100	U	200	100	50	ng/L	1
1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS)	27619-97-2	PFAS by ID SOP	100	U	200	100	50	ng/L	1
1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS)	757124-72-4	PFAS by ID SOP	100	U	200	100	50	ng/L	1
N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA)	2991-50-6	PFAS by ID SOP	100	U	200	100	50	ng/L	1
N-methylperfluoro-1-octanesulfonamide (MeFOSA)	31506-32-8	PFAS by ID SOP	200	U	400	200	100	ng/L	1
N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA)	2355-31-9	PFAS by ID SOP	100	U	200	100	50	ng/L	1
Perfluoro-1-butanesulfonic acid (PFBS)	375-73-5	PFAS by ID SOP	50	U	100	50	25	ng/L	1
Perfluoro-1-decanesulfonic acid (PFDS)	335-77-3	PFAS by ID SOP	50	U	100	50	25	ng/L	1
Perfluoro-1-heptanesulfonic acid (PFHpS)	375-92-8	PFAS by ID SOP	50	U	100	50	25	ng/L	1
Perfluoro-1-nonanesulfonic acid (PFNS)	68259-12-1	PFAS by ID SOP	50	U	100	50	25	ng/L	1
Perfluoro-1-octanesulfonamide (PFOSA)	754-91-6	PFAS by ID SOP	50	U	100	50	25	ng/L	1
Perfluoro-1-pentanesulfonic acid (PFPeS)	2706-91-4	PFAS by ID SOP	50	U	100	50	25	ng/L	1
Perfluorohexanesulfonic acid (PFHxS)	355-46-4	PFAS by ID SOP	82	J	100	50	25	ng/L	1
Perfluoro-n-butanoic acid (PFBA)	375-22-4	PFAS by ID SOP	50	U	100	50	25	ng/L	1
Perfluoro-n-decanoic acid (PFDA)	335-76-2	PFAS by ID SOP	50	U	100	50	25	ng/L	1
Perfluoro-n-dodecanoic acid (PFDoA)	307-55-1	PFAS by ID SOP	50	U	100	50	25	ng/L	1
Perfluoro-n-heptanoic acid (PFHpA)	375-85-9	PFAS by ID SOP	50	U	100	50	25	ng/L	1
Perfluoro-n-hexanoic acid (PFHxA)	307-24-4	PFAS by ID SOP	50	U	100	50	25	ng/L	1
Perfluoro-n-nonanoic acid (PFNA)	375-95-1	PFAS by ID SOP	50	U	100	50	25	ng/L	1
Perfluoro-n-octanoic acid (PFOA)	335-67-1	PFAS by ID SOP	50	U	100	50	25	ng/L	1
Perfluoro-n-pentanoic acid (PFPeA)	2706-90-3	PFAS by ID SOP	50	U	100	50	25	ng/L	1
Perfluoro-n-tetradecanoic acid (PFTeDA)	376-06-7	PFAS by ID SOP	50	U	100	50	25	ng/L	1
Perfluoro-n-tridecanoic acid (PFTrDA)	72629-94-8	PFAS by ID SOP	50	U	100	50	25	ng/L	1
Perfluoro-n-undecanoic acid (PFUdA)	2058-94-8	PFAS by ID SOP	50	U	100	50	25	ng/L	1
Perfluorooctanesulfonic acid (PFOS)	1763-23-1	PFAS by ID SOP	160		100	50	25	ng/L	1

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
13C2_4:2FTS		92	50-150
13C2_6:2FTS		88	50-150
13C2_8:2FTS		83	50-150
13C2_PFDoA		71	50-150
13C2_PFTeDA		72	50-150
13C3_PFBS		71	50-150
13C3_PFHxS		80	50-150
13C4_PFBA		85	50-150
13C4_PFHpA		82	50-150
13C5_PFHxA		84	50-150
13C5_PFPeA		80	50-150
13C6_PFDA		71	50-150
13C7_PFUdA		83	50-150
13C8_PFOA		80	50-150
13C8_PFOS		71	50-150
13C8_PFOSA		82	50-150
13C9_PFNA		90	50-150

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

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SPLP PFAS

Client: Arcadis U.S., Inc.		Laboratory ID: WI03029-001	
Description: 382-5-UT-1		Matrix: Solid	
Date Sampled: 08/30/2021 0830	Project Name: Eielson AFB	% Solids: 82.3	09/04/2021 2059
Date Received: 09/03/2021	Project Number:		

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
d5-EtFOSAA		79	50-150
d-MeFOSA		61	50-150
d3-MeFOSAA		103	50-150

LOQ = Limit of Quantitation	B = Detected in the method blank	E = Quantitation of compound exceeded the calibration range	DL = Detection Limit	Q = Surrogate failure
U = Not detected at or above the LOQ	N = Recovery is out of criteria	P = The RPD between two GC columns exceeds 40%	J = Estimated result < LOQ and ≥ DL	L = LCS/LCSD failure
H = Out of holding time	W = Reported on wet weight basis	LOD = Limit of Detection		S = MS/MSD failure

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PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: WI03029-002
Description: 382-5-UT-2 | Matrix: Solid
Date Sampled: 09/01/2021 1245 | Project Name: Eielson AFB | % Solids: 86.4 09/04/2021 2059
Date Received: 09/03/2021 | Project Number:

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch
1	SOP SPE	PFAS by ID SOP QSM B-15	1	09/05/2021 1540	MMM	09/03/2021 1900	14455

Parameter	CAS Number	Analytical Method	Result	Q	LOQ	LOD	DL	Units	Run
1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS)	39108-34-4	PFAS by ID SOP	1.1	U	2.2	1.1	0.55	ug/kg	1
1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS)	27619-97-2	PFAS by ID SOP	1.1	U	2.2	1.1	0.55	ug/kg	1
1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS)	757124-72-4	PFAS by ID SOP	1.1	U	2.2	1.1	0.55	ug/kg	1
N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA)	2991-50-6	PFAS by ID SOP	1.1	U	2.2	1.1	0.55	ug/kg	1
N-methylperfluoro-1-octanesulfonamide (MeFOSA)	31506-32-8	PFAS by ID SOP	1.1	U	2.2	1.1	0.55	ug/kg	1
N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA)	2355-31-9	PFAS by ID SOP	1.1	U	2.2	1.1	0.55	ug/kg	1
Perfluoro-1-butanesulfonic acid (PFBS)	375-73-5	PFAS by ID SOP	0.55	U	1.1	0.55	0.22	ug/kg	1
Perfluoro-1-decanesulfonic acid (PFDS)	335-77-3	PFAS by ID SOP	0.55	U	1.1	0.55	0.22	ug/kg	1
Perfluoro-1-heptanesulfonic acid (PFHpS)	375-92-8	PFAS by ID SOP	0.55	U	1.1	0.55	0.22	ug/kg	1
Perfluoro-1-nonanesulfonic acid (PFNS)	68259-12-1	PFAS by ID SOP	0.55	U	1.1	0.55	0.22	ug/kg	1
Perfluoro-1-octanesulfonamide (PFOSA)	754-91-6	PFAS by ID SOP	0.55	U	1.1	0.55	0.22	ug/kg	1
Perfluoro-1-pentanesulfonic acid (PFPeS)	2706-91-4	PFAS by ID SOP	0.55	U	1.1	0.55	0.22	ug/kg	1
Perfluorohexanesulfonic acid (PFHxS)	355-46-4	PFAS by ID SOP	1.7		1.1	0.55	0.22	ug/kg	1
Perfluoro-n-butanoic acid (PFBA)	375-22-4	PFAS by ID SOP	0.55	U	1.1	0.55	0.22	ug/kg	1
Perfluoro-n-decanoic acid (PFDA)	335-76-2	PFAS by ID SOP	0.55	U	1.1	0.55	0.22	ug/kg	1
Perfluoro-n-dodecanoic acid (PFDoA)	307-55-1	PFAS by ID SOP	0.55	U	1.1	0.55	0.22	ug/kg	1
Perfluoro-n-heptanoic acid (PFHpA)	375-85-9	PFAS by ID SOP	0.55	U	1.1	0.55	0.22	ug/kg	1
Perfluoro-n-hexanoic acid (PFHxA)	307-24-4	PFAS by ID SOP	0.55	U	1.1	0.55	0.22	ug/kg	1
Perfluoro-n-nonanoic acid (PFNA)	375-95-1	PFAS by ID SOP	0.55	U	1.1	0.55	0.22	ug/kg	1
Perfluoro-n-octanoic acid (PFOA)	335-67-1	PFAS by ID SOP	0.55	U	1.1	0.55	0.22	ug/kg	1
Perfluoro-n-pentanoic acid (PFPeA)	2706-90-3	PFAS by ID SOP	0.55	U	1.1	0.55	0.22	ug/kg	1
Perfluoro-n-tetradecanoic acid (PFTeDA)	376-06-7	PFAS by ID SOP	0.55	U	1.1	0.55	0.22	ug/kg	1
Perfluoro-n-tridecanoic acid (PFTrDA)	72629-94-8	PFAS by ID SOP	0.55	U	1.1	0.55	0.22	ug/kg	1
Perfluoro-n-undecanoic acid (PFUdA)	2058-94-8	PFAS by ID SOP	0.55	U	1.1	0.55	0.22	ug/kg	1
Perfluorooctanesulfonic acid (PFOS)	1763-23-1	PFAS by ID SOP	4.6		1.1	0.55	0.22	ug/kg	1

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
13C2_4:2FTS		83	50-150
13C2_6:2FTS		82	50-150
13C2_8:2FTS		77	50-150
13C2_PFDoA		85	50-150
13C2_PFTeDA		90	50-150
13C3_PFBS		87	50-150
13C3_PFHxS		91	50-150
13C4_PFBA		88	50-150
13C4_PFHpA		90	50-150
13C5_PFHxA		83	50-150
13C5_PFPeA		81	50-150
13C6_PFDA		79	50-150
13C7_PFUdA		81	50-150
13C8_PFOA		105	50-150
13C8_PFOS		73	50-150
13C8_PFOSA		98	50-150
13C9_PFNA		91	50-150

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

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PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.		Laboratory ID: WI03029-002	
Description: 382-5-UT-2		Matrix: Solid	
Date Sampled: 09/01/2021 1245	Project Name: Eielson AFB	% Solids: 86.4	09/04/2021 2059
Date Received: 09/03/2021	Project Number:		

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
d5-EtFOSAA		93	50-150
d-MeFOSA		86	50-150
d3-MeFOSAA		93	50-150

LOQ = Limit of Quantitation	B = Detected in the method blank	E = Quantitation of compound exceeded the calibration range	DL = Detection Limit	Q = Surrogate failure
U = Not detected at or above the LOQ	N = Recovery is out of criteria	P = The RPD between two GC columns exceeds 40%	J = Estimated result < LOQ and ≥ DL	L = LCS/LCSD failure
H = Out of holding time	W = Reported on wet weight basis	LOD = Limit of Detection		S = MS/MSD failure

SPLP PFAS

Client: Arcadis U.S., Inc. | Laboratory ID: WI03029-002
Description: 382-5-UT-2 | Matrix: Solid
Date Sampled: 09/01/2021 1245 | Project Name: Eielson AFB | % Solids: 86.4 09/04/2021 2059
Date Received: 09/03/2021 | Project Number:

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch	Leachate Date
1	1312/PFAS	PFAS by ID SOP QSM B-15	1	09/12/2021 1915	JJG	09/10/2021 1856	15024	09/09/2021 2338

Parameter	CAS Number	Analytical Method	Result	Q	LOQ	LOD	DL	Units	Run
1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS)	39108-34-4	PFAS by ID SOP	100	U	200	100	50	ng/L	1
1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS)	27619-97-2	PFAS by ID SOP	100	U	200	100	50	ng/L	1
1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS)	757124-72-4	PFAS by ID SOP	100	U	200	100	50	ng/L	1
N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA)	2991-50-6	PFAS by ID SOP	100	U	200	100	50	ng/L	1
N-methylperfluoro-1-octanesulfonamide (MeFOSA)	31506-32-8	PFAS by ID SOP	200	U	400	200	100	ng/L	1
N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA)	2355-31-9	PFAS by ID SOP	100	U	200	100	50	ng/L	1
Perfluoro-1-butanesulfonic acid (PFBS)	375-73-5	PFAS by ID SOP	50	U	100	50	25	ng/L	1
Perfluoro-1-decanesulfonic acid (PFDS)	335-77-3	PFAS by ID SOP	50	U	100	50	25	ng/L	1
Perfluoro-1-heptanesulfonic acid (PFHpS)	375-92-8	PFAS by ID SOP	50	U	100	50	25	ng/L	1
Perfluoro-1-nonanesulfonic acid (PFNS)	68259-12-1	PFAS by ID SOP	50	U	100	50	25	ng/L	1
Perfluoro-1-octanesulfonamide (PFOSA)	754-91-6	PFAS by ID SOP	50	U	100	50	25	ng/L	1
Perfluoro-1-pentanesulfonic acid (PFPeS)	2706-91-4	PFAS by ID SOP	50	U	100	50	25	ng/L	1
Perfluorohexanesulfonic acid (PFHxS)	355-46-4	PFAS by ID SOP	65	J	100	50	25	ng/L	1
Perfluoro-n-butanoic acid (PFBA)	375-22-4	PFAS by ID SOP	50	U	100	50	25	ng/L	1
Perfluoro-n-decanoic acid (PFDA)	335-76-2	PFAS by ID SOP	50	U	100	50	25	ng/L	1
Perfluoro-n-dodecanoic acid (PFDoA)	307-55-1	PFAS by ID SOP	50	U	100	50	25	ng/L	1
Perfluoro-n-heptanoic acid (PFHpA)	375-85-9	PFAS by ID SOP	50	U	100	50	25	ng/L	1
Perfluoro-n-hexanoic acid (PFHxA)	307-24-4	PFAS by ID SOP	50	U	100	50	25	ng/L	1
Perfluoro-n-nonanoic acid (PFNA)	375-95-1	PFAS by ID SOP	50	U	100	50	25	ng/L	1
Perfluoro-n-octanoic acid (PFOA)	335-67-1	PFAS by ID SOP	50	U	100	50	25	ng/L	1
Perfluoro-n-pentanoic acid (PFPeA)	2706-90-3	PFAS by ID SOP	50	U	100	50	25	ng/L	1
Perfluoro-n-tetradecanoic acid (PFTeDA)	376-06-7	PFAS by ID SOP	50	U	100	50	25	ng/L	1
Perfluoro-n-tridecanoic acid (PFTrDA)	72629-94-8	PFAS by ID SOP	50	U	100	50	25	ng/L	1
Perfluoro-n-undecanoic acid (PFUdA)	2058-94-8	PFAS by ID SOP	50	U	100	50	25	ng/L	1
Perfluorooctanesulfonic acid (PFOS)	1763-23-1	PFAS by ID SOP	120		100	50	25	ng/L	1

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
13C2_4:2FTS		85	50-150
13C2_6:2FTS		91	50-150
13C2_8:2FTS		80	50-150
13C2_PFDoA		71	50-150
13C2_PFTeDA		79	50-150
13C3_PFBS		82	50-150
13C3_PFHxS		78	50-150
13C4_PFBA		88	50-150
13C4_PFHpA		91	50-150
13C5_PFHxA		88	50-150
13C5_PFPeA		82	50-150
13C6_PFDA		74	50-150
13C7_PFUdA		89	50-150
13C8_PFOA		92	50-150
13C8_PFOS		76	50-150
13C8_PFOSA		87	50-150
13C9_PFNA		86	50-150

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

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SPLP PFAS

Client: Arcadis U.S., Inc.		Laboratory ID: WI03029-002	
Description: 382-5-UT-2		Matrix: Solid	
Date Sampled: 09/01/2021 1245	Project Name: Eielson AFB	% Solids: 86.4	09/04/2021 2059
Date Received: 09/03/2021	Project Number:		

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
d5-EtFOSAA		83	50-150
d-MeFOSA		62	50-150
d3-MeFOSAA		98	50-150

LOQ = Limit of Quantitation	B = Detected in the method blank	E = Quantitation of compound exceeded the calibration range	DL = Detection Limit	Q = Surrogate failure
U = Not detected at or above the LOQ	N = Recovery is out of criteria	P = The RPD between two GC columns exceeds 40%	J = Estimated result < LOQ and ≥ DL	L = LCS/LCSD failure
H = Out of holding time	W = Reported on wet weight basis	LOD = Limit of Detection		S = MS/MSD failure

PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.		Laboratory ID: WI03029-003	
Description: 382-5-G-1		Matrix: Solid	
Date Sampled: 09/01/2021 1245	Project Name: Eielson AFB	% Solids: 98.2	09/04/2021 2059
Date Received: 09/03/2021	Project Number:		

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch
1	SOP SPE	PFAS by ID SOP QSM B-15	1	09/04/2021 1751	JJG	09/03/2021 1900	14455

Parameter	CAS Number	Analytical Method	Result	Q	LOQ	LOD	DL	Units	Run
1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS)	39108-34-4	PFAS by ID SOP	0.12	U	0.23	0.12	0.056	ug/kg	1
1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS)	27619-97-2	PFAS by ID SOP	0.12	U	0.23	0.12	0.056	ug/kg	1
1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS)	757124-72-4	PFAS by ID SOP	0.12	U	0.23	0.12	0.056	ug/kg	1
N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA)	2991-50-6	PFAS by ID SOP	0.12	U	0.23	0.12	0.056	ug/kg	1
N-methylperfluoro-1-octanesulfonamide (MeFOSA)	31506-32-8	PFAS by ID SOP	0.12	U	0.23	0.12	0.056	ug/kg	1
N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA)	2355-31-9	PFAS by ID SOP	0.12	U	0.23	0.12	0.056	ug/kg	1
Perfluoro-1-butanesulfonic acid (PFBS)	375-73-5	PFAS by ID SOP	0.055	U	0.11	0.055	0.023	ug/kg	1
Perfluoro-1-decanesulfonic acid (PFDS)	335-77-3	PFAS by ID SOP	0.055	U	0.11	0.055	0.023	ug/kg	1
Perfluoro-1-heptanesulfonic acid (PFHpS)	375-92-8	PFAS by ID SOP	0.055	U	0.11	0.055	0.023	ug/kg	1
Perfluoro-1-nonanesulfonic acid (PFNS)	68259-12-1	PFAS by ID SOP	0.055	U	0.11	0.055	0.023	ug/kg	1
Perfluoro-1-octanesulfonamide (PFOSA)	754-91-6	PFAS by ID SOP	0.055	U	0.11	0.055	0.023	ug/kg	1
Perfluoro-1-pentanesulfonic acid (PFPeS)	2706-91-4	PFAS by ID SOP	0.055	U	0.11	0.055	0.023	ug/kg	1
Perfluorohexanesulfonic acid (PFHxS)	355-46-4	PFAS by ID SOP	0.055	U	0.11	0.055	0.023	ug/kg	1
Perfluoro-n-butanoic acid (PFBA)	375-22-4	PFAS by ID SOP	0.054	J	0.11	0.055	0.023	ug/kg	1
Perfluoro-n-decanoic acid (PFDA)	335-76-2	PFAS by ID SOP	0.055	U	0.11	0.055	0.023	ug/kg	1
Perfluoro-n-dodecanoic acid (PFDoA)	307-55-1	PFAS by ID SOP	0.055	U	0.11	0.055	0.023	ug/kg	1
Perfluoro-n-heptanoic acid (PFHpA)	375-85-9	PFAS by ID SOP	0.055	U	0.11	0.055	0.023	ug/kg	1
Perfluoro-n-hexanoic acid (PFHxA)	307-24-4	PFAS by ID SOP	0.055	U	0.11	0.055	0.023	ug/kg	1
Perfluoro-n-nonanoic acid (PFNA)	375-95-1	PFAS by ID SOP	0.055	U	0.11	0.055	0.023	ug/kg	1
Perfluoro-n-octanoic acid (PFOA)	335-67-1	PFAS by ID SOP	0.055	U	0.11	0.055	0.023	ug/kg	1
Perfluoro-n-pentanoic acid (PFPeA)	2706-90-3	PFAS by ID SOP	0.055	U	0.11	0.055	0.023	ug/kg	1
Perfluoro-n-tetradecanoic acid (PFTeDA)	376-06-7	PFAS by ID SOP	0.055	U	0.11	0.055	0.023	ug/kg	1
Perfluoro-n-tridecanoic acid (PFTrDA)	72629-94-8	PFAS by ID SOP	0.055	U	0.11	0.055	0.023	ug/kg	1
Perfluoro-n-undecanoic acid (PFUdA)	2058-94-8	PFAS by ID SOP	0.055	U	0.11	0.055	0.023	ug/kg	1
Perfluorooctanesulfonic acid (PFOS)	1763-23-1	PFAS by ID SOP	0.055	U	0.11	0.055	0.023	ug/kg	1

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
13C2_4:2FTS		93	50-150
13C2_6:2FTS		98	50-150
13C2_8:2FTS		99	50-150
13C2_PFDoA		97	50-150
13C2_PFTeDA		94	50-150
13C3_PFBS		96	50-150
13C3_PFHxS		94	50-150
13C4_PFBA		93	50-150
13C4_PFHpA		96	50-150
13C5_PFHxA		94	50-150
13C5_PFPeA		92	50-150
13C6_PFDA		99	50-150
13C7_PFUdA		101	50-150
13C8_PFOA		96	50-150
13C8_PFOS		97	50-150
13C8_PFOSA		110	50-150
13C9_PFNA		96	50-150

LOQ = Limit of Quantitation	B = Detected in the method blank	E = Quantitation of compound exceeded the calibration range	DL = Detection Limit	Q = Surrogate failure
U = Not detected at or above the LOQ	N = Recovery is out of criteria	P = The RPD between two GC columns exceeds 40%	J = Estimated result < LOQ and ≥ DL	L = LCS/LCSD failure
H = Out of holding time	W = Reported on wet weight basis	LOD = Limit of Detection		S = MS/MSD failure

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PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.		Laboratory ID: WI03029-003
Description: 382-5-G-1		Matrix: Solid
Date Sampled: 09/01/2021 1245	Project Name: Eielson AFB	% Solids: 98.2 09/04/2021 2059
Date Received: 09/03/2021	Project Number:	

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
d5-EtFOSAA		98	50-150
d-MeFOSA		104	50-150
d3-MeFOSAA		101	50-150

LOQ = Limit of Quantitation	B = Detected in the method blank	E = Quantitation of compound exceeded the calibration range	DL = Detection Limit	Q = Surrogate failure
U = Not detected at or above the LOQ	N = Recovery is out of criteria	P = The RPD between two GC columns exceeds 40%	J = Estimated result < LOQ and ≥ DL	L = LCS/LCSD failure
H = Out of holding time	W = Reported on wet weight basis	LOD = Limit of Detection		S = MS/MSD failure

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SPLP PFAS

Client: Arcadis U.S., Inc. | Laboratory ID: WI03029-003
Description: 382-5-G-1 | Matrix: Solid
Date Sampled: 09/01/2021 1245 | Project Name: Eielson AFB | % Solids: 98.2 09/04/2021 2059
Date Received: 09/03/2021 | Project Number:

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch	Leachate Date
1	1312/PFAS	PFAS by ID SOP QSM B-15	1	09/12/2021 1925	JJG	09/10/2021 1856	15024	09/09/2021 2338

Parameter	CAS Number	Analytical Method	Result	Q	LOQ	LOD	DL	Units	Run
1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS)	39108-34-4	PFAS by ID SOP	100	U	200	100	50	ng/L	1
1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS)	27619-97-2	PFAS by ID SOP	100	U	200	100	50	ng/L	1
1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS)	757124-72-4	PFAS by ID SOP	100	U	200	100	50	ng/L	1
N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA)	2991-50-6	PFAS by ID SOP	100	U	200	100	50	ng/L	1
N-methylperfluoro-1-octanesulfonamide (MeFOSA)	31506-32-8	PFAS by ID SOP	200	U	400	200	100	ng/L	1
N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA)	2355-31-9	PFAS by ID SOP	100	U	200	100	50	ng/L	1
Perfluoro-1-butanesulfonic acid (PFBS)	375-73-5	PFAS by ID SOP	50	U	100	50	25	ng/L	1
Perfluoro-1-decanesulfonic acid (PFDS)	335-77-3	PFAS by ID SOP	50	U	100	50	25	ng/L	1
Perfluoro-1-heptanesulfonic acid (PFHpS)	375-92-8	PFAS by ID SOP	50	U	100	50	25	ng/L	1
Perfluoro-1-nonanesulfonic acid (PFNS)	68259-12-1	PFAS by ID SOP	50	U	100	50	25	ng/L	1
Perfluoro-1-octanesulfonamide (PFOSA)	754-91-6	PFAS by ID SOP	50	U	100	50	25	ng/L	1
Perfluoro-1-pentanesulfonic acid (PFPeS)	2706-91-4	PFAS by ID SOP	50	U	100	50	25	ng/L	1
Perfluorohexanesulfonic acid (PFHxS)	355-46-4	PFAS by ID SOP	50	U	100	50	25	ng/L	1
Perfluoro-n-butanoic acid (PFBA)	375-22-4	PFAS by ID SOP	50	U	100	50	25	ng/L	1
Perfluoro-n-decanoic acid (PFDA)	335-76-2	PFAS by ID SOP	50	U	100	50	25	ng/L	1
Perfluoro-n-dodecanoic acid (PFDoA)	307-55-1	PFAS by ID SOP	50	U	100	50	25	ng/L	1
Perfluoro-n-heptanoic acid (PFHpA)	375-85-9	PFAS by ID SOP	50	U	100	50	25	ng/L	1
Perfluoro-n-hexanoic acid (PFHxA)	307-24-4	PFAS by ID SOP	50	U	100	50	25	ng/L	1
Perfluoro-n-nonanoic acid (PFNA)	375-95-1	PFAS by ID SOP	50	U	100	50	25	ng/L	1
Perfluoro-n-octanoic acid (PFOA)	335-67-1	PFAS by ID SOP	50	U	100	50	25	ng/L	1
Perfluoro-n-pentanoic acid (PFPeA)	2706-90-3	PFAS by ID SOP	50	U	100	50	25	ng/L	1
Perfluoro-n-tetradecanoic acid (PFTeDA)	376-06-7	PFAS by ID SOP	50	U	100	50	25	ng/L	1
Perfluoro-n-tridecanoic acid (PFTrDA)	72629-94-8	PFAS by ID SOP	50	U	100	50	25	ng/L	1
Perfluoro-n-undecanoic acid (PFUdA)	2058-94-8	PFAS by ID SOP	50	U	100	50	25	ng/L	1
Perfluorooctanesulfonic acid (PFOS)	1763-23-1	PFAS by ID SOP	50	U	100	50	25	ng/L	1

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
13C2_4:2FTS		87	50-150
13C2_6:2FTS		81	50-150
13C2_8:2FTS		75	50-150
13C2_PFDoA		71	50-150
13C2_PFTeDA		79	50-150
13C3_PFBS		79	50-150
13C3_PFHxS		61	50-150
13C4_PFBA		85	50-150
13C4_PFHpA		78	50-150
13C5_PFHxA		83	50-150
13C5_PFPeA		81	50-150
13C6_PFDA		73	50-150
13C7_PFUdA		81	50-150
13C8_PFOA		86	50-150
13C8_PFOS		76	50-150
13C8_PFOSA		89	50-150
13C9_PFNA		84	50-150

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

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SPLP PFAS

Client: Arcadis U.S., Inc.		Laboratory ID: WI03029-003	
Description: 382-5-G-1		Matrix: Solid	
Date Sampled: 09/01/2021 1245	Project Name: Eielson AFB	% Solids: 98.2	09/04/2021 2059
Date Received: 09/03/2021	Project Number:		

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
d5-EtFOSAA		78	50-150
d-MeFOSA		63	50-150
d3-MeFOSAA		96	50-150

LOQ = Limit of Quantitation	B = Detected in the method blank	E = Quantitation of compound exceeded the calibration range	DL = Detection Limit	Q = Surrogate failure
U = Not detected at or above the LOQ	N = Recovery is out of criteria	P = The RPD between two GC columns exceeds 40%	J = Estimated result < LOQ and ≥ DL	L = LCS/LCSD failure
H = Out of holding time	W = Reported on wet weight basis	LOD = Limit of Detection		S = MS/MSD failure

QC Summary

PFAS by LC/MS/MS - MB

Sample ID: WQ14455-001
Batch: 14455
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Solid
Prep Method: SOP SPE
Prep Date: 09/03/2021 1900

Parameter	Result	Q	Dil	LOQ	LOD	DL	Units	Analysis Date
8:2 FTS	1.0	U	1	2.0	1.0	0.50	ug/kg	09/04/2021 1741
6:2 FTS	1.0	U	1	2.0	1.0	0.50	ug/kg	09/04/2021 1741
4:2 FTS	1.0	U	1	2.0	1.0	0.50	ug/kg	09/04/2021 1741
EtFOSAA	1.0	U	1	2.0	1.0	0.50	ug/kg	09/04/2021 1741
MeFOSA	1.0	U	1	2.0	1.0	0.50	ug/kg	09/04/2021 1741
MeFOSAA	1.0	U	1	2.0	1.0	0.50	ug/kg	09/04/2021 1741
PFBS	0.50	U	1	1.0	0.50	0.20	ug/kg	09/04/2021 1741
PFDS	0.50	U	1	1.0	0.50	0.20	ug/kg	09/04/2021 1741
PFHpS	0.50	U	1	1.0	0.50	0.20	ug/kg	09/04/2021 1741
PFNS	0.50	U	1	1.0	0.50	0.20	ug/kg	09/04/2021 1741
PFOSA	0.50	U	1	1.0	0.50	0.20	ug/kg	09/04/2021 1741
PFPeS	0.50	U	1	1.0	0.50	0.20	ug/kg	09/04/2021 1741
PFHxS	0.50	U	1	1.0	0.50	0.20	ug/kg	09/04/2021 1741
PFBA	0.50	U	1	1.0	0.50	0.20	ug/kg	09/04/2021 1741
PFDA	0.50	U	1	1.0	0.50	0.20	ug/kg	09/04/2021 1741
PFDoA	0.50	U	1	1.0	0.50	0.20	ug/kg	09/04/2021 1741
PFHpA	0.50	U	1	1.0	0.50	0.20	ug/kg	09/04/2021 1741
PFHxA	0.50	U	1	1.0	0.50	0.20	ug/kg	09/04/2021 1741
PFNA	0.50	U	1	1.0	0.50	0.20	ug/kg	09/04/2021 1741
PFOA	0.50	U	1	1.0	0.50	0.20	ug/kg	09/04/2021 1741
PFPeA	0.50	U	1	1.0	0.50	0.20	ug/kg	09/04/2021 1741
PFTeDA	0.50	U	1	1.0	0.50	0.20	ug/kg	09/04/2021 1741
PFTrDA	0.50	U	1	1.0	0.50	0.20	ug/kg	09/04/2021 1741
PFUdA	0.50	U	1	1.0	0.50	0.20	ug/kg	09/04/2021 1741
PFOS	0.50	U	1	1.0	0.50	0.20	ug/kg	09/04/2021 1741

Surrogate	Q	% Rec	Acceptance Limit
13C2_4:2FTS		98	50-150
13C2_6:2FTS		88	50-150
13C2_8:2FTS		94	50-150
13C2_PFDoA		95	50-150
13C2_PFTeDA		99	50-150
13C3_PFBS		96	50-150
13C3_PFHxS		95	50-150
13C4_PFBA		90	50-150
13C4_PFHpA		92	50-150
13C5_PFHxA		89	50-150
13C5_PFPeA		89	50-150
13C6_PFDA		92	50-150
13C7_PFUdA		100	50-150
13C8_PFOA		97	50-150

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

PFAS by LC/MS/MS - MB

Sample ID: WQ14455-001
Batch: 14455
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Solid
Prep Method: SOP SPE
Prep Date: 09/03/2021 1900

Surrogate	Q	% Rec	Acceptance Limit
13C8_PFOS		93	50-150
13C8_PFOSA		113	50-150
13C9_PFNA		87	50-150
d5-EtFOSAA		98	50-150
d-MeFOSA		101	50-150
d3-MeFOSAA		106	50-150

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

PFAS by LC/MS/MS - LCS

Sample ID: WQ14455-002
Batch: 14455
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Solid
Prep Method: SOP SPE
Prep Date: 09/03/2021 1900

Parameter	Spike Amount (ug/kg)	Result (ug/kg)	Q	Dil	% Rec	%Rec Limit	Analysis Date
8:2 FTS	1.9	1.5		1	80	65-137	09/04/2021 1730
6:2 FTS	1.9	1.9		1	102	64-140	09/04/2021 1730
4:2 FTS	1.9	1.3		1	70	62-145	09/04/2021 1730
EtFOSAA	2.0	1.7		1	84	61-139	09/04/2021 1730
MeFOSA	2.0	1.5		1	77	70-150	09/04/2021 1730
MeFOSAA	2.0	1.6		1	81	63-144	09/04/2021 1730
PFBS	1.8	1.6		1	94	72-128	09/04/2021 1730
PFDS	1.9	2.2		1	114	59-134	09/04/2021 1730
PFHpS	1.9	1.7		1	87	70-132	09/04/2021 1730
PFNS	1.9	2.1		1	108	69-125	09/04/2021 1730
PFOSA	2.0	1.6		1	82	67-137	09/04/2021 1730
PFPeS	1.9	2.0		1	107	73-123	09/04/2021 1730
PFHxS	1.8	1.6		1	85	67-130	09/04/2021 1730
PFBA	2.0	1.9		1	96	71-135	09/04/2021 1730
PFDA	2.0	1.9		1	96	69-133	09/04/2021 1730
PFDoA	2.0	1.8		1	91	69-135	09/04/2021 1730
PFHpA	2.0	1.9		1	97	71-131	09/04/2021 1730
PFHxA	2.0	2.1		1	103	70-132	09/04/2021 1730
PFNA	2.0	1.9		1	94	72-129	09/04/2021 1730
PFOA	2.0	2.1		1	107	69-133	09/04/2021 1730
PFPeA	2.0	1.9		1	94	69-132	09/04/2021 1730
PFTeDA	2.0	1.9		1	93	69-133	09/04/2021 1730
PFTrDA	2.0	1.9		1	94	66-139	09/04/2021 1730
PFUdA	2.0	2.0		1	98	64-136	09/04/2021 1730
PFOS	1.9	2.1		1	111	68-136	09/04/2021 1730

Surrogate	Q	% Rec	Acceptance Limit
13C2_4:2FTS		96	50-150
13C2_6:2FTS		88	50-150
13C2_8:2FTS		101	50-150
13C2_PFDoA		104	50-150
13C2_PFTeDA		101	50-150
13C3_PFBS		96	50-150
13C3_PFHxS		100	50-150
13C4_PFBA		94	50-150
13C4_PFHpA		98	50-150
13C5_PFHxA		96	50-150
13C5_PFPeA		98	50-150
13C6_PFDA		96	50-150
13C7_PFUdA		97	50-150
13C8_PFOA		97	50-150

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

PFAS by LC/MS/MS - LCS

Sample ID: WQ14455-002
Batch: 14455
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Solid
Prep Method: SOP SPE
Prep Date: 09/03/2021 1900

Surrogate	Q	% Rec	Acceptance Limit
13C8_PFOS		91	50-150
13C8_PFOSA		108	50-150
13C9_PFNA		95	50-150
d5-EtFOSAA		102	50-150
d-MeFOSA		101	50-150
d3-MeFOSAA		103	50-150

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

SPLP PFAS - MB

Sample ID: WQ15024-001
Batch: 15024
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Solid
Prep Method: 1312/PFAS
Prep Date: 09/10/2021 1856 Leachate Date: 09/09/2021 2338

Parameter	Result	Q	Dil	LOQ	LOD	DL	Units	Analysis Date
8:2 FTS	40	U	1	80	40	20	ng/L	09/12/2021 1750
6:2 FTS	40	U	1	80	40	20	ng/L	09/12/2021 1750
4:2 FTS	40	U	1	80	40	20	ng/L	09/12/2021 1750
EtFOSAA	40	U	1	80	40	20	ng/L	09/12/2021 1750
MeFOSA	80	U	1	160	80	40	ng/L	09/12/2021 1750
MeFOSAA	40	U	1	80	40	20	ng/L	09/12/2021 1750
PFBS	20	U	1	40	20	10	ng/L	09/12/2021 1750
PFDS	20	U	1	40	20	10	ng/L	09/12/2021 1750
PFHpS	20	U	1	40	20	10	ng/L	09/12/2021 1750
PFNS	20	U	1	40	20	10	ng/L	09/12/2021 1750
PFOSA	20	U	1	40	20	10	ng/L	09/12/2021 1750
PFPeS	20	U	1	40	20	10	ng/L	09/12/2021 1750
PFHxS	20	U	1	40	20	10	ng/L	09/12/2021 1750
PFBA	20	U	1	40	20	10	ng/L	09/12/2021 1750
PFDA	20	U	1	40	20	10	ng/L	09/12/2021 1750
PFDoA	20	U	1	40	20	10	ng/L	09/12/2021 1750
PFHpA	20	U	1	40	20	10	ng/L	09/12/2021 1750
PFHxA	20	U	1	40	20	10	ng/L	09/12/2021 1750
PFNA	20	U	1	40	20	10	ng/L	09/12/2021 1750
PFOA	20	U	1	40	20	10	ng/L	09/12/2021 1750
PFPeA	20	U	1	40	20	10	ng/L	09/12/2021 1750
PFTeDA	20	U	1	40	20	10	ng/L	09/12/2021 1750
PFTrDA	20	U	1	40	20	10	ng/L	09/12/2021 1750
PFUdA	20	U	1	40	20	10	ng/L	09/12/2021 1750
PFOS	20	U	1	40	20	10	ng/L	09/12/2021 1750

Surrogate	Q	% Rec	Acceptance Limit
13C2_4:2FTS		99	50-150
13C2_6:2FTS		75	50-150
13C2_8:2FTS		86	50-150
13C2_PFDoA		70	50-150
13C2_PFTeDA		81	50-150
13C3_PFBS		82	50-150
13C3_PFHxS		77	50-150
13C4_PFBA		85	50-150
13C4_PFHpA		86	50-150
13C5_PFHxA		87	50-150
13C5_PFPeA		83	50-150
13C6_PFDA		76	50-150
13C7_PFUdA		82	50-150
13C8_PFOA		90	50-150

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

SPLP PFAS - MB

Sample ID: WQ15024-001
Batch: 15024
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Solid
Prep Method: 1312/PFAS
Prep Date: 09/10/2021 1856 Leachate Date: 09/09/2021 2338

Surrogate	Q	% Rec	Acceptance Limit
13C8_PFOS		73	50-150
13C8_PFOSA		84	50-150
13C9_PFNA		88	50-150
d5-EtFOSAA		77	50-150
d-MeFOSA		71	50-150
d3-MeFOSAA		93	50-150

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

SPLP PFAS - LCS

Sample ID: WQ15024-002
Batch: 15024
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Solid
Prep Method: 1312/PFAS
Prep Date: 09/10/2021 1856 Leachate Date: 09/09/2021 2338

Parameter	Spike Amount (ng/L)	Result (ng/L)	Q	Dil	% Rec	%Rec Limit	Analysis Date
8:2 FTS	150	130		1	83	67-138	09/12/2021 1853
6:2 FTS	150	150		1	101	64-140	09/12/2021 1853
4:2 FTS	150	140		1	95	63-143	09/12/2021 1853
EtFOSAA	160	150		1	96	61-135	09/12/2021 1853
MeFOSA	160	150		1	92	68-141	09/12/2021 1853
MeFOSAA	160	160		1	98	65-136	09/12/2021 1853
PFBS	140	150		1	104	72-130	09/12/2021 1853
PFDS	150	120		1	80	53-142	09/12/2021 1853
PFHpS	150	130		1	88	69-134	09/12/2021 1853
PFNS	150	140		1	94	69-127	09/12/2021 1853
PFOSA	160	140		1	87	67-137	09/12/2021 1853
PFPeS	150	160		1	107	71-127	09/12/2021 1853
PFHxS	150	140		1	96	68-131	09/12/2021 1853
PFBA	160	160		1	98	73-129	09/12/2021 1853
PFDA	160	190		1	119	71-129	09/12/2021 1853
PFDoA	160	180		1	115	72-134	09/12/2021 1853
PFHpA	160	160		1	97	72-130	09/12/2021 1853
PFHxA	160	150		1	96	72-129	09/12/2021 1853
PFNA	160	150		1	91	69-130	09/12/2021 1853
PFOA	160	160		1	103	71-133	09/12/2021 1853
PFPeA	160	160		1	103	72-129	09/12/2021 1853
PFTeDA	160	180		1	109	71-132	09/12/2021 1853
PFTrDA	160	160		1	101	65-144	09/12/2021 1853
PFUdA	160	150		1	97	69-133	09/12/2021 1853
PFOS	150	130		1	89	65-140	09/12/2021 1853

Surrogate	Q	% Rec	Acceptance Limit
13C2_4:2FTS		85	50-150
13C2_6:2FTS		83	50-150
13C2_8:2FTS		72	50-150
13C2_PFDoA		67	50-150
13C2_PFTeDA		77	50-150
13C3_PFBS		79	50-150
13C3_PFHxS		84	50-150
13C4_PFBA		82	50-150
13C4_PFHpA		80	50-150
13C5_PFHxA		88	50-150
13C5_PFPeA		83	50-150
13C6_PFDA		67	50-150
13C7_PFUdA		82	50-150
13C8_PFOA		80	50-150

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

SPLP PFAS - LCS

Sample ID: WQ15024-002
Batch: 15024
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Solid
Prep Method: 1312/PFAS
Prep Date: 09/10/2021 1856 Leachate Date: 09/09/2021 2338

Surrogate	Q	% Rec	Acceptance Limit
13C8_PFOS		76	50-150
13C8_PFOSA		84	50-150
13C9_PFNA		83	50-150
d5-EtFOSAA		78	50-150
d-MeFOSA		61	50-150
d3-MeFOSAA		87	50-150

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

Chain of Custody

and

Miscellaneous Documents

Pace Analytical®

PACE ANALYTICAL SERVICES, LLC
106 Vantage Point Drive • West Columbia, SC 29172
Telephone No. 803-791-9700 Fax No. 803-791-9111
www.pacelabs.com

Number 122661

Client: Arcadis	Report to Contact: Nathan Nagle	Telephone No. / E-mail: Nathan.Nagle@arcadis.com	Quote No.: 25048
Address: 10 Friends Ln, Suite 100	Sampler's Signature: x	Analysis (Attach list if more space is needed)	Page ____ of ____
City: Newtown / State: PA / Zip Code: 18940	Printed Name: Nathan Nagle		
Project Name: Eielson Soil Washing			

WI03029
KES2

| Project No.: 30030317 | P.O. No. | | |

Pace Analytical

Samples Receipt Checklist (SRC) (ME0018C-15)
Issuing Authority: Pace ENV - WCOL

Revised:9/29/2020
Page 1 of 1

Sample Receipt Checklist (SRC)

Client: Arcadis Cooler Inspected by/date: KDRW / 09/03/2021 Lot #: WI93039

Means of receipt: ☐ Pace ☐ Client ☐ UPS ☑ FedEx ☐ Other: _____

☑ Yes	☐ No		1. Were custody seals present on the cooler?
☑ Yes	☐ No	☐ NA	2. If custody seals were present, were they intact and unbroken?

pH Strip ID: NA Chlorine Strip ID: NA Tested by: NA

Original temperature upon receipt / Derived (Corrected) temperature upon receipt %Solid Snap-Cup ID: 21-1435

5.9 / 5.9 °C NA / NA °C NA / NA °C NA / NA °C

Method: ☐ Temperature Blank ☑ Against Bottles IR Gun ID: 5 IR Gun Correction Factor: 0 °C

Method of coolant: ☑ Wet Ice ☐ Ice Packs ☐ Dry Ice ☐ None

☐ Yes	☐ No	☑ NA	3. If temperature of any cooler exceeded 6.0°C, was Project Manager Notified? PM was Notified by: phone / email / face-to-face (circle one).
☑ Yes	☐ No	☐ NA	4. Is the commercial courier's packing slip attached to this form?
☑ Yes	☐ No		5. Were proper custody procedures (relinquished/received) followed?
☑ Yes	☐ No		6. Were sample IDs listed on the COC?
☑ Yes	☐ No		7. Were sample IDs listed on all sample containers?
☑ Yes	☐ No		8. Was collection date & time listed on the COC?
☑ Yes	☐ No		9. Was collection date & time listed on all sample containers?
☑ Yes	☐ No		10. Did all container label information (ID, date, time) agree with the COC?
☑ Yes	☐ No		11. Were tests to be performed listed on the COC?
☑ Yes	☐ No		12. Did all samples arrive in the proper containers for each test and/or in good condition (unbroken, lids on, etc.)? _____
☑ Yes	☐ No		13. Was adequate sample volume available?
☐ Yes	☑ No		14. Were all samples received within ½ the holding time or 48 hours, whichever comes first?
☐ Yes	☑ No		15. Were any samples containers missing/excess (circle one) samples Not listed on COC?
☐ Yes	☐ No	☑ NA	16. For VOA and RSK-175 samples, were bubbles present >"pea-size" (¼" or 6mm in diameter) in any of the VOA vials?
☐ Yes	☐ No	☑ NA	17. Were all DRO/metals/nutrient samples received at a pH of < 2?
☐ Yes	☐ No	☑ NA	18. Were all cyanide samples received at a pH > 12 and sulfide samples received at a pH > 9?
☐ Yes	☐ No	☑ NA	19. Were all applicable NH_3/TKN/cyanide/phenol/625.1/608.3 (< 0.5mg/L) samples free of residual chlorine?
☐ Yes	☐ No	☑ NA	20. Were client remarks/requests (i.e. requested dilutions, MS/MSD designations, etc…) correctly transcribed from the COC into the comment section in LIMS?
☐ Yes	☑ No		21. Was the quote number listed on the container label? If yes, Quote # 25048

Sample Preservation (Must be completed for any sample(s) incorrectly preserved or with headspace.)

Sample(s) NA _____ were received incorrectly preserved and were adjusted accordingly in sample receiving with NA mL of circle one: H_2SO_4, HNO_3, HCl, NaOH using SR # NA.

Time of preservation NA. If more than one preservative is needed, please note in the comments below.

Sample(s) NA _____ were received with bubbles >6 mm in diameter.

Samples(s) NA _____ were received with TRC > 0.5 mg/L (If #19 is ***no***) and were adjusted accordingly in sample receiving with sodium thiosulfate ($Na_2S_2O_3$) with Shealy ID: NA.

SR barcode labels applied by: KDRW Date: 09/03/2021

Comments:

Report of Analysis

Arcadis U.S., Inc.
630 Plaza Drive
Suite 600
Highlands Ranch, CO 80129
Attention: Joseph Quinnan

Project Name: Eielson Soil Washing

Lot Number:**WI04012**

Date Completed:09/15/2021

09/15/2021 4:43 PM
Approved and released by:
Project Manager II: **Kathy E. Smith**

The electronic signature above is the equivalent of a handwritten signature.
This report shall not be reproduced, except in its entirety, without the written approval of Pace Analytical Services, LLC.

Pace Analytical Services, LLC (*formerly Shealy Environmental Services, Inc.*)
106 Vantage Point Drive West Columbia, SC 29172
Tel: 803-791-9700 Fax: 803-791-9111 www.pacelabs.com

Case Narrative
Arcadis U.S., Inc.
Lot Number: WI04012

All results listed in this report relate only to the samples that are contained within this report.

Sample receipt, sample analysis, and data review have been performed in accordance with the Pace Quality Assurance Management Plan (QAMP), applicable Shealy standard operating procedures (SOPs), the 2003 NELAC standard, and Shealy policies. Additionally, the DoD QSM version 5.3 has been followed for these samples, and specifically Table B-15 was followed for all PFAS samples. Any exceptions to the QAMP, SOPs, NELAC standards, the DoD QSM, or policies are qualified on the results page or discussed below.

All QC associated with these samples was in compliance with DOD QSM 5.3 table B-15 and our PFAS SOP.

Correction factors (CF) are used to calculate the original sample concentration. The CF is the inverse of the concentration factor (sample volume / extract final volume) times the dilution factor (DF). For undiluted analysis. For undiluted analysis, the extract is prepared for injection by adding 182 uL of sample extract + 8 uL of reagent water + 10 uL of internal standard solution to a polypropylene autosampler vial. An extra correction factor of 0.91 (182 uL / 200 uL = 0.91) applies. The CF is calculated as follows:

CF = DF * FV / Vo

FV is volume of extract (mL)
Vo is initial sample volume (mL)
DF is dilution factor. For undiluted analysis, DF = 1/0.91.

Sample concentration for aqueous samples:
Concentration (ng/L) = Cs*CF,

$$C_s = \frac{\left(\frac{(A_s x C_{is})}{A_{is}}\right) - B}{M1}$$

Where

C_s is on column concentration of target analyte in the sample (ng/L)
C_{is} is concentration of internal standard in the sample (ng/L)
A_s is peak response of target analyte in the sample
A_{is} is peak response of internal standard in the sample
M1 is the average RF from ICAL or the slope from linear regression ICAL
B is the y-intercept from the ICAL

Sample Summary

Arcadis U.S., Inc.

Lot Number: WI04012

Project Name: Eielson Soil Washing

Project Number:

Sample Number	Sample ID	Matrix	Date Sampled	Date Received
001	382-5-Sand	Solid	09/02/2021 1400	09/04/2021

(1 sample)

Detection Summary

Arcadis U.S., Inc.

Lot Number: WI04012

Project Name: Eielson Soil Washing

Project Number:

Sample	Sample ID	Matrix	Parameter	Method	Result	Q	Units	Page
001	382-5-Sand	Solid	PFHxS	PFAS by ID	0.56	J	ug/kg	5
001	382-5-Sand	Solid	PFOS	PFAS by ID	1.2	J	ug/kg	5

(2 detections)

PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: WI04012-001
Description: 382-5-Sand | Matrix: Solid
Date Sampled: 09/02/2021 1400 | Project Name: Eielson Soil Washing | % Solids: 74.2 09/04/2021 2059
Date Received: 09/04/2021 | Project Number:

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch
1	SOP SPE	PFAS by ID SOP QSM B-15	1	09/08/2021 2036	JJG	09/07/2021 1029	14567
2	SOP SPE	PFAS by ID SOP QSM B-15	1	09/13/2021 2203	JJG	09/12/2021 1439	15118

Parameter	CAS Number	Analytical Method	Result	Q	LOQ	LOD	DL	Units	Run
1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS)	39108-34-4	PFAS by ID SOP	1.3	U	2.6	1.3	0.64	ug/kg	1
1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS)	27619-97-2	PFAS by ID SOP	1.2	U	2.3	1.2	0.57	ug/kg	2
1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS)	757124-72-4	PFAS by ID SOP	1.3	U	2.6	1.3	0.64	ug/kg	1
N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA)	2991-50-6	PFAS by ID SOP	1.3	U	2.6	1.3	0.64	ug/kg	1
N-methylperfluoro-1-octanesulfonamide (MeFOSA)	31506-32-8	PFAS by ID SOP	1.3	U	2.6	1.3	0.64	ug/kg	1
N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA)	2355-31-9	PFAS by ID SOP	1.3	U	2.6	1.3	0.64	ug/kg	1
Perfluoro-1-butanesulfonic acid (PFBS)	375-73-5	PFAS by ID SOP	0.65	U	1.3	0.65	0.26	ug/kg	1
Perfluoro-1-decanesulfonic acid (PFDS)	335-77-3	PFAS by ID SOP	0.65	U	1.3	0.65	0.26	ug/kg	1
Perfluoro-1-heptanesulfonic acid (PFHpS)	375-92-8	PFAS by ID SOP	0.65	U	1.3	0.65	0.26	ug/kg	1
Perfluoro-1-nonanesulfonic acid (PFNS)	68259-12-1	PFAS by ID SOP	0.65	U	1.3	0.65	0.26	ug/kg	1
Perfluoro-1-octanesulfonamide (PFOSA)	754-91-6	PFAS by ID SOP	0.65	U	1.3	0.65	0.26	ug/kg	1
Perfluoro-1-pentanesulfonic acid (PFPeS)	2706-91-4	PFAS by ID SOP	0.65	U	1.3	0.65	0.26	ug/kg	1
Perfluorohexanesulfonic acid (PFHxS)	355-46-4	PFAS by ID SOP	0.56	J	1.3	0.65	0.26	ug/kg	1
Perfluoro-n-butanoic acid (PFBA)	375-22-4	PFAS by ID SOP	0.65	U	1.3	0.65	0.26	ug/kg	1
Perfluoro-n-decanoic acid (PFDA)	335-76-2	PFAS by ID SOP	0.65	U	1.3	0.65	0.26	ug/kg	1
Perfluoro-n-dodecanoic acid (PFDoA)	307-55-1	PFAS by ID SOP	0.65	U	1.3	0.65	0.26	ug/kg	1
Perfluoro-n-heptanoic acid (PFHpA)	375-85-9	PFAS by ID SOP	0.65	U	1.3	0.65	0.26	ug/kg	1
Perfluoro-n-hexanoic acid (PFHxA)	307-24-4	PFAS by ID SOP	0.65	U	1.3	0.65	0.26	ug/kg	1
Perfluoro-n-nonanoic acid (PFNA)	375-95-1	PFAS by ID SOP	0.65	U	1.3	0.65	0.26	ug/kg	1
Perfluoro-n-octanoic acid (PFOA)	335-67-1	PFAS by ID SOP	0.65	U	1.3	0.65	0.26	ug/kg	1
Perfluoro-n-pentanoic acid (PFPeA)	2706-90-3	PFAS by ID SOP	0.65	U	1.3	0.65	0.26	ug/kg	1
Perfluoro-n-tetradecanoic acid (PFTeDA)	376-06-7	PFAS by ID SOP	0.65	U	1.3	0.65	0.26	ug/kg	1
Perfluoro-n-tridecanoic acid (PFTrDA)	72629-94-8	PFAS by ID SOP	0.65	U	1.3	0.65	0.26	ug/kg	1
Perfluoro-n-undecanoic acid (PFUdA)	2058-94-8	PFAS by ID SOP	0.65	U	1.3	0.65	0.26	ug/kg	1
Perfluorooctanesulfonic acid (PFOS)	1763-23-1	PFAS by ID SOP	1.2	J	1.3	0.65	0.26	ug/kg	1

Surrogate	Run 1 Q	Run 1 % Recovery	Run 1 Acceptance Limits	Run 2 Q	Run 2 % Recovery	Run 2 Acceptance Limits
13C2_4:2FTS		97	50-150		87	50-150
13C2_6:2FTS		95	50-150		123	50-150
13C2_8:2FTS		117	50-150		98	50-150
13C2_PFDoA		95	50-150		93	50-150
13C2_PFTeDA		98	50-150		94	50-150
13C3_PFBS		94	50-150		97	50-150
13C3_PFHxS		93	50-150		89	50-150
13C4_PFBA		90	50-150		97	50-150
13C4_PFHpA		98	50-150		104	50-150
13C5_PFHxA		95	50-150		101	50-150
13C5_PFPeA		96	50-150		99	50-150
13C6_PFDA		96	50-150		90	50-150
13C7_PFUdA		93	50-150		99	50-150
13C8_PFOA		103	50-150		103	50-150
13C8_PFOS		100	50-150		98	50-150
13C8_PFOSA		95	50-150		102	50-150

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

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PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: WI04012-001
Description: 382-5-Sand | Matrix: Solid
Date Sampled: 09/02/2021 1400 | Project Name: Eielson Soil Washing | % Solids: 74.2 09/04/2021 2059
Date Received: 09/04/2021 | Project Number:

Surrogate	Q	Run 1 % Recovery	Acceptance Limits	Q	Run 2 % Recovery	Acceptance Limits
13C9_PFNA		92	50-150		95	50-150
d5-EtFOSAA		101	50-150		97	50-150
d-MeFOSA		100	50-150		91	50-150
d3-MeFOSAA		108	50-150		110	50-150

LOQ = Limit of Quantitation | B = Detected in the method blank | E = Quantitation of compound exceeded the calibration range | DL = Detection Limit | Q = Surrogate failure
U = Not detected at or above the LOQ | N = Recovery is out of criteria | P = The RPD between two GC columns exceeds 40% | J = Estimated result < LOQ and ≥ DL | L = LCS/LCSD failure
H = Out of holding time | W = Reported on wet weight basis | LOD = Limit of Detection | | S = MS/MSD failure

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SPLP PFAS

Client: Arcadis U.S., Inc.			Laboratory ID: WI04012-001
Description: 382-5-Sand			Matrix: Solid
Date Sampled: 09/02/2021 1400	Project Name: Eielson Soil Washing		% Solids: 74.2 09/04/2021 2059
Date Received: 09/04/2021	Project Number:		

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch	Leachate Date
1	1312/PFAS	PFAS by ID SOP QSM B-15	1	09/12/2021 1936	JJG	09/10/2021 1856	15024	09/09/2021 2338

Parameter	CAS Number	Analytical Method	Result	Q	LOQ	LOD	DL	Units	Run
1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS)	39108-34-4	PFAS by ID SOP	100	U	200	100	50	ng/L	1
1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS)	27619-97-2	PFAS by ID SOP	100	U	200	100	50	ng/L	1
1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS)	757124-72-4	PFAS by ID SOP	100	U	200	100	50	ng/L	1
N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA)	2991-50-6	PFAS by ID SOP	100	U	200	100	50	ng/L	1
N-methylperfluoro-1-octanesulfonamide (MeFOSA)	31506-32-8	PFAS by ID SOP	200	U	400	200	100	ng/L	1
N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA)	2355-31-9	PFAS by ID SOP	100	U	200	100	50	ng/L	1
Perfluoro-1-butanesulfonic acid (PFBS)	375-73-5	PFAS by ID SOP	50	U	100	50	25	ng/L	1
Perfluoro-1-decanesulfonic acid (PFDS)	335-77-3	PFAS by ID SOP	50	U	100	50	25	ng/L	1
Perfluoro-1-heptanesulfonic acid (PFHpS)	375-92-8	PFAS by ID SOP	50	U	100	50	25	ng/L	1
Perfluoro-1-nonanesulfonic acid (PFNS)	68259-12-1	PFAS by ID SOP	50	U	100	50	25	ng/L	1
Perfluoro-1-octanesulfonamide (PFOSA)	754-91-6	PFAS by ID SOP	50	U	100	50	25	ng/L	1
Perfluoro-1-pentanesulfonic acid (PFPeS)	2706-91-4	PFAS by ID SOP	50	U	100	50	25	ng/L	1
Perfluorohexanesulfonic acid (PFHxS)	355-46-4	PFAS by ID SOP	50	U	100	50	25	ng/L	1
Perfluoro-n-butanoic acid (PFBA)	375-22-4	PFAS by ID SOP	50	U	100	50	25	ng/L	1
Perfluoro-n-decanoic acid (PFDA)	335-76-2	PFAS by ID SOP	50	U	100	50	25	ng/L	1
Perfluoro-n-dodecanoic acid (PFDoA)	307-55-1	PFAS by ID SOP	50	U	100	50	25	ng/L	1
Perfluoro-n-heptanoic acid (PFHpA)	375-85-9	PFAS by ID SOP	50	U	100	50	25	ng/L	1
Perfluoro-n-hexanoic acid (PFHxA)	307-24-4	PFAS by ID SOP	50	U	100	50	25	ng/L	1
Perfluoro-n-nonanoic acid (PFNA)	375-95-1	PFAS by ID SOP	50	U	100	50	25	ng/L	1
Perfluoro-n-octanoic acid (PFOA)	335-67-1	PFAS by ID SOP	50	U	100	50	25	ng/L	1
Perfluoro-n-pentanoic acid (PFPeA)	2706-90-3	PFAS by ID SOP	50	U	100	50	25	ng/L	1
Perfluoro-n-tetradecanoic acid (PFTeDA)	376-06-7	PFAS by ID SOP	50	U	100	50	25	ng/L	1
Perfluoro-n-tridecanoic acid (PFTrDA)	72629-94-8	PFAS by ID SOP	50	U	100	50	25	ng/L	1
Perfluoro-n-undecanoic acid (PFUdA)	2058-94-8	PFAS by ID SOP	50	U	100	50	25	ng/L	1
Perfluorooctanesulfonic acid (PFOS)	1763-23-1	PFAS by ID SOP	50	U	100	50	25	ng/L	1

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
13C2_4:2FTS		84	50-150
13C2_6:2FTS		86	50-150
13C2_8:2FTS		71	50-150
13C2_PFDoA		63	50-150
13C2_PFTeDA		74	50-150
13C3_PFBS		76	50-150
13C3_PFHxS		74	50-150
13C4_PFBA		84	50-150
13C4_PFHpA		78	50-150
13C5_PFHxA		89	50-150
13C5_PFPeA		86	50-150
13C6_PFDA		70	50-150
13C7_PFUdA		80	50-150
13C8_PFOA		81	50-150
13C8_PFOS		75	50-150
13C8_PFOSA		81	50-150
13C9_PFNA		79	50-150

LOQ = Limit of Quantitation	B = Detected in the method blank	E = Quantitation of compound exceeded the calibration range	DL = Detection Limit	Q = Surrogate failure
U = Not detected at or above the LOQ	N = Recovery is out of criteria	P = The RPD between two GC columns exceeds 40%	J = Estimated result < LOQ and ≥ DL	L = LCS/LCSD failure
H = Out of holding time	W = Reported on wet weight basis	LOD = Limit of Detection		S = MS/MSD failure

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SPLP PFAS

Client: Arcadis U.S., Inc.		Laboratory ID: WI04012-001
Description: 382-5-Sand		Matrix: Solid
Date Sampled: 09/02/2021 1400	Project Name: Eielson Soil Washing	% Solids: 74.2 09/04/2021 2059
Date Received: 09/04/2021	Project Number:	

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
d5-EtFOSAA		69	50-150
d-MeFOSA		70	50-150
d3-MeFOSAA		89	50-150

LOQ = Limit of Quantitation	B = Detected in the method blank	E = Quantitation of compound exceeded the calibration range	DL = Detection Limit	Q = Surrogate failure
U = Not detected at or above the LOQ	N = Recovery is out of criteria	P = The RPD between two GC columns exceeds 40%	J = Estimated result < LOQ and ≥ DL	L = LCS/LCSD failure
H = Out of holding time	W = Reported on wet weight basis	LOD = Limit of Detection		S = MS/MSD failure

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QC Summary

PFAS by LC/MS/MS - MB

Sample ID: WQ14567-001
Batch: 14567
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Solid
Prep Method: SOP SPE
Prep Date: 09/07/2021 1029

Parameter	Result	Q	Dil	LOQ	LOD	DL	Units	Analysis Date
8:2 FTS	1.0	U	1	2.0	1.0	0.50	ug/kg	09/08/2021 2014
4:2 FTS	1.0	U	1	2.0	1.0	0.50	ug/kg	09/08/2021 2014
EtFOSAA	1.0	U	1	2.0	1.0	0.50	ug/kg	09/08/2021 2014
MeFOSA	1.0	U	1	2.0	1.0	0.50	ug/kg	09/08/2021 2014
MeFOSAA	1.0	U	1	2.0	1.0	0.50	ug/kg	09/08/2021 2014
PFBS	0.50	U	1	1.0	0.50	0.20	ug/kg	09/08/2021 2014
PFDS	0.50	U	1	1.0	0.50	0.20	ug/kg	09/08/2021 2014
PFHpS	0.50	U	1	1.0	0.50	0.20	ug/kg	09/08/2021 2014
PFNS	0.50	U	1	1.0	0.50	0.20	ug/kg	09/08/2021 2014
PFOSA	0.50	U	1	1.0	0.50	0.20	ug/kg	09/08/2021 2014
PFPeS	0.50	U	1	1.0	0.50	0.20	ug/kg	09/08/2021 2014
PFHxS	0.50	U	1	1.0	0.50	0.20	ug/kg	09/08/2021 2014
PFBA	0.50	U	1	1.0	0.50	0.20	ug/kg	09/08/2021 2014
PFDA	0.50	U	1	1.0	0.50	0.20	ug/kg	09/08/2021 2014
PFDoA	0.50	U	1	1.0	0.50	0.20	ug/kg	09/08/2021 2014
PFHpA	0.50	U	1	1.0	0.50	0.20	ug/kg	09/08/2021 2014
PFHxA	0.50	U	1	1.0	0.50	0.20	ug/kg	09/08/2021 2014
PFNA	0.50	U	1	1.0	0.50	0.20	ug/kg	09/08/2021 2014
PFOA	0.50	U	1	1.0	0.50	0.20	ug/kg	09/08/2021 2014
PFPeA	0.50	U	1	1.0	0.50	0.20	ug/kg	09/08/2021 2014
PFTeDA	0.50	U	1	1.0	0.50	0.20	ug/kg	09/08/2021 2014
PFTrDA	0.50	U	1	1.0	0.50	0.20	ug/kg	09/08/2021 2014
PFUdA	0.50	U	1	1.0	0.50	0.20	ug/kg	09/08/2021 2014
PFOS	0.50	U	1	1.0	0.50	0.20	ug/kg	09/08/2021 2014

Surrogate	Q	% Rec	Acceptance Limit
13C2_4:2FTS		99	50-150
13C2_6:2FTS		102	50-150
13C2_8:2FTS		101	50-150
13C2_PFDoA		99	50-150
13C2_PFTeDA		106	50-150
13C3_PFBS		105	50-150
13C3_PFHxS		102	50-150
13C4_PFBA		100	50-150
13C4_PFHpA		106	50-150
13C5_PFHxA		106	50-150
13C5_PFPeA		104	50-150
13C6_PFDA		91	50-150
13C7_PFUdA		110	50-150
13C8_PFOA		107	50-150
13C8_PFOS		109	50-150

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

PFAS by LC/MS/MS - MB

Sample ID: WQ14567-001
Batch: 14567
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Solid
Prep Method: SOP SPE
Prep Date: 09/07/2021 1029

Surrogate	Q	% Rec	Acceptance Limit
13C8_PFOSA		107	50-150
13C9_PFNA		98	50-150
d5-EtFOSAA		105	50-150
d-MeFOSA		102	50-150
d3-MeFOSAA		101	50-150

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

PFAS by LC/MS/MS - LCS

Sample ID: WQ14567-002
Batch: 14567
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Solid
Prep Method: SOP SPE
Prep Date: 09/07/2021 1029

Parameter	Spike Amount (ug/kg)	Result (ug/kg)	Q	Dil	% Rec	%Rec Limit	Analysis Date
8:2 FTS	1.9	2.0		1	105	65-137	09/08/2021 2025
4:2 FTS	1.9	1.8		1	94	62-145	09/08/2021 2025
EtFOSAA	2.0	2.1		1	107	61-139	09/08/2021 2025
MeFOSA	2.0	1.6		1	79	70-150	09/08/2021 2025
MeFOSAA	2.0	2.0		1	102	63-144	09/08/2021 2025
PFBS	1.8	1.7		1	96	72-128	09/08/2021 2025
PFDS	1.9	1.6		1	84	59-134	09/08/2021 2025
PFHpS	1.9	2.2		1	115	70-132	09/08/2021 2025
PFNS	1.9	2.0		1	104	69-125	09/08/2021 2025
PFOSA	2.0	1.8		1	89	67-137	09/08/2021 2025
PFPeS	1.9	2.0		1	106	73-123	09/08/2021 2025
PFHxS	1.8	1.6		1	88	67-130	09/08/2021 2025
PFBA	2.0	1.9		1	93	71-135	09/08/2021 2025
PFDA	2.0	1.7		1	86	69-133	09/08/2021 2025
PFDoA	2.0	2.0		1	98	69-135	09/08/2021 2025
PFHpA	2.0	1.8		1	89	71-131	09/08/2021 2025
PFHxA	2.0	2.0		1	98	70-132	09/08/2021 2025
PFNA	2.0	1.9		1	97	72-129	09/08/2021 2025
PFOA	2.0	1.8		1	88	69-133	09/08/2021 2025
PFPeA	2.0	1.8		1	90	69-132	09/08/2021 2025
PFTeDA	2.0	2.0		1	98	69-133	09/08/2021 2025
PFTrDA	2.0	1.8		1	92	66-139	09/08/2021 2025
PFUdA	2.0	1.6		1	82	64-136	09/08/2021 2025
PFOS	1.9	2.1		1	111	68-136	09/08/2021 2025

Surrogate	Q	% Rec	Acceptance Limit
13C2_4:2FTS		103	50-150
13C2_6:2FTS		96	50-150
13C2_8:2FTS		102	50-150
13C2_PFDoA		94	50-150
13C2_PFTeDA		101	50-150
13C3_PFBS		96	50-150
13C3_PFHxS		94	50-150
13C4_PFBA		96	50-150
13C4_PFHpA		103	50-150
13C5_PFHxA		92	50-150
13C5_PFPeA		99	50-150
13C6_PFDA		98	50-150
13C7_PFUdA		107	50-150
13C8_PFOA		105	50-150
13C8_PFOS		96	50-150

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

PFAS by LC/MS/MS - LCS

Sample ID: WQ14567-002
Batch: 14567
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Solid
Prep Method: SOP SPE
Prep Date: 09/07/2021 1029

Surrogate	Q	% Rec	Acceptance Limit
13C8_PFOSA		106	50-150
13C9_PFNA		90	50-150
d5-EtFOSAA		94	50-150
d-MeFOSA		92	50-150
d3-MeFOSAA		106	50-150

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

SPLP PFAS - MB

Sample ID: WQ15024-001
Batch: 15024
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Solid
Prep Method: 1312/PFAS
Prep Date: 09/10/2021 1856 Leachate Date: 09/09/2021 2338

Parameter	Result	Q	Dil	LOQ	LOD	DL	Units	Analysis Date
8:2 FTS	40	U	1	80	40	20	ng/L	09/12/2021 1750
6:2 FTS	40	U	1	80	40	20	ng/L	09/12/2021 1750
4:2 FTS	40	U	1	80	40	20	ng/L	09/12/2021 1750
EtFOSAA	40	U	1	80	40	20	ng/L	09/12/2021 1750
MeFOSA	80	U	1	160	80	40	ng/L	09/12/2021 1750
MeFOSAA	40	U	1	80	40	20	ng/L	09/12/2021 1750
PFBS	20	U	1	40	20	10	ng/L	09/12/2021 1750
PFDS	20	U	1	40	20	10	ng/L	09/12/2021 1750
PFHpS	20	U	1	40	20	10	ng/L	09/12/2021 1750
PFNS	20	U	1	40	20	10	ng/L	09/12/2021 1750
PFOSA	20	U	1	40	20	10	ng/L	09/12/2021 1750
PFPeS	20	U	1	40	20	10	ng/L	09/12/2021 1750
PFHxS	20	U	1	40	20	10	ng/L	09/12/2021 1750
PFBA	20	U	1	40	20	10	ng/L	09/12/2021 1750
PFDA	20	U	1	40	20	10	ng/L	09/12/2021 1750
PFDoA	20	U	1	40	20	10	ng/L	09/12/2021 1750
PFHpA	20	U	1	40	20	10	ng/L	09/12/2021 1750
PFHxA	20	U	1	40	20	10	ng/L	09/12/2021 1750
PFNA	20	U	1	40	20	10	ng/L	09/12/2021 1750
PFOA	20	U	1	40	20	10	ng/L	09/12/2021 1750
PFPeA	20	U	1	40	20	10	ng/L	09/12/2021 1750
PFTeDA	20	U	1	40	20	10	ng/L	09/12/2021 1750
PFTrDA	20	U	1	40	20	10	ng/L	09/12/2021 1750
PFUdA	20	U	1	40	20	10	ng/L	09/12/2021 1750
PFOS	20	U	1	40	20	10	ng/L	09/12/2021 1750

Surrogate	Q	% Rec	Acceptance Limit
13C2_4:2FTS		99	50-150
13C2_6:2FTS		75	50-150
13C2_8:2FTS		86	50-150
13C2_PFDoA		70	50-150
13C2_PFTeDA		81	50-150
13C3_PFBS		82	50-150
13C3_PFHxS		77	50-150
13C4_PFBA		85	50-150
13C4_PFHpA		86	50-150
13C5_PFHxA		87	50-150
13C5_PFPeA		83	50-150
13C6_PFDA		76	50-150
13C7_PFUdA		82	50-150
13C8_PFOA		90	50-150

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

SPLP PFAS - MB

Sample ID: WQ15024-001
Batch: 15024
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Solid
Prep Method: 1312/PFAS
Prep Date: 09/10/2021 1856 Leachate Date: 09/09/2021 2338

Surrogate	Q	% Rec	Acceptance Limit
13C8_PFOS		73	50-150
13C8_PFOSA		84	50-150
13C9_PFNA		88	50-150
d5-EtFOSAA		77	50-150
d-MeFOSA		71	50-150
d3-MeFOSAA		93	50-150

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

SPLP PFAS - LCS

Sample ID: WQ15024-002
Batch: 15024
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Solid
Prep Method: 1312/PFAS
Prep Date: 09/10/2021 1856 Leachate Date: 09/09/2021 2338

Parameter	Spike Amount (ng/L)	Result (ng/L)	Q	Dil	% Rec	%Rec Limit	Analysis Date
8:2 FTS	150	130		1	83	67-138	09/12/2021 1853
6:2 FTS	150	150		1	101	64-140	09/12/2021 1853
4:2 FTS	150	140		1	95	63-143	09/12/2021 1853
EtFOSAA	160	150		1	96	61-135	09/12/2021 1853
MeFOSA	160	150		1	92	68-141	09/12/2021 1853
MeFOSAA	160	160		1	98	65-136	09/12/2021 1853
PFBS	140	150		1	104	72-130	09/12/2021 1853
PFDS	150	120		1	80	53-142	09/12/2021 1853
PFHpS	150	130		1	88	69-134	09/12/2021 1853
PFNS	150	140		1	94	69-127	09/12/2021 1853
PFOSA	160	140		1	87	67-137	09/12/2021 1853
PFPeS	150	160		1	107	71-127	09/12/2021 1853
PFHxS	150	140		1	96	68-131	09/12/2021 1853
PFBA	160	160		1	98	73-129	09/12/2021 1853
PFDA	160	190		1	119	71-129	09/12/2021 1853
PFDoA	160	180		1	115	72-134	09/12/2021 1853
PFHpA	160	160		1	97	72-130	09/12/2021 1853
PFHxA	160	150		1	96	72-129	09/12/2021 1853
PFNA	160	150		1	91	69-130	09/12/2021 1853
PFOA	160	160		1	103	71-133	09/12/2021 1853
PFPeA	160	160		1	103	72-129	09/12/2021 1853
PFTeDA	160	180		1	109	71-132	09/12/2021 1853
PFTrDA	160	160		1	101	65-144	09/12/2021 1853
PFUdA	160	150		1	97	69-133	09/12/2021 1853
PFOS	150	130		1	89	65-140	09/12/2021 1853

Surrogate	Q	% Rec	Acceptance Limit
13C2_4:2FTS		85	50-150
13C2_6:2FTS		83	50-150
13C2_8:2FTS		72	50-150
13C2_PFDoA		67	50-150
13C2_PFTeDA		77	50-150
13C3_PFBS		79	50-150
13C3_PFHxS		84	50-150
13C4_PFBA		82	50-150
13C4_PFHpA		80	50-150
13C5_PFHxA		88	50-150
13C5_PFPeA		83	50-150
13C6_PFDA		67	50-150
13C7_PFUdA		82	50-150
13C8_PFOA		80	50-150

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

SPLP PFAS - LCS

Sample ID: WQ15024-002
Batch: 15024
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Solid
Prep Method: 1312/PFAS
Prep Date: 09/10/2021 1856 Leachate Date: 09/09/2021 2338

Surrogate	Q	% Rec	Acceptance Limit
13C8_PFOS		76	50-150
13C8_PFOSA		84	50-150
13C9_PFNA		83	50-150
d5-EtFOSAA		78	50-150
d-MeFOSA		61	50-150
d3-MeFOSAA		87	50-150

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

PFAS by LC/MS/MS - MB

Sample ID: WQ15118-001
Batch: 15118
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Solid
Prep Method: SOP SPE
Prep Date: 09/12/2021 1439

Parameter	Result	Q	Dil	LOQ	LOD	DL	Units	Analysis Date
6:2 FTS	1.0	U	1	2.0	1.0	0.50	ug/kg	09/13/2021 1739

Surrogate	Q	% Rec	Acceptance Limit
13C2_4:2FTS		105	50-150
13C2_6:2FTS		119	50-150
13C2_8:2FTS		93	50-150
13C2_PFDoA		101	50-150
13C2_PFTeDA		110	50-150
13C3_PFBS		101	50-150
13C3_PFHxS		111	50-150
13C4_PFBA		102	50-150
13C4_PFHpA		106	50-150
13C5_PFHxA		108	50-150
13C5_PFPeA		103	50-150
13C6_PFDA		105	50-150
13C7_PFUdA		106	50-150
13C8_PFOA		100	50-150
13C8_PFOS		108	50-150
13C8_PFOSA		105	50-150
13C9_PFNA		112	50-150
d5-EtFOSAA		106	50-150
d-MeFOSA		106	50-150
d3-MeFOSAA		100	50-150

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

PFAS by LC/MS/MS - LCS

Sample ID: WQ15118-002
Batch: 15118
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Solid
Prep Method: SOP SPE
Prep Date: 09/12/2021 1439

Parameter	Spike Amount (ug/kg)	Result (ug/kg)	Q	Dil	% Rec	%Rec Limit	Analysis Date
6:2 FTS	1.9	1.7		1	88	64-140	09/13/2021 1749

Surrogate	Q	% Rec	Acceptance Limit
13C2_4:2FTS		106	50-150
13C2_6:2FTS		122	50-150
13C2_8:2FTS		95	50-150
13C2_PFDoA		97	50-150
13C2_PFTeDA		104	50-150
13C3_PFBS		107	50-150
13C3_PFHxS		110	50-150
13C4_PFBA		101	50-150
13C4_PFHpA		107	50-150
13C5_PFHxA		105	50-150
13C5_PFPeA		102	50-150
13C6_PFDA		100	50-150
13C7_PFUdA		104	50-150
13C8_PFOA		102	50-150
13C8_PFOS		114	50-150
13C8_PFOSA		107	50-150
13C9_PFNA		105	50-150
d5-EtFOSAA		96	50-150
d-MeFOSA		92	50-150
d3-MeFOSAA		104	50-150

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

Chain of Custody

and

Miscellaneous Documents

Pace Analytical

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Number 122662

| | | |

Pace Analytical

Samples Receipt Checklist (SRC) (ME0018C-15)
Issuing Authority: Pace ENV - WCOL

Revised:9/29/2020
Page 1 of 1

Sample Receipt Checklist (SRC)

Client: Arcadis Cooler Inspected by/date: JRG2 / 09/04/2021 Lot #: WI04012

Means of receipt: ☐ Pace ☐ Client ☐ UPS ☑ FedEx ☐ Other:

☐ Yes	☑ No		1. Were custody seals present on the cooler?
☐ Yes	☐ No	☑ NA	2. If custody seals were present, were they intact and unbroken?

pH Strip ID: NA Chlorine Strip ID: NA Tested by: NA

Original temperature upon receipt / Derived (Corrected) temperature upon receipt %Solid Snap-Cup ID: 21-1425

1.3 / 1.3 °C NA / NA °C NA / NA °C NA / NA °C

Method: ☑ Temperature Blank ☐ Against Bottles IR Gun ID: 5 IR Gun Correction Factor: 0 °C

Method of coolant: ☑ Wet Ice ☐ Ice Packs ☐ Dry Ice ☐ None

☐ Yes	☐ No	☑ NA	3. If temperature of any cooler exceeded 6.0°C, was Project Manager Notified? PM was Notified by: phone / email / face-to-face (circle one).
☑ Yes	☐ No	☐ NA	4. Is the commercial courier's packing slip attached to this form?
☑ Yes	☐ No		5. Were proper custody procedures (relinquished/received) followed?
☑ Yes	☐ No		6. Were sample IDs listed on the COC?
☑ Yes	☐ No		7. Were sample IDs listed on all sample containers?
☑ Yes	☐ No		8. Was collection date & time listed on the COC?
☑ Yes	☐ No		9. Was collection date & time listed on all sample containers?
☑ Yes	☐ No		10. Did all container label information (ID, date, time) agree with the COC?
☑ Yes	☐ No		11. Were tests to be performed listed on the COC?
☑ Yes	☐ No		12. Did all samples arrive in the proper containers for each test and/or in good condition (unbroken, lids on, etc.)?
☑ Yes	☐ No		13. Was adequate sample volume available?
☑ Yes	☐ No		14. Were all samples received within ½ the holding time or 48 hours, whichever comes first?
☐ Yes	☑ No		15. Were any samples containers missing/excess (circle one) samples Not listed on COC?
☐ Yes	☐ No	☑ NA	16. For VOA and RSK-175 samples, were bubbles present >"pea-size" (¼"or 6mm in diameter) in any of the VOA vials?
☐ Yes	☐ No	☑ NA	17. Were all DRO/metals/nutrient samples received at a pH of < 2?
☐ Yes	☐ No	☑ NA	18. Were all cyanide samples received at a pH > 12 and sulfide samples received at a pH > 9?
☐ Yes	☐ No	☑ NA	19. Were all applicable NH_3/TKN/cyanide/phenol/625.1/608.3 (< 0.5mg/L) samples free of residual chlorine?
☐ Yes	☐ No	☑ NA	20. Were client remarks/requests (i.e. requested dilutions, MS/MSD designations, etc…) correctly transcribed from the COC into the comment section in LIMS?
☐ Yes	☑ No		21. Was the quote number listed on the container label? If yes, Quote #

Sample Preservation (Must be completed for any sample(s) incorrectly preserved or with headspace.)

Sample(s) NA were received incorrectly preserved and were adjusted accordingly in sample receiving with NA mL of circle one: H2SO4, HNO3, HCl, NaOH using SR # NA.
Time of preservation NA. If more than one preservative is needed, please note in the comments below.

Sample(s) NA were received with bubbles >6 mm in diameter.

Samples(s) NA were received with TRC > 0.5 mg/L (If #19 is ***no***) and were adjusted accordingly in sample receiving with sodium thiosulfate ($Na_2S_2O_3$) with Shealy ID: NA.

SR barcode labels applied by: KSC Date: 09/04/2021

Comments:

Report of Analysis

Arcadis U.S., Inc.
630 Plaza Drive
Suite 600
Highlands Ranch, CO 80129
Attention: Nathan Nagle

Project Name: Eielson AFB Soil Washing

Project Number: 30030317

Lot Number:**WI13001**

Date Completed:10/06/2021

10/06/2021 2:07 PM
Approved and released by:
Project Manager II: **Kathy E. Smith**

The electronic signature above is the equivalent of a handwritten signature.
This report shall not be reproduced, except in its entirety, without the written approval of Pace Analytical Services, LLC.

Pace Analytical Services, LLC (*formerly Shealy Environmental Services, Inc.*)
106 Vantage Point Drive West Columbia, SC 29172
Tel: 803-791-9700 Fax: 803-791-9111 www.pacelabs.com

Case Narrative
Arcadis U.S., Inc.
Lot Number: WI13001

This Report of Analysis contains the analytical result(s) for the sample(s) listed on the Sample Summary following this Case Narrative. The sample receiving date is documented in the header information associated with each sample.

All results listed in this report relate only to the samples that are contained within this report.

Sample receipt, sample analysis, and data review have been performed in accordance with the Pace Quality Assurance Management Plan (QAMP), applicable Shealy standard operating procedures (SOPs), the 2003 NELAC standard, and Shealy policies. Additionally, the DoD QSM version 5.3 has been followed for these samples, and specifically Table B-15 was followed for all PFAS samples. Any exceptions to the QAMP, SOPs, NELAC standards, the DoD QSM, or policies are qualified on the results page or discussed below.

Correction factors (CF) are used to calculate the original sample concentration. The CF is the inverse of the concentration factor (sample volume / extract final volume) times the dilution factor (DF). For undiluted analysis. The extract is prepared for injection by adding 182 uL of sample extract + 8 uL of reagent water + 10 uL of internal standard solution to a polypropylene autosampler vial. An extra correction factor of 0.91 (182 uL / 200 uL = 0.91) applies. The CF is calculated as follows:

For solid samples:

CF = DF * FV / Ws/S/1000

FV is volume of extract (mL)
Ws is initial sample weight (gram)
S is %Solids
DF is dilution factor. For undiluted analysis, DF = 1/0.91.

Concentration (ug/kg) = Cs*CF,

$$C_s = \frac{\left(\frac{(A_s x C_{is})}{A_{is}}\right) - B}{M1}$$

Where

C_s is on column concentration of target analyte in the sample (ng/L)
C_{is} is concentration of internal standard in the sample (ng/L)
A_s is peak response of target analyte in the sample
A_{is} is peak response of internal standard in the sample
M1 is the average RF from ICAL or the slope from linear regression ICAL
B is the y-intercept from the ICAL

Pace is a TNI accredited laboratory; however, the following analyses are currently not listed on our TNI scope of accreditation:

Biological Tissue: All, Non-Potable Water: SGT-HEM EPA 1664B, Silica EPA 200.7, Boron, Calcium, Silicon, Strontium EPA 200.8, Bicarbonate, Carbonate, and Hydroxide Alkalinity SM 2320 B-2011, Fecal Coliform SM 9221 C E-2006 & SM 9222D-2006, Strontium SW-846 6010D, VOC SM 6200 B-2011, Drinking Water: VOC (excluding BTEX, MTBE, Naphthalene, & 1,2-dichloroethane) EPA 524.2, Solid Chemical Material: TOC Walkley-Black.

Where applicable, all soil sample results (including LOQ and DL if requested) are corrected for dry weight unless flagged with a "W" qualifier.

If you have any questions regarding this report please contact the Pace Project Manager listed on the cover page.

The MS/MSD associated with sample WI13001-003, WI13001-006 had multiple analytes recovered outside of the acceptance limits. The LCS was recovered within the required acceptance limits; therefore, this demonstrates a matrix effect and data quality is not impacted.

Sample WI13001-009 had multiple surrogates recovered outside of the acceptance limits. The sample was re-extracted and re-analyzed with passing surrogate recoveries. Both sets of data have been reported.

Sample Summary

Arcadis U.S., Inc.

Lot Number: WI13001

Project Name: Eielson AFB Soil Washing

Project Number: 30030317

Sample Number	Sample ID	Matrix	Date Sampled	Date Received
001	382-5-S-2	Solid	09/07/2021 1615	09/13/2021
002	382-5-S-3	Solid	09/07/2021 1620	09/13/2021
003	382-5-S-1	Solid	09/07/2021 1100	09/13/2021
004	382-5-W-UT-1	Aqueous	09/07/2021 1545	09/13/2021
005	382-5-W-T-1	Aqueous	09/07/2021 1550	09/13/2021
006	382-5-G-2	Solid	09/08/2021 0920	09/13/2021
007	382-5-G-3	Solid	09/08/2021 0935	09/13/2021
008	382-5-F-1	Solid	09/08/2021 1000	09/13/2021
009	382-5-F-2	Solid	09/08/2021 1030	09/13/2021
010	382-5-F-3	Solid	09/08/2021 1045	09/13/2021
011	382-5-UT-3	Solid	09/08/2021 1220	09/13/2021
012	Dup-01	Solid	09/08/2021	09/13/2021

(12 samples)

Detection Summary

Arcadis U.S., Inc.

Lot Number: WI13001

Project Name: Eielson AFB Soil Washing

Project Number: 30030317

Sample	Sample ID	Matrix	Parameter	Method	Result	Q	Units	Page
001	382-5-S-2	Solid	6:2 FTS	PFAS by ID	1.0	J	ug/kg	6
001	382-5-S-2	Solid	PFHxS	PFAS by ID	0.23	J	ug/kg	6
001	382-5-S-2	Solid	PFOS	PFAS by ID	0.25	J	ug/kg	6
002	382-5-S-3	Solid	6:2 FTS	PFAS by ID	0.79	J	ug/kg	10
002	382-5-S-3	Solid	PFOS	PFAS by ID	0.25	J	ug/kg	10
003	382-5-S-1	Solid	PFOS	PFAS by ID	0.25	J	ug/kg	14
004	382-5-W-UT-1	Aqueous	8:2 FTS	PFAS by ID	3.2	J	ng/L	18
004	382-5-W-UT-1	Aqueous	6:2 FTS	PFAS by ID	6.2	J	ng/L	18
004	382-5-W-UT-1	Aqueous	PFBS	PFAS by ID	2.2	J	ng/L	18
004	382-5-W-UT-1	Aqueous	PFHpS	PFAS by ID	1.9	J	ng/L	18
004	382-5-W-UT-1	Aqueous	PFPeS	PFAS by ID	3.8	J	ng/L	18
004	382-5-W-UT-1	Aqueous	PFHxS	PFAS by ID	46		ng/L	18
004	382-5-W-UT-1	Aqueous	PFBA	PFAS by ID	3.4	J	ng/L	18
004	382-5-W-UT-1	Aqueous	PFHpA	PFAS by ID	3.2	J	ng/L	18
004	382-5-W-UT-1	Aqueous	PFHxA	PFAS by ID	10		ng/L	18
004	382-5-W-UT-1	Aqueous	PFOA	PFAS by ID	4.6		ng/L	18
004	382-5-W-UT-1	Aqueous	PFPeA	PFAS by ID	10		ng/L	18
004	382-5-W-UT-1	Aqueous	PFOS	PFAS by ID	72		ng/L	18
005	382-5-W-T-1	Aqueous	PFOS	PFAS by ID	1.6	J	ng/L	20
008	382-5-F-1	Solid	PFHxS	PFAS by ID	0.40	J	ug/kg	30
008	382-5-F-1	Solid	PFOS	PFAS by ID	1.6		ug/kg	30
009	382-5-F-2	Solid	PFHxS	PFAS by ID	0.96	J	ug/kg	34
009	382-5-F-2	Solid	PFOS	PFAS by ID	3.1		ug/kg	34
010	382-5-F-3	Solid	6:2 FTS	PFAS by ID	0.98	J	ug/kg	40
010	382-5-F-3	Solid	PFHxS	PFAS by ID	0.44	J	ug/kg	40
010	382-5-F-3	Solid	PFOS	PFAS by ID	2.1		ug/kg	40
011	382-5-UT-3	Solid	PFHxS	PFAS by ID	1.7		ug/kg	44
011	382-5-UT-3	Solid	PFOA	PFAS by ID	0.32	J	ug/kg	44
011	382-5-UT-3	Solid	PFOS	PFAS by ID	5.3		ug/kg	44
011	382-5-UT-3	Solid	PFOS	PFAS by ID	13	J	ng/L	46
012	Dup-01	Solid	6:2 FTS	PFAS by ID	0.94	J	ug/kg	48
012	Dup-01	Solid	PFHxS	PFAS by ID	0.52	J	ug/kg	48
012	Dup-01	Solid	PFOS	PFAS by ID	2.3		ug/kg	48

(33 detections)

PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: WI13001-001
Description: 382-5-S-2 | Matrix: Solid
Date Sampled: 09/07/2021 1615 | Project Name: Eielson AFB Soil Washing | % Solids: 89.3 09/13/2021 2013
Date Received: 09/13/2021 | Project Number: 30030317

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch
1	SOP SPE	PFAS by ID SOP QSM B-15	1	09/14/2021 1317	JJG	09/13/2021 1833	15209

Parameter	CAS Number	Analytical Method	Result	Q	LOQ	LOD	DL	Units	Run
1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS)	39108-34-4	PFAS by ID SOP	1.0	U	2.0	1.0	0.50	ug/kg	1
1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS)	27619-97-2	PFAS by ID SOP	1.0	J	2.0	1.0	0.50	ug/kg	1
1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS)	757124-72-4	PFAS by ID SOP	1.0	U	2.0	1.0	0.50	ug/kg	1
N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA)	2991-50-6	PFAS by ID SOP	1.0	U	2.0	1.0	0.50	ug/kg	1
N-methylperfluoro-1-octanesulfonamide (MeFOSA)	31506-32-8	PFAS by ID SOP	1.0	U	2.0	1.0	0.50	ug/kg	1
N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA)	2355-31-9	PFAS by ID SOP	1.0	U	2.0	1.0	0.50	ug/kg	1
Perfluoro-1-butanesulfonic acid (PFBS)	375-73-5	PFAS by ID SOP	0.50	U	1.0	0.50	0.20	ug/kg	1
Perfluoro-1-decanesulfonic acid (PFDS)	335-77-3	PFAS by ID SOP	0.50	U	1.0	0.50	0.20	ug/kg	1
Perfluoro-1-heptanesulfonic acid (PFHpS)	375-92-8	PFAS by ID SOP	0.50	U	1.0	0.50	0.20	ug/kg	1
Perfluoro-1-nonanesulfonic acid (PFNS)	68259-12-1	PFAS by ID SOP	0.50	U	1.0	0.50	0.20	ug/kg	1
Perfluoro-1-octanesulfonamide (PFOSA)	754-91-6	PFAS by ID SOP	0.50	U	1.0	0.50	0.20	ug/kg	1
Perfluoro-1-pentanesulfonic acid (PFPeS)	2706-91-4	PFAS by ID SOP	0.50	U	1.0	0.50	0.20	ug/kg	1
Perfluorohexanesulfonic acid (PFHxS)	355-46-4	PFAS by ID SOP	0.23	J	1.0	0.50	0.20	ug/kg	1
Perfluoro-n-butanoic acid (PFBA)	375-22-4	PFAS by ID SOP	0.50	U	1.0	0.50	0.20	ug/kg	1
Perfluoro-n-decanoic acid (PFDA)	335-76-2	PFAS by ID SOP	0.50	U	1.0	0.50	0.20	ug/kg	1
Perfluoro-n-dodecanoic acid (PFDoA)	307-55-1	PFAS by ID SOP	0.50	U	1.0	0.50	0.20	ug/kg	1
Perfluoro-n-heptanoic acid (PFHpA)	375-85-9	PFAS by ID SOP	0.50	U	1.0	0.50	0.20	ug/kg	1
Perfluoro-n-hexanoic acid (PFHxA)	307-24-4	PFAS by ID SOP	0.50	U	1.0	0.50	0.20	ug/kg	1
Perfluoro-n-nonanoic acid (PFNA)	375-95-1	PFAS by ID SOP	0.50	U	1.0	0.50	0.20	ug/kg	1
Perfluoro-n-octanoic acid (PFOA)	335-67-1	PFAS by ID SOP	0.50	U	1.0	0.50	0.20	ug/kg	1
Perfluoro-n-pentanoic acid (PFPeA)	2706-90-3	PFAS by ID SOP	0.50	U	1.0	0.50	0.20	ug/kg	1
Perfluoro-n-tetradecanoic acid (PFTeDA)	376-06-7	PFAS by ID SOP	0.50	U	1.0	0.50	0.20	ug/kg	1
Perfluoro-n-tridecanoic acid (PFTrDA)	72629-94-8	PFAS by ID SOP	0.50	U	1.0	0.50	0.20	ug/kg	1
Perfluoro-n-undecanoic acid (PFUdA)	2058-94-8	PFAS by ID SOP	0.50	U	1.0	0.50	0.20	ug/kg	1
Perfluorooctanesulfonic acid (PFOS)	1763-23-1	PFAS by ID SOP	0.25	J	1.0	0.50	0.20	ug/kg	1

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
13C2_4:2FTS		101	50-150
13C2_6:2FTS		86	50-150
13C2_8:2FTS		95	50-150
13C2_PFDoA		100	50-150
13C2_PFTeDA		100	50-150
13C3_PFBS		97	50-150
13C3_PFHxS		102	50-150
13C4_PFBA		98	50-150
13C4_PFHpA		98	50-150
13C5_PFHxA		98	50-150
13C5_PFPeA		95	50-150
13C6_PFDA		100	50-150
13C7_PFUdA		100	50-150
13C8_PFOA		100	50-150
13C8_PFOS		102	50-150
13C8_PFOSA		111	50-150
13C9_PFNA		99	50-150

LOQ = Limit of Quantitation | B = Detected in the method blank | E = Quantitation of compound exceeded the calibration range | DL = Detection Limit | Q = Surrogate failure
U = Not detected at or above the LOQ | N = Recovery is out of criteria | P = The RPD between two GC columns exceeds 40% | J = Estimated result < LOQ and ≥ DL | L = LCS/LCSD failure
H = Out of holding time | W = Reported on wet weight basis | LOD = Limit of Detection | S = MS/MSD failure

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PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.		Laboratory ID: WI13001-001
Description: 382-5-S-2		Matrix: Solid
Date Sampled: 09/07/2021 1615	Project Name: Eielson AFB Soil Washing	% Solids: 89.3 09/13/2021 2013
Date Received: 09/13/2021	Project Number: 30030317	

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
d5-EtFOSAA		94	50-150
d-MeFOSA		91	50-150
d3-MeFOSAA		109	50-150

LOQ = Limit of Quantitation	B = Detected in the method blank	E = Quantitation of compound exceeded the calibration range	DL = Detection Limit	Q = Surrogate failure
U = Not detected at or above the LOQ	N = Recovery is out of criteria	P = The RPD between two GC columns exceeds 40%	J = Estimated result < LOQ and ≥ DL	L = LCS/LCSD failure
H = Out of holding time	W = Reported on wet weight basis	LOD = Limit of Detection		S = MS/MSD failure

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SPLP PFAS

Client: Arcadis U.S., Inc. | Laboratory ID: WI13001-001
Description: 382-5-S-2 | Matrix: Solid
Date Sampled: 09/07/2021 1615 | Project Name: Eielson AFB Soil Washing | % Solids: 89.3 09/13/2021 2013
Date Received: 09/13/2021 | Project Number: 30030317

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch	Leachate Date
1	1312/PFAS	PFAS by ID SOP QSM B-15	1	09/30/2021 1836	JJG	09/29/2021 1716	17007	09/15/2021 0222

Parameter	CAS Number	Analytical Method	Result	Q	LOQ	LOD	DL	Units	Run
1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS)	39108-34-4	PFAS by ID SOP	40	U	80	40	20	ng/L	1
1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS)	27619-97-2	PFAS by ID SOP	40	U	80	40	20	ng/L	1
1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS)	757124-72-4	PFAS by ID SOP	40	U	80	40	20	ng/L	1
N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA)	2991-50-6	PFAS by ID SOP	40	U	80	40	20	ng/L	1
N-methylperfluoro-1-octanesulfonamide (MeFOSA)	31506-32-8	PFAS by ID SOP	80	U	160	80	40	ng/L	1
N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA)	2355-31-9	PFAS by ID SOP	40	U	80	40	20	ng/L	1
Perfluoro-1-butanesulfonic acid (PFBS)	375-73-5	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-1-decanesulfonic acid (PFDS)	335-77-3	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-1-heptanesulfonic acid (PFHpS)	375-92-8	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-1-nonanesulfonic acid (PFNS)	68259-12-1	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-1-octanesulfonamide (PFOSA)	754-91-6	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-1-pentanesulfonic acid (PFPeS)	2706-91-4	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluorohexanesulfonic acid (PFHxS)	355-46-4	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-n-butanoic acid (PFBA)	375-22-4	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-n-decanoic acid (PFDA)	335-76-2	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-n-dodecanoic acid (PFDoA)	307-55-1	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-n-heptanoic acid (PFHpA)	375-85-9	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-n-hexanoic acid (PFHxA)	307-24-4	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-n-nonanoic acid (PFNA)	375-95-1	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-n-octanoic acid (PFOA)	335-67-1	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-n-pentanoic acid (PFPeA)	2706-90-3	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-n-tetradecanoic acid (PFTeDA)	376-06-7	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-n-tridecanoic acid (PFTrDA)	72629-94-8	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-n-undecanoic acid (PFUdA)	2058-94-8	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluorooctanesulfonic acid (PFOS)	1763-23-1	PFAS by ID SOP	20	U	40	20	10	ng/L	1

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
13C2_4:2FTS		98	50-150
13C2_6:2FTS		102	50-150
13C2_8:2FTS		95	50-150
13C2_PFDoA		80	50-150
13C2_PFTeDA		88	50-150
13C3_PFBS		89	50-150
13C3_PFHxS		91	50-150
13C4_PFBA		92	50-150
13C4_PFHpA		93	50-150
13C5_PFHxA		95	50-150
13C5_PFPeA		97	50-150
13C6_PFDA		88	50-150
13C7_PFUdA		94	50-150
13C8_PFOA		93	50-150
13C8_PFOS		85	50-150
13C8_PFOSA		105	50-150
13C9_PFNA		92	50-150

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

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SPLP PFAS

Client: Arcadis U.S., Inc.		Laboratory ID: WI13001-001
Description: 382-5-S-2		Matrix: Solid
Date Sampled: 09/07/2021 1615	Project Name: Eielson AFB Soil Washing	% Solids: 89.3 09/13/2021 2013
Date Received: 09/13/2021	Project Number: 30030317	

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
d5-EtFOSAA		98	50-150
d-MeFOSA		81	50-150
d3-MeFOSAA		101	50-150

LOQ = Limit of Quantitation	B = Detected in the method blank	E = Quantitation of compound exceeded the calibration range	DL = Detection Limit	Q = Surrogate failure
U = Not detected at or above the LOQ	N = Recovery is out of criteria	P = The RPD between two GC columns exceeds 40%	J = Estimated result < LOQ and ≥ DL	L = LCS/LCSD failure
H = Out of holding time	W = Reported on wet weight basis	LOD = Limit of Detection		S = MS/MSD failure

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PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: WI13001-002
Description: 382-5-S-3 | Matrix: Solid
Date Sampled: 09/07/2021 1620 | Project Name: Eielson AFB Soil Washing | % Solids: 87.4 09/15/2021 2332
Date Received: 09/13/2021 | Project Number: 30030317

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch
1	SOP SPE	PFAS by ID SOP QSM B-15	1	09/14/2021 1327	JJG	09/13/2021 1833	15209

Parameter	CAS Number	Analytical Method	Result	Q	LOQ	LOD	DL	Units	Run
1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS)	39108-34-4	PFAS by ID SOP	1.1	U	2.2	1.1	0.55	ug/kg	1
1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS)	27619-97-2	PFAS by ID SOP	0.79	J	2.2	1.1	0.55	ug/kg	1
1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS)	757124-72-4	PFAS by ID SOP	1.1	U	2.2	1.1	0.55	ug/kg	1
N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA)	2991-50-6	PFAS by ID SOP	1.1	U	2.2	1.1	0.55	ug/kg	1
N-methylperfluoro-1-octanesulfonamide (MeFOSA)	31506-32-8	PFAS by ID SOP	1.1	U	2.2	1.1	0.55	ug/kg	1
N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA)	2355-31-9	PFAS by ID SOP	1.1	U	2.2	1.1	0.55	ug/kg	1
Perfluoro-1-butanesulfonic acid (PFBS)	375-73-5	PFAS by ID SOP	0.55	U	1.1	0.55	0.22	ug/kg	1
Perfluoro-1-decanesulfonic acid (PFDS)	335-77-3	PFAS by ID SOP	0.55	U	1.1	0.55	0.22	ug/kg	1
Perfluoro-1-heptanesulfonic acid (PFHpS)	375-92-8	PFAS by ID SOP	0.55	U	1.1	0.55	0.22	ug/kg	1
Perfluoro-1-nonanesulfonic acid (PFNS)	68259-12-1	PFAS by ID SOP	0.55	U	1.1	0.55	0.22	ug/kg	1
Perfluoro-1-octanesulfonamide (PFOSA)	754-91-6	PFAS by ID SOP	0.55	U	1.1	0.55	0.22	ug/kg	1
Perfluoro-1-pentanesulfonic acid (PFPeS)	2706-91-4	PFAS by ID SOP	0.55	U	1.1	0.55	0.22	ug/kg	1
Perfluorohexanesulfonic acid (PFHxS)	355-46-4	PFAS by ID SOP	0.55	U	1.1	0.55	0.22	ug/kg	1
Perfluoro-n-butanoic acid (PFBA)	375-22-4	PFAS by ID SOP	0.55	U	1.1	0.55	0.22	ug/kg	1
Perfluoro-n-decanoic acid (PFDA)	335-76-2	PFAS by ID SOP	0.55	U	1.1	0.55	0.22	ug/kg	1
Perfluoro-n-dodecanoic acid (PFDoA)	307-55-1	PFAS by ID SOP	0.55	U	1.1	0.55	0.22	ug/kg	1
Perfluoro-n-heptanoic acid (PFHpA)	375-85-9	PFAS by ID SOP	0.55	U	1.1	0.55	0.22	ug/kg	1
Perfluoro-n-hexanoic acid (PFHxA)	307-24-4	PFAS by ID SOP	0.55	U	1.1	0.55	0.22	ug/kg	1
Perfluoro-n-nonanoic acid (PFNA)	375-95-1	PFAS by ID SOP	0.55	U	1.1	0.55	0.22	ug/kg	1
Perfluoro-n-octanoic acid (PFOA)	335-67-1	PFAS by ID SOP	0.55	U	1.1	0.55	0.22	ug/kg	1
Perfluoro-n-pentanoic acid (PFPeA)	2706-90-3	PFAS by ID SOP	0.55	U	1.1	0.55	0.22	ug/kg	1
Perfluoro-n-tetradecanoic acid (PFTeDA)	376-06-7	PFAS by ID SOP	0.55	U	1.1	0.55	0.22	ug/kg	1
Perfluoro-n-tridecanoic acid (PFTrDA)	72629-94-8	PFAS by ID SOP	0.55	U	1.1	0.55	0.22	ug/kg	1
Perfluoro-n-undecanoic acid (PFUdA)	2058-94-8	PFAS by ID SOP	0.55	U	1.1	0.55	0.22	ug/kg	1
Perfluorooctanesulfonic acid (PFOS)	1763-23-1	PFAS by ID SOP	0.25	J	1.1	0.55	0.22	ug/kg	1

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
13C2_4:2FTS		121	50-150
13C2_6:2FTS		98	50-150
13C2_8:2FTS		115	50-150
13C2_PFDoA		120	50-150
13C2_PFTeDA		114	50-150
13C3_PFBS		113	50-150
13C3_PFHxS		122	50-150
13C4_PFBA		114	50-150
13C4_PFHpA		114	50-150
13C5_PFHxA		109	50-150
13C5_PFPeA		111	50-150
13C6_PFDA		132	50-150
13C7_PFUdA		118	50-150
13C8_PFOA		112	50-150
13C8_PFOS		117	50-150
13C8_PFOSA		122	50-150
13C9_PFNA		118	50-150

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

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PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.		Laboratory ID: WI13001-002
Description: 382-5-S-3		Matrix: Solid
Date Sampled: 09/07/2021 1620	Project Name: Eielson AFB Soil Washing	% Solids: 87.4 09/15/2021 2332
Date Received: 09/13/2021	Project Number: 30030317	

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
d5-EtFOSAA		121	50-150
d-MeFOSA		105	50-150
d3-MeFOSAA		129	50-150

LOQ = Limit of Quantitation	B = Detected in the method blank	E = Quantitation of compound exceeded the calibration range	DL = Detection Limit	Q = Surrogate failure
U = Not detected at or above the LOQ	N = Recovery is out of criteria	P = The RPD between two GC columns exceeds 40%	J = Estimated result < LOQ and ≥ DL	L = LCS/LCSD failure
H = Out of holding time	W = Reported on wet weight basis	LOD = Limit of Detection		S = MS/MSD failure

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SPLP PFAS

Client: Arcadis U.S., Inc.			Laboratory ID: WI13001-002
Description: 382-5-S-3			Matrix: Solid
Date Sampled: 09/07/2021 1620	Project Name: Eielson AFB Soil Washing		% Solids: 87.4 09/15/2021 2332
Date Received: 09/13/2021	Project Number: 30030317		

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch	Leachate Date
1	1312/PFAS	PFAS by ID SOP QSM B-15	1	09/30/2021 1847	JJG	09/29/2021 1716	17007	09/15/2021 0222

Parameter	CAS Number	Analytical Method	Result	Q	LOQ	LOD	DL	Units	Run
1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS)	39108-34-4	PFAS by ID SOP	40	U	80	40	20	ng/L	1
1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS)	27619-97-2	PFAS by ID SOP	40	U	80	40	20	ng/L	1
1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS)	757124-72-4	PFAS by ID SOP	40	U	80	40	20	ng/L	1
N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA)	2991-50-6	PFAS by ID SOP	40	U	80	40	20	ng/L	1
N-methylperfluoro-1-octanesulfonamide (MeFOSA)	31506-32-8	PFAS by ID SOP	80	U	160	80	40	ng/L	1
N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA)	2355-31-9	PFAS by ID SOP	40	U	80	40	20	ng/L	1
Perfluoro-1-butanesulfonic acid (PFBS)	375-73-5	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-1-decanesulfonic acid (PFDS)	335-77-3	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-1-heptanesulfonic acid (PFHpS)	375-92-8	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-1-nonanesulfonic acid (PFNS)	68259-12-1	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-1-octanesulfonamide (PFOSA)	754-91-6	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-1-pentanesulfonic acid (PFPeS)	2706-91-4	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluorohexanesulfonic acid (PFHxS)	355-46-4	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-n-butanoic acid (PFBA)	375-22-4	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-n-decanoic acid (PFDA)	335-76-2	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-n-dodecanoic acid (PFDoA)	307-55-1	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-n-heptanoic acid (PFHpA)	375-85-9	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-n-hexanoic acid (PFHxA)	307-24-4	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-n-nonanoic acid (PFNA)	375-95-1	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-n-octanoic acid (PFOA)	335-67-1	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-n-pentanoic acid (PFPeA)	2706-90-3	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-n-tetradecanoic acid (PFTeDA)	376-06-7	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-n-tridecanoic acid (PFTrDA)	72629-94-8	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-n-undecanoic acid (PFUdA)	2058-94-8	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluorooctanesulfonic acid (PFOS)	1763-23-1	PFAS by ID SOP	20	U	40	20	10	ng/L	1

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
13C2_4:2FTS		117	50-150
13C2_6:2FTS		116	50-150
13C2_8:2FTS		104	50-150
13C2_PFDoA		83	50-150
13C2_PFTeDA		94	50-150
13C3_PFBS		94	50-150
13C3_PFHxS		89	50-150
13C4_PFBA		100	50-150
13C4_PFHpA		100	50-150
13C5_PFHxA		99	50-150
13C5_PFPeA		105	50-150
13C6_PFDA		96	50-150
13C7_PFUdA		99	50-150
13C8_PFOA		100	50-150
13C8_PFOS		93	50-150
13C8_PFOSA		107	50-150
13C9_PFNA		99	50-150

LOQ = Limit of Quantitation	B = Detected in the method blank	E = Quantitation of compound exceeded the calibration range	DL = Detection Limit	Q = Surrogate failure
U = Not detected at or above the LOQ	N = Recovery is out of criteria	P = The RPD between two GC columns exceeds 40%	J = Estimated result < LOQ and ≥ DL	L = LCS/LCSD failure
H = Out of holding time	W = Reported on wet weight basis	LOD = Limit of Detection		S = MS/MSD failure

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SPLP PFAS

Client: Arcadis U.S., Inc.		Laboratory ID: WI13001-002
Description: 382-5-S-3		Matrix: Solid
Date Sampled: 09/07/2021 1620	Project Name: Eielson AFB Soil Washing	% Solids: 87.4 09/15/2021 2332
Date Received: 09/13/2021	Project Number: 30030317	

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
d5-EtFOSAA		105	50-150
d-MeFOSA		83	50-150
d3-MeFOSAA		107	50-150

LOQ = Limit of Quantitation	B = Detected in the method blank	E = Quantitation of compound exceeded the calibration range	DL = Detection Limit	Q = Surrogate failure
U = Not detected at or above the LOQ	N = Recovery is out of criteria	P = The RPD between two GC columns exceeds 40%	J = Estimated result < LOQ and ≥ DL	L = LCS/LCSD failure
H = Out of holding time	W = Reported on wet weight basis	LOD = Limit of Detection		S = MS/MSD failure

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PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: WI13001-003
Description: 382-5-S-1 | Matrix: Solid
Date Sampled: 09/07/2021 1100 | Project Name: Eielson AFB Soil Washing | % Solids: 89.1 09/13/2021 2013
Date Received: 09/13/2021 | Project Number: 30030317

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch
1	SOP SPE	PFAS by ID SOP QSM B-15	1	09/14/2021 1338	JJG	09/13/2021 1833	15209

Parameter	CAS Number	Analytical Method	Result	Q	LOQ	LOD	DL	Units	Run
1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS)	39108-34-4	PFAS by ID SOP	1.1	U	2.1	1.1	0.53	ug/kg	1
1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS)	27619-97-2	PFAS by ID SOP	1.1	U	2.1	1.1	0.53	ug/kg	1
1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS)	757124-72-4	PFAS by ID SOP	1.1	US	2.1	1.1	0.53	ug/kg	1
N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA)	2991-50-6	PFAS by ID SOP	1.1	U	2.1	1.1	0.53	ug/kg	1
N-methylperfluoro-1-octanesulfonamide (MeFOSA)	31506-32-8	PFAS by ID SOP	1.1	U	2.1	1.1	0.53	ug/kg	1
N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA)	2355-31-9	PFAS by ID SOP	1.1	U	2.1	1.1	0.53	ug/kg	1
Perfluoro-1-butanesulfonic acid (PFBS)	375-73-5	PFAS by ID SOP	0.55	U	1.1	0.55	0.21	ug/kg	1
Perfluoro-1-decanesulfonic acid (PFDS)	335-77-3	PFAS by ID SOP	0.55	U	1.1	0.55	0.21	ug/kg	1
Perfluoro-1-heptanesulfonic acid (PFHpS)	375-92-8	PFAS by ID SOP	0.55	US	1.1	0.55	0.21	ug/kg	1
Perfluoro-1-nonanesulfonic acid (PFNS)	68259-12-1	PFAS by ID SOP	0.55	U	1.1	0.55	0.21	ug/kg	1
Perfluoro-1-octanesulfonamide (PFOSA)	754-91-6	PFAS by ID SOP	0.55	U	1.1	0.55	0.21	ug/kg	1
Perfluoro-1-pentanesulfonic acid (PFPeS)	2706-91-4	PFAS by ID SOP	0.55	US	1.1	0.55	0.21	ug/kg	1
Perfluorohexanesulfonic acid (PFHxS)	355-46-4	PFAS by ID SOP	0.55	US	1.1	0.55	0.21	ug/kg	1
Perfluoro-n-butanoic acid (PFBA)	375-22-4	PFAS by ID SOP	0.55	U	1.1	0.55	0.21	ug/kg	1
Perfluoro-n-decanoic acid (PFDA)	335-76-2	PFAS by ID SOP	0.55	U	1.1	0.55	0.21	ug/kg	1
Perfluoro-n-dodecanoic acid (PFDoA)	307-55-1	PFAS by ID SOP	0.55	U	1.1	0.55	0.21	ug/kg	1
Perfluoro-n-heptanoic acid (PFHpA)	375-85-9	PFAS by ID SOP	0.55	U	1.1	0.55	0.21	ug/kg	1
Perfluoro-n-hexanoic acid (PFHxA)	307-24-4	PFAS by ID SOP	0.55	U	1.1	0.55	0.21	ug/kg	1
Perfluoro-n-nonanoic acid (PFNA)	375-95-1	PFAS by ID SOP	0.55	U	1.1	0.55	0.21	ug/kg	1
Perfluoro-n-octanoic acid (PFOA)	335-67-1	PFAS by ID SOP	0.55	U	1.1	0.55	0.21	ug/kg	1
Perfluoro-n-pentanoic acid (PFPeA)	2706-90-3	PFAS by ID SOP	0.55	U	1.1	0.55	0.21	ug/kg	1
Perfluoro-n-tetradecanoic acid (PFTeDA)	376-06-7	PFAS by ID SOP	0.55	U	1.1	0.55	0.21	ug/kg	1
Perfluoro-n-tridecanoic acid (PFTrDA)	72629-94-8	PFAS by ID SOP	0.55	U	1.1	0.55	0.21	ug/kg	1
Perfluoro-n-undecanoic acid (PFUdA)	2058-94-8	PFAS by ID SOP	0.55	U	1.1	0.55	0.21	ug/kg	1
Perfluorooctanesulfonic acid (PFOS)	1763-23-1	PFAS by ID SOP	0.25	J	1.1	0.55	0.21	ug/kg	1

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
13C2_4:2FTS		107	50-150
13C2_6:2FTS		92	50-150
13C2_8:2FTS		108	50-150
13C2_PFDoA		110	50-150
13C2_PFTeDA		109	50-150
13C3_PFBS		104	50-150
13C3_PFHxS		112	50-150
13C4_PFBA		108	50-150
13C4_PFHpA		108	50-150
13C5_PFHxA		104	50-150
13C5_PFPeA		104	50-150
13C6_PFDA		110	50-150
13C7_PFUdA		114	50-150
13C8_PFOA		106	50-150
13C8_PFOS		121	50-150
13C8_PFOSA		106	50-150
13C9_PFNA		103	50-150

LOQ = Limit of Quantitation | B = Detected in the method blank | E = Quantitation of compound exceeded the calibration range | DL = Detection Limit | Q = Surrogate failure
U = Not detected at or above the LOQ | N = Recovery is out of criteria | P = The RPD between two GC columns exceeds 40% | J = Estimated result < LOQ and ≥ DL | L = LCS/LCSD failure
H = Out of holding time | W = Reported on wet weight basis | LOD = Limit of Detection | S = MS/MSD failure

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PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.		Laboratory ID: WI13001-003	
Description: 382-5-S-1		Matrix: Solid	
Date Sampled: 09/07/2021 1100	Project Name: Eielson AFB Soil Washing	% Solids: 89.1	09/13/2021 2013
Date Received: 09/13/2021	Project Number: 30030317		

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
d5-EtFOSAA		122	50-150
d-MeFOSA		94	50-150
d3-MeFOSAA		129	50-150

LOQ = Limit of Quantitation	B = Detected in the method blank	E = Quantitation of compound exceeded the calibration range	DL = Detection Limit	Q = Surrogate failure
U = Not detected at or above the LOQ	N = Recovery is out of criteria	P = The RPD between two GC columns exceeds 40%	J = Estimated result < LOQ and ≥ DL	L = LCS/LCSD failure
H = Out of holding time	W = Reported on wet weight basis	LOD = Limit of Detection		S = MS/MSD failure

SPLP PFAS

Client: Arcadis U.S., Inc. | Laboratory ID: WI13001-003
Description: 382-5-S-1 | Matrix: Solid
Date Sampled: 09/07/2021 1100 | Project Name: Eielson AFB Soil Washing | % Solids: 89.1 09/13/2021 2013
Date Received: 09/13/2021 | Project Number: 30030317

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch	Leachate Date
1	1312/PFAS	PFAS by ID SOP QSM B-15	1	09/30/2021 1857	JJG	09/29/2021 1716	17007	09/15/2021 0222

Parameter	CAS Number	Analytical Method	Result	Q	LOQ	LOD	DL	Units	Run
1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS)	39108-34-4	PFAS by ID SOP	40	U	80	40	20	ng/L	1
1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS)	27619-97-2	PFAS by ID SOP	40	U	80	40	20	ng/L	1
1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS)	757124-72-4	PFAS by ID SOP	40	U	80	40	20	ng/L	1
N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA)	2991-50-6	PFAS by ID SOP	40	U	80	40	20	ng/L	1
N-methylperfluoro-1-octanesulfonamide (MeFOSA)	31506-32-8	PFAS by ID SOP	80	U	160	80	40	ng/L	1
N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA)	2355-31-9	PFAS by ID SOP	40	U	80	40	20	ng/L	1
Perfluoro-1-butanesulfonic acid (PFBS)	375-73-5	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-1-decanesulfonic acid (PFDS)	335-77-3	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-1-heptanesulfonic acid (PFHpS)	375-92-8	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-1-nonanesulfonic acid (PFNS)	68259-12-1	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-1-octanesulfonamide (PFOSA)	754-91-6	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-1-pentanesulfonic acid (PFPeS)	2706-91-4	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluorohexanesulfonic acid (PFHxS)	355-46-4	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-n-butanoic acid (PFBA)	375-22-4	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-n-decanoic acid (PFDA)	335-76-2	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-n-dodecanoic acid (PFDoA)	307-55-1	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-n-heptanoic acid (PFHpA)	375-85-9	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-n-hexanoic acid (PFHxA)	307-24-4	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-n-nonanoic acid (PFNA)	375-95-1	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-n-octanoic acid (PFOA)	335-67-1	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-n-pentanoic acid (PFPeA)	2706-90-3	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-n-tetradecanoic acid (PFTeDA)	376-06-7	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-n-tridecanoic acid (PFTrDA)	72629-94-8	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-n-undecanoic acid (PFUdA)	2058-94-8	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluorooctanesulfonic acid (PFOS)	1763-23-1	PFAS by ID SOP	20	U	40	20	10	ng/L	1

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
13C2_4:2FTS		112	50-150
13C2_6:2FTS		113	50-150
13C2_8:2FTS		100	50-150
13C2_PFDoA		87	50-150
13C2_PFTeDA		91	50-150
13C3_PFBS		94	50-150
13C3_PFHxS		85	50-150
13C4_PFBA		96	50-150
13C4_PFHpA		96	50-150
13C5_PFHxA		97	50-150
13C5_PFPeA		100	50-150
13C6_PFDA		96	50-150
13C7_PFUdA		100	50-150
13C8_PFOA		95	50-150
13C8_PFOS		83	50-150
13C8_PFOSA		102	50-150
13C9_PFNA		100	50-150

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

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SPLP PFAS

Client: Arcadis U.S., Inc.		Laboratory ID: WI13001-003	
Description: 382-5-S-1		Matrix: Solid	
Date Sampled: 09/07/2021 1100	Project Name: Eielson AFB Soil Washing	% Solids: 89.1	09/13/2021 2013
Date Received: 09/13/2021	Project Number: 30030317		

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
d5-EtFOSAA		104	50-150
d-MeFOSA		88	50-150
d3-MeFOSAA		108	50-150

LOQ = Limit of Quantitation	B = Detected in the method blank	E = Quantitation of compound exceeded the calibration range	DL = Detection Limit	Q = Surrogate failure
U = Not detected at or above the LOQ	N = Recovery is out of criteria	P = The RPD between two GC columns exceeds 40%	J = Estimated result < LOQ and ≥ DL	L = LCS/LCSD failure
H = Out of holding time	W = Reported on wet weight basis	LOD = Limit of Detection		S = MS/MSD failure

PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: WI13001-004
Description: 382-5-W-UT-1 | Matrix: Aqueous
Date Sampled: 09/07/2021 1545 | Project Name: Eielson AFB Soil Washing
Date Received: 09/13/2021 | Project Number: 30030317

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch
1	SOP SPE	PFAS by ID SOP QSM B-15	1	09/15/2021 1453	JJG	09/13/2021 1833	15211

Parameter	CAS Number	Analytical Method	Result	Q	LOQ	LOD	DL	Units	Run
1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS)	39108-34-4	PFAS by ID SOP	3.2	J	7.8	3.9	1.9	ng/L	1
1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS)	27619-97-2	PFAS by ID SOP	6.2	J	7.8	3.9	1.9	ng/L	1
1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS)	757124-72-4	PFAS by ID SOP	3.9	U	7.8	3.9	1.9	ng/L	1
N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA)	2991-50-6	PFAS by ID SOP	3.9	U	7.8	3.9	1.9	ng/L	1
N-methylperfluoro-1-octanesulfonamide (MeFOSA)	31506-32-8	PFAS by ID SOP	8.0	U	16	8.0	3.9	ng/L	1
N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA)	2355-31-9	PFAS by ID SOP	3.9	U	7.8	3.9	1.9	ng/L	1
Perfluoro-1-butanesulfonic acid (PFBS)	375-73-5	PFAS by ID SOP	2.2	J	3.9	2.0	0.97	ng/L	1
Perfluoro-1-decanesulfonic acid (PFDS)	335-77-3	PFAS by ID SOP	2.0	U	3.9	2.0	0.97	ng/L	1
Perfluoro-1-heptanesulfonic acid (PFHpS)	375-92-8	PFAS by ID SOP	1.9	J	3.9	2.0	0.97	ng/L	1
Perfluoro-1-nonanesulfonic acid (PFNS)	68259-12-1	PFAS by ID SOP	2.0	U	3.9	2.0	0.97	ng/L	1
Perfluoro-1-octanesulfonamide (PFOSA)	754-91-6	PFAS by ID SOP	2.0	U	3.9	2.0	0.97	ng/L	1
Perfluoro-1-pentanesulfonic acid (PFPeS)	2706-91-4	PFAS by ID SOP	3.8	J	3.9	2.0	0.97	ng/L	1
Perfluorohexanesulfonic acid (PFHxS)	355-46-4	PFAS by ID SOP	46		3.9	2.0	0.97	ng/L	1
Perfluoro-n-butanoic acid (PFBA)	375-22-4	PFAS by ID SOP	3.4	J	3.9	2.0	0.97	ng/L	1
Perfluoro-n-decanoic acid (PFDA)	335-76-2	PFAS by ID SOP	2.0	U	3.9	2.0	0.97	ng/L	1
Perfluoro-n-dodecanoic acid (PFDoA)	307-55-1	PFAS by ID SOP	2.0	U	3.9	2.0	0.97	ng/L	1
Perfluoro-n-heptanoic acid (PFHpA)	375-85-9	PFAS by ID SOP	3.2	J	3.9	2.0	0.97	ng/L	1
Perfluoro-n-hexanoic acid (PFHxA)	307-24-4	PFAS by ID SOP	10		3.9	2.0	0.97	ng/L	1
Perfluoro-n-nonanoic acid (PFNA)	375-95-1	PFAS by ID SOP	2.0	U	3.9	2.0	0.97	ng/L	1
Perfluoro-n-octanoic acid (PFOA)	335-67-1	PFAS by ID SOP	4.6		3.9	2.0	0.97	ng/L	1
Perfluoro-n-pentanoic acid (PFPeA)	2706-90-3	PFAS by ID SOP	10		3.9	2.0	0.97	ng/L	1
Perfluoro-n-tetradecanoic acid (PFTeDA)	376-06-7	PFAS by ID SOP	2.0	U	3.9	2.0	0.97	ng/L	1
Perfluoro-n-tridecanoic acid (PFTrDA)	72629-94-8	PFAS by ID SOP	2.0	U	3.9	2.0	0.97	ng/L	1
Perfluoro-n-undecanoic acid (PFUdA)	2058-94-8	PFAS by ID SOP	2.0	U	3.9	2.0	0.97	ng/L	1
Perfluorooctanesulfonic acid (PFOS)	1763-23-1	PFAS by ID SOP	72		3.9	2.0	0.97	ng/L	1

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
13C2_4:2FTS		120	50-150
13C2_6:2FTS		127	50-150
13C2_8:2FTS		106	50-150
13C2_PFDoA		99	50-150
13C2_PFTeDA		100	50-150
13C3_PFBS		106	50-150
13C3_PFHxS		107	50-150
13C4_PFBA		121	50-150
13C4_PFHpA		102	50-150
13C5_PFHxA		106	50-150
13C5_PFPeA		107	50-150
13C6_PFDA		95	50-150
13C7_PFUdA		92	50-150
13C8_PFOA		117	50-150
13C8_PFOS		95	50-150
13C8_PFOSA		99	50-150
13C9_PFNA		105	50-150

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

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PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.		Laboratory ID: WI13001-004	
Description: 382-5-W-UT-1		Matrix: Aqueous	
Date Sampled: 09/07/2021 1545	Project Name: Eielson AFB Soil Washing		
Date Received: 09/13/2021	Project Number: 30030317		

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
d5-EtFOSAA		103	50-150
d-MeFOSA		95	50-150
d3-MeFOSAA		103	50-150

LOQ = Limit of Quantitation	B = Detected in the method blank	E = Quantitation of compound exceeded the calibration range	DL = Detection Limit	Q = Surrogate failure
U = Not detected at or above the LOQ	N = Recovery is out of criteria	P = The RPD between two GC columns exceeds 40%	J = Estimated result < LOQ and ≥ DL	L = LCS/LCSD failure
H = Out of holding time	W = Reported on wet weight basis	LOD = Limit of Detection		S = MS/MSD failure

PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: WI13001-005
Description: 382-5-W-T-1 | Matrix: Aqueous
Date Sampled: 09/07/2021 1550 | Project Name: Eielson AFB Soil Washing
Date Received: 09/13/2021 | Project Number: 30030317

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch
1	SOP SPE	PFAS by ID SOP QSM B-15	1	09/15/2021 1504	JJG	09/13/2021 1833	15211

Parameter	CAS Number	Analytical Method	Result	Q	LOQ	LOD	DL	Units	Run
1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS)	39108-34-4	PFAS by ID SOP	3.8	U	7.6	3.8	1.9	ng/L	1
1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS)	27619-97-2	PFAS by ID SOP	3.8	U	7.6	3.8	1.9	ng/L	1
1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS)	757124-72-4	PFAS by ID SOP	3.8	U	7.6	3.8	1.9	ng/L	1
N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA)	2991-50-6	PFAS by ID SOP	3.8	U	7.6	3.8	1.9	ng/L	1
N-methylperfluoro-1-octanesulfonamide (MeFOSA)	31506-32-8	PFAS by ID SOP	7.5	U	15	7.5	3.8	ng/L	1
N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA)	2355-31-9	PFAS by ID SOP	3.8	U	7.6	3.8	1.9	ng/L	1
Perfluoro-1-butanesulfonic acid (PFBS)	375-73-5	PFAS by ID SOP	1.9	U	3.8	1.9	0.95	ng/L	1
Perfluoro-1-decanesulfonic acid (PFDS)	335-77-3	PFAS by ID SOP	1.9	U	3.8	1.9	0.95	ng/L	1
Perfluoro-1-heptanesulfonic acid (PFHpS)	375-92-8	PFAS by ID SOP	1.9	U	3.8	1.9	0.95	ng/L	1
Perfluoro-1-nonanesulfonic acid (PFNS)	68259-12-1	PFAS by ID SOP	1.9	U	3.8	1.9	0.95	ng/L	1
Perfluoro-1-octanesulfonamide (PFOSA)	754-91-6	PFAS by ID SOP	1.9	U	3.8	1.9	0.95	ng/L	1
Perfluoro-1-pentanesulfonic acid (PFPeS)	2706-91-4	PFAS by ID SOP	1.9	U	3.8	1.9	0.95	ng/L	1
Perfluorohexanesulfonic acid (PFHxS)	355-46-4	PFAS by ID SOP	1.9	U	3.8	1.9	0.95	ng/L	1
Perfluoro-n-butanoic acid (PFBA)	375-22-4	PFAS by ID SOP	1.9	U	3.8	1.9	0.95	ng/L	1
Perfluoro-n-decanoic acid (PFDA)	335-76-2	PFAS by ID SOP	1.9	U	3.8	1.9	0.95	ng/L	1
Perfluoro-n-dodecanoic acid (PFDoA)	307-55-1	PFAS by ID SOP	1.9	U	3.8	1.9	0.95	ng/L	1
Perfluoro-n-heptanoic acid (PFHpA)	375-85-9	PFAS by ID SOP	1.9	U	3.8	1.9	0.95	ng/L	1
Perfluoro-n-hexanoic acid (PFHxA)	307-24-4	PFAS by ID SOP	1.9	U	3.8	1.9	0.95	ng/L	1
Perfluoro-n-nonanoic acid (PFNA)	375-95-1	PFAS by ID SOP	1.9	U	3.8	1.9	0.95	ng/L	1
Perfluoro-n-octanoic acid (PFOA)	335-67-1	PFAS by ID SOP	1.9	U	3.8	1.9	0.95	ng/L	1
Perfluoro-n-pentanoic acid (PFPeA)	2706-90-3	PFAS by ID SOP	1.9	U	3.8	1.9	0.95	ng/L	1
Perfluoro-n-tetradecanoic acid (PFTeDA)	376-06-7	PFAS by ID SOP	1.9	U	3.8	1.9	0.95	ng/L	1
Perfluoro-n-tridecanoic acid (PFTrDA)	72629-94-8	PFAS by ID SOP	1.9	U	3.8	1.9	0.95	ng/L	1
Perfluoro-n-undecanoic acid (PFUdA)	2058-94-8	PFAS by ID SOP	1.9	U	3.8	1.9	0.95	ng/L	1
Perfluorooctanesulfonic acid (PFOS)	1763-23-1	PFAS by ID SOP	1.6	J	3.8	1.9	0.95	ng/L	1

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
13C2_4:2FTS		107	50-150
13C2_6:2FTS		133	50-150
13C2_8:2FTS		102	50-150
13C2_PFDoA		95	50-150
13C2_PFTeDA		96	50-150
13C3_PFBS		98	50-150
13C3_PFHxS		107	50-150
13C4_PFBA		106	50-150
13C4_PFHpA		102	50-150
13C5_PFHxA		102	50-150
13C5_PFPeA		106	50-150
13C6_PFDA		90	50-150
13C7_PFUdA		102	50-150
13C8_PFOA		105	50-150
13C8_PFOS		96	50-150
13C8_PFOSA		98	50-150
13C9_PFNA		106	50-150

LOQ = Limit of Quantitation | B = Detected in the method blank | E = Quantitation of compound exceeded the calibration range | DL = Detection Limit | Q = Surrogate failure
U = Not detected at or above the LOQ | N = Recovery is out of criteria | P = The RPD between two GC columns exceeds 40% | J = Estimated result < LOQ and ≥ DL | L = LCS/LCSD failure
H = Out of holding time | W = Reported on wet weight basis | LOD = Limit of Detection | S = MS/MSD failure

PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.		Laboratory ID: WI13001-005	
Description: 382-5-W-T-1		Matrix: Aqueous	
Date Sampled: 09/07/2021 1550	Project Name: Eielson AFB Soil Washing		
Date Received: 09/13/2021	Project Number: 30030317		

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
d5-EtFOSAA		106	50-150
d-MeFOSA		106	50-150
d3-MeFOSAA		112	50-150

LOQ = Limit of Quantitation	B = Detected in the method blank	E = Quantitation of compound exceeded the calibration range	DL = Detection Limit	Q = Surrogate failure
U = Not detected at or above the LOQ	N = Recovery is out of criteria	P = The RPD between two GC columns exceeds 40%	J = Estimated result < LOQ and ≥ DL	L = LCS/LCSD failure
H = Out of holding time	W = Reported on wet weight basis	LOD = Limit of Detection		S = MS/MSD failure

PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: WI13001-006
Description: 382-5-G-2 | Matrix: Solid
Date Sampled: 09/08/2021 0920 | Project Name: Eielson AFB Soil Washing | % Solids: 99.5 09/13/2021 2013
Date Received: 09/13/2021 | Project Number: 30030317

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch
1	SOP SPE	PFAS by ID SOP QSM B-15	1	09/14/2021 1410	JJG	09/13/2021 1833	15209

Parameter	CAS Number	Analytical Method	Result	Q	LOQ	LOD	DL	Units	Run
1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS)	39108-34-4	PFAS by ID SOP	0.55	U	1.1	0.55	0.28	ug/kg	1
1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS)	27619-97-2	PFAS by ID SOP	0.55	U	1.1	0.55	0.28	ug/kg	1
1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS)	757124-72-4	PFAS by ID SOP	0.55	U	1.1	0.55	0.28	ug/kg	1
N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA)	2991-50-6	PFAS by ID SOP	0.55	U	1.1	0.55	0.28	ug/kg	1
N-methylperfluoro-1-octanesulfonamide (MeFOSA)	31506-32-8	PFAS by ID SOP	0.55	U	1.1	0.55	0.28	ug/kg	1
N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA)	2355-31-9	PFAS by ID SOP	0.55	U	1.1	0.55	0.28	ug/kg	1
Perfluoro-1-butanesulfonic acid (PFBS)	375-73-5	PFAS by ID SOP	0.28	U	0.56	0.28	0.11	ug/kg	1
Perfluoro-1-decanesulfonic acid (PFDS)	335-77-3	PFAS by ID SOP	0.28	U	0.56	0.28	0.11	ug/kg	1
Perfluoro-1-heptanesulfonic acid (PFHpS)	375-92-8	PFAS by ID SOP	0.28	U	0.56	0.28	0.11	ug/kg	1
Perfluoro-1-nonanesulfonic acid (PFNS)	68259-12-1	PFAS by ID SOP	0.28	U	0.56	0.28	0.11	ug/kg	1
Perfluoro-1-octanesulfonamide (PFOSA)	754-91-6	PFAS by ID SOP	0.28	U	0.56	0.28	0.11	ug/kg	1
Perfluoro-1-pentanesulfonic acid (PFPeS)	2706-91-4	PFAS by ID SOP	0.28	U	0.56	0.28	0.11	ug/kg	1
Perfluorohexanesulfonic acid (PFHxS)	355-46-4	PFAS by ID SOP	0.28	U	0.56	0.28	0.11	ug/kg	1
Perfluoro-n-butanoic acid (PFBA)	375-22-4	PFAS by ID SOP	0.28	U	0.56	0.28	0.11	ug/kg	1
Perfluoro-n-decanoic acid (PFDA)	335-76-2	PFAS by ID SOP	0.28	U	0.56	0.28	0.11	ug/kg	1
Perfluoro-n-dodecanoic acid (PFDoA)	307-55-1	PFAS by ID SOP	0.28	U	0.56	0.28	0.11	ug/kg	1
Perfluoro-n-heptanoic acid (PFHpA)	375-85-9	PFAS by ID SOP	0.28	U	0.56	0.28	0.11	ug/kg	1
Perfluoro-n-hexanoic acid (PFHxA)	307-24-4	PFAS by ID SOP	0.28	U	0.56	0.28	0.11	ug/kg	1
Perfluoro-n-nonanoic acid (PFNA)	375-95-1	PFAS by ID SOP	0.28	U	0.56	0.28	0.11	ug/kg	1
Perfluoro-n-octanoic acid (PFOA)	335-67-1	PFAS by ID SOP	0.28	U	0.56	0.28	0.11	ug/kg	1
Perfluoro-n-pentanoic acid (PFPeA)	2706-90-3	PFAS by ID SOP	0.28	U	0.56	0.28	0.11	ug/kg	1
Perfluoro-n-tetradecanoic acid (PFTeDA)	376-06-7	PFAS by ID SOP	0.28	U	0.56	0.28	0.11	ug/kg	1
Perfluoro-n-tridecanoic acid (PFTrDA)	72629-94-8	PFAS by ID SOP	0.28	U	0.56	0.28	0.11	ug/kg	1
Perfluoro-n-undecanoic acid (PFUdA)	2058-94-8	PFAS by ID SOP	0.28	U	0.56	0.28	0.11	ug/kg	1
Perfluorooctanesulfonic acid (PFOS)	1763-23-1	PFAS by ID SOP	0.28	U	0.56	0.28	0.11	ug/kg	1

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
13C2_4:2FTS		103	50-150
13C2_6:2FTS		89	50-150
13C2_8:2FTS		97	50-150
13C2_PFDoA		101	50-150
13C2_PFTeDA		105	50-150
13C3_PFBS		103	50-150
13C3_PFHxS		111	50-150
13C4_PFBA		104	50-150
13C4_PFHpA		105	50-150
13C5_PFHxA		103	50-150
13C5_PFPeA		103	50-150
13C6_PFDA		105	50-150
13C7_PFUdA		105	50-150
13C8_PFOA		103	50-150
13C8_PFOS		101	50-150
13C8_PFOSA		106	50-150
13C9_PFNA		105	50-150

LOQ = Limit of Quantitation | B = Detected in the method blank | E = Quantitation of compound exceeded the calibration range | DL = Detection Limit | Q = Surrogate failure
U = Not detected at or above the LOQ | N = Recovery is out of criteria | P = The RPD between two GC columns exceeds 40% | J = Estimated result < LOQ and ≥ DL | L = LCS/LCSD failure
H = Out of holding time | W = Reported on wet weight basis | LOD = Limit of Detection | S = MS/MSD failure

PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.		Laboratory ID: WI13001-006	
Description: 382-5-G-2		Matrix: Solid	
Date Sampled: 09/08/2021 0920	Project Name: Eielson AFB Soil Washing	% Solids: 99.5	09/13/2021 2013
Date Received: 09/13/2021	Project Number: 30030317		

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
d5-EtFOSAA		110	50-150
d-MeFOSA		94	50-150
d3-MeFOSAA		117	50-150

LOQ = Limit of Quantitation	B = Detected in the method blank	E = Quantitation of compound exceeded the calibration range	DL = Detection Limit	Q = Surrogate failure
U = Not detected at or above the LOQ	N = Recovery is out of criteria	P = The RPD between two GC columns exceeds 40%	J = Estimated result < LOQ and ≥ DL	L = LCS/LCSD failure
H = Out of holding time	W = Reported on wet weight basis	LOD = Limit of Detection		S = MS/MSD failure

SPLP PFAS

Client: Arcadis U.S., Inc. | Laboratory ID: WI13001-006
Description: 382-5-G-2 | Matrix: Solid
Date Sampled: 09/08/2021 0920 | Project Name: Eielson AFB Soil Washing | % Solids: 99.5 09/13/2021 2013
Date Received: 09/13/2021 | Project Number: 30030317

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch	Leachate Date
1	1312/PFAS	PFAS by ID SOP QSM B-15	1	09/30/2021 1908	JJG	09/29/2021 1716	17007	09/15/2021 0222

Parameter	CAS Number	Analytical Method	Result	Q	LOQ	LOD	DL	Units	Run
1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS)	39108-34-4	PFAS by ID SOP	40	U	80	40	20	ng/L	1
1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS)	27619-97-2	PFAS by ID SOP	40	U	80	40	20	ng/L	1
1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS)	757124-72-4	PFAS by ID SOP	40	U	80	40	20	ng/L	1
N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA)	2991-50-6	PFAS by ID SOP	40	U	80	40	20	ng/L	1
N-methylperfluoro-1-octanesulfonamide (MeFOSA)	31506-32-8	PFAS by ID SOP	80	U	160	80	40	ng/L	1
N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA)	2355-31-9	PFAS by ID SOP	40	U	80	40	20	ng/L	1
Perfluoro-1-butanesulfonic acid (PFBS)	375-73-5	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-1-decanesulfonic acid (PFDS)	335-77-3	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-1-heptanesulfonic acid (PFHpS)	375-92-8	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-1-nonanesulfonic acid (PFNS)	68259-12-1	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-1-octanesulfonamide (PFOSA)	754-91-6	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-1-pentanesulfonic acid (PFPeS)	2706-91-4	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluorohexanesulfonic acid (PFHxS)	355-46-4	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-n-butanoic acid (PFBA)	375-22-4	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-n-decanoic acid (PFDA)	335-76-2	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-n-dodecanoic acid (PFDoA)	307-55-1	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-n-heptanoic acid (PFHpA)	375-85-9	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-n-hexanoic acid (PFHxA)	307-24-4	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-n-nonanoic acid (PFNA)	375-95-1	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-n-octanoic acid (PFOA)	335-67-1	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-n-pentanoic acid (PFPeA)	2706-90-3	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-n-tetradecanoic acid (PFTeDA)	376-06-7	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-n-tridecanoic acid (PFTrDA)	72629-94-8	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-n-undecanoic acid (PFUdA)	2058-94-8	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluorooctanesulfonic acid (PFOS)	1763-23-1	PFAS by ID SOP	20	US	40	20	10	ng/L	1

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
13C2_4:2FTS		112	50-150
13C2_6:2FTS		120	50-150
13C2_8:2FTS		111	50-150
13C2_PFDoA		86	50-150
13C2_PFTeDA		89	50-150
13C3_PFBS		96	50-150
13C3_PFHxS		88	50-150
13C4_PFBA		98	50-150
13C4_PFHpA		99	50-150
13C5_PFHxA		97	50-150
13C5_PFPeA		106	50-150
13C6_PFDA		97	50-150
13C7_PFUdA		99	50-150
13C8_PFOA		101	50-150
13C8_PFOS		92	50-150
13C8_PFOSA		116	50-150
13C9_PFNA		102	50-150

LOQ = Limit of Quantitation | B = Detected in the method blank | E = Quantitation of compound exceeded the calibration range | DL = Detection Limit | Q = Surrogate failure
U = Not detected at or above the LOQ | N = Recovery is out of criteria | P = The RPD between two GC columns exceeds 40% | J = Estimated result < LOQ and ≥ DL | L = LCS/LCSD failure
H = Out of holding time | W = Reported on wet weight basis | LOD = Limit of Detection | S = MS/MSD failure

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SPLP PFAS

Client: Arcadis U.S., Inc.		Laboratory ID: WI13001-006
Description: 382-5-G-2		Matrix: Solid
Date Sampled: 09/08/2021 0920	Project Name: Eielson AFB Soil Washing	% Solids: 99.5 09/13/2021 2013
Date Received: 09/13/2021	Project Number: 30030317	

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
d5-EtFOSAA		107	50-150
d-MeFOSA		91	50-150
d3-MeFOSAA		110	50-150

LOQ = Limit of Quantitation	B = Detected in the method blank	E = Quantitation of compound exceeded the calibration range	DL = Detection Limit	Q = Surrogate failure
U = Not detected at or above the LOQ	N = Recovery is out of criteria	P = The RPD between two GC columns exceeds 40%	J = Estimated result < LOQ and ≥ DL	L = LCS/LCSD failure
H = Out of holding time	W = Reported on wet weight basis	LOD = Limit of Detection		S = MS/MSD failure

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PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: WI13001-007
Description: 382-5-G-3 | Matrix: Solid
Date Sampled: 09/08/2021 0935 | Project Name: Eielson AFB Soil Washing | % Solids: 99.9 09/13/2021 2013
Date Received: 09/13/2021 | Project Number: 30030317

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch
1	SOP SPE	PFAS by ID SOP QSM B-15	1	09/14/2021 1420	JJG	09/13/2021 1833	15209

Parameter	CAS Number	Analytical Method	Result	Q	LOQ	LOD	DL	Units	Run
1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS)	39108-34-4	PFAS by ID SOP	0.46	U	0.92	0.46	0.23	ug/kg	1
1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS)	27619-97-2	PFAS by ID SOP	0.46	U	0.92	0.46	0.23	ug/kg	1
1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS)	757124-72-4	PFAS by ID SOP	0.46	U	0.92	0.46	0.23	ug/kg	1
N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA)	2991-50-6	PFAS by ID SOP	0.46	U	0.92	0.46	0.23	ug/kg	1
N-methylperfluoro-1-octanesulfonamide (MeFOSA)	31506-32-8	PFAS by ID SOP	0.46	U	0.92	0.46	0.23	ug/kg	1
N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA)	2355-31-9	PFAS by ID SOP	0.46	U	0.92	0.46	0.23	ug/kg	1
Perfluoro-1-butanesulfonic acid (PFBS)	375-73-5	PFAS by ID SOP	0.23	U	0.46	0.23	0.092	ug/kg	1
Perfluoro-1-decanesulfonic acid (PFDS)	335-77-3	PFAS by ID SOP	0.23	U	0.46	0.23	0.092	ug/kg	1
Perfluoro-1-heptanesulfonic acid (PFHpS)	375-92-8	PFAS by ID SOP	0.23	U	0.46	0.23	0.092	ug/kg	1
Perfluoro-1-nonanesulfonic acid (PFNS)	68259-12-1	PFAS by ID SOP	0.23	U	0.46	0.23	0.092	ug/kg	1
Perfluoro-1-octanesulfonamide (PFOSA)	754-91-6	PFAS by ID SOP	0.23	U	0.46	0.23	0.092	ug/kg	1
Perfluoro-1-pentanesulfonic acid (PFPeS)	2706-91-4	PFAS by ID SOP	0.23	U	0.46	0.23	0.092	ug/kg	1
Perfluorohexanesulfonic acid (PFHxS)	355-46-4	PFAS by ID SOP	0.23	U	0.46	0.23	0.092	ug/kg	1
Perfluoro-n-butanoic acid (PFBA)	375-22-4	PFAS by ID SOP	0.23	U	0.46	0.23	0.092	ug/kg	1
Perfluoro-n-decanoic acid (PFDA)	335-76-2	PFAS by ID SOP	0.23	U	0.46	0.23	0.092	ug/kg	1
Perfluoro-n-dodecanoic acid (PFDoA)	307-55-1	PFAS by ID SOP	0.23	U	0.46	0.23	0.092	ug/kg	1
Perfluoro-n-heptanoic acid (PFHpA)	375-85-9	PFAS by ID SOP	0.23	U	0.46	0.23	0.092	ug/kg	1
Perfluoro-n-hexanoic acid (PFHxA)	307-24-4	PFAS by ID SOP	0.23	U	0.46	0.23	0.092	ug/kg	1
Perfluoro-n-nonanoic acid (PFNA)	375-95-1	PFAS by ID SOP	0.23	U	0.46	0.23	0.092	ug/kg	1
Perfluoro-n-octanoic acid (PFOA)	335-67-1	PFAS by ID SOP	0.23	U	0.46	0.23	0.092	ug/kg	1
Perfluoro-n-pentanoic acid (PFPeA)	2706-90-3	PFAS by ID SOP	0.23	U	0.46	0.23	0.092	ug/kg	1
Perfluoro-n-tetradecanoic acid (PFTeDA)	376-06-7	PFAS by ID SOP	0.23	U	0.46	0.23	0.092	ug/kg	1
Perfluoro-n-tridecanoic acid (PFTrDA)	72629-94-8	PFAS by ID SOP	0.23	U	0.46	0.23	0.092	ug/kg	1
Perfluoro-n-undecanoic acid (PFUdA)	2058-94-8	PFAS by ID SOP	0.23	U	0.46	0.23	0.092	ug/kg	1
Perfluorooctanesulfonic acid (PFOS)	1763-23-1	PFAS by ID SOP	0.23	U	0.46	0.23	0.092	ug/kg	1

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
13C2_4:2FTS		106	50-150
13C2_6:2FTS		90	50-150
13C2_8:2FTS		107	50-150
13C2_PFDoA		105	50-150
13C2_PFTeDA		111	50-150
13C3_PFBS		107	50-150
13C3_PFHxS		115	50-150
13C4_PFBA		106	50-150
13C4_PFHpA		108	50-150
13C5_PFHxA		107	50-150
13C5_PFPeA		107	50-150
13C6_PFDA		108	50-150
13C7_PFUdA		108	50-150
13C8_PFOA		108	50-150
13C8_PFOS		106	50-150
13C8_PFOSA		114	50-150
13C9_PFNA		105	50-150

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

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PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.		Laboratory ID: WI13001-007	
Description: 382-5-G-3		Matrix: Solid	
Date Sampled: 09/08/2021 0935	Project Name: Eielson AFB Soil Washing	% Solids: 99.9	09/13/2021 2013
Date Received: 09/13/2021	Project Number: 30030317		

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
d5-EtFOSAA		107	50-150
d-MeFOSA		95	50-150
d3-MeFOSAA		121	50-150

LOQ = Limit of Quantitation	B = Detected in the method blank	E = Quantitation of compound exceeded the calibration range	DL = Detection Limit	Q = Surrogate failure
U = Not detected at or above the LOQ	N = Recovery is out of criteria	P = The RPD between two GC columns exceeds 40%	J = Estimated result < LOQ and ≥ DL	L = LCS/LCSD failure
H = Out of holding time	W = Reported on wet weight basis	LOD = Limit of Detection		S = MS/MSD failure

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SPLP PFAS

Client: Arcadis U.S., Inc. | Laboratory ID: WI13001-007
Description: 382-5-G-3 | Matrix: Solid
Date Sampled: 09/08/2021 0935 | Project Name: Eielson AFB Soil Washing | % Solids: 99.9 09/13/2021 2013
Date Received: 09/13/2021 | Project Number: 30030317

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch	Leachate Date
1	1312/PFAS	PFAS by ID SOP QSM B-15	1	09/30/2021 1939	JJG	09/29/2021 1716	17007	09/15/2021 0222

Parameter	CAS Number	Analytical Method	Result	Q	LOQ	LOD	DL	Units	Run
1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS)	39108-34-4	PFAS by ID SOP	40	U	80	40	20	ng/L	1
1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS)	27619-97-2	PFAS by ID SOP	40	U	80	40	20	ng/L	1
1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS)	757124-72-4	PFAS by ID SOP	40	U	80	40	20	ng/L	1
N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA)	2991-50-6	PFAS by ID SOP	40	U	80	40	20	ng/L	1
N-methylperfluoro-1-octanesulfonamide (MeFOSA)	31506-32-8	PFAS by ID SOP	80	U	160	80	40	ng/L	1
N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA)	2355-31-9	PFAS by ID SOP	40	U	80	40	20	ng/L	1
Perfluoro-1-butanesulfonic acid (PFBS)	375-73-5	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-1-decanesulfonic acid (PFDS)	335-77-3	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-1-heptanesulfonic acid (PFHpS)	375-92-8	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-1-nonanesulfonic acid (PFNS)	68259-12-1	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-1-octanesulfonamide (PFOSA)	754-91-6	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-1-pentanesulfonic acid (PFPeS)	2706-91-4	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluorohexanesulfonic acid (PFHxS)	355-46-4	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-n-butanoic acid (PFBA)	375-22-4	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-n-decanoic acid (PFDA)	335-76-2	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-n-dodecanoic acid (PFDoA)	307-55-1	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-n-heptanoic acid (PFHpA)	375-85-9	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-n-hexanoic acid (PFHxA)	307-24-4	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-n-nonanoic acid (PFNA)	375-95-1	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-n-octanoic acid (PFOA)	335-67-1	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-n-pentanoic acid (PFPeA)	2706-90-3	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-n-tetradecanoic acid (PFTeDA)	376-06-7	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-n-tridecanoic acid (PFTrDA)	72629-94-8	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-n-undecanoic acid (PFUdA)	2058-94-8	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluorooctanesulfonic acid (PFOS)	1763-23-1	PFAS by ID SOP	20	U	40	20	10	ng/L	1

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
13C2_4:2FTS		111	50-150
13C2_6:2FTS		110	50-150
13C2_8:2FTS		101	50-150
13C2_PFDoA		84	50-150
13C2_PFTeDA		87	50-150
13C3_PFBS		90	50-150
13C3_PFHxS		93	50-150
13C4_PFBA		95	50-150
13C4_PFHpA		92	50-150
13C5_PFHxA		97	50-150
13C5_PFPeA		97	50-150
13C6_PFDA		95	50-150
13C7_PFUdA		97	50-150
13C8_PFOA		92	50-150
13C8_PFOS		89	50-150
13C8_PFOSA		103	50-150
13C9_PFNA		99	50-150

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

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SPLP PFAS

Client: Arcadis U.S., Inc.		Laboratory ID: WI13001-007
Description: 382-5-G-3		Matrix: Solid
Date Sampled: 09/08/2021 0935	Project Name: Eielson AFB Soil Washing	% Solids: 99.9 09/13/2021 2013
Date Received: 09/13/2021	Project Number: 30030317	

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
d5-EtFOSAA		101	50-150
d-MeFOSA		97	50-150
d3-MeFOSAA		110	50-150

LOQ = Limit of Quantitation	B = Detected in the method blank	E = Quantitation of compound exceeded the calibration range	DL = Detection Limit	Q = Surrogate failure
U = Not detected at or above the LOQ	N = Recovery is out of criteria	P = The RPD between two GC columns exceeds 40%	J = Estimated result < LOQ and ≥ DL	L = LCS/LCSD failure
H = Out of holding time	W = Reported on wet weight basis	LOD = Limit of Detection		S = MS/MSD failure

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PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: WI13001-008
Description: 382-5-F-1 | Matrix: Solid
Date Sampled: 09/08/2021 1000 | Project Name: Eielson AFB Soil Washing | % Solids: 62.0 09/13/2021 2013
Date Received: 09/13/2021 | Project Number: 30030317

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch
1	SOP SPE	PFAS by ID SOP QSM B-15	1	09/14/2021 1431	JJG	09/13/2021 1833	15209

Parameter	CAS Number	Analytical Method	Result	Q	LOQ	LOD	DL	Units	Run
1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS)	39108-34-4	PFAS by ID SOP	1.4	U	2.7	1.4	0.68	ug/kg	1
1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS)	27619-97-2	PFAS by ID SOP	1.4	U	2.7	1.4	0.68	ug/kg	1
1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS)	757124-72-4	PFAS by ID SOP	1.4	U	2.7	1.4	0.68	ug/kg	1
N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA)	2991-50-6	PFAS by ID SOP	1.4	U	2.7	1.4	0.68	ug/kg	1
N-methylperfluoro-1-octanesulfonamide (MeFOSA)	31506-32-8	PFAS by ID SOP	1.4	U	2.7	1.4	0.68	ug/kg	1
N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA)	2355-31-9	PFAS by ID SOP	1.4	U	2.7	1.4	0.68	ug/kg	1
Perfluoro-1-butanesulfonic acid (PFBS)	375-73-5	PFAS by ID SOP	0.70	U	1.4	0.70	0.27	ug/kg	1
Perfluoro-1-decanesulfonic acid (PFDS)	335-77-3	PFAS by ID SOP	0.70	U	1.4	0.70	0.27	ug/kg	1
Perfluoro-1-heptanesulfonic acid (PFHpS)	375-92-8	PFAS by ID SOP	0.70	U	1.4	0.70	0.27	ug/kg	1
Perfluoro-1-nonanesulfonic acid (PFNS)	68259-12-1	PFAS by ID SOP	0.70	U	1.4	0.70	0.27	ug/kg	1
Perfluoro-1-octanesulfonamide (PFOSA)	754-91-6	PFAS by ID SOP	0.70	U	1.4	0.70	0.27	ug/kg	1
Perfluoro-1-pentanesulfonic acid (PFPeS)	2706-91-4	PFAS by ID SOP	0.70	U	1.4	0.70	0.27	ug/kg	1
Perfluorohexanesulfonic acid (PFHxS)	355-46-4	PFAS by ID SOP	0.40	J	1.4	0.70	0.27	ug/kg	1
Perfluoro-n-butanoic acid (PFBA)	375-22-4	PFAS by ID SOP	0.70	U	1.4	0.70	0.27	ug/kg	1
Perfluoro-n-decanoic acid (PFDA)	335-76-2	PFAS by ID SOP	0.70	U	1.4	0.70	0.27	ug/kg	1
Perfluoro-n-dodecanoic acid (PFDoA)	307-55-1	PFAS by ID SOP	0.70	U	1.4	0.70	0.27	ug/kg	1
Perfluoro-n-heptanoic acid (PFHpA)	375-85-9	PFAS by ID SOP	0.70	U	1.4	0.70	0.27	ug/kg	1
Perfluoro-n-hexanoic acid (PFHxA)	307-24-4	PFAS by ID SOP	0.70	U	1.4	0.70	0.27	ug/kg	1
Perfluoro-n-nonanoic acid (PFNA)	375-95-1	PFAS by ID SOP	0.70	U	1.4	0.70	0.27	ug/kg	1
Perfluoro-n-octanoic acid (PFOA)	335-67-1	PFAS by ID SOP	0.70	U	1.4	0.70	0.27	ug/kg	1
Perfluoro-n-pentanoic acid (PFPeA)	2706-90-3	PFAS by ID SOP	0.70	U	1.4	0.70	0.27	ug/kg	1
Perfluoro-n-tetradecanoic acid (PFTeDA)	376-06-7	PFAS by ID SOP	0.70	U	1.4	0.70	0.27	ug/kg	1
Perfluoro-n-tridecanoic acid (PFTrDA)	72629-94-8	PFAS by ID SOP	0.70	U	1.4	0.70	0.27	ug/kg	1
Perfluoro-n-undecanoic acid (PFUdA)	2058-94-8	PFAS by ID SOP	0.70	U	1.4	0.70	0.27	ug/kg	1
Perfluorooctanesulfonic acid (PFOS)	1763-23-1	PFAS by ID SOP	1.6		1.4	0.70	0.27	ug/kg	1

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
13C2_4:2FTS		115	50-150
13C2_6:2FTS		95	50-150
13C2_8:2FTS		111	50-150
13C2_PFDoA		108	50-150
13C2_PFTeDA		105	50-150
13C3_PFBS		95	50-150
13C3_PFHxS		106	50-150
13C4_PFBA		102	50-150
13C4_PFHpA		104	50-150
13C5_PFHxA		102	50-150
13C5_PFPeA		101	50-150
13C6_PFDA		110	50-150
13C7_PFUdA		110	50-150
13C8_PFOA		102	50-150
13C8_PFOS		102	50-150
13C8_PFOSA		107	50-150
13C9_PFNA		100	50-150

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

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PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.		Laboratory ID: WI13001-008	
Description: 382-5-F-1		Matrix: Solid	
Date Sampled: 09/08/2021 1000	Project Name: Eielson AFB Soil Washing	% Solids: 62.0	09/13/2021 2013
Date Received: 09/13/2021	Project Number: 30030317		

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
d5-EtFOSAA		112	50-150
d-MeFOSA		103	50-150
d3-MeFOSAA		118	50-150

LOQ = Limit of Quantitation	B = Detected in the method blank	E = Quantitation of compound exceeded the calibration range	DL = Detection Limit	Q = Surrogate failure
U = Not detected at or above the LOQ	N = Recovery is out of criteria	P = The RPD between two GC columns exceeds 40%	J = Estimated result < LOQ and ≥ DL	L = LCS/LCSD failure
H = Out of holding time	W = Reported on wet weight basis	LOD = Limit of Detection		S = MS/MSD failure

SPLP PFAS

Client: Arcadis U.S., Inc. | Laboratory ID: WI13001-008
Description: 382-5-F-1 | Matrix: Solid
Date Sampled: 09/08/2021 1000 | Project Name: Eielson AFB Soil Washing | % Solids: 62.0 09/13/2021 2013
Date Received: 09/13/2021 | Project Number: 30030317

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch	Leachate Date
1	1312/PFAS	PFAS by ID SOP QSM B-15	1	09/30/2021 1950	JJG	09/29/2021 1716	17007	09/15/2021 0222

Parameter	CAS Number	Analytical Method	Result	Q	LOQ	LOD	DL	Units	Run
1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS)	39108-34-4	PFAS by ID SOP	40	U	80	40	20	ng/L	1
1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS)	27619-97-2	PFAS by ID SOP	40	U	80	40	20	ng/L	1
1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS)	757124-72-4	PFAS by ID SOP	40	U	80	40	20	ng/L	1
N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA)	2991-50-6	PFAS by ID SOP	40	U	80	40	20	ng/L	1
N-methylperfluoro-1-octanesulfonamide (MeFOSA)	31506-32-8	PFAS by ID SOP	80	U	160	80	40	ng/L	1
N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA)	2355-31-9	PFAS by ID SOP	40	U	80	40	20	ng/L	1
Perfluoro-1-butanesulfonic acid (PFBS)	375-73-5	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-1-decanesulfonic acid (PFDS)	335-77-3	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-1-heptanesulfonic acid (PFHpS)	375-92-8	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-1-nonanesulfonic acid (PFNS)	68259-12-1	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-1-octanesulfonamide (PFOSA)	754-91-6	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-1-pentanesulfonic acid (PFPeS)	2706-91-4	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluorohexanesulfonic acid (PFHxS)	355-46-4	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-n-butanoic acid (PFBA)	375-22-4	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-n-decanoic acid (PFDA)	335-76-2	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-n-dodecanoic acid (PFDoA)	307-55-1	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-n-heptanoic acid (PFHpA)	375-85-9	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-n-hexanoic acid (PFHxA)	307-24-4	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-n-nonanoic acid (PFNA)	375-95-1	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-n-octanoic acid (PFOA)	335-67-1	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-n-pentanoic acid (PFPeA)	2706-90-3	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-n-tetradecanoic acid (PFTeDA)	376-06-7	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-n-tridecanoic acid (PFTrDA)	72629-94-8	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-n-undecanoic acid (PFUdA)	2058-94-8	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluorooctanesulfonic acid (PFOS)	1763-23-1	PFAS by ID SOP	20	U	40	20	10	ng/L	1

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
13C2_4:2FTS		117	50-150
13C2_6:2FTS		120	50-150
13C2_8:2FTS		102	50-150
13C2_PFDoA		90	50-150
13C2_PFTeDA		98	50-150
13C3_PFBS		97	50-150
13C3_PFHxS		96	50-150
13C4_PFBA		105	50-150
13C4_PFHpA		93	50-150
13C5_PFHxA		102	50-150
13C5_PFPeA		102	50-150
13C6_PFDA		97	50-150
13C7_PFUdA		107	50-150
13C8_PFOA		102	50-150
13C8_PFOS		90	50-150
13C8_PFOSA		110	50-150
13C9_PFNA		104	50-150

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

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SPLP PFAS

Client: Arcadis U.S., Inc.		Laboratory ID: WI13001-008
Description: 382-5-F-1		Matrix: Solid
Date Sampled: 09/08/2021 1000	Project Name: Eielson AFB Soil Washing	% Solids: 62.0 09/13/2021 2013
Date Received: 09/13/2021	Project Number: 30030317	

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
d5-EtFOSAA		113	50-150
d-MeFOSA		79	50-150
d3-MeFOSAA		113	50-150

LOQ = Limit of Quantitation	B = Detected in the method blank	E = Quantitation of compound exceeded the calibration range	DL = Detection Limit	Q = Surrogate failure
U = Not detected at or above the LOQ	N = Recovery is out of criteria	P = The RPD between two GC columns exceeds 40%	J = Estimated result < LOQ and ≥ DL	L = LCS/LCSD failure
H = Out of holding time	W = Reported on wet weight basis	LOD = Limit of Detection		S = MS/MSD failure

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PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: WI13001-009
Description: 382-5-F-2 | Matrix: Solid
Date Sampled: 09/08/2021 1030 | Project Name: Eielson AFB Soil Washing | % Solids: 61.0 09/13/2021 2013
Date Received: 09/13/2021 | Project Number: 30030317

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch
1	SOP SPE	PFAS by ID SOP QSM B-15	1	09/14/2021 1442	JJG	09/13/2021 1833	15209
2	SOP SPE	PFAS by ID SOP QSM B-15	1	09/21/2021 1842	JJG	09/20/2021 1859	15911

Parameter	CAS Number	Analytical Method	Result	Q	LOQ	LOD	DL	Units	Run
1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS)	39108-34-4	PFAS by ID SOP	1.6	U	3.2	1.6	0.80	ug/kg	1
1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS)	27619-97-2	PFAS by ID SOP	1.6	UQ	3.2	1.6	0.80	ug/kg	1
1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS)	757124-72-4	PFAS by ID SOP	1.6	U	3.2	1.6	0.80	ug/kg	1
N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA)	2991-50-6	PFAS by ID SOP	1.6	U	3.2	1.6	0.80	ug/kg	1
N-methylperfluoro-1-octanesulfonamide (MeFOSA)	31506-32-8	PFAS by ID SOP	1.6	UQ	3.2	1.6	0.80	ug/kg	1
N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA)	2355-31-9	PFAS by ID SOP	1.6	U	3.2	1.6	0.80	ug/kg	1
Perfluoro-1-butanesulfonic acid (PFBS)	375-73-5	PFAS by ID SOP	0.80	U	1.6	0.80	0.32	ug/kg	1
Perfluoro-1-decanesulfonic acid (PFDS)	335-77-3	PFAS by ID SOP	0.80	U	1.6	0.80	0.32	ug/kg	1
Perfluoro-1-heptanesulfonic acid (PFHpS)	375-92-8	PFAS by ID SOP	0.80	U	1.6	0.80	0.32	ug/kg	1
Perfluoro-1-nonanesulfonic acid (PFNS)	68259-12-1	PFAS by ID SOP	0.80	U	1.6	0.80	0.32	ug/kg	1
Perfluoro-1-octanesulfonamide (PFOSA)	754-91-6	PFAS by ID SOP	0.80	U	1.6	0.80	0.32	ug/kg	1
Perfluoro-1-pentanesulfonic acid (PFPeS)	2706-91-4	PFAS by ID SOP	0.80	U	1.6	0.80	0.32	ug/kg	1
Perfluorohexanesulfonic acid (PFHxS)	355-46-4	PFAS by ID SOP	0.96	J	1.6	0.80	0.32	ug/kg	1
Perfluoro-n-butanoic acid (PFBA)	375-22-4	PFAS by ID SOP	0.80	U	1.6	0.80	0.32	ug/kg	1
Perfluoro-n-decanoic acid (PFDA)	335-76-2	PFAS by ID SOP	0.80	U	1.6	0.80	0.32	ug/kg	1
Perfluoro-n-dodecanoic acid (PFDoA)	307-55-1	PFAS by ID SOP	0.80	U	1.6	0.80	0.32	ug/kg	1
Perfluoro-n-heptanoic acid (PFHpA)	375-85-9	PFAS by ID SOP	0.80	U	1.6	0.80	0.32	ug/kg	1
Perfluoro-n-hexanoic acid (PFHxA)	307-24-4	PFAS by ID SOP	0.80	U	1.6	0.80	0.32	ug/kg	1
Perfluoro-n-nonanoic acid (PFNA)	375-95-1	PFAS by ID SOP	0.80	U	1.6	0.80	0.32	ug/kg	1
Perfluoro-n-octanoic acid (PFOA)	335-67-1	PFAS by ID SOP	0.80	U	1.6	0.80	0.32	ug/kg	1
Perfluoro-n-pentanoic acid (PFPeA)	2706-90-3	PFAS by ID SOP	0.80	UQ	1.6	0.80	0.32	ug/kg	1
Perfluoro-n-tetradecanoic acid (PFTeDA)	376-06-7	PFAS by ID SOP	0.80	U	1.6	0.80	0.32	ug/kg	1
Perfluoro-n-tridecanoic acid (PFTrDA)	72629-94-8	PFAS by ID SOP	0.80	U	1.6	0.80	0.32	ug/kg	1
Perfluoro-n-undecanoic acid (PFUdA)	2058-94-8	PFAS by ID SOP	0.80	U	1.6	0.80	0.32	ug/kg	1
Perfluorooctanesulfonic acid (PFOS)	1763-23-1	PFAS by ID SOP	3.1		1.6	0.80	0.32	ug/kg	1

Surrogate	Q	Run 1 % Recovery	Acceptance Limits	Q	Run 2 % Recovery	Acceptance Limits
13C2_4:2FTS		56	50-150		89	50-150
13C2_6:2FTS	N	46	50-150		83	50-150
13C2_8:2FTS		61	50-150		134	50-150
13C2_PFDoA		52	50-150		93	50-150
13C2_PFTeDA		56	50-150		79	50-150
13C3_PFBS		51	50-150		84	50-150
13C3_PFHxS		56	50-150		87	50-150
13C4_PFBA		50	50-150		85	50-150
13C4_PFHpA		54	50-150		92	50-150
13C5_PFHxA		52	50-150		88	50-150
13C5_PFPeA	N	48	50-150		89	50-150
13C6_PFDA		52	50-150		96	50-150
13C7_PFUdA		56	50-150		99	50-150
13C8_PFOA		52	50-150		91	50-150
13C8_PFOS		60	50-150		90	50-150
13C8_PFOSA		52	50-150		86	50-150

LOQ = Limit of Quantitation | B = Detected in the method blank | E = Quantitation of compound exceeded the calibration range | DL = Detection Limit | Q = Surrogate failure
U = Not detected at or above the LOQ | N = Recovery is out of criteria | P = The RPD between two GC columns exceeds 40% | J = Estimated result < LOQ and ≥ DL | L = LCS/LCSD failure
H = Out of holding time | W = Reported on wet weight basis | LOD = Limit of Detection | S = MS/MSD failure

PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.
Laboratory ID: WI13001-009
Description: 382-5-F-2
Matrix: Solid
Date Sampled: 09/08/2021 1030
Project Name: Eielson AFB Soil Washing
% Solids: 61.0 09/13/2021 2013
Date Received: 09/13/2021
Project Number: 30030317

Surrogate	Q	Run 1 % Recovery	Acceptance Limits	Q	Run 2 % Recovery	Acceptance Limits
13C9_PFNA		51	50-150		90	50-150
d5-EtFOSAA		51	50-150		115	50-150
d-MeFOSA	N	42	50-150		80	50-150
d3-MeFOSAA		55	50-150		116	50-150

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

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PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: WI13001-009
Description: 382-5-F-2 | Matrix: Solid
Date Sampled: 09/08/2021 1030 | Project Name: Eielson AFB Soil Washing | % Solids: 61.0 09/13/2021 2013
Date Received: 09/13/2021 | Project Number: 30030317

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch
1	SOP SPE	PFAS by ID SOP QSM B-15	1	09/14/2021 1442	JJG	09/13/2021 1833	15209
2	SOP SPE	PFAS by ID SOP QSM B-15	1	09/21/2021 1842	JJG	09/20/2021 1859	15911

Parameter	CAS Number	Analytical Method	Result	Q	LOQ	LOD	DL	Units	Run
1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS)	39108-34-4	PFAS by ID SOP	1.4	U	2.8	1.4	0.69	ug/kg	2
1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS)	27619-97-2	PFAS by ID SOP	1.4	U	2.8	1.4	0.69	ug/kg	2
1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS)	757124-72-4	PFAS by ID SOP	1.4	U	2.8	1.4	0.69	ug/kg	2
N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA)	2991-50-6	PFAS by ID SOP	1.4	U	2.8	1.4	0.69	ug/kg	2
N-methylperfluoro-1-octanesulfonamide (MeFOSA)	31506-32-8	PFAS by ID SOP	1.4	U	2.8	1.4	0.69	ug/kg	2
N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA)	2355-31-9	PFAS by ID SOP	1.4	U	2.8	1.4	0.69	ug/kg	2
Perfluoro-1-butanesulfonic acid (PFBS)	375-73-5	PFAS by ID SOP	0.70	U	1.4	0.70	0.28	ug/kg	2
Perfluoro-1-decanesulfonic acid (PFDS)	335-77-3	PFAS by ID SOP	0.70	U	1.4	0.70	0.28	ug/kg	2
Perfluoro-1-heptanesulfonic acid (PFHpS)	375-92-8	PFAS by ID SOP	0.70	U	1.4	0.70	0.28	ug/kg	2
Perfluoro-1-nonanesulfonic acid (PFNS)	68259-12-1	PFAS by ID SOP	0.70	U	1.4	0.70	0.28	ug/kg	2
Perfluoro-1-octanesulfonamide (PFOSA)	754-91-6	PFAS by ID SOP	0.70	U	1.4	0.70	0.28	ug/kg	2
Perfluoro-1-pentanesulfonic acid (PFPeS)	2706-91-4	PFAS by ID SOP	0.70	U	1.4	0.70	0.28	ug/kg	2
Perfluorohexanesulfonic acid (PFHxS)	355-46-4	PFAS by ID SOP	0.74	J	1.4	0.70	0.28	ug/kg	2
Perfluoro-n-butanoic acid (PFBA)	375-22-4	PFAS by ID SOP	0.71	J	1.4	0.70	0.28	ug/kg	2
Perfluoro-n-decanoic acid (PFDA)	335-76-2	PFAS by ID SOP	0.70	U	1.4	0.70	0.28	ug/kg	2
Perfluoro-n-dodecanoic acid (PFDoA)	307-55-1	PFAS by ID SOP	0.70	U	1.4	0.70	0.28	ug/kg	2
Perfluoro-n-heptanoic acid (PFHpA)	375-85-9	PFAS by ID SOP	0.70	U	1.4	0.70	0.28	ug/kg	2
Perfluoro-n-hexanoic acid (PFHxA)	307-24-4	PFAS by ID SOP	0.70	U	1.4	0.70	0.28	ug/kg	2
Perfluoro-n-nonanoic acid (PFNA)	375-95-1	PFAS by ID SOP	0.70	U	1.4	0.70	0.28	ug/kg	2
Perfluoro-n-octanoic acid (PFOA)	335-67-1	PFAS by ID SOP	0.70	U	1.4	0.70	0.28	ug/kg	2
Perfluoro-n-pentanoic acid (PFPeA)	2706-90-3	PFAS by ID SOP	0.70	U	1.4	0.70	0.28	ug/kg	2
Perfluoro-n-tetradecanoic acid (PFTeDA)	376-06-7	PFAS by ID SOP	0.70	U	1.4	0.70	0.28	ug/kg	2
Perfluoro-n-tridecanoic acid (PFTrDA)	72629-94-8	PFAS by ID SOP	0.70	U	1.4	0.70	0.28	ug/kg	2
Perfluoro-n-undecanoic acid (PFUdA)	2058-94-8	PFAS by ID SOP	0.70	U	1.4	0.70	0.28	ug/kg	2
Perfluorooctanesulfonic acid (PFOS)	1763-23-1	PFAS by ID SOP	2.3		1.4	0.70	0.28	ug/kg	2

Surrogate	Run 1 Q	Run 1 % Recovery	Run 1 Acceptance Limits	Run 2 Q	Run 2 % Recovery	Run 2 Acceptance Limits
13C2_4:2FTS		56	50-150		89	50-150
13C2_6:2FTS	N	46	50-150		83	50-150
13C2_8:2FTS		61	50-150		134	50-150
13C2_PFDoA		52	50-150		93	50-150
13C2_PFTeDA		56	50-150		79	50-150
13C3_PFBS		51	50-150		84	50-150
13C3_PFHxS		56	50-150		87	50-150
13C4_PFBA		50	50-150		85	50-150
13C4_PFHpA		54	50-150		92	50-150
13C5_PFHxA		52	50-150		88	50-150
13C5_PFPeA	N	48	50-150		89	50-150
13C6_PFDA		52	50-150		96	50-150
13C7_PFUdA		56	50-150		99	50-150
13C8_PFOA		52	50-150		91	50-150
13C8_PFOS		60	50-150		90	50-150
13C8_PFOSA		52	50-150		86	50-150

LOQ = Limit of Quantitation | B = Detected in the method blank | E = Quantitation of compound exceeded the calibration range | DL = Detection Limit | Q = Surrogate failure
U = Not detected at or above the LOQ | N = Recovery is out of criteria | P = The RPD between two GC columns exceeds 40% | J = Estimated result < LOQ and ≥ DL | L = LCS/LCSD failure
H = Out of holding time | W = Reported on wet weight basis | LOD = Limit of Detection | S = MS/MSD failure

PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.		Laboratory ID: WI13001-009	
Description: 382-5-F-2		Matrix: Solid	
Date Sampled: 09/08/2021 1030	Project Name: Eielson AFB Soil Washing	% Solids: 61.0	09/13/2021 2013
Date Received: 09/13/2021	Project Number: 30030317		

Surrogate	Q	Run 1 % Recovery	Acceptance Limits	Q	Run 2 % Recovery	Acceptance Limits
13C9_PFNA		51	50-150		90	50-150
d5-EtFOSAA		51	50-150		115	50-150
d-MeFOSA	N	42	50-150		80	50-150
d3-MeFOSAA		55	50-150		116	50-150

LOQ = Limit of Quantitation	B = Detected in the method blank	E = Quantitation of compound exceeded the calibration range	DL = Detection Limit	Q = Surrogate failure
U = Not detected at or above the LOQ	N = Recovery is out of criteria	P = The RPD between two GC columns exceeds 40%	J = Estimated result < LOQ and ≥ DL	L = LCS/LCSD failure
H = Out of holding time	W = Reported on wet weight basis	LOD = Limit of Detection		S = MS/MSD failure

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SPLP PFAS

Client: Arcadis U.S., Inc. | Laboratory ID: WI13001-009
Description: 382-5-F-2 | Matrix: Solid
Date Sampled: 09/08/2021 1030 | Project Name: Eielson AFB Soil Washing | % Solids: 61.0 09/13/2021 2013
Date Received: 09/13/2021 | Project Number: 30030317

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch	Leachate Date
1	1312/PFAS	PFAS by ID SOP QSM B-15	1	09/30/2021 2001	JJG	09/29/2021 1716	17007	09/15/2021 0222

Parameter	CAS Number	Analytical Method	Result	Q	LOQ	LOD	DL	Units	Run
1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS)	39108-34-4	PFAS by ID SOP	40	U	80	40	20	ng/L	1
1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS)	27619-97-2	PFAS by ID SOP	40	U	80	40	20	ng/L	1
1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS)	757124-72-4	PFAS by ID SOP	40	U	80	40	20	ng/L	1
N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA)	2991-50-6	PFAS by ID SOP	40	U	80	40	20	ng/L	1
N-methylperfluoro-1-octanesulfonamide (MeFOSA)	31506-32-8	PFAS by ID SOP	80	U	160	80	40	ng/L	1
N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA)	2355-31-9	PFAS by ID SOP	40	U	80	40	20	ng/L	1
Perfluoro-1-butanesulfonic acid (PFBS)	375-73-5	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-1-decanesulfonic acid (PFDS)	335-77-3	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-1-heptanesulfonic acid (PFHpS)	375-92-8	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-1-nonanesulfonic acid (PFNS)	68259-12-1	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-1-octanesulfonamide (PFOSA)	754-91-6	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-1-pentanesulfonic acid (PFPeS)	2706-91-4	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluorohexanesulfonic acid (PFHxS)	355-46-4	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-n-butanoic acid (PFBA)	375-22-4	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-n-decanoic acid (PFDA)	335-76-2	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-n-dodecanoic acid (PFDoA)	307-55-1	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-n-heptanoic acid (PFHpA)	375-85-9	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-n-hexanoic acid (PFHxA)	307-24-4	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-n-nonanoic acid (PFNA)	375-95-1	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-n-octanoic acid (PFOA)	335-67-1	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-n-pentanoic acid (PFPeA)	2706-90-3	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-n-tetradecanoic acid (PFTeDA)	376-06-7	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-n-tridecanoic acid (PFTrDA)	72629-94-8	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-n-undecanoic acid (PFUdA)	2058-94-8	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluorooctanesulfonic acid (PFOS)	1763-23-1	PFAS by ID SOP	20	U	40	20	10	ng/L	1

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
13C2_4:2FTS		96	50-150
13C2_6:2FTS		123	50-150
13C2_8:2FTS		91	50-150
13C2_PFDoA		75	50-150
13C2_PFTeDA		85	50-150
13C3_PFBS		91	50-150
13C3_PFHxS		82	50-150
13C4_PFBA		87	50-150
13C4_PFHpA		91	50-150
13C5_PFHxA		92	50-150
13C5_PFPeA		92	50-150
13C6_PFDA		90	50-150
13C7_PFUdA		85	50-150
13C8_PFOA		92	50-150
13C8_PFOS		85	50-150
13C8_PFOSA		99	50-150
13C9_PFNA		93	50-150

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

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SPLP PFAS

Client: Arcadis U.S., Inc.		Laboratory ID: WI13001-009
Description: 382-5-F-2		Matrix: Solid
Date Sampled: 09/08/2021 1030	Project Name: Eielson AFB Soil Washing	% Solids: 61.0 09/13/2021 2013
Date Received: 09/13/2021	Project Number: 30030317	

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
d5-EtFOSAA		104	50-150
d-MeFOSA		108	50-150
d3-MeFOSAA		99	50-150

LOQ = Limit of Quantitation	B = Detected in the method blank	E = Quantitation of compound exceeded the calibration range	DL = Detection Limit	Q = Surrogate failure
U = Not detected at or above the LOQ	N = Recovery is out of criteria	P = The RPD between two GC columns exceeds 40%	J = Estimated result < LOQ and ≥ DL	L = LCS/LCSD failure
H = Out of holding time	W = Reported on wet weight basis	LOD = Limit of Detection		S = MS/MSD failure

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PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: WI13001-010
Description: 382-5-F-3 | Matrix: Solid
Date Sampled: 09/08/2021 1045 | Project Name: Eielson AFB Soil Washing | % Solids: 60.9 09/13/2021 2013
Date Received: 09/13/2021 | Project Number: 30030317

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch
1	SOP SPE	PFAS by ID SOP QSM B-15	1	09/14/2021 1452	JJG	09/13/2021 1833	15209

Parameter	CAS Number	Analytical Method	Result	Q	LOQ	LOD	DL	Units	Run
1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS)	39108-34-4	PFAS by ID SOP	1.6	U	3.1	1.6	0.77	ug/kg	1
1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS)	27619-97-2	PFAS by ID SOP	0.98	J	3.1	1.6	0.77	ug/kg	1
1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS)	757124-72-4	PFAS by ID SOP	1.6	U	3.1	1.6	0.77	ug/kg	1
N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA)	2991-50-6	PFAS by ID SOP	1.6	U	3.1	1.6	0.77	ug/kg	1
N-methylperfluoro-1-octanesulfonamide (MeFOSA)	31506-32-8	PFAS by ID SOP	1.6	U	3.1	1.6	0.77	ug/kg	1
N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA)	2355-31-9	PFAS by ID SOP	1.6	U	3.1	1.6	0.77	ug/kg	1
Perfluoro-1-butanesulfonic acid (PFBS)	375-73-5	PFAS by ID SOP	0.75	U	1.5	0.75	0.31	ug/kg	1
Perfluoro-1-decanesulfonic acid (PFDS)	335-77-3	PFAS by ID SOP	0.75	U	1.5	0.75	0.31	ug/kg	1
Perfluoro-1-heptanesulfonic acid (PFHpS)	375-92-8	PFAS by ID SOP	0.75	U	1.5	0.75	0.31	ug/kg	1
Perfluoro-1-nonanesulfonic acid (PFNS)	68259-12-1	PFAS by ID SOP	0.75	U	1.5	0.75	0.31	ug/kg	1
Perfluoro-1-octanesulfonamide (PFOSA)	754-91-6	PFAS by ID SOP	0.75	U	1.5	0.75	0.31	ug/kg	1
Perfluoro-1-pentanesulfonic acid (PFPeS)	2706-91-4	PFAS by ID SOP	0.75	U	1.5	0.75	0.31	ug/kg	1
Perfluorohexanesulfonic acid (PFHxS)	355-46-4	PFAS by ID SOP	0.44	J	1.5	0.75	0.31	ug/kg	1
Perfluoro-n-butanoic acid (PFBA)	375-22-4	PFAS by ID SOP	0.75	U	1.5	0.75	0.31	ug/kg	1
Perfluoro-n-decanoic acid (PFDA)	335-76-2	PFAS by ID SOP	0.75	U	1.5	0.75	0.31	ug/kg	1
Perfluoro-n-dodecanoic acid (PFDoA)	307-55-1	PFAS by ID SOP	0.75	U	1.5	0.75	0.31	ug/kg	1
Perfluoro-n-heptanoic acid (PFHpA)	375-85-9	PFAS by ID SOP	0.75	U	1.5	0.75	0.31	ug/kg	1
Perfluoro-n-hexanoic acid (PFHxA)	307-24-4	PFAS by ID SOP	0.75	U	1.5	0.75	0.31	ug/kg	1
Perfluoro-n-nonanoic acid (PFNA)	375-95-1	PFAS by ID SOP	0.75	U	1.5	0.75	0.31	ug/kg	1
Perfluoro-n-octanoic acid (PFOA)	335-67-1	PFAS by ID SOP	0.75	U	1.5	0.75	0.31	ug/kg	1
Perfluoro-n-pentanoic acid (PFPeA)	2706-90-3	PFAS by ID SOP	0.75	U	1.5	0.75	0.31	ug/kg	1
Perfluoro-n-tetradecanoic acid (PFTeDA)	376-06-7	PFAS by ID SOP	0.75	U	1.5	0.75	0.31	ug/kg	1
Perfluoro-n-tridecanoic acid (PFTrDA)	72629-94-8	PFAS by ID SOP	0.75	U	1.5	0.75	0.31	ug/kg	1
Perfluoro-n-undecanoic acid (PFUdA)	2058-94-8	PFAS by ID SOP	0.75	U	1.5	0.75	0.31	ug/kg	1
Perfluorooctanesulfonic acid (PFOS)	1763-23-1	PFAS by ID SOP	2.1		1.5	0.75	0.31	ug/kg	1

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
13C2_4:2FTS		105	50-150
13C2_6:2FTS		91	50-150
13C2_8:2FTS		108	50-150
13C2_PFDoA		106	50-150
13C2_PFTeDA		111	50-150
13C3_PFBS		100	50-150
13C3_PFHxS		106	50-150
13C4_PFBA		99	50-150
13C4_PFHpA		103	50-150
13C5_PFHxA		104	50-150
13C5_PFPeA		98	50-150
13C6_PFDA		108	50-150
13C7_PFUdA		112	50-150
13C8_PFOA		99	50-150
13C8_PFOS		102	50-150
13C8_PFOSA		112	50-150
13C9_PFNA		101	50-150

LOQ = Limit of Quantitation | B = Detected in the method blank | E = Quantitation of compound exceeded the calibration range | DL = Detection Limit | Q = Surrogate failure
U = Not detected at or above the LOQ | N = Recovery is out of criteria | P = The RPD between two GC columns exceeds 40% | J = Estimated result < LOQ and ≥ DL | L = LCS/LCSD failure
H = Out of holding time | W = Reported on wet weight basis | LOD = Limit of Detection | S = MS/MSD failure

PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.		Laboratory ID: WI13001-010
Description: 382-5-F-3		Matrix: Solid
Date Sampled: 09/08/2021 1045	Project Name: Eielson AFB Soil Washing	% Solids: 60.9 09/13/2021 2013
Date Received: 09/13/2021	Project Number: 30030317	

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
d5-EtFOSAA		113	50-150
d-MeFOSA		85	50-150
d3-MeFOSAA		118	50-150

LOQ = Limit of Quantitation	B = Detected in the method blank	E = Quantitation of compound exceeded the calibration range	DL = Detection Limit	Q = Surrogate failure
U = Not detected at or above the LOQ	N = Recovery is out of criteria	P = The RPD between two GC columns exceeds 40%	J = Estimated result < LOQ and ≥ DL	L = LCS/LCSD failure
H = Out of holding time	W = Reported on wet weight basis	LOD = Limit of Detection		S = MS/MSD failure

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SPLP PFAS

Client: Arcadis U.S., Inc. | Laboratory ID: WI13001-010
Description: 382-5-F-3 | Matrix: Solid
Date Sampled: 09/08/2021 1045 | Project Name: Eielson AFB Soil Washing | % Solids: 60.9 09/13/2021 2013
Date Received: 09/13/2021 | Project Number: 30030317

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch	Leachate Date
1	1312/PFAS	PFAS by ID SOP QSM B-15	1	09/30/2021 2011	JJG	09/29/2021 1716	17007	09/15/2021 0222

Parameter	CAS Number	Analytical Method	Result	Q	LOQ	LOD	DL	Units	Run
1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS)	39108-34-4	PFAS by ID SOP	40	U	80	40	20	ng/L	1
1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS)	27619-97-2	PFAS by ID SOP	40	U	80	40	20	ng/L	1
1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS)	757124-72-4	PFAS by ID SOP	40	U	80	40	20	ng/L	1
N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA)	2991-50-6	PFAS by ID SOP	40	U	80	40	20	ng/L	1
N-methylperfluoro-1-octanesulfonamide (MeFOSA)	31506-32-8	PFAS by ID SOP	80	U	160	80	40	ng/L	1
N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA)	2355-31-9	PFAS by ID SOP	40	U	80	40	20	ng/L	1
Perfluoro-1-butanesulfonic acid (PFBS)	375-73-5	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-1-decanesulfonic acid (PFDS)	335-77-3	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-1-heptanesulfonic acid (PFHpS)	375-92-8	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-1-nonanesulfonic acid (PFNS)	68259-12-1	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-1-octanesulfonamide (PFOSA)	754-91-6	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-1-pentanesulfonic acid (PFPeS)	2706-91-4	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluorohexanesulfonic acid (PFHxS)	355-46-4	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-n-butanoic acid (PFBA)	375-22-4	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-n-decanoic acid (PFDA)	335-76-2	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-n-dodecanoic acid (PFDoA)	307-55-1	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-n-heptanoic acid (PFHpA)	375-85-9	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-n-hexanoic acid (PFHxA)	307-24-4	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-n-nonanoic acid (PFNA)	375-95-1	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-n-octanoic acid (PFOA)	335-67-1	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-n-pentanoic acid (PFPeA)	2706-90-3	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-n-tetradecanoic acid (PFTeDA)	376-06-7	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-n-tridecanoic acid (PFTrDA)	72629-94-8	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-n-undecanoic acid (PFUdA)	2058-94-8	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluorooctanesulfonic acid (PFOS)	1763-23-1	PFAS by ID SOP	20	U	40	20	10	ng/L	1

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
13C2_4:2FTS		105	50-150
13C2_6:2FTS		117	50-150
13C2_8:2FTS		90	50-150
13C2_PFDoA		78	50-150
13C2_PFTeDA		86	50-150
13C3_PFBS		94	50-150
13C3_PFHxS		89	50-150
13C4_PFBA		98	50-150
13C4_PFHpA		97	50-150
13C5_PFHxA		98	50-150
13C5_PFPeA		101	50-150
13C6_PFDA		92	50-150
13C7_PFUdA		88	50-150
13C8_PFOA		94	50-150
13C8_PFOS		82	50-150
13C8_PFOSA		105	50-150
13C9_PFNA		93	50-150

LOQ = Limit of Quantitation | B = Detected in the method blank | E = Quantitation of compound exceeded the calibration range | DL = Detection Limit | Q = Surrogate failure
U = Not detected at or above the LOQ | N = Recovery is out of criteria | P = The RPD between two GC columns exceeds 40% | J = Estimated result < LOQ and ≥ DL | L = LCS/LCSD failure
H = Out of holding time | W = Reported on wet weight basis | LOD = Limit of Detection | S = MS/MSD failure

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SPLP PFAS

Client: Arcadis U.S., Inc.		Laboratory ID: WI13001-010
Description: 382-5-F-3		Matrix: Solid
Date Sampled: 09/08/2021 1045	Project Name: Eielson AFB Soil Washing	% Solids: 60.9 09/13/2021 2013
Date Received: 09/13/2021	Project Number: 30030317	

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
d5-EtFOSAA		98	50-150
d-MeFOSA		80	50-150
d3-MeFOSAA		100	50-150

LOQ = Limit of Quantitation	B = Detected in the method blank	E = Quantitation of compound exceeded the calibration range	DL = Detection Limit	Q = Surrogate failure
U = Not detected at or above the LOQ	N = Recovery is out of criteria	P = The RPD between two GC columns exceeds 40%	J = Estimated result < LOQ and ≥ DL	L = LCS/LCSD failure
H = Out of holding time	W = Reported on wet weight basis	LOD = Limit of Detection		S = MS/MSD failure

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PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: WI13001-011
Description: 382-5-UT-3 | Matrix: Solid
Date Sampled: 09/08/2021 1220 | Project Name: Eielson AFB Soil Washing | % Solids: 86.7 09/13/2021 2013
Date Received: 09/13/2021 | Project Number: 30030317

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch
1	SOP SPE	PFAS by ID SOP QSM B-15	1	09/14/2021 1503	JJG	09/13/2021 1833	15209

Parameter	CAS Number	Analytical Method	Result	Q	LOQ	LOD	DL	Units	Run
1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS)	39108-34-4	PFAS by ID SOP	1.2	U	2.3	1.2	0.57	ug/kg	1
1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS)	27619-97-2	PFAS by ID SOP	1.2	U	2.3	1.2	0.57	ug/kg	1
1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS)	757124-72-4	PFAS by ID SOP	1.2	U	2.3	1.2	0.57	ug/kg	1
N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA)	2991-50-6	PFAS by ID SOP	1.2	U	2.3	1.2	0.57	ug/kg	1
N-methylperfluoro-1-octanesulfonamide (MeFOSA)	31506-32-8	PFAS by ID SOP	1.2	U	2.3	1.2	0.57	ug/kg	1
N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA)	2355-31-9	PFAS by ID SOP	1.2	U	2.3	1.2	0.57	ug/kg	1
Perfluoro-1-butanesulfonic acid (PFBS)	375-73-5	PFAS by ID SOP	0.55	U	1.1	0.55	0.23	ug/kg	1
Perfluoro-1-decanesulfonic acid (PFDS)	335-77-3	PFAS by ID SOP	0.55	U	1.1	0.55	0.23	ug/kg	1
Perfluoro-1-heptanesulfonic acid (PFHpS)	375-92-8	PFAS by ID SOP	0.55	U	1.1	0.55	0.23	ug/kg	1
Perfluoro-1-nonanesulfonic acid (PFNS)	68259-12-1	PFAS by ID SOP	0.55	U	1.1	0.55	0.23	ug/kg	1
Perfluoro-1-octanesulfonamide (PFOSA)	754-91-6	PFAS by ID SOP	0.55	U	1.1	0.55	0.23	ug/kg	1
Perfluoro-1-pentanesulfonic acid (PFPeS)	2706-91-4	PFAS by ID SOP	0.55	U	1.1	0.55	0.23	ug/kg	1
Perfluorohexanesulfonic acid (PFHxS)	355-46-4	PFAS by ID SOP	1.7		1.1	0.55	0.23	ug/kg	1
Perfluoro-n-butanoic acid (PFBA)	375-22-4	PFAS by ID SOP	0.55	U	1.1	0.55	0.23	ug/kg	1
Perfluoro-n-decanoic acid (PFDA)	335-76-2	PFAS by ID SOP	0.55	U	1.1	0.55	0.23	ug/kg	1
Perfluoro-n-dodecanoic acid (PFDoA)	307-55-1	PFAS by ID SOP	0.55	U	1.1	0.55	0.23	ug/kg	1
Perfluoro-n-heptanoic acid (PFHpA)	375-85-9	PFAS by ID SOP	0.55	U	1.1	0.55	0.23	ug/kg	1
Perfluoro-n-hexanoic acid (PFHxA)	307-24-4	PFAS by ID SOP	0.55	U	1.1	0.55	0.23	ug/kg	1
Perfluoro-n-nonanoic acid (PFNA)	375-95-1	PFAS by ID SOP	0.55	U	1.1	0.55	0.23	ug/kg	1
Perfluoro-n-octanoic acid (PFOA)	335-67-1	PFAS by ID SOP	0.32	J	1.1	0.55	0.23	ug/kg	1
Perfluoro-n-pentanoic acid (PFPeA)	2706-90-3	PFAS by ID SOP	0.55	U	1.1	0.55	0.23	ug/kg	1
Perfluoro-n-tetradecanoic acid (PFTeDA)	376-06-7	PFAS by ID SOP	0.55	U	1.1	0.55	0.23	ug/kg	1
Perfluoro-n-tridecanoic acid (PFTrDA)	72629-94-8	PFAS by ID SOP	0.55	U	1.1	0.55	0.23	ug/kg	1
Perfluoro-n-undecanoic acid (PFUdA)	2058-94-8	PFAS by ID SOP	0.55	U	1.1	0.55	0.23	ug/kg	1
Perfluorooctanesulfonic acid (PFOS)	1763-23-1	PFAS by ID SOP	5.3		1.1	0.55	0.23	ug/kg	1

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
13C2_4:2FTS		96	50-150
13C2_6:2FTS		80	50-150
13C2_8:2FTS		95	50-150
13C2_PFDoA		93	50-150
13C2_PFTeDA		100	50-150
13C3_PFBS		92	50-150
13C3_PFHxS		100	50-150
13C4_PFBA		93	50-150
13C4_PFHpA		94	50-150
13C5_PFHxA		99	50-150
13C5_PFPeA		90	50-150
13C6_PFDA		93	50-150
13C7_PFUdA		96	50-150
13C8_PFOA		90	50-150
13C8_PFOS		94	50-150
13C8_PFOSA		101	50-150
13C9_PFNA		93	50-150

LOQ = Limit of Quantitation | B = Detected in the method blank | E = Quantitation of compound exceeded the calibration range | DL = Detection Limit | Q = Surrogate failure
U = Not detected at or above the LOQ | N = Recovery is out of criteria | P = The RPD between two GC columns exceeds 40% | J = Estimated result < LOQ and ≥ DL | L = LCS/LCSD failure
H = Out of holding time | W = Reported on wet weight basis | LOD = Limit of Detection | S = MS/MSD failure

PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.		Laboratory ID: WI13001-011
Description: 382-5-UT-3		Matrix: Solid
Date Sampled: 09/08/2021 1220	Project Name: Eielson AFB Soil Washing	% Solids: 86.7 09/13/2021 2013
Date Received: 09/13/2021	Project Number: 30030317	

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
d5-EtFOSAA		96	50-150
d-MeFOSA		84	50-150
d3-MeFOSAA		106	50-150

LOQ = Limit of Quantitation	B = Detected in the method blank	E = Quantitation of compound exceeded the calibration range	DL = Detection Limit	Q = Surrogate failure
U = Not detected at or above the LOQ	N = Recovery is out of criteria	P = The RPD between two GC columns exceeds 40%	J = Estimated result < LOQ and ≥ DL	L = LCS/LCSD failure
H = Out of holding time	W = Reported on wet weight basis	LOD = Limit of Detection		S = MS/MSD failure

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SPLP PFAS

Client: Arcadis U.S., Inc. | Laboratory ID: WI13001-011
Description: 382-5-UT-3 | Matrix: Solid
Date Sampled: 09/08/2021 1220 | Project Name: Eielson AFB Soil Washing | % Solids: 86.7 09/13/2021 2013
Date Received: 09/13/2021 | Project Number: 30030317

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch	Leachate Date
1	1312/PFAS	PFAS by ID SOP QSM B-15	1	09/30/2021 2021	JJG	09/29/2021 1716	17007	09/15/2021 0222

Parameter	CAS Number	Analytical Method	Result	Q	LOQ	LOD	DL	Units	Run
1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS)	39108-34-4	PFAS by ID SOP	40	U	80	40	20	ng/L	1
1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS)	27619-97-2	PFAS by ID SOP	40	U	80	40	20	ng/L	1
1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS)	757124-72-4	PFAS by ID SOP	40	U	80	40	20	ng/L	1
N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA)	2991-50-6	PFAS by ID SOP	40	U	80	40	20	ng/L	1
N-methylperfluoro-1-octanesulfonamide (MeFOSA)	31506-32-8	PFAS by ID SOP	80	U	160	80	40	ng/L	1
N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA)	2355-31-9	PFAS by ID SOP	40	U	80	40	20	ng/L	1
Perfluoro-1-butanesulfonic acid (PFBS)	375-73-5	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-1-decanesulfonic acid (PFDS)	335-77-3	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-1-heptanesulfonic acid (PFHpS)	375-92-8	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-1-nonanesulfonic acid (PFNS)	68259-12-1	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-1-octanesulfonamide (PFOSA)	754-91-6	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-1-pentanesulfonic acid (PFPeS)	2706-91-4	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluorohexanesulfonic acid (PFHxS)	355-46-4	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-n-butanoic acid (PFBA)	375-22-4	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-n-decanoic acid (PFDA)	335-76-2	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-n-dodecanoic acid (PFDoA)	307-55-1	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-n-heptanoic acid (PFHpA)	375-85-9	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-n-hexanoic acid (PFHxA)	307-24-4	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-n-nonanoic acid (PFNA)	375-95-1	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-n-octanoic acid (PFOA)	335-67-1	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-n-pentanoic acid (PFPeA)	2706-90-3	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-n-tetradecanoic acid (PFTeDA)	376-06-7	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-n-tridecanoic acid (PFTrDA)	72629-94-8	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-n-undecanoic acid (PFUdA)	2058-94-8	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluorooctanesulfonic acid (PFOS)	1763-23-1	PFAS by ID SOP	13	J	40	20	10	ng/L	1

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
13C2_4:2FTS		112	50-150
13C2_6:2FTS		110	50-150
13C2_8:2FTS		100	50-150
13C2_PFDoA		78	50-150
13C2_PFTeDA		81	50-150
13C3_PFBS		90	50-150
13C3_PFHxS		88	50-150
13C4_PFBA		91	50-150
13C4_PFHpA		87	50-150
13C5_PFHxA		95	50-150
13C5_PFPeA		96	50-150
13C6_PFDA		91	50-150
13C7_PFUdA		93	50-150
13C8_PFOA		90	50-150
13C8_PFOS		87	50-150
13C8_PFOSA		104	50-150
13C9_PFNA		98	50-150

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

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SPLP PFAS

Client: Arcadis U.S., Inc.		Laboratory ID: WI13001-011
Description: 382-5-UT-3		Matrix: Solid
Date Sampled: 09/08/2021 1220	Project Name: Eielson AFB Soil Washing	% Solids: 86.7 09/13/2021 2013
Date Received: 09/13/2021	Project Number: 30030317	

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
d5-EtFOSAA		100	50-150
d-MeFOSA		83	50-150
d3-MeFOSAA		102	50-150

LOQ = Limit of Quantitation	B = Detected in the method blank	E = Quantitation of compound exceeded the calibration range	DL = Detection Limit	Q = Surrogate failure
U = Not detected at or above the LOQ	N = Recovery is out of criteria	P = The RPD between two GC columns exceeds 40%	J = Estimated result < LOQ and ≥ DL	L = LCS/LCSD failure
H = Out of holding time	W = Reported on wet weight basis	LOD = Limit of Detection		S = MS/MSD failure

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PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: WI13001-012
Description: Dup-01 | Matrix: Solid
Date Sampled: 09/08/2021 | Project Name: Eielson AFB Soil Washing | % Solids: 55.5 09/13/2021 2013
Date Received: 09/13/2021 | Project Number: 30030317

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch
1	SOP SPE	PFAS by ID SOP QSM B-15	1	09/14/2021 1514	JJG	09/13/2021 1833	15209

Parameter	CAS Number	Analytical Method	Result	Q	LOQ	LOD	DL	Units	Run
1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS)	39108-34-4	PFAS by ID SOP	1.8	U	3.6	1.8	0.90	ug/kg	1
1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS)	27619-97-2	PFAS by ID SOP	0.94	J	3.6	1.8	0.90	ug/kg	1
1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS)	757124-72-4	PFAS by ID SOP	1.8	U	3.6	1.8	0.90	ug/kg	1
N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA)	2991-50-6	PFAS by ID SOP	1.8	U	3.6	1.8	0.90	ug/kg	1
N-methylperfluoro-1-octanesulfonamide (MeFOSA)	31506-32-8	PFAS by ID SOP	1.8	U	3.6	1.8	0.90	ug/kg	1
N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA)	2355-31-9	PFAS by ID SOP	1.8	U	3.6	1.8	0.90	ug/kg	1
Perfluoro-1-butanesulfonic acid (PFBS)	375-73-5	PFAS by ID SOP	0.90	U	1.8	0.90	0.36	ug/kg	1
Perfluoro-1-decanesulfonic acid (PFDS)	335-77-3	PFAS by ID SOP	0.90	U	1.8	0.90	0.36	ug/kg	1
Perfluoro-1-heptanesulfonic acid (PFHpS)	375-92-8	PFAS by ID SOP	0.90	U	1.8	0.90	0.36	ug/kg	1
Perfluoro-1-nonanesulfonic acid (PFNS)	68259-12-1	PFAS by ID SOP	0.90	U	1.8	0.90	0.36	ug/kg	1
Perfluoro-1-octanesulfonamide (PFOSA)	754-91-6	PFAS by ID SOP	0.90	U	1.8	0.90	0.36	ug/kg	1
Perfluoro-1-pentanesulfonic acid (PFPeS)	2706-91-4	PFAS by ID SOP	0.90	U	1.8	0.90	0.36	ug/kg	1
Perfluorohexanesulfonic acid (PFHxS)	355-46-4	PFAS by ID SOP	0.52	J	1.8	0.90	0.36	ug/kg	1
Perfluoro-n-butanoic acid (PFBA)	375-22-4	PFAS by ID SOP	0.90	U	1.8	0.90	0.36	ug/kg	1
Perfluoro-n-decanoic acid (PFDA)	335-76-2	PFAS by ID SOP	0.90	U	1.8	0.90	0.36	ug/kg	1
Perfluoro-n-dodecanoic acid (PFDoA)	307-55-1	PFAS by ID SOP	0.90	U	1.8	0.90	0.36	ug/kg	1
Perfluoro-n-heptanoic acid (PFHpA)	375-85-9	PFAS by ID SOP	0.90	U	1.8	0.90	0.36	ug/kg	1
Perfluoro-n-hexanoic acid (PFHxA)	307-24-4	PFAS by ID SOP	0.90	U	1.8	0.90	0.36	ug/kg	1
Perfluoro-n-nonanoic acid (PFNA)	375-95-1	PFAS by ID SOP	0.90	U	1.8	0.90	0.36	ug/kg	1
Perfluoro-n-octanoic acid (PFOA)	335-67-1	PFAS by ID SOP	0.90	U	1.8	0.90	0.36	ug/kg	1
Perfluoro-n-pentanoic acid (PFPeA)	2706-90-3	PFAS by ID SOP	0.90	U	1.8	0.90	0.36	ug/kg	1
Perfluoro-n-tetradecanoic acid (PFTeDA)	376-06-7	PFAS by ID SOP	0.90	U	1.8	0.90	0.36	ug/kg	1
Perfluoro-n-tridecanoic acid (PFTrDA)	72629-94-8	PFAS by ID SOP	0.90	U	1.8	0.90	0.36	ug/kg	1
Perfluoro-n-undecanoic acid (PFUdA)	2058-94-8	PFAS by ID SOP	0.90	U	1.8	0.90	0.36	ug/kg	1
Perfluorooctanesulfonic acid (PFOS)	1763-23-1	PFAS by ID SOP	2.3		1.8	0.90	0.36	ug/kg	1

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
13C2_4:2FTS		107	50-150
13C2_6:2FTS		97	50-150
13C2_8:2FTS		102	50-150
13C2_PFDoA		106	50-150
13C2_PFTeDA		103	50-150
13C3_PFBS		102	50-150
13C3_PFHxS		101	50-150
13C4_PFBA		101	50-150
13C4_PFHpA		102	50-150
13C5_PFHxA		98	50-150
13C5_PFPeA		96	50-150
13C6_PFDA		105	50-150
13C7_PFUdA		112	50-150
13C8_PFOA		97	50-150
13C8_PFOS		109	50-150
13C8_PFOSA		109	50-150
13C9_PFNA		101	50-150

LOQ = Limit of Quantitation | B = Detected in the method blank | E = Quantitation of compound exceeded the calibration range | DL = Detection Limit | Q = Surrogate failure
U = Not detected at or above the LOQ | N = Recovery is out of criteria | P = The RPD between two GC columns exceeds 40% | J = Estimated result < LOQ and ≥ DL | L = LCS/LCSD failure
H = Out of holding time | W = Reported on wet weight basis | LOD = Limit of Detection | S = MS/MSD failure

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PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.		Laboratory ID: WI13001-012
Description: Dup-01		Matrix: Solid
Date Sampled: 09/08/2021	Project Name: Eielson AFB Soil Washing	% Solids: 55.5 09/13/2021 2013
Date Received: 09/13/2021	Project Number: 30030317	

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
d5-EtFOSAA		109	50-150
d-MeFOSA		90	50-150
d3-MeFOSAA		117	50-150

LOQ = Limit of Quantitation	B = Detected in the method blank	E = Quantitation of compound exceeded the calibration range	DL = Detection Limit	Q = Surrogate failure
U = Not detected at or above the LOQ	N = Recovery is out of criteria	P = The RPD between two GC columns exceeds 40%	J = Estimated result < LOQ and ≥ DL	L = LCS/LCSD failure
H = Out of holding time	W = Reported on wet weight basis	LOD = Limit of Detection		S = MS/MSD failure

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SPLP PFAS

Client: Arcadis U.S., Inc. | Laboratory ID: WI13001-012
Description: Dup-01 | Matrix: Solid
Date Sampled: 09/08/2021 | Project Name: Eielson AFB Soil Washing | % Solids: 55.5 09/13/2021 2013
Date Received: 09/13/2021 | Project Number: 30030317

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch	Leachate Date
1	1312/PFAS	PFAS by ID SOP QSM B-15	1	09/30/2021 2032	JJG	09/29/2021 1716	17007	09/15/2021 0222

Parameter	CAS Number	Analytical Method	Result	Q	LOQ	LOD	DL	Units	Run
1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS)	39108-34-4	PFAS by ID SOP	40	U	80	40	20	ng/L	1
1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS)	27619-97-2	PFAS by ID SOP	40	U	80	40	20	ng/L	1
1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS)	757124-72-4	PFAS by ID SOP	40	U	80	40	20	ng/L	1
N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA)	2991-50-6	PFAS by ID SOP	40	U	80	40	20	ng/L	1
N-methylperfluoro-1-octanesulfonamide (MeFOSA)	31506-32-8	PFAS by ID SOP	80	U	160	80	40	ng/L	1
N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA)	2355-31-9	PFAS by ID SOP	40	U	80	40	20	ng/L	1
Perfluoro-1-butanesulfonic acid (PFBS)	375-73-5	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-1-decanesulfonic acid (PFDS)	335-77-3	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-1-heptanesulfonic acid (PFHpS)	375-92-8	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-1-nonanesulfonic acid (PFNS)	68259-12-1	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-1-octanesulfonamide (PFOSA)	754-91-6	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-1-pentanesulfonic acid (PFPeS)	2706-91-4	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluorohexanesulfonic acid (PFHxS)	355-46-4	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-n-butanoic acid (PFBA)	375-22-4	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-n-decanoic acid (PFDA)	335-76-2	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-n-dodecanoic acid (PFDoA)	307-55-1	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-n-heptanoic acid (PFHpA)	375-85-9	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-n-hexanoic acid (PFHxA)	307-24-4	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-n-nonanoic acid (PFNA)	375-95-1	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-n-octanoic acid (PFOA)	335-67-1	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-n-pentanoic acid (PFPeA)	2706-90-3	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-n-tetradecanoic acid (PFTeDA)	376-06-7	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-n-tridecanoic acid (PFTrDA)	72629-94-8	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-n-undecanoic acid (PFUdA)	2058-94-8	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluorooctanesulfonic acid (PFOS)	1763-23-1	PFAS by ID SOP	20	U	40	20	10	ng/L	1

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
13C2_4:2FTS		110	50-150
13C2_6:2FTS		110	50-150
13C2_8:2FTS		102	50-150
13C2_PFDoA		85	50-150
13C2_PFTeDA		93	50-150
13C3_PFBS		90	50-150
13C3_PFHxS		93	50-150
13C4_PFBA		103	50-150
13C4_PFHpA		96	50-150
13C5_PFHxA		98	50-150
13C5_PFPeA		101	50-150
13C6_PFDA		93	50-150
13C7_PFUdA		97	50-150
13C8_PFOA		92	50-150
13C8_PFOS		91	50-150
13C8_PFOSA		109	50-150
13C9_PFNA		94	50-150

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

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SPLP PFAS

Client: Arcadis U.S., Inc.		Laboratory ID: WI13001-012
Description: Dup-01		Matrix: Solid
Date Sampled: 09/08/2021	Project Name: Eielson AFB Soil Washing	% Solids: 55.5 09/13/2021 2013
Date Received: 09/13/2021	Project Number: 30030317	

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
d5-EtFOSAA		106	50-150
d-MeFOSA		99	50-150
d3-MeFOSAA		105	50-150

LOQ = Limit of Quantitation	B = Detected in the method blank	E = Quantitation of compound exceeded the calibration range	DL = Detection Limit	Q = Surrogate failure
U = Not detected at or above the LOQ	N = Recovery is out of criteria	P = The RPD between two GC columns exceeds 40%	J = Estimated result < LOQ and ≥ DL	L = LCS/LCSD failure
H = Out of holding time	W = Reported on wet weight basis	LOD = Limit of Detection		S = MS/MSD failure

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QC Summary

PFAS by LC/MS/MS - MB

Sample ID: WQ15209-001
Batch: 15209
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Solid
Prep Method: SOP SPE
Prep Date: 09/13/2021 1833

Parameter	Result	Q	Dil	LOQ	LOD	DL	Units	Analysis Date
8:2 FTS	1.0	U	1	2.0	1.0	0.50	ug/kg	09/14/2021 1255
6:2 FTS	1.0	U	1	2.0	1.0	0.50	ug/kg	09/14/2021 1255
4:2 FTS	1.0	U	1	2.0	1.0	0.50	ug/kg	09/14/2021 1255
EtFOSAA	1.0	U	1	2.0	1.0	0.50	ug/kg	09/14/2021 1255
MeFOSA	1.0	U	1	2.0	1.0	0.50	ug/kg	09/14/2021 1255
MeFOSAA	1.0	U	1	2.0	1.0	0.50	ug/kg	09/14/2021 1255
PFBS	0.50	U	1	1.0	0.50	0.20	ug/kg	09/14/2021 1255
PFDS	0.50	U	1	1.0	0.50	0.20	ug/kg	09/14/2021 1255
PFHpS	0.50	U	1	1.0	0.50	0.20	ug/kg	09/14/2021 1255
PFNS	0.50	U	1	1.0	0.50	0.20	ug/kg	09/14/2021 1255
PFOSA	0.50	U	1	1.0	0.50	0.20	ug/kg	09/14/2021 1255
PFPeS	0.50	U	1	1.0	0.50	0.20	ug/kg	09/14/2021 1255
PFHxS	0.50	U	1	1.0	0.50	0.20	ug/kg	09/14/2021 1255
PFBA	0.50	U	1	1.0	0.50	0.20	ug/kg	09/14/2021 1255
PFDA	0.50	U	1	1.0	0.50	0.20	ug/kg	09/14/2021 1255
PFDoA	0.50	U	1	1.0	0.50	0.20	ug/kg	09/14/2021 1255
PFHpA	0.50	U	1	1.0	0.50	0.20	ug/kg	09/14/2021 1255
PFHxA	0.50	U	1	1.0	0.50	0.20	ug/kg	09/14/2021 1255
PFNA	0.50	U	1	1.0	0.50	0.20	ug/kg	09/14/2021 1255
PFOA	0.50	U	1	1.0	0.50	0.20	ug/kg	09/14/2021 1255
PFPeA	0.50	U	1	1.0	0.50	0.20	ug/kg	09/14/2021 1255
PFTeDA	0.50	U	1	1.0	0.50	0.20	ug/kg	09/14/2021 1255
PFTrDA	0.50	U	1	1.0	0.50	0.20	ug/kg	09/14/2021 1255
PFUdA	0.50	U	1	1.0	0.50	0.20	ug/kg	09/14/2021 1255
PFOS	0.50	U	1	1.0	0.50	0.20	ug/kg	09/14/2021 1255

Surrogate	Q	% Rec	Acceptance Limit
13C2_4:2FTS		121	50-150
13C2_6:2FTS		94	50-150
13C2_8:2FTS		105	50-150
13C2_PFDoA		111	50-150
13C2_PFTeDA		111	50-150
13C3_PFBS		104	50-150
13C3_PFHxS		116	50-150
13C4_PFBA		106	50-150
13C4_PFHpA		107	50-150
13C5_PFHxA		104	50-150
13C5_PFPeA		104	50-150
13C6_PFDA		111	50-150
13C7_PFUdA		112	50-150
13C8_PFOA		108	50-150

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

PFAS by LC/MS/MS - MB

Sample ID: WQ15209-001
Batch: 15209
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Solid
Prep Method: SOP SPE
Prep Date: 09/13/2021 1833

Surrogate	Q	% Rec	Acceptance Limit
13C8_PFOS		106	50-150
13C8_PFOSA		114	50-150
13C9_PFNA		108	50-150
d5-EtFOSAA		104	50-150
d-MeFOSA		90	50-150
d3-MeFOSAA		122	50-150

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

PFAS by LC/MS/MS - LCS

Sample ID: WQ15209-002
Batch: 15209
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Solid
Prep Method: SOP SPE
Prep Date: 09/13/2021 1833

Parameter	Spike Amount (ug/kg)	Result (ug/kg)	Q	Dil	% Rec	%Rec Limit	Analysis Date
8:2 FTS	1.9	1.8		1	92	65-137	09/14/2021 1306
6:2 FTS	1.9	2.1		1	111	64-140	09/14/2021 1306
4:2 FTS	1.9	2.0		1	110	62-145	09/14/2021 1306
EtFOSAA	2.0	1.9		1	95	61-139	09/14/2021 1306
MeFOSA	2.0	1.7		1	84	70-150	09/14/2021 1306
MeFOSAA	2.0	2.2		1	110	63-144	09/14/2021 1306
PFBS	1.8	1.7		1	96	72-128	09/14/2021 1306
PFDS	1.9	1.6		1	82	59-134	09/14/2021 1306
PFHpS	1.9	2.2		1	115	70-132	09/14/2021 1306
PFNS	1.9	1.9		1	98	69-125	09/14/2021 1306
PFOSA	2.0	1.6		1	80	67-137	09/14/2021 1306
PFPeS	1.9	1.8		1	96	73-123	09/14/2021 1306
PFHxS	1.8	1.7		1	91	67-130	09/14/2021 1306
PFBA	2.0	1.9		1	95	71-135	09/14/2021 1306
PFDA	2.0	1.8		1	89	69-133	09/14/2021 1306
PFDoA	2.0	1.9		1	93	69-135	09/14/2021 1306
PFHpA	2.0	2.0		1	102	71-131	09/14/2021 1306
PFHxA	2.0	1.8		1	88	70-132	09/14/2021 1306
PFNA	2.0	1.8		1	88	72-129	09/14/2021 1306
PFOA	2.0	2.1		1	104	69-133	09/14/2021 1306
PFPeA	2.0	1.9		1	93	69-132	09/14/2021 1306
PFTeDA	2.0	1.8		1	91	69-133	09/14/2021 1306
PFTrDA	2.0	2.1		1	104	66-139	09/14/2021 1306
PFUdA	2.0	1.8		1	92	64-136	09/14/2021 1306
PFOS	1.9	1.8		1	99	68-136	09/14/2021 1306

Surrogate	Q	% Rec	Acceptance Limit
13C2_4:2FTS		106	50-150
13C2_6:2FTS		94	50-150
13C2_8:2FTS		97	50-150
13C2_PFDoA		105	50-150
13C2_PFTeDA		113	50-150
13C3_PFBS		98	50-150
13C3_PFHxS		108	50-150
13C4_PFBA		104	50-150
13C4_PFHpA		107	50-150
13C5_PFHxA		108	50-150
13C5_PFPeA		103	50-150
13C6_PFDA		108	50-150
13C7_PFUdA		110	50-150
13C8_PFOA		103	50-150

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

PFAS by LC/MS/MS - LCS

Sample ID: WQ15209-002
Batch: 15209
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Solid
Prep Method: SOP SPE
Prep Date: 09/13/2021 1833

Surrogate	Q	% Rec	Acceptance Limit
13C8_PFOS		99	50-150
13C8_PFOSA		115	50-150
13C9_PFNA		104	50-150
d5-EtFOSAA		116	50-150
d-MeFOSA		95	50-150
d3-MeFOSAA		120	50-150

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

PFAS by LC/MS/MS - MS

Sample ID: WI13001-003MS
Batch: 15209
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Solid
Prep Method: SOP SPE
Prep Date: 09/13/2021 1833

Parameter	Sample Amount (ug/kg)	Spike Amount (ug/kg)	Result (ug/kg)	Q	Dil	% Rec	%Rec Limit	Analysis Date
8:2 FTS	ND	2.1	1.8		1	87	65-137	09/14/2021 1349
6:2 FTS	ND	2.0	2.3		1	113	64-140	09/14/2021 1349
4:2 FTS	ND	2.0	2.0		1	99	62-145	09/14/2021 1349
EtFOSAA	ND	2.2	1.9		1	90	61-139	09/14/2021 1349
MeFOSA	ND	2.2	2.4		1	109	70-150	09/14/2021 1349
MeFOSAA	ND	2.2	2.0		1	94	63-144	09/14/2021 1349
PFBS	ND	1.9	1.8		1	95	72-128	09/14/2021 1349
PFDS	ND	2.1	2.3		1	110	59-134	09/14/2021 1349
PFHpS	ND	2.1	2.4		1	115	70-132	09/14/2021 1349
PFNS	ND	2.1	2.1		1	100	69-125	09/14/2021 1349
PFOSA	ND	2.2	1.8		1	84	67-137	09/14/2021 1349
PFPeS	ND	2.0	1.8		1	90	73-123	09/14/2021 1349
PFHxS	ND	2.0	2.1		1	109	67-130	09/14/2021 1349
PFBA	ND	2.2	2.1		1	96	71-135	09/14/2021 1349
PFDA	ND	2.2	2.2		1	103	69-133	09/14/2021 1349
PFDoA	ND	2.2	2.1		1	97	69-135	09/14/2021 1349
PFHpA	ND	2.2	2.0		1	92	71-131	09/14/2021 1349
PFHxA	ND	2.2	2.0		1	92	70-132	09/14/2021 1349
PFNA	ND	2.2	2.0		1	93	72-129	09/14/2021 1349
PFOA	ND	2.2	2.0		1	92	69-133	09/14/2021 1349
PFPeA	ND	2.2	2.2		1	100	69-132	09/14/2021 1349
PFTeDA	ND	2.2	2.1		1	98	69-133	09/14/2021 1349
PFTrDA	ND	2.2	2.2		1	104	66-139	09/14/2021 1349
PFUdA	ND	2.2	2.0		1	93	64-136	09/14/2021 1349
PFOS	0.25	2.0	2.2		1	97	68-136	09/14/2021 1349

Surrogate	Q	% Rec	Acceptance Limit
13C2_4:2FTS		103	50-150
13C2_6:2FTS		84	50-150
13C2_8:2FTS		99	50-150
13C2_PFDoA		103	50-150
13C2_PFTeDA		104	50-150
13C3_PFBS		96	50-150
13C3_PFHxS		100	50-150
13C4_PFBA		100	50-150
13C4_PFHpA		103	50-150
13C5_PFHxA		96	50-150
13C5_PFPeA		98	50-150
13C6_PFDA		100	50-150
13C7_PFUdA		106	50-150
13C8_PFOA		103	50-150

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

PFAS by LC/MS/MS - MS

Sample ID: WI13001-003MS
Batch: 15209
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Solid
Prep Method: SOP SPE
Prep Date: 09/13/2021 1833

Surrogate	Q	% Rec	Acceptance Limit
13C8_PFOS		95	50-150
13C8_PFOSA		103	50-150
13C9_PFNA		98	50-150
d5-EtFOSAA		101	50-150
d-MeFOSA		81	50-150
d3-MeFOSAA		113	50-150

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

PFAS by LC/MS/MS - MSD

Sample ID: WI13001-003MD
Batch: 15209
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Solid
Prep Method: SOP SPE
Prep Date: 09/13/2021 1833

Parameter	Sample Amount (ug/kg)	Spike Amount (ug/kg)	Result (ug/kg)	Q	Dil	% Rec	% RPD	%Rec Limit	% RPD Limit	Analysis Date
8:2 FTS	ND	1.8	2.3		1	124	23	65-137	30	09/14/2021 1359
6:2 FTS	ND	1.8	2.1		1	117	8.3	64-140	30	09/14/2021 1359
4:2 FTS	ND	1.8	2.6	N	1	147	27	62-145	30	09/14/2021 1359
EtFOSAA	ND	1.9	2.5		1	132	26	61-139	30	09/14/2021 1359
MeFOSA	ND	1.9	2.3		1	121	1.9	70-150	30	09/14/2021 1359
MeFOSAA	ND	1.9	2.7		1	141	28	63-144	30	09/14/2021 1359
PFBS	ND	1.7	2.0		1	119	11	72-128	30	09/14/2021 1359
PFDS	ND	1.8	2.0		1	111	11	59-134	30	09/14/2021 1359
PFHpS	ND	1.8	2.4	N	1	133	2.8	70-132	30	09/14/2021 1359
PFNS	ND	1.8	1.9		1	102	9.6	69-125	30	09/14/2021 1359
PFOSA	ND	1.9	2.2		1	113	18	67-137	30	09/14/2021 1359
PFPeS	ND	1.8	2.3	N	1	128	23	73-123	30	09/14/2021 1359
PFHxS	ND	1.7	2.5	N	1	141	13	67-130	30	09/14/2021 1359
PFBA	ND	1.9	2.3		1	121	10	71-135	30	09/14/2021 1359
PFDA	ND	1.9	2.2		1	117	0.68	69-133	30	09/14/2021 1359
PFDoA	ND	1.9	2.2		1	117	6.0	69-135	30	09/14/2021 1359
PFHpA	ND	1.9	2.4		1	125	19	71-131	30	09/14/2021 1359
PFHxA	ND	1.9	2.4		1	126	19	70-132	30	09/14/2021 1359
PFNA	ND	1.9	2.4		1	128	20	72-129	30	09/14/2021 1359
PFOA	ND	1.9	2.4		1	126	19	69-133	30	09/14/2021 1359
PFPeA	ND	1.9	2.3		1	120	5.9	69-132	30	09/14/2021 1359
PFTeDA	ND	1.9	2.4		1	128	14	69-133	30	09/14/2021 1359
PFTrDA	ND	1.9	2.5		1	129	9.0	66-139	30	09/14/2021 1359
PFUdA	ND	1.9	2.0		1	105	0.089	64-136	30	09/14/2021 1359
PFOS	0.25	1.8	2.1		1	107	1.8	68-136	30	09/14/2021 1359

Surrogate	Q	% Rec	Acceptance Limit
13C2_4:2FTS		82	50-150
13C2_6:2FTS		75	50-150
13C2_8:2FTS		77	50-150
13C2_PFDoA		87	50-150
13C2_PFTeDA		85	50-150
13C3_PFBS		84	50-150
13C3_PFHxS		88	50-150
13C4_PFBA		83	50-150
13C4_PFHpA		82	50-150
13C5_PFHxA		82	50-150
13C5_PFPeA		83	50-150
13C6_PFDA		87	50-150
13C7_PFUdA		86	50-150
13C8_PFOA		83	50-150

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

PFAS by LC/MS/MS - MSD

Sample ID: WI13001-003MD
Batch: 15209
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Solid
Prep Method: SOP SPE
Prep Date: 09/13/2021 1833

Surrogate	Q	% Rec	Acceptance Limit
13C8_PFOS		91	50-150
13C8_PFOSA		90	50-150
13C9_PFNA		85	50-150
d5-EtFOSAA		89	50-150
d-MeFOSA		74	50-150
d3-MeFOSAA		91	50-150

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

PFAS by LC/MS/MS - MB

Sample ID: WQ15211-001
Batch: 15211
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Aqueous
Prep Method: SOP SPE
Prep Date: 09/13/2021 1833

Parameter	Result	Q	Dil	LOQ	LOD	DL	Units	Analysis Date
8:2 FTS	4.0	U	1	8.0	4.0	2.0	ng/L	09/14/2021 1234
6:2 FTS	4.0	U	1	8.0	4.0	2.0	ng/L	09/14/2021 1234
4:2 FTS	4.0	U	1	8.0	4.0	2.0	ng/L	09/14/2021 1234
EtFOSAA	4.0	U	1	8.0	4.0	2.0	ng/L	09/14/2021 1234
MeFOSA	8.0	U	1	16	8.0	4.0	ng/L	09/14/2021 1234
MeFOSAA	4.0	U	1	8.0	4.0	2.0	ng/L	09/14/2021 1234
PFBS	2.0	U	1	4.0	2.0	1.0	ng/L	09/14/2021 1234
PFDS	2.0	U	1	4.0	2.0	1.0	ng/L	09/14/2021 1234
PFHpS	2.0	U	1	4.0	2.0	1.0	ng/L	09/14/2021 1234
PFNS	2.0	U	1	4.0	2.0	1.0	ng/L	09/14/2021 1234
PFOSA	2.0	U	1	4.0	2.0	1.0	ng/L	09/14/2021 1234
PFPeS	2.0	U	1	4.0	2.0	1.0	ng/L	09/14/2021 1234
PFHxS	2.0	U	1	4.0	2.0	1.0	ng/L	09/14/2021 1234
PFBA	2.0	U	1	4.0	2.0	1.0	ng/L	09/14/2021 1234
PFDA	2.0	U	1	4.0	2.0	1.0	ng/L	09/14/2021 1234
PFDoA	2.0	U	1	4.0	2.0	1.0	ng/L	09/14/2021 1234
PFHpA	2.0	U	1	4.0	2.0	1.0	ng/L	09/14/2021 1234
PFHxA	2.0	U	1	4.0	2.0	1.0	ng/L	09/14/2021 1234
PFNA	2.0	U	1	4.0	2.0	1.0	ng/L	09/14/2021 1234
PFOA	2.0	U	1	4.0	2.0	1.0	ng/L	09/14/2021 1234
PFPeA	2.0	U	1	4.0	2.0	1.0	ng/L	09/14/2021 1234
PFTeDA	2.0	U	1	4.0	2.0	1.0	ng/L	09/14/2021 1234
PFTrDA	2.0	U	1	4.0	2.0	1.0	ng/L	09/14/2021 1234
PFUdA	2.0	U	1	4.0	2.0	1.0	ng/L	09/14/2021 1234
PFOS	2.0	U	1	4.0	2.0	1.0	ng/L	09/14/2021 1234

Surrogate	Q	% Rec	Acceptance Limit
13C2_4:2FTS		104	50-150
13C2_6:2FTS		88	50-150
13C2_8:2FTS		103	50-150
13C2_PFDoA		98	50-150
13C2_PFTeDA		106	50-150
13C3_PFBS		89	50-150
13C3_PFHxS		101	50-150
13C4_PFBA		102	50-150
13C4_PFHpA		95	50-150
13C5_PFHxA		100	50-150
13C5_PFPeA		95	50-150
13C6_PFDA		102	50-150
13C7_PFUdA		108	50-150
13C8_PFOA		98	50-150

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

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PFAS by LC/MS/MS - MB

Sample ID: WQ15211-001
Batch: 15211
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Aqueous
Prep Method: SOP SPE
Prep Date: 09/13/2021 1833

Surrogate	Q	% Rec	Acceptance Limit
13C8_PFOS		98	50-150
13C8_PFOSA		99	50-150
13C9_PFNA		101	50-150
d5-EtFOSAA		97	50-150
d-MeFOSA		77	50-150
d3-MeFOSAA		107	50-150

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

PFAS by LC/MS/MS - LCS

Sample ID: WQ15211-002
Batch: 15211
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Aqueous
Prep Method: SOP SPE
Prep Date: 09/13/2021 1833

Parameter	Spike Amount (ng/L)	Result (ng/L)	Q	Dil	% Rec	%Rec Limit	Analysis Date
8:2 FTS	15	18		1	115	67-138	09/14/2021 1245
6:2 FTS	15	14		1	95	64-140	09/14/2021 1245
4:2 FTS	15	15		1	104	63-143	09/14/2021 1245
EtFOSAA	16	16		1	101	61-135	09/14/2021 1245
MeFOSA	16	19		1	116	68-141	09/14/2021 1245
MeFOSAA	16	14		1	88	65-136	09/14/2021 1245
PFBS	14	12		1	88	72-130	09/14/2021 1245
PFDS	15	14		1	90	53-142	09/14/2021 1245
PFHpS	15	15		1	101	69-134	09/14/2021 1245
PFNS	15	15		1	95	69-127	09/14/2021 1245
PFOSA	16	14		1	91	67-137	09/14/2021 1245
PFPeS	15	14		1	95	71-127	09/14/2021 1245
PFHxS	15	14		1	94	68-131	09/14/2021 1245
PFBA	16	16		1	98	73-129	09/14/2021 1245
PFDA	16	14		1	90	71-129	09/14/2021 1245
PFDoA	16	16		1	99	72-134	09/14/2021 1245
PFHpA	16	15		1	94	72-130	09/14/2021 1245
PFHxA	16	15		1	96	72-129	09/14/2021 1245
PFNA	16	16		1	99	69-130	09/14/2021 1245
PFOA	16	15		1	96	71-133	09/14/2021 1245
PFPeA	16	15		1	96	72-129	09/14/2021 1245
PFTeDA	16	16		1	101	71-132	09/14/2021 1245
PFTrDA	16	18		1	112	65-144	09/14/2021 1245
PFUdA	16	15		1	93	69-133	09/14/2021 1245
PFOS	15	14		1	92	65-140	09/14/2021 1245

Surrogate	Q	% Rec	Acceptance Limit
13C2_4:2FTS		106	50-150
13C2_6:2FTS		92	50-150
13C2_8:2FTS		105	50-150
13C2_PFDoA		105	50-150
13C2_PFTeDA		108	50-150
13C3_PFBS		110	50-150
13C3_PFHxS		113	50-150
13C4_PFBA		107	50-150
13C4_PFHpA		110	50-150
13C5_PFHxA		106	50-150
13C5_PFPeA		106	50-150
13C6_PFDA		115	50-150
13C7_PFUdA		106	50-150
13C8_PFOA		110	50-150

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

PFAS by LC/MS/MS - LCS

Sample ID: WQ15211-002
Batch: 15211
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Aqueous
Prep Method: SOP SPE
Prep Date: 09/13/2021 1833

Surrogate	Q	% Rec	Acceptance Limit
13C8_PFOS		105	50-150
13C8_PFOSA		105	50-150
13C9_PFNA		110	50-150
d5-EtFOSAA		107	50-150
d-MeFOSA		65	50-150
d3-MeFOSAA		115	50-150

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

PFAS by LC/MS/MS - MB

Sample ID: WQ15911-001
Batch: 15911
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Solid
Prep Method: SOP SPE
Prep Date: 09/20/2021 1859

Parameter	Result	Q	Dil	LOQ	LOD	DL	Units	Analysis Date
8:2 FTS	1.0	U	1	2.0	1.0	0.50	ug/kg	09/21/2021 1749
6:2 FTS	1.0	U	1	2.0	1.0	0.50	ug/kg	09/21/2021 1749
4:2 FTS	1.0	U	1	2.0	1.0	0.50	ug/kg	09/21/2021 1749
EtFOSAA	1.0	U	1	2.0	1.0	0.50	ug/kg	09/21/2021 1749
MeFOSA	1.0	U	1	2.0	1.0	0.50	ug/kg	09/21/2021 1749
MeFOSAA	1.0	U	1	2.0	1.0	0.50	ug/kg	09/21/2021 1749
PFBS	0.50	U	1	1.0	0.50	0.20	ug/kg	09/21/2021 1749
PFDS	0.50	U	1	1.0	0.50	0.20	ug/kg	09/21/2021 1749
PFHpS	0.50	U	1	1.0	0.50	0.20	ug/kg	09/21/2021 1749
PFNS	0.50	U	1	1.0	0.50	0.20	ug/kg	09/21/2021 1749
PFOSA	0.50	U	1	1.0	0.50	0.20	ug/kg	09/21/2021 1749
PFPeS	0.50	U	1	1.0	0.50	0.20	ug/kg	09/21/2021 1749
PFHxS	0.50	U	1	1.0	0.50	0.20	ug/kg	09/21/2021 1749
PFBA	0.50	U	1	1.0	0.50	0.20	ug/kg	09/21/2021 1749
PFDA	0.50	U	1	1.0	0.50	0.20	ug/kg	09/21/2021 1749
PFDoA	0.50	U	1	1.0	0.50	0.20	ug/kg	09/21/2021 1749
PFHpA	0.50	U	1	1.0	0.50	0.20	ug/kg	09/21/2021 1749
PFHxA	0.50	U	1	1.0	0.50	0.20	ug/kg	09/21/2021 1749
PFNA	0.50	U	1	1.0	0.50	0.20	ug/kg	09/21/2021 1749
PFOA	0.50	U	1	1.0	0.50	0.20	ug/kg	09/21/2021 1749
PFPeA	0.50	U	1	1.0	0.50	0.20	ug/kg	09/21/2021 1749
PFTeDA	0.50	U	1	1.0	0.50	0.20	ug/kg	09/21/2021 1749
PFTrDA	0.50	U	1	1.0	0.50	0.20	ug/kg	09/21/2021 1749
PFUdA	0.50	U	1	1.0	0.50	0.20	ug/kg	09/21/2021 1749
PFOS	0.50	U	1	1.0	0.50	0.20	ug/kg	09/21/2021 1749

Surrogate	Q	% Rec	Acceptance Limit
13C2_4:2FTS		94	50-150
13C2_6:2FTS		79	50-150
13C2_8:2FTS		106	50-150
13C2_PFDoA		91	50-150
13C2_PFTeDA		95	50-150
13C3_PFBS		89	50-150
13C3_PFHxS		101	50-150
13C4_PFBA		93	50-150
13C4_PFHpA		98	50-150
13C5_PFHxA		94	50-150
13C5_PFPeA		94	50-150
13C6_PFDA		90	50-150
13C7_PFUdA		95	50-150
13C8_PFOA		97	50-150

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

PFAS by LC/MS/MS - MB

Sample ID: WQ15911-001
Batch: 15911
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Solid
Prep Method: SOP SPE
Prep Date: 09/20/2021 1859

Surrogate	Q	% Rec	Acceptance Limit
13C8_PFOS		89	50-150
13C8_PFOSA		95	50-150
13C9_PFNA		92	50-150
d5-EtFOSAA		93	50-150
d-MeFOSA		93	50-150
d3-MeFOSAA		100	50-150

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

PFAS by LC/MS/MS - LCS

Sample ID: WQ15911-002
Batch: 15911
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Solid
Prep Method: SOP SPE
Prep Date: 09/20/2021 1859

Parameter	Spike Amount (ug/kg)	Result (ug/kg)	Q	Dil	% Rec	%Rec Limit	Analysis Date
8:2 FTS	1.9	2.0		1	102	65-137	09/21/2021 1759
6:2 FTS	1.9	1.3		1	69	64-140	09/21/2021 1759
4:2 FTS	1.9	1.9		1	104	62-145	09/21/2021 1759
EtFOSAA	2.0	1.4		1	71	61-139	09/21/2021 1759
MeFOSA	2.0	2.1		1	106	70-150	09/21/2021 1759
MeFOSAA	2.0	1.6		1	82	63-144	09/21/2021 1759
PFBS	1.8	1.7		1	94	72-128	09/21/2021 1759
PFDS	1.9	1.5		1	77	59-134	09/21/2021 1759
PFHpS	1.9	1.9		1	99	70-132	09/21/2021 1759
PFNS	1.9	1.7		1	88	69-125	09/21/2021 1759
PFOSA	2.0	1.9		1	96	67-137	09/21/2021 1759
PFPeS	1.9	1.9		1	101	73-123	09/21/2021 1759
PFHxS	1.8	1.8		1	99	67-130	09/21/2021 1759
PFBA	2.0	1.9		1	96	71-135	09/21/2021 1759
PFDA	2.0	1.9		1	93	69-133	09/21/2021 1759
PFDoA	2.0	1.9		1	95	69-135	09/21/2021 1759
PFHpA	2.0	1.9		1	96	71-131	09/21/2021 1759
PFHxA	2.0	1.9		1	95	70-132	09/21/2021 1759
PFNA	2.0	2.0		1	99	72-129	09/21/2021 1759
PFOA	2.0	1.8		1	88	69-133	09/21/2021 1759
PFPeA	2.0	1.8		1	92	69-132	09/21/2021 1759
PFTeDA	2.0	1.9		1	97	69-133	09/21/2021 1759
PFTrDA	2.0	2.0		1	99	66-139	09/21/2021 1759
PFUdA	2.0	1.8		1	91	64-136	09/21/2021 1759
PFOS	1.9	1.6		1	86	68-136	09/21/2021 1759

Surrogate	Q	% Rec	Acceptance Limit
13C2_4:2FTS		98	50-150
13C2_6:2FTS		85	50-150
13C2_8:2FTS		106	50-150
13C2_PFDoA		92	50-150
13C2_PFTeDA		97	50-150
13C3_PFBS		95	50-150
13C3_PFHxS		101	50-150
13C4_PFBA		96	50-150
13C4_PFHpA		100	50-150
13C5_PFHxA		100	50-150
13C5_PFPeA		99	50-150
13C6_PFDA		102	50-150
13C7_PFUdA		101	50-150
13C8_PFOA		99	50-150

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

PFAS by LC/MS/MS - LCS

Sample ID: WQ15911-002
Batch: 15911
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Solid
Prep Method: SOP SPE
Prep Date: 09/20/2021 1859

Surrogate	Q	% Rec	Acceptance Limit
13C8_PFOS		94	50-150
13C8_PFOSA		100	50-150
13C9_PFNA		95	50-150
d5-EtFOSAA		97	50-150
d-MeFOSA		88	50-150
d3-MeFOSAA		105	50-150

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

SPLP PFAS - MB

Sample ID: WQ17007-001
Batch: 17007
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Solid
Prep Method: 1312/PFAS
Prep Date: 09/29/2021 1716 Leachate Date: 09/15/2021 0222

Parameter	Result	Q	Dil	LOQ	LOD	DL	Units	Analysis Date
8:2 FTS	40	U	1	80	40	20	ng/L	09/30/2021 1744
6:2 FTS	40	U	1	80	40	20	ng/L	09/30/2021 1744
4:2 FTS	40	U	1	80	40	20	ng/L	09/30/2021 1744
EtFOSAA	40	U	1	80	40	20	ng/L	09/30/2021 1744
MeFOSA	80	U	1	160	80	40	ng/L	09/30/2021 1744
MeFOSAA	40	U	1	80	40	20	ng/L	09/30/2021 1744
PFBS	20	U	1	40	20	10	ng/L	09/30/2021 1744
PFDS	20	U	1	40	20	10	ng/L	09/30/2021 1744
PFHpS	20	U	1	40	20	10	ng/L	09/30/2021 1744
PFNS	20	U	1	40	20	10	ng/L	09/30/2021 1744
PFOSA	20	U	1	40	20	10	ng/L	09/30/2021 1744
PFPeS	20	U	1	40	20	10	ng/L	09/30/2021 1744
PFHxS	20	U	1	40	20	10	ng/L	09/30/2021 1744
PFBA	20	U	1	40	20	10	ng/L	09/30/2021 1744
PFDA	20	U	1	40	20	10	ng/L	09/30/2021 1744
PFDoA	20	U	1	40	20	10	ng/L	09/30/2021 1744
PFHpA	20	U	1	40	20	10	ng/L	09/30/2021 1744
PFHxA	20	U	1	40	20	10	ng/L	09/30/2021 1744
PFNA	20	U	1	40	20	10	ng/L	09/30/2021 1744
PFOA	20	U	1	40	20	10	ng/L	09/30/2021 1744
PFPeA	20	U	1	40	20	10	ng/L	09/30/2021 1744
PFTeDA	20	U	1	40	20	10	ng/L	09/30/2021 1744
PFTrDA	20	U	1	40	20	10	ng/L	09/30/2021 1744
PFUdA	20	U	1	40	20	10	ng/L	09/30/2021 1744
PFOS	20	U	1	40	20	10	ng/L	09/30/2021 1744

Surrogate	Q	% Rec	Acceptance Limit
13C2_4:2FTS		117	50-150
13C2_6:2FTS		117	50-150
13C2_8:2FTS		96	50-150
13C2_PFDoA		88	50-150
13C2_PFTeDA		97	50-150
13C3_PFBS		98	50-150
13C3_PFHxS		95	50-150
13C4_PFBA		97	50-150
13C4_PFHpA		100	50-150
13C5_PFHxA		97	50-150
13C5_PFPeA		104	50-150
13C6_PFDA		95	50-150
13C7_PFUdA		102	50-150
13C8_PFOA		101	50-150

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

SPLP PFAS - MB

Sample ID: WQ17007-001
Batch: 17007
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Solid
Prep Method: 1312/PFAS
Prep Date: 09/29/2021 1716 Leachate Date: 09/15/2021 0222

Surrogate	Q	% Rec	Acceptance Limit
13C8_PFOS		87	50-150
13C8_PFOSA		107	50-150
13C9_PFNA		101	50-150
d5-EtFOSAA		107	50-150
d-MeFOSA		85	50-150
d3-MeFOSAA		109	50-150

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

SPLP PFAS - LCS

Sample ID: WQ17007-002
Batch: 17007
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Solid
Prep Method: 1312/PFAS
Prep Date: 09/29/2021 1716 Leachate Date: 09/15/2021 0222

Parameter	Spike Amount (ng/L)	Result (ng/L)	Q	Dil	% Rec	%Rec Limit	Analysis Date
8:2 FTS	15	15		1	95	67-138	09/30/2021 1805
6:2 FTS	15	14		1	89	64-140	09/30/2021 1805
4:2 FTS	15	13		1	88	63-143	09/30/2021 1805
EtFOSAA	16	15		1	96	61-135	09/30/2021 1805
MeFOSA	16	13		1	82	68-141	09/30/2021 1805
MeFOSAA	16	13		1	84	65-136	09/30/2021 1805
PFBS	14	15		1	105	72-130	09/30/2021 1805
PFDS	15	15		1	95	53-142	09/30/2021 1805
PFHpS	15	14		1	95	69-134	09/30/2021 1805
PFNS	15	17		1	112	69-127	09/30/2021 1805
PFOSA	16	16		1	98	67-137	09/30/2021 1805
PFPeS	15	14		1	97	71-127	09/30/2021 1805
PFHxS	15	15		1	100	68-131	09/30/2021 1805
PFBA	16	16		1	97	73-129	09/30/2021 1805
PFDA	16	18		1	110	71-129	09/30/2021 1805
PFDoA	16	16		1	98	72-134	09/30/2021 1805
PFHpA	16	15		1	96	72-130	09/30/2021 1805
PFHxA	16	16		1	98	72-129	09/30/2021 1805
PFNA	16	16		1	99	69-130	09/30/2021 1805
PFOA	16	15		1	97	71-133	09/30/2021 1805
PFPeA	16	16		1	101	72-129	09/30/2021 1805
PFTeDA	16	16		1	97	71-132	09/30/2021 1805
PFTrDA	16	16		1	101	65-144	09/30/2021 1805
PFUdA	16	17		1	107	69-133	09/30/2021 1805
PFOS	15	15		1	99	65-140	09/30/2021 1805

Surrogate	Q	% Rec	Acceptance Limit
13C2_4:2FTS		113	50-150
13C2_6:2FTS		112	50-150
13C2_8:2FTS		98	50-150
13C2_PFDoA		87	50-150
13C2_PFTeDA		95	50-150
13C3_PFBS		94	50-150
13C3_PFHxS		94	50-150
13C4_PFBA		98	50-150
13C4_PFHpA		100	50-150
13C5_PFHxA		101	50-150
13C5_PFPeA		100	50-150
13C6_PFDA		96	50-150
13C7_PFUdA		100	50-150
13C8_PFOA		101	50-150

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

SPLP PFAS - LCS

Sample ID: WQ17007-002
Batch: 17007
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Solid
Prep Method: 1312/PFAS
Prep Date: 09/29/2021 1716 Leachate Date: 09/15/2021 0222

Surrogate	Q	% Rec	Acceptance Limit
13C8_PFOS		91	50-150
13C8_PFOSA		105	50-150
13C9_PFNA		101	50-150
d5-EtFOSAA		105	50-150
d-MeFOSA		90	50-150
d3-MeFOSAA		115	50-150

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

SPLP PFAS - MS

Sample ID: WI13001-006MS
Batch: 17007
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Solid
Prep Method: 1312/PFAS
Prep Date: 09/29/2021 1716 Leachate Date: 09/15/2021 0222

Parameter	Sample Amount (ng/L)	Spike Amount (ng/L)	Result (ng/L)	Q	Dil	% Rec	%Rec Limit	Analysis Date
8:2 FTS	ND	15	14		1	94	67-138	09/30/2021 1918
6:2 FTS	ND	15	15		1	97	64-140	09/30/2021 1918
4:2 FTS	ND	15	13		1	85	63-143	09/30/2021 1918
EtFOSAA	ND	16	16		1	100	61-135	09/30/2021 1918
MeFOSA	ND	16	16		1	103	68-141	09/30/2021 1918
MeFOSAA	ND	16	13		1	83	65-136	09/30/2021 1918
PFBS	ND	14	13		1	95	72-130	09/30/2021 1918
PFDS	ND	15	13		1	86	53-142	09/30/2021 1918
PFHpS	ND	15	14		1	93	69-134	09/30/2021 1918
PFNS	ND	15	15		1	99	69-127	09/30/2021 1918
PFOSA	ND	16	14		1	89	67-137	09/30/2021 1918
PFPeS	ND	15	13		1	87	71-127	09/30/2021 1918
PFHxS	ND	15	14		1	97	68-131	09/30/2021 1918
PFBA	ND	16	16		1	97	73-129	09/30/2021 1918
PFDA	ND	16	16		1	102	71-129	09/30/2021 1918
PFDoA	ND	16	16		1	101	72-134	09/30/2021 1918
PFHpA	ND	16	16		1	100	72-130	09/30/2021 1918
PFHxA	ND	16	16		1	101	72-129	09/30/2021 1918
PFNA	ND	16	15		1	96	69-130	09/30/2021 1918
PFOA	ND	16	14		1	88	71-133	09/30/2021 1918
PFPeA	ND	16	16		1	99	72-129	09/30/2021 1918
PFTeDA	ND	16	16		1	98	71-132	09/30/2021 1918
PFTrDA	ND	16	15		1	95	65-144	09/30/2021 1918
PFUdA	ND	16	16		1	99	69-133	09/30/2021 1918
PFOS	ND	15	21	N	1	142	65-140	09/30/2021 1918

Surrogate	Q	% Rec	Acceptance Limit
13C2_4:2FTS		113	50-150
13C2_6:2FTS		118	50-150
13C2_8:2FTS		107	50-150
13C2_PFDoA		92	50-150
13C2_PFTeDA		83	50-150
13C3_PFBS		96	50-150
13C3_PFHxS		99	50-150
13C4_PFBA		98	50-150
13C4_PFHpA		94	50-150
13C5_PFHxA		98	50-150
13C5_PFPeA		102	50-150
13C6_PFDA		98	50-150
13C7_PFUdA		102	50-150
13C8_PFOA		103	50-150

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

SPLP PFAS - MS

Sample ID: WI13001-006MS
Batch: 17007
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Solid
Prep Method: 1312/PFAS
Prep Date: 09/29/2021 1716 Leachate Date: 09/15/2021 0222

Surrogate	Q	% Rec	Acceptance Limit
13C8_PFOS		97	50-150
13C8_PFOSA		109	50-150
13C9_PFNA		102	50-150
d5-EtFOSAA		102	50-150
d-MeFOSA		81	50-150
d3-MeFOSAA		112	50-150

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

SPLP PFAS - MSD

Sample ID: WI13001-006MD
Batch: 17007
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Solid
Prep Method: 1312/PFAS
Prep Date: 09/29/2021 1716 Leachate Date: 09/15/2021 0222

Parameter	Sample Amount (ng/L)	Spike Amount (ng/L)	Result (ng/L)	Q	Dil	% Rec	% RPD	%Rec Limit	% RPD Limit	Analysis Date
8:2 FTS	ND	15	15		1	99	4.4	67-138	30	09/30/2021 1929
6:2 FTS	ND	15	12		1	80	19	64-140	30	09/30/2021 1929
4:2 FTS	ND	15	14		1	93	8.1	63-143	30	09/30/2021 1929
EtFOSAA	ND	16	19		1	117	16	61-135	30	09/30/2021 1929
MeFOSA	ND	16	15		1	92	11	68-141	30	09/30/2021 1929
MeFOSAA	ND	16	15		1	92	9.9	65-136	30	09/30/2021 1929
PFBS	ND	14	14		1	97	2.2	72-130	30	09/30/2021 1929
PFDS	ND	15	17		1	112	26	53-142	30	09/30/2021 1929
PFHpS	ND	15	16		1	102	9.0	69-134	30	09/30/2021 1929
PFNS	ND	15	16		1	102	2.1	69-127	30	09/30/2021 1929
PFOSA	ND	16	15		1	95	6.8	67-137	30	09/30/2021 1929
PFPeS	ND	15	15		1	99	13	71-127	30	09/30/2021 1929
PFHxS	ND	15	15		1	103	6.2	68-131	30	09/30/2021 1929
PFBA	ND	16	16		1	98	1.0	73-129	30	09/30/2021 1929
PFDA	ND	16	17		1	105	3.0	71-129	30	09/30/2021 1929
PFDoA	ND	16	16		1	100	0.62	72-134	30	09/30/2021 1929
PFHpA	ND	16	16		1	99	0.65	72-130	30	09/30/2021 1929
PFHxA	ND	16	15		1	96	4.9	72-129	30	09/30/2021 1929
PFNA	ND	16	16		1	99	3.7	69-130	30	09/30/2021 1929
PFOA	ND	16	15		1	97	9.4	71-133	30	09/30/2021 1929
PFPeA	ND	16	16		1	99	0.020	72-129	30	09/30/2021 1929
PFTeDA	ND	16	16		1	97	0.54	71-132	30	09/30/2021 1929
PFTrDA	ND	16	16		1	99	4.1	65-144	30	09/30/2021 1929
PFUdA	ND	16	16		1	100	1.7	69-133	30	09/30/2021 1929
PFOS	ND	15	21	N	1	141	0.88	65-140	30	09/30/2021 1929

Surrogate	Q	% Rec	Acceptance Limit
13C2_4:2FTS		119	50-150
13C2_6:2FTS		115	50-150
13C2_8:2FTS		106	50-150
13C2_PFDoA		85	50-150
13C2_PFTeDA		86	50-150
13C3_PFBS		96	50-150
13C3_PFHxS		92	50-150
13C4_PFBA		97	50-150
13C4_PFHpA		95	50-150
13C5_PFHxA		99	50-150
13C5_PFPeA		103	50-150
13C6_PFDA		92	50-150
13C7_PFUdA		101	50-150
13C8_PFOA		98	50-150

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

SPLP PFAS - MSD

Sample ID: WI13001-006MD
Batch: 17007
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Solid
Prep Method: 1312/PFAS
Prep Date: 09/29/2021 1716 Leachate Date: 09/15/2021 0222

Surrogate	Q	% Rec	Acceptance Limit
13C8_PFOS		91	50-150
13C8_PFOSA		110	50-150
13C9_PFNA		101	50-150
d5-EtFOSAA		104	50-150
d-MeFOSA		88	50-150
d3-MeFOSAA		109	50-150

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

Chain of Custody

and

Miscellaneous Documents

Pace Analytical®

PACE ANALYTICAL SERVICES, LLC
106 Vantage Point Drive • West Columbia, SC 29172
Telephone No. 803-791-9700 Fax No. 803-791-9111
www.pacelabs.com

Number 122663

Client: Arcadis	Report to Contact: Nathan Nagle	Telephone No. / E-mail: nathan.nagle@arcadis.com	Quote No.: 25048
Address: 10 Friends Ln, Suite 100	Sampler's Signature: x Lindsay Powell	Analysis (Attach list if more space is needed)	Page 1 of 2
City: Newtown	State: PA	Zip Code: 18940	Printed Name: Lindsay Powell	
Project Name: Carlson Soil Washing			
Project No.: 30030317	P.O. No.		

WI13001
KES2

Sample ID / Description (Containers for each sample may be combined on one line.)	Collection Date(s)	Collection Time (Military)	Sediment	Matrix: Aqueous	Matrix: Solid	Matrix: Non-Aqueous	No. of Containers by Preservative Type: Unpres.	HNO3	HCl	NaOH	Na2S2O3	Field Filtered	PFAS GSM Table B-15	SPLP PFAS	Screen PFAS: PFOA, PFOS	Remarks / Cooler I.D.
382-5-S-2	9/7/21	1105			X								X	X	X	< 5 ppb
382-5-S-3	9/7/21	1120			X								X	X	X	↓
382-5-S-1	9/7/21	1100			X								X	X	X	
382-5-W-UT-1	9/7/21	1545		X									X			up to 100 ppb
382-5-W-T-1	9/7/21	1550		X									X			< 5 ppb
382-5-G-2 (MS/MSD)	9/8/21	0920			X								X	X	X	< [MS/MSD]
382-5-G-3	9/8/21	0935			X								X	X	X	rush 24 hr TAT on screen
382-5-F-1	9/8/21	1000			X								X	X	X	
382-5-F-2	9/8/21	1030			X								X	X	X	
382-5-F-3	9/8/21	1045			X		↓						X	X	X	5 day TAT on rest

Turn Around Time Required (Prior lab approval required for expedited TAT.): ☐ Standard ☒ Rush (Specify) 24 hr on screen

Sample Disposal: ☐ Return to Client ☐ Disposal by Lab

Possible Hazard Identification: ☐ Non-Hazard ☐ Flammable ☐ Skin Irritant ☐ Poison ☐ Unknown

QC Requirements (Specify)

	Date	Time		Date	Time
1. Relinquished by: Lindsay Powell	9/9/21	0800	1. Received by		
2. Relinquished by			2. Received by		
3. Relinquished by			2. Received by		
4. Relinquished by: fedex	9-13-21	800	4. Laboratory received by: Elizabeth Williams	9/13/21	0900

Note: All samples are retained for four weeks from receipt unless other arrangements are made.

LAB USE ONLY — Received on Ice (Circle) (Yes) No Ice Pack — Receipt Temp 3.2 °C — Temp Blank ☐ Y ☒ N

DISTRIBUTION: WHITE & YELLOW-Return to laboratory with Sample(s); PINK-Field/Client Copy

Document Number: ME005N2-01

PACE ANALYTICAL SERVICES, LLC

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Telephone No. 803-791-9700 Fax No. 803-791-9111
www.pacelabs.com

Number 122674

Client: Arcadis	Report to Contact: Nathan Nagle	Telephone No. / E-mail: nathan.nagle@arcadis.com	Quote No.: 25048
Address: 10 Friends Ln, Suite 100	Sampler's Signature: x Lindsay Powell	Analysis (Attach list if more space is needed)	Page 1 of 2
City: Newtown	State: PA	Zip Code: 18940	Printed Name: Lindsay Powell
Project Name: Ericson Soil Washing			
Project No.: 30030317	P.O. No.:		

WI13001
KES2

Sample ID / Description (Containers for each sample may be combined on one line.)	Collection Date(s)	Collection Time (Military)	Grab/Composite	Aqueous	Solid	Non-Aqueous	Matrix	Unpres.	H2SO4	HNO3	HCl	NaOH	5035 Kit	Field Filtered	No of Containers by Preservative Type	PFAS QSM Table B-15	SPLP PFAS	Screen PFAS: PFOA, PFOS	Remarks / Cooler I.D.
382-5-UT-3	9/8/21	1220	G		X			X								X	X	X	up to 100 ppb
Dup-01	9/8/21	—	G		X			X								X	X	X	<5 ppb
END OF RECORD																			rush 24 hr TAT on screen
																			5 day TAT on rest

JP 9/9/21

Turn Around Time Required (Prior lab approval required for expedited TAT.)	Sample Disposal	Possible Hazard Identification	QC Requirements (Specify)
☐ Standard ☐ Rush (Specify)	☐ Return to Client ☐ Disposal by Lab	☐ Non-Hazard ☐ Flammable ☐ Skin Irritant ☐ Poison ☐ Unknown	

	Date	Time		Date	Time
1. Relinquished by: Lindsay Powell	9/9/21	0800	1. Received by		
2. Relinquished by	Date	Time	2. Received by	Date	Time
3. Relinquished by	Date	Time	3. Received by	Date	Time
4. Relinquished by: fedex	9.13.21	900	4. Laboratory received by: Kenyon Means	Date: 9/13/21	Time: 0900

Note: All samples are retained for four weeks from receipt unless other arrangements are made.

LAB USE ONLY — Received on Ice (Circle) (Yes) No Ice Pack — Receipt Temp 3.2 °C — Temp Blank ☐ Y ☐N

DISTRIBUTION: WHITE & YELLOW-Return to laboratory with Sample(s); PINK-Field/Client Copy

Document Number: ME003N2 01

PACE ANALYTICAL SERVICES, LLC

Pace Analytical

Samples Receipt Checklist (SRC) (ME0018C-15)
Issuing Authority: Pace ENV - WCOL

Revised:9/29/2020
Page 1 of 1

Sample Receipt Checklist (SRC)

Client: Arcadis Cooler Inspected by/date: KDRW / 09/13/2021 Lot #: W113091

Means of receipt: ☐ Pace ☐ Client ☐ UPS ☑ FedEx ☐ Other: _____

☐ Yes	☑ No		1. Were custody seals present on the cooler?
☐ Yes	☐ No	☑ NA	2. If custody seals were present, were they intact and unbroken?

pH Strip ID: NA Chlorine Strip ID: NA Tested by: NA

Original temperature upon receipt / Derived (Corrected) temperature upon receipt %Solid Snap-Cup ID: 21-128

3.2 / 3.2 °C NA / NA °C NA / NA °C NA / NA °C

Method: ☐ Temperature Blank ☑ Against Bottles IR Gun ID: 5 IR Gun Correction Factor: 0 °C

Method of coolant: ☑ Wet Ice ☐ Ice Packs ☐ Dry Ice ☐ None

☐ Yes	☐ No	☑ NA	3. If temperature of any cooler exceeded 6.0°C, was Project Manager Notified? PM was Notified by: phone / email / face-to-face (circle one).
☑ Yes	☐ No	☐ NA	4. Is the commercial courier's packing slip attached to this form?
☑ Yes	☐ No		5. Were proper custody procedures (relinquished/received) followed?
☑ Yes	☐ No		6. Were sample IDs listed on the COC?
☑ Yes	☐ No		7. Were sample IDs listed on all sample containers?
☑ Yes	☐ No		8. Was collection date & time listed on the COC?
☑ Yes	☐ No		9. Was collection date & time listed on all sample containers?
☑ Yes	☐ No		10. Did all container label information (ID, date, time) agree with the COC?
☑ Yes	☐ No		11. Were tests to be performed listed on the COC?
☑ Yes	☐ No		12. Did all samples arrive in the proper containers for each test and/or in good condition (unbroken, lids on, etc.)? _____
☑ Yes	☐ No		13. Was adequate sample volume available?
☐ Yes	☑ No		14. Were all samples received within ½ the holding time or 48 hours, whichever comes first?
☐ Yes	☑ No		15. Were any samples containers missing/excess (circle one) samples Not Listed on COC?
☐ Yes	☐ No	☑ NA	16. For VOA and RSK-175 samples, were bubbles present >"pea-size" (¼"or 6mm in diameter) in any of the VOA vials?
☐ Yes	☐ No	☑ NA	17. Were all DRO/metals/nutrient samples received at a pH of < 2?
☐ Yes	☐ No	☑ NA	18. Were all cyanide samples received at a pH > 12 and sulfide samples received at a pH > 9?
☐ Yes	☐ No	☑ NA	19. Were all applicable NH_3/TKN/cyanide/phenol/625.1/608.3 (< 0.5mg/L) samples free of residual chlorine?
☐ Yes	☐ No	☑ NA	20. Were client remarks/requests (i.e. requested dilutions, MS/MSD designations, etc…) correctly transcribed from the COC into the comment section in LIMS?
☑ Yes	☐ No		21. Was the quote number listed on the container label? If yes, Quote # 25048

Sample Preservation (Must be completed for any sample(s) incorrectly preserved or with headspace.)

Sample(s) NA were received incorrectly preserved and were adjusted accordingly in sample receiving with NA mL of circle one: H2SO4, HNO3, HCl, NaOH using SR # NA.
Time of preservation NA. If more than one preservative is needed, please note in the comments below.

Sample(s) NA were received with bubbles >6 mm in diameter.

Samples(s) NA were received with TRC > 0.5 mg/L (If #19 is *no*) and were adjusted accordingly in sample receiving with sodium thiosulfate ($Na_2S_2O_3$) with Shealy ID: NA.

SR barcode labels applied by: KDRW Date: 09/13/2021

Comments:

Report of Analysis

Arcadis U.S., Inc.
630 Plaza Drive
Suite 600
Highlands Ranch, CO 80129
Attention: Joseph Quinnan

Project Name: Eielson AFB Soil Washing

Project Number: 30030317

Lot Number:**WI17023**

Date Completed:10/06/2021

10/06/2021 1:53 PM
Approved and released by:
Project Manager II: **Kathy E. Smith**

The electronic signature above is the equivalent of a handwritten signature.
This report shall not be reproduced, except in its entirety, without the written approval of Pace Analytical Services, LLC.

Pace Analytical Services, LLC (*formerly Shealy Environmental Services, Inc.*)
106 Vantage Point Drive West Columbia, SC 29172
Tel: 803-791-9700 Fax: 803-791-9111 www.pacelabs.com

Case Narrative
Arcadis U.S., Inc.
Lot Number: WI17023

This Report of Analysis contains the analytical result(s) for the sample(s) listed on the Sample Summary following this Case Narrative. The sample receiving date is documented in the header information associated with each sample.

All results listed in this report relate only to the samples that are contained within this report.

Sample receipt, sample analysis, and data review have been performed in accordance with the Pace Quality Assurance Management Plan (QAMP), applicable Shealy standard operating procedures (SOPs), the 2003 NELAC standard, and Shealy policies. Additionally, the DoD QSM version 5.3 has been followed for these samples, and specifically Table B-15 was followed for all PFAS samples. Any exceptions to the QAMP, SOPs, NELAC standards, the DoD QSM, or policies are qualified on the results page or discussed below.

Correction factors (CF) are used to calculate the original sample concentration. The CF is the inverse of the concentration factor (sample volume / extract final volume) times the dilution factor (DF). For undiluted analysis. The extract is prepared for injection by adding 182 uL of sample extract + 8 uL of reagent water + 10 uL of internal standard solution to a polypropylene autosampler vial. An extra correction factor of 0.91 (182 uL / 200 uL = 0.91) applies. The CF is calculated as follows:

For solid samples:

CF = DF * FV / Ws/S/1000

FV is volume of extract (mL)
Ws is initial sample weight (gram)
S is %Solids
DF is dilution factor. For undiluted analysis, DF = 1/0.91.

Concentration (ug/kg) = Cs*CF,

$$C_s = \frac{\left(\frac{(A_s x C_{is})}{A_{is}}\right) - B}{M1}$$

Where

C_s is on column concentration of target analyte in the sample (ng/L)
C_{is} is concentration of internal standard in the sample (ng/L)
A_s is peak response of target analyte in the sample
A_{is} is peak response of internal standard in the sample
M1 is the average RF from ICAL or the slope from linear regression ICAL
B is the y-intercept from the ICAL

Pace is a TNI accredited laboratory; however, the following analyses are currently not listed on our TNI scope of accreditation:

Biological Tissue: All, Non-Potable Water: SGT-HEM EPA 1664B, Silica EPA 200.7, Boron, Calcium, Silicon, Strontium EPA 200.8, Bicarbonate, Carbonate, and Hydroxide Alkalinity SM 2320 B-2011, Fecal Coliform SM 9221 C E-2006 & SM 9222D-2006, Strontium SW-846 6010D, VOC SM 6200 B-2011, Drinking Water: VOC (excluding BTEX, MTBE, Naphthalene, & 1,2-dichloroethane) EPA 524.2, Solid Chemical Material: TOC Walkley-Black.

Where applicable, all soil sample results (including LOQ and DL if requested) are corrected for dry weight unless flagged with a "W" qualifier.

If you have any questions regarding this report please contact the Pace Project Manager listed on the cover page.

The method blank associated with prep batch 16138 contained analytes: 8:2 FTS surrogate was greater than method criteria. The following samples were affected: WI17023-001, WI17023-002, WI17023-003, WI17023-006, WI17055-001, WI17055-002, WI17055-003, WI17055-004, WI17055-005, WI17055-006, WI17055-007, WI17055-008, WI17055-009, WI17055-010, WI17055-011, WI17055-012. The data has been reported. Method blank was non detect for 8:2 FTS; Samples unaffected. WI17023-001 (385-4-UT-1) (Run 2) (Analysis Batch 16338) (Prep Batch 16138) DOD List PFAS by Isotope Dilution (DOD QSM 5.3)

The MS/MSD associated with samples WI17023-001, WI17023-002 had multiple analytes recovered outside of the acceptance limits. The LCS was recovered within the required acceptance limits; therefore, this demonstrates a matrix effect and data quality is not impacted.

Semivolatiles
The LCS associated with batch 16015 had Chrysene recovered above the acceptance limits. This demonstrates a high bias on analytical results. There were no detections for this compound in the samples associated with this batch; therefore, data quality is not impacted.

Sample Summary

Arcadis U.S., Inc.

Lot Number: WI17023

Project Name: Eielson AFB Soil Washing

Project Number: 30030317

Sample Number	Sample ID	Matrix	Date Sampled	Date Received
001	385-4-UT-1	Solid	09/13/2021 1355	09/17/2021
002	385-4-S-1	Solid	09/15/2021 1145	09/17/2021
003	385-4-G-1	Solid	09/15/2021 1210	09/17/2021
004	385-4-W-UT-1	Aqueous	09/15/2021 1315	09/17/2021
005	385-4-W-T-1	Aqueous	09/15/2021 1300	09/17/2021
006	DUP-02	Solid	09/15/2021	09/17/2021
007	DUP-03	Aqueous	09/15/2021	09/17/2021

(7 samples)

Detection Summary

Arcadis U.S., Inc.

Lot Number: WI17023

Project Name: Eielson AFB Soil Washing

Project Number: 30030317

Sample	Sample ID	Matrix	Parameter	Method	Result	Q	Units	Page
001	385-4-UT-1	Solid	Acenaphthene	8270E	54		ug/kg	7
001	385-4-UT-1	Solid	Acenaphthylene	8270E	38		ug/kg	7
001	385-4-UT-1	Solid	Anthracene	8270E	130		ug/kg	7
001	385-4-UT-1	Solid	Benzo(a)anthracene	8270E	500	S	ug/kg	7
001	385-4-UT-1	Solid	Benzo(a)pyrene	8270E	820	S	ug/kg	7
001	385-4-UT-1	Solid	Benzo(b)fluoranthene	8270E	970	S	ug/kg	7
001	385-4-UT-1	Solid	Benzo(g,h,i)perylene	8270E	390	S	ug/kg	7
001	385-4-UT-1	Solid	Benzo(k)fluoranthene	8270E	420	S	ug/kg	7
001	385-4-UT-1	Solid	Chrysene	8270E	750	S	ug/kg	7
001	385-4-UT-1	Solid	Fluoranthene	8270E	1300	S	ug/kg	7
001	385-4-UT-1	Solid	Fluorene	8270E	60		ug/kg	7
001	385-4-UT-1	Solid	Indeno(1,2,3-c,d)pyrene	8270E	380	S	ug/kg	7
001	385-4-UT-1	Solid	1-Methylnaphthalene	8270E	27	J	ug/kg	7
001	385-4-UT-1	Solid	2-Methylnaphthalene	8270E	33		ug/kg	7
001	385-4-UT-1	Solid	Naphthalene	8270E	26	J	ug/kg	7
001	385-4-UT-1	Solid	Phenanthrene	8270E	650	S	ug/kg	7
001	385-4-UT-1	Solid	Pyrene	8270E	1000	S	ug/kg	7
001	385-4-UT-1	Solid	PFBS	PFAS by ID	0.22	J	ug/kg	8
001	385-4-UT-1	Solid	PFHxS	PFAS by ID	4.8		ug/kg	8
001	385-4-UT-1	Solid	PFBA	PFAS by ID	0.21	J	ug/kg	8
001	385-4-UT-1	Solid	PFDA	PFAS by ID	0.21	J	ug/kg	8
001	385-4-UT-1	Solid	PFHpA	PFAS by ID	0.45	J	ug/kg	8
001	385-4-UT-1	Solid	PFHxA	PFAS by ID	0.71	J	ug/kg	8
001	385-4-UT-1	Solid	PFNA	PFAS by ID	0.20	J	ug/kg	8
001	385-4-UT-1	Solid	PFOA	PFAS by ID	0.78	J	ug/kg	8
001	385-4-UT-1	Solid	PFPeA	PFAS by ID	0.37	J	ug/kg	8
001	385-4-UT-1	Solid	PFOS	PFAS by ID	9.2		ug/kg	8
001	385-4-UT-1	Solid	PFHxS	PFAS by ID	96		ng/L	10
001	385-4-UT-1	Solid	PFHxA	PFAS by ID	15	J	ng/L	10
001	385-4-UT-1	Solid	PFOA	PFAS by ID	18	J	ng/L	10
001	385-4-UT-1	Solid	PFOS	PFAS by ID	180		ng/L	10
002	385-4-S-1	Solid	Acenaphthene	8270E	220		ug/kg	12
002	385-4-S-1	Solid	Acenaphthylene	8270E	37		ug/kg	12
002	385-4-S-1	Solid	Anthracene	8270E	590		ug/kg	12
002	385-4-S-1	Solid	Benzo(a)anthracene	8270E	1400		ug/kg	12
002	385-4-S-1	Solid	Benzo(a)pyrene	8270E	1400		ug/kg	12
002	385-4-S-1	Solid	Benzo(b)fluoranthene	8270E	1500		ug/kg	12
002	385-4-S-1	Solid	Benzo(g,h,i)perylene	8270E	460		ug/kg	12
002	385-4-S-1	Solid	Benzo(k)fluoranthene	8270E	700		ug/kg	12
002	385-4-S-1	Solid	Chrysene	8270E	1800		ug/kg	12
002	385-4-S-1	Solid	Fluoranthene	8270E	3700		ug/kg	12
002	385-4-S-1	Solid	Fluorene	8270E	290		ug/kg	12
002	385-4-S-1	Solid	Indeno(1,2,3-c,d)pyrene	8270E	470		ug/kg	12

Sample	Sample ID	Matrix	Parameter	Method	Result	Q	Units	Page
002	385-4-S-1	Solid	1-Methylnaphthalene	8270E	38		ug/kg	12
002	385-4-S-1	Solid	2-Methylnaphthalene	8270E	36		ug/kg	12
002	385-4-S-1	Solid	Naphthalene	8270E	27	J	ug/kg	12
002	385-4-S-1	Solid	Phenanthrene	8270E	2600		ug/kg	12
002	385-4-S-1	Solid	Pyrene	8270E	2900		ug/kg	12
002	385-4-S-1	Solid	PFHxS	PFAS by ID	0.40	J	ug/kg	13
002	385-4-S-1	Solid	PFOS	PFAS by ID	0.80	J	ug/kg	13
003	385-4-G-1	Solid	Anthracene	8270E	1.0	J	ug/kg	17
003	385-4-G-1	Solid	Benzo(a)anthracene	8270E	2.8		ug/kg	17
003	385-4-G-1	Solid	Benzo(a)pyrene	8270E	2.8		ug/kg	17
003	385-4-G-1	Solid	Benzo(b)fluoranthene	8270E	2.4	J	ug/kg	17
003	385-4-G-1	Solid	Benzo(g,h,i)perylene	8270E	1.4	J	ug/kg	17
003	385-4-G-1	Solid	Benzo(k)fluoranthene	8270E	1.6	J	ug/kg	17
003	385-4-G-1	Solid	Fluoranthene	8270E	2.4	J	ug/kg	17
003	385-4-G-1	Solid	Indeno(1,2,3-c,d)pyrene	8270E	1.3	J	ug/kg	17
003	385-4-G-1	Solid	Pyrene	8270E	2.5	J	ug/kg	17
003	385-4-G-1	Solid	PFOS	PFAS by ID	0.28	J	ug/kg	18
003	385-4-G-1	Solid	6:2 FTS	PFAS by ID	37	J	ng/L	20
004	385-4-W-UT-1	Aqueous	Naphthalene	8270E	0.072	J	ug/L	22
004	385-4-W-UT-1	Aqueous	PFBS	PFAS by ID	7.8		ng/L	23
004	385-4-W-UT-1	Aqueous	PFHpS	PFAS by ID	2.4	J	ng/L	23
004	385-4-W-UT-1	Aqueous	PFOSA	PFAS by ID	2.2	J	ng/L	23
004	385-4-W-UT-1	Aqueous	PFPeS	PFAS by ID	5.9		ng/L	23
004	385-4-W-UT-1	Aqueous	PFHxS	PFAS by ID	160		ng/L	23
004	385-4-W-UT-1	Aqueous	PFBA	PFAS by ID	5.9		ng/L	23
004	385-4-W-UT-1	Aqueous	PFDA	PFAS by ID	3.4	J	ng/L	23
004	385-4-W-UT-1	Aqueous	PFHpA	PFAS by ID	18		ng/L	23
004	385-4-W-UT-1	Aqueous	PFHxA	PFAS by ID	24		ng/L	23
004	385-4-W-UT-1	Aqueous	PFNA	PFAS by ID	4.4		ng/L	23
004	385-4-W-UT-1	Aqueous	PFOA	PFAS by ID	25		ng/L	23
004	385-4-W-UT-1	Aqueous	PFPeA	PFAS by ID	12		ng/L	23
004	385-4-W-UT-1	Aqueous	PFOS	PFAS by ID	190		ng/L	23
005	385-4-W-T-1	Aqueous	Naphthalene	8270E	0.11	J	ug/L	25
006	DUP-02	Solid	Anthracene	8270E	0.60	J	ug/kg	28
006	DUP-02	Solid	Benzo(a)anthracene	8270E	1.6	J	ug/kg	28
006	DUP-02	Solid	Benzo(a)pyrene	8270E	1.2	J	ug/kg	28
006	DUP-02	Solid	Benzo(b)fluoranthene	8270E	0.93	J	ug/kg	28
006	DUP-02	Solid	Benzo(k)fluoranthene	8270E	1.0	J	ug/kg	28
006	DUP-02	Solid	Fluoranthene	8270E	1.1	J	ug/kg	28
006	DUP-02	Solid	Pyrene	8270E	1.1	J	ug/kg	28
006	DUP-02	Solid	PFHxS	PFAS by ID	0.34	J	ug/kg	29
006	DUP-02	Solid	PFOA	PFAS by ID	0.14	J	ug/kg	29
006	DUP-02	Solid	PFOS	PFAS by ID	0.75		ug/kg	29
007	DUP-03	Aqueous	Naphthalene	8270E	0.14	J	ug/L	33

(87 detections)

Semivolatile Organic Compounds by GC/MS

Client: Arcadis U.S., Inc. | Laboratory ID: WI17023-001
Description: 385-4-UT-1 | Matrix: Solid
Date Sampled: 09/13/2021 1355 | Project Name: Eielson AFB Soil Washing | % Solids: 86.8 09/18/2021 1903
Date Received: 09/17/2021 | Project Number: 30030317

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch
1	3546	8270E	10	09/21/2021 1147	STM	09/20/2021 1656	15888

Parameter	CAS Number	Analytical Method	Result	Q	LOQ	LOD	DL	Units	Run
Acenaphthene	83-32-9	8270E	54		31	23	9.5	ug/kg	1
Acenaphthylene	208-96-8	8270E	38		31	23	11	ug/kg	1
Anthracene	120-12-7	8270E	130		31	23	5.8	ug/kg	1
Benzo(a)anthracene	56-55-3	8270E	500	S	31	23	6.7	ug/kg	1
Benzo(a)pyrene	50-32-8	8270E	820	S	31	23	7.5	ug/kg	1
Benzo(b)fluoranthene	205-99-2	8270E	970	S	31	23	5.7	ug/kg	1
Benzo(g,h,i)perylene	191-24-2	8270E	390	S	31	23	7.4	ug/kg	1
Benzo(k)fluoranthene	207-08-9	8270E	420	S	31	17	5.5	ug/kg	1
Chrysene	218-01-9	8270E	750	S	31	17	5.1	ug/kg	1
Dibenzo(a,h)anthracene	53-70-3	8270E	23	U	31	23	5.8	ug/kg	1
Fluoranthene	206-44-0	8270E	1300	S	31	17	4.8	ug/kg	1
Fluorene	86-73-7	8270E	60		31	23	6.5	ug/kg	1
Indeno(1,2,3-c,d)pyrene	193-39-5	8270E	380	S	31	23	11	ug/kg	1
1-Methylnaphthalene	90-12-0	8270E	27	J	31	23	11	ug/kg	1
2-Methylnaphthalene	91-57-6	8270E	33		31	23	11	ug/kg	1
Naphthalene	91-20-3	8270E	26	J	31	23	11	ug/kg	1
Phenanthrene	85-01-8	8270E	650	S	31	23	8.2	ug/kg	1
Pyrene	129-00-0	8270E	1000	S	31	23	5.7	ug/kg	1

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
2-Fluorobiphenyl		102	44-115
Nitrobenzene-d5		105	37-122
Terphenyl-d14		99	54-127

LOQ = Limit of Quantitation | B = Detected in the method blank | E = Quantitation of compound exceeded the calibration range | DL = Detection Limit | Q = Surrogate failure
U = Not detected at or above the LOQ | N = Recovery is out of criteria | P = The RPD between two GC columns exceeds 40% | J = Estimated result < LOQ and ≥ DL | L = LCS/LCSD failure
H = Out of holding time | W = Reported on wet weight basis | LOD = Limit of Detection | S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: WI17023-001
Description: 385-4-UT-1 | Matrix: Solid
Date Sampled: 09/13/2021 1355 | Project Name: Eielson AFB Soil Washing | % Solids: 86.8 09/18/2021 1903
Date Received: 09/17/2021 | Project Number: 30030317

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch
1	SOP SPE	PFAS by ID SOP QSM B-15	1	09/20/2021 1420	JJG	09/19/2021 1515	15796
2	SOP SPE	PFAS by ID SOP QSM B-15	1	09/23/2021 1516	NK1	09/22/2021 1232	16138

Parameter	CAS Number	Analytical Method	Result	Q	LOQ	LOD	DL	Units	Run
1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS)	39108-34-4	PFAS by ID SOP	1.0	U	2.0	1.0	0.49	ug/kg	1
1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS)	27619-97-2	PFAS by ID SOP	1.1	U	2.1	1.1	0.53	ug/kg	2
1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS)	757124-72-4	PFAS by ID SOP	1.0	U	2.0	1.0	0.49	ug/kg	1
N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA)	2991-50-6	PFAS by ID SOP	1.0	U	2.0	1.0	0.49	ug/kg	1
N-methylperfluoro-1-octanesulfonamide (MeFOSA)	31506-32-8	PFAS by ID SOP	1.0	U	2.0	1.0	0.49	ug/kg	1
N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA)	2355-31-9	PFAS by ID SOP	1.0	U	2.0	1.0	0.49	ug/kg	1
Perfluoro-1-butanesulfonic acid (PFBS)	375-73-5	PFAS by ID SOP	0.22	J	0.98	0.49	0.20	ug/kg	1
Perfluoro-1-decanesulfonic acid (PFDS)	335-77-3	PFAS by ID SOP	0.49	U	0.98	0.49	0.20	ug/kg	1
Perfluoro-1-heptanesulfonic acid (PFHpS)	375-92-8	PFAS by ID SOP	0.49	U	0.98	0.49	0.20	ug/kg	1
Perfluoro-1-nonanesulfonic acid (PFNS)	68259-12-1	PFAS by ID SOP	0.49	U	0.98	0.49	0.20	ug/kg	1
Perfluoro-1-octanesulfonamide (PFOSA)	754-91-6	PFAS by ID SOP	0.49	U	0.98	0.49	0.20	ug/kg	1
Perfluoro-1-pentanesulfonic acid (PFPeS)	2706-91-4	PFAS by ID SOP	0.49	U	0.98	0.49	0.20	ug/kg	1
Perfluorohexanesulfonic acid (PFHxS)	355-46-4	PFAS by ID SOP	4.8		0.98	0.49	0.20	ug/kg	1
Perfluoro-n-butanoic acid (PFBA)	375-22-4	PFAS by ID SOP	0.21	J	0.98	0.49	0.20	ug/kg	1
Perfluoro-n-decanoic acid (PFDA)	335-76-2	PFAS by ID SOP	0.21	J	0.98	0.49	0.20	ug/kg	1
Perfluoro-n-dodecanoic acid (PFDoA)	307-55-1	PFAS by ID SOP	0.49	U	0.98	0.49	0.20	ug/kg	1
Perfluoro-n-heptanoic acid (PFHpA)	375-85-9	PFAS by ID SOP	0.45	J	0.98	0.49	0.20	ug/kg	1
Perfluoro-n-hexanoic acid (PFHxA)	307-24-4	PFAS by ID SOP	0.71	J	0.98	0.49	0.20	ug/kg	1
Perfluoro-n-nonanoic acid (PFNA)	375-95-1	PFAS by ID SOP	0.20	J	0.98	0.49	0.20	ug/kg	1
Perfluoro-n-octanoic acid (PFOA)	335-67-1	PFAS by ID SOP	0.78	J	0.98	0.49	0.20	ug/kg	1
Perfluoro-n-pentanoic acid (PFPeA)	2706-90-3	PFAS by ID SOP	0.37	J	0.98	0.49	0.20	ug/kg	1
Perfluoro-n-tetradecanoic acid (PFTeDA)	376-06-7	PFAS by ID SOP	0.49	U	0.98	0.49	0.20	ug/kg	1
Perfluoro-n-tridecanoic acid (PFTrDA)	72629-94-8	PFAS by ID SOP	0.49	U	0.98	0.49	0.20	ug/kg	1
Perfluoro-n-undecanoic acid (PFUdA)	2058-94-8	PFAS by ID SOP	0.49	U	0.98	0.49	0.20	ug/kg	1
Perfluorooctanesulfonic acid (PFOS)	1763-23-1	PFAS by ID SOP	9.2		0.98	0.49	0.20	ug/kg	1

Surrogate	Run 1 Q	Run 1 % Recovery	Run 1 Acceptance Limits	Run 2 Q	Run 2 % Recovery	Run 2 Acceptance Limits
13C2_4:2FTS		80	50-150		104	50-150
13C2_6:2FTS		80	50-150		106	50-150
13C2_8:2FTS		84	50-150		113	50-150
13C2_PFDoA		78	50-150		93	50-150
13C2_PFTeDA		70	50-150		101	50-150
13C3_PFBS		74	50-150		99	50-150
13C3_PFHxS		80	50-150		99	50-150
13C4_PFBA		76	50-150		96	50-150
13C4_PFHpA		79	50-150		97	50-150
13C5_PFHxA		80	50-150		95	50-150
13C5_PFPeA		77	50-150		93	50-150
13C6_PFDA		80	50-150		94	50-150
13C7_PFUdA		80	50-150		95	50-150
13C8_PFOA		78	50-150		101	50-150
13C8_PFOS		80	50-150		97	50-150
13C8_PFOSA		78	50-150		96	50-150

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

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PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.
Laboratory ID: WI17023-001
Description: 385-4-UT-1
Matrix: Solid
Date Sampled: 09/13/2021 1355
Project Name: Eielson AFB Soil Washing
% Solids: 86.8 09/18/2021 1903
Date Received: 09/17/2021
Project Number: 30030317

Surrogate	Q	Run 1 % Recovery	Acceptance Limits	Q	Run 2 % Recovery	Acceptance Limits
13C9_PFNA		74	50-150		101	50-150
d5-EtFOSAA		81	50-150		105	50-150
d-MeFOSA		73	50-150		97	50-150
d3-MeFOSAA		84	50-150		100	50-150

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SPLP PFAS

Client: Arcadis U.S., Inc. | Laboratory ID: WI17023-001
Description: 385-4-UT-1 | Matrix: Solid
Date Sampled: 09/13/2021 1355 | Project Name: Eielson AFB Soil Washing | % Solids: 86.8 09/18/2021 1903
Date Received: 09/17/2021 | Project Number: 30030317

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch	Leachate Date
1	1312/PFAS	PFAS by ID SOP QSM B-15	1	09/30/2021 2104	JJG	09/29/2021 1716	17010	09/21/2021 2318

Parameter	CAS Number	Analytical Method	Result	Q	LOQ	LOD	DL	Units	Run
1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS)	39108-34-4	PFAS by ID SOP	40	U	80	40	20	ng/L	1
1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS)	27619-97-2	PFAS by ID SOP	40	U	80	40	20	ng/L	1
1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS)	757124-72-4	PFAS by ID SOP	40	U	80	40	20	ng/L	1
N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA)	2991-50-6	PFAS by ID SOP	40	U	80	40	20	ng/L	1
N-methylperfluoro-1-octanesulfonamide (MeFOSA)	31506-32-8	PFAS by ID SOP	80	U	160	80	40	ng/L	1
N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA)	2355-31-9	PFAS by ID SOP	40	U	80	40	20	ng/L	1
Perfluoro-1-butanesulfonic acid (PFBS)	375-73-5	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-1-decanesulfonic acid (PFDS)	335-77-3	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-1-heptanesulfonic acid (PFHpS)	375-92-8	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-1-nonanesulfonic acid (PFNS)	68259-12-1	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-1-octanesulfonamide (PFOSA)	754-91-6	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-1-pentanesulfonic acid (PFPeS)	2706-91-4	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluorohexanesulfonic acid (PFHxS)	355-46-4	PFAS by ID SOP	96		40	20	10	ng/L	1
Perfluoro-n-butanoic acid (PFBA)	375-22-4	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-n-decanoic acid (PFDA)	335-76-2	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-n-dodecanoic acid (PFDoA)	307-55-1	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-n-heptanoic acid (PFHpA)	375-85-9	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-n-hexanoic acid (PFHxA)	307-24-4	PFAS by ID SOP	15	J	40	20	10	ng/L	1
Perfluoro-n-nonanoic acid (PFNA)	375-95-1	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-n-octanoic acid (PFOA)	335-67-1	PFAS by ID SOP	18	J	40	20	10	ng/L	1
Perfluoro-n-pentanoic acid (PFPeA)	2706-90-3	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-n-tetradecanoic acid (PFTeDA)	376-06-7	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-n-tridecanoic acid (PFTrDA)	72629-94-8	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-n-undecanoic acid (PFUdA)	2058-94-8	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluorooctanesulfonic acid (PFOS)	1763-23-1	PFAS by ID SOP	180		40	20	10	ng/L	1

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
13C2_4:2FTS		111	50-150
13C2_6:2FTS		105	50-150
13C2_8:2FTS		107	50-150
13C2_PFDoA		77	50-150
13C2_PFTeDA		86	50-150
13C3_PFBS		96	50-150
13C3_PFHxS		90	50-150
13C4_PFBA		93	50-150
13C4_PFHpA		95	50-150
13C5_PFHxA		93	50-150
13C5_PFPeA		96	50-150
13C6_PFDA		89	50-150
13C7_PFUdA		89	50-150
13C8_PFOA		93	50-150
13C8_PFOS		83	50-150
13C8_PFOSA		103	50-150
13C9_PFNA		96	50-150

LOQ = Limit of Quantitation
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N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
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SPLP PFAS

Client: Arcadis U.S., Inc.		Laboratory ID: WI17023-001
Description: 385-4-UT-1		Matrix: Solid
Date Sampled: 09/13/2021 1355	Project Name: Eielson AFB Soil Washing	% Solids: 86.8 09/18/2021 1903
Date Received: 09/17/2021	Project Number: 30030317	

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
d5-EtFOSAA		94	50-150
d-MeFOSA		103	50-150
d3-MeFOSAA		100	50-150

LOQ = Limit of Quantitation	B = Detected in the method blank	E = Quantitation of compound exceeded the calibration range	DL = Detection Limit	Q = Surrogate failure
U = Not detected at or above the LOQ	N = Recovery is out of criteria	P = The RPD between two GC columns exceeds 40%	J = Estimated result < LOQ and ≥ DL	L = LCS/LCSD failure
H = Out of holding time	W = Reported on wet weight basis	LOD = Limit of Detection		S = MS/MSD failure

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Semivolatile Organic Compounds by GC/MS

Client: Arcadis U.S., Inc. | Laboratory ID: WI17023-002
Description: 385-4-S-1 | Matrix: Solid
Date Sampled: 09/15/2021 1145 | Project Name: Eielson AFB Soil Washing | % Solids: 89.8 09/18/2021 1903
Date Received: 09/17/2021 | Project Number: 30030317

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch
1	3546	8270E	10	09/21/2021 1420	STM	09/20/2021 1656	15888

Parameter	CAS Number	Analytical Method	Result	Q	LOQ	LOD	DL	Units	Run
Acenaphthene	83-32-9	8270E	220		30	22	9.2	ug/kg	1
Acenaphthylene	208-96-8	8270E	37		30	22	11	ug/kg	1
Anthracene	120-12-7	8270E	590		30	22	5.7	ug/kg	1
Benzo(a)anthracene	56-55-3	8270E	1400		30	22	6.6	ug/kg	1
Benzo(a)pyrene	50-32-8	8270E	1400		30	22	7.3	ug/kg	1
Benzo(b)fluoranthene	205-99-2	8270E	1500		30	22	5.6	ug/kg	1
Benzo(g,h,i)perylene	191-24-2	8270E	460		30	22	7.2	ug/kg	1
Benzo(k)fluoranthene	207-08-9	8270E	700		30	17	5.3	ug/kg	1
Chrysene	218-01-9	8270E	1800		30	17	5.0	ug/kg	1
Dibenzo(a,h)anthracene	53-70-3	8270E	22	U	30	22	5.7	ug/kg	1
Fluoranthene	206-44-0	8270E	3700		30	17	4.7	ug/kg	1
Fluorene	86-73-7	8270E	290		30	22	6.3	ug/kg	1
Indeno(1,2,3-c,d)pyrene	193-39-5	8270E	470		30	22	11	ug/kg	1
1-Methylnaphthalene	90-12-0	8270E	38		30	22	11	ug/kg	1
2-Methylnaphthalene	91-57-6	8270E	36		30	22	11	ug/kg	1
Naphthalene	91-20-3	8270E	27	J	30	22	11	ug/kg	1
Phenanthrene	85-01-8	8270E	2600		30	22	8.0	ug/kg	1
Pyrene	129-00-0	8270E	2900		30	22	5.6	ug/kg	1

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
2-Fluorobiphenyl		89	44-115
Nitrobenzene-d5		77	37-122
Terphenyl-d14		90	54-127

LOQ = Limit of Quantitation | B = Detected in the method blank | E = Quantitation of compound exceeded the calibration range | DL = Detection Limit | Q = Surrogate failure
U = Not detected at or above the LOQ | N = Recovery is out of criteria | P = The RPD between two GC columns exceeds 40% | J = Estimated result < LOQ and ≥ DL | L = LCS/LCSD failure
H = Out of holding time | W = Reported on wet weight basis | LOD = Limit of Detection | S = MS/MSD failure

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PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: WI17023-002
Description: 385-4-S-1 | Matrix: Solid
Date Sampled: 09/15/2021 1145 | Project Name: Eielson AFB Soil Washing | % Solids: 89.8 09/18/2021 1903
Date Received: 09/17/2021 | Project Number: 30030317

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch
1	SOP SPE	PFAS by ID SOP QSM B-15	1	09/20/2021 1430	JJG	09/19/2021 1515	15796
2	SOP SPE	PFAS by ID SOP QSM B-15	1	09/23/2021 1529	NK1	09/22/2021 1232	16138

Parameter	CAS Number	Analytical Method	Result	Q	LOQ	LOD	DL	Units	Run
1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS)	39108-34-4	PFAS by ID SOP	1.1	U	2.1	1.1	0.52	ug/kg	1
1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS)	27619-97-2	PFAS by ID SOP	1.1	U	2.1	1.1	0.54	ug/kg	2
1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS)	757124-72-4	PFAS by ID SOP	1.1	U	2.1	1.1	0.52	ug/kg	1
N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA)	2991-50-6	PFAS by ID SOP	1.1	U	2.1	1.1	0.52	ug/kg	1
N-methylperfluoro-1-octanesulfonamide (MeFOSA)	31506-32-8	PFAS by ID SOP	1.1	U	2.1	1.1	0.52	ug/kg	1
N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA)	2355-31-9	PFAS by ID SOP	1.1	U	2.1	1.1	0.52	ug/kg	1
Perfluoro-1-butanesulfonic acid (PFBS)	375-73-5	PFAS by ID SOP	0.50	U	1.0	0.50	0.21	ug/kg	1
Perfluoro-1-decanesulfonic acid (PFDS)	335-77-3	PFAS by ID SOP	0.50	U	1.0	0.50	0.21	ug/kg	1
Perfluoro-1-heptanesulfonic acid (PFHpS)	375-92-8	PFAS by ID SOP	0.50	U	1.0	0.50	0.21	ug/kg	1
Perfluoro-1-nonanesulfonic acid (PFNS)	68259-12-1	PFAS by ID SOP	0.50	U	1.0	0.50	0.21	ug/kg	1
Perfluoro-1-octanesulfonamide (PFOSA)	754-91-6	PFAS by ID SOP	0.50	U	1.0	0.50	0.21	ug/kg	1
Perfluoro-1-pentanesulfonic acid (PFPeS)	2706-91-4	PFAS by ID SOP	0.50	U	1.0	0.50	0.21	ug/kg	1
Perfluorohexanesulfonic acid (PFHxS)	355-46-4	PFAS by ID SOP	0.40	J	1.0	0.50	0.21	ug/kg	1
Perfluoro-n-butanoic acid (PFBA)	375-22-4	PFAS by ID SOP	0.50	U	1.0	0.50	0.21	ug/kg	1
Perfluoro-n-decanoic acid (PFDA)	335-76-2	PFAS by ID SOP	0.50	U	1.0	0.50	0.21	ug/kg	1
Perfluoro-n-dodecanoic acid (PFDoA)	307-55-1	PFAS by ID SOP	0.50	U	1.0	0.50	0.21	ug/kg	1
Perfluoro-n-heptanoic acid (PFHpA)	375-85-9	PFAS by ID SOP	0.50	U	1.0	0.50	0.21	ug/kg	1
Perfluoro-n-hexanoic acid (PFHxA)	307-24-4	PFAS by ID SOP	0.50	U	1.0	0.50	0.21	ug/kg	1
Perfluoro-n-nonanoic acid (PFNA)	375-95-1	PFAS by ID SOP	0.50	U	1.0	0.50	0.21	ug/kg	1
Perfluoro-n-octanoic acid (PFOA)	335-67-1	PFAS by ID SOP	0.50	U	1.0	0.50	0.21	ug/kg	1
Perfluoro-n-pentanoic acid (PFPeA)	2706-90-3	PFAS by ID SOP	0.50	U	1.0	0.50	0.21	ug/kg	1
Perfluoro-n-tetradecanoic acid (PFTeDA)	376-06-7	PFAS by ID SOP	0.50	U	1.0	0.50	0.21	ug/kg	1
Perfluoro-n-tridecanoic acid (PFTrDA)	72629-94-8	PFAS by ID SOP	0.50	U	1.0	0.50	0.21	ug/kg	1
Perfluoro-n-undecanoic acid (PFUdA)	2058-94-8	PFAS by ID SOP	0.50	U	1.0	0.50	0.21	ug/kg	1
Perfluorooctanesulfonic acid (PFOS)	1763-23-1	PFAS by ID SOP	0.80	J	1.0	0.50	0.21	ug/kg	1

Surrogate	Run 1 Q	Run 1 % Recovery	Run 1 Acceptance Limits	Run 2 Q	Run 2 % Recovery	Run 2 Acceptance Limits
13C2_4:2FTS		90	50-150		101	50-150
13C2_6:2FTS		84	50-150		99	50-150
13C2_8:2FTS		86	50-150		104	50-150
13C2_PFDoA		86	50-150		88	50-150
13C2_PFTeDA		85	50-150		94	50-150
13C3_PFBS		86	50-150		95	50-150
13C3_PFHxS		90	50-150		96	50-150
13C4_PFBA		87	50-150		94	50-150
13C4_PFHpA		87	50-150		93	50-150
13C5_PFHxA		86	50-150		100	50-150
13C5_PFPeA		84	50-150		92	50-150
13C6_PFDA		86	50-150		94	50-150
13C7_PFUdA		88	50-150		89	50-150
13C8_PFOA		79	50-150		100	50-150
13C8_PFOS		87	50-150		97	50-150
13C8_PFOSA		85	50-150		92	50-150

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E = Quantitation of compound exceeded the calibration range
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LOD = Limit of Detection
DL = Detection Limit
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PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.
Laboratory ID: WI17023-002
Description: 385-4-S-1
Matrix: Solid
Date Sampled: 09/15/2021 1145
Project Name: Eielson AFB Soil Washing
% Solids: 89.8 09/18/2021 1903
Date Received: 09/17/2021
Project Number: 30030317

Surrogate	Q	Run 1 % Recovery	Acceptance Limits	Q	Run 2 % Recovery	Acceptance Limits
13C9_PFNA		88	50-150		97	50-150
d5-EtFOSAA		93	50-150		96	50-150
d-MeFOSA		81	50-150		97	50-150
d3-MeFOSAA		91	50-150		94	50-150

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

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SPLP PFAS

Client: Arcadis U.S., Inc. | Laboratory ID: WI17023-002
Description: 385-4-S-1 | Matrix: Solid
Date Sampled: 09/15/2021 1145 | Project Name: Eielson AFB Soil Washing | % Solids: 89.8 09/18/2021 1903
Date Received: 09/17/2021 | Project Number: 30030317

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch	Leachate Date
1	1312/PFAS	PFAS by ID SOP QSM B-15	1	09/30/2021 2114	JJG	09/29/2021 1716	17010	09/21/2021 2318

Parameter	CAS Number	Analytical Method	Result	Q	LOQ	LOD	DL	Units	Run
1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS)	39108-34-4	PFAS by ID SOP	40	U	80	40	20	ng/L	1
1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS)	27619-97-2	PFAS by ID SOP	40	US	80	40	20	ng/L	1
1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS)	757124-72-4	PFAS by ID SOP	40	U	80	40	20	ng/L	1
N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA)	2991-50-6	PFAS by ID SOP	40	U	80	40	20	ng/L	1
N-methylperfluoro-1-octanesulfonamide (MeFOSA)	31506-32-8	PFAS by ID SOP	80	U	160	80	40	ng/L	1
N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA)	2355-31-9	PFAS by ID SOP	40	U	80	40	20	ng/L	1
Perfluoro-1-butanesulfonic acid (PFBS)	375-73-5	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-1-decanesulfonic acid (PFDS)	335-77-3	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-1-heptanesulfonic acid (PFHpS)	375-92-8	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-1-nonanesulfonic acid (PFNS)	68259-12-1	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-1-octanesulfonamide (PFOSA)	754-91-6	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-1-pentanesulfonic acid (PFPeS)	2706-91-4	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluorohexanesulfonic acid (PFHxS)	355-46-4	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-n-butanoic acid (PFBA)	375-22-4	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-n-decanoic acid (PFDA)	335-76-2	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-n-dodecanoic acid (PFDoA)	307-55-1	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-n-heptanoic acid (PFHpA)	375-85-9	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-n-hexanoic acid (PFHxA)	307-24-4	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-n-nonanoic acid (PFNA)	375-95-1	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-n-octanoic acid (PFOA)	335-67-1	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-n-pentanoic acid (PFPeA)	2706-90-3	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-n-tetradecanoic acid (PFTeDA)	376-06-7	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-n-tridecanoic acid (PFTrDA)	72629-94-8	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-n-undecanoic acid (PFUdA)	2058-94-8	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluorooctanesulfonic acid (PFOS)	1763-23-1	PFAS by ID SOP	20	U	40	20	10	ng/L	1

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
13C2_4:2FTS		106	50-150
13C2_6:2FTS		105	50-150
13C2_8:2FTS		106	50-150
13C2_PFDoA		76	50-150
13C2_PFTeDA		84	50-150
13C3_PFBS		89	50-150
13C3_PFHxS		87	50-150
13C4_PFBA		94	50-150
13C4_PFHpA		94	50-150
13C5_PFHxA		91	50-150
13C5_PFPeA		93	50-150
13C6_PFDA		90	50-150
13C7_PFUdA		91	50-150
13C8_PFOA		88	50-150
13C8_PFOS		81	50-150
13C8_PFOSA		102	50-150
13C9_PFNA		93	50-150

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

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SPLP PFAS

Client: Arcadis U.S., Inc.		Laboratory ID: WI17023-002
Description: 385-4-S-1		Matrix: Solid
Date Sampled: 09/15/2021 1145	Project Name: Eielson AFB Soil Washing	% Solids: 89.8 09/18/2021 1903
Date Received: 09/17/2021	Project Number: 30030317	

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
d5-EtFOSAA		105	50-150
d-MeFOSA		78	50-150
d3-MeFOSAA		101	50-150

LOQ = Limit of Quantitation	B = Detected in the method blank	E = Quantitation of compound exceeded the calibration range	DL = Detection Limit	Q = Surrogate failure
U = Not detected at or above the LOQ	N = Recovery is out of criteria	P = The RPD between two GC columns exceeds 40%	J = Estimated result < LOQ and ≥ DL	L = LCS/LCSD failure
H = Out of holding time	W = Reported on wet weight basis	LOD = Limit of Detection		S = MS/MSD failure

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Semivolatile Organic Compounds by GC/MS

Client: Arcadis U.S., Inc. | Laboratory ID: WI17023-003
Description: 385-4-G-1 | Matrix: Solid
Date Sampled: 09/15/2021 1210 | Project Name: Eielson AFB Soil Washing | % Solids: 97.4 09/18/2021 1903
Date Received: 09/17/2021 | Project Number: 30030317

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch
1	3546	8270E	1	09/21/2021 1213	STM	09/20/2021 1656	15888

Parameter	CAS Number	Analytical Method	Result	Q	LOQ	LOD	DL	Units	Run
Acenaphthene	83-32-9	8270E	2.1	U	2.8	2.1	0.85	ug/kg	1
Acenaphthylene	208-96-8	8270E	2.1	U	2.8	2.1	0.98	ug/kg	1
Anthracene	120-12-7	8270E	1.0	J	2.8	2.1	0.52	ug/kg	1
Benzo(a)anthracene	56-55-3	8270E	2.8		2.8	2.1	0.61	ug/kg	1
Benzo(a)pyrene	50-32-8	8270E	2.8		2.8	2.1	0.68	ug/kg	1
Benzo(b)fluoranthene	205-99-2	8270E	2.4	J	2.8	2.1	0.51	ug/kg	1
Benzo(g,h,i)perylene	191-24-2	8270E	1.4	J	2.8	2.1	0.67	ug/kg	1
Benzo(k)fluoranthene	207-08-9	8270E	1.6	J	2.8	1.6	0.49	ug/kg	1
Chrysene	218-01-9	8270E	1.6	U	2.8	1.6	0.46	ug/kg	1
Dibenzo(a,h)anthracene	53-70-3	8270E	2.1	U	2.8	2.1	0.52	ug/kg	1
Fluoranthene	206-44-0	8270E	2.4	J	2.8	1.6	0.43	ug/kg	1
Fluorene	86-73-7	8270E	2.1	U	2.8	2.1	0.59	ug/kg	1
Indeno(1,2,3-c,d)pyrene	193-39-5	8270E	1.3	J	2.8	2.1	1.0	ug/kg	1
1-Methylnaphthalene	90-12-0	8270E	2.1	U	2.8	2.1	1.0	ug/kg	1
2-Methylnaphthalene	91-57-6	8270E	2.1	U	2.8	2.1	1.0	ug/kg	1
Naphthalene	91-20-3	8270E	2.1	U	2.8	2.1	1.0	ug/kg	1
Phenanthrene	85-01-8	8270E	2.1	U	2.8	2.1	0.74	ug/kg	1
Pyrene	129-00-0	8270E	2.5	J	2.8	2.1	0.51	ug/kg	1

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
2-Fluorobiphenyl		73	44-115
Nitrobenzene-d5		72	37-122
Terphenyl-d14		80	54-127

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
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PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: WI17023-003
Description: 385-4-G-1 | Matrix: Solid
Date Sampled: 09/15/2021 1210 | Project Name: Eielson AFB Soil Washing | % Solids: 97.4 09/18/2021 1903
Date Received: 09/17/2021 | Project Number: 30030317

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch
1	SOP SPE	PFAS by ID SOP QSM B-15	1	09/20/2021 1502	JJG	09/19/2021 1515	15796
2	SOP SPE	PFAS by ID SOP QSM B-15	1	09/23/2021 1541	NK1	09/22/2021 1232	16138

Parameter	CAS Number	Analytical Method	Result	Q	LOQ	LOD	DL	Units	Run
1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS)	39108-34-4	PFAS by ID SOP	0.55	U	1.1	0.55	0.27	ug/kg	1
1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS)	27619-97-2	PFAS by ID SOP	0.55	U	1.1	0.55	0.27	ug/kg	2
1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS)	757124-72-4	PFAS by ID SOP	0.55	U	1.1	0.55	0.27	ug/kg	1
N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA)	2991-50-6	PFAS by ID SOP	0.55	U	1.1	0.55	0.27	ug/kg	1
N-methylperfluoro-1-octanesulfonamide (MeFOSA)	31506-32-8	PFAS by ID SOP	0.55	U	1.1	0.55	0.27	ug/kg	1
N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA)	2355-31-9	PFAS by ID SOP	0.55	U	1.1	0.55	0.27	ug/kg	1
Perfluoro-1-butanesulfonic acid (PFBS)	375-73-5	PFAS by ID SOP	0.28	U	0.55	0.28	0.11	ug/kg	1
Perfluoro-1-decanesulfonic acid (PFDS)	335-77-3	PFAS by ID SOP	0.28	U	0.55	0.28	0.11	ug/kg	1
Perfluoro-1-heptanesulfonic acid (PFHpS)	375-92-8	PFAS by ID SOP	0.28	U	0.55	0.28	0.11	ug/kg	1
Perfluoro-1-nonanesulfonic acid (PFNS)	68259-12-1	PFAS by ID SOP	0.28	U	0.55	0.28	0.11	ug/kg	1
Perfluoro-1-octanesulfonamide (PFOSA)	754-91-6	PFAS by ID SOP	0.28	U	0.55	0.28	0.11	ug/kg	1
Perfluoro-1-pentanesulfonic acid (PFPeS)	2706-91-4	PFAS by ID SOP	0.28	U	0.55	0.28	0.11	ug/kg	1
Perfluorohexanesulfonic acid (PFHxS)	355-46-4	PFAS by ID SOP	0.28	U	0.55	0.28	0.11	ug/kg	1
Perfluoro-n-butanoic acid (PFBA)	375-22-4	PFAS by ID SOP	0.28	U	0.55	0.28	0.11	ug/kg	1
Perfluoro-n-decanoic acid (PFDA)	335-76-2	PFAS by ID SOP	0.28	U	0.55	0.28	0.11	ug/kg	1
Perfluoro-n-dodecanoic acid (PFDoA)	307-55-1	PFAS by ID SOP	0.28	U	0.55	0.28	0.11	ug/kg	1
Perfluoro-n-heptanoic acid (PFHpA)	375-85-9	PFAS by ID SOP	0.28	U	0.55	0.28	0.11	ug/kg	1
Perfluoro-n-hexanoic acid (PFHxA)	307-24-4	PFAS by ID SOP	0.28	U	0.55	0.28	0.11	ug/kg	1
Perfluoro-n-nonanoic acid (PFNA)	375-95-1	PFAS by ID SOP	0.28	U	0.55	0.28	0.11	ug/kg	1
Perfluoro-n-octanoic acid (PFOA)	335-67-1	PFAS by ID SOP	0.28	U	0.55	0.28	0.11	ug/kg	1
Perfluoro-n-pentanoic acid (PFPeA)	2706-90-3	PFAS by ID SOP	0.28	U	0.55	0.28	0.11	ug/kg	1
Perfluoro-n-tetradecanoic acid (PFTeDA)	376-06-7	PFAS by ID SOP	0.28	U	0.55	0.28	0.11	ug/kg	1
Perfluoro-n-tridecanoic acid (PFTrDA)	72629-94-8	PFAS by ID SOP	0.28	U	0.55	0.28	0.11	ug/kg	1
Perfluoro-n-undecanoic acid (PFUdA)	2058-94-8	PFAS by ID SOP	0.28	U	0.55	0.28	0.11	ug/kg	1
Perfluorooctanesulfonic acid (PFOS)	1763-23-1	PFAS by ID SOP	0.28	J	0.55	0.28	0.11	ug/kg	1

Surrogate	Run 1 Q	Run 1 % Recovery	Run 1 Acceptance Limits	Run 2 Q	Run 2 % Recovery	Run 2 Acceptance Limits
13C2_4:2FTS		91	50-150		107	50-150
13C2_6:2FTS		89	50-150		105	50-150
13C2_8:2FTS		91	50-150		111	50-150
13C2_PFDoA		87	50-150		97	50-150
13C2_PFTeDA		88	50-150		101	50-150
13C3_PFBS		90	50-150		103	50-150
13C3_PFHxS		95	50-150		103	50-150
13C4_PFBA		88	50-150		100	50-150
13C4_PFHpA		89	50-150		98	50-150
13C5_PFHxA		91	50-150		107	50-150
13C5_PFPeA		86	50-150		98	50-150
13C6_PFDA		91	50-150		99	50-150
13C7_PFUdA		89	50-150		95	50-150
13C8_PFOA		91	50-150		104	50-150
13C8_PFOS		92	50-150		106	50-150
13C8_PFOSA		87	50-150		106	50-150

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
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B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

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PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.
Laboratory ID: WI17023-003
Description: 385-4-G-1
Matrix: Solid
Date Sampled: 09/15/2021 1210
Project Name: Eielson AFB Soil Washing
% Solids: 97.4 09/18/2021 1903
Date Received: 09/17/2021
Project Number: 30030317

Surrogate	Q	Run 1 % Recovery	Acceptance Limits	Q	Run 2 % Recovery	Acceptance Limits
13C9_PFNA		92	50-150		106	50-150
d5-EtFOSAA		97	50-150		103	50-150
d-MeFOSA		100	50-150		105	50-150
d3-MeFOSAA		92	50-150		98	50-150

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
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J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
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S = MS/MSD failure

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SPLP PFAS

Client: Arcadis U.S., Inc. | Laboratory ID: WI17023-003
Description: 385-4-G-1 | Matrix: Solid
Date Sampled: 09/15/2021 1210 | Project Name: Eielson AFB Soil Washing | % Solids: 97.4 09/18/2021 1903
Date Received: 09/17/2021 | Project Number: 30030317

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch	Leachate Date
1	1312/PFAS	PFAS by ID SOP QSM B-15	1	09/30/2021 2146	JJG	09/29/2021 1716	17010	09/21/2021 2318

Parameter	CAS Number	Analytical Method	Result	Q	LOQ	LOD	DL	Units	Run
1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS)	39108-34-4	PFAS by ID SOP	40	U	80	40	20	ng/L	1
1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS)	27619-97-2	PFAS by ID SOP	37	J	80	40	20	ng/L	1
1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS)	757124-72-4	PFAS by ID SOP	40	U	80	40	20	ng/L	1
N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA)	2991-50-6	PFAS by ID SOP	40	U	80	40	20	ng/L	1
N-methylperfluoro-1-octanesulfonamide (MeFOSA)	31506-32-8	PFAS by ID SOP	80	U	160	80	40	ng/L	1
N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA)	2355-31-9	PFAS by ID SOP	40	U	80	40	20	ng/L	1
Perfluoro-1-butanesulfonic acid (PFBS)	375-73-5	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-1-decanesulfonic acid (PFDS)	335-77-3	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-1-heptanesulfonic acid (PFHpS)	375-92-8	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-1-nonanesulfonic acid (PFNS)	68259-12-1	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-1-octanesulfonamide (PFOSA)	754-91-6	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-1-pentanesulfonic acid (PFPeS)	2706-91-4	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluorohexanesulfonic acid (PFHxS)	355-46-4	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-n-butanoic acid (PFBA)	375-22-4	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-n-decanoic acid (PFDA)	335-76-2	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-n-dodecanoic acid (PFDoA)	307-55-1	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-n-heptanoic acid (PFHpA)	375-85-9	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-n-hexanoic acid (PFHxA)	307-24-4	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-n-nonanoic acid (PFNA)	375-95-1	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-n-octanoic acid (PFOA)	335-67-1	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-n-pentanoic acid (PFPeA)	2706-90-3	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-n-tetradecanoic acid (PFTeDA)	376-06-7	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-n-tridecanoic acid (PFTrDA)	72629-94-8	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-n-undecanoic acid (PFUdA)	2058-94-8	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluorooctanesulfonic acid (PFOS)	1763-23-1	PFAS by ID SOP	20	U	40	20	10	ng/L	1

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
13C2_4:2FTS		105	50-150
13C2_6:2FTS		95	50-150
13C2_8:2FTS		98	50-150
13C2_PFDoA		76	50-150
13C2_PFTeDA		77	50-150
13C3_PFBS		85	50-150
13C3_PFHxS		83	50-150
13C4_PFBA		89	50-150
13C4_PFHpA		89	50-150
13C5_PFHxA		88	50-150
13C5_PFPeA		92	50-150
13C6_PFDA		86	50-150
13C7_PFUdA		88	50-150
13C8_PFOA		89	50-150
13C8_PFOS		80	50-150
13C8_PFOSA		97	50-150
13C9_PFNA		88	50-150

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

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SPLP PFAS

Client: Arcadis U.S., Inc.		Laboratory ID: WI17023-003
Description: 385-4-G-1		Matrix: Solid
Date Sampled: 09/15/2021 1210	Project Name: Eielson AFB Soil Washing	% Solids: 97.4 09/18/2021 1903
Date Received: 09/17/2021	Project Number: 30030317	

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
d5-EtFOSAA		91	50-150
d-MeFOSA		81	50-150
d3-MeFOSAA		91	50-150

LOQ = Limit of Quantitation	B = Detected in the method blank	E = Quantitation of compound exceeded the calibration range	DL = Detection Limit	Q = Surrogate failure
U = Not detected at or above the LOQ	N = Recovery is out of criteria	P = The RPD between two GC columns exceeds 40%	J = Estimated result < LOQ and ≥ DL	L = LCS/LCSD failure
H = Out of holding time	W = Reported on wet weight basis	LOD = Limit of Detection		S = MS/MSD failure

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Semivolatile Organic Compounds by GC/MS

Client: Arcadis U.S., Inc. | Laboratory ID: WI17023-004
Description: 385-4-W-UT-1 | Matrix: Aqueous
Date Sampled: 09/15/2021 1315 | Project Name: Eielson AFB Soil Washing
Date Received: 09/17/2021 | Project Number: 30030317

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch
1	3520C	8270E	1	09/22/2021 1626	STM	09/21/2021 1300	16015

Parameter	CAS Number	Analytical Method	Result	Q	LOQ	LOD	DL	Units	Run
Acenaphthene	83-32-9	8270E	0.10	U	0.20	0.10	0.040	ug/L	1
Acenaphthylene	208-96-8	8270E	0.10	U	0.20	0.10	0.040	ug/L	1
Anthracene	120-12-7	8270E	0.10	U	0.20	0.10	0.040	ug/L	1
Benzo(a)anthracene	56-55-3	8270E	0.10	U	0.20	0.10	0.040	ug/L	1
Benzo(a)pyrene	50-32-8	8270E	0.10	U	0.20	0.10	0.040	ug/L	1
Benzo(b)fluoranthene	205-99-2	8270E	0.10	U	0.20	0.10	0.040	ug/L	1
Benzo(g,h,i)perylene	191-24-2	8270E	0.10	U	0.20	0.10	0.040	ug/L	1
Benzo(k)fluoranthene	207-08-9	8270E	0.10	U	0.20	0.10	0.040	ug/L	1
Chrysene	218-01-9	8270E	0.10	UL	0.20	0.10	0.040	ug/L	1
Dibenzo(a,h)anthracene	53-70-3	8270E	0.10	U	0.20	0.10	0.040	ug/L	1
Fluoranthene	206-44-0	8270E	0.10	U	0.20	0.10	0.040	ug/L	1
Fluorene	86-73-7	8270E	0.10	U	0.20	0.10	0.040	ug/L	1
Indeno(1,2,3-c,d)pyrene	193-39-5	8270E	0.10	U	0.20	0.10	0.040	ug/L	1
1-Methylnaphthalene	90-12-0	8270E	0.10	U	0.20	0.10	0.040	ug/L	1
2-Methylnaphthalene	91-57-6	8270E	0.10	U	0.20	0.10	0.040	ug/L	1
Naphthalene	91-20-3	8270E	0.072	J	0.20	0.10	0.040	ug/L	1
Phenanthrene	85-01-8	8270E	0.10	U	0.20	0.10	0.040	ug/L	1
Pyrene	129-00-0	8270E	0.10	U	0.20	0.10	0.040	ug/L	1

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
2-Fluorobiphenyl		85	44-119
Nitrobenzene-d5		90	44-120
Terphenyl-d14		98	50-134

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

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PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: WI17023-004
Description: 385-4-W-UT-1 | Matrix: Aqueous
Date Sampled: 09/15/2021 1315 | Project Name: Eielson AFB Soil Washing
Date Received: 09/17/2021 | Project Number: 30030317

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch
1	SOP SPE	PFAS by ID SOP QSM B-15	1	09/19/2021 1847	JJG	09/17/2021 1758	15718

Parameter	CAS Number	Analytical Method	Result	Q	LOQ	LOD	DL	Units	Run
1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS)	39108-34-4	PFAS by ID SOP	4.0	U	8.0	4.0	2.0	ng/L	1
1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS)	27619-97-2	PFAS by ID SOP	4.0	U	8.0	4.0	2.0	ng/L	1
1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS)	757124-72-4	PFAS by ID SOP	4.0	U	8.0	4.0	2.0	ng/L	1
N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA)	2991-50-6	PFAS by ID SOP	4.0	U	8.0	4.0	2.0	ng/L	1
N-methylperfluoro-1-octanesulfonamide (MeFOSA)	31506-32-8	PFAS by ID SOP	8.0	U	16	8.0	4.0	ng/L	1
N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA)	2355-31-9	PFAS by ID SOP	4.0	U	8.0	4.0	2.0	ng/L	1
Perfluoro-1-butanesulfonic acid (PFBS)	375-73-5	PFAS by ID SOP	7.8		4.0	2.0	1.0	ng/L	1
Perfluoro-1-decanesulfonic acid (PFDS)	335-77-3	PFAS by ID SOP	2.0	U	4.0	2.0	1.0	ng/L	1
Perfluoro-1-heptanesulfonic acid (PFHpS)	375-92-8	PFAS by ID SOP	2.4	J	4.0	2.0	1.0	ng/L	1
Perfluoro-1-nonanesulfonic acid (PFNS)	68259-12-1	PFAS by ID SOP	2.0	U	4.0	2.0	1.0	ng/L	1
Perfluoro-1-octanesulfonamide (PFOSA)	754-91-6	PFAS by ID SOP	2.2	J	4.0	2.0	1.0	ng/L	1
Perfluoro-1-pentanesulfonic acid (PFPeS)	2706-91-4	PFAS by ID SOP	5.9		4.0	2.0	1.0	ng/L	1
Perfluorohexanesulfonic acid (PFHxS)	355-46-4	PFAS by ID SOP	160		4.0	2.0	1.0	ng/L	1
Perfluoro-n-butanoic acid (PFBA)	375-22-4	PFAS by ID SOP	5.9		4.0	2.0	1.0	ng/L	1
Perfluoro-n-decanoic acid (PFDA)	335-76-2	PFAS by ID SOP	3.4	J	4.0	2.0	1.0	ng/L	1
Perfluoro-n-dodecanoic acid (PFDoA)	307-55-1	PFAS by ID SOP	2.0	U	4.0	2.0	1.0	ng/L	1
Perfluoro-n-heptanoic acid (PFHpA)	375-85-9	PFAS by ID SOP	18		4.0	2.0	1.0	ng/L	1
Perfluoro-n-hexanoic acid (PFHxA)	307-24-4	PFAS by ID SOP	24		4.0	2.0	1.0	ng/L	1
Perfluoro-n-nonanoic acid (PFNA)	375-95-1	PFAS by ID SOP	4.4		4.0	2.0	1.0	ng/L	1
Perfluoro-n-octanoic acid (PFOA)	335-67-1	PFAS by ID SOP	25		4.0	2.0	1.0	ng/L	1
Perfluoro-n-pentanoic acid (PFPeA)	2706-90-3	PFAS by ID SOP	12		4.0	2.0	1.0	ng/L	1
Perfluoro-n-tetradecanoic acid (PFTeDA)	376-06-7	PFAS by ID SOP	2.0	U	4.0	2.0	1.0	ng/L	1
Perfluoro-n-tridecanoic acid (PFTrDA)	72629-94-8	PFAS by ID SOP	2.0	U	4.0	2.0	1.0	ng/L	1
Perfluoro-n-undecanoic acid (PFUdA)	2058-94-8	PFAS by ID SOP	2.0	U	4.0	2.0	1.0	ng/L	1
Perfluorooctanesulfonic acid (PFOS)	1763-23-1	PFAS by ID SOP	190		4.0	2.0	1.0	ng/L	1

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
13C2_4:2FTS		115	50-150
13C2_6:2FTS		126	50-150
13C2_8:2FTS		109	50-150
13C2_PFDoA		93	50-150
13C2_PFTeDA		100	50-150
13C3_PFBS		106	50-150
13C3_PFHxS		101	50-150
13C4_PFBA		111	50-150
13C4_PFHpA		106	50-150
13C5_PFHxA		114	50-150
13C5_PFPeA		111	50-150
13C6_PFDA		101	50-150
13C7_PFUdA		109	50-150
13C8_PFOA		114	50-150
13C8_PFOS		102	50-150
13C8_PFOSA		109	50-150
13C9_PFNA		104	50-150

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

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PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.		Laboratory ID: WI17023-004	
Description: 385-4-W-UT-1		Matrix: Aqueous	
Date Sampled: 09/15/2021 1315	Project Name: Eielson AFB Soil Washing		
Date Received: 09/17/2021	Project Number: 30030317		

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
d5-EtFOSAA		105	50-150
d-MeFOSA		99	50-150
d3-MeFOSAA		101	50-150

LOQ = Limit of Quantitation	B = Detected in the method blank	E = Quantitation of compound exceeded the calibration range	DL = Detection Limit	Q = Surrogate failure
U = Not detected at or above the LOQ	N = Recovery is out of criteria	P = The RPD between two GC columns exceeds 40%	J = Estimated result < LOQ and ≥ DL	L = LCS/LCSD failure
H = Out of holding time	W = Reported on wet weight basis	LOD = Limit of Detection		S = MS/MSD failure

Semivolatile Organic Compounds by GC/MS

Client: Arcadis U.S., Inc. | Laboratory ID: WI17023-005
Description: 385-4-W-T-1 | Matrix: Aqueous
Date Sampled: 09/15/2021 1300 | Project Name: Eielson AFB Soil Washing
Date Received: 09/17/2021 | Project Number: 30030317

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch
1	3520C	8270E	1	09/22/2021 1652	STM	09/21/2021 1300	16015

Parameter	CAS Number	Analytical Method	Result	Q	LOQ	LOD	DL	Units	Run
Acenaphthene	83-32-9	8270E	0.10	U	0.20	0.10	0.040	ug/L	1
Acenaphthylene	208-96-8	8270E	0.10	U	0.20	0.10	0.040	ug/L	1
Anthracene	120-12-7	8270E	0.10	U	0.20	0.10	0.040	ug/L	1
Benzo(a)anthracene	56-55-3	8270E	0.10	U	0.20	0.10	0.040	ug/L	1
Benzo(a)pyrene	50-32-8	8270E	0.10	U	0.20	0.10	0.040	ug/L	1
Benzo(b)fluoranthene	205-99-2	8270E	0.10	U	0.20	0.10	0.040	ug/L	1
Benzo(g,h,i)perylene	191-24-2	8270E	0.10	U	0.20	0.10	0.040	ug/L	1
Benzo(k)fluoranthene	207-08-9	8270E	0.10	U	0.20	0.10	0.040	ug/L	1
Chrysene	218-01-9	8270E	0.10	UL	0.20	0.10	0.040	ug/L	1
Dibenzo(a,h)anthracene	53-70-3	8270E	0.10	U	0.20	0.10	0.040	ug/L	1
Fluoranthene	206-44-0	8270E	0.10	U	0.20	0.10	0.040	ug/L	1
Fluorene	86-73-7	8270E	0.10	U	0.20	0.10	0.040	ug/L	1
Indeno(1,2,3-c,d)pyrene	193-39-5	8270E	0.10	U	0.20	0.10	0.040	ug/L	1
1-Methylnaphthalene	90-12-0	8270E	0.10	U	0.20	0.10	0.040	ug/L	1
2-Methylnaphthalene	91-57-6	8270E	0.10	U	0.20	0.10	0.040	ug/L	1
Naphthalene	91-20-3	8270E	0.11	J	0.20	0.10	0.040	ug/L	1
Phenanthrene	85-01-8	8270E	0.10	U	0.20	0.10	0.040	ug/L	1
Pyrene	129-00-0	8270E	0.10	U	0.20	0.10	0.040	ug/L	1

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
2-Fluorobiphenyl		77	44-119
Nitrobenzene-d5		76	44-120
Terphenyl-d14		88	50-134

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

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PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: WI17023-005
Description: 385-4-W-T-1 | Matrix: Aqueous
Date Sampled: 09/15/2021 1300 | Project Name: Eielson AFB Soil Washing
Date Received: 09/17/2021 | Project Number: 30030317

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch
1	SOP SPE	PFAS by ID SOP QSM B-15	1	09/20/2021 1523	JJG	09/17/2021 1758	15718

Parameter	CAS Number	Analytical Method	Result	Q	LOQ	LOD	DL	Units	Run
1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS)	39108-34-4	PFAS by ID SOP	3.9	U	7.8	3.9	1.9	ng/L	1
1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS)	27619-97-2	PFAS by ID SOP	3.9	U	7.8	3.9	1.9	ng/L	1
1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS)	757124-72-4	PFAS by ID SOP	3.9	U	7.8	3.9	1.9	ng/L	1
N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA)	2991-50-6	PFAS by ID SOP	3.9	U	7.8	3.9	1.9	ng/L	1
N-methylperfluoro-1-octanesulfonamide (MeFOSA)	31506-32-8	PFAS by ID SOP	8.0	U	16	8.0	3.9	ng/L	1
N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA)	2355-31-9	PFAS by ID SOP	3.9	U	7.8	3.9	1.9	ng/L	1
Perfluoro-1-butanesulfonic acid (PFBS)	375-73-5	PFAS by ID SOP	2.0	U	3.9	2.0	0.97	ng/L	1
Perfluoro-1-decanesulfonic acid (PFDS)	335-77-3	PFAS by ID SOP	2.0	U	3.9	2.0	0.97	ng/L	1
Perfluoro-1-heptanesulfonic acid (PFHpS)	375-92-8	PFAS by ID SOP	2.0	U	3.9	2.0	0.97	ng/L	1
Perfluoro-1-nonanesulfonic acid (PFNS)	68259-12-1	PFAS by ID SOP	2.0	U	3.9	2.0	0.97	ng/L	1
Perfluoro-1-octanesulfonamide (PFOSA)	754-91-6	PFAS by ID SOP	2.0	U	3.9	2.0	0.97	ng/L	1
Perfluoro-1-pentanesulfonic acid (PFPeS)	2706-91-4	PFAS by ID SOP	2.0	U	3.9	2.0	0.97	ng/L	1
Perfluorohexanesulfonic acid (PFHxS)	355-46-4	PFAS by ID SOP	2.0	U	3.9	2.0	0.97	ng/L	1
Perfluoro-n-butanoic acid (PFBA)	375-22-4	PFAS by ID SOP	2.0	U	3.9	2.0	0.97	ng/L	1
Perfluoro-n-decanoic acid (PFDA)	335-76-2	PFAS by ID SOP	2.0	U	3.9	2.0	0.97	ng/L	1
Perfluoro-n-dodecanoic acid (PFDoA)	307-55-1	PFAS by ID SOP	2.0	U	3.9	2.0	0.97	ng/L	1
Perfluoro-n-heptanoic acid (PFHpA)	375-85-9	PFAS by ID SOP	2.0	U	3.9	2.0	0.97	ng/L	1
Perfluoro-n-hexanoic acid (PFHxA)	307-24-4	PFAS by ID SOP	2.0	U	3.9	2.0	0.97	ng/L	1
Perfluoro-n-nonanoic acid (PFNA)	375-95-1	PFAS by ID SOP	2.0	U	3.9	2.0	0.97	ng/L	1
Perfluoro-n-octanoic acid (PFOA)	335-67-1	PFAS by ID SOP	2.0	U	3.9	2.0	0.97	ng/L	1
Perfluoro-n-pentanoic acid (PFPeA)	2706-90-3	PFAS by ID SOP	2.0	U	3.9	2.0	0.97	ng/L	1
Perfluoro-n-tetradecanoic acid (PFTeDA)	376-06-7	PFAS by ID SOP	2.0	U	3.9	2.0	0.97	ng/L	1
Perfluoro-n-tridecanoic acid (PFTrDA)	72629-94-8	PFAS by ID SOP	2.0	U	3.9	2.0	0.97	ng/L	1
Perfluoro-n-undecanoic acid (PFUdA)	2058-94-8	PFAS by ID SOP	2.0	U	3.9	2.0	0.97	ng/L	1
Perfluorooctanesulfonic acid (PFOS)	1763-23-1	PFAS by ID SOP	2.0	U	3.9	2.0	0.97	ng/L	1

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
13C2_4:2FTS		111	50-150
13C2_6:2FTS		126	50-150
13C2_8:2FTS		101	50-150
13C2_PFDoA		94	50-150
13C2_PFTeDA		92	50-150
13C3_PFBS		99	50-150
13C3_PFHxS		96	50-150
13C4_PFBA		102	50-150
13C4_PFHpA		108	50-150
13C5_PFHxA		106	50-150
13C5_PFPeA		105	50-150
13C6_PFDA		98	50-150
13C7_PFUdA		100	50-150
13C8_PFOA		118	50-150
13C8_PFOS		97	50-150
13C8_PFOSA		106	50-150
13C9_PFNA		104	50-150

LOQ = Limit of Quantitation | B = Detected in the method blank | E = Quantitation of compound exceeded the calibration range | DL = Detection Limit | Q = Surrogate failure
U = Not detected at or above the LOQ | N = Recovery is out of criteria | P = The RPD between two GC columns exceeds 40% | J = Estimated result < LOQ and ≥ DL | L = LCS/LCSD failure
H = Out of holding time | W = Reported on wet weight basis | LOD = Limit of Detection | S = MS/MSD failure

PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.		Laboratory ID: WI17023-005	
Description: 385-4-W-T-1		Matrix: Aqueous	
Date Sampled: 09/15/2021 1300	Project Name: Eielson AFB Soil Washing		
Date Received: 09/17/2021	Project Number: 30030317		

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
d5-EtFOSAA		103	50-150
d-MeFOSA		101	50-150
d3-MeFOSAA		101	50-150

LOQ = Limit of Quantitation	B = Detected in the method blank	E = Quantitation of compound exceeded the calibration range	DL = Detection Limit	Q = Surrogate failure
U = Not detected at or above the LOQ	N = Recovery is out of criteria	P = The RPD between two GC columns exceeds 40%	J = Estimated result < LOQ and ≥ DL	L = LCS/LCSD failure
H = Out of holding time	W = Reported on wet weight basis	LOD = Limit of Detection		S = MS/MSD failure

Semivolatile Organic Compounds by GC/MS

Client: Arcadis U.S., Inc. | Laboratory ID: WI17023-006
Description: DUP-02 | Matrix: Solid
Date Sampled: 09/15/2021 | Project Name: Eielson AFB Soil Washing | % Solids: 99.7 09/18/2021 1903
Date Received: 09/17/2021 | Project Number: 30030317

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch
1	3546	8270E	1	09/21/2021 1238	STM	09/20/2021 1656	15888

Parameter	CAS Number	Analytical Method	Result	Q	LOQ	LOD	DL	Units	Run
Acenaphthene	83-32-9	8270E	2.0	U	2.7	2.0	0.82	ug/kg	1
Acenaphthylene	208-96-8	8270E	2.0	U	2.7	2.0	0.93	ug/kg	1
Anthracene	120-12-7	8270E	0.60	J	2.7	2.0	0.50	ug/kg	1
Benzo(a)anthracene	56-55-3	8270E	1.6	J	2.7	2.0	0.58	ug/kg	1
Benzo(a)pyrene	50-32-8	8270E	1.2	J	2.7	2.0	0.65	ug/kg	1
Benzo(b)fluoranthene	205-99-2	8270E	0.93	J	2.7	2.0	0.49	ug/kg	1
Benzo(g,h,i)perylene	191-24-2	8270E	2.0	U	2.7	2.0	0.64	ug/kg	1
Benzo(k)fluoranthene	207-08-9	8270E	1.0	J	2.7	1.5	0.47	ug/kg	1
Chrysene	218-01-9	8270E	1.5	U	2.7	1.5	0.44	ug/kg	1
Dibenzo(a,h)anthracene	53-70-3	8270E	2.0	U	2.7	2.0	0.50	ug/kg	1
Fluoranthene	206-44-0	8270E	1.1	J	2.7	1.5	0.41	ug/kg	1
Fluorene	86-73-7	8270E	2.0	U	2.7	2.0	0.56	ug/kg	1
Indeno(1,2,3-c,d)pyrene	193-39-5	8270E	2.0	U	2.7	2.0	0.98	ug/kg	1
1-Methylnaphthalene	90-12-0	8270E	2.0	U	2.7	2.0	0.96	ug/kg	1
2-Methylnaphthalene	91-57-6	8270E	2.0	U	2.7	2.0	0.97	ug/kg	1
Naphthalene	91-20-3	8270E	2.0	U	2.7	2.0	0.95	ug/kg	1
Phenanthrene	85-01-8	8270E	2.0	U	2.7	2.0	0.71	ug/kg	1
Pyrene	129-00-0	8270E	1.1	J	2.7	2.0	0.49	ug/kg	1

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
2-Fluorobiphenyl		62	44-115
Nitrobenzene-d5		63	37-122
Terphenyl-d14		68	54-127

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

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PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: WI17023-006
Description: DUP-02 | Matrix: Solid
Date Sampled: 09/15/2021 | Project Name: Eielson AFB Soil Washing | % Solids: 99.7 09/18/2021 1903
Date Received: 09/17/2021 | Project Number: 30030317

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch
1	SOP SPE	PFAS by ID SOP QSM B-15	1	09/20/2021 1513	JJG	09/19/2021 1515	15796
2	SOP SPE	PFAS by ID SOP QSM B-15	1	09/23/2021 1554	NK1	09/22/2021 1232	16138

Parameter	CAS Number	Analytical Method	Result	Q	LOQ	LOD	DL	Units	Run
1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS)	39108-34-4	PFAS by ID SOP	0.70	U	1.4	0.70	0.36	ug/kg	1
1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS)	27619-97-2	PFAS by ID SOP	0.50	U	1.0	0.50	0.26	ug/kg	2
1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS)	757124-72-4	PFAS by ID SOP	0.70	U	1.4	0.70	0.36	ug/kg	1
N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA)	2991-50-6	PFAS by ID SOP	0.70	U	1.4	0.70	0.36	ug/kg	1
N-methylperfluoro-1-octanesulfonamide (MeFOSA)	31506-32-8	PFAS by ID SOP	0.70	U	1.4	0.70	0.36	ug/kg	1
N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA)	2355-31-9	PFAS by ID SOP	0.70	U	1.4	0.70	0.36	ug/kg	1
Perfluoro-1-butanesulfonic acid (PFBS)	375-73-5	PFAS by ID SOP	0.36	U	0.71	0.36	0.14	ug/kg	1
Perfluoro-1-decanesulfonic acid (PFDS)	335-77-3	PFAS by ID SOP	0.36	U	0.71	0.36	0.14	ug/kg	1
Perfluoro-1-heptanesulfonic acid (PFHpS)	375-92-8	PFAS by ID SOP	0.36	U	0.71	0.36	0.14	ug/kg	1
Perfluoro-1-nonanesulfonic acid (PFNS)	68259-12-1	PFAS by ID SOP	0.36	U	0.71	0.36	0.14	ug/kg	1
Perfluoro-1-octanesulfonamide (PFOSA)	754-91-6	PFAS by ID SOP	0.36	U	0.71	0.36	0.14	ug/kg	1
Perfluoro-1-pentanesulfonic acid (PFPeS)	2706-91-4	PFAS by ID SOP	0.36	U	0.71	0.36	0.14	ug/kg	1
Perfluorohexanesulfonic acid (PFHxS)	355-46-4	PFAS by ID SOP	0.34	J	0.71	0.36	0.14	ug/kg	1
Perfluoro-n-butanoic acid (PFBA)	375-22-4	PFAS by ID SOP	0.36	U	0.71	0.36	0.14	ug/kg	1
Perfluoro-n-decanoic acid (PFDA)	335-76-2	PFAS by ID SOP	0.36	U	0.71	0.36	0.14	ug/kg	1
Perfluoro-n-dodecanoic acid (PFDoA)	307-55-1	PFAS by ID SOP	0.36	U	0.71	0.36	0.14	ug/kg	1
Perfluoro-n-heptanoic acid (PFHpA)	375-85-9	PFAS by ID SOP	0.36	U	0.71	0.36	0.14	ug/kg	1
Perfluoro-n-hexanoic acid (PFHxA)	307-24-4	PFAS by ID SOP	0.36	U	0.71	0.36	0.14	ug/kg	1
Perfluoro-n-nonanoic acid (PFNA)	375-95-1	PFAS by ID SOP	0.36	U	0.71	0.36	0.14	ug/kg	1
Perfluoro-n-octanoic acid (PFOA)	335-67-1	PFAS by ID SOP	0.14	J	0.71	0.36	0.14	ug/kg	1
Perfluoro-n-pentanoic acid (PFPeA)	2706-90-3	PFAS by ID SOP	0.36	U	0.71	0.36	0.14	ug/kg	1
Perfluoro-n-tetradecanoic acid (PFTeDA)	376-06-7	PFAS by ID SOP	0.36	U	0.71	0.36	0.14	ug/kg	1
Perfluoro-n-tridecanoic acid (PFTrDA)	72629-94-8	PFAS by ID SOP	0.36	U	0.71	0.36	0.14	ug/kg	1
Perfluoro-n-undecanoic acid (PFUdA)	2058-94-8	PFAS by ID SOP	0.36	U	0.71	0.36	0.14	ug/kg	1
Perfluorooctanesulfonic acid (PFOS)	1763-23-1	PFAS by ID SOP	0.75		0.71	0.36	0.14	ug/kg	1

Surrogate	Run 1 Q	Run 1 % Recovery	Run 1 Acceptance Limits	Run 2 Q	Run 2 % Recovery	Run 2 Acceptance Limits
13C2_4:2FTS		98	50-150		104	50-150
13C2_6:2FTS		85	50-150		107	50-150
13C2_8:2FTS		98	50-150		106	50-150
13C2_PFDoA		91	50-150		98	50-150
13C2_PFTeDA		91	50-150		101	50-150
13C3_PFBS		95	50-150		100	50-150
13C3_PFHxS		96	50-150		105	50-150
13C4_PFBA		91	50-150		101	50-150
13C4_PFHpA		100	50-150		100	50-150
13C5_PFHxA		93	50-150		103	50-150
13C5_PFPeA		93	50-150		95	50-150
13C6_PFDA		91	50-150		101	50-150
13C7_PFUdA		90	50-150		99	50-150
13C8_PFOA		94	50-150		101	50-150
13C8_PFOS		98	50-150		105	50-150
13C8_PFOSA		91	50-150		100	50-150

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

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PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.
Laboratory ID: WI17023-006
Description: DUP-02
Matrix: Solid
Date Sampled: 09/15/2021
Project Name: Eielson AFB Soil Washing
% Solids: 99.7 09/18/2021 1903
Date Received: 09/17/2021
Project Number: 30030317

Surrogate	Q	Run 1 % Recovery	Acceptance Limits	Q	Run 2 % Recovery	Acceptance Limits
13C9_PFNA		92	50-150		110	50-150
d5-EtFOSAA		95	50-150		107	50-150
d-MeFOSA		105	50-150		102	50-150
d3-MeFOSAA		89	50-150		104	50-150

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
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DL = Detection Limit
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SPLP PFAS

Client: Arcadis U.S., Inc. | Laboratory ID: WI17023-006
Description: DUP-02 | Matrix: Solid
Date Sampled: 09/15/2021 | Project Name: Eielson AFB Soil Washing | % Solids: 99.7 09/18/2021 1903
Date Received: 09/17/2021 | Project Number: 30030317

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch	Leachate Date
1	1312/PFAS	PFAS by ID SOP QSM B-15	1	09/30/2021 2156	JJG	09/29/2021 1716	17010	09/21/2021 2318

Parameter	CAS Number	Analytical Method	Result	Q	LOQ	LOD	DL	Units	Run
1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS)	39108-34-4	PFAS by ID SOP	40	U	80	40	20	ng/L	1
1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS)	27619-97-2	PFAS by ID SOP	40	U	80	40	20	ng/L	1
1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS)	757124-72-4	PFAS by ID SOP	40	U	80	40	20	ng/L	1
N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA)	2991-50-6	PFAS by ID SOP	40	U	80	40	20	ng/L	1
N-methylperfluoro-1-octanesulfonamide (MeFOSA)	31506-32-8	PFAS by ID SOP	80	U	160	80	40	ng/L	1
N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA)	2355-31-9	PFAS by ID SOP	40	U	80	40	20	ng/L	1
Perfluoro-1-butanesulfonic acid (PFBS)	375-73-5	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-1-decanesulfonic acid (PFDS)	335-77-3	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-1-heptanesulfonic acid (PFHpS)	375-92-8	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-1-nonanesulfonic acid (PFNS)	68259-12-1	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-1-octanesulfonamide (PFOSA)	754-91-6	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-1-pentanesulfonic acid (PFPeS)	2706-91-4	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluorohexanesulfonic acid (PFHxS)	355-46-4	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-n-butanoic acid (PFBA)	375-22-4	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-n-decanoic acid (PFDA)	335-76-2	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-n-dodecanoic acid (PFDoA)	307-55-1	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-n-heptanoic acid (PFHpA)	375-85-9	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-n-hexanoic acid (PFHxA)	307-24-4	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-n-nonanoic acid (PFNA)	375-95-1	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-n-octanoic acid (PFOA)	335-67-1	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-n-pentanoic acid (PFPeA)	2706-90-3	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-n-tetradecanoic acid (PFTeDA)	376-06-7	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-n-tridecanoic acid (PFTrDA)	72629-94-8	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-n-undecanoic acid (PFUdA)	2058-94-8	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluorooctanesulfonic acid (PFOS)	1763-23-1	PFAS by ID SOP	20	U	40	20	10	ng/L	1

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
13C2_4:2FTS		112	50-150
13C2_6:2FTS		114	50-150
13C2_8:2FTS		96	50-150
13C2_PFDoA		85	50-150
13C2_PFTeDA		86	50-150
13C3_PFBS		97	50-150
13C3_PFHxS		91	50-150
13C4_PFBA		97	50-150
13C4_PFHpA		94	50-150
13C5_PFHxA		98	50-150
13C5_PFPeA		102	50-150
13C6_PFDA		94	50-150
13C7_PFUdA		98	50-150
13C8_PFOA		95	50-150
13C8_PFOS		87	50-150
13C8_PFOSA		109	50-150
13C9_PFNA		94	50-150

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

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SPLP PFAS

Client: Arcadis U.S., Inc.		Laboratory ID: WI17023-006
Description: DUP-02		Matrix: Solid
Date Sampled: 09/15/2021	Project Name: Eielson AFB Soil Washing	% Solids: 99.7 09/18/2021 1903
Date Received: 09/17/2021	Project Number: 30030317	

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
d5-EtFOSAA		99	50-150
d-MeFOSA		90	50-150
d3-MeFOSAA		108	50-150

LOQ = Limit of Quantitation	B = Detected in the method blank	E = Quantitation of compound exceeded the calibration range	DL = Detection Limit	Q = Surrogate failure
U = Not detected at or above the LOQ	N = Recovery is out of criteria	P = The RPD between two GC columns exceeds 40%	J = Estimated result < LOQ and ≥ DL	L = LCS/LCSD failure
H = Out of holding time	W = Reported on wet weight basis	LOD = Limit of Detection		S = MS/MSD failure

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Semivolatile Organic Compounds by GC/MS

Client: Arcadis U.S., Inc. | Laboratory ID: WI17023-007
Description: DUP-03 | Matrix: Aqueous
Date Sampled: 09/15/2021 | Project Name: Eielson AFB Soil Washing
Date Received: 09/17/2021 | Project Number: 30030317

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch
1	3520C	8270E	1	09/22/2021 1718	STM	09/21/2021 1300	16015

Parameter	CAS Number	Analytical Method	Result	Q	LOQ	LOD	DL	Units	Run
Acenaphthene	83-32-9	8270E	0.10	U	0.20	0.10	0.040	ug/L	1
Acenaphthylene	208-96-8	8270E	0.10	U	0.20	0.10	0.040	ug/L	1
Anthracene	120-12-7	8270E	0.10	U	0.20	0.10	0.040	ug/L	1
Benzo(a)anthracene	56-55-3	8270E	0.10	U	0.20	0.10	0.040	ug/L	1
Benzo(a)pyrene	50-32-8	8270E	0.10	U	0.20	0.10	0.040	ug/L	1
Benzo(b)fluoranthene	205-99-2	8270E	0.10	U	0.20	0.10	0.040	ug/L	1
Benzo(g,h,i)perylene	191-24-2	8270E	0.10	U	0.20	0.10	0.040	ug/L	1
Benzo(k)fluoranthene	207-08-9	8270E	0.10	U	0.20	0.10	0.040	ug/L	1
Chrysene	218-01-9	8270E	0.10	UL	0.20	0.10	0.040	ug/L	1
Dibenzo(a,h)anthracene	53-70-3	8270E	0.10	U	0.20	0.10	0.040	ug/L	1
Fluoranthene	206-44-0	8270E	0.10	U	0.20	0.10	0.040	ug/L	1
Fluorene	86-73-7	8270E	0.10	U	0.20	0.10	0.040	ug/L	1
Indeno(1,2,3-c,d)pyrene	193-39-5	8270E	0.10	U	0.20	0.10	0.040	ug/L	1
1-Methylnaphthalene	90-12-0	8270E	0.10	U	0.20	0.10	0.040	ug/L	1
2-Methylnaphthalene	91-57-6	8270E	0.10	U	0.20	0.10	0.040	ug/L	1
Naphthalene	91-20-3	8270E	0.14	J	0.20	0.10	0.040	ug/L	1
Phenanthrene	85-01-8	8270E	0.10	U	0.20	0.10	0.040	ug/L	1
Pyrene	129-00-0	8270E	0.10	U	0.20	0.10	0.040	ug/L	1

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
2-Fluorobiphenyl		87	44-119
Nitrobenzene-d5		86	44-120
Terphenyl-d14		96	50-134

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
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PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: WI17023-007
Description: DUP-03 | Matrix: Aqueous
Date Sampled: 09/15/2021 | Project Name: Eielson AFB Soil Washing
Date Received: 09/17/2021 | Project Number: 30030317

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch
1	SOP SPE	PFAS by ID SOP QSM B-15	1	09/19/2021 2126	JJG	09/17/2021 1758	15718

Parameter	CAS Number	Analytical Method	Result	Q	LOQ	LOD	DL	Units	Run
1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS)	39108-34-4	PFAS by ID SOP	3.9	U	7.7	3.9	1.9	ng/L	1
1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS)	27619-97-2	PFAS by ID SOP	3.9	U	7.7	3.9	1.9	ng/L	1
1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS)	757124-72-4	PFAS by ID SOP	3.9	U	7.7	3.9	1.9	ng/L	1
N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA)	2991-50-6	PFAS by ID SOP	3.9	U	7.7	3.9	1.9	ng/L	1
N-methylperfluoro-1-octanesulfonamide (MeFOSA)	31506-32-8	PFAS by ID SOP	7.5	U	15	7.5	3.9	ng/L	1
N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA)	2355-31-9	PFAS by ID SOP	3.9	U	7.7	3.9	1.9	ng/L	1
Perfluoro-1-butanesulfonic acid (PFBS)	375-73-5	PFAS by ID SOP	2.0	U	3.9	2.0	0.97	ng/L	1
Perfluoro-1-decanesulfonic acid (PFDS)	335-77-3	PFAS by ID SOP	2.0	U	3.9	2.0	0.97	ng/L	1
Perfluoro-1-heptanesulfonic acid (PFHpS)	375-92-8	PFAS by ID SOP	2.0	U	3.9	2.0	0.97	ng/L	1
Perfluoro-1-nonanesulfonic acid (PFNS)	68259-12-1	PFAS by ID SOP	2.0	U	3.9	2.0	0.97	ng/L	1
Perfluoro-1-octanesulfonamide (PFOSA)	754-91-6	PFAS by ID SOP	2.0	U	3.9	2.0	0.97	ng/L	1
Perfluoro-1-pentanesulfonic acid (PFPeS)	2706-91-4	PFAS by ID SOP	2.0	U	3.9	2.0	0.97	ng/L	1
Perfluorohexanesulfonic acid (PFHxS)	355-46-4	PFAS by ID SOP	2.0	U	3.9	2.0	0.97	ng/L	1
Perfluoro-n-butanoic acid (PFBA)	375-22-4	PFAS by ID SOP	2.0	U	3.9	2.0	0.97	ng/L	1
Perfluoro-n-decanoic acid (PFDA)	335-76-2	PFAS by ID SOP	2.0	U	3.9	2.0	0.97	ng/L	1
Perfluoro-n-dodecanoic acid (PFDoA)	307-55-1	PFAS by ID SOP	2.0	U	3.9	2.0	0.97	ng/L	1
Perfluoro-n-heptanoic acid (PFHpA)	375-85-9	PFAS by ID SOP	2.0	U	3.9	2.0	0.97	ng/L	1
Perfluoro-n-hexanoic acid (PFHxA)	307-24-4	PFAS by ID SOP	2.0	U	3.9	2.0	0.97	ng/L	1
Perfluoro-n-nonanoic acid (PFNA)	375-95-1	PFAS by ID SOP	2.0	U	3.9	2.0	0.97	ng/L	1
Perfluoro-n-octanoic acid (PFOA)	335-67-1	PFAS by ID SOP	2.0	U	3.9	2.0	0.97	ng/L	1
Perfluoro-n-pentanoic acid (PFPeA)	2706-90-3	PFAS by ID SOP	2.0	U	3.9	2.0	0.97	ng/L	1
Perfluoro-n-tetradecanoic acid (PFTeDA)	376-06-7	PFAS by ID SOP	2.0	U	3.9	2.0	0.97	ng/L	1
Perfluoro-n-tridecanoic acid (PFTrDA)	72629-94-8	PFAS by ID SOP	2.0	U	3.9	2.0	0.97	ng/L	1
Perfluoro-n-undecanoic acid (PFUdA)	2058-94-8	PFAS by ID SOP	2.0	U	3.9	2.0	0.97	ng/L	1
Perfluorooctanesulfonic acid (PFOS)	1763-23-1	PFAS by ID SOP	2.0	U	3.9	2.0	0.97	ng/L	1

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
13C2_4:2FTS		122	50-150
13C2_6:2FTS		149	50-150
13C2_8:2FTS		114	50-150
13C2_PFDoA		92	50-150
13C2_PFTeDA		101	50-150
13C3_PFBS		104	50-150
13C3_PFHxS		110	50-150
13C4_PFBA		110	50-150
13C4_PFHpA		104	50-150
13C5_PFHxA		117	50-150
13C5_PFPeA		105	50-150
13C6_PFDA		106	50-150
13C7_PFUdA		111	50-150
13C8_PFOA		123	50-150
13C8_PFOS		108	50-150
13C8_PFOSA		115	50-150
13C9_PFNA		109	50-150

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.			Laboratory ID: WI17023-007
Description: DUP-03			Matrix: Aqueous
Date Sampled: 09/15/2021		Project Name: Eielson AFB Soil Washing	
Date Received: 09/17/2021		Project Number: 30030317	

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
d5-EtFOSAA		111	50-150
d-MeFOSA		109	50-150
d3-MeFOSAA		113	50-150

LOQ = Limit of Quantitation	B = Detected in the method blank	E = Quantitation of compound exceeded the calibration range	DL = Detection Limit	Q = Surrogate failure
U = Not detected at or above the LOQ	N = Recovery is out of criteria	P = The RPD between two GC columns exceeds 40%	J = Estimated result < LOQ and ≥ DL	L = LCS/LCSD failure
H = Out of holding time	W = Reported on wet weight basis	LOD = Limit of Detection		S = MS/MSD failure

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QC Summary

Semivolatile Organic Compounds by GC/MS - MB

Sample ID: WQ15888-001
Batch: 15888
Analytical Method: 8270E

Matrix: Solid
Prep Method: 3546
Prep Date: 09/20/2021 1656

Parameter	Result	Q	Dil	LOQ	LOD	DL	Units	Analysis Date
Acenaphthene	2.0	U	1	2.7	2.0	0.83	ug/kg	09/21/2021 1006
Acenaphthylene	2.0	U	1	2.7	2.0	0.95	ug/kg	09/21/2021 1006
Anthracene	2.0	U	1	2.7	2.0	0.51	ug/kg	09/21/2021 1006
Benzo(a)anthracene	2.0	U	1	2.7	2.0	0.59	ug/kg	09/21/2021 1006
Benzo(a)pyrene	2.0	U	1	2.7	2.0	0.66	ug/kg	09/21/2021 1006
Benzo(b)fluoranthene	2.0	U	1	2.7	2.0	0.50	ug/kg	09/21/2021 1006
Benzo(g,h,i)perylene	2.0	U	1	2.7	2.0	0.65	ug/kg	09/21/2021 1006
Benzo(k)fluoranthene	1.5	U	1	2.7	1.5	0.48	ug/kg	09/21/2021 1006
Chrysene	1.5	U	1	2.7	1.5	0.45	ug/kg	09/21/2021 1006
Dibenzo(a,h)anthracene	2.0	U	1	2.7	2.0	0.51	ug/kg	09/21/2021 1006
Fluoranthene	1.5	U	1	2.7	1.5	0.42	ug/kg	09/21/2021 1006
Fluorene	2.0	U	1	2.7	2.0	0.57	ug/kg	09/21/2021 1006
Indeno(1,2,3-c,d)pyrene	2.0	U	1	2.7	2.0	1.0	ug/kg	09/21/2021 1006
1-Methylnaphthalene	2.0	U	1	2.7	2.0	0.98	ug/kg	09/21/2021 1006
2-Methylnaphthalene	2.0	U	1	2.7	2.0	0.99	ug/kg	09/21/2021 1006
Naphthalene	2.0	U	1	2.7	2.0	0.97	ug/kg	09/21/2021 1006
Phenanthrene	2.0	U	1	2.7	2.0	0.72	ug/kg	09/21/2021 1006
Pyrene	2.0	U	1	2.7	2.0	0.50	ug/kg	09/21/2021 1006

Surrogate	Q	% Rec	Acceptance Limit
2-Fluorobiphenyl		69	44-115
Nitrobenzene-d5		67	37-122
Terphenyl-d14		67	54-127

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

Semivolatile Organic Compounds by GC/MS - LCS

Sample ID: WQ15888-002
Batch: 15888
Analytical Method: 8270E

Matrix: Solid
Prep Method: 3546
Prep Date: 09/20/2021 1656

Parameter	Spike Amount (ug/kg)	Result (ug/kg)	Q	Dil	% Rec	%Rec Limit	Analysis Date
Acenaphthene	130	89		1	67	40-123	09/21/2021 1031
Acenaphthylene	130	100		1	78	32-132	09/21/2021 1031
Anthracene	130	110		1	81	47-123	09/21/2021 1031
Benzo(a)anthracene	130	110		1	85	49-126	09/21/2021 1031
Benzo(a)pyrene	130	130		1	94	45-129	09/21/2021 1031
Benzo(b)fluoranthene	130	120		1	90	45-132	09/21/2021 1031
Benzo(g,h,i)perylene	130	130		1	101	43-134	09/21/2021 1031
Benzo(k)fluoranthene	130	120		1	88	47-132	09/21/2021 1031
Chrysene	130	120		1	93	50-124	09/21/2021 1031
Dibenzo(a,h)anthracene	130	130		1	98	45-134	09/21/2021 1031
Fluoranthene	130	110		1	81	50-127	09/21/2021 1031
Fluorene	130	93		1	70	43-125	09/21/2021 1031
Indeno(1,2,3-c,d)pyrene	130	130		1	96	45-133	09/21/2021 1031
1-Methylnaphthalene	130	95		1	72	40-119	09/21/2021 1031
2-Methylnaphthalene	130	99		1	74	38-122	09/21/2021 1031
Naphthalene	130	91		1	68	35-123	09/21/2021 1031
Phenanthrene	130	99		1	74	50-121	09/21/2021 1031
Pyrene	130	110		1	84	47-127	09/21/2021 1031

Surrogate	Q	% Rec	Acceptance Limit
2-Fluorobiphenyl		75	44-115
Nitrobenzene-d5		71	37-122
Terphenyl-d14		82	54-127

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

Semivolatile Organic Compounds by GC/MS - MS

Sample ID: WI17023-001MS
Batch: 15888
Analytical Method: 8270E

Matrix: Solid
Prep Method: 3546
Prep Date: 09/20/2021 1656

Parameter	Sample Amount (ug/kg)	Spike Amount (ug/kg)	Result (ug/kg)	Q	Dil	% Rec	%Rec Limit	Analysis Date
Acenaphthene	54	150	160		10	68	40-123	09/21/2021 1511
Acenaphthylene	38	150	150		10	74	32-132	09/21/2021 1511
Anthracene	130	150	230		10	67	47-123	09/21/2021 1511
Benzo(a)anthracene	500	150	570	N	10	48	49-126	09/21/2021 1511
Benzo(a)pyrene	820	150	610	N	10	-136	45-129	09/21/2021 1511
Benzo(b)fluoranthene	970	150	690	N	10	-185	45-132	09/21/2021 1511
Benzo(g,h,i)perylene	390	150	240	N	10	-98	43-134	09/21/2021 1511
Benzo(k)fluoranthene	420	150	410	N	10	-3.5	47-132	09/21/2021 1511
Chrysene	750	150	740	N	10	-2.4	50-124	09/21/2021 1511
Dibenzo(a,h)anthracene	ND	150	110		10	71	45-134	09/21/2021 1511
Fluoranthene	1300	150	1200	N	10	-67	50-127	09/21/2021 1511
Fluorene	60	150	160		10	65	43-125	09/21/2021 1511
Indeno(1,2,3-c,d)pyrene	380	150	250	N	10	-84	45-133	09/21/2021 1511
1-Methylnaphthalene	27	150	130		10	69	40-119	09/21/2021 1511
2-Methylnaphthalene	33	150	150		10	75	38-122	09/21/2021 1511
Naphthalene	26	150	130		10	67	35-123	09/21/2021 1511
Phenanthrene	650	150	700	N	10	31	50-121	09/21/2021 1511
Pyrene	1000	150	1000	N	10	-11	47-127	09/21/2021 1511

Surrogate	Q	% Rec	Acceptance Limit
2-Fluorobiphenyl		82	44-115
Nitrobenzene-d5		75	37-122
Terphenyl-d14		80	54-127

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

Semivolatile Organic Compounds by GC/MS - MSD

Sample ID: WI17023-001MD
Batch: 15888
Analytical Method: 8270E

Matrix: Solid
Prep Method: 3546
Prep Date: 09/20/2021 1656

Parameter	Sample Amount (ug/kg)	Spike Amount (ug/kg)	Result (ug/kg)	Q	Dil	% Rec	% RPD	%Rec Limit	% RPD Limit	Analysis Date
Acenaphthene	54	150	160		10	70	0.80	40-123	20	09/21/2021 1536
Acenaphthylene	38	150	140		10	66	10	32-132	20	09/21/2021 1536
Anthracene	130	150	280		10	98	18	47-123	20	09/21/2021 1536
Benzo(a)anthracene	500	150	680		10	122	18	49-126	20	09/21/2021 1536
Benzo(a)pyrene	820	150	780	N,+	10	-24	25	45-129	20	09/21/2021 1536
Benzo(b)fluoranthene	970	150	960	N,+	10	-8.6	33	45-132	20	09/21/2021 1536
Benzo(g,h,i)perylene	390	150	260	N	10	-89	6.2	43-134	20	09/21/2021 1536
Benzo(k)fluoranthene	420	150	480	N	10	41	15	47-132	20	09/21/2021 1536
Chrysene	750	150	900		10	101	19	50-124	20	09/21/2021 1536
Dibenzo(a,h)anthracene	ND	150	120		10	80	11	45-134	20	09/21/2021 1536
Fluoranthene	1300	150	1600	N,+	10	164	25	50-127	20	09/21/2021 1536
Fluorene	60	150	170		10	74	7.9	43-125	20	09/21/2021 1536
Indeno(1,2,3-c,d)pyrene	380	150	270	N	10	-74	6.3	45-133	20	09/21/2021 1536
1-Methylnaphthalene	27	150	120		10	64	7.6	40-119	20	09/21/2021 1536
2-Methylnaphthalene	33	150	130		10	67	9.2	38-122	20	09/21/2021 1536
Naphthalene	26	150	120		10	63	5.3	35-123	20	09/21/2021 1536
Phenanthrene	650	150	900	N,+	10	164	25	50-121	20	09/21/2021 1536
Pyrene	1000	150	1300	N,+	10	153	22	47-127	20	09/21/2021 1536

Surrogate	Q	% Rec	Acceptance Limit
2-Fluorobiphenyl		68	44-115
Nitrobenzene-d5		65	37-122
Terphenyl-d14		70	54-127

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

Semivolatile Organic Compounds by GC/MS - MB

Sample ID: WQ16015-001
Batch: 16015
Analytical Method: 8270E

Matrix: Aqueous
Prep Method: 3520C
Prep Date: 09/21/2021 1300

Parameter	Result	Q	Dil	LOQ	LOD	DL	Units	Analysis Date
Acenaphthene	0.10	U	1	0.20	0.10	0.040	ug/L	09/22/2021 1534
Acenaphthylene	0.10	U	1	0.20	0.10	0.040	ug/L	09/22/2021 1534
Anthracene	0.10	U	1	0.20	0.10	0.040	ug/L	09/22/2021 1534
Benzo(a)anthracene	0.10	U	1	0.20	0.10	0.040	ug/L	09/22/2021 1534
Benzo(a)pyrene	0.10	U	1	0.20	0.10	0.040	ug/L	09/22/2021 1534
Benzo(b)fluoranthene	0.10	U	1	0.20	0.10	0.040	ug/L	09/22/2021 1534
Benzo(g,h,i)perylene	0.10	U	1	0.20	0.10	0.040	ug/L	09/22/2021 1534
Benzo(k)fluoranthene	0.10	U	1	0.20	0.10	0.040	ug/L	09/22/2021 1534
Chrysene	0.10	U	1	0.20	0.10	0.040	ug/L	09/22/2021 1534
Dibenzo(a,h)anthracene	0.10	U	1	0.20	0.10	0.040	ug/L	09/22/2021 1534
Fluoranthene	0.10	U	1	0.20	0.10	0.040	ug/L	09/22/2021 1534
Fluorene	0.10	U	1	0.20	0.10	0.040	ug/L	09/22/2021 1534
Indeno(1,2,3-c,d)pyrene	0.10	U	1	0.20	0.10	0.040	ug/L	09/22/2021 1534
1-Methylnaphthalene	0.10	U	1	0.20	0.10	0.040	ug/L	09/22/2021 1534
2-Methylnaphthalene	0.10	U	1	0.20	0.10	0.040	ug/L	09/22/2021 1534
Naphthalene	0.10	U	1	0.20	0.10	0.040	ug/L	09/22/2021 1534
Phenanthrene	0.10	U	1	0.20	0.10	0.040	ug/L	09/22/2021 1534
Pyrene	0.10	U	1	0.20	0.10	0.040	ug/L	09/22/2021 1534

Surrogate	Q	% Rec	Acceptance Limit
2-Fluorobiphenyl		107	44-119
Nitrobenzene-d5		110	44-120
Terphenyl-d14		107	50-134

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

Semivolatile Organic Compounds by GC/MS - LCS

Sample ID: WQ16015-002
Batch: 16015
Analytical Method: 8270E

Matrix: Aqueous
Prep Method: 3520C
Prep Date: 09/21/2021 1300

Parameter	Spike Amount (ug/L)	Result (ug/L)	Q	Dil	% Rec	%Rec Limit	Analysis Date
Acenaphthene	8.0	8.2		1	102	47-122	09/22/2021 1600
Acenaphthylene	8.0	9.5		1	119	41-130	09/22/2021 1600
Anthracene	8.0	8.8		1	109	57-123	09/22/2021 1600
Benzo(a)anthracene	8.0	9.7		1	121	58-125	09/22/2021 1600
Benzo(a)pyrene	8.0	9.6		1	120	54-128	09/22/2021 1600
Benzo(b)fluoranthene	8.0	9.4		1	117	53-131	09/22/2021 1600
Benzo(g,h,i)perylene	8.0	9.8		1	123	50-134	09/22/2021 1600
Benzo(k)fluoranthene	8.0	10		1	128	57-129	09/22/2021 1600
Chrysene	8.0	10	N	1	131	59-123	09/22/2021 1600
Dibenzo(a,h)anthracene	8.0	10		1	127	51-134	09/22/2021 1600
Fluoranthene	8.0	8.9		1	111	57-128	09/22/2021 1600
Fluorene	8.0	8.4		1	105	52-124	09/22/2021 1600
Indeno(1,2,3-c,d)pyrene	8.0	9.9		1	123	52-134	09/22/2021 1600
1-Methylnaphthalene	8.0	9.1		1	114	41-119	09/22/2021 1600
2-Methylnaphthalene	8.0	9.6		1	120	40-121	09/22/2021 1600
Naphthalene	8.0	9.2		1	115	40-121	09/22/2021 1600
Phenanthrene	8.0	8.2		1	103	59-120	09/22/2021 1600
Pyrene	8.0	9.4		1	118	57-126	09/22/2021 1600

Surrogate	Q	% Rec	Acceptance Limit
2-Fluorobiphenyl		110	44-119
Nitrobenzene-d5	N	133	44-120
Terphenyl-d14		109	50-134

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

Semivolatile Organic Compounds by GC/MS - MS

Sample ID: WI17023-004MS
Batch: 16015
Analytical Method: 8270E

Matrix: Aqueous
Prep Method: 3520C
Prep Date: 09/21/2021 1300

Parameter	Sample Amount (ug/L)	Spike Amount (ug/L)	Result (ug/L)	Q	Dil	% Rec	%Rec Limit	Analysis Date
Acenaphthene	ND	16	14		1	86	47-122	09/22/2021 2225
Acenaphthylene	ND	16	16		1	98	41-130	09/22/2021 2225
Anthracene	ND	16	15		1	91	57-123	09/22/2021 2225
Benzo(a)anthracene	ND	16	16		1	98	58-125	09/22/2021 2225
Benzo(a)pyrene	ND	16	12		1	78	54-128	09/22/2021 2225
Benzo(b)fluoranthene	ND	16	12		1	78	53-131	09/22/2021 2225
Benzo(g,h,i)perylene	ND	16	9.7		1	61	50-134	09/22/2021 2225
Benzo(k)fluoranthene	ND	16	12		1	73	57-129	09/22/2021 2225
Chrysene	ND	16	16		1	103	59-123	09/22/2021 2225
Dibenzo(a,h)anthracene	ND	16	10		1	64	51-134	09/22/2021 2225
Fluoranthene	ND	16	14		1	91	57-128	09/22/2021 2225
Fluorene	ND	16	14		1	88	52-124	09/22/2021 2225
Indeno(1,2,3-c,d)pyrene	ND	16	10		1	64	52-134	09/22/2021 2225
1-Methylnaphthalene	ND	16	15		1	93	41-119	09/22/2021 2225
2-Methylnaphthalene	ND	16	15		1	97	40-121	09/22/2021 2225
Naphthalene	0.072	16	14		1	90	40-121	09/22/2021 2225
Phenanthrene	ND	16	13		1	84	59-120	09/22/2021 2225
Pyrene	ND	16	15		1	95	57-126	09/22/2021 2225

Surrogate	Q	% Rec	Acceptance Limit
2-Fluorobiphenyl		90	44-119
Nitrobenzene-d5		102	44-120
Terphenyl-d14		91	50-134

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

Semivolatile Organic Compounds by GC/MS - MSD

Sample ID: WI17023-004MD
Batch: 16015
Analytical Method: 8270E

Matrix: Aqueous
Prep Method: 3520C
Prep Date: 09/21/2021 1300

Parameter	Sample Amount (ug/L)	Spike Amount (ug/L)	Result (ug/L)	Q	Dil	% Rec	% RPD	%Rec Limit	% RPD Limit	Analysis Date
Acenaphthene	ND	16	12		1	77	11	47-122	20	09/22/2021 2251
Acenaphthylene	ND	16	14		1	89	10	41-130	20	09/22/2021 2251
Anthracene	ND	16	14		1	87	4.9	57-123	20	09/22/2021 2251
Benzo(a)anthracene	ND	16	15		1	94	4.0	58-125	20	09/22/2021 2251
Benzo(a)pyrene	ND	16	15		1	95	20	54-128	20	09/22/2021 2251
Benzo(b)fluoranthene	ND	16	16	+	1	99	24	53-131	20	09/22/2021 2251
Benzo(g,h,i)perylene	ND	16	13	+	1	82	29	50-134	20	09/22/2021 2251
Benzo(k)fluoranthene	ND	16	15	+	1	92	23	57-129	20	09/22/2021 2251
Chrysene	ND	16	16		1	99	4.0	59-123	20	09/22/2021 2251
Dibenzo(a,h)anthracene	ND	16	14	+	1	87	31	51-134	20	09/22/2021 2251
Fluoranthene	ND	16	14		1	90	0.76	57-128	20	09/22/2021 2251
Fluorene	ND	16	13		1	80	9.5	52-124	20	09/22/2021 2251
Indeno(1,2,3-c,d)pyrene	ND	16	15	+	1	96	40	52-134	20	09/22/2021 2251
1-Methylnaphthalene	ND	16	13		1	81	14	41-119	20	09/22/2021 2251
2-Methylnaphthalene	ND	16	14		1	85	13	40-121	20	09/22/2021 2251
Naphthalene	0.072	16	13		1	78	14	40-121	20	09/22/2021 2251
Phenanthrene	ND	16	13		1	80	5.0	59-120	20	09/22/2021 2251
Pyrene	ND	16	14		1	90	5.1	57-126	20	09/22/2021 2251

Surrogate	Q	% Rec	Acceptance Limit
2-Fluorobiphenyl		80	44-119
Nitrobenzene-d5		90	44-120
Terphenyl-d14		88	50-134

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

PFAS by LC/MS/MS - MB

Sample ID: WQ15718-001
Batch: 15718
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Aqueous
Prep Method: SOP SPE
Prep Date: 09/17/2021 1758

Parameter	Result	Q	Dil	LOQ	LOD	DL	Units	Analysis Date
8:2 FTS	4.0	U	1	8.0	4.0	2.0	ng/L	09/19/2021 1701
6:2 FTS	4.0	U	1	8.0	4.0	2.0	ng/L	09/19/2021 1701
4:2 FTS	4.0	U	1	8.0	4.0	2.0	ng/L	09/19/2021 1701
EtFOSAA	4.0	U	1	8.0	4.0	2.0	ng/L	09/19/2021 1701
MeFOSA	8.0	U	1	16	8.0	4.0	ng/L	09/19/2021 1701
MeFOSAA	4.0	U	1	8.0	4.0	2.0	ng/L	09/19/2021 1701
PFBS	2.0	U	1	4.0	2.0	1.0	ng/L	09/19/2021 1701
PFDS	2.0	U	1	4.0	2.0	1.0	ng/L	09/19/2021 1701
PFHpS	2.0	U	1	4.0	2.0	1.0	ng/L	09/19/2021 1701
PFNS	2.0	U	1	4.0	2.0	1.0	ng/L	09/19/2021 1701
PFOSA	2.0	U	1	4.0	2.0	1.0	ng/L	09/19/2021 1701
PFPeS	2.0	U	1	4.0	2.0	1.0	ng/L	09/19/2021 1701
PFHxS	2.0	U	1	4.0	2.0	1.0	ng/L	09/19/2021 1701
PFBA	2.0	U	1	4.0	2.0	1.0	ng/L	09/19/2021 1701
PFDA	2.0	U	1	4.0	2.0	1.0	ng/L	09/19/2021 1701
PFDoA	2.0	U	1	4.0	2.0	1.0	ng/L	09/19/2021 1701
PFHpA	2.0	U	1	4.0	2.0	1.0	ng/L	09/19/2021 1701
PFHxA	2.0	U	1	4.0	2.0	1.0	ng/L	09/19/2021 1701
PFNA	2.0	U	1	4.0	2.0	1.0	ng/L	09/19/2021 1701
PFOA	2.0	U	1	4.0	2.0	1.0	ng/L	09/19/2021 1701
PFPeA	2.0	U	1	4.0	2.0	1.0	ng/L	09/19/2021 1701
PFTeDA	2.0	U	1	4.0	2.0	1.0	ng/L	09/19/2021 1701
PFTrDA	2.0	U	1	4.0	2.0	1.0	ng/L	09/19/2021 1701
PFUdA	2.0	U	1	4.0	2.0	1.0	ng/L	09/19/2021 1701
PFOS	2.0	U	1	4.0	2.0	1.0	ng/L	09/19/2021 1701

Surrogate	Q	% Rec	Acceptance Limit
13C2_4:2FTS		107	50-150
13C2_6:2FTS		105	50-150
13C2_8:2FTS		98	50-150
13C2_PFDoA		99	50-150
13C2_PFTeDA		95	50-150
13C3_PFBS		102	50-150
13C3_PFHxS		106	50-150
13C4_PFBA		105	50-150
13C4_PFHpA		95	50-150
13C5_PFHxA		104	50-150
13C5_PFPeA		105	50-150
13C6_PFDA		98	50-150
13C7_PFUdA		113	50-150
13C8_PFOA		108	50-150

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

PFAS by LC/MS/MS - MB

Sample ID: WQ15718-001
Batch: 15718
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Aqueous
Prep Method: SOP SPE
Prep Date: 09/17/2021 1758

Surrogate	Q	% Rec	Acceptance Limit
13C8_PFOS		105	50-150
13C8_PFOSA		101	50-150
13C9_PFNA		112	50-150
d5-EtFOSAA		108	50-150
d-MeFOSA		93	50-150
d3-MeFOSAA		103	50-150

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

PFAS by LC/MS/MS - LCS

Sample ID: WQ15718-002
Batch: 15718
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Aqueous
Prep Method: SOP SPE
Prep Date: 09/17/2021 1758

Parameter	Spike Amount (ng/L)	Result (ng/L)	Q	Dil	% Rec	%Rec Limit	Analysis Date
8:2 FTS	15	14		1	89	67-138	09/19/2021 1711
6:2 FTS	15	11		1	72	64-140	09/19/2021 1711
4:2 FTS	15	14		1	93	63-143	09/19/2021 1711
EtFOSAA	16	15		1	92	61-135	09/19/2021 1711
MeFOSA	16	16		1	103	68-141	09/19/2021 1711
MeFOSAA	16	16		1	103	65-136	09/19/2021 1711
PFBS	14	13		1	91	72-130	09/19/2021 1711
PFDS	15	14		1	92	53-142	09/19/2021 1711
PFHpS	15	14		1	92	69-134	09/19/2021 1711
PFNS	15	13		1	84	69-127	09/19/2021 1711
PFOSA	16	15		1	92	67-137	09/19/2021 1711
PFPeS	15	13		1	84	71-127	09/19/2021 1711
PFHxS	15	13		1	91	68-131	09/19/2021 1711
PFBA	16	15		1	94	73-129	09/19/2021 1711
PFDA	16	15		1	91	71-129	09/19/2021 1711
PFDoA	16	15		1	94	72-134	09/19/2021 1711
PFHpA	16	16		1	98	72-130	09/19/2021 1711
PFHxA	16	14		1	90	72-129	09/19/2021 1711
PFNA	16	15		1	93	69-130	09/19/2021 1711
PFOA	16	15		1	93	71-133	09/19/2021 1711
PFPeA	16	16		1	97	72-129	09/19/2021 1711
PFTeDA	16	16		1	99	71-132	09/19/2021 1711
PFTrDA	16	14		1	90	65-144	09/19/2021 1711
PFUdA	16	15		1	96	69-133	09/19/2021 1711
PFOS	15	14		1	93	65-140	09/19/2021 1711

Surrogate	Q	% Rec	Acceptance Limit
13C2_4:2FTS		120	50-150
13C2_6:2FTS		119	50-150
13C2_8:2FTS		109	50-150
13C2_PFDoA		103	50-150
13C2_PFTeDA		100	50-150
13C3_PFBS		110	50-150
13C3_PFHxS		116	50-150
13C4_PFBA		113	50-150
13C4_PFHpA		109	50-150
13C5_PFHxA		117	50-150
13C5_PFPeA		110	50-150
13C6_PFDA		108	50-150
13C7_PFUdA		122	50-150
13C8_PFOA		113	50-150

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

PFAS by LC/MS/MS - LCS

Sample ID: WQ15718-002
Batch: 15718
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Aqueous
Prep Method: SOP SPE
Prep Date: 09/17/2021 1758

Surrogate	Q	% Rec	Acceptance Limit
13C8_PFOS		110	50-150
13C8_PFOSA		113	50-150
13C9_PFNA		122	50-150
d5-EtFOSAA		115	50-150
d-MeFOSA		100	50-150
d3-MeFOSAA		108	50-150

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

PFAS by LC/MS/MS - LCSD

Sample ID: WQ15718-003
Batch: 15718
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Aqueous
Prep Method: SOP SPE
Prep Date: 09/17/2021 1758

Parameter	Spike Amount (ng/L)	Result (ng/L)	Q	Dil	% Rec	% RPD	%Rec Limit	% RPD Limit	Analysis Date
8:2 FTS	15	13		1	84	5.4	67-138	30	09/19/2021 1722
6:2 FTS	15	14		1	96	29	64-140	30	09/19/2021 1722
4:2 FTS	15	13		1	90	3.4	63-143	30	09/19/2021 1722
EtFOSAA	16	15		1	95	3.0	61-135	30	09/19/2021 1722
MeFOSA	16	13		1	83	21	68-141	30	09/19/2021 1722
MeFOSAA	16	14		1	89	14	65-136	30	09/19/2021 1722
PFBS	14	12		1	88	3.1	72-130	30	09/19/2021 1722
PFDS	15	12		1	80	14	53-142	30	09/19/2021 1722
PFHpS	15	15		1	95	3.4	69-134	30	09/19/2021 1722
PFNS	15	14		1	89	6.8	69-127	30	09/19/2021 1722
PFOSA	16	15		1	92	0.0061	67-137	30	09/19/2021 1722
PFPeS	15	14		1	91	7.2	71-127	30	09/19/2021 1722
PFHxS	15	14		1	97	6.2	68-131	30	09/19/2021 1722
PFBA	16	15		1	93	1.2	73-129	30	09/19/2021 1722
PFDA	16	15		1	96	5.1	71-129	30	09/19/2021 1722
PFDoA	16	16		1	98	4.1	72-134	30	09/19/2021 1722
PFHpA	16	15		1	92	6.4	72-130	30	09/19/2021 1722
PFHxA	16	16		1	101	11	72-129	30	09/19/2021 1722
PFNA	16	15		1	97	4.4	69-130	30	09/19/2021 1722
PFOA	16	15		1	92	0.46	71-133	30	09/19/2021 1722
PFPeA	16	15		1	94	3.4	72-129	30	09/19/2021 1722
PFTeDA	16	16		1	97	1.7	71-132	30	09/19/2021 1722
PFTrDA	16	15		1	94	4.2	65-144	30	09/19/2021 1722
PFUdA	16	15		1	94	2.1	69-133	30	09/19/2021 1722
PFOS	15	12		1	83	11	65-140	30	09/19/2021 1722

Surrogate	Q	% Rec	Acceptance Limit
13C2_4:2FTS		110	50-150
13C2_6:2FTS		113	50-150
13C2_8:2FTS		108	50-150
13C2_PFDoA		99	50-150
13C2_PFTeDA		101	50-150
13C3_PFBS		110	50-150
13C3_PFHxS		104	50-150
13C4_PFBA		110	50-150
13C4_PFHpA		106	50-150
13C5_PFHxA		112	50-150
13C5_PFPeA		108	50-150
13C6_PFDA		106	50-150
13C7_PFUdA		118	50-150
13C8_PFOA		112	50-150

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

PFAS by LC/MS/MS - LCSD

Sample ID: WQ15718-003
Batch: 15718
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Aqueous
Prep Method: SOP SPE
Prep Date: 09/17/2021 1758

Surrogate	Q	% Rec	Acceptance Limit
13C8_PFOS		106	50-150
13C8_PFOSA		108	50-150
13C9_PFNA		113	50-150
d5-EtFOSAA		108	50-150
d-MeFOSA		65	50-150
d3-MeFOSAA		105	50-150

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

PFAS by LC/MS/MS - MB

Sample ID: WQ15796-001
Batch: 15796
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Solid
Prep Method: SOP SPE
Prep Date: 09/19/2021 1515

Parameter	Result	Q	Dil	LOQ	LOD	DL	Units	Analysis Date
8:2 FTS	1.0	U	1	2.0	1.0	0.50	ug/kg	09/20/2021 1358
4:2 FTS	1.0	U	1	2.0	1.0	0.50	ug/kg	09/20/2021 1358
EtFOSAA	1.0	U	1	2.0	1.0	0.50	ug/kg	09/20/2021 1358
MeFOSA	1.0	U	1	2.0	1.0	0.50	ug/kg	09/20/2021 1358
MeFOSAA	1.0	U	1	2.0	1.0	0.50	ug/kg	09/20/2021 1358
PFBS	0.50	U	1	1.0	0.50	0.20	ug/kg	09/20/2021 1358
PFDS	0.50	U	1	1.0	0.50	0.20	ug/kg	09/20/2021 1358
PFHpS	0.50	U	1	1.0	0.50	0.20	ug/kg	09/20/2021 1358
PFNS	0.50	U	1	1.0	0.50	0.20	ug/kg	09/20/2021 1358
PFOSA	0.50	U	1	1.0	0.50	0.20	ug/kg	09/20/2021 1358
PFPeS	0.50	U	1	1.0	0.50	0.20	ug/kg	09/20/2021 1358
PFHxS	0.50	U	1	1.0	0.50	0.20	ug/kg	09/20/2021 1358
PFBA	0.50	U	1	1.0	0.50	0.20	ug/kg	09/20/2021 1358
PFDA	0.50	U	1	1.0	0.50	0.20	ug/kg	09/20/2021 1358
PFDoA	0.50	U	1	1.0	0.50	0.20	ug/kg	09/20/2021 1358
PFHpA	0.50	U	1	1.0	0.50	0.20	ug/kg	09/20/2021 1358
PFHxA	0.50	U	1	1.0	0.50	0.20	ug/kg	09/20/2021 1358
PFNA	0.50	U	1	1.0	0.50	0.20	ug/kg	09/20/2021 1358
PFOA	0.50	U	1	1.0	0.50	0.20	ug/kg	09/20/2021 1358
PFPeA	0.50	U	1	1.0	0.50	0.20	ug/kg	09/20/2021 1358
PFTeDA	0.50	U	1	1.0	0.50	0.20	ug/kg	09/20/2021 1358
PFTrDA	0.50	U	1	1.0	0.50	0.20	ug/kg	09/20/2021 1358
PFUdA	0.50	U	1	1.0	0.50	0.20	ug/kg	09/20/2021 1358
PFOS	0.50	U	1	1.0	0.50	0.20	ug/kg	09/20/2021 1358

Surrogate	Q	% Rec	Acceptance Limit
13C2_4:2FTS		91	50-150
13C2_6:2FTS		95	50-150
13C2_8:2FTS		96	50-150
13C2_PFDoA		95	50-150
13C2_PFTeDA		96	50-150
13C3_PFBS		91	50-150
13C3_PFHxS		100	50-150
13C4_PFBA		95	50-150
13C4_PFHpA		97	50-150
13C5_PFHxA		94	50-150
13C5_PFPeA		94	50-150
13C6_PFDA		99	50-150
13C7_PFUdA		104	50-150
13C8_PFOA		97	50-150
13C8_PFOS		99	50-150

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

PFAS by LC/MS/MS - MB

Sample ID: WQ15796-001
Batch: 15796
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Solid
Prep Method: SOP SPE
Prep Date: 09/19/2021 1515

Surrogate	Q	% Rec	Acceptance Limit
13C8_PFOSA		92	50-150
13C9_PFNA		98	50-150
d5-EtFOSAA		103	50-150
d-MeFOSA		100	50-150
d3-MeFOSAA		104	50-150

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

PFAS by LC/MS/MS - LCS

Sample ID: WQ15796-002
Batch: 15796
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Solid
Prep Method: SOP SPE
Prep Date: 09/19/2021 1515

Parameter	Spike Amount (ug/kg)	Result (ug/kg)	Q	Dil	% Rec	%Rec Limit	Analysis Date
8:2 FTS	1.9	1.7		1	90	65-137	09/20/2021 1409
4:2 FTS	1.9	1.9		1	104	62-145	09/20/2021 1409
EtFOSAA	2.0	1.4		1	70	61-139	09/20/2021 1409
MeFOSA	2.0	1.7		1	84	70-150	09/20/2021 1409
MeFOSAA	2.0	1.9		1	93	63-144	09/20/2021 1409
PFBS	1.8	1.5		1	83	72-128	09/20/2021 1409
PFDS	1.9	2.0		1	102	59-134	09/20/2021 1409
PFHpS	1.9	1.6		1	86	70-132	09/20/2021 1409
PFNS	1.9	1.7		1	87	69-125	09/20/2021 1409
PFOSA	2.0	2.0		1	100	67-137	09/20/2021 1409
PFPeS	1.9	1.6		1	86	73-123	09/20/2021 1409
PFHxS	1.8	1.9		1	104	67-130	09/20/2021 1409
PFBA	2.0	1.8		1	91	71-135	09/20/2021 1409
PFDA	2.0	2.0		1	98	69-133	09/20/2021 1409
PFDoA	2.0	2.0		1	101	69-135	09/20/2021 1409
PFHpA	2.0	1.9		1	93	71-131	09/20/2021 1409
PFHxA	2.0	1.8		1	92	70-132	09/20/2021 1409
PFNA	2.0	1.8		1	90	72-129	09/20/2021 1409
PFOA	2.0	1.8		1	89	69-133	09/20/2021 1409
PFPeA	2.0	1.8		1	91	69-132	09/20/2021 1409
PFTeDA	2.0	1.8		1	92	69-133	09/20/2021 1409
PFTrDA	2.0	1.9		1	94	66-139	09/20/2021 1409
PFUdA	2.0	1.9		1	94	64-136	09/20/2021 1409
PFOS	1.9	1.5		1	79	68-136	09/20/2021 1409

Surrogate	Q	% Rec	Acceptance Limit
13C2_4:2FTS		92	50-150
13C2_6:2FTS		89	50-150
13C2_8:2FTS		91	50-150
13C2_PFDoA		88	50-150
13C2_PFTeDA		92	50-150
13C3_PFBS		91	50-150
13C3_PFHxS		96	50-150
13C4_PFBA		91	50-150
13C4_PFHpA		91	50-150
13C5_PFHxA		94	50-150
13C5_PFPeA		92	50-150
13C6_PFDA		88	50-150
13C7_PFUdA		84	50-150
13C8_PFOA		91	50-150
13C8_PFOS		92	50-150

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

PFAS by LC/MS/MS - LCS

Sample ID: WQ15796-002
Batch: 15796
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Solid
Prep Method: SOP SPE
Prep Date: 09/19/2021 1515

Surrogate	Q	% Rec	Acceptance Limit
13C8_PFOSA		88	50-150
13C9_PFNA		95	50-150
d5-EtFOSAA		97	50-150
d-MeFOSA		92	50-150
d3-MeFOSAA		95	50-150

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

PFAS by LC/MS/MS - MS

Sample ID: WI17023-002MS
Batch: 15796
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Solid
Prep Method: SOP SPE
Prep Date: 09/19/2021 1515

Parameter	Sample Amount (ug/kg)	Spike Amount (ug/kg)	Result (ug/kg)	Q	Dil	% Rec	%Rec Limit	Analysis Date
8:2 FTS	ND	1.9	2.3		1	118	65-137	09/20/2021 1441
4:2 FTS	ND	1.9	1.8		1	98	62-145	09/20/2021 1441
EtFOSAA	ND	2.0	2.0		1	100	61-139	09/20/2021 1441
MeFOSA	ND	2.0	2.6		1	130	70-150	09/20/2021 1441
MeFOSAA	ND	2.0	1.9		1	93	63-144	09/20/2021 1441
PFBS	ND	1.8	1.8		1	98	72-128	09/20/2021 1441
PFDS	ND	1.9	1.8		1	94	59-134	09/20/2021 1441
PFHpS	ND	1.9	1.9		1	101	70-132	09/20/2021 1441
PFNS	ND	1.9	2.0		1	102	69-125	09/20/2021 1441
PFOSA	ND	2.0	2.0		1	98	67-137	09/20/2021 1441
PFPeS	ND	1.9	2.0		1	104	73-123	09/20/2021 1441
PFHxS	0.40	1.8	2.3		1	101	67-130	09/20/2021 1441
PFBA	ND	2.0	2.1		1	102	71-135	09/20/2021 1441
PFDA	ND	2.0	2.2		1	109	69-133	09/20/2021 1441
PFDoA	ND	2.0	2.1		1	104	69-135	09/20/2021 1441
PFHpA	ND	2.0	2.1		1	103	71-131	09/20/2021 1441
PFHxA	ND	2.0	2.2		1	110	70-132	09/20/2021 1441
PFNA	ND	2.0	2.2		1	109	72-129	09/20/2021 1441
PFOA	ND	2.0	2.0		1	97	69-133	09/20/2021 1441
PFPeA	ND	2.0	2.1		1	104	69-132	09/20/2021 1441
PFTeDA	ND	2.0	2.1		1	103	69-133	09/20/2021 1441
PFTrDA	ND	2.0	2.3		1	112	66-139	09/20/2021 1441
PFUdA	ND	2.0	2.2		1	110	64-136	09/20/2021 1441
PFOS	0.80	1.9	2.4		1	84	68-136	09/20/2021 1441

Surrogate	Q	% Rec	Acceptance Limit
13C2_4:2FTS		85	50-150
13C2_6:2FTS		84	50-150
13C2_8:2FTS		87	50-150
13C2_PFDoA		82	50-150
13C2_PFTeDA		86	50-150
13C3_PFBS		81	50-150
13C3_PFHxS		85	50-150
13C4_PFBA		82	50-150
13C4_PFHpA		86	50-150
13C5_PFHxA		82	50-150
13C5_PFPeA		81	50-150
13C6_PFDA		79	50-150
13C7_PFUdA		83	50-150
13C8_PFOA		85	50-150
13C8_PFOS		85	50-150

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

PFAS by LC/MS/MS - MS

Sample ID: WI17023-002MS
Batch: 15796
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Solid
Prep Method: SOP SPE
Prep Date: 09/19/2021 1515

Surrogate	Q	% Rec	Acceptance Limit
13C8_PFOSA		81	50-150
13C9_PFNA		84	50-150
d5-EtFOSAA		91	50-150
d-MeFOSA		92	50-150
d3-MeFOSAA		90	50-150

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

PFAS by LC/MS/MS - MSD

Sample ID: WI17023-002MD
Batch: 15796
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Solid
Prep Method: SOP SPE
Prep Date: 09/19/2021 1515

Parameter	Sample Amount (ug/kg)	Spike Amount (ug/kg)	Result (ug/kg)	Q	Dil	% Rec	% RPD	%Rec Limit	% RPD Limit	Analysis Date
8:2 FTS	ND	2.0	1.7		1	84	28	65-137	30	09/20/2021 1451
4:2 FTS	ND	2.0	1.8		1	92	1.1	62-145	30	09/20/2021 1451
EtFOSAA	ND	2.1	1.9		1	92	4.3	61-139	30	09/20/2021 1451
MeFOSA	ND	2.1	2.3		1	108	14	70-150	30	09/20/2021 1451
MeFOSAA	ND	2.1	2.1		1	98	9.8	63-144	30	09/20/2021 1451
PFBS	ND	1.9	1.8		1	96	2.5	72-128	30	09/20/2021 1451
PFDS	ND	2.0	1.7		1	85	5.8	59-134	30	09/20/2021 1451
PFHpS	ND	2.0	1.8		1	87	9.6	70-132	30	09/20/2021 1451
PFNS	ND	2.0	1.6		1	79	21	69-125	30	09/20/2021 1451
PFOSA	ND	2.1	2.2		1	102	9.1	67-137	30	09/20/2021 1451
PFPeS	ND	2.0	1.9		1	96	3.2	73-123	30	09/20/2021 1451
PFHxS	0.40	1.9	1.9		1	76	19	67-130	30	09/20/2021 1451
PFBA	ND	2.1	2.1		1	100	3.1	71-135	30	09/20/2021 1451
PFDA	ND	2.1	2.0		1	96	7.4	69-133	30	09/20/2021 1451
PFDoA	ND	2.1	2.1		1	99	0.23	69-135	30	09/20/2021 1451
PFHpA	ND	2.1	2.0		1	96	2.0	71-131	30	09/20/2021 1451
PFHxA	ND	2.1	2.1		1	97	7.5	70-132	30	09/20/2021 1451
PFNA	ND	2.1	2.0		1	96	7.2	72-129	30	09/20/2021 1451
PFOA	ND	2.1	2.0		1	96	3.8	69-133	30	09/20/2021 1451
PFPeA	ND	2.1	2.1		1	100	1.2	69-132	30	09/20/2021 1451
PFTeDA	ND	2.1	2.1		1	101	2.9	69-133	30	09/20/2021 1451
PFTrDA	ND	2.1	2.0		1	96	9.9	66-139	30	09/20/2021 1451
PFUdA	ND	2.1	2.0		1	96	8.4	64-136	30	09/20/2021 1451
PFOS	0.80	2.0	2.3		1	78	1.3	68-136	30	09/20/2021 1451

Surrogate	Q	% Rec	Acceptance Limit
13C2_4:2FTS		85	50-150
13C2_6:2FTS		84	50-150
13C2_8:2FTS		86	50-150
13C2_PFDoA		85	50-150
13C2_PFTeDA		84	50-150
13C3_PFBS		83	50-150
13C3_PFHxS		95	50-150
13C4_PFBA		86	50-150
13C4_PFHpA		86	50-150
13C5_PFHxA		87	50-150
13C5_PFPeA		83	50-150
13C6_PFDA		86	50-150
13C7_PFUdA		90	50-150
13C8_PFOA		88	50-150
13C8_PFOS		90	50-150

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

Sample ID: WI17023-002MD
Batch: 15796
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Solid
Prep Method: SOP SPE
Prep Date: 09/19/2021 1515

Surrogate	Q	% Rec	Acceptance Limit
13C8_PFOSA		84	50-150
13C9_PFNA		84	50-150
d5-EtFOSAA		92	50-150
d-MeFOSA		93	50-150
d3-MeFOSAA		88	50-150

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

PFAS by LC/MS/MS - MB

Sample ID: WQ16138-001
Batch: 16138
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Solid
Prep Method: SOP SPE
Prep Date: 09/22/2021 1232

Parameter	Result	Q	Dil	LOQ	LOD	DL	Units	Analysis Date
6:2 FTS	1.0	U	1	2.0	1.0	0.50	ug/kg	09/23/2021 1451

Surrogate	Q	% Rec	Acceptance Limit
13C2_4:2FTS		124	50-150
13C2_6:2FTS		145	50-150
13C2_8:2FTS	N	210	50-150
13C2_PFDoA		105	50-150
13C2_PFTeDA		112	50-150
13C3_PFBS		106	50-150
13C3_PFHxS		104	50-150
13C4_PFBA		108	50-150
13C4_PFHpA		102	50-150
13C5_PFHxA		111	50-150
13C5_PFPeA		102	50-150
13C6_PFDA		117	50-150
13C7_PFUdA		111	50-150
13C8_PFOA		114	50-150
13C8_PFOS		109	50-150
13C8_PFOSA		105	50-150
13C9_PFNA		115	50-150
d5-EtFOSAA		108	50-150
d-MeFOSA		100	50-150
d3-MeFOSAA		99	50-150

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

PFAS by LC/MS/MS - LCS

Sample ID: WQ16138-002
Batch: 16138
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Solid
Prep Method: SOP SPE
Prep Date: 09/22/2021 1232

Parameter	Spike Amount (ug/kg)	Result (ug/kg)	Q	Dil	% Rec	%Rec Limit	Analysis Date
6:2 FTS	1.9	1.4		1	72	64-140	09/23/2021 1503

Surrogate	Q	% Rec	Acceptance Limit
13C2_4:2FTS		105	50-150
13C2_6:2FTS		103	50-150
13C2_8:2FTS		105	50-150
13C2_PFDoA		99	50-150
13C2_PFTeDA		103	50-150
13C3_PFBS		103	50-150
13C3_PFHxS		101	50-150
13C4_PFBA		101	50-150
13C4_PFHpA		97	50-150
13C5_PFHxA		106	50-150
13C5_PFPeA		98	50-150
13C6_PFDA		103	50-150
13C7_PFUdA		99	50-150
13C8_PFOA		102	50-150
13C8_PFOS		108	50-150
13C8_PFOSA		99	50-150
13C9_PFNA		110	50-150
d5-EtFOSAA		107	50-150
d-MeFOSA		105	50-150
d3-MeFOSAA		99	50-150

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

SPLP PFAS - MB

Sample ID: WQ17010-001
Batch: 17010
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Solid
Prep Method: 1312/PFAS
Prep Date: 09/29/2021 1716 Leachate Date: 09/21/2021 2318

Parameter	Result	Q	Dil	LOQ	LOD	DL	Units	Analysis Date
8:2 FTS	40	U	1	80	40	20	ng/L	09/30/2021 1744
6:2 FTS	40	U	1	80	40	20	ng/L	09/30/2021 1744
4:2 FTS	40	U	1	80	40	20	ng/L	09/30/2021 1744
EtFOSAA	40	U	1	80	40	20	ng/L	09/30/2021 1744
MeFOSA	80	U	1	160	80	40	ng/L	09/30/2021 1744
MeFOSAA	40	U	1	80	40	20	ng/L	09/30/2021 1744
PFBS	20	U	1	40	20	10	ng/L	09/30/2021 1744
PFDS	20	U	1	40	20	10	ng/L	09/30/2021 1744
PFHpS	20	U	1	40	20	10	ng/L	09/30/2021 1744
PFNS	20	U	1	40	20	10	ng/L	09/30/2021 1744
PFOSA	20	U	1	40	20	10	ng/L	09/30/2021 1744
PFPeS	20	U	1	40	20	10	ng/L	09/30/2021 1744
PFHxS	20	U	1	40	20	10	ng/L	09/30/2021 1744
PFBA	20	U	1	40	20	10	ng/L	09/30/2021 1744
PFDA	20	U	1	40	20	10	ng/L	09/30/2021 1744
PFDoA	20	U	1	40	20	10	ng/L	09/30/2021 1744
PFHpA	20	U	1	40	20	10	ng/L	09/30/2021 1744
PFHxA	20	U	1	40	20	10	ng/L	09/30/2021 1744
PFNA	20	U	1	40	20	10	ng/L	09/30/2021 1744
PFOA	20	U	1	40	20	10	ng/L	09/30/2021 1744
PFPeA	20	U	1	40	20	10	ng/L	09/30/2021 1744
PFTeDA	20	U	1	40	20	10	ng/L	09/30/2021 1744
PFTrDA	20	U	1	40	20	10	ng/L	09/30/2021 1744
PFUdA	20	U	1	40	20	10	ng/L	09/30/2021 1744
PFOS	20	U	1	40	20	10	ng/L	09/30/2021 1744

Surrogate	Q	% Rec	Acceptance Limit
13C2_4:2FTS		117	50-150
13C2_6:2FTS		117	50-150
13C2_8:2FTS		96	50-150
13C2_PFDoA		88	50-150
13C2_PFTeDA		97	50-150
13C3_PFBS		98	50-150
13C3_PFHxS		95	50-150
13C4_PFBA		97	50-150
13C4_PFHpA		100	50-150
13C5_PFHxA		97	50-150
13C5_PFPeA		104	50-150
13C6_PFDA		95	50-150
13C7_PFUdA		102	50-150
13C8_PFOA		101	50-150

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

SPLP PFAS - MB

Sample ID: WQ17010-001
Batch: 17010
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Solid
Prep Method: 1312/PFAS
Prep Date: 09/29/2021 1716 Leachate Date: 09/21/2021 2318

Surrogate	Q	% Rec	Acceptance Limit
13C8_PFOS		87	50-150
13C8_PFOSA		107	50-150
13C9_PFNA		101	50-150
d5-EtFOSAA		107	50-150
d-MeFOSA		85	50-150
d3-MeFOSAA		109	50-150

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

SPLP PFAS - LCS

Sample ID: WQ17010-002
Batch: 17010
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Solid
Prep Method: 1312/PFAS
Prep Date: 09/29/2021 1716 Leachate Date: 09/21/2021 2318

Parameter	Spike Amount (ng/L)	Result (ng/L)	Q	Dil	% Rec	%Rec Limit	Analysis Date
8:2 FTS	15	14		1	93	67-138	09/30/2021 1826
6:2 FTS	15	15		1	102	64-140	09/30/2021 1826
4:2 FTS	15	14		1	92	63-143	09/30/2021 1826
EtFOSAA	16	16		1	102	61-135	09/30/2021 1826
MeFOSA	16	14		1	86	68-141	09/30/2021 1826
MeFOSAA	16	14		1	86	65-136	09/30/2021 1826
PFBS	14	14		1	99	72-130	09/30/2021 1826
PFDS	15	16		1	103	53-142	09/30/2021 1826
PFHpS	15	15		1	97	69-134	09/30/2021 1826
PFNS	15	18		1	118	69-127	09/30/2021 1826
PFOSA	16	15		1	92	67-137	09/30/2021 1826
PFPeS	15	15		1	100	71-127	09/30/2021 1826
PFHxS	15	14		1	95	68-131	09/30/2021 1826
PFBA	16	16		1	98	73-129	09/30/2021 1826
PFDA	16	16		1	102	71-129	09/30/2021 1826
PFDoA	16	16		1	97	72-134	09/30/2021 1826
PFHpA	16	16		1	98	72-130	09/30/2021 1826
PFHxA	16	15		1	97	72-129	09/30/2021 1826
PFNA	16	15		1	95	69-130	09/30/2021 1826
PFOA	16	15		1	97	71-133	09/30/2021 1826
PFPeA	16	15		1	96	72-129	09/30/2021 1826
PFTeDA	16	16		1	102	71-132	09/30/2021 1826
PFTrDA	16	16		1	101	65-144	09/30/2021 1826
PFUdA	16	15		1	96	69-133	09/30/2021 1826
PFOS	15	15		1	99	65-140	09/30/2021 1826

Surrogate	Q	% Rec	Acceptance Limit
13C2_4:2FTS		116	50-150
13C2_6:2FTS		119	50-150
13C2_8:2FTS		104	50-150
13C2_PFDoA		88	50-150
13C2_PFTeDA		94	50-150
13C3_PFBS		95	50-150
13C3_PFHxS		99	50-150
13C4_PFBA		98	50-150
13C4_PFHpA		98	50-150
13C5_PFHxA		101	50-150
13C5_PFPeA		106	50-150
13C6_PFDA		97	50-150
13C7_PFUdA		95	50-150
13C8_PFOA		97	50-150

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

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SPLP PFAS - LCS

Sample ID: WQ17010-002
Batch: 17010
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Solid
Prep Method: 1312/PFAS
Prep Date: 09/29/2021 1716 Leachate Date: 09/21/2021 2318

Surrogate	Q	% Rec	Acceptance Limit
13C8_PFOS		91	50-150
13C8_PFOSA		104	50-150
13C9_PFNA		101	50-150
d5-EtFOSAA		103	50-150
d-MeFOSA		72	50-150
d3-MeFOSAA		111	50-150

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

SPLP PFAS - MS

Sample ID: WI17023-002MS
Batch: 17010
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Solid
Prep Method: 1312/PFAS
Prep Date: 09/29/2021 1716 Leachate Date: 09/21/2021 2318

Parameter	Sample Amount (ng/L)	Spike Amount (ng/L)	Result (ng/L)	Q	Dil	% Rec	%Rec Limit	Analysis Date
8:2 FTS	ND	150	170		1	114	67-138	09/30/2021 2125
6:2 FTS	ND	150	160		1	106	64-140	09/30/2021 2125
4:2 FTS	ND	150	150		1	98	63-143	09/30/2021 2125
EtFOSAA	ND	160	150		1	94	61-135	09/30/2021 2125
MeFOSA	ND	160	120		1	74	68-141	09/30/2021 2125
MeFOSAA	ND	160	140		1	89	65-136	09/30/2021 2125
PFBS	ND	140	150		1	103	72-130	09/30/2021 2125
PFDS	ND	150	160		1	101	53-142	09/30/2021 2125
PFHpS	ND	150	150		1	99	69-134	09/30/2021 2125
PFNS	ND	150	170		1	114	69-127	09/30/2021 2125
PFOSA	ND	160	170		1	106	67-137	09/30/2021 2125
PFPeS	ND	150	160		1	105	71-127	09/30/2021 2125
PFHxS	ND	150	150		1	106	68-131	09/30/2021 2125
PFBA	ND	160	160		1	98	73-129	09/30/2021 2125
PFDA	ND	160	150		1	95	71-129	09/30/2021 2125
PFDoA	ND	160	160		1	98	72-134	09/30/2021 2125
PFHpA	ND	160	160		1	99	72-130	09/30/2021 2125
PFHxA	ND	160	160		1	100	72-129	09/30/2021 2125
PFNA	ND	160	160		1	97	69-130	09/30/2021 2125
PFOA	ND	160	150		1	94	71-133	09/30/2021 2125
PFPeA	ND	160	160		1	97	72-129	09/30/2021 2125
PFTeDA	ND	160	150		1	97	71-132	09/30/2021 2125
PFTrDA	ND	160	160		1	98	65-144	09/30/2021 2125
PFUdA	ND	160	160		1	102	69-133	09/30/2021 2125
PFOS	ND	150	160		1	110	65-140	09/30/2021 2125

Surrogate	Q	% Rec	Acceptance Limit
13C2_4:2FTS		101	50-150
13C2_6:2FTS		97	50-150
13C2_8:2FTS		91	50-150
13C2_PFDoA		76	50-150
13C2_PFTeDA		86	50-150
13C3_PFBS		84	50-150
13C3_PFHxS		87	50-150
13C4_PFBA		92	50-150
13C4_PFHpA		90	50-150
13C5_PFHxA		90	50-150
13C5_PFPeA		93	50-150
13C6_PFDA		89	50-150
13C7_PFUdA		89	50-150
13C8_PFOA		92	50-150

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

SPLP PFAS - MS

Sample ID: WI17023-002MS
Batch: 17010
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Solid
Prep Method: 1312/PFAS
Prep Date: 09/29/2021 1716 Leachate Date: 09/21/2021 2318

Surrogate	Q	% Rec	Acceptance Limit
13C8_PFOS		80	50-150
13C8_PFOSA		95	50-150
13C9_PFNA		91	50-150
d5-EtFOSAA		101	50-150
d-MeFOSA		96	50-150
d3-MeFOSAA		98	50-150

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

SPLP PFAS - MSD

Sample ID: WI17023-002MD
Batch: 17010
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Solid
Prep Method: 1312/PFAS
Prep Date: 09/29/2021 1716 Leachate Date: 09/21/2021 2318

Parameter	Sample Amount (ng/L)	Spike Amount (ng/L)	Result (ng/L)	Q	Dil	% Rec	% RPD	%Rec Limit	% RPD Limit	Analysis Date
8:2 FTS	ND	150	140		1	94	19	67-138	30	09/30/2021 2135
6:2 FTS	ND	150	270	N,+	1	181	52	64-140	30	09/30/2021 2135
4:2 FTS	ND	150	160		1	105	6.9	63-143	30	09/30/2021 2135
EtFOSAA	ND	160	140		1	89	6.0	61-135	30	09/30/2021 2135
MeFOSA	ND	160	160		1	100	30	68-141	30	09/30/2021 2135
MeFOSAA	ND	160	140		1	90	1.2	65-136	30	09/30/2021 2135
PFBS	ND	140	140		1	102	0.30	72-130	30	09/30/2021 2135
PFDS	ND	150	170		1	111	9.6	53-142	30	09/30/2021 2135
PFHpS	ND	150	150		1	97	1.7	69-134	30	09/30/2021 2135
PFNS	ND	150	160		1	106	7.0	69-127	30	09/30/2021 2135
PFOSA	ND	160	150		1	94	12	67-137	30	09/30/2021 2135
PFPeS	ND	150	140		1	91	14	71-127	30	09/30/2021 2135
PFHxS	ND	150	140		1	93	13	68-131	30	09/30/2021 2135
PFBA	ND	160	160		1	101	2.8	73-129	30	09/30/2021 2135
PFDA	ND	160	170		1	108	13	71-129	30	09/30/2021 2135
PFDoA	ND	160	170		1	104	5.4	72-134	30	09/30/2021 2135
PFHpA	ND	160	160		1	101	2.2	72-130	30	09/30/2021 2135
PFHxA	ND	160	160		1	99	0.19	72-129	30	09/30/2021 2135
PFNA	ND	160	160		1	100	2.7	69-130	30	09/30/2021 2135
PFOA	ND	160	150		1	95	1.1	71-133	30	09/30/2021 2135
PFPeA	ND	160	160		1	101	3.7	72-129	30	09/30/2021 2135
PFTeDA	ND	160	160		1	101	4.4	71-132	30	09/30/2021 2135
PFTrDA	ND	160	160		1	103	5.0	65-144	30	09/30/2021 2135
PFUdA	ND	160	170		1	104	1.4	69-133	30	09/30/2021 2135
PFOS	ND	150	160		1	108	1.9	65-140	30	09/30/2021 2135

Surrogate	Q	% Rec	Acceptance Limit
13C2_4:2FTS		100	50-150
13C2_6:2FTS		101	50-150
13C2_8:2FTS		105	50-150
13C2_PFDoA		77	50-150
13C2_PFTeDA		84	50-150
13C3_PFBS		90	50-150
13C3_PFHxS		90	50-150
13C4_PFBA		89	50-150
13C4_PFHpA		86	50-150
13C5_PFHxA		91	50-150
13C5_PFPeA		96	50-150
13C6_PFDA		88	50-150
13C7_PFUdA		89	50-150
13C8_PFOA		89	50-150

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

SPLP PFAS - MSD

Sample ID: WI17023-002MD
Batch: 17010
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Solid
Prep Method: 1312/PFAS
Prep Date: 09/29/2021 1716 Leachate Date: 09/21/2021 2318

Surrogate	Q	% Rec	Acceptance Limit
13C8_PFOS		81	50-150
13C8_PFOSA		104	50-150
13C9_PFNA		91	50-150
d5-EtFOSAA		101	50-150
d-MeFOSA		81	50-150
d3-MeFOSAA		105	50-150

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

Chain of Custody

and

Miscellaneous Documents

Pace Analytical®

PACE ANALYTICAL SERVICES, LLC
105 Vantage Point Drive • West Columbia, SC 29172
Telephone No. 803-791-9700 Fax No. 803-791-9111
www.pacelabs.com

Number 122666

Client: Arcadis	Report to Contact: Nathan Nagle	Telephone No. / E-mail: nathan.nagle@arcadis.com	Quote No: 25048
Address: 10 Friends Ln, Suite 100	Sampler's Signature: Lindsay Powell	Analysis (Attach list if more space is needed)	Page: 1 of 1
City: Newtown	State: PA Zip Code: 18940	Printed Name: Lindsay Powell	Lot # Bar Code: WI17023
Project Name: Erickson Soil Washing	P.O. No.:		KES2
Project No.: 30030317			

Sample ID / Description (Containers for each sample may be combined on one line.)	Collection Date(s)	Collection Time (Military)	Grab/Composite	Matrix: Aqueous	Solid	Non-aqueous	No. of Containers by Preservative Type: Unpres.	H2SO4	HNO3	HCl	NaOH	NaHSO4	Other	PFAS QSM 1.0/1.0_9-15	SOP PFAS	Screen PFOS, PFOA, PFBS	PAH	
385-4-UT-1	9/13/21	1355	G		X		X							X	X	X	X	up to 100 ppb
385-4-S-1	9/15/21	1145	G		X		X							X	X	X	X	MS/MSD up to 5 ppb ↓
385-4-G-1	9/15/21	1210	G		X		X							X	X	X	X	
385-4-W-UT-1	9/15/21	1315	G	X			X							X			X	up to 100 ppb
385-4-W-T-1	9/15/21	1300	G	X			X							X			X	∠ 5 ppb
DUP-02	9/15/21	—	G	X			X							X	X	X	X	
DUP-03	9/15/21	—	G	X			X							X			X	rush 24 hr TAT on all screens,
END OF RECORD																		5 day TAT all others

yp 9/16/21

Turn Around Time Required (Prior lab approval required for expedited TAT.): ☐ Standard ☒ Rush (Specify) 24 hr on screens

Sample Disposal: ☐ Return to Client ☐ Disposal by Lab

Possible Hazard Identification: ☐ Non Hazard ☐ Flammable ☐ Skin Irritant ☐ Poison ☐ Unknown

QC Requirements (Specify)

	Date	Time
1. Relinquished by: Lindsay Powell	9/16/21	0800
2. Relinquished by:		
3. Relinquished by:		
4. Relinquished by: FedEx	9-17-21	1025

	Date	Time
1. Received by:		
2. Received by:		
3. Received by:		
4. Laboratory received by: Raheem Means	9-17-21	1025

Temp Blank ☐Y ☐N

LAB USE ONLY
Received on Ice (Circle) Yes No Ice Pack
Receipt Temp: 5.6 °C

Note: All samples are retained for four weeks from receipt unless other arrangements are made.

Document Number: ME003NP-01

DISTRIBUTION: WHITE & YELLOW-Return to laboratory with Sample(s); PINK-Field/Client Copy

PACE ANALYTICAL SERVICES, LLC

Pace Analytical

Samples Receipt Checklist (SRC) (ME0018C-15)
Issuing Authority: Pace ENV - WCOL

Revised:9/29/2020
Page 1 of 1

Sample Receipt Checklist (SRC)

Client: ARCADIS Cooler Inspected by/date: JRG2 / 9/17/2021 Lot #: WI17023

Means of receipt: ☐ Pace ☐ Client ☐ UPS ☑ FedEx ☐ Other:

☑ Yes	☐ No		1. Were custody seals present on the cooler?
☑ Yes	☐ No	☐ NA	2. If custody seals were present, were they intact and unbroken?

pH Strip ID: NA Chlorine Strip ID: NA Tested by: NA

Original temperature upon receipt / Derived (Corrected) temperature upon receipt %Solid Snap-Cup ID: 21-1928

5.6 / 5.6 °C NA / NA °C NA / NA °C NA / NA °C

Method: ☑ Temperature Blank ☐ Against Bottles IR Gun ID: 5 IR Gun Correction Factor: 0 °C

Method of coolant: ☑ Wet Ice ☐ Ice Packs ☐ Dry Ice ☐ None

☐ Yes	☐ No	☑ NA	3. If temperature of any cooler exceeded 6.0°C, was Project Manager Notified? PM was Notified by: phone / email / face-to-face (circle one).
☑ Yes	☐ No	☐ NA	4. Is the commercial courier's packing slip attached to this form?
☑ Yes	☐ No		5. Were proper custody procedures (relinquished/received) followed?
☑ Yes	☐ No		6. Were sample IDs listed on the COC?
☑ Yes	☐ No		7. Were sample IDs listed on all sample containers?
☑ Yes	☐ No		8. Was collection date & time listed on the COC?
☑ Yes	☐ No		9. Was collection date & time listed on all sample containers?
☑ Yes	☐ No		10. Did all container label information (ID, date, time) agree with the COC?
☑ Yes	☐ No		11. Were tests to be performed listed on the COC?
☑ Yes	☐ No		12. Did all samples arrive in the proper containers for each test and/or in good condition (unbroken, lids on, etc.)?
☑ Yes	☐ No		13. Was adequate sample volume available?
☐ Yes	☑ No		14. Were all samples received within ½ the holding time or 48 hours, whichever comes first?
☐ Yes	☑ No		15. Were any samples containers missing/excess (circle one) samples Not listed on COC?
☐ Yes	☐ No	☑ NA	16. For VOA and RSK-175 samples, were bubbles present >"pea-size" (¼"or 6mm in diameter) in any of the VOA vials?
☐ Yes	☐ No	☑ NA	17. Were all DRO/metals/nutrient samples received at a pH of < 2?
☐ Yes	☐ No	☑ NA	18. Were all cyanide samples received at a pH > 12 and sulfide samples received at a pH > 9?
☐ Yes	☐ No	☑ NA	19. Were all applicable NH_3/TKN/cyanide/phenol/625.1/608.3 (< 0.5mg/L) samples free of residual chlorine?
☑ Yes	☐ No	☐ NA	20. Were client remarks/requests (i.e. requested dilutions, MS/MSD designations, etc…) correctly transcribed from the COC into the comment section in LIMS?
☐ Yes	☑ No		21. Was the quote number listed on the container label? If yes, Quote # NA

Sample Preservation (Must be completed for any sample(s) incorrectly preserved or with headspace.)

Sample(s) NA were received incorrectly preserved and were adjusted accordingly in sample receiving with NA mL of circle one: H2SO4, HNO3, HCl, NaOH using SR # NA.
Time of preservation NA. If more than one preservative is needed, please note in the comments below.

Sample(s) NA were received with bubbles >6 mm in diameter.

Samples(s) NA were received with TRC > 0.5 mg/L (If #19 is ***no***) and were adjusted accordingly in sample receiving with sodium thiosulfate ($Na_2S_2O_3$) with Shealy ID: NA.

SR barcode labels applied by: KDRW Date: 9/17/2021

Comments:

Report of Analysis

Arcadis U.S., Inc.
630 Plaza Drive
Suite 600
Highlands Ranch, CO 80129
Attention: Joseph Quinnan

Project Name: Eielson AFB Soil Washing

Project Number: 30030317

Lot Number:**WI22013**

Date Completed:10/03/2021

10/04/2021 10:18 AM
Approved and released by:
Project Manager II: **Kathy E. Smith**

The electronic signature above is the equivalent of a handwritten signature.
This report shall not be reproduced, except in its entirety, without the written approval of Pace Analytical Services, LLC.

Pace Analytical Services, LLC (*formerly Shealy Environmental Services, Inc.*)
106 Vantage Point Drive West Columbia, SC 29172
Tel: 803-791-9700 Fax: 803-791-9111 www.pacelabs.com

Case Narrative
Arcadis U.S., Inc.
Lot Number: WI22013

This Report of Analysis contains the analytical result(s) for the sample(s) listed on the Sample Summary following this Case Narrative. The sample receiving date is documented in the header information associated with each sample.

All results listed in this report relate only to the samples that are contained within this report.

Sample receipt, sample analysis, and data review have been performed in accordance with the Pace Quality Assurance Management Plan (QAMP), applicable Shealy standard operating procedures (SOPs), the 2003 NELAC standard, and Shealy policies. Additionally, the DoD QSM version 5.3 has been followed for these samples, and specifically Table B-15 was followed for all PFAS samples. Any exceptions to the QAMP, SOPs, NELAC standards, the DoD QSM, or policies are qualified on the results page or discussed below.

Correction factors (CF) are used to calculate the original sample concentration. The CF is the inverse of the concentration factor (sample volume / extract final volume) times the dilution factor (DF). For undiluted analysis. The extract is prepared for injection by adding 182 uL of sample extract + 8 uL of reagent water + 10 uL of internal standard solution to a polypropylene autosampler vial. An extra correction factor of 0.91 (182 uL / 200 uL = 0.91) applies. The CF is calculated as follows:

For solid samples:

CF = DF * FV / Ws/S/1000

FV is volume of extract (mL)
Ws is initial sample weight (gram)
S is %Solids
DF is dilution factor. For undiluted analysis, DF = 1/0.91.

Concentration (ug/kg) = Cs*CF,

$$C_s = \frac{\left(\frac{(A_s x C_{is})}{A_{is}}\right) - B}{M1}$$

Where

C_s is on column concentration of target analyte in the sample (ng/L)
C_{is} is concentration of internal standard in the sample (ng/L)
A_s is peak response of target analyte in the sample
A_{is} is peak response of internal standard in the sample
M1 is the average RF from ICAL or the slope from linear regression ICAL
B is the y-intercept from the ICAL

Pace is a TNI accredited laboratory; however, the following analyses are currently not listed on our TNI scope of accreditation:

Biological Tissue: All, Non-Potable Water: SGT-HEM EPA 1664B, Silica EPA 200.7, Boron, Calcium, Silicon, Strontium EPA 200.8, Bicarbonate, Carbonate, and Hydroxide Alkalinity SM 2320 B-2011, Fecal Coliform SM 9221 C E-2006 & SM 9222D-2006, Strontium SW-846 6010D, VOC SM 6200 B-2011, Drinking Water: VOC (excluding BTEX, MTBE, Naphthalene, & 1,2-dichloroethane) EPA 524.2, Solid Chemical Material: TOC Walkley-Black.

Where applicable, all soil sample results (including LOQ and DL if requested) are corrected for dry weight unless flagged with a "W" qualifier.

If you have any questions regarding this report please contact the Pace Project Manager listed on the cover page.

Semivolatiles
Samples WI22013-001, WI22013-002, WI22013-005, WI22013-006, WI22013-007, WI22013-008 had the surrogate Nitrobenzene-d5 recovered outside of the acceptance limits due to dilution. The dilution impacted the surrogate recoveries, thus negating their usefulness concerning quality control. The sample results are reported and no corrective action is required.

PFAS
The method blank associated with batch 16193 had PFBA detected at a concentration that was above the MDL but below ½ the PQL. All samples associated with this method blank that have detections for PFBA have been flagged with a "B".

Sample Summary

Arcadis U.S., Inc.

Lot Number: WI22013

Project Name: Eielson AFB Soil Washing

Project Number: 30030317

Sample Number	Sample ID	Matrix	Date Sampled	Date Received
001	385-4-S-2	Solid	09/17/2021 1215	09/22/2021
002	385-4-S-3	Solid	09/18/2021 1700	09/22/2021
003	385-4-G-2	Solid	09/17/2021 1230	09/22/2021
004	385-4-G-3	Solid	09/18/2021 1615	09/22/2021
005	385-4-UT-2	Solid	09/17/2021 1245	09/22/2021
006	385-4-UT-3	Solid	09/17/2021 1500	09/22/2021
007	385-4-UT-4	Solid	09/18/2021 1100	09/22/2021
008	385-4-UT-5	Solid	09/18/2021 1630	09/22/2021

(8 samples)

Detection Summary

Arcadis U.S., Inc.

Lot Number: WI22013

Project Name: Eielson AFB Soil Washing

Project Number: 30030317

Sample	Sample ID	Matrix	Parameter	Method	Result	Q	Units	Page
001	385-4-S-2	Solid	Acenaphthene	8270E	190	Q	ug/kg	9
001	385-4-S-2	Solid	Acenaphthylene	8270E	52	JQ	ug/kg	9
001	385-4-S-2	Solid	Anthracene	8270E	460	Q	ug/kg	9
001	385-4-S-2	Solid	Benzo(a)anthracene	8270E	1600	Q	ug/kg	9
001	385-4-S-2	Solid	Benzo(a)pyrene	8270E	2100	Q	ug/kg	9
001	385-4-S-2	Solid	Benzo(b)fluoranthene	8270E	2300	Q	ug/kg	9
001	385-4-S-2	Solid	Benzo(g,h,i)perylene	8270E	1100	Q	ug/kg	9
001	385-4-S-2	Solid	Benzo(k)fluoranthene	8270E	900	Q	ug/kg	9
001	385-4-S-2	Solid	Chrysene	8270E	1800	Q	ug/kg	9
001	385-4-S-2	Solid	Fluoranthene	8270E	3700	Q	ug/kg	9
001	385-4-S-2	Solid	Fluorene	8270E	230	Q	ug/kg	9
001	385-4-S-2	Solid	Indeno(1,2,3-c,d)pyrene	8270E	980	Q	ug/kg	9
001	385-4-S-2	Solid	1-Methylnaphthalene	8270E	49	JQ	ug/kg	9
001	385-4-S-2	Solid	2-Methylnaphthalene	8270E	53	JQ	ug/kg	9
001	385-4-S-2	Solid	Naphthalene	8270E	44	JQ	ug/kg	9
001	385-4-S-2	Solid	Phenanthrene	8270E	2800	Q	ug/kg	9
001	385-4-S-2	Solid	Pyrene	8270E	3400	Q	ug/kg	9
001	385-4-S-2	Solid	PFHxS	PFAS by ID	0.31	J	ug/kg	10
001	385-4-S-2	Solid	PFOS	PFAS by ID	0.87	J	ug/kg	10
002	385-4-S-3	Solid	Acenaphthene	8270E	600	Q	ug/kg	14
002	385-4-S-3	Solid	Acenaphthylene	8270E	92	Q	ug/kg	14
002	385-4-S-3	Solid	Anthracene	8270E	1300	Q	ug/kg	14
002	385-4-S-3	Solid	Benzo(a)anthracene	8270E	2600	Q	ug/kg	14
002	385-4-S-3	Solid	Benzo(a)pyrene	8270E	3100	Q	ug/kg	14
002	385-4-S-3	Solid	Benzo(b)fluoranthene	8270E	3600	Q	ug/kg	14
002	385-4-S-3	Solid	Benzo(g,h,i)perylene	8270E	1400	Q	ug/kg	14
002	385-4-S-3	Solid	Benzo(k)fluoranthene	8270E	1400	Q	ug/kg	14
002	385-4-S-3	Solid	Chrysene	8270E	2800	Q	ug/kg	14
002	385-4-S-3	Solid	Fluoranthene	8270E	6800	Q	ug/kg	14
002	385-4-S-3	Solid	Fluorene	8270E	720	Q	ug/kg	14
002	385-4-S-3	Solid	Indeno(1,2,3-c,d)pyrene	8270E	1300	Q	ug/kg	14
002	385-4-S-3	Solid	1-Methylnaphthalene	8270E	140	Q	ug/kg	14
002	385-4-S-3	Solid	2-Methylnaphthalene	8270E	170	Q	ug/kg	14
002	385-4-S-3	Solid	Naphthalene	8270E	160	Q	ug/kg	14
002	385-4-S-3	Solid	Phenanthrene	8270E	6700	Q	ug/kg	14
002	385-4-S-3	Solid	Pyrene	8270E	6000	Q	ug/kg	14
002	385-4-S-3	Solid	PFHxS	PFAS by ID	0.59	J	ug/kg	15
002	385-4-S-3	Solid	PFOS	PFAS by ID	1.1		ug/kg	15
002	385-4-S-3	Solid	PFOS	PFAS by ID	11	J	ng/L	17
003	385-4-G-2	Solid	Benzo(a)anthracene	8270E	2.6	J	ug/kg	19
003	385-4-G-2	Solid	Benzo(a)pyrene	8270E	3.9		ug/kg	19
003	385-4-G-2	Solid	Benzo(b)fluoranthene	8270E	4.0		ug/kg	19
003	385-4-G-2	Solid	Benzo(g,h,i)perylene	8270E	3.3		ug/kg	19

Sample	Sample ID	Matrix	Parameter	Method	Result	Q	Units	Page
003	385-4-G-2	Solid	Benzo(k)fluoranthene	8270E	1.6	J	ug/kg	19
003	385-4-G-2	Solid	Chrysene	8270E	2.1	J	ug/kg	19
003	385-4-G-2	Solid	Fluoranthene	8270E	2.8		ug/kg	19
003	385-4-G-2	Solid	Indeno(1,2,3-c,d)pyrene	8270E	2.6	J	ug/kg	19
003	385-4-G-2	Solid	Phenanthrene	8270E	1.6	J	ug/kg	19
003	385-4-G-2	Solid	Pyrene	8270E	3.4		ug/kg	19
004	385-4-G-3	Solid	Benzo(a)anthracene	8270E	2.1	J	ug/kg	24
004	385-4-G-3	Solid	Benzo(a)pyrene	8270E	2.5	J	ug/kg	24
004	385-4-G-3	Solid	Benzo(b)fluoranthene	8270E	3.0		ug/kg	24
004	385-4-G-3	Solid	Benzo(g,h,i)perylene	8270E	2.0	J	ug/kg	24
004	385-4-G-3	Solid	Benzo(k)fluoranthene	8270E	1.1	J	ug/kg	24
004	385-4-G-3	Solid	Chrysene	8270E	1.9	J	ug/kg	24
004	385-4-G-3	Solid	Fluoranthene	8270E	2.6		ug/kg	24
004	385-4-G-3	Solid	Indeno(1,2,3-c,d)pyrene	8270E	1.3	J	ug/kg	24
004	385-4-G-3	Solid	Phenanthrene	8270E	1.5	J	ug/kg	24
004	385-4-G-3	Solid	Pyrene	8270E	3.0		ug/kg	24
005	385-4-UT-2	Solid	Acenaphthene	8270E	96	JQ	ug/kg	29
005	385-4-UT-2	Solid	Anthracene	8270E	280	Q	ug/kg	29
005	385-4-UT-2	Solid	Benzo(a)anthracene	8270E	910	Q	ug/kg	29
005	385-4-UT-2	Solid	Benzo(a)pyrene	8270E	1500	Q	ug/kg	29
005	385-4-UT-2	Solid	Benzo(b)fluoranthene	8270E	1700	Q	ug/kg	29
005	385-4-UT-2	Solid	Benzo(g,h,i)perylene	8270E	810	Q	ug/kg	29
005	385-4-UT-2	Solid	Benzo(k)fluoranthene	8270E	740	Q	ug/kg	29
005	385-4-UT-2	Solid	Chrysene	8270E	1300	Q	ug/kg	29
005	385-4-UT-2	Solid	Fluoranthene	8270E	2200	Q	ug/kg	29
005	385-4-UT-2	Solid	Fluorene	8270E	110	JQ	ug/kg	29
005	385-4-UT-2	Solid	Indeno(1,2,3-c,d)pyrene	8270E	720	Q	ug/kg	29
005	385-4-UT-2	Solid	Phenanthrene	8270E	1400	Q	ug/kg	29
005	385-4-UT-2	Solid	Pyrene	8270E	2100	Q	ug/kg	29
005	385-4-UT-2	Solid	PFOSA	PFAS by ID	0.37	J	ug/kg	30
005	385-4-UT-2	Solid	PFPeS	PFAS by ID	0.29	J	ug/kg	30
005	385-4-UT-2	Solid	PFHxS	PFAS by ID	7.0		ug/kg	30
005	385-4-UT-2	Solid	PFBA	PFAS by ID	0.22	BJ	ug/kg	30
005	385-4-UT-2	Solid	PFDA	PFAS by ID	0.22	J	ug/kg	30
005	385-4-UT-2	Solid	PFHpA	PFAS by ID	0.64	J	ug/kg	30
005	385-4-UT-2	Solid	PFHxA	PFAS by ID	0.98	J	ug/kg	30
005	385-4-UT-2	Solid	PFNA	PFAS by ID	0.26	J	ug/kg	30
005	385-4-UT-2	Solid	PFOA	PFAS by ID	1.8		ug/kg	30
005	385-4-UT-2	Solid	PFPeA	PFAS by ID	0.48	J	ug/kg	30
005	385-4-UT-2	Solid	PFOS	PFAS by ID	13		ug/kg	30
005	385-4-UT-2	Solid	PFBS	PFAS by ID	13	J	ng/L	32
005	385-4-UT-2	Solid	PFPeS	PFAS by ID	12	J	ng/L	32
005	385-4-UT-2	Solid	PFHxS	PFAS by ID	230		ng/L	32
005	385-4-UT-2	Solid	PFHpA	PFAS by ID	32	J	ng/L	32
005	385-4-UT-2	Solid	PFHxA	PFAS by ID	40		ng/L	32
005	385-4-UT-2	Solid	PFOA	PFAS by ID	51		ng/L	32
005	385-4-UT-2	Solid	PFPeA	PFAS by ID	20	J	ng/L	32
005	385-4-UT-2	Solid	PFOS	PFAS by ID	400		ng/L	32

Sample	Sample ID	Matrix	Parameter	Method	Result	Q	Units	Page
006	385-4-UT-3	Solid	Acenaphthene	8270E	83	JQ	ug/kg	34
006	385-4-UT-3	Solid	Anthracene	8270E	300	Q	ug/kg	34
006	385-4-UT-3	Solid	Benzo(a)anthracene	8270E	910	Q	ug/kg	34
006	385-4-UT-3	Solid	Benzo(a)pyrene	8270E	1400	Q	ug/kg	34
006	385-4-UT-3	Solid	Benzo(b)fluoranthene	8270E	1500	Q	ug/kg	34
006	385-4-UT-3	Solid	Benzo(g,h,i)perylene	8270E	700	Q	ug/kg	34
006	385-4-UT-3	Solid	Benzo(k)fluoranthene	8270E	630	Q	ug/kg	34
006	385-4-UT-3	Solid	Chrysene	8270E	1200	Q	ug/kg	34
006	385-4-UT-3	Solid	Fluoranthene	8270E	2100	Q	ug/kg	34
006	385-4-UT-3	Solid	Fluorene	8270E	92	JQ	ug/kg	34
006	385-4-UT-3	Solid	Indeno(1,2,3-c,d)pyrene	8270E	590	Q	ug/kg	34
006	385-4-UT-3	Solid	Phenanthrene	8270E	1300	Q	ug/kg	34
006	385-4-UT-3	Solid	Pyrene	8270E	2000	Q	ug/kg	34
006	385-4-UT-3	Solid	PFBS	PFAS by ID	0.31	J	ug/kg	35
006	385-4-UT-3	Solid	PFOSA	PFAS by ID	0.31	J	ug/kg	35
006	385-4-UT-3	Solid	PFPeS	PFAS by ID	0.42	J	ug/kg	35
006	385-4-UT-3	Solid	PFHxS	PFAS by ID	7.5		ug/kg	35
006	385-4-UT-3	Solid	PFBA	PFAS by ID	0.33	BJ	ug/kg	35
006	385-4-UT-3	Solid	PFDA	PFAS by ID	0.31	J	ug/kg	35
006	385-4-UT-3	Solid	PFHpA	PFAS by ID	0.92	J	ug/kg	35
006	385-4-UT-3	Solid	PFHxA	PFAS by ID	1.2		ug/kg	35
006	385-4-UT-3	Solid	PFNA	PFAS by ID	0.27	J	ug/kg	35
006	385-4-UT-3	Solid	PFOA	PFAS by ID	1.4		ug/kg	35
006	385-4-UT-3	Solid	PFPeA	PFAS by ID	0.62	J	ug/kg	35
006	385-4-UT-3	Solid	PFOS	PFAS by ID	14		ug/kg	35
006	385-4-UT-3	Solid	PFBS	PFAS by ID	11	J	ng/L	37
006	385-4-UT-3	Solid	PFPeS	PFAS by ID	11	J	ng/L	37
006	385-4-UT-3	Solid	PFHxS	PFAS by ID	210		ng/L	37
006	385-4-UT-3	Solid	PFHpA	PFAS by ID	28	J	ng/L	37
006	385-4-UT-3	Solid	PFHxA	PFAS by ID	35	J	ng/L	37
006	385-4-UT-3	Solid	PFOA	PFAS by ID	48		ng/L	37
006	385-4-UT-3	Solid	PFPeA	PFAS by ID	17	J	ng/L	37
006	385-4-UT-3	Solid	PFOS	PFAS by ID	300		ng/L	37
007	385-4-UT-4	Solid	Acenaphthene	8270E	78	JQ	ug/kg	39
007	385-4-UT-4	Solid	Anthracene	8270E	260	Q	ug/kg	39
007	385-4-UT-4	Solid	Benzo(a)anthracene	8270E	810	Q	ug/kg	39
007	385-4-UT-4	Solid	Benzo(a)pyrene	8270E	1100	Q	ug/kg	39
007	385-4-UT-4	Solid	Benzo(b)fluoranthene	8270E	1300	Q	ug/kg	39
007	385-4-UT-4	Solid	Benzo(g,h,i)perylene	8270E	600	Q	ug/kg	39
007	385-4-UT-4	Solid	Benzo(k)fluoranthene	8270E	550	Q	ug/kg	39
007	385-4-UT-4	Solid	Chrysene	8270E	1100	Q	ug/kg	39
007	385-4-UT-4	Solid	Fluoranthene	8270E	1900	Q	ug/kg	39
007	385-4-UT-4	Solid	Fluorene	8270E	90	JQ	ug/kg	39
007	385-4-UT-4	Solid	Indeno(1,2,3-c,d)pyrene	8270E	580	Q	ug/kg	39
007	385-4-UT-4	Solid	Phenanthrene	8270E	1200	Q	ug/kg	39
007	385-4-UT-4	Solid	Pyrene	8270E	1700	Q	ug/kg	39
007	385-4-UT-4	Solid	PFOSA	PFAS by ID	0.36	J	ug/kg	40
007	385-4-UT-4	Solid	PFPeS	PFAS by ID	0.35	J	ug/kg	40

Sample	Sample ID	Matrix	Parameter	Method	Result	Q	Units	Page
007	385-4-UT-4	Solid	PFHxS	PFAS by ID	6.8		ug/kg	40
007	385-4-UT-4	Solid	PFBA	PFAS by ID	0.26	BJ	ug/kg	40
007	385-4-UT-4	Solid	PFDA	PFAS by ID	0.25	J	ug/kg	40
007	385-4-UT-4	Solid	PFHpA	PFAS by ID	0.73	J	ug/kg	40
007	385-4-UT-4	Solid	PFHxA	PFAS by ID	0.96	J	ug/kg	40
007	385-4-UT-4	Solid	PFNA	PFAS by ID	0.22	J	ug/kg	40
007	385-4-UT-4	Solid	PFOA	PFAS by ID	1.4		ug/kg	40
007	385-4-UT-4	Solid	PFPeA	PFAS by ID	0.49	J	ug/kg	40
007	385-4-UT-4	Solid	PFOS	PFAS by ID	12		ug/kg	40
007	385-4-UT-4	Solid	PFBS	PFAS by ID	11	J	ng/L	42
007	385-4-UT-4	Solid	PFHxS	PFAS by ID	200		ng/L	42
007	385-4-UT-4	Solid	PFHpA	PFAS by ID	25	J	ng/L	42
007	385-4-UT-4	Solid	PFHxA	PFAS by ID	29	J	ng/L	42
007	385-4-UT-4	Solid	PFOA	PFAS by ID	34	J	ng/L	42
007	385-4-UT-4	Solid	PFPeA	PFAS by ID	15	J	ng/L	42
007	385-4-UT-4	Solid	PFOS	PFAS by ID	290		ng/L	42
008	385-4-UT-5	Solid	Acenaphthene	8270E	170	Q	ug/kg	44
008	385-4-UT-5	Solid	Anthracene	8270E	550	Q	ug/kg	44
008	385-4-UT-5	Solid	Benzo(a)anthracene	8270E	1400	Q	ug/kg	44
008	385-4-UT-5	Solid	Benzo(a)pyrene	8270E	1900	Q	ug/kg	44
008	385-4-UT-5	Solid	Benzo(b)fluoranthene	8270E	2400	Q	ug/kg	44
008	385-4-UT-5	Solid	Benzo(g,h,i)perylene	8270E	870	Q	ug/kg	44
008	385-4-UT-5	Solid	Benzo(k)fluoranthene	8270E	830	Q	ug/kg	44
008	385-4-UT-5	Solid	Chrysene	8270E	1500	Q	ug/kg	44
008	385-4-UT-5	Solid	Fluoranthene	8270E	3300	Q	ug/kg	44
008	385-4-UT-5	Solid	Fluorene	8270E	220	Q	ug/kg	44
008	385-4-UT-5	Solid	Indeno(1,2,3-c,d)pyrene	8270E	750	Q	ug/kg	44
008	385-4-UT-5	Solid	Phenanthrene	8270E	2500	Q	ug/kg	44
008	385-4-UT-5	Solid	Pyrene	8270E	3000	Q	ug/kg	44
008	385-4-UT-5	Solid	PFBS	PFAS by ID	0.22	J	ug/kg	45
008	385-4-UT-5	Solid	PFOSA	PFAS by ID	0.24	J	ug/kg	45
008	385-4-UT-5	Solid	PFPeS	PFAS by ID	0.33	J	ug/kg	45
008	385-4-UT-5	Solid	PFHxS	PFAS by ID	6.5		ug/kg	45
008	385-4-UT-5	Solid	PFBA	PFAS by ID	0.31	BJ	ug/kg	45
008	385-4-UT-5	Solid	PFHpA	PFAS by ID	0.70	J	ug/kg	45
008	385-4-UT-5	Solid	PFHxA	PFAS by ID	1.1		ug/kg	45
008	385-4-UT-5	Solid	PFOA	PFAS by ID	1.1		ug/kg	45
008	385-4-UT-5	Solid	PFPeA	PFAS by ID	0.56	J	ug/kg	45
008	385-4-UT-5	Solid	PFOS	PFAS by ID	11		ug/kg	45
008	385-4-UT-5	Solid	PFBS	PFAS by ID	12	J	ng/L	47
008	385-4-UT-5	Solid	PFHxS	PFAS by ID	190		ng/L	47
008	385-4-UT-5	Solid	PFHpA	PFAS by ID	24	J	ng/L	47
008	385-4-UT-5	Solid	PFHxA	PFAS by ID	33	J	ng/L	47
008	385-4-UT-5	Solid	PFOA	PFAS by ID	39	J	ng/L	47
008	385-4-UT-5	Solid	PFPeA	PFAS by ID	17	J	ng/L	47
008	385-4-UT-5	Solid	PFOS	PFAS by ID	270		ng/L	47

Sample	Sample ID	Matrix	Parameter	Method	Result	Q	Units	Page

(185 detections)

Semivolatile Organic Compounds by GC/MS

Client: Arcadis U.S., Inc. | Laboratory ID: WI22013-001
Description: 385-4-S-2 | Matrix: Solid
Date Sampled: 09/17/2021 1215 | Project Name: Eielson AFB Soil Washing | % Solids: 89.5 09/22/2021 2333
Date Received: 09/22/2021 | Project Number: 30030317

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch
1	3546	8270E	20	09/24/2021 1838	SCD	09/23/2021 2120	16363

Parameter	CAS Number	Analytical Method	Result	Q	LOQ	LOD	DL	Units	Run
Acenaphthene	83-32-9	8270E	190	Q	60	44	19	ug/kg	1
Acenaphthylene	208-96-8	8270E	52	JQ	60	44	21	ug/kg	1
Anthracene	120-12-7	8270E	460	Q	60	44	11	ug/kg	1
Benzo(a)anthracene	56-55-3	8270E	1600	Q	60	44	13	ug/kg	1
Benzo(a)pyrene	50-32-8	8270E	2100	Q	60	44	15	ug/kg	1
Benzo(b)fluoranthene	205-99-2	8270E	2300	Q	60	44	11	ug/kg	1
Benzo(g,h,i)perylene	191-24-2	8270E	1100	Q	60	44	15	ug/kg	1
Benzo(k)fluoranthene	207-08-9	8270E	900	Q	60	33	11	ug/kg	1
Chrysene	218-01-9	8270E	1800	Q	60	33	10	ug/kg	1
Dibenzo(a,h)anthracene	53-70-3	8270E	44	UQ	60	44	11	ug/kg	1
Fluoranthene	206-44-0	8270E	3700	Q	60	33	9.4	ug/kg	1
Fluorene	86-73-7	8270E	230	Q	60	44	13	ug/kg	1
Indeno(1,2,3-c,d)pyrene	193-39-5	8270E	980	Q	60	44	22	ug/kg	1
1-Methylnaphthalene	90-12-0	8270E	49	JQ	60	44	22	ug/kg	1
2-Methylnaphthalene	91-57-6	8270E	53	JQ	60	44	22	ug/kg	1
Naphthalene	91-20-3	8270E	44	JQ	60	44	22	ug/kg	1
Phenanthrene	85-01-8	8270E	2800	Q	60	44	16	ug/kg	1
Pyrene	129-00-0	8270E	3400	Q	60	44	11	ug/kg	1

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
2-Fluorobiphenyl		80	44-115
Nitrobenzene-d5	N	170	37-122
Terphenyl-d14		91	54-127

LOQ = Limit of Quantitation | B = Detected in the method blank | E = Quantitation of compound exceeded the calibration range | DL = Detection Limit | Q = Surrogate failure
U = Not detected at or above the LOQ | N = Recovery is out of criteria | P = The RPD between two GC columns exceeds 40% | J = Estimated result < LOQ and ≥ DL | L = LCS/LCSD failure
H = Out of holding time | W = Reported on wet weight basis | LOD = Limit of Detection | S = MS/MSD failure

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PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: WI22013-001
Description: 385-4-S-2 | Matrix: Solid
Date Sampled: 09/17/2021 1215 | Project Name: Eielson AFB Soil Washing | % Solids: 89.5 09/22/2021 2333
Date Received: 09/22/2021 | Project Number: 30030317

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch
1	SOP SPE	PFAS by ID SOP QSM B-15	1	09/23/2021 1144	MMM	09/22/2021 1715	16193

Parameter	CAS Number	Analytical Method	Result	Q	LOQ	LOD	DL	Units	Run
1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS)	39108-34-4	PFAS by ID SOP	1.0	U	2.0	1.0	0.50	ug/kg	1
1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS)	27619-97-2	PFAS by ID SOP	1.0	U	2.0	1.0	0.50	ug/kg	1
1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS)	757124-72-4	PFAS by ID SOP	1.0	U	2.0	1.0	0.50	ug/kg	1
N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA)	2991-50-6	PFAS by ID SOP	1.0	U	2.0	1.0	0.50	ug/kg	1
N-methylperfluoro-1-octanesulfonamide (MeFOSA)	31506-32-8	PFAS by ID SOP	1.0	U	2.0	1.0	0.50	ug/kg	1
N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA)	2355-31-9	PFAS by ID SOP	1.0	U	2.0	1.0	0.50	ug/kg	1
Perfluoro-1-butanesulfonic acid (PFBS)	375-73-5	PFAS by ID SOP	0.50	U	1.0	0.50	0.20	ug/kg	1
Perfluoro-1-decanesulfonic acid (PFDS)	335-77-3	PFAS by ID SOP	0.50	U	1.0	0.50	0.20	ug/kg	1
Perfluoro-1-heptanesulfonic acid (PFHpS)	375-92-8	PFAS by ID SOP	0.50	U	1.0	0.50	0.20	ug/kg	1
Perfluoro-1-nonanesulfonic acid (PFNS)	68259-12-1	PFAS by ID SOP	0.50	U	1.0	0.50	0.20	ug/kg	1
Perfluoro-1-octanesulfonamide (PFOSA)	754-91-6	PFAS by ID SOP	0.50	U	1.0	0.50	0.20	ug/kg	1
Perfluoro-1-pentanesulfonic acid (PFPeS)	2706-91-4	PFAS by ID SOP	0.50	U	1.0	0.50	0.20	ug/kg	1
Perfluorohexanesulfonic acid (PFHxS)	355-46-4	PFAS by ID SOP	0.31	J	1.0	0.50	0.20	ug/kg	1
Perfluoro-n-butanoic acid (PFBA)	375-22-4	PFAS by ID SOP	0.50	U	1.0	0.50	0.20	ug/kg	1
Perfluoro-n-decanoic acid (PFDA)	335-76-2	PFAS by ID SOP	0.50	U	1.0	0.50	0.20	ug/kg	1
Perfluoro-n-dodecanoic acid (PFDoA)	307-55-1	PFAS by ID SOP	0.50	U	1.0	0.50	0.20	ug/kg	1
Perfluoro-n-heptanoic acid (PFHpA)	375-85-9	PFAS by ID SOP	0.50	U	1.0	0.50	0.20	ug/kg	1
Perfluoro-n-hexanoic acid (PFHxA)	307-24-4	PFAS by ID SOP	0.50	U	1.0	0.50	0.20	ug/kg	1
Perfluoro-n-nonanoic acid (PFNA)	375-95-1	PFAS by ID SOP	0.50	U	1.0	0.50	0.20	ug/kg	1
Perfluoro-n-octanoic acid (PFOA)	335-67-1	PFAS by ID SOP	0.50	U	1.0	0.50	0.20	ug/kg	1
Perfluoro-n-pentanoic acid (PFPeA)	2706-90-3	PFAS by ID SOP	0.50	U	1.0	0.50	0.20	ug/kg	1
Perfluoro-n-tetradecanoic acid (PFTeDA)	376-06-7	PFAS by ID SOP	0.50	U	1.0	0.50	0.20	ug/kg	1
Perfluoro-n-tridecanoic acid (PFTrDA)	72629-94-8	PFAS by ID SOP	0.50	U	1.0	0.50	0.20	ug/kg	1
Perfluoro-n-undecanoic acid (PFUdA)	2058-94-8	PFAS by ID SOP	0.50	U	1.0	0.50	0.20	ug/kg	1
Perfluorooctanesulfonic acid (PFOS)	1763-23-1	PFAS by ID SOP	0.87	J	1.0	0.50	0.20	ug/kg	1

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
13C2_4:2FTS		90	50-150
13C2_6:2FTS		99	50-150
13C2_8:2FTS		130	50-150
13C2_PFDoA		95	50-150
13C2_PFTeDA		95	50-150
13C3_PFBS		95	50-150
13C3_PFHxS		92	50-150
13C4_PFBA		94	50-150
13C4_PFHpA		93	50-150
13C5_PFHxA		91	50-150
13C5_PFPeA		92	50-150
13C6_PFDA		87	50-150
13C7_PFUdA		101	50-150
13C8_PFOA		97	50-150
13C8_PFOS		90	50-150
13C8_PFOSA		96	50-150
13C9_PFNA		100	50-150

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

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PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.		Laboratory ID: WI22013-001
Description: 385-4-S-2		Matrix: Solid
Date Sampled: 09/17/2021 1215	Project Name: Eielson AFB Soil Washing	% Solids: 89.5 09/22/2021 2333
Date Received: 09/22/2021	Project Number: 30030317	

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
d5-EtFOSAA		102	50-150
d-MeFOSA		81	50-150
d3-MeFOSAA		95	50-150

LOQ = Limit of Quantitation	B = Detected in the method blank	E = Quantitation of compound exceeded the calibration range	DL = Detection Limit	Q = Surrogate failure
U = Not detected at or above the LOQ	N = Recovery is out of criteria	P = The RPD between two GC columns exceeds 40%	J = Estimated result < LOQ and ≥ DL	L = LCS/LCSD failure
H = Out of holding time	W = Reported on wet weight basis	LOD = Limit of Detection		S = MS/MSD failure

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SPLP PFAS

Client: Arcadis U.S., Inc. | Laboratory ID: WI22013-001
Description: 385-4-S-2 | Matrix: Solid
Date Sampled: 09/17/2021 1215 | Project Name: Eielson AFB Soil Washing | % Solids: 89.5 09/22/2021 2333
Date Received: 09/22/2021 | Project Number: 30030317

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch	Leachate Date
1	1312/PFAS	PFAS by ID SOP QSM B-15	1	10/01/2021 1319	MMM	09/30/2021 1724	17232	09/29/2021 0311

Parameter	CAS Number	Analytical Method	Result	Q	LOQ	LOD	DL	Units	Run
1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS)	39108-34-4	PFAS by ID SOP	40	U	80	40	20	ng/L	1
1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS)	27619-97-2	PFAS by ID SOP	40	U	80	40	20	ng/L	1
1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS)	757124-72-4	PFAS by ID SOP	40	U	80	40	20	ng/L	1
N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA)	2991-50-6	PFAS by ID SOP	40	U	80	40	20	ng/L	1
N-methylperfluoro-1-octanesulfonamide (MeFOSA)	31506-32-8	PFAS by ID SOP	80	U	160	80	40	ng/L	1
N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA)	2355-31-9	PFAS by ID SOP	40	U	80	40	20	ng/L	1
Perfluoro-1-butanesulfonic acid (PFBS)	375-73-5	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-1-decanesulfonic acid (PFDS)	335-77-3	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-1-heptanesulfonic acid (PFHpS)	375-92-8	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-1-nonanesulfonic acid (PFNS)	68259-12-1	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-1-octanesulfonamide (PFOSA)	754-91-6	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-1-pentanesulfonic acid (PFPeS)	2706-91-4	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluorohexanesulfonic acid (PFHxS)	355-46-4	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-n-butanoic acid (PFBA)	375-22-4	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-n-decanoic acid (PFDA)	335-76-2	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-n-dodecanoic acid (PFDoA)	307-55-1	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-n-heptanoic acid (PFHpA)	375-85-9	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-n-hexanoic acid (PFHxA)	307-24-4	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-n-nonanoic acid (PFNA)	375-95-1	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-n-octanoic acid (PFOA)	335-67-1	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-n-pentanoic acid (PFPeA)	2706-90-3	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-n-tetradecanoic acid (PFTeDA)	376-06-7	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-n-tridecanoic acid (PFTrDA)	72629-94-8	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-n-undecanoic acid (PFUdA)	2058-94-8	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluorooctanesulfonic acid (PFOS)	1763-23-1	PFAS by ID SOP	20	U	40	20	10	ng/L	1

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
13C2_4:2FTS		97	50-150
13C2_6:2FTS		119	50-150
13C2_8:2FTS		101	50-150
13C2_PFDoA		85	50-150
13C2_PFTeDA		91	50-150
13C3_PFBS		89	50-150
13C3_PFHxS		77	50-150
13C4_PFBA		90	50-150
13C4_PFHpA		92	50-150
13C5_PFHxA		102	50-150
13C5_PFPeA		102	50-150
13C6_PFDA		96	50-150
13C7_PFUdA		88	50-150
13C8_PFOA		87	50-150
13C8_PFOS		87	50-150
13C8_PFOSA		95	50-150
13C9_PFNA		88	50-150

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

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SPLP PFAS

Client: Arcadis U.S., Inc.		Laboratory ID: WI22013-001
Description: 385-4-S-2		Matrix: Solid
Date Sampled: 09/17/2021 1215	Project Name: Eielson AFB Soil Washing	% Solids: 89.5 09/22/2021 2333
Date Received: 09/22/2021	Project Number: 30030317	

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
d5-EtFOSAA		94	50-150
d-MeFOSA		76	50-150
d3-MeFOSAA		89	50-150

LOQ = Limit of Quantitation	B = Detected in the method blank	E = Quantitation of compound exceeded the calibration range	DL = Detection Limit	Q = Surrogate failure
U = Not detected at or above the LOQ	N = Recovery is out of criteria	P = The RPD between two GC columns exceeds 40%	J = Estimated result < LOQ and ≥ DL	L = LCS/LCSD failure
H = Out of holding time	W = Reported on wet weight basis	LOD = Limit of Detection		S = MS/MSD failure

Semivolatile Organic Compounds by GC/MS

Client: Arcadis U.S., Inc. | Laboratory ID: WI22013-002
Description: 385-4-S-3 | Matrix: Solid
Date Sampled: 09/18/2021 1700 | Project Name: Eielson AFB Soil Washing | % Solids: 89.3 09/22/2021 2333
Date Received: 09/22/2021 | Project Number: 30030317

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch
1	3546	8270E	20	09/24/2021 1903	SCD	09/23/2021 2120	16363

Parameter	CAS Number	Analytical Method	Result	Q	LOQ	LOD	DL	Units	Run
Acenaphthene	83-32-9	8270E	600	Q	58	43	18	ug/kg	1
Acenaphthylene	208-96-8	8270E	92	Q	58	43	20	ug/kg	1
Anthracene	120-12-7	8270E	1300	Q	58	43	11	ug/kg	1
Benzo(a)anthracene	56-55-3	8270E	2600	Q	58	43	13	ug/kg	1
Benzo(a)pyrene	50-32-8	8270E	3100	Q	58	43	14	ug/kg	1
Benzo(b)fluoranthene	205-99-2	8270E	3600	Q	58	43	11	ug/kg	1
Benzo(g,h,i)perylene	191-24-2	8270E	1400	Q	58	43	14	ug/kg	1
Benzo(k)fluoranthene	207-08-9	8270E	1400	Q	58	32	10	ug/kg	1
Chrysene	218-01-9	8270E	2800	Q	58	32	9.7	ug/kg	1
Dibenzo(a,h)anthracene	53-70-3	8270E	43	UQ	58	43	11	ug/kg	1
Fluoranthene	206-44-0	8270E	6800	Q	58	32	9.0	ug/kg	1
Fluorene	86-73-7	8270E	720	Q	58	43	12	ug/kg	1
Indeno(1,2,3-c,d)pyrene	193-39-5	8270E	1300	Q	58	43	22	ug/kg	1
1-Methylnaphthalene	90-12-0	8270E	140	Q	58	43	21	ug/kg	1
2-Methylnaphthalene	91-57-6	8270E	170	Q	58	43	21	ug/kg	1
Naphthalene	91-20-3	8270E	160	Q	58	43	21	ug/kg	1
Phenanthrene	85-01-8	8270E	6700	Q	58	43	16	ug/kg	1
Pyrene	129-00-0	8270E	6000	Q	58	43	11	ug/kg	1

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
2-Fluorobiphenyl		76	44-115
Nitrobenzene-d5	N	164	37-122
Terphenyl-d14		82	54-127

LOQ = Limit of Quantitation | B = Detected in the method blank | E = Quantitation of compound exceeded the calibration range | DL = Detection Limit | Q = Surrogate failure
U = Not detected at or above the LOQ | N = Recovery is out of criteria | P = The RPD between two GC columns exceeds 40% | J = Estimated result < LOQ and ≥ DL | L = LCS/LCSD failure
H = Out of holding time | W = Reported on wet weight basis | LOD = Limit of Detection | S = MS/MSD failure

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PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: WI22013-002
Description: 385-4-S-3 | Matrix: Solid
Date Sampled: 09/18/2021 1700 | Project Name: Eielson AFB Soil Washing | % Solids: 89.3 09/22/2021 2333
Date Received: 09/22/2021 | Project Number: 30030317

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch
1	SOP SPE	PFAS by ID SOP QSM B-15	1	09/23/2021 1215	MMM	09/22/2021 1715	16193

Parameter	CAS Number	Analytical Method	Result	Q	LOQ	LOD	DL	Units	Run
1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS)	39108-34-4	PFAS by ID SOP	0.95	U	1.9	0.95	0.49	ug/kg	1
1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS)	27619-97-2	PFAS by ID SOP	0.95	U	1.9	0.95	0.49	ug/kg	1
1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS)	757124-72-4	PFAS by ID SOP	0.95	U	1.9	0.95	0.49	ug/kg	1
N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA)	2991-50-6	PFAS by ID SOP	0.95	U	1.9	0.95	0.49	ug/kg	1
N-methylperfluoro-1-octanesulfonamide (MeFOSA)	31506-32-8	PFAS by ID SOP	0.95	U	1.9	0.95	0.49	ug/kg	1
N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA)	2355-31-9	PFAS by ID SOP	0.95	U	1.9	0.95	0.49	ug/kg	1
Perfluoro-1-butanesulfonic acid (PFBS)	375-73-5	PFAS by ID SOP	0.49	U	0.97	0.49	0.19	ug/kg	1
Perfluoro-1-decanesulfonic acid (PFDS)	335-77-3	PFAS by ID SOP	0.49	U	0.97	0.49	0.19	ug/kg	1
Perfluoro-1-heptanesulfonic acid (PFHpS)	375-92-8	PFAS by ID SOP	0.49	U	0.97	0.49	0.19	ug/kg	1
Perfluoro-1-nonanesulfonic acid (PFNS)	68259-12-1	PFAS by ID SOP	0.49	U	0.97	0.49	0.19	ug/kg	1
Perfluoro-1-octanesulfonamide (PFOSA)	754-91-6	PFAS by ID SOP	0.49	U	0.97	0.49	0.19	ug/kg	1
Perfluoro-1-pentanesulfonic acid (PFPeS)	2706-91-4	PFAS by ID SOP	0.49	U	0.97	0.49	0.19	ug/kg	1
Perfluorohexanesulfonic acid (PFHxS)	355-46-4	PFAS by ID SOP	0.59	J	0.97	0.49	0.19	ug/kg	1
Perfluoro-n-butanoic acid (PFBA)	375-22-4	PFAS by ID SOP	0.49	U	0.97	0.49	0.19	ug/kg	1
Perfluoro-n-decanoic acid (PFDA)	335-76-2	PFAS by ID SOP	0.49	U	0.97	0.49	0.19	ug/kg	1
Perfluoro-n-dodecanoic acid (PFDoA)	307-55-1	PFAS by ID SOP	0.49	U	0.97	0.49	0.19	ug/kg	1
Perfluoro-n-heptanoic acid (PFHpA)	375-85-9	PFAS by ID SOP	0.49	U	0.97	0.49	0.19	ug/kg	1
Perfluoro-n-hexanoic acid (PFHxA)	307-24-4	PFAS by ID SOP	0.49	U	0.97	0.49	0.19	ug/kg	1
Perfluoro-n-nonanoic acid (PFNA)	375-95-1	PFAS by ID SOP	0.49	U	0.97	0.49	0.19	ug/kg	1
Perfluoro-n-octanoic acid (PFOA)	335-67-1	PFAS by ID SOP	0.49	U	0.97	0.49	0.19	ug/kg	1
Perfluoro-n-pentanoic acid (PFPeA)	2706-90-3	PFAS by ID SOP	0.49	U	0.97	0.49	0.19	ug/kg	1
Perfluoro-n-tetradecanoic acid (PFTeDA)	376-06-7	PFAS by ID SOP	0.49	U	0.97	0.49	0.19	ug/kg	1
Perfluoro-n-tridecanoic acid (PFTrDA)	72629-94-8	PFAS by ID SOP	0.49	U	0.97	0.49	0.19	ug/kg	1
Perfluoro-n-undecanoic acid (PFUdA)	2058-94-8	PFAS by ID SOP	0.49	U	0.97	0.49	0.19	ug/kg	1
Perfluorooctanesulfonic acid (PFOS)	1763-23-1	PFAS by ID SOP	1.1		0.97	0.49	0.19	ug/kg	1

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
13C2_4:2FTS		87	50-150
13C2_6:2FTS		105	50-150
13C2_8:2FTS		129	50-150
13C2_PFDoA		108	50-150
13C2_PFTeDA		99	50-150
13C3_PFBS		102	50-150
13C3_PFHxS		93	50-150
13C4_PFBA		95	50-150
13C4_PFHpA		92	50-150
13C5_PFHxA		98	50-150
13C5_PFPeA		95	50-150
13C6_PFDA		99	50-150
13C7_PFUdA		102	50-150
13C8_PFOA		104	50-150
13C8_PFOS		89	50-150
13C8_PFOSA		103	50-150
13C9_PFNA		98	50-150

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

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PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.		Laboratory ID: WI22013-002
Description: 385-4-S-3		Matrix: Solid
Date Sampled: 09/18/2021 1700	Project Name: Eielson AFB Soil Washing	% Solids: 89.3 09/22/2021 2333
Date Received: 09/22/2021	Project Number: 30030317	

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
d5-EtFOSAA		108	50-150
d-MeFOSA		95	50-150
d3-MeFOSAA		102	50-150

LOQ = Limit of Quantitation	B = Detected in the method blank	E = Quantitation of compound exceeded the calibration range	DL = Detection Limit	Q = Surrogate failure
U = Not detected at or above the LOQ	N = Recovery is out of criteria	P = The RPD between two GC columns exceeds 40%	J = Estimated result < LOQ and ≥ DL	L = LCS/LCSD failure
H = Out of holding time	W = Reported on wet weight basis	LOD = Limit of Detection		S = MS/MSD failure

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SPLP PFAS

Client: Arcadis U.S., Inc. | Laboratory ID: WI22013-002
Description: 385-4-S-3 | Matrix: Solid
Date Sampled: 09/18/2021 1700 | Project Name: Eielson AFB Soil Washing | % Solids: 89.3 09/22/2021 2333
Date Received: 09/22/2021 | Project Number: 30030317

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch	Leachate Date
1	1312/PFAS	PFAS by ID SOP QSM B-15	1	10/01/2021 1330	MMM	09/30/2021 1724	17232	09/29/2021 0311

Parameter	CAS Number	Analytical Method	Result	Q	LOQ	LOD	DL	Units	Run
1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS)	39108-34-4	PFAS by ID SOP	40	U	80	40	20	ng/L	1
1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS)	27619-97-2	PFAS by ID SOP	40	U	80	40	20	ng/L	1
1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS)	757124-72-4	PFAS by ID SOP	40	U	80	40	20	ng/L	1
N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA)	2991-50-6	PFAS by ID SOP	40	U	80	40	20	ng/L	1
N-methylperfluoro-1-octanesulfonamide (MeFOSA)	31506-32-8	PFAS by ID SOP	80	U	160	80	40	ng/L	1
N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA)	2355-31-9	PFAS by ID SOP	40	U	80	40	20	ng/L	1
Perfluoro-1-butanesulfonic acid (PFBS)	375-73-5	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-1-decanesulfonic acid (PFDS)	335-77-3	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-1-heptanesulfonic acid (PFHpS)	375-92-8	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-1-nonanesulfonic acid (PFNS)	68259-12-1	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-1-octanesulfonamide (PFOSA)	754-91-6	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-1-pentanesulfonic acid (PFPeS)	2706-91-4	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluorohexanesulfonic acid (PFHxS)	355-46-4	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-n-butanoic acid (PFBA)	375-22-4	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-n-decanoic acid (PFDA)	335-76-2	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-n-dodecanoic acid (PFDoA)	307-55-1	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-n-heptanoic acid (PFHpA)	375-85-9	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-n-hexanoic acid (PFHxA)	307-24-4	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-n-nonanoic acid (PFNA)	375-95-1	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-n-octanoic acid (PFOA)	335-67-1	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-n-pentanoic acid (PFPeA)	2706-90-3	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-n-tetradecanoic acid (PFTeDA)	376-06-7	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-n-tridecanoic acid (PFTrDA)	72629-94-8	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-n-undecanoic acid (PFUdA)	2058-94-8	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluorooctanesulfonic acid (PFOS)	1763-23-1	PFAS by ID SOP	11	J	40	20	10	ng/L	1

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
13C2_4:2FTS		108	50-150
13C2_6:2FTS		120	50-150
13C2_8:2FTS		115	50-150
13C2_PFDoA		101	50-150
13C2_PFTeDA		101	50-150
13C3_PFBS		96	50-150
13C3_PFHxS		81	50-150
13C4_PFBA		94	50-150
13C4_PFHpA		104	50-150
13C5_PFHxA		100	50-150
13C5_PFPeA		106	50-150
13C6_PFDA		103	50-150
13C7_PFUdA		96	50-150
13C8_PFOA		98	50-150
13C8_PFOS		97	50-150
13C8_PFOSA		108	50-150
13C9_PFNA		97	50-150

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

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SPLP PFAS

Client: Arcadis U.S., Inc.		Laboratory ID: WI22013-002
Description: 385-4-S-3		Matrix: Solid
Date Sampled: 09/18/2021 1700	Project Name: Eielson AFB Soil Washing	% Solids: 89.3 09/22/2021 2333
Date Received: 09/22/2021	Project Number: 30030317	

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
d5-EtFOSAA		108	50-150
d-MeFOSA		75	50-150
d3-MeFOSAA		97	50-150

LOQ = Limit of Quantitation	B = Detected in the method blank	E = Quantitation of compound exceeded the calibration range	DL = Detection Limit	Q = Surrogate failure
U = Not detected at or above the LOQ	N = Recovery is out of criteria	P = The RPD between two GC columns exceeds 40%	J = Estimated result < LOQ and ≥ DL	L = LCS/LCSD failure
H = Out of holding time	W = Reported on wet weight basis	LOD = Limit of Detection		S = MS/MSD failure

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Semivolatile Organic Compounds by GC/MS

Client: Arcadis U.S., Inc. | Laboratory ID: WI22013-003
Description: 385-4-G-2 | Matrix: Solid
Date Sampled: 09/17/2021 1230 | Project Name: Eielson AFB Soil Washing | % Solids: 98.6 09/22/2021 2333
Date Received: 09/22/2021 | Project Number: 30030317

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch
1	3546	8270E	1	09/24/2021 1927	SCD	09/23/2021 2120	16363

Parameter	CAS Number	Analytical Method	Result	Q	LOQ	LOD	DL	Units	Run
Acenaphthene	83-32-9	8270E	2.0	U	2.7	2.0	0.82	ug/kg	1
Acenaphthylene	208-96-8	8270E	2.0	U	2.7	2.0	0.94	ug/kg	1
Anthracene	120-12-7	8270E	2.0	U	2.7	2.0	0.50	ug/kg	1
Benzo(a)anthracene	56-55-3	8270E	2.6	J	2.7	2.0	0.58	ug/kg	1
Benzo(a)pyrene	50-32-8	8270E	3.9		2.7	2.0	0.65	ug/kg	1
Benzo(b)fluoranthene	205-99-2	8270E	4.0		2.7	2.0	0.49	ug/kg	1
Benzo(g,h,i)perylene	191-24-2	8270E	3.3		2.7	2.0	0.64	ug/kg	1
Benzo(k)fluoranthene	207-08-9	8270E	1.6	J	2.7	1.5	0.47	ug/kg	1
Chrysene	218-01-9	8270E	2.1	J	2.7	1.5	0.44	ug/kg	1
Dibenzo(a,h)anthracene	53-70-3	8270E	2.0	U	2.7	2.0	0.50	ug/kg	1
Fluoranthene	206-44-0	8270E	2.8		2.7	1.5	0.41	ug/kg	1
Fluorene	86-73-7	8270E	2.0	U	2.7	2.0	0.56	ug/kg	1
Indeno(1,2,3-c,d)pyrene	193-39-5	8270E	2.6	J	2.7	2.0	0.99	ug/kg	1
1-Methylnaphthalene	90-12-0	8270E	2.0	U	2.7	2.0	0.97	ug/kg	1
2-Methylnaphthalene	91-57-6	8270E	2.0	U	2.7	2.0	0.98	ug/kg	1
Naphthalene	91-20-3	8270E	2.0	U	2.7	2.0	0.96	ug/kg	1
Phenanthrene	85-01-8	8270E	1.6	J	2.7	2.0	0.71	ug/kg	1
Pyrene	129-00-0	8270E	3.4		2.7	2.0	0.49	ug/kg	1

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
2-Fluorobiphenyl		68	44-115
Nitrobenzene-d5		64	37-122
Terphenyl-d14		80	54-127

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

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PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: WI22013-003
Description: 385-4-G-2 | Matrix: Solid
Date Sampled: 09/17/2021 1230 | Project Name: Eielson AFB Soil Washing | % Solids: 98.6 09/22/2021 2333
Date Received: 09/22/2021 | Project Number: 30030317

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch
1	SOP SPE	PFAS by ID SOP QSM B-15	1	09/23/2021 1226	MMM	09/22/2021 1715	16193

Parameter	CAS Number	Analytical Method	Result	Q	LOQ	LOD	DL	Units	Run
1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS)	39108-34-4	PFAS by ID SOP	0.85	U	1.7	0.85	0.43	ug/kg	1
1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS)	27619-97-2	PFAS by ID SOP	0.85	U	1.7	0.85	0.43	ug/kg	1
1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS)	757124-72-4	PFAS by ID SOP	0.85	U	1.7	0.85	0.43	ug/kg	1
N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA)	2991-50-6	PFAS by ID SOP	0.85	U	1.7	0.85	0.43	ug/kg	1
N-methylperfluoro-1-octanesulfonamide (MeFOSA)	31506-32-8	PFAS by ID SOP	0.85	U	1.7	0.85	0.43	ug/kg	1
N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA)	2355-31-9	PFAS by ID SOP	0.85	U	1.7	0.85	0.43	ug/kg	1
Perfluoro-1-butanesulfonic acid (PFBS)	375-73-5	PFAS by ID SOP	0.44	U	0.87	0.44	0.17	ug/kg	1
Perfluoro-1-decanesulfonic acid (PFDS)	335-77-3	PFAS by ID SOP	0.44	U	0.87	0.44	0.17	ug/kg	1
Perfluoro-1-heptanesulfonic acid (PFHpS)	375-92-8	PFAS by ID SOP	0.44	U	0.87	0.44	0.17	ug/kg	1
Perfluoro-1-nonanesulfonic acid (PFNS)	68259-12-1	PFAS by ID SOP	0.44	U	0.87	0.44	0.17	ug/kg	1
Perfluoro-1-octanesulfonamide (PFOSA)	754-91-6	PFAS by ID SOP	0.44	U	0.87	0.44	0.17	ug/kg	1
Perfluoro-1-pentanesulfonic acid (PFPeS)	2706-91-4	PFAS by ID SOP	0.44	U	0.87	0.44	0.17	ug/kg	1
Perfluorohexanesulfonic acid (PFHxS)	355-46-4	PFAS by ID SOP	0.44	U	0.87	0.44	0.17	ug/kg	1
Perfluoro-n-butanoic acid (PFBA)	375-22-4	PFAS by ID SOP	0.44	U	0.87	0.44	0.17	ug/kg	1
Perfluoro-n-decanoic acid (PFDA)	335-76-2	PFAS by ID SOP	0.44	U	0.87	0.44	0.17	ug/kg	1
Perfluoro-n-dodecanoic acid (PFDoA)	307-55-1	PFAS by ID SOP	0.44	U	0.87	0.44	0.17	ug/kg	1
Perfluoro-n-heptanoic acid (PFHpA)	375-85-9	PFAS by ID SOP	0.44	U	0.87	0.44	0.17	ug/kg	1
Perfluoro-n-hexanoic acid (PFHxA)	307-24-4	PFAS by ID SOP	0.44	U	0.87	0.44	0.17	ug/kg	1
Perfluoro-n-nonanoic acid (PFNA)	375-95-1	PFAS by ID SOP	0.44	U	0.87	0.44	0.17	ug/kg	1
Perfluoro-n-octanoic acid (PFOA)	335-67-1	PFAS by ID SOP	0.44	U	0.87	0.44	0.17	ug/kg	1
Perfluoro-n-pentanoic acid (PFPeA)	2706-90-3	PFAS by ID SOP	0.44	U	0.87	0.44	0.17	ug/kg	1
Perfluoro-n-tetradecanoic acid (PFTeDA)	376-06-7	PFAS by ID SOP	0.44	U	0.87	0.44	0.17	ug/kg	1
Perfluoro-n-tridecanoic acid (PFTrDA)	72629-94-8	PFAS by ID SOP	0.44	U	0.87	0.44	0.17	ug/kg	1
Perfluoro-n-undecanoic acid (PFUdA)	2058-94-8	PFAS by ID SOP	0.44	U	0.87	0.44	0.17	ug/kg	1
Perfluorooctanesulfonic acid (PFOS)	1763-23-1	PFAS by ID SOP	0.44	U	0.87	0.44	0.17	ug/kg	1

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
13C2_4:2FTS		99	50-150
13C2_6:2FTS		101	50-150
13C2_8:2FTS		107	50-150
13C2_PFDoA		104	50-150
13C2_PFTeDA		103	50-150
13C3_PFBS		106	50-150
13C3_PFHxS		94	50-150
13C4_PFBA		98	50-150
13C4_PFHpA		106	50-150
13C5_PFHxA		94	50-150
13C5_PFPeA		94	50-150
13C6_PFDA		99	50-150
13C7_PFUdA		104	50-150
13C8_PFOA		98	50-150
13C8_PFOS		103	50-150
13C8_PFOSA		102	50-150
13C9_PFNA		99	50-150

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

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PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.		Laboratory ID: WI22013-003
Description: 385-4-G-2		Matrix: Solid
Date Sampled: 09/17/2021 1230	Project Name: Eielson AFB Soil Washing	% Solids: 98.6 09/22/2021 2333
Date Received: 09/22/2021	Project Number: 30030317	

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
d5-EtFOSAA		104	50-150
d-MeFOSA		97	50-150
d3-MeFOSAA		103	50-150

LOQ = Limit of Quantitation	B = Detected in the method blank	E = Quantitation of compound exceeded the calibration range	DL = Detection Limit	Q = Surrogate failure
U = Not detected at or above the LOQ	N = Recovery is out of criteria	P = The RPD between two GC columns exceeds 40%	J = Estimated result < LOQ and ≥ DL	L = LCS/LCSD failure
H = Out of holding time	W = Reported on wet weight basis	LOD = Limit of Detection		S = MS/MSD failure

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SPLP PFAS

Client: Arcadis U.S., Inc. | Laboratory ID: WI22013-003
Description: 385-4-G-2 | Matrix: Solid
Date Sampled: 09/17/2021 1230 | Project Name: Eielson AFB Soil Washing | % Solids: 98.6 09/22/2021 2333
Date Received: 09/22/2021 | Project Number: 30030317

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch	Leachate Date
1	1312/PFAS	PFAS by ID SOP QSM B-15	1	10/01/2021 1340	MMM	09/30/2021 1724	17232	09/29/2021 0311

Parameter	CAS Number	Analytical Method	Result	Q	LOQ	LOD	DL	Units	Run
1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS)	39108-34-4	PFAS by ID SOP	40	U	80	40	20	ng/L	1
1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS)	27619-97-2	PFAS by ID SOP	40	U	80	40	20	ng/L	1
1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS)	757124-72-4	PFAS by ID SOP	40	U	80	40	20	ng/L	1
N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA)	2991-50-6	PFAS by ID SOP	40	U	80	40	20	ng/L	1
N-methylperfluoro-1-octanesulfonamide (MeFOSA)	31506-32-8	PFAS by ID SOP	80	U	160	80	40	ng/L	1
N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA)	2355-31-9	PFAS by ID SOP	40	U	80	40	20	ng/L	1
Perfluoro-1-butanesulfonic acid (PFBS)	375-73-5	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-1-decanesulfonic acid (PFDS)	335-77-3	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-1-heptanesulfonic acid (PFHpS)	375-92-8	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-1-nonanesulfonic acid (PFNS)	68259-12-1	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-1-octanesulfonamide (PFOSA)	754-91-6	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-1-pentanesulfonic acid (PFPeS)	2706-91-4	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluorohexanesulfonic acid (PFHxS)	355-46-4	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-n-butanoic acid (PFBA)	375-22-4	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-n-decanoic acid (PFDA)	335-76-2	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-n-dodecanoic acid (PFDoA)	307-55-1	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-n-heptanoic acid (PFHpA)	375-85-9	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-n-hexanoic acid (PFHxA)	307-24-4	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-n-nonanoic acid (PFNA)	375-95-1	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-n-octanoic acid (PFOA)	335-67-1	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-n-pentanoic acid (PFPeA)	2706-90-3	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-n-tetradecanoic acid (PFTeDA)	376-06-7	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-n-tridecanoic acid (PFTrDA)	72629-94-8	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-n-undecanoic acid (PFUdA)	2058-94-8	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluorooctanesulfonic acid (PFOS)	1763-23-1	PFAS by ID SOP	20	U	40	20	10	ng/L	1

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
13C2_4:2FTS		101	50-150
13C2_6:2FTS		102	50-150
13C2_8:2FTS		99	50-150
13C2_PFDoA		94	50-150
13C2_PFTeDA		96	50-150
13C3_PFBS		91	50-150
13C3_PFHxS		79	50-150
13C4_PFBA		91	50-150
13C4_PFHpA		92	50-150
13C5_PFHxA		98	50-150
13C5_PFPeA		99	50-150
13C6_PFDA		96	50-150
13C7_PFUdA		86	50-150
13C8_PFOA		92	50-150
13C8_PFOS		91	50-150
13C8_PFOSA		102	50-150
13C9_PFNA		86	50-150

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

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SPLP PFAS

Client: Arcadis U.S., Inc.		Laboratory ID: WI22013-003
Description: 385-4-G-2		Matrix: Solid
Date Sampled: 09/17/2021 1230	Project Name: Eielson AFB Soil Washing	% Solids: 98.6 09/22/2021 2333
Date Received: 09/22/2021	Project Number: 30030317	

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
d5-EtFOSAA		102	50-150
d-MeFOSA		74	50-150
d3-MeFOSAA		89	50-150

LOQ = Limit of Quantitation	B = Detected in the method blank	E = Quantitation of compound exceeded the calibration range	DL = Detection Limit	Q = Surrogate failure
U = Not detected at or above the LOQ	N = Recovery is out of criteria	P = The RPD between two GC columns exceeds 40%	J = Estimated result < LOQ and ≥ DL	L = LCS/LCSD failure
H = Out of holding time	W = Reported on wet weight basis	LOD = Limit of Detection		S = MS/MSD failure

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Semivolatile Organic Compounds by GC/MS

Client: Arcadis U.S., Inc. | Laboratory ID: WI22013-004
Description: 385-4-G-3 | Matrix: Solid
Date Sampled: 09/18/2021 1615 | Project Name: Eielson AFB Soil Washing | % Solids: 98.6 09/22/2021 2333
Date Received: 09/22/2021 | Project Number: 30030317

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch
1	3546	8270E	1	09/24/2021 2155	SCD	09/23/2021 2120	16363

Parameter	CAS Number	Analytical Method	Result	Q	LOQ	LOD	DL	Units	Run
Acenaphthene	83-32-9	8270E	1.9	U	2.6	1.9	0.81	ug/kg	1
Acenaphthylene	208-96-8	8270E	1.9	U	2.6	1.9	0.93	ug/kg	1
Anthracene	120-12-7	8270E	1.9	U	2.6	1.9	0.50	ug/kg	1
Benzo(a)anthracene	56-55-3	8270E	2.1	J	2.6	1.9	0.58	ug/kg	1
Benzo(a)pyrene	50-32-8	8270E	2.5	J	2.6	1.9	0.65	ug/kg	1
Benzo(b)fluoranthene	205-99-2	8270E	3.0		2.6	1.9	0.49	ug/kg	1
Benzo(g,h,i)perylene	191-24-2	8270E	2.0	J	2.6	1.9	0.64	ug/kg	1
Benzo(k)fluoranthene	207-08-9	8270E	1.1	J	2.6	1.4	0.47	ug/kg	1
Chrysene	218-01-9	8270E	1.9	J	2.6	1.4	0.44	ug/kg	1
Dibenzo(a,h)anthracene	53-70-3	8270E	1.9	U	2.6	1.9	0.50	ug/kg	1
Fluoranthene	206-44-0	8270E	2.6		2.6	1.4	0.41	ug/kg	1
Fluorene	86-73-7	8270E	1.9	U	2.6	1.9	0.56	ug/kg	1
Indeno(1,2,3-c,d)pyrene	193-39-5	8270E	1.3	J	2.6	1.9	0.98	ug/kg	1
1-Methylnaphthalene	90-12-0	8270E	1.9	U	2.6	1.9	0.96	ug/kg	1
2-Methylnaphthalene	91-57-6	8270E	1.9	U	2.6	1.9	0.97	ug/kg	1
Naphthalene	91-20-3	8270E	1.9	U	2.6	1.9	0.95	ug/kg	1
Phenanthrene	85-01-8	8270E	1.5	J	2.6	1.9	0.71	ug/kg	1
Pyrene	129-00-0	8270E	3.0		2.6	1.9	0.49	ug/kg	1

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
2-Fluorobiphenyl		92	44-115
Nitrobenzene-d5		84	37-122
Terphenyl-d14		109	54-127

LOQ = Limit of Quantitation | B = Detected in the method blank | E = Quantitation of compound exceeded the calibration range | DL = Detection Limit | Q = Surrogate failure
U = Not detected at or above the LOQ | N = Recovery is out of criteria | P = The RPD between two GC columns exceeds 40% | J = Estimated result < LOQ and ≥ DL | L = LCS/LCSD failure
H = Out of holding time | W = Reported on wet weight basis | LOD = Limit of Detection | S = MS/MSD failure

PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: WI22013-004
Description: 385-4-G-3 | Matrix: Solid
Date Sampled: 09/18/2021 1615 | Project Name: Eielson AFB Soil Washing | % Solids: 98.6 09/22/2021 2333
Date Received: 09/22/2021 | Project Number: 30030317

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch
1	SOP SPE	PFAS by ID SOP QSM B-15	1	09/23/2021 1236	MMM	09/22/2021 1715	16193

Parameter	CAS Number	Analytical Method	Result	Q	LOQ	LOD	DL	Units	Run
1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS)	39108-34-4	PFAS by ID SOP	0.90	U	1.8	0.90	0.45	ug/kg	1
1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS)	27619-97-2	PFAS by ID SOP	0.90	U	1.8	0.90	0.45	ug/kg	1
1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS)	757124-72-4	PFAS by ID SOP	0.90	U	1.8	0.90	0.45	ug/kg	1
N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA)	2991-50-6	PFAS by ID SOP	0.90	U	1.8	0.90	0.45	ug/kg	1
N-methylperfluoro-1-octanesulfonamide (MeFOSA)	31506-32-8	PFAS by ID SOP	0.90	U	1.8	0.90	0.45	ug/kg	1
N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA)	2355-31-9	PFAS by ID SOP	0.90	U	1.8	0.90	0.45	ug/kg	1
Perfluoro-1-butanesulfonic acid (PFBS)	375-73-5	PFAS by ID SOP	0.46	U	0.91	0.46	0.18	ug/kg	1
Perfluoro-1-decanesulfonic acid (PFDS)	335-77-3	PFAS by ID SOP	0.46	U	0.91	0.46	0.18	ug/kg	1
Perfluoro-1-heptanesulfonic acid (PFHpS)	375-92-8	PFAS by ID SOP	0.46	U	0.91	0.46	0.18	ug/kg	1
Perfluoro-1-nonanesulfonic acid (PFNS)	68259-12-1	PFAS by ID SOP	0.46	U	0.91	0.46	0.18	ug/kg	1
Perfluoro-1-octanesulfonamide (PFOSA)	754-91-6	PFAS by ID SOP	0.46	U	0.91	0.46	0.18	ug/kg	1
Perfluoro-1-pentanesulfonic acid (PFPeS)	2706-91-4	PFAS by ID SOP	0.46	U	0.91	0.46	0.18	ug/kg	1
Perfluorohexanesulfonic acid (PFHxS)	355-46-4	PFAS by ID SOP	0.46	U	0.91	0.46	0.18	ug/kg	1
Perfluoro-n-butanoic acid (PFBA)	375-22-4	PFAS by ID SOP	0.46	U	0.91	0.46	0.18	ug/kg	1
Perfluoro-n-decanoic acid (PFDA)	335-76-2	PFAS by ID SOP	0.46	U	0.91	0.46	0.18	ug/kg	1
Perfluoro-n-dodecanoic acid (PFDoA)	307-55-1	PFAS by ID SOP	0.46	U	0.91	0.46	0.18	ug/kg	1
Perfluoro-n-heptanoic acid (PFHpA)	375-85-9	PFAS by ID SOP	0.46	U	0.91	0.46	0.18	ug/kg	1
Perfluoro-n-hexanoic acid (PFHxA)	307-24-4	PFAS by ID SOP	0.46	U	0.91	0.46	0.18	ug/kg	1
Perfluoro-n-nonanoic acid (PFNA)	375-95-1	PFAS by ID SOP	0.46	U	0.91	0.46	0.18	ug/kg	1
Perfluoro-n-octanoic acid (PFOA)	335-67-1	PFAS by ID SOP	0.46	U	0.91	0.46	0.18	ug/kg	1
Perfluoro-n-pentanoic acid (PFPeA)	2706-90-3	PFAS by ID SOP	0.46	U	0.91	0.46	0.18	ug/kg	1
Perfluoro-n-tetradecanoic acid (PFTeDA)	376-06-7	PFAS by ID SOP	0.46	U	0.91	0.46	0.18	ug/kg	1
Perfluoro-n-tridecanoic acid (PFTrDA)	72629-94-8	PFAS by ID SOP	0.46	U	0.91	0.46	0.18	ug/kg	1
Perfluoro-n-undecanoic acid (PFUdA)	2058-94-8	PFAS by ID SOP	0.46	U	0.91	0.46	0.18	ug/kg	1
Perfluorooctanesulfonic acid (PFOS)	1763-23-1	PFAS by ID SOP	0.46	U	0.91	0.46	0.18	ug/kg	1

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
13C2_4:2FTS		98	50-150
13C2_6:2FTS		106	50-150
13C2_8:2FTS		122	50-150
13C2_PFDoA		98	50-150
13C2_PFTeDA		104	50-150
13C3_PFBS		93	50-150
13C3_PFHxS		93	50-150
13C4_PFBA		95	50-150
13C4_PFHpA		109	50-150
13C5_PFHxA		93	50-150
13C5_PFPeA		97	50-150
13C6_PFDA		98	50-150
13C7_PFUdA		100	50-150
13C8_PFOA		97	50-150
13C8_PFOS		86	50-150
13C8_PFOSA		104	50-150
13C9_PFNA		98	50-150

LOQ = Limit of Quantitation | B = Detected in the method blank | E = Quantitation of compound exceeded the calibration range | DL = Detection Limit | Q = Surrogate failure
U = Not detected at or above the LOQ | N = Recovery is out of criteria | P = The RPD between two GC columns exceeds 40% | J = Estimated result < LOQ and ≥ DL | L = LCS/LCSD failure
H = Out of holding time | W = Reported on wet weight basis | LOD = Limit of Detection | S = MS/MSD failure

PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.		Laboratory ID: WI22013-004
Description: 385-4-G-3		Matrix: Solid
Date Sampled: 09/18/2021 1615	Project Name: Eielson AFB Soil Washing	% Solids: 98.6 09/22/2021 2333
Date Received: 09/22/2021	Project Number: 30030317	

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
d5-EtFOSAA		108	50-150
d-MeFOSA		93	50-150
d3-MeFOSAA		103	50-150

LOQ = Limit of Quantitation	B = Detected in the method blank	E = Quantitation of compound exceeded the calibration range	DL = Detection Limit	Q = Surrogate failure
U = Not detected at or above the LOQ	N = Recovery is out of criteria	P = The RPD between two GC columns exceeds 40%	J = Estimated result < LOQ and ≥ DL	L = LCS/LCSD failure
H = Out of holding time	W = Reported on wet weight basis	LOD = Limit of Detection		S = MS/MSD failure

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SPLP PFAS

Client: Arcadis U.S., Inc. | Laboratory ID: WI22013-004
Description: 385-4-G-3 | Matrix: Solid
Date Sampled: 09/18/2021 1615 | Project Name: Eielson AFB Soil Washing | % Solids: 98.6 09/22/2021 2333
Date Received: 09/22/2021 | Project Number: 30030317

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch	Leachate Date
1	1312/PFAS	PFAS by ID SOP QSM B-15	1	10/01/2021 1412	MMM	09/30/2021 1724	17232	09/29/2021 0311

Parameter	CAS Number	Analytical Method	Result	Q	LOQ	LOD	DL	Units	Run
1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS)	39108-34-4	PFAS by ID SOP	40	U	80	40	20	ng/L	1
1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS)	27619-97-2	PFAS by ID SOP	40	U	80	40	20	ng/L	1
1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS)	757124-72-4	PFAS by ID SOP	40	U	80	40	20	ng/L	1
N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA)	2991-50-6	PFAS by ID SOP	40	U	80	40	20	ng/L	1
N-methylperfluoro-1-octanesulfonamide (MeFOSA)	31506-32-8	PFAS by ID SOP	80	U	160	80	40	ng/L	1
N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA)	2355-31-9	PFAS by ID SOP	40	U	80	40	20	ng/L	1
Perfluoro-1-butanesulfonic acid (PFBS)	375-73-5	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-1-decanesulfonic acid (PFDS)	335-77-3	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-1-heptanesulfonic acid (PFHpS)	375-92-8	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-1-nonanesulfonic acid (PFNS)	68259-12-1	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-1-octanesulfonamide (PFOSA)	754-91-6	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-1-pentanesulfonic acid (PFPeS)	2706-91-4	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluorohexanesulfonic acid (PFHxS)	355-46-4	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-n-butanoic acid (PFBA)	375-22-4	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-n-decanoic acid (PFDA)	335-76-2	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-n-dodecanoic acid (PFDoA)	307-55-1	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-n-heptanoic acid (PFHpA)	375-85-9	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-n-hexanoic acid (PFHxA)	307-24-4	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-n-nonanoic acid (PFNA)	375-95-1	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-n-octanoic acid (PFOA)	335-67-1	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-n-pentanoic acid (PFPeA)	2706-90-3	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-n-tetradecanoic acid (PFTeDA)	376-06-7	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-n-tridecanoic acid (PFTrDA)	72629-94-8	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-n-undecanoic acid (PFUdA)	2058-94-8	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluorooctanesulfonic acid (PFOS)	1763-23-1	PFAS by ID SOP	20	U	40	20	10	ng/L	1

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
13C2_4:2FTS		115	50-150
13C2_6:2FTS		109	50-150
13C2_8:2FTS		105	50-150
13C2_PFDoA		98	50-150
13C2_PFTeDA		100	50-150
13C3_PFBS		94	50-150
13C3_PFHxS		80	50-150
13C4_PFBA		95	50-150
13C4_PFHpA		99	50-150
13C5_PFHxA		104	50-150
13C5_PFPeA		99	50-150
13C6_PFDA		97	50-150
13C7_PFUdA		91	50-150
13C8_PFOA		98	50-150
13C8_PFOS		99	50-150
13C8_PFOSA		124	50-150
13C9_PFNA		92	50-150

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

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SPLP PFAS

Client: Arcadis U.S., Inc.		Laboratory ID: WI22013-004
Description: 385-4-G-3		Matrix: Solid
Date Sampled: 09/18/2021 1615	Project Name: Eielson AFB Soil Washing	% Solids: 98.6 09/22/2021 2333
Date Received: 09/22/2021	Project Number: 30030317	

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
d5-EtFOSAA		104	50-150
d-MeFOSA		71	50-150
d3-MeFOSAA		96	50-150

LOQ = Limit of Quantitation	B = Detected in the method blank	E = Quantitation of compound exceeded the calibration range	DL = Detection Limit	Q = Surrogate failure
U = Not detected at or above the LOQ	N = Recovery is out of criteria	P = The RPD between two GC columns exceeds 40%	J = Estimated result < LOQ and ≥ DL	L = LCS/LCSD failure
H = Out of holding time	W = Reported on wet weight basis	LOD = Limit of Detection		S = MS/MSD failure

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Semivolatile Organic Compounds by GC/MS

Client: Arcadis U.S., Inc. | Laboratory ID: WI22013-005
Description: 385-4-UT-2 | Matrix: Solid
Date Sampled: 09/17/2021 1245 | Project Name: Eielson AFB Soil Washing | % Solids: 87.4 09/25/2021 2040
Date Received: 09/22/2021 | Project Number: 30030317

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch
1	3546	8270E	50	09/24/2021 2016	SCD	09/23/2021 2120	16363

Parameter	CAS Number	Analytical Method	Result	Q	LOQ	LOD	DL	Units	Run
Acenaphthene	83-32-9	8270E	96	JQ	150	110	45	ug/kg	1
Acenaphthylene	208-96-8	8270E	110	UQ	150	110	52	ug/kg	1
Anthracene	120-12-7	8270E	280	Q	150	110	28	ug/kg	1
Benzo(a)anthracene	56-55-3	8270E	910	Q	150	110	32	ug/kg	1
Benzo(a)pyrene	50-32-8	8270E	1500	Q	150	110	36	ug/kg	1
Benzo(b)fluoranthene	205-99-2	8270E	1700	Q	150	110	27	ug/kg	1
Benzo(g,h,i)perylene	191-24-2	8270E	810	Q	150	110	36	ug/kg	1
Benzo(k)fluoranthene	207-08-9	8270E	740	Q	150	83	26	ug/kg	1
Chrysene	218-01-9	8270E	1300	Q	150	83	25	ug/kg	1
Dibenzo(a,h)anthracene	53-70-3	8270E	110	UQ	150	110	28	ug/kg	1
Fluoranthene	206-44-0	8270E	2200	Q	150	83	23	ug/kg	1
Fluorene	86-73-7	8270E	110	JQ	150	110	31	ug/kg	1
Indeno(1,2,3-c,d)pyrene	193-39-5	8270E	720	Q	150	110	55	ug/kg	1
1-Methylnaphthalene	90-12-0	8270E	110	UQ	150	110	54	ug/kg	1
2-Methylnaphthalene	91-57-6	8270E	110	UQ	150	110	54	ug/kg	1
Naphthalene	91-20-3	8270E	110	UQ	150	110	53	ug/kg	1
Phenanthrene	85-01-8	8270E	1400	Q	150	110	39	ug/kg	1
Pyrene	129-00-0	8270E	2100	Q	150	110	27	ug/kg	1

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
2-Fluorobiphenyl		85	44-115
Nitrobenzene-d5	N	337	37-122
Terphenyl-d14		99	54-127

LOQ = Limit of Quantitation | B = Detected in the method blank | E = Quantitation of compound exceeded the calibration range | DL = Detection Limit | Q = Surrogate failure
U = Not detected at or above the LOQ | N = Recovery is out of criteria | P = The RPD between two GC columns exceeds 40% | J = Estimated result < LOQ and ≥ DL | L = LCS/LCSD failure
H = Out of holding time | W = Reported on wet weight basis | LOD = Limit of Detection | S = MS/MSD failure

PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: WI22013-005
Description: 385-4-UT-2 | Matrix: Solid
Date Sampled: 09/17/2021 1245 | Project Name: Eielson AFB Soil Washing | % Solids: 87.4 09/25/2021 2040
Date Received: 09/22/2021 | Project Number: 30030317

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch
1	SOP SPE	PFAS by ID SOP QSM B-15	1	09/23/2021 1247	MMM	09/22/2021 1715	16193

Parameter	CAS Number	Analytical Method	Result	Q	LOQ	LOD	DL	Units	Run
1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS)	39108-34-4	PFAS by ID SOP	1.1	U	2.2	1.1	0.56	ug/kg	1
1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS)	27619-97-2	PFAS by ID SOP	1.1	U	2.2	1.1	0.56	ug/kg	1
1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS)	757124-72-4	PFAS by ID SOP	1.1	U	2.2	1.1	0.56	ug/kg	1
N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA)	2991-50-6	PFAS by ID SOP	1.1	U	2.2	1.1	0.56	ug/kg	1
N-methylperfluoro-1-octanesulfonamide (MeFOSA)	31506-32-8	PFAS by ID SOP	1.1	U	2.2	1.1	0.56	ug/kg	1
N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA)	2355-31-9	PFAS by ID SOP	1.1	U	2.2	1.1	0.56	ug/kg	1
Perfluoro-1-butanesulfonic acid (PFBS)	375-73-5	PFAS by ID SOP	0.55	U	1.1	0.55	0.22	ug/kg	1
Perfluoro-1-decanesulfonic acid (PFDS)	335-77-3	PFAS by ID SOP	0.55	U	1.1	0.55	0.22	ug/kg	1
Perfluoro-1-heptanesulfonic acid (PFHpS)	375-92-8	PFAS by ID SOP	0.55	U	1.1	0.55	0.22	ug/kg	1
Perfluoro-1-nonanesulfonic acid (PFNS)	68259-12-1	PFAS by ID SOP	0.55	U	1.1	0.55	0.22	ug/kg	1
Perfluoro-1-octanesulfonamide (PFOSA)	754-91-6	PFAS by ID SOP	0.37	J	1.1	0.55	0.22	ug/kg	1
Perfluoro-1-pentanesulfonic acid (PFPeS)	2706-91-4	PFAS by ID SOP	0.29	J	1.1	0.55	0.22	ug/kg	1
Perfluorohexanesulfonic acid (PFHxS)	355-46-4	PFAS by ID SOP	7.0		1.1	0.55	0.22	ug/kg	1
Perfluoro-n-butanoic acid (PFBA)	375-22-4	PFAS by ID SOP	0.22	BJ	1.1	0.55	0.22	ug/kg	1
Perfluoro-n-decanoic acid (PFDA)	335-76-2	PFAS by ID SOP	0.22	J	1.1	0.55	0.22	ug/kg	1
Perfluoro-n-dodecanoic acid (PFDoA)	307-55-1	PFAS by ID SOP	0.55	U	1.1	0.55	0.22	ug/kg	1
Perfluoro-n-heptanoic acid (PFHpA)	375-85-9	PFAS by ID SOP	0.64	J	1.1	0.55	0.22	ug/kg	1
Perfluoro-n-hexanoic acid (PFHxA)	307-24-4	PFAS by ID SOP	0.98	J	1.1	0.55	0.22	ug/kg	1
Perfluoro-n-nonanoic acid (PFNA)	375-95-1	PFAS by ID SOP	0.26	J	1.1	0.55	0.22	ug/kg	1
Perfluoro-n-octanoic acid (PFOA)	335-67-1	PFAS by ID SOP	1.8		1.1	0.55	0.22	ug/kg	1
Perfluoro-n-pentanoic acid (PFPeA)	2706-90-3	PFAS by ID SOP	0.48	J	1.1	0.55	0.22	ug/kg	1
Perfluoro-n-tetradecanoic acid (PFTeDA)	376-06-7	PFAS by ID SOP	0.55	U	1.1	0.55	0.22	ug/kg	1
Perfluoro-n-tridecanoic acid (PFTrDA)	72629-94-8	PFAS by ID SOP	0.55	U	1.1	0.55	0.22	ug/kg	1
Perfluoro-n-undecanoic acid (PFUdA)	2058-94-8	PFAS by ID SOP	0.55	U	1.1	0.55	0.22	ug/kg	1
Perfluorooctanesulfonic acid (PFOS)	1763-23-1	PFAS by ID SOP	13		1.1	0.55	0.22	ug/kg	1

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
13C2_4:2FTS		90	50-150
13C2_6:2FTS		116	50-150
13C2_8:2FTS		127	50-150
13C2_PFDoA		103	50-150
13C2_PFTeDA		98	50-150
13C3_PFBS		91	50-150
13C3_PFHxS		87	50-150
13C4_PFBA		96	50-150
13C4_PFHpA		99	50-150
13C5_PFHxA		98	50-150
13C5_PFPeA		96	50-150
13C6_PFDA		97	50-150
13C7_PFUdA		96	50-150
13C8_PFOA		101	50-150
13C8_PFOS		94	50-150
13C8_PFOSA		99	50-150
13C9_PFNA		97	50-150

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

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PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.		Laboratory ID: WI22013-005
Description: 385-4-UT-2		Matrix: Solid
Date Sampled: 09/17/2021 1245	Project Name: Eielson AFB Soil Washing	% Solids: 87.4 09/25/2021 2040
Date Received: 09/22/2021	Project Number: 30030317	

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
d5-EtFOSAA		107	50-150
d-MeFOSA		91	50-150
d3-MeFOSAA		103	50-150

LOQ = Limit of Quantitation	B = Detected in the method blank	E = Quantitation of compound exceeded the calibration range	DL = Detection Limit	Q = Surrogate failure
U = Not detected at or above the LOQ	N = Recovery is out of criteria	P = The RPD between two GC columns exceeds 40%	J = Estimated result < LOQ and ≥ DL	L = LCS/LCSD failure
H = Out of holding time	W = Reported on wet weight basis	LOD = Limit of Detection		S = MS/MSD failure

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SPLP PFAS

Client: Arcadis U.S., Inc. | Laboratory ID: WI22013-005
Description: 385-4-UT-2 | Matrix: Solid
Date Sampled: 09/17/2021 1245 | Project Name: Eielson AFB Soil Washing | % Solids: 87.4 09/25/2021 2040
Date Received: 09/22/2021 | Project Number: 30030317

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch	Leachate Date
1	1312/PFAS	PFAS by ID SOP QSM B-15	1	10/01/2021 1423	MMM	09/30/2021 1724	17232	09/29/2021 0311

Parameter	CAS Number	Analytical Method	Result	Q	LOQ	LOD	DL	Units	Run
1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS)	39108-34-4	PFAS by ID SOP	40	U	80	40	20	ng/L	1
1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS)	27619-97-2	PFAS by ID SOP	40	U	80	40	20	ng/L	1
1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS)	757124-72-4	PFAS by ID SOP	40	U	80	40	20	ng/L	1
N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA)	2991-50-6	PFAS by ID SOP	40	U	80	40	20	ng/L	1
N-methylperfluoro-1-octanesulfonamide (MeFOSA)	31506-32-8	PFAS by ID SOP	80	U	160	80	40	ng/L	1
N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA)	2355-31-9	PFAS by ID SOP	40	U	80	40	20	ng/L	1
Perfluoro-1-butanesulfonic acid (PFBS)	375-73-5	PFAS by ID SOP	13	J	40	20	10	ng/L	1
Perfluoro-1-decanesulfonic acid (PFDS)	335-77-3	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-1-heptanesulfonic acid (PFHpS)	375-92-8	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-1-nonanesulfonic acid (PFNS)	68259-12-1	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-1-octanesulfonamide (PFOSA)	754-91-6	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-1-pentanesulfonic acid (PFPeS)	2706-91-4	PFAS by ID SOP	12	J	40	20	10	ng/L	1
Perfluorohexanesulfonic acid (PFHxS)	355-46-4	PFAS by ID SOP	230		40	20	10	ng/L	1
Perfluoro-n-butanoic acid (PFBA)	375-22-4	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-n-decanoic acid (PFDA)	335-76-2	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-n-dodecanoic acid (PFDoA)	307-55-1	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-n-heptanoic acid (PFHpA)	375-85-9	PFAS by ID SOP	32	J	40	20	10	ng/L	1
Perfluoro-n-hexanoic acid (PFHxA)	307-24-4	PFAS by ID SOP	40		40	20	10	ng/L	1
Perfluoro-n-nonanoic acid (PFNA)	375-95-1	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-n-octanoic acid (PFOA)	335-67-1	PFAS by ID SOP	51		40	20	10	ng/L	1
Perfluoro-n-pentanoic acid (PFPeA)	2706-90-3	PFAS by ID SOP	20	J	40	20	10	ng/L	1
Perfluoro-n-tetradecanoic acid (PFTeDA)	376-06-7	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-n-tridecanoic acid (PFTrDA)	72629-94-8	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-n-undecanoic acid (PFUdA)	2058-94-8	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluorooctanesulfonic acid (PFOS)	1763-23-1	PFAS by ID SOP	400		40	20	10	ng/L	1

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
13C2_4:2FTS		109	50-150
13C2_6:2FTS		101	50-150
13C2_8:2FTS		107	50-150
13C2_PFDoA		93	50-150
13C2_PFTeDA		96	50-150
13C3_PFBS		94	50-150
13C3_PFHxS		80	50-150
13C4_PFBA		93	50-150
13C4_PFHpA		92	50-150
13C5_PFHxA		95	50-150
13C5_PFPeA		102	50-150
13C6_PFDA		91	50-150
13C7_PFUdA		94	50-150
13C8_PFOA		91	50-150
13C8_PFOS		89	50-150
13C8_PFOSA		106	50-150
13C9_PFNA		91	50-150

LOQ = Limit of Quantitation | B = Detected in the method blank | E = Quantitation of compound exceeded the calibration range | DL = Detection Limit | Q = Surrogate failure
U = Not detected at or above the LOQ | N = Recovery is out of criteria | P = The RPD between two GC columns exceeds 40% | J = Estimated result < LOQ and ≥ DL | L = LCS/LCSD failure
H = Out of holding time | W = Reported on wet weight basis | LOD = Limit of Detection | S = MS/MSD failure

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SPLP PFAS

Client: Arcadis U.S., Inc.		Laboratory ID: WI22013-005
Description: 385-4-UT-2		Matrix: Solid
Date Sampled: 09/17/2021 1245	Project Name: Eielson AFB Soil Washing	% Solids: 87.4 09/25/2021 2040
Date Received: 09/22/2021	Project Number: 30030317	

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
d5-EtFOSAA		94	50-150
d-MeFOSA		86	50-150
d3-MeFOSAA		97	50-150

LOQ = Limit of Quantitation	B = Detected in the method blank	E = Quantitation of compound exceeded the calibration range	DL = Detection Limit	Q = Surrogate failure
U = Not detected at or above the LOQ	N = Recovery is out of criteria	P = The RPD between two GC columns exceeds 40%	J = Estimated result < LOQ and ≥ DL	L = LCS/LCSD failure
H = Out of holding time	W = Reported on wet weight basis	LOD = Limit of Detection		S = MS/MSD failure

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Semivolatile Organic Compounds by GC/MS

Client: Arcadis U.S., Inc. | Laboratory ID: WI22013-006
Description: 385-4-UT-3 | Matrix: Solid
Date Sampled: 09/17/2021 1500 | Project Name: Eielson AFB Soil Washing | % Solids: 87.7 09/22/2021 2333
Date Received: 09/22/2021 | Project Number: 30030317

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch
1	3546	8270E	50	09/24/2021 2041	SCD	09/23/2021 2120	16363

Parameter	CAS Number	Analytical Method	Result	Q	LOQ	LOD	DL	Units	Run
Acenaphthene	83-32-9	8270E	83	JQ	150	110	46	ug/kg	1
Acenaphthylene	208-96-8	8270E	110	UQ	150	110	52	ug/kg	1
Anthracene	120-12-7	8270E	300	Q	150	110	28	ug/kg	1
Benzo(a)anthracene	56-55-3	8270E	910	Q	150	110	32	ug/kg	1
Benzo(a)pyrene	50-32-8	8270E	1400	Q	150	110	36	ug/kg	1
Benzo(b)fluoranthene	205-99-2	8270E	1500	Q	150	110	27	ug/kg	1
Benzo(g,h,i)perylene	191-24-2	8270E	700	Q	150	110	36	ug/kg	1
Benzo(k)fluoranthene	207-08-9	8270E	630	Q	150	83	26	ug/kg	1
Chrysene	218-01-9	8270E	1200	Q	150	83	25	ug/kg	1
Dibenzo(a,h)anthracene	53-70-3	8270E	110	UQ	150	110	28	ug/kg	1
Fluoranthene	206-44-0	8270E	2100	Q	150	83	23	ug/kg	1
Fluorene	86-73-7	8270E	92	JQ	150	110	31	ug/kg	1
Indeno(1,2,3-c,d)pyrene	193-39-5	8270E	590	Q	150	110	55	ug/kg	1
1-Methylnaphthalene	90-12-0	8270E	110	UQ	150	110	54	ug/kg	1
2-Methylnaphthalene	91-57-6	8270E	110	UQ	150	110	54	ug/kg	1
Naphthalene	91-20-3	8270E	110	UQ	150	110	53	ug/kg	1
Phenanthrene	85-01-8	8270E	1300	Q	150	110	39	ug/kg	1
Pyrene	129-00-0	8270E	2000	Q	150	110	27	ug/kg	1

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
2-Fluorobiphenyl		79	44-115
Nitrobenzene-d5	N	336	37-122
Terphenyl-d14		91	54-127

LOQ = Limit of Quantitation | B = Detected in the method blank | E = Quantitation of compound exceeded the calibration range | DL = Detection Limit | Q = Surrogate failure
U = Not detected at or above the LOQ | N = Recovery is out of criteria | P = The RPD between two GC columns exceeds 40% | J = Estimated result < LOQ and ≥ DL | L = LCS/LCSD failure
H = Out of holding time | W = Reported on wet weight basis | LOD = Limit of Detection | S = MS/MSD failure

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PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: WI22013-006
Description: 385-4-UT-3 | Matrix: Solid
Date Sampled: 09/17/2021 1500 | Project Name: Eielson AFB Soil Washing | % Solids: 87.7 09/22/2021 2333
Date Received: 09/22/2021 | Project Number: 30030317

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch
1	SOP SPE	PFAS by ID SOP QSM B-15	1	09/23/2021 1258	MMM	09/22/2021 1715	16193

Parameter	CAS Number	Analytical Method	Result	Q	LOQ	LOD	DL	Units	Run
1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS)	39108-34-4	PFAS by ID SOP	1.1	U	2.2	1.1	0.54	ug/kg	1
1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS)	27619-97-2	PFAS by ID SOP	1.1	U	2.2	1.1	0.54	ug/kg	1
1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS)	757124-72-4	PFAS by ID SOP	1.1	U	2.2	1.1	0.54	ug/kg	1
N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA)	2991-50-6	PFAS by ID SOP	1.1	U	2.2	1.1	0.54	ug/kg	1
N-methylperfluoro-1-octanesulfonamide (MeFOSA)	31506-32-8	PFAS by ID SOP	1.1	U	2.2	1.1	0.54	ug/kg	1
N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA)	2355-31-9	PFAS by ID SOP	1.1	U	2.2	1.1	0.54	ug/kg	1
Perfluoro-1-butanesulfonic acid (PFBS)	375-73-5	PFAS by ID SOP	0.31	J	1.1	0.55	0.22	ug/kg	1
Perfluoro-1-decanesulfonic acid (PFDS)	335-77-3	PFAS by ID SOP	0.55	U	1.1	0.55	0.22	ug/kg	1
Perfluoro-1-heptanesulfonic acid (PFHpS)	375-92-8	PFAS by ID SOP	0.55	U	1.1	0.55	0.22	ug/kg	1
Perfluoro-1-nonanesulfonic acid (PFNS)	68259-12-1	PFAS by ID SOP	0.55	U	1.1	0.55	0.22	ug/kg	1
Perfluoro-1-octanesulfonamide (PFOSA)	754-91-6	PFAS by ID SOP	0.31	J	1.1	0.55	0.22	ug/kg	1
Perfluoro-1-pentanesulfonic acid (PFPeS)	2706-91-4	PFAS by ID SOP	0.42	J	1.1	0.55	0.22	ug/kg	1
Perfluorohexanesulfonic acid (PFHxS)	355-46-4	PFAS by ID SOP	7.5		1.1	0.55	0.22	ug/kg	1
Perfluoro-n-butanoic acid (PFBA)	375-22-4	PFAS by ID SOP	0.33	BJ	1.1	0.55	0.22	ug/kg	1
Perfluoro-n-decanoic acid (PFDA)	335-76-2	PFAS by ID SOP	0.31	J	1.1	0.55	0.22	ug/kg	1
Perfluoro-n-dodecanoic acid (PFDoA)	307-55-1	PFAS by ID SOP	0.55	U	1.1	0.55	0.22	ug/kg	1
Perfluoro-n-heptanoic acid (PFHpA)	375-85-9	PFAS by ID SOP	0.92	J	1.1	0.55	0.22	ug/kg	1
Perfluoro-n-hexanoic acid (PFHxA)	307-24-4	PFAS by ID SOP	1.2		1.1	0.55	0.22	ug/kg	1
Perfluoro-n-nonanoic acid (PFNA)	375-95-1	PFAS by ID SOP	0.27	J	1.1	0.55	0.22	ug/kg	1
Perfluoro-n-octanoic acid (PFOA)	335-67-1	PFAS by ID SOP	1.4		1.1	0.55	0.22	ug/kg	1
Perfluoro-n-pentanoic acid (PFPeA)	2706-90-3	PFAS by ID SOP	0.62	J	1.1	0.55	0.22	ug/kg	1
Perfluoro-n-tetradecanoic acid (PFTeDA)	376-06-7	PFAS by ID SOP	0.55	U	1.1	0.55	0.22	ug/kg	1
Perfluoro-n-tridecanoic acid (PFTrDA)	72629-94-8	PFAS by ID SOP	0.55	U	1.1	0.55	0.22	ug/kg	1
Perfluoro-n-undecanoic acid (PFUdA)	2058-94-8	PFAS by ID SOP	0.55	U	1.1	0.55	0.22	ug/kg	1
Perfluorooctanesulfonic acid (PFOS)	1763-23-1	PFAS by ID SOP	14		1.1	0.55	0.22	ug/kg	1

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
13C2_4:2FTS		77	50-150
13C2_6:2FTS		85	50-150
13C2_8:2FTS		96	50-150
13C2_PFDoA		76	50-150
13C2_PFTeDA		72	50-150
13C3_PFBS		75	50-150
13C3_PFHxS		77	50-150
13C4_PFBA		72	50-150
13C4_PFHpA		75	50-150
13C5_PFHxA		72	50-150
13C5_PFPeA		72	50-150
13C6_PFDA		70	50-150
13C7_PFUdA		75	50-150
13C8_PFOA		74	50-150
13C8_PFOS		75	50-150
13C8_PFOSA		85	50-150
13C9_PFNA		72	50-150

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

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PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.		Laboratory ID: WI22013-006
Description: 385-4-UT-3		Matrix: Solid
Date Sampled: 09/17/2021 1500	Project Name: Eielson AFB Soil Washing	% Solids: 87.7 09/22/2021 2333
Date Received: 09/22/2021	Project Number: 30030317	

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
d5-EtFOSAA		81	50-150
d-MeFOSA		69	50-150
d3-MeFOSAA		77	50-150

LOQ = Limit of Quantitation	B = Detected in the method blank	E = Quantitation of compound exceeded the calibration range	DL = Detection Limit	Q = Surrogate failure
U = Not detected at or above the LOQ	N = Recovery is out of criteria	P = The RPD between two GC columns exceeds 40%	J = Estimated result < LOQ and ≥ DL	L = LCS/LCSD failure
H = Out of holding time	W = Reported on wet weight basis	LOD = Limit of Detection		S = MS/MSD failure

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SPLP PFAS

Client: Arcadis U.S., Inc. | Laboratory ID: WI22013-006
Description: 385-4-UT-3 | Matrix: Solid
Date Sampled: 09/17/2021 1500 | Project Name: Eielson AFB Soil Washing | % Solids: 87.7 09/22/2021 2333
Date Received: 09/22/2021 | Project Number: 30030317

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch	Leachate Date
1	1312/PFAS	PFAS by ID SOP QSM B-15	1	10/01/2021 1433	MMM	09/30/2021 1724	17232	09/29/2021 0311

Parameter	CAS Number	Analytical Method	Result	Q	LOQ	LOD	DL	Units	Run
1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS)	39108-34-4	PFAS by ID SOP	40	U	80	40	20	ng/L	1
1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS)	27619-97-2	PFAS by ID SOP	40	U	80	40	20	ng/L	1
1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS)	757124-72-4	PFAS by ID SOP	40	U	80	40	20	ng/L	1
N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA)	2991-50-6	PFAS by ID SOP	40	U	80	40	20	ng/L	1
N-methylperfluoro-1-octanesulfonamide (MeFOSA)	31506-32-8	PFAS by ID SOP	80	U	160	80	40	ng/L	1
N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA)	2355-31-9	PFAS by ID SOP	40	U	80	40	20	ng/L	1
Perfluoro-1-butanesulfonic acid (PFBS)	375-73-5	PFAS by ID SOP	11	J	40	20	10	ng/L	1
Perfluoro-1-decanesulfonic acid (PFDS)	335-77-3	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-1-heptanesulfonic acid (PFHpS)	375-92-8	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-1-nonanesulfonic acid (PFNS)	68259-12-1	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-1-octanesulfonamide (PFOSA)	754-91-6	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-1-pentanesulfonic acid (PFPeS)	2706-91-4	PFAS by ID SOP	11	J	40	20	10	ng/L	1
Perfluorohexanesulfonic acid (PFHxS)	355-46-4	PFAS by ID SOP	210		40	20	10	ng/L	1
Perfluoro-n-butanoic acid (PFBA)	375-22-4	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-n-decanoic acid (PFDA)	335-76-2	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-n-dodecanoic acid (PFDoA)	307-55-1	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-n-heptanoic acid (PFHpA)	375-85-9	PFAS by ID SOP	28	J	40	20	10	ng/L	1
Perfluoro-n-hexanoic acid (PFHxA)	307-24-4	PFAS by ID SOP	35	J	40	20	10	ng/L	1
Perfluoro-n-nonanoic acid (PFNA)	375-95-1	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-n-octanoic acid (PFOA)	335-67-1	PFAS by ID SOP	48		40	20	10	ng/L	1
Perfluoro-n-pentanoic acid (PFPeA)	2706-90-3	PFAS by ID SOP	17	J	40	20	10	ng/L	1
Perfluoro-n-tetradecanoic acid (PFTeDA)	376-06-7	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-n-tridecanoic acid (PFTrDA)	72629-94-8	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-n-undecanoic acid (PFUdA)	2058-94-8	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluorooctanesulfonic acid (PFOS)	1763-23-1	PFAS by ID SOP	300		40	20	10	ng/L	1

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
13C2_4:2FTS		104	50-150
13C2_6:2FTS		112	50-150
13C2_8:2FTS		96	50-150
13C2_PFDoA		97	50-150
13C2_PFTeDA		98	50-150
13C3_PFBS		88	50-150
13C3_PFHxS		79	50-150
13C4_PFBA		90	50-150
13C4_PFHpA		83	50-150
13C5_PFHxA		95	50-150
13C5_PFPeA		95	50-150
13C6_PFDA		87	50-150
13C7_PFUdA		96	50-150
13C8_PFOA		87	50-150
13C8_PFOS		88	50-150
13C8_PFOSA		97	50-150
13C9_PFNA		90	50-150

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

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SPLP PFAS

Client: Arcadis U.S., Inc.		Laboratory ID: WI22013-006
Description: 385-4-UT-3		Matrix: Solid
Date Sampled: 09/17/2021 1500	Project Name: Eielson AFB Soil Washing	% Solids: 87.7 09/22/2021 2333
Date Received: 09/22/2021	Project Number: 30030317	

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
d5-EtFOSAA		99	50-150
d-MeFOSA		81	50-150
d3-MeFOSAA		95	50-150

LOQ = Limit of Quantitation	B = Detected in the method blank	E = Quantitation of compound exceeded the calibration range	DL = Detection Limit	Q = Surrogate failure
U = Not detected at or above the LOQ	N = Recovery is out of criteria	P = The RPD between two GC columns exceeds 40%	J = Estimated result < LOQ and ≥ DL	L = LCS/LCSD failure
H = Out of holding time	W = Reported on wet weight basis	LOD = Limit of Detection		S = MS/MSD failure

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Semivolatile Organic Compounds by GC/MS

Client: Arcadis U.S., Inc. | Laboratory ID: WI22013-007
Description: 385-4-UT-4 | Matrix: Solid
Date Sampled: 09/18/2021 1100 | Project Name: Eielson AFB Soil Washing | % Solids: 89.2 09/22/2021 2333
Date Received: 09/22/2021 | Project Number: 30030317

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch
1	3546	8270E	50	09/24/2021 2106	SCD	09/23/2021 2120	16363

Parameter	CAS Number	Analytical Method	Result	Q	LOQ	LOD	DL	Units	Run
Acenaphthene	83-32-9	8270E	78	JQ	150	110	45	ug/kg	1
Acenaphthylene	208-96-8	8270E	110	UQ	150	110	52	ug/kg	1
Anthracene	120-12-7	8270E	260	Q	150	110	28	ug/kg	1
Benzo(a)anthracene	56-55-3	8270E	810	Q	150	110	32	ug/kg	1
Benzo(a)pyrene	50-32-8	8270E	1100	Q	150	110	36	ug/kg	1
Benzo(b)fluoranthene	205-99-2	8270E	1300	Q	150	110	27	ug/kg	1
Benzo(g,h,i)perylene	191-24-2	8270E	600	Q	150	110	35	ug/kg	1
Benzo(k)fluoranthene	207-08-9	8270E	550	Q	150	83	26	ug/kg	1
Chrysene	218-01-9	8270E	1100	Q	150	83	24	ug/kg	1
Dibenzo(a,h)anthracene	53-70-3	8270E	110	UQ	150	110	28	ug/kg	1
Fluoranthene	206-44-0	8270E	1900	Q	150	83	23	ug/kg	1
Fluorene	86-73-7	8270E	90	JQ	150	110	31	ug/kg	1
Indeno(1,2,3-c,d)pyrene	193-39-5	8270E	580	Q	150	110	54	ug/kg	1
1-Methylnaphthalene	90-12-0	8270E	110	UQ	150	110	53	ug/kg	1
2-Methylnaphthalene	91-57-6	8270E	110	UQ	150	110	54	ug/kg	1
Naphthalene	91-20-3	8270E	110	UQ	150	110	53	ug/kg	1
Phenanthrene	85-01-8	8270E	1200	Q	150	110	39	ug/kg	1
Pyrene	129-00-0	8270E	1700	Q	150	110	27	ug/kg	1

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
2-Fluorobiphenyl		91	44-115
Nitrobenzene-d5	N	341	37-122
Terphenyl-d14		110	54-127

LOQ = Limit of Quantitation | B = Detected in the method blank | E = Quantitation of compound exceeded the calibration range | DL = Detection Limit | Q = Surrogate failure
U = Not detected at or above the LOQ | N = Recovery is out of criteria | P = The RPD between two GC columns exceeds 40% | J = Estimated result < LOQ and ≥ DL | L = LCS/LCSD failure
H = Out of holding time | W = Reported on wet weight basis | LOD = Limit of Detection | S = MS/MSD failure

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PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: WI22013-007
Description: 385-4-UT-4 | Matrix: Solid
Date Sampled: 09/18/2021 1100 | Project Name: Eielson AFB Soil Washing | % Solids: 89.2 09/22/2021 2333
Date Received: 09/22/2021 | Project Number: 30030317

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch
1	SOP SPE	PFAS by ID SOP QSM B-15	1	09/23/2021 1308	MMM	09/22/2021 1715	16193

Parameter	CAS Number	Analytical Method	Result	Q	LOQ	LOD	DL	Units	Run
1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS)	39108-34-4	PFAS by ID SOP	1.0	U	2.0	1.0	0.49	ug/kg	1
1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS)	27619-97-2	PFAS by ID SOP	1.0	U	2.0	1.0	0.49	ug/kg	1
1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS)	757124-72-4	PFAS by ID SOP	1.0	U	2.0	1.0	0.49	ug/kg	1
N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA)	2991-50-6	PFAS by ID SOP	1.0	U	2.0	1.0	0.49	ug/kg	1
N-methylperfluoro-1-octanesulfonamide (MeFOSA)	31506-32-8	PFAS by ID SOP	1.0	U	2.0	1.0	0.49	ug/kg	1
N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA)	2355-31-9	PFAS by ID SOP	1.0	U	2.0	1.0	0.49	ug/kg	1
Perfluoro-1-butanesulfonic acid (PFBS)	375-73-5	PFAS by ID SOP	0.49	U	0.98	0.49	0.20	ug/kg	1
Perfluoro-1-decanesulfonic acid (PFDS)	335-77-3	PFAS by ID SOP	0.49	U	0.98	0.49	0.20	ug/kg	1
Perfluoro-1-heptanesulfonic acid (PFHpS)	375-92-8	PFAS by ID SOP	0.49	U	0.98	0.49	0.20	ug/kg	1
Perfluoro-1-nonanesulfonic acid (PFNS)	68259-12-1	PFAS by ID SOP	0.49	U	0.98	0.49	0.20	ug/kg	1
Perfluoro-1-octanesulfonamide (PFOSA)	754-91-6	PFAS by ID SOP	0.36	J	0.98	0.49	0.20	ug/kg	1
Perfluoro-1-pentanesulfonic acid (PFPeS)	2706-91-4	PFAS by ID SOP	0.35	J	0.98	0.49	0.20	ug/kg	1
Perfluorohexanesulfonic acid (PFHxS)	355-46-4	PFAS by ID SOP	6.8		0.98	0.49	0.20	ug/kg	1
Perfluoro-n-butanoic acid (PFBA)	375-22-4	PFAS by ID SOP	0.26	BJ	0.98	0.49	0.20	ug/kg	1
Perfluoro-n-decanoic acid (PFDA)	335-76-2	PFAS by ID SOP	0.25	J	0.98	0.49	0.20	ug/kg	1
Perfluoro-n-dodecanoic acid (PFDoA)	307-55-1	PFAS by ID SOP	0.49	U	0.98	0.49	0.20	ug/kg	1
Perfluoro-n-heptanoic acid (PFHpA)	375-85-9	PFAS by ID SOP	0.73	J	0.98	0.49	0.20	ug/kg	1
Perfluoro-n-hexanoic acid (PFHxA)	307-24-4	PFAS by ID SOP	0.96	J	0.98	0.49	0.20	ug/kg	1
Perfluoro-n-nonanoic acid (PFNA)	375-95-1	PFAS by ID SOP	0.22	J	0.98	0.49	0.20	ug/kg	1
Perfluoro-n-octanoic acid (PFOA)	335-67-1	PFAS by ID SOP	1.4		0.98	0.49	0.20	ug/kg	1
Perfluoro-n-pentanoic acid (PFPeA)	2706-90-3	PFAS by ID SOP	0.49	J	0.98	0.49	0.20	ug/kg	1
Perfluoro-n-tetradecanoic acid (PFTeDA)	376-06-7	PFAS by ID SOP	0.49	U	0.98	0.49	0.20	ug/kg	1
Perfluoro-n-tridecanoic acid (PFTrDA)	72629-94-8	PFAS by ID SOP	0.49	U	0.98	0.49	0.20	ug/kg	1
Perfluoro-n-undecanoic acid (PFUdA)	2058-94-8	PFAS by ID SOP	0.49	U	0.98	0.49	0.20	ug/kg	1
Perfluorooctanesulfonic acid (PFOS)	1763-23-1	PFAS by ID SOP	12		0.98	0.49	0.20	ug/kg	1

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
13C2_4:2FTS		80	50-150
13C2_6:2FTS		92	50-150
13C2_8:2FTS		102	50-150
13C2_PFDoA		87	50-150
13C2_PFTeDA		84	50-150
13C3_PFBS		81	50-150
13C3_PFHxS		77	50-150
13C4_PFBA		79	50-150
13C4_PFHpA		82	50-150
13C5_PFHxA		76	50-150
13C5_PFPeA		82	50-150
13C6_PFDA		77	50-150
13C7_PFUdA		79	50-150
13C8_PFOA		74	50-150
13C8_PFOS		76	50-150
13C8_PFOSA		81	50-150
13C9_PFNA		78	50-150

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

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PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.		Laboratory ID: WI22013-007	
Description: 385-4-UT-4		Matrix: Solid	
Date Sampled: 09/18/2021 1100	Project Name: Eielson AFB Soil Washing	% Solids: 89.2	09/22/2021 2333
Date Received: 09/22/2021	Project Number: 30030317		

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
d5-EtFOSAA		89	50-150
d-MeFOSA		77	50-150
d3-MeFOSAA		86	50-150

LOQ = Limit of Quantitation	B = Detected in the method blank	E = Quantitation of compound exceeded the calibration range	DL = Detection Limit	Q = Surrogate failure
U = Not detected at or above the LOQ	N = Recovery is out of criteria	P = The RPD between two GC columns exceeds 40%	J = Estimated result < LOQ and ≥ DL	L = LCS/LCSD failure
H = Out of holding time	W = Reported on wet weight basis	LOD = Limit of Detection		S = MS/MSD failure

SPLP PFAS

Client: Arcadis U.S., Inc. | Laboratory ID: WI22013-007
Description: 385-4-UT-4 | Matrix: Solid
Date Sampled: 09/18/2021 1100 | Project Name: Eielson AFB Soil Washing | % Solids: 89.2 09/22/2021 2333
Date Received: 09/22/2021 | Project Number: 30030317

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch	Leachate Date
1	1312/PFAS	PFAS by ID SOP QSM B-15	1	10/01/2021 1444	MMM	09/30/2021 1724	17232	09/29/2021 0311

Parameter	CAS Number	Analytical Method	Result	Q	LOQ	LOD	DL	Units	Run
1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS)	39108-34-4	PFAS by ID SOP	40	U	80	40	20	ng/L	1
1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS)	27619-97-2	PFAS by ID SOP	40	U	80	40	20	ng/L	1
1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS)	757124-72-4	PFAS by ID SOP	40	U	80	40	20	ng/L	1
N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA)	2991-50-6	PFAS by ID SOP	40	U	80	40	20	ng/L	1
N-methylperfluoro-1-octanesulfonamide (MeFOSA)	31506-32-8	PFAS by ID SOP	80	U	160	80	40	ng/L	1
N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA)	2355-31-9	PFAS by ID SOP	40	U	80	40	20	ng/L	1
Perfluoro-1-butanesulfonic acid (PFBS)	375-73-5	PFAS by ID SOP	11	J	40	20	10	ng/L	1
Perfluoro-1-decanesulfonic acid (PFDS)	335-77-3	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-1-heptanesulfonic acid (PFHpS)	375-92-8	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-1-nonanesulfonic acid (PFNS)	68259-12-1	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-1-octanesulfonamide (PFOSA)	754-91-6	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-1-pentanesulfonic acid (PFPeS)	2706-91-4	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluorohexanesulfonic acid (PFHxS)	355-46-4	PFAS by ID SOP	200		40	20	10	ng/L	1
Perfluoro-n-butanoic acid (PFBA)	375-22-4	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-n-decanoic acid (PFDA)	335-76-2	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-n-dodecanoic acid (PFDoA)	307-55-1	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-n-heptanoic acid (PFHpA)	375-85-9	PFAS by ID SOP	25	J	40	20	10	ng/L	1
Perfluoro-n-hexanoic acid (PFHxA)	307-24-4	PFAS by ID SOP	29	J	40	20	10	ng/L	1
Perfluoro-n-nonanoic acid (PFNA)	375-95-1	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-n-octanoic acid (PFOA)	335-67-1	PFAS by ID SOP	34	J	40	20	10	ng/L	1
Perfluoro-n-pentanoic acid (PFPeA)	2706-90-3	PFAS by ID SOP	15	J	40	20	10	ng/L	1
Perfluoro-n-tetradecanoic acid (PFTeDA)	376-06-7	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-n-tridecanoic acid (PFTrDA)	72629-94-8	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-n-undecanoic acid (PFUdA)	2058-94-8	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluorooctanesulfonic acid (PFOS)	1763-23-1	PFAS by ID SOP	290		40	20	10	ng/L	1

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
13C2_4:2FTS		102	50-150
13C2_6:2FTS		104	50-150
13C2_8:2FTS		99	50-150
13C2_PFDoA		89	50-150
13C2_PFTeDA		94	50-150
13C3_PFBS		90	50-150
13C3_PFHxS		76	50-150
13C4_PFBA		91	50-150
13C4_PFHpA		93	50-150
13C5_PFHxA		97	50-150
13C5_PFPeA		99	50-150
13C6_PFDA		88	50-150
13C7_PFUdA		86	50-150
13C8_PFOA		89	50-150
13C8_PFOS		89	50-150
13C8_PFOSA		103	50-150
13C9_PFNA		89	50-150

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

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SPLP PFAS

Client: Arcadis U.S., Inc.		Laboratory ID: WI22013-007
Description: 385-4-UT-4		Matrix: Solid
Date Sampled: 09/18/2021 1100	Project Name: Eielson AFB Soil Washing	% Solids: 89.2 09/22/2021 2333
Date Received: 09/22/2021	Project Number: 30030317	

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
d5-EtFOSAA		99	50-150
d-MeFOSA		84	50-150
d3-MeFOSAA		92	50-150

LOQ = Limit of Quantitation	B = Detected in the method blank	E = Quantitation of compound exceeded the calibration range	DL = Detection Limit	Q = Surrogate failure
U = Not detected at or above the LOQ	N = Recovery is out of criteria	P = The RPD between two GC columns exceeds 40%	J = Estimated result < LOQ and ≥ DL	L = LCS/LCSD failure
H = Out of holding time	W = Reported on wet weight basis	LOD = Limit of Detection		S = MS/MSD failure

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Semivolatile Organic Compounds by GC/MS

Client: Arcadis U.S., Inc. | Laboratory ID: WI22013-008
Description: 385-4-UT-5 | Matrix: Solid
Date Sampled: 09/18/2021 1630 | Project Name: Eielson AFB Soil Washing | % Solids: 87.7 09/22/2021 2333
Date Received: 09/22/2021 | Project Number: 30030317

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch
1	3546	8270E	50	09/24/2021 2130	SCD	09/23/2021 2120	16363

Parameter	CAS Number	Analytical Method	Result	Q	LOQ	LOD	DL	Units	Run
Acenaphthene	83-32-9	8270E	170	Q	150	110	46	ug/kg	1
Acenaphthylene	208-96-8	8270E	110	UQ	150	110	53	ug/kg	1
Anthracene	120-12-7	8270E	550	Q	150	110	28	ug/kg	1
Benzo(a)anthracene	56-55-3	8270E	1400	Q	150	110	33	ug/kg	1
Benzo(a)pyrene	50-32-8	8270E	1900	Q	150	110	37	ug/kg	1
Benzo(b)fluoranthene	205-99-2	8270E	2400	Q	150	110	28	ug/kg	1
Benzo(g,h,i)perylene	191-24-2	8270E	870	Q	150	110	36	ug/kg	1
Benzo(k)fluoranthene	207-08-9	8270E	830	Q	150	83	27	ug/kg	1
Chrysene	218-01-9	8270E	1500	Q	150	83	25	ug/kg	1
Dibenzo(a,h)anthracene	53-70-3	8270E	110	UQ	150	110	28	ug/kg	1
Fluoranthene	206-44-0	8270E	3300	Q	150	83	23	ug/kg	1
Fluorene	86-73-7	8270E	220	Q	150	110	32	ug/kg	1
Indeno(1,2,3-c,d)pyrene	193-39-5	8270E	750	Q	150	110	56	ug/kg	1
1-Methylnaphthalene	90-12-0	8270E	110	UQ	150	110	54	ug/kg	1
2-Methylnaphthalene	91-57-6	8270E	110	UQ	150	110	55	ug/kg	1
Naphthalene	91-20-3	8270E	110	UQ	150	110	54	ug/kg	1
Phenanthrene	85-01-8	8270E	2500	Q	150	110	40	ug/kg	1
Pyrene	129-00-0	8270E	3000	Q	150	110	28	ug/kg	1

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
2-Fluorobiphenyl		81	44-115
Nitrobenzene-d5	N	342	37-122
Terphenyl-d14		90	54-127

LOQ = Limit of Quantitation | B = Detected in the method blank | E = Quantitation of compound exceeded the calibration range | DL = Detection Limit | Q = Surrogate failure
U = Not detected at or above the LOQ | N = Recovery is out of criteria | P = The RPD between two GC columns exceeds 40% | J = Estimated result < LOQ and ≥ DL | L = LCS/LCSD failure
H = Out of holding time | W = Reported on wet weight basis | LOD = Limit of Detection | S = MS/MSD failure

PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: WI22013-008
Description: 385-4-UT-5 | Matrix: Solid
Date Sampled: 09/18/2021 1630 | Project Name: Eielson AFB Soil Washing | % Solids: 87.7 09/22/2021 2333
Date Received: 09/22/2021 | Project Number: 30030317

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch
1	SOP SPE	PFAS by ID SOP QSM B-15	1	09/23/2021 1319	MMM	09/22/2021 1715	16193

Parameter	CAS Number	Analytical Method	Result	Q	LOQ	LOD	DL	Units	Run
1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS)	39108-34-4	PFAS by ID SOP	1.1	U	2.1	1.1	0.52	ug/kg	1
1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS)	27619-97-2	PFAS by ID SOP	1.1	U	2.1	1.1	0.52	ug/kg	1
1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS)	757124-72-4	PFAS by ID SOP	1.1	U	2.1	1.1	0.52	ug/kg	1
N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA)	2991-50-6	PFAS by ID SOP	1.1	U	2.1	1.1	0.52	ug/kg	1
N-methylperfluoro-1-octanesulfonamide (MeFOSA)	31506-32-8	PFAS by ID SOP	1.1	U	2.1	1.1	0.52	ug/kg	1
N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA)	2355-31-9	PFAS by ID SOP	1.1	U	2.1	1.1	0.52	ug/kg	1
Perfluoro-1-butanesulfonic acid (PFBS)	375-73-5	PFAS by ID SOP	0.22	J	1.0	0.50	0.21	ug/kg	1
Perfluoro-1-decanesulfonic acid (PFDS)	335-77-3	PFAS by ID SOP	0.50	U	1.0	0.50	0.21	ug/kg	1
Perfluoro-1-heptanesulfonic acid (PFHpS)	375-92-8	PFAS by ID SOP	0.50	U	1.0	0.50	0.21	ug/kg	1
Perfluoro-1-nonanesulfonic acid (PFNS)	68259-12-1	PFAS by ID SOP	0.50	U	1.0	0.50	0.21	ug/kg	1
Perfluoro-1-octanesulfonamide (PFOSA)	754-91-6	PFAS by ID SOP	0.24	J	1.0	0.50	0.21	ug/kg	1
Perfluoro-1-pentanesulfonic acid (PFPeS)	2706-91-4	PFAS by ID SOP	0.33	J	1.0	0.50	0.21	ug/kg	1
Perfluorohexanesulfonic acid (PFHxS)	355-46-4	PFAS by ID SOP	6.5		1.0	0.50	0.21	ug/kg	1
Perfluoro-n-butanoic acid (PFBA)	375-22-4	PFAS by ID SOP	0.31	BJ	1.0	0.50	0.21	ug/kg	1
Perfluoro-n-decanoic acid (PFDA)	335-76-2	PFAS by ID SOP	0.50	U	1.0	0.50	0.21	ug/kg	1
Perfluoro-n-dodecanoic acid (PFDoA)	307-55-1	PFAS by ID SOP	0.50	U	1.0	0.50	0.21	ug/kg	1
Perfluoro-n-heptanoic acid (PFHpA)	375-85-9	PFAS by ID SOP	0.70	J	1.0	0.50	0.21	ug/kg	1
Perfluoro-n-hexanoic acid (PFHxA)	307-24-4	PFAS by ID SOP	1.1		1.0	0.50	0.21	ug/kg	1
Perfluoro-n-nonanoic acid (PFNA)	375-95-1	PFAS by ID SOP	0.50	U	1.0	0.50	0.21	ug/kg	1
Perfluoro-n-octanoic acid (PFOA)	335-67-1	PFAS by ID SOP	1.1		1.0	0.50	0.21	ug/kg	1
Perfluoro-n-pentanoic acid (PFPeA)	2706-90-3	PFAS by ID SOP	0.56	J	1.0	0.50	0.21	ug/kg	1
Perfluoro-n-tetradecanoic acid (PFTeDA)	376-06-7	PFAS by ID SOP	0.50	U	1.0	0.50	0.21	ug/kg	1
Perfluoro-n-tridecanoic acid (PFTrDA)	72629-94-8	PFAS by ID SOP	0.50	U	1.0	0.50	0.21	ug/kg	1
Perfluoro-n-undecanoic acid (PFUdA)	2058-94-8	PFAS by ID SOP	0.50	U	1.0	0.50	0.21	ug/kg	1
Perfluorooctanesulfonic acid (PFOS)	1763-23-1	PFAS by ID SOP	11		1.0	0.50	0.21	ug/kg	1

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
13C2_4:2FTS		89	50-150
13C2_6:2FTS		99	50-150
13C2_8:2FTS		117	50-150
13C2_PFDoA		96	50-150
13C2_PFTeDA		91	50-150
13C3_PFBS		89	50-150
13C3_PFHxS		81	50-150
13C4_PFBA		91	50-150
13C4_PFHpA		93	50-150
13C5_PFHxA		90	50-150
13C5_PFPeA		92	50-150
13C6_PFDA		94	50-150
13C7_PFUdA		90	50-150
13C8_PFOA		86	50-150
13C8_PFOS		85	50-150
13C8_PFOSA		88	50-150
13C9_PFNA		92	50-150

LOQ = Limit of Quantitation | B = Detected in the method blank | E = Quantitation of compound exceeded the calibration range | DL = Detection Limit | Q = Surrogate failure
U = Not detected at or above the LOQ | N = Recovery is out of criteria | P = The RPD between two GC columns exceeds 40% | J = Estimated result < LOQ and ≥ DL | L = LCS/LCSD failure
H = Out of holding time | W = Reported on wet weight basis | LOD = Limit of Detection | S = MS/MSD failure

PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.		Laboratory ID: WI22013-008
Description: 385-4-UT-5		Matrix: Solid
Date Sampled: 09/18/2021 1630	Project Name: Eielson AFB Soil Washing	% Solids: 87.7 09/22/2021 2333
Date Received: 09/22/2021	Project Number: 30030317	

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
d5-EtFOSAA		103	50-150
d-MeFOSA		89	50-150
d3-MeFOSAA		89	50-150

LOQ = Limit of Quantitation	B = Detected in the method blank	E = Quantitation of compound exceeded the calibration range	DL = Detection Limit	Q = Surrogate failure
U = Not detected at or above the LOQ	N = Recovery is out of criteria	P = The RPD between two GC columns exceeds 40%	J = Estimated result < LOQ and ≥ DL	L = LCS/LCSD failure
H = Out of holding time	W = Reported on wet weight basis	LOD = Limit of Detection		S = MS/MSD failure

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SPLP PFAS

Client: Arcadis U.S., Inc. | Laboratory ID: WI22013-008
Description: 385-4-UT-5 | Matrix: Solid
Date Sampled: 09/18/2021 1630 | Project Name: Eielson AFB Soil Washing | % Solids: 87.7 09/22/2021 2333
Date Received: 09/22/2021 | Project Number: 30030317

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch	Leachate Date
1	1312/PFAS	PFAS by ID SOP QSM B-15	1	10/01/2021 1454	MMM	09/30/2021 1724	17232	09/29/2021 0311

Parameter	CAS Number	Analytical Method	Result	Q	LOQ	LOD	DL	Units	Run
1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS)	39108-34-4	PFAS by ID SOP	40	U	80	40	20	ng/L	1
1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS)	27619-97-2	PFAS by ID SOP	40	U	80	40	20	ng/L	1
1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS)	757124-72-4	PFAS by ID SOP	40	U	80	40	20	ng/L	1
N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA)	2991-50-6	PFAS by ID SOP	40	U	80	40	20	ng/L	1
N-methylperfluoro-1-octanesulfonamide (MeFOSA)	31506-32-8	PFAS by ID SOP	80	U	160	80	40	ng/L	1
N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA)	2355-31-9	PFAS by ID SOP	40	U	80	40	20	ng/L	1
Perfluoro-1-butanesulfonic acid (PFBS)	375-73-5	PFAS by ID SOP	12	J	40	20	10	ng/L	1
Perfluoro-1-decanesulfonic acid (PFDS)	335-77-3	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-1-heptanesulfonic acid (PFHpS)	375-92-8	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-1-nonanesulfonic acid (PFNS)	68259-12-1	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-1-octanesulfonamide (PFOSA)	754-91-6	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-1-pentanesulfonic acid (PFPeS)	2706-91-4	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluorohexanesulfonic acid (PFHxS)	355-46-4	PFAS by ID SOP	190		40	20	10	ng/L	1
Perfluoro-n-butanoic acid (PFBA)	375-22-4	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-n-decanoic acid (PFDA)	335-76-2	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-n-dodecanoic acid (PFDoA)	307-55-1	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-n-heptanoic acid (PFHpA)	375-85-9	PFAS by ID SOP	24	J	40	20	10	ng/L	1
Perfluoro-n-hexanoic acid (PFHxA)	307-24-4	PFAS by ID SOP	33	J	40	20	10	ng/L	1
Perfluoro-n-nonanoic acid (PFNA)	375-95-1	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-n-octanoic acid (PFOA)	335-67-1	PFAS by ID SOP	39	J	40	20	10	ng/L	1
Perfluoro-n-pentanoic acid (PFPeA)	2706-90-3	PFAS by ID SOP	17	J	40	20	10	ng/L	1
Perfluoro-n-tetradecanoic acid (PFTeDA)	376-06-7	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-n-tridecanoic acid (PFTrDA)	72629-94-8	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-n-undecanoic acid (PFUdA)	2058-94-8	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluorooctanesulfonic acid (PFOS)	1763-23-1	PFAS by ID SOP	270		40	20	10	ng/L	1

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
13C2_4:2FTS		123	50-150
13C2_6:2FTS		109	50-150
13C2_8:2FTS		107	50-150
13C2_PFDoA		97	50-150
13C2_PFTeDA		98	50-150
13C3_PFBS		94	50-150
13C3_PFHxS		84	50-150
13C4_PFBA		93	50-150
13C4_PFHpA		97	50-150
13C5_PFHxA		98	50-150
13C5_PFPeA		99	50-150
13C6_PFDA		97	50-150
13C7_PFUdA		86	50-150
13C8_PFOA		95	50-150
13C8_PFOS		99	50-150
13C8_PFOSA		105	50-150
13C9_PFNA		97	50-150

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

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SPLP PFAS

Client: Arcadis U.S., Inc.		Laboratory ID: WI22013-008
Description: 385-4-UT-5		Matrix: Solid
Date Sampled: 09/18/2021 1630	Project Name: Eielson AFB Soil Washing	% Solids: 87.7 09/22/2021 2333
Date Received: 09/22/2021	Project Number: 30030317	

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
d5-EtFOSAA		100	50-150
d-MeFOSA		79	50-150
d3-MeFOSAA		93	50-150

LOQ = Limit of Quantitation	B = Detected in the method blank	E = Quantitation of compound exceeded the calibration range	DL = Detection Limit	Q = Surrogate failure
U = Not detected at or above the LOQ	N = Recovery is out of criteria	P = The RPD between two GC columns exceeds 40%	J = Estimated result < LOQ and ≥ DL	L = LCS/LCSD failure
H = Out of holding time	W = Reported on wet weight basis	LOD = Limit of Detection		S = MS/MSD failure

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QC Summary

Semivolatile Organic Compounds by GC/MS - MB

Sample ID: WQ16363-001
Batch: 16363
Analytical Method: 8270E

Matrix: Solid
Prep Method: 3546
Prep Date: 09/23/2021 2120

Parameter	Result	Q	Dil	LOQ	LOD	DL	Units	Analysis Date
Acenaphthene	2.0	U	1	2.7	2.0	0.83	ug/kg	09/24/2021 1631
Acenaphthylene	2.0	U	1	2.7	2.0	0.95	ug/kg	09/24/2021 1631
Anthracene	2.0	U	1	2.7	2.0	0.51	ug/kg	09/24/2021 1631
Benzo(a)anthracene	2.0	U	1	2.7	2.0	0.59	ug/kg	09/24/2021 1631
Benzo(a)pyrene	2.0	U	1	2.7	2.0	0.66	ug/kg	09/24/2021 1631
Benzo(b)fluoranthene	2.0	U	1	2.7	2.0	0.50	ug/kg	09/24/2021 1631
Benzo(g,h,i)perylene	2.0	U	1	2.7	2.0	0.65	ug/kg	09/24/2021 1631
Benzo(k)fluoranthene	1.5	U	1	2.7	1.5	0.48	ug/kg	09/24/2021 1631
Chrysene	1.5	U	1	2.7	1.5	0.45	ug/kg	09/24/2021 1631
Dibenzo(a,h)anthracene	2.0	U	1	2.7	2.0	0.51	ug/kg	09/24/2021 1631
Fluoranthene	1.5	U	1	2.7	1.5	0.42	ug/kg	09/24/2021 1631
Fluorene	2.0	U	1	2.7	2.0	0.57	ug/kg	09/24/2021 1631
Indeno(1,2,3-c,d)pyrene	2.0	U	1	2.7	2.0	1.0	ug/kg	09/24/2021 1631
1-Methylnaphthalene	2.0	U	1	2.7	2.0	0.98	ug/kg	09/24/2021 1631
2-Methylnaphthalene	2.0	U	1	2.7	2.0	0.99	ug/kg	09/24/2021 1631
Naphthalene	2.0	U	1	2.7	2.0	0.97	ug/kg	09/24/2021 1631
Phenanthrene	2.0	U	1	2.7	2.0	0.72	ug/kg	09/24/2021 1631
Pyrene	2.0	U	1	2.7	2.0	0.50	ug/kg	09/24/2021 1631

Surrogate	Q	% Rec	Acceptance Limit
2-Fluorobiphenyl		77	44-115
Nitrobenzene-d5		69	37-122
Terphenyl-d14		93	54-127

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

Semivolatile Organic Compounds by GC/MS - LCS

Sample ID: WQ16363-002
Batch: 16363
Analytical Method: 8270E

Matrix: Solid
Prep Method: 3546
Prep Date: 09/23/2021 2120

Parameter	Spike Amount (ug/kg)	Result (ug/kg)	Q	Dil	% Rec	%Rec Limit	Analysis Date
Acenaphthene	130	140		1	103	40-123	09/24/2021 1655
Acenaphthylene	130	150		1	113	32-132	09/24/2021 1655
Anthracene	130	160		1	117	47-123	09/24/2021 1655
Benzo(a)anthracene	130	150		1	115	49-126	09/24/2021 1655
Benzo(a)pyrene	130	160		1	124	45-129	09/24/2021 1655
Benzo(b)fluoranthene	130	160		1	122	45-132	09/24/2021 1655
Benzo(g,h,i)perylene	130	170		1	125	43-134	09/24/2021 1655
Benzo(k)fluoranthene	130	170		1	129	47-132	09/24/2021 1655
Chrysene	130	160		1	122	50-124	09/24/2021 1655
Dibenzo(a,h)anthracene	130	160		1	122	45-134	09/24/2021 1655
Fluoranthene	130	140		1	102	50-127	09/24/2021 1655
Fluorene	130	140		1	107	43-125	09/24/2021 1655
Indeno(1,2,3-c,d)pyrene	130	170		1	124	45-133	09/24/2021 1655
1-Methylnaphthalene	130	130		1	101	40-119	09/24/2021 1655
2-Methylnaphthalene	130	140		1	106	38-122	09/24/2021 1655
Naphthalene	130	140		1	107	35-123	09/24/2021 1655
Phenanthrene	130	150		1	110	50-121	09/24/2021 1655
Pyrene	130	160		1	121	47-127	09/24/2021 1655

Surrogate	Q	% Rec	Acceptance Limit
2-Fluorobiphenyl		102	44-115
Nitrobenzene-d5		97	37-122
Terphenyl-d14		115	54-127

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

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PFAS by LC/MS/MS - MB

Sample ID: WQ16193-001
Batch: 16193
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Solid
Prep Method: SOP SPE
Prep Date: 09/22/2021 1715

Parameter	Result	Q	Dil	LOQ	LOD	DL	Units	Analysis Date
8:2 FTS	1.0	U	1	2.0	1.0	0.50	ug/kg	09/23/2021 1122
6:2 FTS	1.0	U	1	2.0	1.0	0.50	ug/kg	09/23/2021 1122
4:2 FTS	1.0	U	1	2.0	1.0	0.50	ug/kg	09/23/2021 1122
EtFOSAA	1.0	U	1	2.0	1.0	0.50	ug/kg	09/23/2021 1122
MeFOSA	1.0	U	1	2.0	1.0	0.50	ug/kg	09/23/2021 1122
MeFOSAA	1.0	U	1	2.0	1.0	0.50	ug/kg	09/23/2021 1122
PFBS	0.50	U	1	1.0	0.50	0.20	ug/kg	09/23/2021 1122
PFDS	0.50	U	1	1.0	0.50	0.20	ug/kg	09/23/2021 1122
PFHpS	0.50	U	1	1.0	0.50	0.20	ug/kg	09/23/2021 1122
PFNS	0.50	U	1	1.0	0.50	0.20	ug/kg	09/23/2021 1122
PFOSA	0.50	U	1	1.0	0.50	0.20	ug/kg	09/23/2021 1122
PFPeS	0.50	U	1	1.0	0.50	0.20	ug/kg	09/23/2021 1122
PFHxS	0.50	U	1	1.0	0.50	0.20	ug/kg	09/23/2021 1122
PFBA	0.21	J	1	1.0	0.50	0.20	ug/kg	09/23/2021 1122
PFDA	0.50	U	1	1.0	0.50	0.20	ug/kg	09/23/2021 1122
PFDoA	0.50	U	1	1.0	0.50	0.20	ug/kg	09/23/2021 1122
PFHpA	0.50	U	1	1.0	0.50	0.20	ug/kg	09/23/2021 1122
PFHxA	0.50	U	1	1.0	0.50	0.20	ug/kg	09/23/2021 1122
PFNA	0.50	U	1	1.0	0.50	0.20	ug/kg	09/23/2021 1122
PFOA	0.50	U	1	1.0	0.50	0.20	ug/kg	09/23/2021 1122
PFPeA	0.50	U	1	1.0	0.50	0.20	ug/kg	09/23/2021 1122
PFTeDA	0.50	U	1	1.0	0.50	0.20	ug/kg	09/23/2021 1122
PFTrDA	0.50	U	1	1.0	0.50	0.20	ug/kg	09/23/2021 1122
PFUdA	0.50	U	1	1.0	0.50	0.20	ug/kg	09/23/2021 1122
PFOS	0.50	U	1	1.0	0.50	0.20	ug/kg	09/23/2021 1122

Surrogate	Q	% Rec	Acceptance Limit
13C2_4:2FTS		89	50-150
13C2_6:2FTS		112	50-150
13C2_8:2FTS		124	50-150
13C2_PFDoA		96	50-150
13C2_PFTeDA		104	50-150
13C3_PFBS		96	50-150
13C3_PFHxS		93	50-150
13C4_PFBA		94	50-150
13C4_PFHpA		101	50-150
13C5_PFHxA		94	50-150
13C5_PFPeA		101	50-150
13C6_PFDA		94	50-150
13C7_PFUdA		99	50-150
13C8_PFOA		96	50-150

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

PFAS by LC/MS/MS - MB

Sample ID: WQ16193-001
Batch: 16193
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Solid
Prep Method: SOP SPE
Prep Date: 09/22/2021 1715

Surrogate	Q	% Rec	Acceptance Limit
13C8_PFOS		96	50-150
13C8_PFOSA		102	50-150
13C9_PFNA		95	50-150
d5-EtFOSAA		102	50-150
d-MeFOSA		82	50-150
d3-MeFOSAA		95	50-150

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

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PFAS by LC/MS/MS - LCS

Sample ID: WQ16193-002
Batch: 16193
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Solid
Prep Method: SOP SPE
Prep Date: 09/22/2021 1715

Parameter	Spike Amount (ug/kg)	Result (ug/kg)	Q	Dil	% Rec	%Rec Limit	Analysis Date
8:2 FTS	1.9	1.8		1	93	65-137	09/23/2021 1133
6:2 FTS	1.9	1.8		1	94	64-140	09/23/2021 1133
4:2 FTS	1.9	1.7		1	92	62-145	09/23/2021 1133
EtFOSAA	2.0	1.7		1	84	61-139	09/23/2021 1133
MeFOSA	2.0	1.8		1	90	70-150	09/23/2021 1133
MeFOSAA	2.0	1.8		1	90	63-144	09/23/2021 1133
PFBS	1.8	1.6		1	93	72-128	09/23/2021 1133
PFDS	1.9	2.1		1	107	59-134	09/23/2021 1133
PFHpS	1.9	1.6		1	85	70-132	09/23/2021 1133
PFNS	1.9	1.9		1	100	69-125	09/23/2021 1133
PFOSA	2.0	2.0		1	101	67-137	09/23/2021 1133
PFPeS	1.9	1.8		1	96	73-123	09/23/2021 1133
PFHxS	1.8	1.7		1	91	67-130	09/23/2021 1133
PFBA	2.0	2.0		1	100	71-135	09/23/2021 1133
PFDA	2.0	1.8		1	91	69-133	09/23/2021 1133
PFDoA	2.0	2.0		1	98	69-135	09/23/2021 1133
PFHpA	2.0	2.0		1	98	71-131	09/23/2021 1133
PFHxA	2.0	1.9		1	97	70-132	09/23/2021 1133
PFNA	2.0	2.1		1	107	72-129	09/23/2021 1133
PFOA	2.0	2.1		1	104	69-133	09/23/2021 1133
PFPeA	2.0	2.0		1	102	69-132	09/23/2021 1133
PFTeDA	2.0	2.0		1	98	69-133	09/23/2021 1133
PFTrDA	2.0	1.6		1	82	66-139	09/23/2021 1133
PFUdA	2.0	2.0		1	100	64-136	09/23/2021 1133
PFOS	1.9	1.8		1	99	68-136	09/23/2021 1133

Surrogate	Q	% Rec	Acceptance Limit
13C2_4:2FTS		97	50-150
13C2_6:2FTS		111	50-150
13C2_8:2FTS		111	50-150
13C2_PFDoA		97	50-150
13C2_PFTeDA		103	50-150
13C3_PFBS		96	50-150
13C3_PFHxS		100	50-150
13C4_PFBA		96	50-150
13C4_PFHpA		99	50-150
13C5_PFHxA		96	50-150
13C5_PFPeA		96	50-150
13C6_PFDA		92	50-150
13C7_PFUdA		98	50-150
13C8_PFOA		99	50-150

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

PFAS by LC/MS/MS - LCS

Sample ID: WQ16193-002
Batch: 16193
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Solid
Prep Method: SOP SPE
Prep Date: 09/22/2021 1715

Surrogate	Q	% Rec	Acceptance Limit
13C8_PFOS		96	50-150
13C8_PFOSA		96	50-150
13C9_PFNA		96	50-150
d5-EtFOSAA		105	50-150
d-MeFOSA		86	50-150
d3-MeFOSAA		95	50-150

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

PFAS by LC/MS/MS - MS

Sample ID: WI22013-001MS
Batch: 16193
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Solid
Prep Method: SOP SPE
Prep Date: 09/22/2021 1715

Parameter	Sample Amount (ug/kg)	Spike Amount (ug/kg)	Result (ug/kg)	Q	Dil	% Rec	%Rec Limit	Analysis Date
8:2 FTS	ND	1.9	2.2		1	117	65-137	09/23/2021 1154
6:2 FTS	ND	1.8	1.9		1	104	64-140	09/23/2021 1154
4:2 FTS	ND	1.8	1.8		1	102	62-145	09/23/2021 1154
EtFOSAA	ND	1.9	1.7		1	88	61-139	09/23/2021 1154
MeFOSA	ND	1.9	1.9		1	98	70-150	09/23/2021 1154
MeFOSAA	ND	1.9	1.9		1	99	63-144	09/23/2021 1154
PFBS	ND	1.7	1.4		1	79	72-128	09/23/2021 1154
PFDS	ND	1.9	1.7		1	92	59-134	09/23/2021 1154
PFHpS	ND	1.8	1.7		1	94	70-132	09/23/2021 1154
PFNS	ND	1.9	1.8		1	99	69-125	09/23/2021 1154
PFOSA	ND	1.9	2.1		1	110	67-137	09/23/2021 1154
PFPeS	ND	1.8	1.7		1	93	73-123	09/23/2021 1154
PFHxS	0.31	1.8	2.1		1	102	67-130	09/23/2021 1154
PFBA	ND	1.9	1.8		1	95	71-135	09/23/2021 1154
PFDA	ND	1.9	1.9		1	96	69-133	09/23/2021 1154
PFDoA	ND	1.9	1.9		1	98	69-135	09/23/2021 1154
PFHpA	ND	1.9	1.8		1	93	71-131	09/23/2021 1154
PFHxA	ND	1.9	1.8		1	94	70-132	09/23/2021 1154
PFNA	ND	1.9	1.8		1	91	72-129	09/23/2021 1154
PFOA	ND	1.9	2.0		1	106	69-133	09/23/2021 1154
PFPeA	ND	1.9	1.8		1	95	69-132	09/23/2021 1154
PFTeDA	ND	1.9	1.9		1	98	69-133	09/23/2021 1154
PFTrDA	ND	1.9	1.6		1	85	66-139	09/23/2021 1154
PFUdA	ND	1.9	1.9		1	99	64-136	09/23/2021 1154
PFOS	0.87	1.8	3.0		1	117	68-136	09/23/2021 1154

Surrogate	Q	% Rec	Acceptance Limit
13C2_4:2FTS		95	50-150
13C2_6:2FTS		106	50-150
13C2_8:2FTS		127	50-150
13C2_PFDoA		100	50-150
13C2_PFTeDA		98	50-150
13C3_PFBS		95	50-150
13C3_PFHxS		97	50-150
13C4_PFBA		97	50-150
13C4_PFHpA		102	50-150
13C5_PFHxA		102	50-150
13C5_PFPeA		97	50-150
13C6_PFDA		94	50-150
13C7_PFUdA		98	50-150
13C8_PFOA		93	50-150

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

PFAS by LC/MS/MS - MS

Sample ID: WI22013-001MS
Batch: 16193
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Solid
Prep Method: SOP SPE
Prep Date: 09/22/2021 1715

Surrogate	Q	% Rec	Acceptance Limit
13C8_PFOS		94	50-150
13C8_PFOSA		99	50-150
13C9_PFNA		105	50-150
d5-EtFOSAA		109	50-150
d-MeFOSA		92	50-150
d3-MeFOSAA		98	50-150

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

PFAS by LC/MS/MS - MSD

Sample ID: WI22013-001MD
Batch: 16193
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Solid
Prep Method: SOP SPE
Prep Date: 09/22/2021 1715

Parameter	Sample Amount (ug/kg)	Spike Amount (ug/kg)	Result (ug/kg)	Q	Dil	% Rec	% RPD	%Rec Limit	% RPD Limit	Analysis Date
8:2 FTS	ND	2.1	1.9		1	93	11	65-137	30	09/23/2021 1205
6:2 FTS	ND	2.1	1.8		1	88	4.4	64-140	30	09/23/2021 1205
4:2 FTS	ND	2.0	1.8		1	86	4.6	62-145	30	09/23/2021 1205
EtFOSAA	ND	2.2	2.1		1	98	23	61-139	30	09/23/2021 1205
MeFOSA	ND	2.2	2.8	+	1	126	38	70-150	30	09/23/2021 1205
MeFOSAA	ND	2.2	2.1		1	96	9.7	63-144	30	09/23/2021 1205
PFBS	ND	1.9	1.8		1	91	26	72-128	30	09/23/2021 1205
PFDS	ND	2.1	2.0		1	95	16	59-134	30	09/23/2021 1205
PFHpS	ND	2.1	1.8		1	87	3.7	70-132	30	09/23/2021 1205
PFNS	ND	2.1	2.0		1	96	10	69-125	30	09/23/2021 1205
PFOSA	ND	2.2	2.2		1	98	1.1	67-137	30	09/23/2021 1205
PFPeS	ND	2.0	2.0		1	96	15	73-123	30	09/23/2021 1205
PFHxS	0.31	2.0	2.5		1	110	16	67-130	30	09/23/2021 1205
PFBA	ND	2.2	2.2		1	102	20	71-135	30	09/23/2021 1205
PFDA	ND	2.2	2.1		1	97	13	69-133	30	09/23/2021 1205
PFDoA	ND	2.2	2.1		1	96	11	69-135	30	09/23/2021 1205
PFHpA	ND	2.2	1.9		1	85	3.9	71-131	30	09/23/2021 1205
PFHxA	ND	2.2	2.3		1	103	22	70-132	30	09/23/2021 1205
PFNA	ND	2.2	2.2		1	100	21	72-129	30	09/23/2021 1205
PFOA	ND	2.2	2.2		1	101	7.6	69-133	30	09/23/2021 1205
PFPeA	ND	2.2	2.3		1	104	21	69-132	30	09/23/2021 1205
PFTeDA	ND	2.2	2.1		1	97	12	69-133	30	09/23/2021 1205
PFTrDA	ND	2.2	1.9		1	87	15	66-139	30	09/23/2021 1205
PFUdA	ND	2.2	2.1		1	97	11	64-136	30	09/23/2021 1205
PFOS	0.87	2.0	3.1		1	112	5.6	68-136	30	09/23/2021 1205

Surrogate	Q	% Rec	Acceptance Limit
13C2_4:2FTS		101	50-150
13C2_6:2FTS		111	50-150
13C2_8:2FTS		121	50-150
13C2_PFDoA		101	50-150
13C2_PFTeDA		103	50-150
13C3_PFBS		92	50-150
13C3_PFHxS		94	50-150
13C4_PFBA		90	50-150
13C4_PFHpA		103	50-150
13C5_PFHxA		90	50-150
13C5_PFPeA		92	50-150
13C6_PFDA		96	50-150
13C7_PFUdA		96	50-150
13C8_PFOA		97	50-150

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

Sample ID: WI22013-001MD
Batch: 16193
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Solid
Prep Method: SOP SPE
Prep Date: 09/22/2021 1715

Surrogate	Q	% Rec	Acceptance Limit
13C8_PFOS		96	50-150
13C8_PFOSA		95	50-150
13C9_PFNA		96	50-150
d5-EtFOSAA		101	50-150
d-MeFOSA		87	50-150
d3-MeFOSAA		101	50-150

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

SPLP PFAS - MB

Sample ID: WQ17232-001
Batch: 17232
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Solid
Prep Method: 1312/PFAS
Prep Date: 09/30/2021 1724 Leachate Date: 09/29/2021 0311

Parameter	Result	Q	Dil	LOQ	LOD	DL	Units	Analysis Date
8:2 FTS	40	U	1	80	40	20	ng/L	10/01/2021 1247
6:2 FTS	40	U	1	80	40	20	ng/L	10/01/2021 1247
4:2 FTS	40	U	1	80	40	20	ng/L	10/01/2021 1247
EtFOSAA	40	U	1	80	40	20	ng/L	10/01/2021 1247
MeFOSA	80	U	1	160	80	40	ng/L	10/01/2021 1247
MeFOSAA	40	U	1	80	40	20	ng/L	10/01/2021 1247
PFBS	20	U	1	40	20	10	ng/L	10/01/2021 1247
PFDS	20	U	1	40	20	10	ng/L	10/01/2021 1247
PFHpS	20	U	1	40	20	10	ng/L	10/01/2021 1247
PFNS	20	U	1	40	20	10	ng/L	10/01/2021 1247
PFOSA	20	U	1	40	20	10	ng/L	10/01/2021 1247
PFPeS	20	U	1	40	20	10	ng/L	10/01/2021 1247
PFHxS	20	U	1	40	20	10	ng/L	10/01/2021 1247
PFBA	20	U	1	40	20	10	ng/L	10/01/2021 1247
PFDA	20	U	1	40	20	10	ng/L	10/01/2021 1247
PFDoA	20	U	1	40	20	10	ng/L	10/01/2021 1247
PFHpA	20	U	1	40	20	10	ng/L	10/01/2021 1247
PFHxA	20	U	1	40	20	10	ng/L	10/01/2021 1247
PFNA	20	U	1	40	20	10	ng/L	10/01/2021 1247
PFOA	20	U	1	40	20	10	ng/L	10/01/2021 1247
PFPeA	20	U	1	40	20	10	ng/L	10/01/2021 1247
PFTeDA	20	U	1	40	20	10	ng/L	10/01/2021 1247
PFTrDA	20	U	1	40	20	10	ng/L	10/01/2021 1247
PFUdA	20	U	1	40	20	10	ng/L	10/01/2021 1247
PFOS	20	U	1	40	20	10	ng/L	10/01/2021 1247

Surrogate	Q	% Rec	Acceptance Limit
13C2_4:2FTS		109	50-150
13C2_6:2FTS		118	50-150
13C2_8:2FTS		117	50-150
13C2_PFDoA		107	50-150
13C2_PFTeDA		99	50-150
13C3_PFBS		93	50-150
13C3_PFHxS		83	50-150
13C4_PFBA		98	50-150
13C4_PFHpA		98	50-150
13C5_PFHxA		110	50-150
13C5_PFPeA		105	50-150
13C6_PFDA		101	50-150
13C7_PFUdA		89	50-150
13C8_PFOA		100	50-150

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

SPLP PFAS - MB

Sample ID: WQ17232-001
Batch: 17232
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Solid
Prep Method: 1312/PFAS
Prep Date: 09/30/2021 1724 Leachate Date: 09/29/2021 0311

Surrogate	Q	% Rec	Acceptance Limit
13C8_PFOS		95	50-150
13C8_PFOSA		106	50-150
13C9_PFNA		95	50-150
d5-EtFOSAA		104	50-150
d-MeFOSA		92	50-150
d3-MeFOSAA		96	50-150

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

SPLP PFAS - LCS

Sample ID: WQ17232-002
Batch: 17232
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Solid
Prep Method: 1312/PFAS
Prep Date: 09/30/2021 1724 Leachate Date: 09/29/2021 0311

Parameter	Spike Amount (ng/L)	Result (ng/L)	Q	Dil	% Rec	%Rec Limit	Analysis Date
8:2 FTS	150	150		1	100	67-138	10/01/2021 1258
6:2 FTS	150	140		1	94	64-140	10/01/2021 1258
4:2 FTS	150	130		1	90	63-143	10/01/2021 1258
EtFOSAA	160	170		1	104	61-135	10/01/2021 1258
MeFOSA	160	120		1	77	68-141	10/01/2021 1258
MeFOSAA	160	160		1	100	65-136	10/01/2021 1258
PFBS	140	120		1	88	72-130	10/01/2021 1258
PFDS	150	170		1	109	53-142	10/01/2021 1258
PFHpS	150	140		1	93	69-134	10/01/2021 1258
PFNS	150	170		1	109	69-127	10/01/2021 1258
PFOSA	160	140		1	86	67-137	10/01/2021 1258
PFPeS	150	170		1	110	71-127	10/01/2021 1258
PFHxS	150	130		1	91	68-131	10/01/2021 1258
PFBA	160	170		1	103	73-129	10/01/2021 1258
PFDA	160	170		1	104	71-129	10/01/2021 1258
PFDoA	160	170		1	106	72-134	10/01/2021 1258
PFHpA	160	180		1	110	72-130	10/01/2021 1258
PFHxA	160	150		1	95	72-129	10/01/2021 1258
PFNA	160	150		1	93	69-130	10/01/2021 1258
PFOA	160	170		1	108	71-133	10/01/2021 1258
PFPeA	160	170		1	105	72-129	10/01/2021 1258
PFTeDA	160	170		1	107	71-132	10/01/2021 1258
PFTrDA	160	150		1	93	65-144	10/01/2021 1258
PFUdA	160	150		1	97	69-133	10/01/2021 1258
PFOS	150	150		1	98	65-140	10/01/2021 1258

Surrogate	Q	% Rec	Acceptance Limit
13C2_4:2FTS		115	50-150
13C2_6:2FTS		114	50-150
13C2_8:2FTS		107	50-150
13C2_PFDoA		98	50-150
13C2_PFTeDA		100	50-150
13C3_PFBS		99	50-150
13C3_PFHxS		89	50-150
13C4_PFBA		99	50-150
13C4_PFHpA		93	50-150
13C5_PFHxA		110	50-150
13C5_PFPeA		102	50-150
13C6_PFDA		98	50-150
13C7_PFUdA		101	50-150
13C8_PFOA		92	50-150

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

SPLP PFAS - LCS

Sample ID: WQ17232-002
Batch: 17232
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Solid
Prep Method: 1312/PFAS
Prep Date: 09/30/2021 1724 Leachate Date: 09/29/2021 0311

Surrogate	Q	% Rec	Acceptance Limit
13C8_PFOS		97	50-150
13C8_PFOSA		115	50-150
13C9_PFNA		96	50-150
d5-EtFOSAA		102	50-150
d-MeFOSA		81	50-150
d3-MeFOSAA		97	50-150

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

SPLP PFAS - MS

Sample ID: WI22013-003MS
Batch: 17232
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Solid
Prep Method: 1312/PFAS
Prep Date: 09/30/2021 1724 Leachate Date: 09/29/2021 0311

Parameter	Sample Amount (ng/L)	Spike Amount (ng/L)	Result (ng/L)	Q	Dil	% Rec	%Rec Limit	Analysis Date
8:2 FTS	ND	150	130		1	82	67-138	10/01/2021 1351
6:2 FTS	ND	150	140		1	94	64-140	10/01/2021 1351
4:2 FTS	ND	150	130		1	84	63-143	10/01/2021 1351
EtFOSAA	ND	160	170		1	107	61-135	10/01/2021 1351
MeFOSA	ND	160	170		1	104	68-141	10/01/2021 1351
MeFOSAA	ND	160	160		1	99	65-136	10/01/2021 1351
PFBS	ND	140	140		1	98	72-130	10/01/2021 1351
PFDS	ND	150	150		1	97	53-142	10/01/2021 1351
PFHpS	ND	150	140		1	92	69-134	10/01/2021 1351
PFNS	ND	150	150		1	96	69-127	10/01/2021 1351
PFOSA	ND	160	150		1	91	67-137	10/01/2021 1351
PFPeS	ND	150	170		1	114	71-127	10/01/2021 1351
PFHxS	ND	150	140		1	97	68-131	10/01/2021 1351
PFBA	ND	160	170		1	106	73-129	10/01/2021 1351
PFDA	ND	160	150		1	92	71-129	10/01/2021 1351
PFDoA	ND	160	160		1	98	72-134	10/01/2021 1351
PFHpA	ND	160	170		1	107	72-130	10/01/2021 1351
PFHxA	ND	160	170		1	108	72-129	10/01/2021 1351
PFNA	ND	160	150		1	94	69-130	10/01/2021 1351
PFOA	ND	160	170		1	108	71-133	10/01/2021 1351
PFPeA	ND	160	160		1	100	72-129	10/01/2021 1351
PFTeDA	ND	160	150		1	96	71-132	10/01/2021 1351
PFTrDA	ND	160	150		1	94	65-144	10/01/2021 1351
PFUdA	ND	160	160		1	102	69-133	10/01/2021 1351
PFOS	ND	150	140		1	95	65-140	10/01/2021 1351

Surrogate	Q	% Rec	Acceptance Limit
13C2_4:2FTS		107	50-150
13C2_6:2FTS		117	50-150
13C2_8:2FTS		120	50-150
13C2_PFDoA		97	50-150
13C2_PFTeDA		98	50-150
13C3_PFBS		91	50-150
13C3_PFHxS		85	50-150
13C4_PFBA		93	50-150
13C4_PFHpA		96	50-150
13C5_PFHxA		100	50-150
13C5_PFPeA		104	50-150
13C6_PFDA		108	50-150
13C7_PFUdA		87	50-150
13C8_PFOA		95	50-150

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

SPLP PFAS - MS

Sample ID: WI22013-003MS
Batch: 17232
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Solid
Prep Method: 1312/PFAS
Prep Date: 09/30/2021 1724 Leachate Date: 09/29/2021 0311

Surrogate	Q	% Rec	Acceptance Limit
13C8_PFOS		99	50-150
13C8_PFOSA		104	50-150
13C9_PFNA		97	50-150
d5-EtFOSAA		103	50-150
d-MeFOSA		81	50-150
d3-MeFOSAA		98	50-150

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

SPLP PFAS - MSD

Sample ID: WI22013-003MD
Batch: 17232
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Solid
Prep Method: 1312/PFAS
Prep Date: 09/30/2021 1724 Leachate Date: 09/29/2021 0311

Parameter	Sample Amount (ng/L)	Spike Amount (ng/L)	Result (ng/L)	Q	Dil	% Rec	% RPD	%Rec Limit	% RPD Limit	Analysis Date
8:2 FTS	ND	150	170		1	108	27	67-138	30	10/01/2021 1402
6:2 FTS	ND	150	160		1	107	12	64-140	30	10/01/2021 1402
4:2 FTS	ND	150	140		1	96	13	63-143	30	10/01/2021 1402
EtFOSAA	ND	160	160		1	100	6.7	61-135	30	10/01/2021 1402
MeFOSA	ND	160	200		1	124	18	68-141	30	10/01/2021 1402
MeFOSAA	ND	160	140		1	89	11	65-136	30	10/01/2021 1402
PFBS	ND	140	140		1	101	2.8	72-130	30	10/01/2021 1402
PFDS	ND	150	130		1	85	13	53-142	30	10/01/2021 1402
PFHpS	ND	150	140		1	90	1.6	69-134	30	10/01/2021 1402
PFNS	ND	150	150		1	98	1.5	69-127	30	10/01/2021 1402
PFOSA	ND	160	150		1	93	1.7	67-137	30	10/01/2021 1402
PFPeS	ND	150	160		1	107	5.7	71-127	30	10/01/2021 1402
PFHxS	ND	150	150		1	104	7.4	68-131	30	10/01/2021 1402
PFBA	ND	160	160		1	98	8.4	73-129	30	10/01/2021 1402
PFDA	ND	160	170		1	105	14	71-129	30	10/01/2021 1402
PFDoA	ND	160	190		1	117	18	72-134	30	10/01/2021 1402
PFHpA	ND	160	170		1	108	0.64	72-130	30	10/01/2021 1402
PFHxA	ND	160	160		1	101	6.6	72-129	30	10/01/2021 1402
PFNA	ND	160	160		1	103	8.3	69-130	30	10/01/2021 1402
PFOA	ND	160	160		1	103	4.8	71-133	30	10/01/2021 1402
PFPeA	ND	160	160		1	100	0.34	72-129	30	10/01/2021 1402
PFTeDA	ND	160	170		1	106	9.5	71-132	30	10/01/2021 1402
PFTrDA	ND	160	170		1	105	11	65-144	30	10/01/2021 1402
PFUdA	ND	160	160		1	102	0.52	69-133	30	10/01/2021 1402
PFOS	ND	150	150		1	101	5.9	65-140	30	10/01/2021 1402

Surrogate	Q	% Rec	Acceptance Limit
13C2_4:2FTS		112	50-150
13C2_6:2FTS		110	50-150
13C2_8:2FTS		92	50-150
13C2_PFDoA		85	50-150
13C2_PFTeDA		93	50-150
13C3_PFBS		85	50-150
13C3_PFHxS		77	50-150
13C4_PFBA		92	50-150
13C4_PFHpA		90	50-150
13C5_PFHxA		95	50-150
13C5_PFPeA		99	50-150
13C6_PFDA		93	50-150
13C7_PFUdA		88	50-150
13C8_PFOA		89	50-150

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

SPLP PFAS - MSD

Sample ID: WI22013-003MD
Batch: 17232
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Solid
Prep Method: 1312/PFAS
Prep Date: 09/30/2021 1724 Leachate Date: 09/29/2021 0311

Surrogate	Q	% Rec	Acceptance Limit
13C8_PFOS		92	50-150
13C8_PFOSA		103	50-150
13C9_PFNA		85	50-150
d5-EtFOSAA		94	50-150
d-MeFOSA		73	50-150
d3-MeFOSAA		95	50-150

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

Chain of Custody

and

Miscellaneous Documents

Pace Analytical®

PACE ANALYTICAL SERVICES, LLC
106 Vantage Point Drive • West Columbia, SC 29172
Telephone No. 803-791-9700 Fax No. 803-791-9111
www.pacelabs.com

Number 122681

Client: Arcadis	Report to Contact: Nathan Nagle	Telephone No. / E-mail: Nathan.Nagle@arcadis.com
Address: 10 Friend Ln, Ste 100	Sampler's Signature: x Jake Schenk	Quote No.
City: Newtown; State: PA; Zip Code: 18940	Printed Name: Jacob Schenk	Page 1 of 1
Project Name: Eielson Soil washing		WI22013
Project No.: 30030317	P.O. No.	KES2

Sample ID / Description (Containers for each sample may be combined on one line)	Collection Date(s)	Collection Time (Military)	Grab/Composite	Matrix: Aqueous	Matrix: Solid	Matrix: Non-Aqueous	No of Containers / Preservative Type: Unpres	HNO3	NAOH	HCl	NaOH	SAPP	Field Filtered	PFAS QSM Table B-15	SPLP PFAS	Screen PFOS, PFOA, PFBS	PAH	Remarks / Cooler I.D.
385-4-5-2			G		X		3							X	X	X	X	Unknown PPB on untreated, <10ppb on the rest
385-4-5-3																		24hr TAT on screen, 5 day TAT on the rest
385-4-6-2																		
385-4-6-3																		
385-4-UT-2																		
385-4-UT-3																		
385-4-UT-4																		
385-4-UT-5			G		X		3							X	X	X	X	

Turn Around Time Required (Prior lab approval required for expedited TAT.) ☐ Standard ☑ Rush (Specify) 24hr on Screen

Sample Disposal ☐ Return to Client ☑ Disposal by Lab

Possible Hazard Identification ☑ Non-Hazard ☐ Flammable ☐ Skin Irritant ☐ Poison ☐ Unknown

QC Requirements (Specify)

	Date	Time		Date	Time
1. Relinquished by: Jake Schenk / Arcadis	9/21/21	1200	1. Received by		
2. Relinquished by			2. Received by		
3. Relinquished by			3. Received by		
4. Relinquished by: FedEx	9/22/21	0945	4. Laboratory received by: Greg Hamilton	9/22/21	0945

Note: All samples are retained for four weeks from receipt unless other arrangements are made.

LAB USE ONLY
Received on ice (Circle) (Yes) No Ice Pack — Receipt Temp. 3.2 °C — Temp Blank ☑ Y ☐ N

DISTRIBUTION: WHITE & YELLOW-Return to laboratory with Sample(s); PINK-Field/Client Copy

Document Number: ME005N2-01

PACE ANALYTICAL SERVICES, LLC

Pace Analytical

Samples Receipt Checklist (SRC) (ME0018C-15)
Issuing Authority: Pace ENV - WCOL

Revised:9/29/2020
Page 1 of 1

Sample Receipt Checklist (SRC)

Client: ARCADIS Cooler Inspected by/date: JRG2 / 09/22/2021 Lot #: WI22013

Means of receipt: ☐ Pace ☐ Client ☐ UPS ☑ FedEx ☐ Other:

☑ Yes	☐ No		1. Were custody seals present on the cooler?
☑ Yes	☐ No	☐ NA	2. If custody seals were present, were they intact and unbroken?

pH Strip ID: NA Chlorine Strip ID: NA Tested by: NA

Original temperature upon receipt / Derived (Corrected) temperature upon receipt %Solid Snap-Cup ID: 21-1928

3.2 / 3.2 °C NA / NA °C NA / NA °C NA / NA °C

Method: ☑ Temperature Blank ☐ Against Bottles IR Gun ID: 5 IR Gun Correction Factor: 0 °C

Method of coolant: ☑ Wet Ice ☐ Ice Packs ☐ Dry Ice ☐ None

☐ Yes	☐ No	☑ NA	3. If temperature of any cooler exceeded 6.0°C, was Project Manager Notified? PM was Notified by: phone / email / face-to-face (circle one).
☑ Yes	☐ No	☐ NA	4. Is the commercial courier's packing slip attached to this form?
☑ Yes	☐ No		5. Were proper custody procedures (relinquished/received) followed?
☑ Yes	☐ No		6. Were sample IDs listed on the COC?
☑ Yes	☐ No		7. Were sample IDs listed on all sample containers?
☑ Yes	☐ No		8. Was collection date & time listed on the COC?
☑ Yes	☐ No		9. Was collection date & time listed on all sample containers?
☑ Yes	☐ No		10. Did all container label information (ID, date, time) agree with the COC?
☑ Yes	☐ No		11. Were tests to be performed listed on the COC?
☑ Yes	☐ No		12. Did all samples arrive in the proper containers for each test and/or in good condition (unbroken, lids on, etc.)?
☑ Yes	☐ No		13. Was adequate sample volume available?
☐ Yes	☑ No		14. Were all samples received within ½ the holding time or 48 hours, whichever comes first?
☐ Yes	☑ No		15. Were any samples containers missing/excess (circle one) samples Not listed on COC?
☐ Yes	☐ No	☑ NA	16. For VOA and RSK-175 samples, were bubbles present >"pea-size" (¼"or 6mm in diameter) in any of the VOA vials?
☐ Yes	☐ No	☑ NA	17. Were all DRO/metals/nutrient samples received at a pH of < 2?
☐ Yes	☐ No	☑ NA	18. Were all cyanide samples received at a pH > 12 and sulfide samples received at a pH > 9?
☐ Yes	☐ No	☑ NA	19. Were all applicable NH_3/TKN/cyanide/phenol/625.1/608.3 (< 0.5mg/L) samples free of residual chlorine?
☐ Yes	☐ No	☑ NA	20. Were client remarks/requests (i.e. requested dilutions, MS/MSD designations, etc…) correctly transcribed from the COC into the comment section in LIMS?
☐ Yes	☑ No		21. Was the quote number listed on the container label? If yes, Quote # NA

Sample Preservation (Must be completed for any sample(s) incorrectly preserved or with headspace.)

Sample(s) NA were received incorrectly preserved and were adjusted accordingly in sample receiving with NA mL of circle one: H2SO4, HNO3, HCl, NaOH using SR # NA. Time of preservation NA. If more than one preservative is needed, please note in the comments below.

Sample(s) NA were received with bubbles >6 mm in diameter.

Samples(s) NA were received with TRC > 0.5 mg/L (If #19 is ***no***) and were adjusted accordingly in sample receiving with sodium thiosulfate ($Na_2S_2O_3$) with Shealy ID: NA.

SR barcode labels applied by: JRG2 Date: 09/22/2021

Comments:

Report of Analysis

Arcadis U.S., Inc.
630 Plaza Drive
Suite 600
Highlands Ranch, CO 80129
Attention: Joseph Quinnan

Project Name: Eielson AFB

Project Number: 30030317

Lot Number:**WI28012**

Date Completed:10/27/2021

10/28/2021 1:06 PM
Approved and released by:
Project Manager II: **Kathy E. Smith**

The electronic signature above is the equivalent of a handwritten signature.
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Case Narrative
Arcadis U.S., Inc.
Lot Number: WI28012

This Report of Analysis contains the analytical result(s) for the sample(s) listed on the Sample Summary following this Case Narrative. The sample receiving date is documented in the header information associated with each sample.

All results listed in this report relate only to the samples that are contained within this report.

Sample receipt, sample analysis, and data review have been performed in accordance with the Pace Quality Assurance Management Plan (QAMP), applicable Shealy standard operating procedures (SOPs), the 2003 NELAC standard, and Shealy policies. Additionally, the DoD QSM version 5.3 has been followed for these samples, and specifically Table B-15 was followed for all PFAS samples. Any exceptions to the QAMP, SOPs, NELAC standards, the DoD QSM, or policies are qualified on the results page or discussed below.

All QC associated with these samples was in compliance with DOD QSM 5.3 table B-15 and our PFAS SOP.

Correction factors (CF) are used to calculate the original sample concentration. The CF is the inverse of the concentration factor (sample volume / extract final volume) times the dilution factor (DF). For undiluted analysis. For undiluted analysis, the extract is prepared for injection by adding 182 uL of sample extract + 8 uL of reagent water + 10 uL of internal standard solution to a polypropylene autosampler vial. An extra correction factor of 0.91 (182 uL / 200 uL = 0.91) applies. The CF is calculated as follows:

CF = DF * FV / Vo

FV is volume of extract (mL)
Vo is initial sample volume (mL)
DF is dilution factor. For undiluted analysis, DF = 1/0.91.

Sample concentration for aqueous samples:
Concentration (ng/L) = Cs*CF,

$$C_s = \frac{\left(\frac{(A_s x C_{is})}{A_{is}}\right) - B}{M1}$$

Where

C_s is on column concentration of target analyte in the sample (ng/L)
C_{is} is concentration of internal standard in the sample (ng/L)
A_s is peak response of target analyte in the sample
A_{is} is peak response of internal standard in the sample
M1 is the average RF from ICAL or the slope from linear regression ICAL
B is the y-intercept from the ICAL

Pace is a TNI accredited laboratory; however, the following analyses are currently not listed on our TNI scope of accreditation:

Biological Tissue: All, Non-Potable Water: SGT-HEM EPA 1664B, Silica EPA 200.7, Boron, Calcium, Silicon, Strontium EPA 200.8, Bicarbonate, Carbonate, and Hydroxide Alkalinity SM 2320 B-2011, Fecal Coliform SM 9221 C E-2006 & SM 9222D-2006, Strontium SW-846 6010D, VOC SM 6200 B-2011, Drinking Water: VOC (excluding BTEX, MTBE, Naphthalene, & 1,2-dichloroethane) EPA 524.2, Solid Chemical Material: TOC Walkley-Black.

Where applicable, all soil sample results (including LOQ and DL if requested) are corrected for dry weight unless flagged with a "W" qualifier.

If you have any questions regarding this report please contact the Pace Project Manager listed on the cover page.

Sample Summary
Arcadis U.S., Inc.
Lot Number: WI28012
Project Name: Eielson AFB
Project Number: 30030317

Sample Number	Sample ID	Matrix	Date Sampled	Date Received
001	393-1-UT-1	Solid	09/22/2021 1120	09/28/2021
002	393-1-UT-2	Solid	09/22/2021 1300	09/28/2021
003	393-1-UT-3	Solid	09/23/2021 1400	09/28/2021
004	393-1-G-1	Solid	09/22/2021 1320	09/28/2021
005	393-1-G-2	Solid	09/22/2021 1345	09/28/2021
006	393-1-G-3	Solid	09/23/2021 1500	09/28/2021
007	393-1-S-1	Solid	09/22/2021 1400	09/28/2021
008	393-1-S-2	Solid	09/22/2021 1500	09/28/2021
009	393-1-S-3	Solid	09/23/2021 1600	09/28/2021
010	DUP-04	Solid	09/22/2021	09/28/2021

(10 samples)

Detection Summary
Arcadis U.S., Inc.
Lot Number: WI28012
Project Name: Eielson AFB
Project Number: 30030317

Sample	Sample ID	Matrix	Parameter	Method	Result	Q	Units	Page
001	393-1-UT-1	Solid	8:2 FTS	PFAS by ID	31		ug/kg	9
001	393-1-UT-1	Solid	6:2 FTS	PFAS by ID	6.5		ug/kg	9
001	393-1-UT-1	Solid	PFBS	PFAS by ID	1.4		ug/kg	9
001	393-1-UT-1	Solid	PFDS	PFAS by ID	3.2		ug/kg	9
001	393-1-UT-1	Solid	PFHpS	PFAS by ID	0.85	J	ug/kg	9
001	393-1-UT-1	Solid	PFNS	PFAS by ID	4.5		ug/kg	9
001	393-1-UT-1	Solid	PFOSA	PFAS by ID	20		ug/kg	9
001	393-1-UT-1	Solid	PFPeS	PFAS by ID	1.7		ug/kg	9
001	393-1-UT-1	Solid	PFHxS	PFAS by ID	30		ug/kg	9
001	393-1-UT-1	Solid	PFBA	PFAS by ID	0.70	J	ug/kg	9
001	393-1-UT-1	Solid	PFDA	PFAS by ID	2.6		ug/kg	9
001	393-1-UT-1	Solid	PFDoA	PFAS by ID	0.86	J	ug/kg	9
001	393-1-UT-1	Solid	PFHpA	PFAS by ID	1.4		ug/kg	9
001	393-1-UT-1	Solid	PFHxA	PFAS by ID	6.6		ug/kg	9
001	393-1-UT-1	Solid	PFNA	PFAS by ID	0.71	J	ug/kg	9
001	393-1-UT-1	Solid	PFOA	PFAS by ID	12		ug/kg	9
001	393-1-UT-1	Solid	PFPeA	PFAS by ID	2.6		ug/kg	9
001	393-1-UT-1	Solid	PFTrDA	PFAS by ID	0.24	J	ug/kg	9
001	393-1-UT-1	Solid	PFUdA	PFAS by ID	1.3		ug/kg	9
001	393-1-UT-1	Solid	PFOS	PFAS by ID	640		ug/kg	9
001	393-1-UT-1	Solid	8:2 FTS	PFAS by ID	540		ng/L	11
001	393-1-UT-1	Solid	6:2 FTS	PFAS by ID	300		ng/L	11
001	393-1-UT-1	Solid	PFBS	PFAS by ID	40		ng/L	11
001	393-1-UT-1	Solid	PFHpS	PFAS by ID	16	J	ng/L	11
001	393-1-UT-1	Solid	PFNS	PFAS by ID	58	J	ng/L	11
001	393-1-UT-1	Solid	PFOSA	PFAS by ID	480		ng/L	11
001	393-1-UT-1	Solid	PFPeS	PFAS by ID	52		ng/L	11
001	393-1-UT-1	Solid	PFHxS	PFAS by ID	780		ng/L	11
001	393-1-UT-1	Solid	PFBA	PFAS by ID	27	J	ng/L	11
001	393-1-UT-1	Solid	PFDA	PFAS by ID	46		ng/L	11
001	393-1-UT-1	Solid	PFHpA	PFAS by ID	46		ng/L	11
001	393-1-UT-1	Solid	PFHxA	PFAS by ID	220		ng/L	11
001	393-1-UT-1	Solid	PFNA	PFAS by ID	21	J	ng/L	11
001	393-1-UT-1	Solid	PFOA	PFAS by ID	180		ng/L	11
001	393-1-UT-1	Solid	PFPeA	PFAS by ID	90		ng/L	11
001	393-1-UT-1	Solid	PFOS	PFAS by ID	15000		ng/L	11
002	393-1-UT-2	Solid	8:2 FTS	PFAS by ID	25		ug/kg	13
002	393-1-UT-2	Solid	6:2 FTS	PFAS by ID	6.7		ug/kg	13
002	393-1-UT-2	Solid	PFBS	PFAS by ID	1.6		ug/kg	13
002	393-1-UT-2	Solid	PFDS	PFAS by ID	2.1		ug/kg	13
002	393-1-UT-2	Solid	PFHpS	PFAS by ID	0.68	J	ug/kg	13
002	393-1-UT-2	Solid	PFNS	PFAS by ID	2.9		ug/kg	13
002	393-1-UT-2	Solid	PFOSA	PFAS by ID	18		ug/kg	13

Detection Summary (Continued)

Lot Number: WI28012

Sample	Sample ID	Matrix	Parameter	Method	Result	Q	Units	Page
002	393-1-UT-2	Solid	PFPeS	PFAS by ID	1.8		ug/kg	13
002	393-1-UT-2	Solid	PFHxS	PFAS by ID	27		ug/kg	13
002	393-1-UT-2	Solid	PFBA	PFAS by ID	0.77	J	ug/kg	13
002	393-1-UT-2	Solid	PFDA	PFAS by ID	2.1		ug/kg	13
002	393-1-UT-2	Solid	PFDoA	PFAS by ID	0.64	J	ug/kg	13
002	393-1-UT-2	Solid	PFHpA	PFAS by ID	1.4		ug/kg	13
002	393-1-UT-2	Solid	PFHxA	PFAS by ID	7.5		ug/kg	13
002	393-1-UT-2	Solid	PFNA	PFAS by ID	0.58	J	ug/kg	13
002	393-1-UT-2	Solid	PFOA	PFAS by ID	6.3		ug/kg	13
002	393-1-UT-2	Solid	PFPeA	PFAS by ID	3.2		ug/kg	13
002	393-1-UT-2	Solid	PFTrDA	PFAS by ID	0.21	J	ug/kg	13
002	393-1-UT-2	Solid	PFUdA	PFAS by ID	1.0		ug/kg	13
002	393-1-UT-2	Solid	PFOS	PFAS by ID	480		ug/kg	13
002	393-1-UT-2	Solid	8:2 FTS	PFAS by ID	840		ng/L	15
002	393-1-UT-2	Solid	6:2 FTS	PFAS by ID	410		ng/L	15
002	393-1-UT-2	Solid	PFBS	PFAS by ID	48		ng/L	15
002	393-1-UT-2	Solid	PFHpS	PFAS by ID	23	J	ng/L	15
002	393-1-UT-2	Solid	PFNS	PFAS by ID	90		ng/L	15
002	393-1-UT-2	Solid	PFOSA	PFAS by ID	660		ng/L	15
002	393-1-UT-2	Solid	PFPeS	PFAS by ID	69		ng/L	15
002	393-1-UT-2	Solid	PFHxS	PFAS by ID	1100		ng/L	15
002	393-1-UT-2	Solid	PFBA	PFAS by ID	29	J	ng/L	15
002	393-1-UT-2	Solid	PFDA	PFAS by ID	66		ng/L	15
002	393-1-UT-2	Solid	PFHpA	PFAS by ID	51		ng/L	15
002	393-1-UT-2	Solid	PFHxA	PFAS by ID	250		ng/L	15
002	393-1-UT-2	Solid	PFNA	PFAS by ID	27	J	ng/L	15
002	393-1-UT-2	Solid	PFOA	PFAS by ID	240		ng/L	15
002	393-1-UT-2	Solid	PFPeA	PFAS by ID	100		ng/L	15
002	393-1-UT-2	Solid	PFUdA	PFAS by ID	17	J	ng/L	15
002	393-1-UT-2	Solid	PFOS	PFAS by ID	21000		ng/L	15
003	393-1-UT-3	Solid	8:2 FTS	PFAS by ID	65		ug/kg	17
003	393-1-UT-3	Solid	6:2 FTS	PFAS by ID	14		ug/kg	17
003	393-1-UT-3	Solid	EtFOSAA	PFAS by ID	0.58	J	ug/kg	17
003	393-1-UT-3	Solid	PFBS	PFAS by ID	4.3		ug/kg	17
003	393-1-UT-3	Solid	PFDS	PFAS by ID	11		ug/kg	17
003	393-1-UT-3	Solid	PFHpS	PFAS by ID	1.5		ug/kg	17
003	393-1-UT-3	Solid	PFNS	PFAS by ID	13		ug/kg	17
003	393-1-UT-3	Solid	PFOSA	PFAS by ID	47		ug/kg	17
003	393-1-UT-3	Solid	PFPeS	PFAS by ID	4.5		ug/kg	17
003	393-1-UT-3	Solid	PFHxS	PFAS by ID	61		ug/kg	17
003	393-1-UT-3	Solid	PFBA	PFAS by ID	2.1		ug/kg	17
003	393-1-UT-3	Solid	PFDA	PFAS by ID	5.8		ug/kg	17
003	393-1-UT-3	Solid	PFDoA	PFAS by ID	2.1		ug/kg	17
003	393-1-UT-3	Solid	PFHpA	PFAS by ID	2.7		ug/kg	17
003	393-1-UT-3	Solid	PFHxA	PFAS by ID	17		ug/kg	17
003	393-1-UT-3	Solid	PFNA	PFAS by ID	1.9		ug/kg	17
003	393-1-UT-3	Solid	PFOA	PFAS by ID	9.3		ug/kg	17
003	393-1-UT-3	Solid	PFPeA	PFAS by ID	7.0		ug/kg	17

Detection Summary (Continued)

Lot Number: WI28012

Sample	Sample ID	Matrix	Parameter	Method	Result	Q	Units	Page
003	393-1-UT-3	Solid	PFTeDA	PFAS by ID	0.43	J	ug/kg	17
003	393-1-UT-3	Solid	PFTrDA	PFAS by ID	0.72	J	ug/kg	17
003	393-1-UT-3	Solid	PFUdA	PFAS by ID	2.9		ug/kg	17
003	393-1-UT-3	Solid	PFOS	PFAS by ID	1200		ug/kg	17
003	393-1-UT-3	Solid	8:2 FTS	PFAS by ID	1500		ng/L	19
003	393-1-UT-3	Solid	6:2 FTS	PFAS by ID	580		ng/L	19
003	393-1-UT-3	Solid	PFBS	PFAS by ID	140		ng/L	19
003	393-1-UT-3	Solid	PFHpS	PFAS by ID	35	J	ng/L	19
003	393-1-UT-3	Solid	PFNS	PFAS by ID	120		ng/L	19
003	393-1-UT-3	Solid	PFOSA	PFAS by ID	1100		ng/L	19
003	393-1-UT-3	Solid	PFPeS	PFAS by ID	160		ng/L	19
003	393-1-UT-3	Solid	PFHxS	PFAS by ID	2200		ng/L	19
003	393-1-UT-3	Solid	PFBA	PFAS by ID	82		ng/L	19
003	393-1-UT-3	Solid	PFDA	PFAS by ID	130		ng/L	19
003	393-1-UT-3	Solid	PFHpA	PFAS by ID	100		ng/L	19
003	393-1-UT-3	Solid	PFHxA	PFAS by ID	720		ng/L	19
003	393-1-UT-3	Solid	PFNA	PFAS by ID	62		ng/L	19
003	393-1-UT-3	Solid	PFOA	PFAS by ID	310		ng/L	19
003	393-1-UT-3	Solid	PFPeA	PFAS by ID	270		ng/L	19
003	393-1-UT-3	Solid	PFUdA	PFAS by ID	23	J	ng/L	19
003	393-1-UT-3	Solid	PFOS	PFAS by ID	44000		ng/L	19
004	393-1-G-1	Solid	PFHxS	PFAS by ID	0.35	J	ug/kg	21
004	393-1-G-1	Solid	PFOS	PFAS by ID	1.5		ug/kg	21
004	393-1-G-1	Solid	6:2 FTS	PFAS by ID	29	J	ng/L	23
004	393-1-G-1	Solid	PFHxS	PFAS by ID	29	J	ng/L	23
004	393-1-G-1	Solid	PFHxA	PFAS by ID	17	J	ng/L	23
004	393-1-G-1	Solid	PFOA	PFAS by ID	14	J	ng/L	23
004	393-1-G-1	Solid	PFOS	PFAS by ID	450		ng/L	23
005	393-1-G-2	Solid	PFBA	PFAS by ID	2.9		ug/kg	25
005	393-1-G-2	Solid	6:2 FTS	PFAS by ID	23	J	ng/L	27
005	393-1-G-2	Solid	PFHxS	PFAS by ID	77		ng/L	27
005	393-1-G-2	Solid	PFHxA	PFAS by ID	39	J	ng/L	27
005	393-1-G-2	Solid	PFOA	PFAS by ID	17	J	ng/L	27
005	393-1-G-2	Solid	PFPeA	PFAS by ID	14	J	ng/L	27
005	393-1-G-2	Solid	PFOS	PFAS by ID	470		ng/L	27
006	393-1-G-3	Solid	PFHxS	PFAS by ID	0.70	J	ug/kg	29
006	393-1-G-3	Solid	PFHxA	PFAS by ID	0.26	J	ug/kg	29
006	393-1-G-3	Solid	PFOS	PFAS by ID	5.3		ug/kg	29
006	393-1-G-3	Solid	PFHxS	PFAS by ID	24	J	ng/L	31
006	393-1-G-3	Solid	PFHxA	PFAS by ID	15	J	ng/L	31
006	393-1-G-3	Solid	PFOS	PFAS by ID	190		ng/L	31
007	393-1-S-1	Solid	8:2 FTS	PFAS by ID	2.4		ug/kg	33
007	393-1-S-1	Solid	6:2 FTS	PFAS by ID	1.1	J	ug/kg	33
007	393-1-S-1	Solid	PFBS	PFAS by ID	0.25	J	ug/kg	33
007	393-1-S-1	Solid	PFDS	PFAS by ID	0.50	J	ug/kg	33
007	393-1-S-1	Solid	PFHpS	PFAS by ID	0.24	J	ug/kg	33
007	393-1-S-1	Solid	PFNS	PFAS by ID	0.51	J	ug/kg	33
007	393-1-S-1	Solid	PFOSA	PFAS by ID	1.6		ug/kg	33

Detection Summary (Continued)

Lot Number: WI28012

Sample	Sample ID	Matrix	Parameter	Method	Result	Q	Units	Page
007	393-1-S-1	Solid	PFPeS	PFAS by ID	0.25	J	ug/kg	33
007	393-1-S-1	Solid	PFHxS	PFAS by ID	4.4		ug/kg	33
007	393-1-S-1	Solid	PFHxA	PFAS by ID	0.37	J	ug/kg	33
007	393-1-S-1	Solid	PFOA	PFAS by ID	0.73	J	ug/kg	33
007	393-1-S-1	Solid	PFOS	PFAS by ID	48		ug/kg	33
007	393-1-S-1	Solid	8:2 FTS	PFAS by ID	28	J	ng/L	35
007	393-1-S-1	Solid	PFOSA	PFAS by ID	30	J	ng/L	35
007	393-1-S-1	Solid	PFHxS	PFAS by ID	53		ng/L	35
007	393-1-S-1	Solid	PFHxA	PFAS by ID	13	J	ng/L	35
007	393-1-S-1	Solid	PFOA	PFAS by ID	17	J	ng/L	35
007	393-1-S-1	Solid	PFOS	PFAS by ID	470		ng/L	35
008	393-1-S-2	Solid	8:2 FTS	PFAS by ID	5.0		ug/kg	37
008	393-1-S-2	Solid	PFBS	PFAS by ID	0.63	J	ug/kg	37
008	393-1-S-2	Solid	PFDS	PFAS by ID	1.2		ug/kg	37
008	393-1-S-2	Solid	PFHpS	PFAS by ID	0.28	J	ug/kg	37
008	393-1-S-2	Solid	PFNS	PFAS by ID	1.0		ug/kg	37
008	393-1-S-2	Solid	PFOSA	PFAS by ID	2.2		ug/kg	37
008	393-1-S-2	Solid	PFPeS	PFAS by ID	0.43	J	ug/kg	37
008	393-1-S-2	Solid	PFHxS	PFAS by ID	4.2		ug/kg	37
008	393-1-S-2	Solid	PFDA	PFAS by ID	0.19	J	ug/kg	37
008	393-1-S-2	Solid	PFDoA	PFAS by ID	0.39	J	ug/kg	37
008	393-1-S-2	Solid	PFHxA	PFAS by ID	0.40	J	ug/kg	37
008	393-1-S-2	Solid	PFOA	PFAS by ID	0.37	J	ug/kg	37
008	393-1-S-2	Solid	PFUdA	PFAS by ID	0.59	J	ug/kg	37
008	393-1-S-2	Solid	PFOS	PFAS by ID	62		ug/kg	37
008	393-1-S-2	Solid	8:2 FTS	PFAS by ID	34	J	ng/L	39
008	393-1-S-2	Solid	PFOSA	PFAS by ID	30	J	ng/L	39
008	393-1-S-2	Solid	PFHxS	PFAS by ID	46		ng/L	39
008	393-1-S-2	Solid	PFHxA	PFAS by ID	12	J	ng/L	39
008	393-1-S-2	Solid	PFOA	PFAS by ID	17	J	ng/L	39
008	393-1-S-2	Solid	PFOS	PFAS by ID	510		ng/L	39
009	393-1-S-3	Solid	8:2 FTS	PFAS by ID	1.1	J	ug/kg	41
009	393-1-S-3	Solid	PFBS	PFAS by ID	0.26	J	ug/kg	41
009	393-1-S-3	Solid	PFDS	PFAS by ID	0.29	J	ug/kg	41
009	393-1-S-3	Solid	PFOSA	PFAS by ID	1.1		ug/kg	41
009	393-1-S-3	Solid	PFPeS	PFAS by ID	0.24	J	ug/kg	41
009	393-1-S-3	Solid	PFHxS	PFAS by ID	3.0		ug/kg	41
009	393-1-S-3	Solid	PFHxA	PFAS by ID	0.33	J	ug/kg	41
009	393-1-S-3	Solid	PFOA	PFAS by ID	0.53	J	ug/kg	41
009	393-1-S-3	Solid	PFOS	PFAS by ID	32		ug/kg	41
009	393-1-S-3	Solid	8:2 FTS	PFAS by ID	22	J	ng/L	43
009	393-1-S-3	Solid	PFOSA	PFAS by ID	33	J	ng/L	43
009	393-1-S-3	Solid	PFHxS	PFAS by ID	58		ng/L	43
009	393-1-S-3	Solid	PFHxA	PFAS by ID	13	J	ng/L	43
009	393-1-S-3	Solid	PFOA	PFAS by ID	11	J	ng/L	43
009	393-1-S-3	Solid	PFOS	PFAS by ID	540		ng/L	43
010	DUP-04	Solid	8:2 FTS	PFAS by ID	1.0	J	ug/kg	45
010	DUP-04	Solid	PFDS	PFAS by ID	0.36	J	ug/kg	45

Detection Summary (Continued)

Lot Number: WI28012

Sample	Sample ID	Matrix	Parameter	Method	Result	Q	Units	Page
010	DUP-04	Solid	PFOSA	PFAS by ID	1.4		ug/kg	45
010	DUP-04	Solid	PFHxS	PFAS by ID	1.7		ug/kg	45
010	DUP-04	Solid	PFHxA	PFAS by ID	0.29	J	ug/kg	45
010	DUP-04	Solid	PFOA	PFAS by ID	0.28	J	ug/kg	45
010	DUP-04	Solid	PFOS	PFAS by ID	26		ug/kg	45
010	DUP-04	Solid	PFOSA	PFAS by ID	32	J	ng/L	47
010	DUP-04	Solid	PFHxS	PFAS by ID	29	J	ng/L	47
010	DUP-04	Solid	PFHxA	PFAS by ID	10	J	ng/L	47
010	DUP-04	Solid	PFOA	PFAS by ID	20	J	ng/L	47
010	DUP-04	Solid	PFOS	PFAS by ID	440		ng/L	47

(197 detections)

PFAS by LC/MS/MS

Client: **Arcadis U.S., Inc.** | Laboratory ID: **WI28012-001**

Description: **393-1-UT-1** | Matrix: **Solid**

Date Sampled: **09/22/2021 1120** | Project Name: **Eielson AFB** | % Solids: **92.6** **09/28/2021 2312**

Date Received: **09/28/2021** | Project Number: **30030317**

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch
1	SOP SPE	PFAS by ID SOP QSM B-15	1	09/29/2021 1646	NK1	09/29/2021 1247	16945
2	SOP SPE	PFAS by ID SOP QSM B-15	5	09/30/2021 1622	NK1	09/29/2021 1247	16945

Parameter	CAS Number	Analytical Method	Result	Q	LOQ	LOD	DL	Units	Run
1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS)	**39108-34-4**	**PFAS by ID SOP**	**31**		**1.9**	0.95	**0.47**	**ug/kg**	**1**
1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS)	**27619-97-2**	**PFAS by ID SOP**	**6.5**		**1.9**	0.95	**0.47**	**ug/kg**	**1**
1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS)	757124-72-4	PFAS by ID SOP	0.95	U	1.9	0.95	0.47	ug/kg	1
N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA)	2991-50-6	PFAS by ID SOP	0.95	U	1.9	0.95	0.47	ug/kg	1
N-methylperfluoro-1-octanesulfonamide (MeFOSA)	31506-32-8	PFAS by ID SOP	0.95	U	1.9	0.95	0.47	ug/kg	1
N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA)	2355-31-9	PFAS by ID SOP	0.95	U	1.9	0.95	0.47	ug/kg	1
Perfluoro-1-butanesulfonic acid (PFBS)	**375-73-5**	**PFAS by ID SOP**	**1.4**		**0.95**	0.48	**0.19**	**ug/kg**	**1**
Perfluoro-1-decanesulfonic acid (PFDS)	**335-77-3**	**PFAS by ID SOP**	**3.2**		**0.95**	0.48	**0.19**	**ug/kg**	**1**
Perfluoro-1-heptanesulfonic acid (PFHpS)	**375-92-8**	**PFAS by ID SOP**	**0.85**	**J**	**0.95**	0.48	**0.19**	**ug/kg**	**1**
Perfluoro-1-nonanesulfonic acid (PFNS)	**68259-12-1**	**PFAS by ID SOP**	**4.5**		**0.95**	0.48	**0.19**	**ug/kg**	**1**
Perfluoro-1-octanesulfonamide (PFOSA)	**754-91-6**	**PFAS by ID SOP**	**20**		**0.95**	0.48	**0.19**	**ug/kg**	**1**
Perfluoro-1-pentanesulfonic acid (PFPeS)	**2706-91-4**	**PFAS by ID SOP**	**1.7**		**0.95**	0.48	**0.19**	**ug/kg**	**1**
Perfluorohexanesulfonic acid (PFHxS)	**355-46-4**	**PFAS by ID SOP**	**30**		**0.95**	0.48	**0.19**	**ug/kg**	**1**
Perfluoro-n-butanoic acid (PFBA)	**375-22-4**	**PFAS by ID SOP**	**0.70**	**J**	**0.95**	0.48	**0.19**	**ug/kg**	**1**
Perfluoro-n-decanoic acid (PFDA)	**335-76-2**	**PFAS by ID SOP**	**2.6**		**0.95**	0.48	**0.19**	**ug/kg**	**1**
Perfluoro-n-dodecanoic acid (PFDoA)	**307-55-1**	**PFAS by ID SOP**	**0.86**	**J**	**0.95**	0.48	**0.19**	**ug/kg**	**1**
Perfluoro-n-heptanoic acid (PFHpA)	**375-85-9**	**PFAS by ID SOP**	**1.4**		**0.95**	0.48	**0.19**	**ug/kg**	**1**
Perfluoro-n-hexanoic acid (PFHxA)	**307-24-4**	**PFAS by ID SOP**	**6.6**		**0.95**	0.48	**0.19**	**ug/kg**	**1**
Perfluoro-n-nonanoic acid (PFNA)	**375-95-1**	**PFAS by ID SOP**	**0.71**	**J**	**0.95**	0.48	**0.19**	**ug/kg**	**1**
Perfluoro-n-octanoic acid (PFOA)	**335-67-1**	**PFAS by ID SOP**	**12**		**0.95**	0.48	**0.19**	**ug/kg**	**1**
Perfluoro-n-pentanoic acid (PFPeA)	**2706-90-3**	**PFAS by ID SOP**	**2.6**		**0.95**	0.48	**0.19**	**ug/kg**	**1**
Perfluoro-n-tetradecanoic acid (PFTeDA)	376-06-7	PFAS by ID SOP	0.48	U	0.95	0.48	0.19	ug/kg	1
Perfluoro-n-tridecanoic acid (PFTrDA)	**72629-94-8**	**PFAS by ID SOP**	**0.24**	**J**	**0.95**	0.48	**0.19**	**ug/kg**	**1**
Perfluoro-n-undecanoic acid (PFUdA)	**2058-94-8**	**PFAS by ID SOP**	**1.3**		**0.95**	0.48	**0.19**	**ug/kg**	**1**
Perfluorooctanesulfonic acid (PFOS)	**1763-23-1**	**PFAS by ID SOP**	**640**		**4.7**	2.4	**0.95**	**ug/kg**	**2**

Surrogate	Run 1 Q	Run 1 % Recovery	Run 1 Acceptance Limits	Run 2 Q	Run 2 % Recovery	Run 2 Acceptance Limits
13C2_4:2FTS		76	50-150		131	50-150
13C2_6:2FTS		80	50-150	N	158	50-150
13C2_8:2FTS		77	50-150	N	183	50-150
13C2_PFDoA		75	50-150		107	50-150
13C2_PFTeDA		69	50-150		101	50-150
13C3_PFBS		69	50-150		94	50-150
13C3_PFHxS		70	50-150		94	50-150
13C4_PFBA		68	50-150		97	50-150
13C4_PFHpA		69	50-150		96	50-150
13C5_PFHxA		70	50-150		95	50-150
13C5_PFPeA		68	50-150		94	50-150
13C6_PFDA		68	50-150		102	50-150
13C7_PFUdA		69	50-150		97	50-150
13C8_PFOA		70	50-150		95	50-150
13C8_PFOS		64	50-150		89	50-150
13C8_PFOSA		66	50-150		89	50-150

LOQ = Limit of Quantitation | B = Detected in the method blank | E = Quantitation of compound exceeded the calibration range | DL = Detection Limit | Q = Surrogate failure

U = Not detected at or above the LOQ | N = Recovery is out of criteria | P = The RPD between two GC columns exceeds 40% | J = Estimated result < LOQ and ≥ DL | L = LCS/LCSD failure

H = Out of holding time | W = Reported on wet weight basis | LOD = Limit of Detection | S = MS/MSD failure

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PFAS by LC/MS/MS

Client: **Arcadis U.S., Inc.**		Laboratory ID: **WI28012-001**	
Description: **393-1-UT-1**		Matrix: **Solid**	
Date Sampled: **09/22/2021 1120**	Project Name: **Eielson AFB**	% Solids: **92.6**	**09/28/2021 2312**
Date Received: **09/28/2021**	Project Number: **30030317**		

Surrogate	Q	Run 1 % Recovery	Acceptance Limits	Q	Run 2 % Recovery	Acceptance Limits
13C9_PFNA		66	50-150		95	50-150
d5-EtFOSAA		76	50-150		93	50-150
d-MeFOSA		80	50-150		87	50-150
d3-MeFOSAA		75	50-150		86	50-150

LOQ = Limit of Quantitation	B = Detected in the method blank	E = Quantitation of compound exceeded the calibration range	DL = Detection Limit	Q = Surrogate failure
U = Not detected at or above the LOQ	N = Recovery is out of criteria	P = The RPD between two GC columns exceeds 40%	J = Estimated result < LOQ and ≥ DL	L = LCS/LCSD failure
H = Out of holding time	W = Reported on wet weight basis	LOD = Limit of Detection		S = MS/MSD failure

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SPLP PFAS

Client: **Arcadis U.S., Inc.**		Laboratory ID: **WI28012-001**	
Description: **393-1-UT-1**		Matrix: **Solid**	
Date Sampled: **09/22/2021 1120**	Project Name: **Eielson AFB**	% Solids: **92.6**	**09/28/2021 2312**
Date Received: **09/28/2021**	Project Number: **30030317**		

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch	Leachate Date
1	1312/PFAS	PFAS by ID SOP QSM B-15	1	10/21/2021 1414	JJG	10/20/2021 1345	19466	10/16/2021 0006
2	1312/PFAS	PFAS by ID SOP QSM B-15	5	10/24/2021 1546	JJG	10/20/2021 1345	19466	10/16/2021 0006

Parameter	CAS Number	Analytical Method	Result	Q	LOQ	LOD	DL	Units	Run
1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS)	**39108-34-4**	**PFAS by ID SOP**	**540**		**80**	40	**20**	**ng/L**	**1**
1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS)	**27619-97-2**	**PFAS by ID SOP**	**300**		**80**	40	**20**	**ng/L**	**1**
1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS)	757124-72-4	PFAS by ID SOP	40	U	80	40	20	ng/L	1
N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA)	2991-50-6	PFAS by ID SOP	40	U	80	40	20	ng/L	1
N-methylperfluoro-1-octanesulfonamide (MeFOSA)	31506-32-8	PFAS by ID SOP	80	U	160	80	40	ng/L	1
N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA)	2355-31-9	PFAS by ID SOP	40	U	80	40	20	ng/L	1
Perfluoro-1-butanesulfonic acid (PFBS)	**375-73-5**	**PFAS by ID SOP**	**40**		**40**	20	**10**	**ng/L**	**1**
Perfluoro-1-decanesulfonic acid (PFDS)	335-77-3	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-1-heptanesulfonic acid (PFHpS)	**375-92-8**	**PFAS by ID SOP**	**16**	**J**	**40**	20	**10**	**ng/L**	**1**
Perfluoro-1-nonanesulfonic acid (PFNS)	**68259-12-1**	**PFAS by ID SOP**	**58**	**J**	**200**	100	**50**	**ng/L**	**2**
Perfluoro-1-octanesulfonamide (PFOSA)	**754-91-6**	**PFAS by ID SOP**	**480**		**40**	20	**10**	**ng/L**	**1**
Perfluoro-1-pentanesulfonic acid (PFPeS)	**2706-91-4**	**PFAS by ID SOP**	**52**		**40**	20	**10**	**ng/L**	**1**
Perfluorohexanesulfonic acid (PFHxS)	**355-46-4**	**PFAS by ID SOP**	**780**		**40**	20	**10**	**ng/L**	**1**
Perfluoro-n-butanoic acid (PFBA)	**375-22-4**	**PFAS by ID SOP**	**27**	**J**	**40**	20	**10**	**ng/L**	**1**
Perfluoro-n-decanoic acid (PFDA)	**335-76-2**	**PFAS by ID SOP**	**46**		**40**	20	**10**	**ng/L**	**1**
Perfluoro-n-dodecanoic acid (PFDoA)	307-55-1	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-n-heptanoic acid (PFHpA)	**375-85-9**	**PFAS by ID SOP**	**46**		**40**	20	**10**	**ng/L**	**1**
Perfluoro-n-hexanoic acid (PFHxA)	**307-24-4**	**PFAS by ID SOP**	**220**		**40**	20	**10**	**ng/L**	**1**
Perfluoro-n-nonanoic acid (PFNA)	**375-95-1**	**PFAS by ID SOP**	**21**	**J**	**40**	20	**10**	**ng/L**	**1**
Perfluoro-n-octanoic acid (PFOA)	**335-67-1**	**PFAS by ID SOP**	**180**		**40**	20	**10**	**ng/L**	**1**
Perfluoro-n-pentanoic acid (PFPeA)	**2706-90-3**	**PFAS by ID SOP**	**90**		**40**	20	**10**	**ng/L**	**1**
Perfluoro-n-tetradecanoic acid (PFTeDA)	376-06-7	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-n-tridecanoic acid (PFTrDA)	72629-94-8	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-n-undecanoic acid (PFUdA)	2058-94-8	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluorooctanesulfonic acid (PFOS)	**1763-23-1**	**PFAS by ID SOP**	**15000**		**200**	100	**50**	**ng/L**	**2**

Surrogate	Run 1 Q	Run 1 % Recovery	Run 1 Acceptance Limits	Run 2 Q	Run 2 % Recovery	Run 2 Acceptance Limits
13C2_4:2FTS		100	50-150		90	50-150
13C2_6:2FTS		100	50-150		95	50-150
13C2_8:2FTS		101	50-150		87	50-150
13C2_PFDoA		94	50-150		92	50-150
13C2_PFTeDA		94	50-150		96	50-150
13C3_PFBS		96	50-150		99	50-150
13C3_PFHxS		100	50-150		97	50-150
13C4_PFBA		93	50-150		97	50-150
13C4_PFHpA		84	50-150		98	50-150
13C5_PFHxA		97	50-150		96	50-150
13C5_PFPeA		96	50-150		93	50-150
13C6_PFDA		92	50-150		98	50-150
13C7_PFUdA		92	50-150		98	50-150
13C8_PFOA		95	50-150		98	50-150
13C8_PFOS		88	50-150		87	50-150
13C8_PFOSA		101	50-150		90	50-150

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

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SPLP PFAS

Client: **Arcadis U.S., Inc.**		Laboratory ID: **WI28012-001**	
Description: **393-1-UT-1**		Matrix: **Solid**	
Date Sampled: **09/22/2021 1120**	Project Name: **Eielson AFB**	% Solids: **92.6**	**09/28/2021 2312**
Date Received: **09/28/2021**	Project Number: **30030317**		

Surrogate	Q	Run 1 % Recovery	Acceptance Limits	Q	Run 2 % Recovery	Acceptance Limits
13C9_PFNA		90	50-150		91	50-150
d5-EtFOSAA		108	50-150		86	50-150
d-MeFOSA		99	50-150		95	50-150
d3-MeFOSAA		99	50-150		84	50-150

LOQ = Limit of Quantitation	B = Detected in the method blank	E = Quantitation of compound exceeded the calibration range	DL = Detection Limit	Q = Surrogate failure
U = Not detected at or above the LOQ	N = Recovery is out of criteria	P = The RPD between two GC columns exceeds 40%	J = Estimated result < LOQ and ≥ DL	L = LCS/LCSD failure
H = Out of holding time	W = Reported on wet weight basis	LOD = Limit of Detection		S = MS/MSD failure

PFAS by LC/MS/MS

Client: **Arcadis U.S., Inc.** Laboratory ID: **WI28012-002**

Description: **393-1-UT-2** Matrix: **Solid**

Date Sampled: **09/22/2021 1300** Project Name: **Eielson AFB** % Solids: **93.3** **09/28/2021 2312**

Date Received: **09/28/2021** Project Number: **30030317**

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch
1	SOP SPE	PFAS by ID SOP QSM B-15	1	09/29/2021 1658	NK1	09/29/2021 1247	16945
2	SOP SPE	PFAS by ID SOP QSM B-15	5	09/30/2021 1635	NK1	09/29/2021 1247	16945

Parameter	CAS Number	Analytical Method	Result	Q	LOQ	LOD	DL	Units	Run
1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS)	**39108-34-4**	**PFAS by ID SOP**	**25**		**1.9**	0.95	**0.49**	**ug/kg**	**1**
1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS)	**27619-97-2**	**PFAS by ID SOP**	**6.7**		**1.9**	0.95	**0.49**	**ug/kg**	**1**
1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS)	757124-72-4	PFAS by ID SOP	0.95	U	1.9	0.95	0.49	ug/kg	1
N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA)	2991-50-6	PFAS by ID SOP	0.95	U	1.9	0.95	0.49	ug/kg	1
N-methylperfluoro-1-octanesulfonamide (MeFOSA)	31506-32-8	PFAS by ID SOP	0.95	U	1.9	0.95	0.49	ug/kg	1
N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA)	2355-31-9	PFAS by ID SOP	0.95	U	1.9	0.95	0.49	ug/kg	1
Perfluoro-1-butanesulfonic acid (PFBS)	**375-73-5**	**PFAS by ID SOP**	**1.6**		**0.97**	0.49	**0.19**	**ug/kg**	**1**
Perfluoro-1-decanesulfonic acid (PFDS)	**335-77-3**	**PFAS by ID SOP**	**2.1**		**0.97**	0.49	**0.19**	**ug/kg**	**1**
Perfluoro-1-heptanesulfonic acid (PFHpS)	**375-92-8**	**PFAS by ID SOP**	**0.68**	**J**	**0.97**	0.49	**0.19**	**ug/kg**	**1**
Perfluoro-1-nonanesulfonic acid (PFNS)	**68259-12-1**	**PFAS by ID SOP**	**2.9**		**0.97**	0.49	**0.19**	**ug/kg**	**1**
Perfluoro-1-octanesulfonamide (PFOSA)	**754-91-6**	**PFAS by ID SOP**	**18**		**0.97**	0.49	**0.19**	**ug/kg**	**1**
Perfluoro-1-pentanesulfonic acid (PFPeS)	**2706-91-4**	**PFAS by ID SOP**	**1.8**		**0.97**	0.49	**0.19**	**ug/kg**	**1**
Perfluorohexanesulfonic acid (PFHxS)	**355-46-4**	**PFAS by ID SOP**	**27**		**0.97**	0.49	**0.19**	**ug/kg**	**1**
Perfluoro-n-butanoic acid (PFBA)	**375-22-4**	**PFAS by ID SOP**	**0.77**	**J**	**0.97**	0.49	**0.19**	**ug/kg**	**1**
Perfluoro-n-decanoic acid (PFDA)	**335-76-2**	**PFAS by ID SOP**	**2.1**		**0.97**	0.49	**0.19**	**ug/kg**	**1**
Perfluoro-n-dodecanoic acid (PFDoA)	**307-55-1**	**PFAS by ID SOP**	**0.64**	**J**	**0.97**	0.49	**0.19**	**ug/kg**	**1**
Perfluoro-n-heptanoic acid (PFHpA)	**375-85-9**	**PFAS by ID SOP**	**1.4**		**0.97**	0.49	**0.19**	**ug/kg**	**1**
Perfluoro-n-hexanoic acid (PFHxA)	**307-24-4**	**PFAS by ID SOP**	**7.5**		**0.97**	0.49	**0.19**	**ug/kg**	**1**
Perfluoro-n-nonanoic acid (PFNA)	**375-95-1**	**PFAS by ID SOP**	**0.58**	**J**	**0.97**	0.49	**0.19**	**ug/kg**	**1**
Perfluoro-n-octanoic acid (PFOA)	**335-67-1**	**PFAS by ID SOP**	**6.3**		**0.97**	0.49	**0.19**	**ug/kg**	**1**
Perfluoro-n-pentanoic acid (PFPeA)	**2706-90-3**	**PFAS by ID SOP**	**3.2**		**0.97**	0.49	**0.19**	**ug/kg**	**1**
Perfluoro-n-tetradecanoic acid (PFTeDA)	376-06-7	PFAS by ID SOP	0.49	U	0.97	0.49	0.19	ug/kg	1
Perfluoro-n-tridecanoic acid (PFTrDA)	**72629-94-8**	**PFAS by ID SOP**	**0.21**	**J**	**0.97**	0.49	**0.19**	**ug/kg**	**1**
Perfluoro-n-undecanoic acid (PFUdA)	**2058-94-8**	**PFAS by ID SOP**	**1.0**		**0.97**	0.49	**0.19**	**ug/kg**	**1**
Perfluorooctanesulfonic acid (PFOS)	**1763-23-1**	**PFAS by ID SOP**	**480**		**4.9**	2.5	**0.97**	**ug/kg**	**2**

Surrogate	Q	Run 1 % Recovery	Acceptance Limits	Q	Run 2 % Recovery	Acceptance Limits
13C2_4:2FTS		81	50-150		102	50-150
13C2_6:2FTS		82	50-150	N	39	50-150
13C2_8:2FTS		81	50-150		92	50-150
13C2_PFDoA		72	50-150		103	50-150
13C2_PFTeDA		73	50-150		109	50-150
13C3_PFBS		74	50-150		93	50-150
13C3_PFHxS		74	50-150		97	50-150
13C4_PFBA		75	50-150		97	50-150
13C4_PFHpA		75	50-150		99	50-150
13C5_PFHxA		74	50-150		98	50-150
13C5_PFPeA		74	50-150		98	50-150
13C6_PFDA		73	50-150		107	50-150
13C7_PFUdA		70	50-150		95	50-150
13C8_PFOA		73	50-150		96	50-150
13C8_PFOS		69	50-150		94	50-150
13C8_PFOSA		70	50-150		96	50-150

LOQ = Limit of Quantitation
B = Detected in the method blank
E = Quantitation of compound exceeded the calibration range
DL = Detection Limit
Q = Surrogate failure
U = Not detected at or above the LOQ
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
J = Estimated result < LOQ and ≥ DL
L = LCS/LCSD failure
H = Out of holding time
W = Reported on wet weight basis
LOD = Limit of Detection
S = MS/MSD failure

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PFAS by LC/MS/MS

Client: **Arcadis U.S., Inc.**		Laboratory ID: **WI28012-002**
Description: **393-1-UT-2**		Matrix: **Solid**
Date Sampled: **09/22/2021 1300**	Project Name: **Eielson AFB**	% Solids: **93.3 09/28/2021 2312**
Date Received: **09/28/2021**	Project Number: **30030317**	

Surrogate	Q	Run 1 % Recovery	Acceptance Limits	Q	Run 2 % Recovery	Acceptance Limits
13C9_PFNA		71	50-150		99	50-150
d5-EtFOSAA		82	50-150		99	50-150
d-MeFOSA		85	50-150		108	50-150
d3-MeFOSAA		80	50-150		100	50-150

LOQ = Limit of Quantitation	B = Detected in the method blank	E = Quantitation of compound exceeded the calibration range	DL = Detection Limit	Q = Surrogate failure
U = Not detected at or above the LOQ	N = Recovery is out of criteria	P = The RPD between two GC columns exceeds 40%	J = Estimated result < LOQ and ≥ DL	L = LCS/LCSD failure
H = Out of holding time	W = Reported on wet weight basis	LOD = Limit of Detection		S = MS/MSD failure

SPLP PFAS

Client: **Arcadis U.S., Inc.**		Laboratory ID: **WI28012-002**	
Description: **393-1-UT-2**		Matrix: **Solid**	
Date Sampled: **09/22/2021 1300**	Project Name: **Eielson AFB**	% Solids: **93.3**	**09/28/2021 2312**
Date Received: **09/28/2021**	Project Number: **30030317**		

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch	Leachate Date
1	1312/PFAS	PFAS by ID SOP QSM B-15	1	10/21/2021 1425	JJG	10/20/2021 1345	19466	10/16/2021 0006
2	1312/PFAS	PFAS by ID SOP QSM B-15	10	10/24/2021 1628	JJG	10/20/2021 1345	19466	10/16/2021 0006

Parameter	CAS Number	Analytical Method	Result	Q	LOQ	LOD	DL	Units	Run
1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS)	**39108-34-4**	**PFAS by ID SOP**	**840**		**80**	40	**20**	**ng/L**	**1**
1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS)	**27619-97-2**	**PFAS by ID SOP**	**410**		**80**	40	**20**	**ng/L**	**1**
1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS)	757124-72-4	PFAS by ID SOP	40	U	80	40	20	ng/L	1
N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA)	2991-50-6	PFAS by ID SOP	40	U	80	40	20	ng/L	1
N-methylperfluoro-1-octanesulfonamide (MeFOSA)	31506-32-8	PFAS by ID SOP	80	U	160	80	40	ng/L	1
N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA)	2355-31-9	PFAS by ID SOP	40	U	80	40	20	ng/L	1
Perfluoro-1-butanesulfonic acid (PFBS)	**375-73-5**	**PFAS by ID SOP**	**48**		**40**	20	**10**	**ng/L**	**1**
Perfluoro-1-decanesulfonic acid (PFDS)	335-77-3	PFAS by ID SOP	200	U	400	200	100	ng/L	2
Perfluoro-1-heptanesulfonic acid (PFHpS)	**375-92-8**	**PFAS by ID SOP**	**23**	**J**	**40**	20	**10**	**ng/L**	**1**
Perfluoro-1-nonanesulfonic acid (PFNS)	**68259-12-1**	**PFAS by ID SOP**	**90**		**40**	20	**10**	**ng/L**	**1**
Perfluoro-1-octanesulfonamide (PFOSA)	**754-91-6**	**PFAS by ID SOP**	**660**		**40**	20	**10**	**ng/L**	**1**
Perfluoro-1-pentanesulfonic acid (PFPeS)	**2706-91-4**	**PFAS by ID SOP**	**69**		**40**	20	**10**	**ng/L**	**1**
Perfluorohexanesulfonic acid (PFHxS)	**355-46-4**	**PFAS by ID SOP**	**1100**		**40**	20	**10**	**ng/L**	**1**
Perfluoro-n-butanoic acid (PFBA)	**375-22-4**	**PFAS by ID SOP**	**29**	**J**	**40**	20	**10**	**ng/L**	**1**
Perfluoro-n-decanoic acid (PFDA)	**335-76-2**	**PFAS by ID SOP**	**66**		**40**	20	**10**	**ng/L**	**1**
Perfluoro-n-dodecanoic acid (PFDoA)	307-55-1	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-n-heptanoic acid (PFHpA)	**375-85-9**	**PFAS by ID SOP**	**51**		**40**	20	**10**	**ng/L**	**1**
Perfluoro-n-hexanoic acid (PFHxA)	**307-24-4**	**PFAS by ID SOP**	**250**		**40**	20	**10**	**ng/L**	**1**
Perfluoro-n-nonanoic acid (PFNA)	**375-95-1**	**PFAS by ID SOP**	**27**	**J**	**40**	20	**10**	**ng/L**	**1**
Perfluoro-n-octanoic acid (PFOA)	**335-67-1**	**PFAS by ID SOP**	**240**		**40**	20	**10**	**ng/L**	**1**
Perfluoro-n-pentanoic acid (PFPeA)	**2706-90-3**	**PFAS by ID SOP**	**100**		**40**	20	**10**	**ng/L**	**1**
Perfluoro-n-tetradecanoic acid (PFTeDA)	376-06-7	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-n-tridecanoic acid (PFTrDA)	72629-94-8	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-n-undecanoic acid (PFUdA)	**2058-94-8**	**PFAS by ID SOP**	**17**	**J**	**40**	20	**10**	**ng/L**	**1**
Perfluorooctanesulfonic acid (PFOS)	**1763-23-1**	**PFAS by ID SOP**	**21000**		**400**	200	**100**	**ng/L**	**2**

Surrogate	Q	Run 1 % Recovery	Acceptance Limits	Q	Run 2 % Recovery	Acceptance Limits
13C2_4:2FTS		92	50-150		83	50-150
13C2_6:2FTS		90	50-150		84	50-150
13C2_8:2FTS		95	50-150		91	50-150
13C2_PFDoA		86	50-150		85	50-150
13C2_PFTeDA		88	50-150		94	50-150
13C3_PFBS		84	50-150		98	50-150
13C3_PFHxS		86	50-150		93	50-150
13C4_PFBA		87	50-150		95	50-150
13C4_PFHpA		84	50-150		97	50-150
13C5_PFHxA		91	50-150		96	50-150
13C5_PFPeA		87	50-150		92	50-150
13C6_PFDA		82	50-150		100	50-150
13C7_PFUdA		83	50-150		93	50-150
13C8_PFOA		87	50-150		97	50-150
13C8_PFOS		85	50-150		87	50-150
13C8_PFOSA		93	50-150		87	50-150

LOQ = Limit of Quantitation	B = Detected in the method blank	E = Quantitation of compound exceeded the calibration range	DL = Detection Limit	Q = Surrogate failure
U = Not detected at or above the LOQ	N = Recovery is out of criteria	P = The RPD between two GC columns exceeds 40%	J = Estimated result < LOQ and ≥ DL	L = LCS/LCSD failure
H = Out of holding time	W = Reported on wet weight basis	LOD = Limit of Detection		S = MS/MSD failure

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SPLP PFAS

Client: **Arcadis U.S., Inc.**		Laboratory ID: **WI28012-002**
Description: **393-1-UT-2**		Matrix: **Solid**
Date Sampled: **09/22/2021 1300**	Project Name: **Eielson AFB**	% Solids: **93.3 09/28/2021 2312**
Date Received: **09/28/2021**	Project Number: **30030317**	

Surrogate	Q	Run 1 % Recovery	Acceptance Limits	Q	Run 2 % Recovery	Acceptance Limits
13C9_PFNA		79	50-150		92	50-150
d5-EtFOSAA		100	50-150		85	50-150
d-MeFOSA		85	50-150		94	50-150
d3-MeFOSAA		94	50-150		89	50-150

LOQ = Limit of Quantitation	B = Detected in the method blank	E = Quantitation of compound exceeded the calibration range	DL = Detection Limit	Q = Surrogate failure
U = Not detected at or above the LOQ	N = Recovery is out of criteria	P = The RPD between two GC columns exceeds 40%	J = Estimated result < LOQ and ≥ DL	L = LCS/LCSD failure
H = Out of holding time	W = Reported on wet weight basis	LOD = Limit of Detection		S = MS/MSD failure

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PFAS by LC/MS/MS

Client: **Arcadis U.S., Inc.** Laboratory ID: **WI28012-003**

Description: **393-1-UT-3** Matrix: **Solid**

Date Sampled: **09/23/2021 1400** Project Name: **Eielson AFB** % Solids: **91.8** **09/28/2021 2312**

Date Received: **09/28/2021** Project Number: **30030317**

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch
1	SOP SPE	PFAS by ID SOP QSM B-15	1	09/29/2021 1711	NK1	09/29/2021 1247	16945
2	SOP SPE	PFAS by ID SOP QSM B-15	20	09/30/2021 1647	NK1	09/29/2021 1247	16945

Parameter	CAS Number	Analytical Method	Result	Q	LOQ	LOD	DL	Units	Run
1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS)	**39108-34-4**	**PFAS by ID SOP**	**65**		**1.8**	0.90	**0.45**	**ug/kg**	**1**
1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS)	**27619-97-2**	**PFAS by ID SOP**	**14**		**1.8**	0.90	**0.45**	**ug/kg**	**1**
1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS)	757124-72-4	PFAS by ID SOP	0.90	U	1.8	0.90	0.45	ug/kg	1
N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA)	**2991-50-6**	**PFAS by ID SOP**	**0.58**	**J**	**1.8**	0.90	**0.45**	**ug/kg**	**1**
N-methylperfluoro-1-octanesulfonamide (MeFOSA)	31506-32-8	PFAS by ID SOP	0.90	U	1.8	0.90	0.45	ug/kg	1
N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA)	2355-31-9	PFAS by ID SOP	0.90	U	1.8	0.90	0.45	ug/kg	1
Perfluoro-1-butanesulfonic acid (PFBS)	**375-73-5**	**PFAS by ID SOP**	**4.3**		**0.91**	0.46	**0.18**	**ug/kg**	**1**
Perfluoro-1-decanesulfonic acid (PFDS)	**335-77-3**	**PFAS by ID SOP**	**11**		**0.91**	0.46	**0.18**	**ug/kg**	**1**
Perfluoro-1-heptanesulfonic acid (PFHpS)	**375-92-8**	**PFAS by ID SOP**	**1.5**		**0.91**	0.46	**0.18**	**ug/kg**	**1**
Perfluoro-1-nonanesulfonic acid (PFNS)	**68259-12-1**	**PFAS by ID SOP**	**13**		**0.91**	0.46	**0.18**	**ug/kg**	**1**
Perfluoro-1-octanesulfonamide (PFOSA)	**754-91-6**	**PFAS by ID SOP**	**47**		**0.91**	0.46	**0.18**	**ug/kg**	**1**
Perfluoro-1-pentanesulfonic acid (PFPeS)	**2706-91-4**	**PFAS by ID SOP**	**4.5**		**0.91**	0.46	**0.18**	**ug/kg**	**1**
Perfluorohexanesulfonic acid (PFHxS)	**355-46-4**	**PFAS by ID SOP**	**61**		**0.91**	0.46	**0.18**	**ug/kg**	**1**
Perfluoro-n-butanoic acid (PFBA)	**375-22-4**	**PFAS by ID SOP**	**2.1**		**0.91**	0.46	**0.18**	**ug/kg**	**1**
Perfluoro-n-decanoic acid (PFDA)	**335-76-2**	**PFAS by ID SOP**	**5.8**		**0.91**	0.46	**0.18**	**ug/kg**	**1**
Perfluoro-n-dodecanoic acid (PFDoA)	**307-55-1**	**PFAS by ID SOP**	**2.1**		**0.91**	0.46	**0.18**	**ug/kg**	**1**
Perfluoro-n-heptanoic acid (PFHpA)	**375-85-9**	**PFAS by ID SOP**	**2.7**		**0.91**	0.46	**0.18**	**ug/kg**	**1**
Perfluoro-n-hexanoic acid (PFHxA)	**307-24-4**	**PFAS by ID SOP**	**17**		**0.91**	0.46	**0.18**	**ug/kg**	**1**
Perfluoro-n-nonanoic acid (PFNA)	**375-95-1**	**PFAS by ID SOP**	**1.9**		**0.91**	0.46	**0.18**	**ug/kg**	**1**
Perfluoro-n-octanoic acid (PFOA)	**335-67-1**	**PFAS by ID SOP**	**9.3**		**0.91**	0.46	**0.18**	**ug/kg**	**1**
Perfluoro-n-pentanoic acid (PFPeA)	**2706-90-3**	**PFAS by ID SOP**	**7.0**		**0.91**	0.46	**0.18**	**ug/kg**	**1**
Perfluoro-n-tetradecanoic acid (PFTeDA)	**376-06-7**	**PFAS by ID SOP**	**0.43**	**J**	**0.91**	0.46	**0.18**	**ug/kg**	**1**
Perfluoro-n-tridecanoic acid (PFTrDA)	**72629-94-8**	**PFAS by ID SOP**	**0.72**	**J**	**0.91**	0.46	**0.18**	**ug/kg**	**1**
Perfluoro-n-undecanoic acid (PFUdA)	**2058-94-8**	**PFAS by ID SOP**	**2.9**		**0.91**	0.46	**0.18**	**ug/kg**	**1**
Perfluorooctanesulfonic acid (PFOS)	**1763-23-1**	**PFAS by ID SOP**	**1200**		**18**	9.0	**3.6**	**ug/kg**	**2**

Surrogate	Run 1 Q	Run 1 % Recovery	Run 1 Acceptance Limits	Run 2 Q	Run 2 % Recovery	Run 2 Acceptance Limits
13C2_4:2FTS		87	50-150		104	50-150
13C2_6:2FTS		87	50-150		98	50-150
13C2_8:2FTS		89	50-150		99	50-150
13C2_PFDoA		76	50-150		108	50-150
13C2_PFTeDA		79	50-150		109	50-150
13C3_PFBS		76	50-150		96	50-150
13C3_PFHxS		75	50-150		100	50-150
13C4_PFBA		76	50-150		97	50-150
13C4_PFHpA		77	50-150		101	50-150
13C5_PFHxA		79	50-150		102	50-150
13C5_PFPeA		79	50-150		98	50-150
13C6_PFDA		75	50-150		105	50-150
13C7_PFUdA		72	50-150		99	50-150
13C8_PFOA		75	50-150		98	50-150
13C8_PFOS		59	50-150		99	50-150
13C8_PFOSA		68	50-150		95	50-150

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

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PFAS by LC/MS/MS

Client: **Arcadis U.S., Inc.**		Laboratory ID: **WI28012-003**
Description: **393-1-UT-3**		Matrix: **Solid**
Date Sampled: **09/23/2021 1400**	Project Name: **Eielson AFB**	% Solids: **91.8** **09/28/2021 2312**
Date Received: **09/28/2021**	Project Number: **30030317**	

Surrogate	Q	Run 1 % Recovery	Acceptance Limits	Q	Run 2 % Recovery	Acceptance Limits
13C9_PFNA		66	50-150		102	50-150
d5-EtFOSAA		83	50-150		103	50-150
d-MeFOSA		88	50-150		107	50-150
d3-MeFOSAA		84	50-150		101	50-150

LOQ = Limit of Quantitation	B = Detected in the method blank	E = Quantitation of compound exceeded the calibration range	DL = Detection Limit	Q = Surrogate failure
U = Not detected at or above the LOQ	N = Recovery is out of criteria	P = The RPD between two GC columns exceeds 40%	J = Estimated result < LOQ and ≥ DL	L = LCS/LCSD failure
H = Out of holding time	W = Reported on wet weight basis	LOD = Limit of Detection		S = MS/MSD failure

SPLP PFAS

Client: **Arcadis U.S., Inc.** Laboratory ID: **WI28012-003**

Description: **393-1-UT-3** Matrix: **Solid**

Date Sampled: **09/23/2021 1400** Project Name: **Eielson AFB** % Solids: **91.8** **09/28/2021 2312**

Date Received: **09/28/2021** Project Number: **30030317**

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch	Leachate Date
1	1312/PFAS	PFAS by ID SOP QSM B-15	1	10/21/2021 1435	JJG	10/20/2021 1345	19466	10/16/2021 0006
2	1312/PFAS	PFAS by ID SOP QSM B-15	20	10/24/2021 1638	JJG	10/20/2021 1345	19466	10/16/2021 0006

Parameter	CAS Number	Analytical Method	Result	Q	LOQ	LOD	DL	Units	Run
1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS)	**39108-34-4**	**PFAS by ID SOP**	**1500**		**80**	40	**20**	**ng/L**	**1**
1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS)	**27619-97-2**	**PFAS by ID SOP**	**580**		**80**	40	**20**	**ng/L**	**1**
1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS)	757124-72-4	PFAS by ID SOP	40	U	80	40	20	ng/L	1
N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA)	2991-50-6	PFAS by ID SOP	40	U	80	40	20	ng/L	1
N-methylperfluoro-1-octanesulfonamide (MeFOSA)	31506-32-8	PFAS by ID SOP	80	U	160	80	40	ng/L	1
N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA)	2355-31-9	PFAS by ID SOP	40	U	80	40	20	ng/L	1
Perfluoro-1-butanesulfonic acid (PFBS)	**375-73-5**	**PFAS by ID SOP**	**140**		**40**	20	**10**	**ng/L**	**1**
Perfluoro-1-decanesulfonic acid (PFDS)	335-77-3	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-1-heptanesulfonic acid (PFHpS)	**375-92-8**	**PFAS by ID SOP**	**35**	**J**	**40**	20	**10**	**ng/L**	**1**
Perfluoro-1-nonanesulfonic acid (PFNS)	**68259-12-1**	**PFAS by ID SOP**	**120**		**40**	20	**10**	**ng/L**	**1**
Perfluoro-1-octanesulfonamide (PFOSA)	**754-91-6**	**PFAS by ID SOP**	**1100**		**40**	20	**10**	**ng/L**	**1**
Perfluoro-1-pentanesulfonic acid (PFPeS)	**2706-91-4**	**PFAS by ID SOP**	**160**		**40**	20	**10**	**ng/L**	**1**
Perfluorohexanesulfonic acid (PFHxS)	**355-46-4**	**PFAS by ID SOP**	**2200**		**40**	20	**10**	**ng/L**	**1**
Perfluoro-n-butanoic acid (PFBA)	**375-22-4**	**PFAS by ID SOP**	**82**		**40**	20	**10**	**ng/L**	**1**
Perfluoro-n-decanoic acid (PFDA)	**335-76-2**	**PFAS by ID SOP**	**130**		**40**	20	**10**	**ng/L**	**1**
Perfluoro-n-dodecanoic acid (PFDoA)	307-55-1	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-n-heptanoic acid (PFHpA)	**375-85-9**	**PFAS by ID SOP**	**100**		**40**	20	**10**	**ng/L**	**1**
Perfluoro-n-hexanoic acid (PFHxA)	**307-24-4**	**PFAS by ID SOP**	**720**		**40**	20	**10**	**ng/L**	**1**
Perfluoro-n-nonanoic acid (PFNA)	**375-95-1**	**PFAS by ID SOP**	**62**		**40**	20	**10**	**ng/L**	**1**
Perfluoro-n-octanoic acid (PFOA)	**335-67-1**	**PFAS by ID SOP**	**310**		**40**	20	**10**	**ng/L**	**1**
Perfluoro-n-pentanoic acid (PFPeA)	**2706-90-3**	**PFAS by ID SOP**	**270**		**40**	20	**10**	**ng/L**	**1**
Perfluoro-n-tetradecanoic acid (PFTeDA)	376-06-7	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-n-tridecanoic acid (PFTrDA)	72629-94-8	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-n-undecanoic acid (PFUdA)	**2058-94-8**	**PFAS by ID SOP**	**23**	**J**	**40**	20	**10**	**ng/L**	**1**
Perfluorooctanesulfonic acid (PFOS)	**1763-23-1**	**PFAS by ID SOP**	**44000**		**800**	400	**200**	**ng/L**	**2**

Surrogate	Q	Run 1 % Recovery	Acceptance Limits	Q	Run 2 % Recovery	Acceptance Limits
13C2_4:2FTS		101	50-150		88	50-150
13C2_6:2FTS		94	50-150		82	50-150
13C2_8:2FTS		99	50-150		88	50-150
13C2_PFDoA		90	50-150		91	50-150
13C2_PFTeDA		89	50-150		96	50-150
13C3_PFBS		89	50-150		102	50-150
13C3_PFHxS		87	50-150		94	50-150
13C4_PFBA		90	50-150		96	50-150
13C4_PFHpA		84	50-150		98	50-150
13C5_PFHxA		87	50-150		90	50-150
13C5_PFPeA		93	50-150		93	50-150
13C6_PFDA		88	50-150		92	50-150
13C7_PFUdA		92	50-150		93	50-150
13C8_PFOA		86	50-150		96	50-150
13C8_PFOS		72	50-150		89	50-150
13C8_PFOSA		98	50-150		90	50-150

LOQ = Limit of Quantitation
B = Detected in the method blank
E = Quantitation of compound exceeded the calibration range
DL = Detection Limit
Q = Surrogate failure
U = Not detected at or above the LOQ
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
J = Estimated result < LOQ and ≥ DL
L = LCS/LCSD failure
H = Out of holding time
W = Reported on wet weight basis
LOD = Limit of Detection
S = MS/MSD failure

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SPLP PFAS

Client: **Arcadis U.S., Inc.**		Laboratory ID: **WI28012-003**
Description: **393-1-UT-3**		Matrix: **Solid**
Date Sampled: **09/23/2021 1400**	Project Name: **Eielson AFB**	% Solids: **91.8**	**09/28/2021 2312**
Date Received: **09/28/2021**	Project Number: **30030317**	

Surrogate	Q	Run 1 % Recovery	Acceptance Limits	Q	Run 2 % Recovery	Acceptance Limits
13C9_PFNA		67	50-150		87	50-150
d5-EtFOSAA		102	50-150		87	50-150
d-MeFOSA		91	50-150		90	50-150
d3-MeFOSAA		97	50-150		86	50-150

LOQ = Limit of Quantitation	B = Detected in the method blank	E = Quantitation of compound exceeded the calibration range	DL = Detection Limit	Q = Surrogate failure
U = Not detected at or above the LOQ	N = Recovery is out of criteria	P = The RPD between two GC columns exceeds 40%	J = Estimated result < LOQ and ≥ DL	L = LCS/LCSD failure
H = Out of holding time	W = Reported on wet weight basis	LOD = Limit of Detection		S = MS/MSD failure

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PFAS by LC/MS/MS

Client: **Arcadis U.S., Inc.** Laboratory ID: **WI28012-004**

Description: **393-1-G-1** Matrix: **Solid**

Date Sampled: **09/22/2021 1320** Project Name: **Eielson AFB** % Solids: **99.2** **09/28/2021 2312**

Date Received: **09/28/2021** Project Number: **30030317**

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch
1	SOP SPE	PFAS by ID SOP QSM B-15	1	09/29/2021 1724	NK1	09/29/2021 1247	16945
2	SOP SPE	PFAS by ID SOP QSM B-15	1	09/30/2021 1700	NK1	09/29/2021 1247	16945

Parameter	CAS Number	Analytical Method	Result	Q	LOQ	LOD	DL	Units	Run
1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS)	39108-34-4	PFAS by ID SOP	0.80	U	1.6	0.80	0.39	ug/kg	1
1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS)	27619-97-2	PFAS by ID SOP	0.80	U	1.6	0.80	0.39	ug/kg	1
1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS)	757124-72-4	PFAS by ID SOP	0.80	U	1.6	0.80	0.39	ug/kg	1
N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA)	2991-50-6	PFAS by ID SOP	0.80	U	1.6	0.80	0.39	ug/kg	1
N-methylperfluoro-1-octanesulfonamide (MeFOSA)	31506-32-8	PFAS by ID SOP	0.80	U	1.6	0.80	0.39	ug/kg	1
N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA)	2355-31-9	PFAS by ID SOP	0.80	U	1.6	0.80	0.39	ug/kg	1
Perfluoro-1-butanesulfonic acid (PFBS)	375-73-5	PFAS by ID SOP	0.39	U	0.78	0.39	0.16	ug/kg	1
Perfluoro-1-decanesulfonic acid (PFDS)	335-77-3	PFAS by ID SOP	0.39	U	0.78	0.39	0.16	ug/kg	1
Perfluoro-1-heptanesulfonic acid (PFHpS)	375-92-8	PFAS by ID SOP	0.39	U	0.78	0.39	0.16	ug/kg	1
Perfluoro-1-nonanesulfonic acid (PFNS)	68259-12-1	PFAS by ID SOP	0.39	U	0.78	0.39	0.16	ug/kg	1
Perfluoro-1-octanesulfonamide (PFOSA)	754-91-6	PFAS by ID SOP	0.39	U	0.78	0.39	0.16	ug/kg	1
Perfluoro-1-pentanesulfonic acid (PFPeS)	2706-91-4	PFAS by ID SOP	0.39	U	0.78	0.39	0.16	ug/kg	1
Perfluorohexanesulfonic acid (PFHxS)	**355-46-4**	**PFAS by ID SOP**	**0.35**	**J**	**0.78**	0.39	**0.16**	**ug/kg**	**1**
Perfluoro-n-butanoic acid (PFBA)	375-22-4	PFAS by ID SOP	0.39	U	0.78	0.39	0.16	ug/kg	1
Perfluoro-n-decanoic acid (PFDA)	335-76-2	PFAS by ID SOP	0.39	U	0.78	0.39	0.16	ug/kg	1
Perfluoro-n-dodecanoic acid (PFDoA)	307-55-1	PFAS by ID SOP	0.39	U	0.78	0.39	0.16	ug/kg	1
Perfluoro-n-heptanoic acid (PFHpA)	375-85-9	PFAS by ID SOP	0.39	U	0.78	0.39	0.16	ug/kg	1
Perfluoro-n-hexanoic acid (PFHxA)	307-24-4	PFAS by ID SOP	0.39	U	0.78	0.39	0.16	ug/kg	1
Perfluoro-n-nonanoic acid (PFNA)	375-95-1	PFAS by ID SOP	0.39	U	0.78	0.39	0.16	ug/kg	1
Perfluoro-n-octanoic acid (PFOA)	335-67-1	PFAS by ID SOP	0.39	U	0.78	0.39	0.16	ug/kg	1
Perfluoro-n-pentanoic acid (PFPeA)	2706-90-3	PFAS by ID SOP	0.39	U	0.78	0.39	0.16	ug/kg	1
Perfluoro-n-tetradecanoic acid (PFTeDA)	376-06-7	PFAS by ID SOP	0.39	U	0.78	0.39	0.16	ug/kg	1
Perfluoro-n-tridecanoic acid (PFTrDA)	72629-94-8	PFAS by ID SOP	0.39	U	0.78	0.39	0.16	ug/kg	1
Perfluoro-n-undecanoic acid (PFUdA)	2058-94-8	PFAS by ID SOP	0.39	U	0.78	0.39	0.16	ug/kg	1
Perfluorooctanesulfonic acid (PFOS)	**1763-23-1**	**PFAS by ID SOP**	**1.5**		**0.78**	0.39	**0.16**	**ug/kg**	**2**

Surrogate	Run 1 Q	Run 1 % Recovery	Run 1 Acceptance Limits	Run 2 Q	Run 2 % Recovery	Run 2 Acceptance Limits
13C2_4:2FTS		87	50-150		77	50-150
13C2_6:2FTS		89	50-150		74	50-150
13C2_8:2FTS		89	50-150		74	50-150
13C2_PFDoA		83	50-150		76	50-150
13C2_PFTeDA		78	50-150		74	50-150
13C3_PFBS		80	50-150		72	50-150
13C3_PFHxS		76	50-150		72	50-150
13C4_PFBA		79	50-150		74	50-150
13C4_PFHpA		82	50-150		74	50-150
13C5_PFHxA		80	50-150		72	50-150
13C5_PFPeA		83	50-150		69	50-150
13C6_PFDA		82	50-150		73	50-150
13C7_PFUdA		82	50-150		71	50-150
13C8_PFOA		82	50-150		71	50-150
13C8_PFOS		80	50-150		71	50-150
13C8_PFOSA		86	50-150		78	50-150

LOQ = Limit of Quantitation
B = Detected in the method blank
E = Quantitation of compound exceeded the calibration range
DL = Detection Limit
Q = Surrogate failure
U = Not detected at or above the LOQ
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
J = Estimated result < LOQ and ≥ DL
L = LCS/LCSD failure
H = Out of holding time
W = Reported on wet weight basis
LOD = Limit of Detection
S = MS/MSD failure

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PFAS by LC/MS/MS

Client: **Arcadis U.S., Inc.**		Laboratory ID: **WI28012-004**	
Description: **393-1-G-1**		Matrix: **Solid**	
Date Sampled: **09/22/2021 1320**	Project Name: **Eielson AFB**	% Solids: **99.2**	**09/28/2021 2312**
Date Received: **09/28/2021**	Project Number: **30030317**		

Surrogate	Q	Run 1 % Recovery	Acceptance Limits	Q	Run 2 % Recovery	Acceptance Limits
13C9_PFNA		82	50-150		73	50-150
d5-EtFOSAA		92	50-150		77	50-150
d-MeFOSA		96	50-150		79	50-150
d3-MeFOSAA		87	50-150		77	50-150

LOQ = Limit of Quantitation	B = Detected in the method blank	E = Quantitation of compound exceeded the calibration range	DL = Detection Limit	Q = Surrogate failure
U = Not detected at or above the LOQ	N = Recovery is out of criteria	P = The RPD between two GC columns exceeds 40%	J = Estimated result < LOQ and ≥ DL	L = LCS/LCSD failure
H = Out of holding time	W = Reported on wet weight basis	LOD = Limit of Detection		S = MS/MSD failure

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SPLP PFAS

Client: **Arcadis U.S., Inc.** Laboratory ID: **WI28012-004**
Description: **393-1-G-1** Matrix: **Solid**
Date Sampled: **09/22/2021 1320** Project Name: **Eielson AFB** % Solids: **99.2** **09/28/2021 2312**
Date Received: **09/28/2021** Project Number: **30030317**

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch	Leachate Date
1	1312/PFAS	PFAS by ID SOP QSM B-15	1	10/21/2021 1445	JJG	10/20/2021 1345	19466	10/16/2021 0006

Parameter	CAS Number	Analytical Method	Result	Q	LOQ	LOD	DL	Units	Run
1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS)	39108-34-4	PFAS by ID SOP	40	U	80	40	20	ng/L	1
1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS)	**27619-97-2**	**PFAS by ID SOP**	**29**	**J**	**80**	40	**20**	**ng/L**	**1**
1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS)	757124-72-4	PFAS by ID SOP	40	U	80	40	20	ng/L	1
N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA)	2991-50-6	PFAS by ID SOP	40	U	80	40	20	ng/L	1
N-methylperfluoro-1-octanesulfonamide (MeFOSA)	31506-32-8	PFAS by ID SOP	80	U	160	80	40	ng/L	1
N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA)	2355-31-9	PFAS by ID SOP	40	U	80	40	20	ng/L	1
Perfluoro-1-butanesulfonic acid (PFBS)	375-73-5	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-1-decanesulfonic acid (PFDS)	335-77-3	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-1-heptanesulfonic acid (PFHpS)	375-92-8	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-1-nonanesulfonic acid (PFNS)	68259-12-1	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-1-octanesulfonamide (PFOSA)	754-91-6	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-1-pentanesulfonic acid (PFPeS)	2706-91-4	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluorohexanesulfonic acid (PFHxS)	**355-46-4**	**PFAS by ID SOP**	**29**	**J**	**40**	20	**10**	**ng/L**	**1**
Perfluoro-n-butanoic acid (PFBA)	375-22-4	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-n-decanoic acid (PFDA)	335-76-2	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-n-dodecanoic acid (PFDoA)	307-55-1	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-n-heptanoic acid (PFHpA)	375-85-9	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-n-hexanoic acid (PFHxA)	**307-24-4**	**PFAS by ID SOP**	**17**	**J**	**40**	20	**10**	**ng/L**	**1**
Perfluoro-n-nonanoic acid (PFNA)	375-95-1	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-n-octanoic acid (PFOA)	**335-67-1**	**PFAS by ID SOP**	**14**	**J**	**40**	20	**10**	**ng/L**	**1**
Perfluoro-n-pentanoic acid (PFPeA)	2706-90-3	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-n-tetradecanoic acid (PFTeDA)	376-06-7	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-n-tridecanoic acid (PFTrDA)	72629-94-8	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-n-undecanoic acid (PFUdA)	2058-94-8	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluorooctanesulfonic acid (PFOS)	**1763-23-1**	**PFAS by ID SOP**	**450**		**40**	20	**10**	**ng/L**	**1**

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
13C2_4:2FTS		108	50-150
13C2_6:2FTS		108	50-150
13C2_8:2FTS		106	50-150
13C2_PFDoA		95	50-150
13C2_PFTeDA		94	50-150
13C3_PFBS		96	50-150
13C3_PFHxS		104	50-150
13C4_PFBA		95	50-150
13C4_PFHpA		95	50-150
13C5_PFHxA		99	50-150
13C5_PFPeA		96	50-150
13C6_PFDA		93	50-150
13C7_PFUdA		95	50-150
13C8_PFOA		100	50-150
13C8_PFOS		99	50-150
13C8_PFOSA		102	50-150
13C9_PFNA		100	50-150

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
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SPLP PFAS

Client: **Arcadis U.S., Inc.**		Laboratory ID: **WI28012-004**	
Description: **393-1-G-1**		Matrix: **Solid**	
Date Sampled: **09/22/2021 1320**	Project Name: **Eielson AFB**	% Solids: **99.2**	**09/28/2021 2312**
Date Received: **09/28/2021**	Project Number: **30030317**		

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
d5-EtFOSAA		110	50-150
d-MeFOSA		99	50-150
d3-MeFOSAA		102	50-150

LOQ = Limit of Quantitation	B = Detected in the method blank	E = Quantitation of compound exceeded the calibration range	DL = Detection Limit	Q = Surrogate failure
U = Not detected at or above the LOQ	N = Recovery is out of criteria	P = The RPD between two GC columns exceeds 40%	J = Estimated result < LOQ and ≥ DL	L = LCS/LCSD failure
H = Out of holding time	W = Reported on wet weight basis	LOD = Limit of Detection		S = MS/MSD failure

PFAS by LC/MS/MS

Client: **Arcadis U.S., Inc.** Laboratory ID: **WI28012-005**
Description: **393-1-G-2** Matrix: **Solid**
Date Sampled: **09/22/2021 1345** Project Name: **Eielson AFB** % Solids: **99.3** **09/28/2021 2312**
Date Received: **09/28/2021** Project Number: **30030317**

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch
1	SOP SPE	PFAS by ID SOP QSM B-15	1	09/29/2021 1736	NK1	09/29/2021 1247	16945

Parameter	CAS Number	Analytical Method	Result	Q	LOQ	LOD	DL	Units	Run
1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS)	39108-34-4	PFAS by ID SOP	0.95	U	1.9	0.95	0.48	ug/kg	1
1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS)	27619-97-2	PFAS by ID SOP	0.95	U	1.9	0.95	0.48	ug/kg	1
1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS)	757124-72-4	PFAS by ID SOP	0.95	U	1.9	0.95	0.48	ug/kg	1
N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA)	2991-50-6	PFAS by ID SOP	0.95	U	1.9	0.95	0.48	ug/kg	1
N-methylperfluoro-1-octanesulfonamide (MeFOSA)	31506-32-8	PFAS by ID SOP	0.95	U	1.9	0.95	0.48	ug/kg	1
N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA)	2355-31-9	PFAS by ID SOP	0.95	U	1.9	0.95	0.48	ug/kg	1
Perfluoro-1-butanesulfonic acid (PFBS)	375-73-5	PFAS by ID SOP	0.49	U	0.97	0.49	0.19	ug/kg	1
Perfluoro-1-decanesulfonic acid (PFDS)	335-77-3	PFAS by ID SOP	0.49	U	0.97	0.49	0.19	ug/kg	1
Perfluoro-1-heptanesulfonic acid (PFHpS)	375-92-8	PFAS by ID SOP	0.49	U	0.97	0.49	0.19	ug/kg	1
Perfluoro-1-nonanesulfonic acid (PFNS)	68259-12-1	PFAS by ID SOP	0.49	U	0.97	0.49	0.19	ug/kg	1
Perfluoro-1-octanesulfonamide (PFOSA)	754-91-6	PFAS by ID SOP	0.49	U	0.97	0.49	0.19	ug/kg	1
Perfluoro-1-pentanesulfonic acid (PFPeS)	2706-91-4	PFAS by ID SOP	0.49	U	0.97	0.49	0.19	ug/kg	1
Perfluorohexanesulfonic acid (PFHxS)	355-46-4	PFAS by ID SOP	0.49	U	0.97	0.49	0.19	ug/kg	1
Perfluoro-n-butanoic acid (PFBA)	**375-22-4**	**PFAS by ID SOP**	**2.9**		**0.97**	0.49	**0.19**	**ug/kg**	**1**
Perfluoro-n-decanoic acid (PFDA)	335-76-2	PFAS by ID SOP	0.49	U	0.97	0.49	0.19	ug/kg	1
Perfluoro-n-dodecanoic acid (PFDoA)	307-55-1	PFAS by ID SOP	0.49	U	0.97	0.49	0.19	ug/kg	1
Perfluoro-n-heptanoic acid (PFHpA)	375-85-9	PFAS by ID SOP	0.49	U	0.97	0.49	0.19	ug/kg	1
Perfluoro-n-hexanoic acid (PFHxA)	307-24-4	PFAS by ID SOP	0.49	U	0.97	0.49	0.19	ug/kg	1
Perfluoro-n-nonanoic acid (PFNA)	375-95-1	PFAS by ID SOP	0.49	U	0.97	0.49	0.19	ug/kg	1
Perfluoro-n-octanoic acid (PFOA)	335-67-1	PFAS by ID SOP	0.49	U	0.97	0.49	0.19	ug/kg	1
Perfluoro-n-pentanoic acid (PFPeA)	2706-90-3	PFAS by ID SOP	0.49	U	0.97	0.49	0.19	ug/kg	1
Perfluoro-n-tetradecanoic acid (PFTeDA)	376-06-7	PFAS by ID SOP	0.49	U	0.97	0.49	0.19	ug/kg	1
Perfluoro-n-tridecanoic acid (PFTrDA)	72629-94-8	PFAS by ID SOP	0.49	U	0.97	0.49	0.19	ug/kg	1
Perfluoro-n-undecanoic acid (PFUdA)	2058-94-8	PFAS by ID SOP	0.49	U	0.97	0.49	0.19	ug/kg	1
Perfluorooctanesulfonic acid (PFOS)	1763-23-1	PFAS by ID SOP	0.49	U	0.97	0.49	0.19	ug/kg	1

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
13C2_4:2FTS		72	50-150
13C2_6:2FTS		73	50-150
13C2_8:2FTS		70	50-150
13C2_PFDoA		67	50-150
13C2_PFTeDA		60	50-150
13C3_PFBS		62	50-150
13C3_PFHxS		61	50-150
13C4_PFBA		63	50-150
13C4_PFHpA		63	50-150
13C5_PFHxA		65	50-150
13C5_PFPeA		65	50-150
13C6_PFDA		62	50-150
13C7_PFUdA		63	50-150
13C8_PFOA		64	50-150
13C8_PFOS		61	50-150
13C8_PFOSA		66	50-150
13C9_PFNA		62	50-150

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

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PFAS by LC/MS/MS

Client: **Arcadis U.S., Inc.**		Laboratory ID: **WI28012-005**	
Description: **393-1-G-2**		Matrix: **Solid**	
Date Sampled: **09/22/2021 1345**	Project Name: **Eielson AFB**	% Solids: **99.3**	**09/28/2021 2312**
Date Received: **09/28/2021**	Project Number: **30030317**		

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
d5-EtFOSAA		70	50-150
d-MeFOSA		69	50-150
d3-MeFOSAA		67	50-150

LOQ = Limit of Quantitation	B = Detected in the method blank	E = Quantitation of compound exceeded the calibration range	DL = Detection Limit	Q = Surrogate failure
U = Not detected at or above the LOQ	N = Recovery is out of criteria	P = The RPD between two GC columns exceeds 40%	J = Estimated result < LOQ and ≥ DL	L = LCS/LCSD failure
H = Out of holding time	W = Reported on wet weight basis	LOD = Limit of Detection		S = MS/MSD failure

SPLP PFAS

Client: **Arcadis U.S., Inc.** Laboratory ID: **WI28012-005**
Description: **393-1-G-2** Matrix: **Solid**
Date Sampled: **09/22/2021 1345** Project Name: **Eielson AFB** % Solids: **99.3** **09/28/2021 2312**
Date Received: **09/28/2021** Project Number: **30030317**

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch	Leachate Date
1	1312/PFAS	PFAS by ID SOP QSM B-15	1	10/21/2021 1456	JJG	10/20/2021 1345	19466	10/16/2021 0006

Parameter	CAS Number	Analytical Method	Result	Q	LOQ	LOD	DL	Units	Run
1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS)	39108-34-4	PFAS by ID SOP	40	U	80	40	20	ng/L	1
1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS)	**27619-97-2**	**PFAS by ID SOP**	**23**	**J**	**80**	40	**20**	**ng/L**	**1**
1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS)	757124-72-4	PFAS by ID SOP	40	U	80	40	20	ng/L	1
N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA)	2991-50-6	PFAS by ID SOP	40	U	80	40	20	ng/L	1
N-methylperfluoro-1-octanesulfonamide (MeFOSA)	31506-32-8	PFAS by ID SOP	80	U	160	80	40	ng/L	1
N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA)	2355-31-9	PFAS by ID SOP	40	U	80	40	20	ng/L	1
Perfluoro-1-butanesulfonic acid (PFBS)	375-73-5	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-1-decanesulfonic acid (PFDS)	335-77-3	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-1-heptanesulfonic acid (PFHpS)	375-92-8	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-1-nonanesulfonic acid (PFNS)	68259-12-1	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-1-octanesulfonamide (PFOSA)	754-91-6	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-1-pentanesulfonic acid (PFPeS)	2706-91-4	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluorohexanesulfonic acid (PFHxS)	**355-46-4**	**PFAS by ID SOP**	**77**		**40**	20	**10**	**ng/L**	**1**
Perfluoro-n-butanoic acid (PFBA)	375-22-4	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-n-decanoic acid (PFDA)	335-76-2	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-n-dodecanoic acid (PFDoA)	307-55-1	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-n-heptanoic acid (PFHpA)	375-85-9	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-n-hexanoic acid (PFHxA)	**307-24-4**	**PFAS by ID SOP**	**39**	**J**	**40**	20	**10**	**ng/L**	**1**
Perfluoro-n-nonanoic acid (PFNA)	375-95-1	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-n-octanoic acid (PFOA)	**335-67-1**	**PFAS by ID SOP**	**17**	**J**	**40**	20	**10**	**ng/L**	**1**
Perfluoro-n-pentanoic acid (PFPeA)	**2706-90-3**	**PFAS by ID SOP**	**14**	**J**	**40**	20	**10**	**ng/L**	**1**
Perfluoro-n-tetradecanoic acid (PFTeDA)	376-06-7	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-n-tridecanoic acid (PFTrDA)	72629-94-8	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-n-undecanoic acid (PFUdA)	2058-94-8	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluorooctanesulfonic acid (PFOS)	**1763-23-1**	**PFAS by ID SOP**	**470**		**40**	20	**10**	**ng/L**	**1**

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
13C2_4:2FTS		109	50-150
13C2_6:2FTS		103	50-150
13C2_8:2FTS		94	50-150
13C2_PFDoA		91	50-150
13C2_PFTeDA		95	50-150
13C3_PFBS		95	50-150
13C3_PFHxS		102	50-150
13C4_PFBA		95	50-150
13C4_PFHpA		89	50-150
13C5_PFHxA		92	50-150
13C5_PFPeA		97	50-150
13C6_PFDA		87	50-150
13C7_PFUdA		89	50-150
13C8_PFOA		95	50-150
13C8_PFOS		101	50-150
13C8_PFOSA		94	50-150
13C9_PFNA		102	50-150

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

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SPLP PFAS

Client: **Arcadis U.S., Inc.**		Laboratory ID: **WI28012-005**	
Description: **393-1-G-2**		Matrix: **Solid**	
Date Sampled: **09/22/2021 1345**	Project Name: **Eielson AFB**	% Solids: **99.3**	**09/28/2021 2312**
Date Received: **09/28/2021**	Project Number: **30030317**		

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
d5-EtFOSAA		106	50-150
d-MeFOSA		104	50-150
d3-MeFOSAA		98	50-150

LOQ = Limit of Quantitation	B = Detected in the method blank	E = Quantitation of compound exceeded the calibration range	DL = Detection Limit	Q = Surrogate failure
U = Not detected at or above the LOQ	N = Recovery is out of criteria	P = The RPD between two GC columns exceeds 40%	J = Estimated result < LOQ and ≥ DL	L = LCS/LCSD failure
H = Out of holding time	W = Reported on wet weight basis	LOD = Limit of Detection		S = MS/MSD failure

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PFAS by LC/MS/MS

Client: **Arcadis U.S., Inc.** Laboratory ID: **WI28012-006**
Description: **393-1-G-3** Matrix: **Solid**
Date Sampled: **09/23/2021 1500** Project Name: **Eielson AFB** % Solids: **98.9** **09/28/2021 2312**
Date Received: **09/28/2021** Project Number: **30030317**

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch
1	SOP SPE	PFAS by ID SOP QSM B-15	1	09/29/2021 1749	NK1	09/29/2021 1247	16945

Parameter	CAS Number	Analytical Method	Result	Q	LOQ	LOD	DL	Units	Run
1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS)	39108-34-4	PFAS by ID SOP	0.75	U	1.5	0.75	0.39	ug/kg	1
1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS)	27619-97-2	PFAS by ID SOP	0.75	U	1.5	0.75	0.39	ug/kg	1
1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS)	757124-72-4	PFAS by ID SOP	0.75	U	1.5	0.75	0.39	ug/kg	1
N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA)	2991-50-6	PFAS by ID SOP	0.75	U	1.5	0.75	0.39	ug/kg	1
N-methylperfluoro-1-octanesulfonamide (MeFOSA)	31506-32-8	PFAS by ID SOP	0.75	U	1.5	0.75	0.39	ug/kg	1
N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA)	2355-31-9	PFAS by ID SOP	0.75	U	1.5	0.75	0.39	ug/kg	1
Perfluoro-1-butanesulfonic acid (PFBS)	375-73-5	PFAS by ID SOP	0.39	U	0.77	0.39	0.15	ug/kg	1
Perfluoro-1-decanesulfonic acid (PFDS)	335-77-3	PFAS by ID SOP	0.39	U	0.77	0.39	0.15	ug/kg	1
Perfluoro-1-heptanesulfonic acid (PFHpS)	375-92-8	PFAS by ID SOP	0.39	U	0.77	0.39	0.15	ug/kg	1
Perfluoro-1-nonanesulfonic acid (PFNS)	68259-12-1	PFAS by ID SOP	0.39	U	0.77	0.39	0.15	ug/kg	1
Perfluoro-1-octanesulfonamide (PFOSA)	754-91-6	PFAS by ID SOP	0.39	U	0.77	0.39	0.15	ug/kg	1
Perfluoro-1-pentanesulfonic acid (PFPeS)	2706-91-4	PFAS by ID SOP	0.39	U	0.77	0.39	0.15	ug/kg	1
Perfluorohexanesulfonic acid (PFHxS)	**355-46-4**	**PFAS by ID SOP**	**0.70**	**J**	**0.77**	0.39	**0.15**	**ug/kg**	**1**
Perfluoro-n-butanoic acid (PFBA)	375-22-4	PFAS by ID SOP	0.39	U	0.77	0.39	0.15	ug/kg	1
Perfluoro-n-decanoic acid (PFDA)	335-76-2	PFAS by ID SOP	0.39	U	0.77	0.39	0.15	ug/kg	1
Perfluoro-n-dodecanoic acid (PFDoA)	307-55-1	PFAS by ID SOP	0.39	U	0.77	0.39	0.15	ug/kg	1
Perfluoro-n-heptanoic acid (PFHpA)	375-85-9	PFAS by ID SOP	0.39	U	0.77	0.39	0.15	ug/kg	1
Perfluoro-n-hexanoic acid (PFHxA)	**307-24-4**	**PFAS by ID SOP**	**0.26**	**J**	**0.77**	0.39	**0.15**	**ug/kg**	**1**
Perfluoro-n-nonanoic acid (PFNA)	375-95-1	PFAS by ID SOP	0.39	U	0.77	0.39	0.15	ug/kg	1
Perfluoro-n-octanoic acid (PFOA)	335-67-1	PFAS by ID SOP	0.39	U	0.77	0.39	0.15	ug/kg	1
Perfluoro-n-pentanoic acid (PFPeA)	2706-90-3	PFAS by ID SOP	0.39	U	0.77	0.39	0.15	ug/kg	1
Perfluoro-n-tetradecanoic acid (PFTeDA)	376-06-7	PFAS by ID SOP	0.39	U	0.77	0.39	0.15	ug/kg	1
Perfluoro-n-tridecanoic acid (PFTrDA)	72629-94-8	PFAS by ID SOP	0.39	U	0.77	0.39	0.15	ug/kg	1
Perfluoro-n-undecanoic acid (PFUdA)	2058-94-8	PFAS by ID SOP	0.39	U	0.77	0.39	0.15	ug/kg	1
Perfluorooctanesulfonic acid (PFOS)	**1763-23-1**	**PFAS by ID SOP**	**5.3**		**0.77**	0.39	**0.15**	**ug/kg**	**1**

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
13C2_4:2FTS		84	50-150
13C2_6:2FTS		83	50-150
13C2_8:2FTS		84	50-150
13C2_PFDoA		83	50-150
13C2_PFTeDA		75	50-150
13C3_PFBS		76	50-150
13C3_PFHxS		74	50-150
13C4_PFBA		77	50-150
13C4_PFHpA		78	50-150
13C5_PFHxA		78	50-150
13C5_PFPeA		78	50-150
13C6_PFDA		76	50-150
13C7_PFUdA		78	50-150
13C8_PFOA		77	50-150
13C8_PFOS		75	50-150
13C8_PFOSA		80	50-150
13C9_PFNA		77	50-150

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

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PFAS by LC/MS/MS

Client: **Arcadis U.S., Inc.**		Laboratory ID: **WI28012-006**	
Description: **393-1-G-3**		Matrix: **Solid**	
Date Sampled: **09/23/2021 1500**	Project Name: **Eielson AFB**	% Solids: **98.9**	**09/28/2021 2312**
Date Received: **09/28/2021**	Project Number: **30030317**		

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
d5-EtFOSAA		85	50-150
d-MeFOSA		91	50-150
d3-MeFOSAA		81	50-150

LOQ = Limit of Quantitation	B = Detected in the method blank	E = Quantitation of compound exceeded the calibration range	DL = Detection Limit	Q = Surrogate failure
U = Not detected at or above the LOQ	N = Recovery is out of criteria	P = The RPD between two GC columns exceeds 40%	J = Estimated result < LOQ and ≥ DL	L = LCS/LCSD failure
H = Out of holding time	W = Reported on wet weight basis	LOD = Limit of Detection		S = MS/MSD failure

SPLP PFAS

Client: **Arcadis U.S., Inc.** Laboratory ID: **WI28012-006**
Description: **393-1-G-3** Matrix: **Solid**
Date Sampled: **09/23/2021 1500** Project Name: **Eielson AFB** % Solids: **98.9** **09/28/2021 2312**
Date Received: **09/28/2021** Project Number: **30030317**

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch	Leachate Date
1	1312/PFAS	PFAS by ID SOP QSM B-15	1	10/21/2021 1507	JJG	10/20/2021 1345	19466	10/16/2021 0006

Parameter	CAS Number	Analytical Method	Result	Q	LOQ	LOD	DL	Units	Run
1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS)	39108-34-4	PFAS by ID SOP	40	U	80	40	20	ng/L	1
1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS)	27619-97-2	PFAS by ID SOP	40	U	80	40	20	ng/L	1
1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS)	757124-72-4	PFAS by ID SOP	40	U	80	40	20	ng/L	1
N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA)	2991-50-6	PFAS by ID SOP	40	U	80	40	20	ng/L	1
N-methylperfluoro-1-octanesulfonamide (MeFOSA)	31506-32-8	PFAS by ID SOP	80	U	160	80	40	ng/L	1
N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA)	2355-31-9	PFAS by ID SOP	40	U	80	40	20	ng/L	1
Perfluoro-1-butanesulfonic acid (PFBS)	375-73-5	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-1-decanesulfonic acid (PFDS)	335-77-3	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-1-heptanesulfonic acid (PFHpS)	375-92-8	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-1-nonanesulfonic acid (PFNS)	68259-12-1	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-1-octanesulfonamide (PFOSA)	754-91-6	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-1-pentanesulfonic acid (PFPeS)	2706-91-4	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluorohexanesulfonic acid (PFHxS)	**355-46-4**	**PFAS by ID SOP**	**24**	**J**	**40**	20	**10**	**ng/L**	**1**
Perfluoro-n-butanoic acid (PFBA)	375-22-4	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-n-decanoic acid (PFDA)	335-76-2	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-n-dodecanoic acid (PFDoA)	307-55-1	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-n-heptanoic acid (PFHpA)	375-85-9	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-n-hexanoic acid (PFHxA)	**307-24-4**	**PFAS by ID SOP**	**15**	**J**	**40**	20	**10**	**ng/L**	**1**
Perfluoro-n-nonanoic acid (PFNA)	375-95-1	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-n-octanoic acid (PFOA)	335-67-1	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-n-pentanoic acid (PFPeA)	2706-90-3	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-n-tetradecanoic acid (PFTeDA)	376-06-7	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-n-tridecanoic acid (PFTrDA)	72629-94-8	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-n-undecanoic acid (PFUdA)	2058-94-8	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluorooctanesulfonic acid (PFOS)	**1763-23-1**	**PFAS by ID SOP**	**190**		**40**	20	**10**	**ng/L**	**1**

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
13C2_4:2FTS		113	50-150
13C2_6:2FTS		108	50-150
13C2_8:2FTS		107	50-150
13C2_PFDoA		98	50-150
13C2_PFTeDA		96	50-150
13C3_PFBS		101	50-150
13C3_PFHxS		104	50-150
13C4_PFBA		99	50-150
13C4_PFHpA		95	50-150
13C5_PFHxA		100	50-150
13C5_PFPeA		102	50-150
13C6_PFDA		102	50-150
13C7_PFUdA		92	50-150
13C8_PFOA		99	50-150
13C8_PFOS		104	50-150
13C8_PFOSA		108	50-150
13C9_PFNA		103	50-150

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

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SPLP PFAS

Client: **Arcadis U.S., Inc.**		Laboratory ID: **WI28012-006**	
Description: **393-1-G-3**		Matrix: **Solid**	
Date Sampled: **09/23/2021 1500**	Project Name: **Eielson AFB**	% Solids: **98.9**	**09/28/2021 2312**
Date Received: **09/28/2021**	Project Number: **30030317**		

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
d5-EtFOSAA		112	50-150
d-MeFOSA		103	50-150
d3-MeFOSAA		100	50-150

LOQ = Limit of Quantitation	B = Detected in the method blank	E = Quantitation of compound exceeded the calibration range	DL = Detection Limit	Q = Surrogate failure
U = Not detected at or above the LOQ	N = Recovery is out of criteria	P = The RPD between two GC columns exceeds 40%	J = Estimated result < LOQ and ≥ DL	L = LCS/LCSD failure
H = Out of holding time	W = Reported on wet weight basis	LOD = Limit of Detection		S = MS/MSD failure

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PFAS by LC/MS/MS

Client: **Arcadis U.S., Inc.**		Laboratory ID: **WI28012-007**	
Description: **393-1-S-1**		Matrix: **Solid**	
Date Sampled: **09/22/2021 1400**	Project Name: **Eielson AFB**	% Solids: **93.9**	**09/28/2021 2312**
Date Received: **09/28/2021**	Project Number: **30030317**		

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch
1	SOP SPE	PFAS by ID SOP QSM B-15	1	09/29/2021 1802	NK1	09/29/2021 1247	16945

Parameter	CAS Number	Analytical Method	Result	Q	LOQ	LOD	DL	Units	Run
1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS)	**39108-34-4**	**PFAS by ID SOP**	**2.4**		**2.0**	1.0	**0.50**	**ug/kg**	**1**
1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS)	**27619-97-2**	**PFAS by ID SOP**	**1.1**	**J**	**2.0**	1.0	**0.50**	**ug/kg**	**1**
1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS)	757124-72-4	PFAS by ID SOP	1.0	U	2.0	1.0	0.50	ug/kg	1
N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA)	2991-50-6	PFAS by ID SOP	1.0	U	2.0	1.0	0.50	ug/kg	1
N-methylperfluoro-1-octanesulfonamide (MeFOSA)	31506-32-8	PFAS by ID SOP	1.0	U	2.0	1.0	0.50	ug/kg	1
N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA)	2355-31-9	PFAS by ID SOP	1.0	U	2.0	1.0	0.50	ug/kg	1
Perfluoro-1-butanesulfonic acid (PFBS)	**375-73-5**	**PFAS by ID SOP**	**0.25**	**J**	**1.0**	0.50	**0.20**	**ug/kg**	**1**
Perfluoro-1-decanesulfonic acid (PFDS)	**335-77-3**	**PFAS by ID SOP**	**0.50**	**J**	**1.0**	0.50	**0.20**	**ug/kg**	**1**
Perfluoro-1-heptanesulfonic acid (PFHpS)	**375-92-8**	**PFAS by ID SOP**	**0.24**	**J**	**1.0**	0.50	**0.20**	**ug/kg**	**1**
Perfluoro-1-nonanesulfonic acid (PFNS)	**68259-12-1**	**PFAS by ID SOP**	**0.51**	**J**	**1.0**	0.50	**0.20**	**ug/kg**	**1**
Perfluoro-1-octanesulfonamide (PFOSA)	**754-91-6**	**PFAS by ID SOP**	**1.6**		**1.0**	0.50	**0.20**	**ug/kg**	**1**
Perfluoro-1-pentanesulfonic acid (PFPeS)	**2706-91-4**	**PFAS by ID SOP**	**0.25**	**J**	**1.0**	0.50	**0.20**	**ug/kg**	**1**
Perfluorohexanesulfonic acid (PFHxS)	**355-46-4**	**PFAS by ID SOP**	**4.4**		**1.0**	0.50	**0.20**	**ug/kg**	**1**
Perfluoro-n-butanoic acid (PFBA)	375-22-4	PFAS by ID SOP	0.50	U	1.0	0.50	0.20	ug/kg	1
Perfluoro-n-decanoic acid (PFDA)	335-76-2	PFAS by ID SOP	0.50	U	1.0	0.50	0.20	ug/kg	1
Perfluoro-n-dodecanoic acid (PFDoA)	307-55-1	PFAS by ID SOP	0.50	U	1.0	0.50	0.20	ug/kg	1
Perfluoro-n-heptanoic acid (PFHpA)	375-85-9	PFAS by ID SOP	0.50	U	1.0	0.50	0.20	ug/kg	1
Perfluoro-n-hexanoic acid (PFHxA)	**307-24-4**	**PFAS by ID SOP**	**0.37**	**J**	**1.0**	0.50	**0.20**	**ug/kg**	**1**
Perfluoro-n-nonanoic acid (PFNA)	375-95-1	PFAS by ID SOP	0.50	U	1.0	0.50	0.20	ug/kg	1
Perfluoro-n-octanoic acid (PFOA)	**335-67-1**	**PFAS by ID SOP**	**0.73**	**J**	**1.0**	0.50	**0.20**	**ug/kg**	**1**
Perfluoro-n-pentanoic acid (PFPeA)	2706-90-3	PFAS by ID SOP	0.50	U	1.0	0.50	0.20	ug/kg	1
Perfluoro-n-tetradecanoic acid (PFTeDA)	376-06-7	PFAS by ID SOP	0.50	U	1.0	0.50	0.20	ug/kg	1
Perfluoro-n-tridecanoic acid (PFTrDA)	72629-94-8	PFAS by ID SOP	0.50	U	1.0	0.50	0.20	ug/kg	1
Perfluoro-n-undecanoic acid (PFUdA)	2058-94-8	PFAS by ID SOP	0.50	U	1.0	0.50	0.20	ug/kg	1
Perfluorooctanesulfonic acid (PFOS)	**1763-23-1**	**PFAS by ID SOP**	**48**		**1.0**	0.50	**0.20**	**ug/kg**	**1**

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
13C2_4:2FTS		83	50-150
13C2_6:2FTS		87	50-150
13C2_8:2FTS		84	50-150
13C2_PFDoA		81	50-150
13C2_PFTeDA		79	50-150
13C3_PFBS		77	50-150
13C3_PFHxS		77	50-150
13C4_PFBA		76	50-150
13C4_PFHpA		77	50-150
13C5_PFHxA		77	50-150
13C5_PFPeA		78	50-150
13C6_PFDA		77	50-150
13C7_PFUdA		78	50-150
13C8_PFOA		79	50-150
13C8_PFOS		76	50-150
13C8_PFOSA		79	50-150
13C9_PFNA		78	50-150

LOQ = Limit of Quantitation	B = Detected in the method blank	E = Quantitation of compound exceeded the calibration range	DL = Detection Limit	Q = Surrogate failure
U = Not detected at or above the LOQ	N = Recovery is out of criteria	P = The RPD between two GC columns exceeds 40%	J = Estimated result < LOQ and ≥ DL	L = LCS/LCSD failure
H = Out of holding time	W = Reported on wet weight basis	LOD = Limit of Detection		S = MS/MSD failure

PFAS by LC/MS/MS

Client: **Arcadis U.S., Inc.**		Laboratory ID: **WI28012-007**	
Description: **393-1-S-1**		Matrix: **Solid**	
Date Sampled: **09/22/2021 1400**	Project Name: **Eielson AFB**	% Solids: **93.9**	**09/28/2021 2312**
Date Received: **09/28/2021**	Project Number: **30030317**		

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
d5-EtFOSAA		86	50-150
d-MeFOSA		92	50-150
d3-MeFOSAA		85	50-150

LOQ = Limit of Quantitation	B = Detected in the method blank	E = Quantitation of compound exceeded the calibration range	DL = Detection Limit	Q = Surrogate failure
U = Not detected at or above the LOQ	N = Recovery is out of criteria	P = The RPD between two GC columns exceeds 40%	J = Estimated result < LOQ and ≥ DL	L = LCS/LCSD failure
H = Out of holding time	W = Reported on wet weight basis	LOD = Limit of Detection		S = MS/MSD failure

SPLP PFAS

Client: **Arcadis U.S., Inc.** Laboratory ID: **WI28012-007**
Description: **393-1-S-1** Matrix: **Solid**
Date Sampled: **09/22/2021 1400** Project Name: **Eielson AFB** % Solids: **93.9** **09/28/2021 2312**
Date Received: **09/28/2021** Project Number: **30030317**

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch	Leachate Date
1	1312/PFAS	PFAS by ID SOP QSM B-15	1	10/21/2021 1517	JJG	10/20/2021 1345	19466	10/16/2021 0006

Parameter	CAS Number	Analytical Method	Result	Q	LOQ	LOD	DL	Units	Run
1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS)	**39108-34-4**	**PFAS by ID SOP**	**28**	**J**	**80**	40	**20**	**ng/L**	**1**
1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS)	27619-97-2	PFAS by ID SOP	40	U	80	40	20	ng/L	1
1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS)	757124-72-4	PFAS by ID SOP	40	U	80	40	20	ng/L	1
N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA)	2991-50-6	PFAS by ID SOP	40	U	80	40	20	ng/L	1
N-methylperfluoro-1-octanesulfonamide (MeFOSA)	31506-32-8	PFAS by ID SOP	80	U	160	80	40	ng/L	1
N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA)	2355-31-9	PFAS by ID SOP	40	U	80	40	20	ng/L	1
Perfluoro-1-butanesulfonic acid (PFBS)	375-73-5	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-1-decanesulfonic acid (PFDS)	335-77-3	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-1-heptanesulfonic acid (PFHpS)	375-92-8	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-1-nonanesulfonic acid (PFNS)	68259-12-1	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-1-octanesulfonamide (PFOSA)	**754-91-6**	**PFAS by ID SOP**	**30**	**J**	**40**	20	**10**	**ng/L**	**1**
Perfluoro-1-pentanesulfonic acid (PFPeS)	2706-91-4	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluorohexanesulfonic acid (PFHxS)	**355-46-4**	**PFAS by ID SOP**	**53**		**40**	20	**10**	**ng/L**	**1**
Perfluoro-n-butanoic acid (PFBA)	375-22-4	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-n-decanoic acid (PFDA)	335-76-2	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-n-dodecanoic acid (PFDoA)	307-55-1	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-n-heptanoic acid (PFHpA)	375-85-9	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-n-hexanoic acid (PFHxA)	**307-24-4**	**PFAS by ID SOP**	**13**	**J**	**40**	20	**10**	**ng/L**	**1**
Perfluoro-n-nonanoic acid (PFNA)	375-95-1	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-n-octanoic acid (PFOA)	**335-67-1**	**PFAS by ID SOP**	**17**	**J**	**40**	20	**10**	**ng/L**	**1**
Perfluoro-n-pentanoic acid (PFPeA)	2706-90-3	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-n-tetradecanoic acid (PFTeDA)	376-06-7	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-n-tridecanoic acid (PFTrDA)	72629-94-8	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-n-undecanoic acid (PFUdA)	2058-94-8	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluorooctanesulfonic acid (PFOS)	**1763-23-1**	**PFAS by ID SOP**	**470**		**40**	20	**10**	**ng/L**	**1**

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
13C2_4:2FTS		101	50-150
13C2_6:2FTS		106	50-150
13C2_8:2FTS		92	50-150
13C2_PFDoA		80	50-150
13C2_PFTeDA		85	50-150
13C3_PFBS		84	50-150
13C3_PFHxS		86	50-150
13C4_PFBA		88	50-150
13C4_PFHpA		84	50-150
13C5_PFHxA		88	50-150
13C5_PFPeA		90	50-150
13C6_PFDA		88	50-150
13C7_PFUdA		86	50-150
13C8_PFOA		90	50-150
13C8_PFOS		92	50-150
13C8_PFOSA		93	50-150
13C9_PFNA		99	50-150

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

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SPLP PFAS

Client: **Arcadis U.S., Inc.**		Laboratory ID: **WI28012-007**	
Description: **393-1-S-1**		Matrix: **Solid**	
Date Sampled: **09/22/2021 1400**	Project Name: **Eielson AFB**	% Solids: **93.9**	**09/28/2021 2312**
Date Received: **09/28/2021**	Project Number: **30030317**		

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
d5-EtFOSAA		103	50-150
d-MeFOSA		86	50-150
d3-MeFOSAA		90	50-150

LOQ = Limit of Quantitation	B = Detected in the method blank	E = Quantitation of compound exceeded the calibration range	DL = Detection Limit	Q = Surrogate failure
U = Not detected at or above the LOQ	N = Recovery is out of criteria	P = The RPD between two GC columns exceeds 40%	J = Estimated result < LOQ and ≥ DL	L = LCS/LCSD failure
H = Out of holding time	W = Reported on wet weight basis	LOD = Limit of Detection		S = MS/MSD failure

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PFAS by LC/MS/MS

Client: **Arcadis U.S., Inc.**		Laboratory ID: **WI28012-008**	
Description: **393-1-S-2**		Matrix: **Solid**	
Date Sampled: **09/22/2021 1500**	Project Name: **Eielson AFB**	% Solids: **91.4**	**09/28/2021 2312**
Date Received: **09/28/2021**	Project Number: **30030317**		

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch
1	SOP SPE	PFAS by ID SOP QSM B-15	1	09/29/2021 1815	NK1	09/29/2021 1247	16945

Parameter	CAS Number	Analytical Method	Result	Q	LOQ	LOD	DL	Units	Run
1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS)	**39108-34-4**	**PFAS by ID SOP**	**5.0**		**1.8**	0.90	**0.46**	**ug/kg**	**1**
1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS)	27619-97-2	PFAS by ID SOP	0.90	U	1.8	0.90	0.46	ug/kg	1
1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS)	757124-72-4	PFAS by ID SOP	0.90	U	1.8	0.90	0.46	ug/kg	1
N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA)	2991-50-6	PFAS by ID SOP	0.90	U	1.8	0.90	0.46	ug/kg	1
N-methylperfluoro-1-octanesulfonamide (MeFOSA)	31506-32-8	PFAS by ID SOP	0.90	U	1.8	0.90	0.46	ug/kg	1
N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA)	2355-31-9	PFAS by ID SOP	0.90	U	1.8	0.90	0.46	ug/kg	1
Perfluoro-1-butanesulfonic acid (PFBS)	**375-73-5**	**PFAS by ID SOP**	**0.63**	**J**	**0.91**	0.46	**0.18**	**ug/kg**	**1**
Perfluoro-1-decanesulfonic acid (PFDS)	**335-77-3**	**PFAS by ID SOP**	**1.2**		**0.91**	0.46	**0.18**	**ug/kg**	**1**
Perfluoro-1-heptanesulfonic acid (PFHpS)	**375-92-8**	**PFAS by ID SOP**	**0.28**	**J**	**0.91**	0.46	**0.18**	**ug/kg**	**1**
Perfluoro-1-nonanesulfonic acid (PFNS)	**68259-12-1**	**PFAS by ID SOP**	**1.0**		**0.91**	0.46	**0.18**	**ug/kg**	**1**
Perfluoro-1-octanesulfonamide (PFOSA)	**754-91-6**	**PFAS by ID SOP**	**2.2**		**0.91**	0.46	**0.18**	**ug/kg**	**1**
Perfluoro-1-pentanesulfonic acid (PFPeS)	**2706-91-4**	**PFAS by ID SOP**	**0.43**	**J**	**0.91**	0.46	**0.18**	**ug/kg**	**1**
Perfluorohexanesulfonic acid (PFHxS)	**355-46-4**	**PFAS by ID SOP**	**4.2**		**0.91**	0.46	**0.18**	**ug/kg**	**1**
Perfluoro-n-butanoic acid (PFBA)	375-22-4	PFAS by ID SOP	0.46	U	0.91	0.46	0.18	ug/kg	1
Perfluoro-n-decanoic acid (PFDA)	**335-76-2**	**PFAS by ID SOP**	**0.19**	**J**	**0.91**	0.46	**0.18**	**ug/kg**	**1**
Perfluoro-n-dodecanoic acid (PFDoA)	**307-55-1**	**PFAS by ID SOP**	**0.39**	**J**	**0.91**	0.46	**0.18**	**ug/kg**	**1**
Perfluoro-n-heptanoic acid (PFHpA)	375-85-9	PFAS by ID SOP	0.46	U	0.91	0.46	0.18	ug/kg	1
Perfluoro-n-hexanoic acid (PFHxA)	**307-24-4**	**PFAS by ID SOP**	**0.40**	**J**	**0.91**	0.46	**0.18**	**ug/kg**	**1**
Perfluoro-n-nonanoic acid (PFNA)	375-95-1	PFAS by ID SOP	0.46	U	0.91	0.46	0.18	ug/kg	1
Perfluoro-n-octanoic acid (PFOA)	**335-67-1**	**PFAS by ID SOP**	**0.37**	**J**	**0.91**	0.46	**0.18**	**ug/kg**	**1**
Perfluoro-n-pentanoic acid (PFPeA)	2706-90-3	PFAS by ID SOP	0.46	U	0.91	0.46	0.18	ug/kg	1
Perfluoro-n-tetradecanoic acid (PFTeDA)	376-06-7	PFAS by ID SOP	0.46	U	0.91	0.46	0.18	ug/kg	1
Perfluoro-n-tridecanoic acid (PFTrDA)	72629-94-8	PFAS by ID SOP	0.46	U	0.91	0.46	0.18	ug/kg	1
Perfluoro-n-undecanoic acid (PFUdA)	**2058-94-8**	**PFAS by ID SOP**	**0.59**	**J**	**0.91**	0.46	**0.18**	**ug/kg**	**1**
Perfluorooctanesulfonic acid (PFOS)	**1763-23-1**	**PFAS by ID SOP**	**62**		**0.91**	0.46	**0.18**	**ug/kg**	**1**

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
13C2_4:2FTS		83	50-150
13C2_6:2FTS		86	50-150
13C2_8:2FTS		84	50-150
13C2_PFDoA		77	50-150
13C2_PFTeDA		76	50-150
13C3_PFBS		76	50-150
13C3_PFHxS		76	50-150
13C4_PFBA		75	50-150
13C4_PFHpA		75	50-150
13C5_PFHxA		75	50-150
13C5_PFPeA		76	50-150
13C6_PFDA		77	50-150
13C7_PFUdA		75	50-150
13C8_PFOA		76	50-150
13C8_PFOS		74	50-150
13C8_PFOSA		73	50-150
13C9_PFNA		76	50-150

LOQ = Limit of Quantitation	B = Detected in the method blank	E = Quantitation of compound exceeded the calibration range	DL = Detection Limit	Q = Surrogate failure
U = Not detected at or above the LOQ	N = Recovery is out of criteria	P = The RPD between two GC columns exceeds 40%	J = Estimated result < LOQ and ≥ DL	L = LCS/LCSD failure
H = Out of holding time	W = Reported on wet weight basis	LOD = Limit of Detection		S = MS/MSD failure

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PFAS by LC/MS/MS

Client: **Arcadis U.S., Inc.**		Laboratory ID: **WI28012-008**	
Description: **393-1-S-2**		Matrix: **Solid**	
Date Sampled: **09/22/2021 1500**	Project Name: **Eielson AFB**	% Solids: **91.4**	**09/28/2021 2312**
Date Received: **09/28/2021**	Project Number: **30030317**		

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
d5-EtFOSAA		86	50-150
d-MeFOSA		79	50-150
d3-MeFOSAA		82	50-150

LOQ = Limit of Quantitation	B = Detected in the method blank	E = Quantitation of compound exceeded the calibration range	DL = Detection Limit	Q = Surrogate failure
U = Not detected at or above the LOQ	N = Recovery is out of criteria	P = The RPD between two GC columns exceeds 40%	J = Estimated result < LOQ and ≥ DL	L = LCS/LCSD failure
H = Out of holding time	W = Reported on wet weight basis	LOD = Limit of Detection		S = MS/MSD failure

SPLP PFAS

Client: **Arcadis U.S., Inc.** Laboratory ID: **WI28012-008**
Description: **393-1-S-2** Matrix: **Solid**
Date Sampled: **09/22/2021 1500** Project Name: **Eielson AFB** % Solids: **91.4** **09/28/2021 2312**
Date Received: **09/28/2021** Project Number: **30030317**

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch	Leachate Date
1	1312/PFAS	PFAS by ID SOP QSM B-15	1	10/21/2021 1528	JJG	10/20/2021 1345	19466	10/16/2021 0006

Parameter	CAS Number	Analytical Method	Result	Q	LOQ	LOD	DL	Units	Run
1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS)	**39108-34-4**	**PFAS by ID SOP**	**34**	**J**	**80**	40	**20**	**ng/L**	**1**
1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS)	27619-97-2	PFAS by ID SOP	40	U	80	40	20	ng/L	1
1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS)	757124-72-4	PFAS by ID SOP	40	U	80	40	20	ng/L	1
N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA)	2991-50-6	PFAS by ID SOP	40	U	80	40	20	ng/L	1
N-methylperfluoro-1-octanesulfonamide (MeFOSA)	31506-32-8	PFAS by ID SOP	80	U	160	80	40	ng/L	1
N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA)	2355-31-9	PFAS by ID SOP	40	U	80	40	20	ng/L	1
Perfluoro-1-butanesulfonic acid (PFBS)	375-73-5	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-1-decanesulfonic acid (PFDS)	335-77-3	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-1-heptanesulfonic acid (PFHpS)	375-92-8	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-1-nonanesulfonic acid (PFNS)	68259-12-1	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-1-octanesulfonamide (PFOSA)	**754-91-6**	**PFAS by ID SOP**	**30**	**J**	**40**	20	**10**	**ng/L**	**1**
Perfluoro-1-pentanesulfonic acid (PFPeS)	2706-91-4	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluorohexanesulfonic acid (PFHxS)	**355-46-4**	**PFAS by ID SOP**	**46**		**40**	20	**10**	**ng/L**	**1**
Perfluoro-n-butanoic acid (PFBA)	375-22-4	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-n-decanoic acid (PFDA)	335-76-2	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-n-dodecanoic acid (PFDoA)	307-55-1	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-n-heptanoic acid (PFHpA)	375-85-9	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-n-hexanoic acid (PFHxA)	**307-24-4**	**PFAS by ID SOP**	**12**	**J**	**40**	20	**10**	**ng/L**	**1**
Perfluoro-n-nonanoic acid (PFNA)	375-95-1	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-n-octanoic acid (PFOA)	**335-67-1**	**PFAS by ID SOP**	**17**	**J**	**40**	20	**10**	**ng/L**	**1**
Perfluoro-n-pentanoic acid (PFPeA)	2706-90-3	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-n-tetradecanoic acid (PFTeDA)	376-06-7	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-n-tridecanoic acid (PFTrDA)	72629-94-8	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-n-undecanoic acid (PFUdA)	2058-94-8	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluorooctanesulfonic acid (PFOS)	**1763-23-1**	**PFAS by ID SOP**	**510**		**40**	20	**10**	**ng/L**	**1**

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
13C2_4:2FTS		111	50-150
13C2_6:2FTS		109	50-150
13C2_8:2FTS		105	50-150
13C2_PFDoA		97	50-150
13C2_PFTeDA		98	50-150
13C3_PFBS		98	50-150
13C3_PFHxS		107	50-150
13C4_PFBA		99	50-150
13C4_PFHpA		97	50-150
13C5_PFHxA		101	50-150
13C5_PFPeA		101	50-150
13C6_PFDA		97	50-150
13C7_PFUdA		100	50-150
13C8_PFOA		99	50-150
13C8_PFOS		114	50-150
13C8_PFOSA		107	50-150
13C9_PFNA		106	50-150

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

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SPLP PFAS

Client: **Arcadis U.S., Inc.**		Laboratory ID: **WI28012-008**	
Description: **393-1-S-2**		Matrix: **Solid**	
Date Sampled: **09/22/2021 1500**	Project Name: **Eielson AFB**	% Solids: **91.4**	**09/28/2021 2312**
Date Received: **09/28/2021**	Project Number: **30030317**		

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
d5-EtFOSAA		112	50-150
d-MeFOSA		100	50-150
d3-MeFOSAA		101	50-150

LOQ = Limit of Quantitation	B = Detected in the method blank	E = Quantitation of compound exceeded the calibration range	DL = Detection Limit	Q = Surrogate failure
U = Not detected at or above the LOQ	N = Recovery is out of criteria	P = The RPD between two GC columns exceeds 40%	J = Estimated result < LOQ and ≥ DL	L = LCS/LCSD failure
H = Out of holding time	W = Reported on wet weight basis	LOD = Limit of Detection		S = MS/MSD failure

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PFAS by LC/MS/MS

Client: **Arcadis U.S., Inc.**		Laboratory ID: **WI28012-009**	
Description: **393-1-S-3**		Matrix: **Solid**	
Date Sampled: **09/23/2021 1600**	Project Name: **Eielson AFB**	% Solids: **93.4**	**09/28/2021 2312**
Date Received: **09/28/2021**	Project Number: **30030317**		

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch
1	SOP SPE	PFAS by ID SOP QSM B-15	1	09/29/2021 1827	NK1	09/29/2021 1247	16945

Parameter	CAS Number	Analytical Method	Result	Q	LOQ	LOD	DL	Units	Run
1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS)	**39108-34-4**	**PFAS by ID SOP**	**1.1**	**J**	**2.1**	1.1	**0.54**	**ug/kg**	**1**
1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS)	27619-97-2	PFAS by ID SOP	1.1	U	2.1	1.1	0.54	ug/kg	1
1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS)	757124-72-4	PFAS by ID SOP	1.1	U	2.1	1.1	0.54	ug/kg	1
N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA)	2991-50-6	PFAS by ID SOP	1.1	U	2.1	1.1	0.54	ug/kg	1
N-methylperfluoro-1-octanesulfonamide (MeFOSA)	31506-32-8	PFAS by ID SOP	1.1	U	2.1	1.1	0.54	ug/kg	1
N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA)	2355-31-9	PFAS by ID SOP	1.1	U	2.1	1.1	0.54	ug/kg	1
Perfluoro-1-butanesulfonic acid (PFBS)	**375-73-5**	**PFAS by ID SOP**	**0.26**	**J**	**1.1**	0.55	**0.21**	**ug/kg**	**1**
Perfluoro-1-decanesulfonic acid (PFDS)	**335-77-3**	**PFAS by ID SOP**	**0.29**	**J**	**1.1**	0.55	**0.21**	**ug/kg**	**1**
Perfluoro-1-heptanesulfonic acid (PFHpS)	375-92-8	PFAS by ID SOP	0.55	U	1.1	0.55	0.21	ug/kg	1
Perfluoro-1-nonanesulfonic acid (PFNS)	68259-12-1	PFAS by ID SOP	0.55	U	1.1	0.55	0.21	ug/kg	1
Perfluoro-1-octanesulfonamide (PFOSA)	**754-91-6**	**PFAS by ID SOP**	**1.1**		**1.1**	0.55	**0.21**	**ug/kg**	**1**
Perfluoro-1-pentanesulfonic acid (PFPeS)	**2706-91-4**	**PFAS by ID SOP**	**0.24**	**J**	**1.1**	0.55	**0.21**	**ug/kg**	**1**
Perfluorohexanesulfonic acid (PFHxS)	**355-46-4**	**PFAS by ID SOP**	**3.0**		**1.1**	0.55	**0.21**	**ug/kg**	**1**
Perfluoro-n-butanoic acid (PFBA)	375-22-4	PFAS by ID SOP	0.55	U	1.1	0.55	0.21	ug/kg	1
Perfluoro-n-decanoic acid (PFDA)	335-76-2	PFAS by ID SOP	0.55	U	1.1	0.55	0.21	ug/kg	1
Perfluoro-n-dodecanoic acid (PFDoA)	307-55-1	PFAS by ID SOP	0.55	U	1.1	0.55	0.21	ug/kg	1
Perfluoro-n-heptanoic acid (PFHpA)	375-85-9	PFAS by ID SOP	0.55	U	1.1	0.55	0.21	ug/kg	1
Perfluoro-n-hexanoic acid (PFHxA)	**307-24-4**	**PFAS by ID SOP**	**0.33**	**J**	**1.1**	0.55	**0.21**	**ug/kg**	**1**
Perfluoro-n-nonanoic acid (PFNA)	375-95-1	PFAS by ID SOP	0.55	U	1.1	0.55	0.21	ug/kg	1
Perfluoro-n-octanoic acid (PFOA)	**335-67-1**	**PFAS by ID SOP**	**0.53**	**J**	**1.1**	0.55	**0.21**	**ug/kg**	**1**
Perfluoro-n-pentanoic acid (PFPeA)	2706-90-3	PFAS by ID SOP	0.55	U	1.1	0.55	0.21	ug/kg	1
Perfluoro-n-tetradecanoic acid (PFTeDA)	376-06-7	PFAS by ID SOP	0.55	U	1.1	0.55	0.21	ug/kg	1
Perfluoro-n-tridecanoic acid (PFTrDA)	72629-94-8	PFAS by ID SOP	0.55	U	1.1	0.55	0.21	ug/kg	1
Perfluoro-n-undecanoic acid (PFUdA)	2058-94-8	PFAS by ID SOP	0.55	U	1.1	0.55	0.21	ug/kg	1
Perfluorooctanesulfonic acid (PFOS)	**1763-23-1**	**PFAS by ID SOP**	**32**		**1.1**	0.55	**0.21**	**ug/kg**	**1**

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
13C2_4:2FTS		68	50-150
13C2_6:2FTS		70	50-150
13C2_8:2FTS		59	50-150
13C2_PFDoA		64	50-150
13C2_PFTeDA		58	50-150
13C3_PFBS		62	50-150
13C3_PFHxS		62	50-150
13C4_PFBA		63	50-150
13C4_PFHpA		62	50-150
13C5_PFHxA		61	50-150
13C5_PFPeA		63	50-150
13C6_PFDA		59	50-150
13C7_PFUdA		58	50-150
13C8_PFOA		59	50-150
13C8_PFOS		59	50-150
13C8_PFOSA		64	50-150
13C9_PFNA		61	50-150

LOQ = Limit of Quantitation	B = Detected in the method blank	E = Quantitation of compound exceeded the calibration range	DL = Detection Limit	Q = Surrogate failure
U = Not detected at or above the LOQ	N = Recovery is out of criteria	P = The RPD between two GC columns exceeds 40%	J = Estimated result < LOQ and ≥ DL	L = LCS/LCSD failure
H = Out of holding time	W = Reported on wet weight basis	LOD = Limit of Detection		S = MS/MSD failure

PFAS by LC/MS/MS

Client: **Arcadis U.S., Inc.**		Laboratory ID: **WI28012-009**	
Description: **393-1-S-3**		Matrix: **Solid**	
Date Sampled: **09/23/2021 1600**	Project Name: **Eielson AFB**	% Solids: **93.4**	**09/28/2021 2312**
Date Received: **09/28/2021**	Project Number: **30030317**		

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
d5-EtFOSAA		68	50-150
d-MeFOSA		70	50-150
d3-MeFOSAA		65	50-150

LOQ = Limit of Quantitation	B = Detected in the method blank	E = Quantitation of compound exceeded the calibration range	DL = Detection Limit	Q = Surrogate failure
U = Not detected at or above the LOQ	N = Recovery is out of criteria	P = The RPD between two GC columns exceeds 40%	J = Estimated result < LOQ and ≥ DL	L = LCS/LCSD failure
H = Out of holding time	W = Reported on wet weight basis	LOD = Limit of Detection		S = MS/MSD failure

SPLP PFAS

Client: **Arcadis U.S., Inc.** Laboratory ID: **WI28012-009**
Description: **393-1-S-3** Matrix: **Solid**
Date Sampled: **09/23/2021 1600** Project Name: **Eielson AFB** % Solids: **93.4** **09/28/2021 2312**
Date Received: **09/28/2021** Project Number: **30030317**

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch	Leachate Date
1	1312/PFAS	PFAS by ID SOP QSM B-15	1	10/21/2021 1652	JJG	10/20/2021 1345	19466	10/16/2021 0006

Parameter	CAS Number	Analytical Method	Result	Q	LOQ	LOD	DL	Units	Run
1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS)	**39108-34-4**	**PFAS by ID SOP**	**22**	**J**	**80**	40	**20**	**ng/L**	**1**
1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS)	27619-97-2	PFAS by ID SOP	40	U	80	40	20	ng/L	1
1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS)	757124-72-4	PFAS by ID SOP	40	U	80	40	20	ng/L	1
N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA)	2991-50-6	PFAS by ID SOP	40	U	80	40	20	ng/L	1
N-methylperfluoro-1-octanesulfonamide (MeFOSA)	31506-32-8	PFAS by ID SOP	80	U	160	80	40	ng/L	1
N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA)	2355-31-9	PFAS by ID SOP	40	U	80	40	20	ng/L	1
Perfluoro-1-butanesulfonic acid (PFBS)	375-73-5	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-1-decanesulfonic acid (PFDS)	335-77-3	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-1-heptanesulfonic acid (PFHpS)	375-92-8	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-1-nonanesulfonic acid (PFNS)	68259-12-1	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-1-octanesulfonamide (PFOSA)	**754-91-6**	**PFAS by ID SOP**	**33**	**J**	**40**	20	**10**	**ng/L**	**1**
Perfluoro-1-pentanesulfonic acid (PFPeS)	2706-91-4	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluorohexanesulfonic acid (PFHxS)	**355-46-4**	**PFAS by ID SOP**	**58**		**40**	20	**10**	**ng/L**	**1**
Perfluoro-n-butanoic acid (PFBA)	375-22-4	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-n-decanoic acid (PFDA)	335-76-2	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-n-dodecanoic acid (PFDoA)	307-55-1	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-n-heptanoic acid (PFHpA)	375-85-9	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-n-hexanoic acid (PFHxA)	**307-24-4**	**PFAS by ID SOP**	**13**	**J**	**40**	20	**10**	**ng/L**	**1**
Perfluoro-n-nonanoic acid (PFNA)	375-95-1	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-n-octanoic acid (PFOA)	**335-67-1**	**PFAS by ID SOP**	**11**	**J**	**40**	20	**10**	**ng/L**	**1**
Perfluoro-n-pentanoic acid (PFPeA)	2706-90-3	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-n-tetradecanoic acid (PFTeDA)	376-06-7	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-n-tridecanoic acid (PFTrDA)	72629-94-8	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-n-undecanoic acid (PFUdA)	2058-94-8	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluorooctanesulfonic acid (PFOS)	**1763-23-1**	**PFAS by ID SOP**	**540**		**40**	20	**10**	**ng/L**	**1**

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
13C2_4:2FTS		107	50-150
13C2_6:2FTS		120	50-150
13C2_8:2FTS		97	50-150
13C2_PFDoA		91	50-150
13C2_PFTeDA		97	50-150
13C3_PFBS		100	50-150
13C3_PFHxS		97	50-150
13C4_PFBA		95	50-150
13C4_PFHpA		89	50-150
13C5_PFHxA		102	50-150
13C5_PFPeA		99	50-150
13C6_PFDA		92	50-150
13C7_PFUdA		91	50-150
13C8_PFOA		100	50-150
13C8_PFOS		109	50-150
13C8_PFOSA		109	50-150
13C9_PFNA		99	50-150

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

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SPLP PFAS

Client: **Arcadis U.S., Inc.**		Laboratory ID: **WI28012-009**	
Description: **393-1-S-3**		Matrix: **Solid**	
Date Sampled: **09/23/2021 1600**	Project Name: **Eielson AFB**	% Solids: **93.4**	**09/28/2021 2312**
Date Received: **09/28/2021**	Project Number: **30030317**		

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
d5-EtFOSAA		109	50-150
d-MeFOSA		95	50-150
d3-MeFOSAA		103	50-150

LOQ = Limit of Quantitation	B = Detected in the method blank	E = Quantitation of compound exceeded the calibration range	DL = Detection Limit	Q = Surrogate failure
U = Not detected at or above the LOQ	N = Recovery is out of criteria	P = The RPD between two GC columns exceeds 40%	J = Estimated result < LOQ and ≥ DL	L = LCS/LCSD failure
H = Out of holding time	W = Reported on wet weight basis	LOD = Limit of Detection		S = MS/MSD failure

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PFAS by LC/MS/MS

Client: **Arcadis U.S., Inc.** Laboratory ID: **WI28012-010**
Description: **DUP-04** Matrix: **Solid**
Date Sampled: **09/22/2021** Project Name: **Eielson AFB** % Solids: **92.2** **09/28/2021 2312**
Date Received: **09/28/2021** Project Number: **30030317**

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch
1	SOP SPE	PFAS by ID SOP QSM B-15	1	09/29/2021 1840	NK1	09/29/2021 1247	16945

Parameter	CAS Number	Analytical Method	Result	Q	LOQ	LOD	DL	Units	Run
1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS)	**39108-34-4**	**PFAS by ID SOP**	**1.0**	**J**	**2.1**	1.1	**0.54**	**ug/kg**	**1**
1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS)	27619-97-2	PFAS by ID SOP	1.1	U	2.1	1.1	0.54	ug/kg	1
1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS)	757124-72-4	PFAS by ID SOP	1.1	U	2.1	1.1	0.54	ug/kg	1
N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA)	2991-50-6	PFAS by ID SOP	1.1	U	2.1	1.1	0.54	ug/kg	1
N-methylperfluoro-1-octanesulfonamide (MeFOSA)	31506-32-8	PFAS by ID SOP	1.1	U	2.1	1.1	0.54	ug/kg	1
N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA)	2355-31-9	PFAS by ID SOP	1.1	U	2.1	1.1	0.54	ug/kg	1
Perfluoro-1-butanesulfonic acid (PFBS)	375-73-5	PFAS by ID SOP	0.55	U	1.1	0.55	0.21	ug/kg	1
Perfluoro-1-decanesulfonic acid (PFDS)	**335-77-3**	**PFAS by ID SOP**	**0.36**	**J**	**1.1**	0.55	**0.21**	**ug/kg**	**1**
Perfluoro-1-heptanesulfonic acid (PFHpS)	375-92-8	PFAS by ID SOP	0.55	U	1.1	0.55	0.21	ug/kg	1
Perfluoro-1-nonanesulfonic acid (PFNS)	68259-12-1	PFAS by ID SOP	0.55	U	1.1	0.55	0.21	ug/kg	1
Perfluoro-1-octanesulfonamide (PFOSA)	**754-91-6**	**PFAS by ID SOP**	**1.4**		**1.1**	0.55	**0.21**	**ug/kg**	**1**
Perfluoro-1-pentanesulfonic acid (PFPeS)	2706-91-4	PFAS by ID SOP	0.55	U	1.1	0.55	0.21	ug/kg	1
Perfluorohexanesulfonic acid (PFHxS)	**355-46-4**	**PFAS by ID SOP**	**1.7**		**1.1**	0.55	**0.21**	**ug/kg**	**1**
Perfluoro-n-butanoic acid (PFBA)	375-22-4	PFAS by ID SOP	0.55	U	1.1	0.55	0.21	ug/kg	1
Perfluoro-n-decanoic acid (PFDA)	335-76-2	PFAS by ID SOP	0.55	U	1.1	0.55	0.21	ug/kg	1
Perfluoro-n-dodecanoic acid (PFDoA)	307-55-1	PFAS by ID SOP	0.55	U	1.1	0.55	0.21	ug/kg	1
Perfluoro-n-heptanoic acid (PFHpA)	375-85-9	PFAS by ID SOP	0.55	U	1.1	0.55	0.21	ug/kg	1
Perfluoro-n-hexanoic acid (PFHxA)	**307-24-4**	**PFAS by ID SOP**	**0.29**	**J**	**1.1**	0.55	**0.21**	**ug/kg**	**1**
Perfluoro-n-nonanoic acid (PFNA)	375-95-1	PFAS by ID SOP	0.55	U	1.1	0.55	0.21	ug/kg	1
Perfluoro-n-octanoic acid (PFOA)	**335-67-1**	**PFAS by ID SOP**	**0.28**	**J**	**1.1**	0.55	**0.21**	**ug/kg**	**1**
Perfluoro-n-pentanoic acid (PFPeA)	2706-90-3	PFAS by ID SOP	0.55	U	1.1	0.55	0.21	ug/kg	1
Perfluoro-n-tetradecanoic acid (PFTeDA)	376-06-7	PFAS by ID SOP	0.55	U	1.1	0.55	0.21	ug/kg	1
Perfluoro-n-tridecanoic acid (PFTrDA)	72629-94-8	PFAS by ID SOP	0.55	U	1.1	0.55	0.21	ug/kg	1
Perfluoro-n-undecanoic acid (PFUdA)	2058-94-8	PFAS by ID SOP	0.55	U	1.1	0.55	0.21	ug/kg	1
Perfluorooctanesulfonic acid (PFOS)	**1763-23-1**	**PFAS by ID SOP**	**26**		**1.1**	0.55	**0.21**	**ug/kg**	**1**

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
13C2_4:2FTS		82	50-150
13C2_6:2FTS		87	50-150
13C2_8:2FTS		86	50-150
13C2_PFDoA		83	50-150
13C2_PFTeDA		76	50-150
13C3_PFBS		78	50-150
13C3_PFHxS		76	50-150
13C4_PFBA		77	50-150
13C4_PFHpA		77	50-150
13C5_PFHxA		78	50-150
13C5_PFPeA		79	50-150
13C6_PFDA		77	50-150
13C7_PFUdA		77	50-150
13C8_PFOA		76	50-150
13C8_PFOS		76	50-150
13C8_PFOSA		80	50-150
13C9_PFNA		77	50-150

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

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PFAS by LC/MS/MS

Client: **Arcadis U.S., Inc.**		Laboratory ID: **WI28012-010**	
Description: **DUP-04**		Matrix: **Solid**	
Date Sampled: **09/22/2021**	Project Name: **Eielson AFB**	% Solids: **92.2**	**09/28/2021 2312**
Date Received: **09/28/2021**	Project Number: **30030317**		

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
d5-EtFOSAA		84	50-150
d-MeFOSA		91	50-150
d3-MeFOSAA		85	50-150

LOQ = Limit of Quantitation	B = Detected in the method blank	E = Quantitation of compound exceeded the calibration range	DL = Detection Limit	Q = Surrogate failure
U = Not detected at or above the LOQ	N = Recovery is out of criteria	P = The RPD between two GC columns exceeds 40%	J = Estimated result < LOQ and ≥ DL	L = LCS/LCSD failure
H = Out of holding time	W = Reported on wet weight basis	LOD = Limit of Detection		S = MS/MSD failure

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SPLP PFAS

Client: **Arcadis U.S., Inc.** Laboratory ID: **WI28012-010**
Description: **DUP-04** Matrix: **Solid**
Date Sampled: **09/22/2021** Project Name: **Eielson AFB** % Solids: **92.2 09/28/2021 2312**
Date Received: **09/28/2021** Project Number: **30030317**

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch	Leachate Date
1	1312/PFAS	PFAS by ID SOP QSM B-15	1	10/21/2021 1702	JJG	10/20/2021 1345	19466	10/16/2021 0006

Parameter	CAS Number	Analytical Method	Result	Q	LOQ	LOD	DL	Units	Run
1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS)	39108-34-4	PFAS by ID SOP	40	U	80	40	20	ng/L	1
1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS)	27619-97-2	PFAS by ID SOP	40	U	80	40	20	ng/L	1
1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS)	757124-72-4	PFAS by ID SOP	40	U	80	40	20	ng/L	1
N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA)	2991-50-6	PFAS by ID SOP	40	U	80	40	20	ng/L	1
N-methylperfluoro-1-octanesulfonamide (MeFOSA)	31506-32-8	PFAS by ID SOP	80	U	160	80	40	ng/L	1
N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA)	2355-31-9	PFAS by ID SOP	40	U	80	40	20	ng/L	1
Perfluoro-1-butanesulfonic acid (PFBS)	375-73-5	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-1-decanesulfonic acid (PFDS)	335-77-3	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-1-heptanesulfonic acid (PFHpS)	375-92-8	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-1-nonanesulfonic acid (PFNS)	68259-12-1	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-1-octanesulfonamide (PFOSA)	**754-91-6**	**PFAS by ID SOP**	**32**	**J**	**40**	20	**10**	**ng/L**	**1**
Perfluoro-1-pentanesulfonic acid (PFPeS)	2706-91-4	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluorohexanesulfonic acid (PFHxS)	**355-46-4**	**PFAS by ID SOP**	**29**	**J**	**40**	20	**10**	**ng/L**	**1**
Perfluoro-n-butanoic acid (PFBA)	375-22-4	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-n-decanoic acid (PFDA)	335-76-2	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-n-dodecanoic acid (PFDoA)	307-55-1	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-n-heptanoic acid (PFHpA)	375-85-9	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-n-hexanoic acid (PFHxA)	**307-24-4**	**PFAS by ID SOP**	**10**	**J**	**40**	20	**10**	**ng/L**	**1**
Perfluoro-n-nonanoic acid (PFNA)	375-95-1	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-n-octanoic acid (PFOA)	**335-67-1**	**PFAS by ID SOP**	**20**	**J**	**40**	20	**10**	**ng/L**	**1**
Perfluoro-n-pentanoic acid (PFPeA)	2706-90-3	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-n-tetradecanoic acid (PFTeDA)	376-06-7	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-n-tridecanoic acid (PFTrDA)	72629-94-8	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluoro-n-undecanoic acid (PFUdA)	2058-94-8	PFAS by ID SOP	20	U	40	20	10	ng/L	1
Perfluorooctanesulfonic acid (PFOS)	**1763-23-1**	**PFAS by ID SOP**	**440**		**40**	20	**10**	**ng/L**	**1**

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
13C2_4:2FTS		104	50-150
13C2_6:2FTS		102	50-150
13C2_8:2FTS		92	50-150
13C2_PFDoA		91	50-150
13C2_PFTeDA		88	50-150
13C3_PFBS		92	50-150
13C3_PFHxS		97	50-150
13C4_PFBA		90	50-150
13C4_PFHpA		88	50-150
13C5_PFHxA		93	50-150
13C5_PFPeA		92	50-150
13C6_PFDA		89	50-150
13C7_PFUdA		90	50-150
13C8_PFOA		89	50-150
13C8_PFOS		98	50-150
13C8_PFOSA		99	50-150
13C9_PFNA		91	50-150

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

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SPLP PFAS

Client: **Arcadis U.S., Inc.**		Laboratory ID: **WI28012-010**	
Description: **DUP-04**		Matrix: **Solid**	
Date Sampled: **09/22/2021**	Project Name: **Eielson AFB**	% Solids: **92.2**	**09/28/2021 2312**
Date Received: **09/28/2021**	Project Number: **30030317**		

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
d5-EtFOSAA		105	50-150
d-MeFOSA		100	50-150
d3-MeFOSAA		93	50-150

LOQ = Limit of Quantitation	B = Detected in the method blank	E = Quantitation of compound exceeded the calibration range	DL = Detection Limit	Q = Surrogate failure
U = Not detected at or above the LOQ	N = Recovery is out of criteria	P = The RPD between two GC columns exceeds 40%	J = Estimated result < LOQ and ≥ DL	L = LCS/LCSD failure
H = Out of holding time	W = Reported on wet weight basis	LOD = Limit of Detection		S = MS/MSD failure

QC Summary

PFAS by LC/MS/MS - MB

Sample ID: WQ16945-001
Batch: 16945
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Solid
Prep Method: SOP SPE
Prep Date: 09/29/2021 1247

Parameter	Result	Q	Dil	LOQ	LOD	DL	Units	Analysis Date
8:2 FTS	1.0	U	1	2.0	1.0	0.50	ug/kg	09/29/2021 1620
6:2 FTS	1.0	U	1	2.0	1.0	0.50	ug/kg	09/29/2021 1620
4:2 FTS	1.0	U	1	2.0	1.0	0.50	ug/kg	09/29/2021 1620
EtFOSAA	1.0	U	1	2.0	1.0	0.50	ug/kg	09/29/2021 1620
MeFOSA	1.0	U	1	2.0	1.0	0.50	ug/kg	09/29/2021 1620
MeFOSAA	1.0	U	1	2.0	1.0	0.50	ug/kg	09/29/2021 1620
PFBS	0.50	U	1	1.0	0.50	0.20	ug/kg	09/29/2021 1620
PFDS	0.50	U	1	1.0	0.50	0.20	ug/kg	09/29/2021 1620
PFHpS	0.50	U	1	1.0	0.50	0.20	ug/kg	09/29/2021 1620
PFNS	0.50	U	1	1.0	0.50	0.20	ug/kg	09/29/2021 1620
PFOSA	0.50	U	1	1.0	0.50	0.20	ug/kg	09/29/2021 1620
PFPeS	0.50	U	1	1.0	0.50	0.20	ug/kg	09/29/2021 1620
PFHxS	0.50	U	1	1.0	0.50	0.20	ug/kg	09/29/2021 1620
PFBA	0.50	U	1	1.0	0.50	0.20	ug/kg	09/29/2021 1620
PFDA	0.50	U	1	1.0	0.50	0.20	ug/kg	09/29/2021 1620
PFDoA	0.50	U	1	1.0	0.50	0.20	ug/kg	09/29/2021 1620
PFHpA	0.50	U	1	1.0	0.50	0.20	ug/kg	09/29/2021 1620
PFHxA	0.50	U	1	1.0	0.50	0.20	ug/kg	09/29/2021 1620
PFNA	0.50	U	1	1.0	0.50	0.20	ug/kg	09/29/2021 1620
PFOA	0.50	U	1	1.0	0.50	0.20	ug/kg	09/29/2021 1620
PFPeA	0.50	U	1	1.0	0.50	0.20	ug/kg	09/29/2021 1620
PFTeDA	0.50	U	1	1.0	0.50	0.20	ug/kg	09/29/2021 1620
PFTrDA	0.50	U	1	1.0	0.50	0.20	ug/kg	09/29/2021 1620
PFUdA	0.50	U	1	1.0	0.50	0.20	ug/kg	09/29/2021 1620
PFOS	0.50	U	1	1.0	0.50	0.20	ug/kg	09/29/2021 1620

Surrogate	Q	% Rec	Acceptance Limit
13C2_4:2FTS		107	50-150
13C2_6:2FTS		115	50-150
13C2_8:2FTS		144	50-150
13C2_PFDoA		97	50-150
13C2_PFTeDA		91	50-150
13C3_PFBS		88	50-150
13C3_PFHxS		85	50-150
13C4_PFBA		91	50-150
13C4_PFHpA		85	50-150
13C5_PFHxA		86	50-150
13C5_PFPeA		86	50-150
13C6_PFDA		89	50-150
13C7_PFUdA		88	50-150
13C8_PFOA		87	50-150

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

PFAS by LC/MS/MS - MB

Sample ID: WQ16945-001
Batch: 16945
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Solid
Prep Method: SOP SPE
Prep Date: 09/29/2021 1247

Surrogate	Q	% Rec	Acceptance Limit
13C8_PFOS		86	50-150
13C8_PFOSA		92	50-150
13C9_PFNA		89	50-150
d5-EtFOSAA		95	50-150
d-MeFOSA		92	50-150
d3-MeFOSAA		91	50-150

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

PFAS by LC/MS/MS - LCS

Sample ID: WQ16945-002
Batch: 16945
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Solid
Prep Method: SOP SPE
Prep Date: 09/29/2021 1247

Parameter	Spike Amount (ug/kg)	Result (ug/kg)	Q	Dil	% Rec	%Rec Limit	Analysis Date
8:2 FTS	1.9	1.8		1	95	65-137	09/29/2021 1633
6:2 FTS	1.9	1.9		1	98	64-140	09/29/2021 1633
4:2 FTS	1.9	1.8		1	99	62-145	09/29/2021 1633
EtFOSAA	2.0	1.7		1	85	61-139	09/29/2021 1633
MeFOSA	2.0	1.8		1	92	70-150	09/29/2021 1633
MeFOSAA	2.0	1.8		1	92	63-144	09/29/2021 1633
PFBS	1.8	1.8		1	103	72-128	09/29/2021 1633
PFDS	1.9	1.9		1	98	59-134	09/29/2021 1633
PFHpS	1.9	1.9		1	99	70-132	09/29/2021 1633
PFNS	1.9	1.9		1	97	69-125	09/29/2021 1633
PFOSA	2.0	1.9		1	95	67-137	09/29/2021 1633
PFPeS	1.9	1.8		1	96	73-123	09/29/2021 1633
PFHxS	1.8	1.7		1	95	67-130	09/29/2021 1633
PFBA	2.0	1.9		1	95	71-135	09/29/2021 1633
PFDA	2.0	1.8		1	92	69-133	09/29/2021 1633
PFDoA	2.0	2.1		1	105	69-135	09/29/2021 1633
PFHpA	2.0	2.0		1	98	71-131	09/29/2021 1633
PFHxA	2.0	1.9		1	95	70-132	09/29/2021 1633
PFNA	2.0	1.9		1	97	72-129	09/29/2021 1633
PFOA	2.0	2.0		1	98	69-133	09/29/2021 1633
PFPeA	2.0	2.0		1	99	69-132	09/29/2021 1633
PFTeDA	2.0	2.0		1	99	69-133	09/29/2021 1633
PFTrDA	2.0	2.2		1	111	66-139	09/29/2021 1633
PFUdA	2.0	2.0		1	98	64-136	09/29/2021 1633
PFOS	1.9	1.9		1	101	68-136	09/29/2021 1633

Surrogate	Q	% Rec	Acceptance Limit
13C2_4:2FTS		82	50-150
13C2_6:2FTS		80	50-150
13C2_8:2FTS		86	50-150
13C2_PFDoA		76	50-150
13C2_PFTeDA		77	50-150
13C3_PFBS		77	50-150
13C3_PFHxS		76	50-150
13C4_PFBA		78	50-150
13C4_PFHpA		79	50-150
13C5_PFHxA		80	50-150
13C5_PFPeA		79	50-150
13C6_PFDA		78	50-150
13C7_PFUdA		77	50-150
13C8_PFOA		75	50-150

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

PFAS by LC/MS/MS - LCS

Sample ID: WQ16945-002
Batch: 16945
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Solid
Prep Method: SOP SPE
Prep Date: 09/29/2021 1247

Surrogate	Q	% Rec	Acceptance Limit
13C8_PFOS		76	50-150
13C8_PFOSA		82	50-150
13C9_PFNA		71	50-150
d5-EtFOSAA		84	50-150
d-MeFOSA		91	50-150
d3-MeFOSAA		83	50-150

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

SPLP PFAS - MB

Sample ID: WQ19466-001
Batch: 19466
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Solid
Prep Method: 1312/PFAS
Prep Date: 10/20/2021 1345 **Leachate Date:** 10/16/2021 0006

Parameter	Result	Q	Dil	LOQ	LOD	DL	Units	Analysis Date
8:2 FTS	40	U	1	80	40	20	ng/L	10/21/2021 1343
6:2 FTS	40	U	1	80	40	20	ng/L	10/21/2021 1343
4:2 FTS	40	U	1	80	40	20	ng/L	10/21/2021 1343
EtFOSAA	40	U	1	80	40	20	ng/L	10/21/2021 1343
MeFOSA	80	U	1	160	80	40	ng/L	10/21/2021 1343
MeFOSAA	40	U	1	80	40	20	ng/L	10/21/2021 1343
PFBS	20	U	1	40	20	10	ng/L	10/21/2021 1343
PFDS	20	U	1	40	20	10	ng/L	10/21/2021 1343
PFHpS	20	U	1	40	20	10	ng/L	10/21/2021 1343
PFNS	20	U	1	40	20	10	ng/L	10/21/2021 1343
PFOSA	20	U	1	40	20	10	ng/L	10/21/2021 1343
PFPeS	20	U	1	40	20	10	ng/L	10/21/2021 1343
PFHxS	20	U	1	40	20	10	ng/L	10/21/2021 1343
PFBA	20	U	1	40	20	10	ng/L	10/21/2021 1343
PFDA	20	U	1	40	20	10	ng/L	10/21/2021 1343
PFDoA	20	U	1	40	20	10	ng/L	10/21/2021 1343
PFHpA	20	U	1	40	20	10	ng/L	10/21/2021 1343
PFHxA	20	U	1	40	20	10	ng/L	10/21/2021 1343
PFNA	20	U	1	40	20	10	ng/L	10/21/2021 1343
PFOA	20	U	1	40	20	10	ng/L	10/21/2021 1343
PFPeA	20	U	1	40	20	10	ng/L	10/21/2021 1343
PFTeDA	20	U	1	40	20	10	ng/L	10/21/2021 1343
PFTrDA	20	U	1	40	20	10	ng/L	10/21/2021 1343
PFUdA	20	U	1	40	20	10	ng/L	10/21/2021 1343
PFOS	20	U	1	40	20	10	ng/L	10/21/2021 1343

Surrogate	Q	% Rec	Acceptance Limit
13C2_4:2FTS		106	50-150
13C2_6:2FTS		102	50-150
13C2_8:2FTS		92	50-150
13C2_PFDoA		89	50-150
13C2_PFTeDA		89	50-150
13C3_PFBS		90	50-150
13C3_PFHxS		97	50-150
13C4_PFBA		94	50-150
13C4_PFHpA		88	50-150
13C5_PFHxA		94	50-150
13C5_PFPeA		92	50-150
13C6_PFDA		89	50-150
13C7_PFUdA		93	50-150
13C8_PFOA		93	50-150

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

SPLP PFAS - MB

Sample ID: WQ19466-001
Batch: 19466
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Solid
Prep Method: 1312/PFAS
Prep Date: 10/20/2021 1345 **Leachate Date:** 10/16/2021 0006

Surrogate	Q	% Rec	Acceptance Limit
13C8_PFOS		95	50-150
13C8_PFOSA		104	50-150
13C9_PFNA		97	50-150
d5-EtFOSAA		93	50-150
d-MeFOSA		96	50-150
d3-MeFOSAA		92	50-150

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

SPLP PFAS - LCS

Sample ID: WQ19466-002 **Matrix:** Solid
Batch: 19466 **Prep Method:** 1312/PFAS
Analytical Method: PFAS by ID SOP QSM B-15 **Prep Date:** 10/20/2021 1345 **Leachate Date:** 10/16/2021 0006

Parameter	Spike Amount (ng/L)	Result (ng/L)	Q	Dil	% Rec	%Rec Limit	Analysis Date
8:2 FTS	150	170		1	111	67-138	10/21/2021 1404
6:2 FTS	150	150		1	98	64-140	10/21/2021 1404
4:2 FTS	150	150		1	98	63-143	10/21/2021 1404
EtFOSAA	160	170		1	109	61-135	10/21/2021 1404
MeFOSA	160	130		1	78	68-141	10/21/2021 1404
MeFOSAA	160	160		1	103	65-136	10/21/2021 1404
PFBS	140	140		1	98	72-130	10/21/2021 1404
PFDS	150	150		1	99	53-142	10/21/2021 1404
PFHpS	150	140		1	94	69-134	10/21/2021 1404
PFNS	150	150		1	98	69-127	10/21/2021 1404
PFOSA	160	150		1	93	67-137	10/21/2021 1404
PFPeS	150	150		1	97	71-127	10/21/2021 1404
PFHxS	150	140		1	98	68-131	10/21/2021 1404
PFBA	160	150		1	95	73-129	10/21/2021 1404
PFDA	160	170		1	103	71-129	10/21/2021 1404
PFDoA	160	170		1	105	72-134	10/21/2021 1404
PFHpA	160	160		1	100	72-130	10/21/2021 1404
PFHxA	160	160		1	100	72-129	10/21/2021 1404
PFNA	160	160		1	99	69-130	10/21/2021 1404
PFOA	160	150		1	94	71-133	10/21/2021 1404
PFPeA	160	160		1	102	72-129	10/21/2021 1404
PFTeDA	160	170		1	104	71-132	10/21/2021 1404
PFTrDA	160	150		1	96	65-144	10/21/2021 1404
PFUdA	160	160		1	100	69-133	10/21/2021 1404
PFOS	150	140		1	97	65-140	10/21/2021 1404

Surrogate	Q	% Rec	Acceptance Limit
13C2_4:2FTS		105	50-150
13C2_6:2FTS		99	50-150
13C2_8:2FTS		100	50-150
13C2_PFDoA		92	50-150
13C2_PFTeDA		92	50-150
13C3_PFBS		96	50-150
13C3_PFHxS		96	50-150
13C4_PFBA		93	50-150
13C4_PFHpA		89	50-150
13C5_PFHxA		98	50-150
13C5_PFPeA		93	50-150
13C6_PFDA		90	50-150
13C7_PFUdA		90	50-150
13C8_PFOA		94	50-150

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
N = Recovery is out of criteria
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
* = RSD is out of criteria
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

SPLP PFAS - LCS

Sample ID: WQ19466-002
Batch: 19466
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Solid
Prep Method: 1312/PFAS
Prep Date: 10/20/2021 1345 **Leachate Date:** 10/16/2021 0006

Surrogate	Q	% Rec	Acceptance Limit
13C8_PFOS		103	50-150
13C8_PFOSA		97	50-150
13C9_PFNA		99	50-150
d5-EtFOSAA		99	50-150
d-MeFOSA		105	50-150
d3-MeFOSAA		91	50-150

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

SPLP PFAS - MS

Sample ID: WI28012-008MS
Batch: 19466
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Solid
Prep Method: 1312/PFAS
Prep Date: 10/20/2021 1345 **Leachate Date:** 10/16/2021 0006

Parameter	Sample Amount (ng/L)	Spike Amount (ng/L)	Result (ng/L)	Q	Dil	% Rec	%Rec Limit	Analysis Date
8:2 FTS	34	150	160		1	84	67-138	10/21/2021 1538
6:2 FTS	ND	150	140		1	95	64-140	10/21/2021 1538
4:2 FTS	ND	150	140		1	97	63-143	10/21/2021 1538
EtFOSAA	ND	160	150		1	94	61-135	10/21/2021 1538
MeFOSA	ND	160	190		1	117	68-141	10/21/2021 1538
MeFOSAA	ND	160	160		1	103	65-136	10/21/2021 1538
PFBS	ND	140	140		1	98	72-130	10/21/2021 1538
PFDS	ND	150	170		1	107	53-142	10/21/2021 1538
PFHpS	ND	150	150		1	101	69-134	10/21/2021 1538
PFNS	ND	150	170		1	109	69-127	10/21/2021 1538
PFOSA	30	160	170		1	90	67-137	10/21/2021 1538
PFPeS	ND	150	150		1	97	71-127	10/21/2021 1538
PFHxS	46	150	180		1	95	68-131	10/21/2021 1538
PFBA	ND	160	160		1	99	73-129	10/21/2021 1538
PFDA	ND	160	160		1	97	71-129	10/21/2021 1538
PFDoA	ND	160	160		1	101	72-134	10/21/2021 1538
PFHpA	ND	160	160		1	99	72-130	10/21/2021 1538
PFHxA	12	160	170		1	96	72-129	10/21/2021 1538
PFNA	ND	160	160		1	101	69-130	10/21/2021 1538
PFOA	17	160	170		1	95	71-133	10/21/2021 1538
PFPeA	ND	160	170		1	103	72-129	10/21/2021 1538
PFTeDA	ND	160	160		1	103	71-132	10/21/2021 1538
PFTrDA	ND	160	160		1	101	65-144	10/21/2021 1538
PFUdA	ND	160	170		1	106	69-133	10/21/2021 1538
PFOS	510	150	660		1	105	65-140	10/21/2021 1538

Surrogate	Q	% Rec	Acceptance Limit
13C2_4:2FTS		96	50-150
13C2_6:2FTS		98	50-150
13C2_8:2FTS		92	50-150
13C2_PFDoA		82	50-150
13C2_PFTeDA		85	50-150
13C3_PFBS		88	50-150
13C3_PFHxS		93	50-150
13C4_PFBA		86	50-150
13C4_PFHpA		81	50-150
13C5_PFHxA		91	50-150
13C5_PFPeA		88	50-150
13C6_PFDA		83	50-150
13C7_PFUdA		81	50-150
13C8_PFOA		88	50-150

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

SPLP PFAS - MS

Sample ID: WI28012-008MS
Batch: 19466
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Solid
Prep Method: 1312/PFAS
Prep Date: 10/20/2021 1345 **Leachate Date:** 10/16/2021 0006

Surrogate	Q	% Rec	Acceptance Limit
13C8_PFOS		94	50-150
13C8_PFOSA		93	50-150
13C9_PFNA		91	50-150
d5-EtFOSAA		94	50-150
d-MeFOSA		84	50-150
d3-MeFOSAA		86	50-150

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

SPLP PFAS - MSD

Sample ID: WI28012-008MD
Batch: 19466
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Solid
Prep Method: 1312/PFAS
Prep Date: 10/20/2021 1345 **Leachate Date:** 10/16/2021 0006

Parameter	Sample Amount (ng/L)	Spike Amount (ng/L)	Result (ng/L)	Q	Dil	% Rec	% RPD	%Rec Limit	% RPD Limit	Analysis Date
8:2 FTS	34	150	220		1	120	29	67-138	30	10/21/2021 1549
6:2 FTS	ND	150	160		1	105	10	64-140	30	10/21/2021 1549
4:2 FTS	ND	150	140		1	93	4.5	63-143	30	10/21/2021 1549
EtFOSAA	ND	160	150		1	95	1.6	61-135	30	10/21/2021 1549
MeFOSA	ND	160	160		1	97	19	68-141	30	10/21/2021 1549
MeFOSAA	ND	160	150		1	97	6.3	65-136	30	10/21/2021 1549
PFBS	ND	140	130		1	94	4.3	72-130	30	10/21/2021 1549
PFDS	ND	150	180		1	115	6.9	53-142	30	10/21/2021 1549
PFHpS	ND	150	150		1	99	1.5	69-134	30	10/21/2021 1549
PFNS	ND	150	150		1	101	8.0	69-127	30	10/21/2021 1549
PFOSA	30	160	170		1	90	0.0037	67-137	30	10/21/2021 1549
PFPeS	ND	150	140		1	90	6.9	71-127	30	10/21/2021 1549
PFHxS	46	150	180		1	90	4.4	68-131	30	10/21/2021 1549
PFBA	ND	160	160		1	98	0.98	73-129	30	10/21/2021 1549
PFDA	ND	160	160		1	102	4.5	71-129	30	10/21/2021 1549
PFDoA	ND	160	160		1	102	1.4	72-134	30	10/21/2021 1549
PFHpA	ND	160	160		1	98	0.54	72-130	30	10/21/2021 1549
PFHxA	12	160	160		1	96	0.55	72-129	30	10/21/2021 1549
PFNA	ND	160	160		1	98	3.1	69-130	30	10/21/2021 1549
PFOA	17	160	150		1	86	8.4	71-133	30	10/21/2021 1549
PFPeA	ND	160	150		1	95	8.0	72-129	30	10/21/2021 1549
PFTeDA	ND	160	160		1	98	5.2	71-132	30	10/21/2021 1549
PFTrDA	ND	160	160		1	98	2.9	65-144	30	10/21/2021 1549
PFUdA	ND	160	150		1	96	9.9	69-133	30	10/21/2021 1549
PFOS	510	150	690		1	126	4.5	65-140	30	10/21/2021 1549

Surrogate	Q	% Rec	Acceptance Limit
13C2_4:2FTS		98	50-150
13C2_6:2FTS		96	50-150
13C2_8:2FTS		81	50-150
13C2_PFDoA		89	50-150
13C2_PFTeDA		90	50-150
13C3_PFBS		92	50-150
13C3_PFHxS		94	50-150
13C4_PFBA		89	50-150
13C4_PFHpA		82	50-150
13C5_PFHxA		89	50-150
13C5_PFPeA		91	50-150
13C6_PFDA		86	50-150
13C7_PFUdA		88	50-150
13C8_PFOA		89	50-150

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

SPLP PFAS - MSD

Sample ID: WI28012-008MD
Batch: 19466
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Solid
Prep Method: 1312/PFAS
Prep Date: 10/20/2021 1345 **Leachate Date:** 10/16/2021 0006

Surrogate	Q	% Rec	Acceptance Limit
13C8_PFOS		92	50-150
13C8_PFOSA		99	50-150
13C9_PFNA		92	50-150
d5-EtFOSAA		103	50-150
d-MeFOSA		95	50-150
d3-MeFOSAA		95	50-150

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

Chain of Custody
and
Miscellaneous Documents

Pace Analytical®

PACE ANALYTICAL SERVICES, LLC
106 Vantage Point Drive • West Columbia, SC 29172
Telephone No. 803-791-9700 Fax No. 803-791-9111
www.pacelabs.com

Number 122687

Client: Aradi's	Report to Contact: Nathan Nagle	Telephone No. / E-mail: Nathan.Nagle@aradis.com	Quote No.
Address: 10 Friends Lane, Ste 100	Sampler's Signature: X	Analysis (Attach list if more space is needed)	Page ___ of ___
City: Newtown	State: PA	Zip Code: 18940	Printed Name: Jacob Schenk
Project Name: Elelson Soil Washing			WI28012
Project No.: 800303?7	P.O. No.		KES2

Sample ID / Description (Containers for each sample may be combined on one line.)	Collection Date(s)	Collection Time (Military)	Grab/Composite	Matrix: Aqueous	Soil	Non Aqueous	No of Containers by Preservative Type: Unpres	H2SO4	HNO3	HCl	NaOH	NaHSO4	Na2S2O3	Methanol	Other	PFAS Table 8-15	SPLP PFAS	Screen PFOS, PFOA, PFBS	Remarks / Cooler I.D.
393-1-UT-1	9/22/21	1120	G		X		X									1	1	X	
393-1-UT-2	9/22/21	1300														1	1		
393-1-UT-3	9/23/21	1400														1	1		
393-1-G-1	9/22/21	1320														1	1		
393-1-G-2	9/22/21	1345														1	1		
393-1-G-3	9/23/21	1500														1	1		
393-1-S-1	9/22/21	1400														1	1		
393-1-S-2	9/22/21	1500														3	3		MS/MSD
393-1-S-3	9/23/21	1600														1	1		
DUP-04	9/22/21	—	G		X		X									1	1	X	

Turn Around Time Required (Prior lab approval required for expedited TAT.): ☐ Standard ☑ Rush (Specify) 5 day or Screen

Sample Disposal: ☐ Return to Client ☑ Disposal by Lab

Possible Hazard Identification: ☒ Non-Hazard ☐ Flammable ☐ Skin Irritant ☐ Poison ☐ Unknown

QC Requirements (Specify)

	Date	Time		Date	Time
1. Relinquished by	9/27/21	1200	1. Received by		
2. Relinquished by			2. Received by		
3. Relinquished by			3. Received by		
4. Relinquished by: Fedex	9/28/21	0945	4. Laboratory received by	9/28/21	0945

Note: All samples are retained for four weeks from receipt unless other arrangements are made.

LAB USE ONLY — Received on ice (Circle) (Yes) No Ice Pack — Receipt Temp: 5.2 °C — Temp Blank ☐ Y ☒ N

DISTRIBUTION: WHITE & YELLOW-Return to laboratory with Sample(s); PINK-Field/Client Copy

Document Number: ME002N2-01

PACE ANALYTICAL SERVICES, LLC

PaceAnalytical

Samples Receipt Checklist (SRC) (ME0018C-15)
Issuing Authority: Pace ENV - WCOL

Revised:9/29/2020
Page 1 of 1

Sample Receipt Checklist (SRC)

Client: Arcadis Cooler Inspected by/date: JRG2 / 09/28/2021 Lot #: WI28012

Means of receipt: ☐ Pace ☐ Client ☐ UPS ☑ FedEx ☐ Other:

☑ Yes	☐ No		1. Were custody seals present on the cooler?
☑ Yes	☐ No	☐ NA	2. If custody seals were present, were they intact and unbroken?

pH Strip ID: NA Chlorine Strip ID: NA Tested by: NA

Original temperature upon receipt / Derived (Corrected) temperature upon receipt %Solid Snap-Cup ID: NA

4.3 / 4.3 °C NA / NA °C NA / NA °C NA / NA °C

Method: ☐ Temperature Blank ☑ Against Bottles IR Gun ID: 5 IR Gun Correction Factor: 0 °C

Method of coolant: ☑ Wet Ice ☐ Ice Packs ☐ Dry Ice ☐ None

☐ Yes	☐ No	☑ NA	3. If temperature of any cooler exceeded 6.0°C, was Project Manager Notified? PM was Notified by: phone / email / face-to-face (circle one).
☑ Yes	☐ No	☐ NA	4. Is the commercial courier's packing slip attached to this form?
☑ Yes	☐ No		5. Were proper custody procedures (relinquished/received) followed?
☑ Yes	☐ No		6. Were sample IDs listed on the COC?
☑ Yes	☐ No		7. Were sample IDs listed on all sample containers?
☑ Yes	☐ No		8. Was collection date & time listed on the COC?
☑ Yes	☐ No		9. Was collection date & time listed on all sample containers?
☑ Yes	☐ No		10. Did all container label information (ID, date, time) agree with the COC?
☑ Yes	☐ No		11. Were tests to be performed listed on the COC?
☑ Yes	☐ No		12. Did all samples arrive in the proper containers for each test and/or in good condition (unbroken, lids on, etc.)?
☑ Yes	☐ No		13. Was adequate sample volume available?
☐ Yes	☑ No		14. Were all samples received within ½ the holding time or 48 hours, whichever comes first?
☐ Yes	☑ No		15. Were any samples containers missing/excess (circle one) samples Not listed on COC?
☐ Yes	☐ No	☑ NA	16. For VOA and RSK-175 samples, were bubbles present >"pea-size" (¼" or 6mm in diameter) in any of the VOA vials?
☐ Yes	☐ No	☑ NA	17. Were all DRO/metals/nutrient samples received at a pH of < 2?
☐ Yes	☐ No	☑ NA	18. Were all cyanide samples received at a pH > 12 and sulfide samples received at a pH > 9?
☐ Yes	☐ No	☑ NA	19. Were all applicable NH_3/TKN/cyanide/phenol/625.1/608.3 (< 0.5mg/L) samples free of residual chlorine?
☐ Yes	☐ No	☑ NA	20. Were client remarks/requests (i.e. requested dilutions, MS/MSD designations, etc...) correctly transcribed from the COC into the comment section in LIMS?
☐ Yes	☑ No		21. Was the quote number listed on the container label? If yes, Quote # 25048

Sample Preservation (Must be completed for any sample(s) incorrectly preserved or with headspace.)

Sample(s) NA were received incorrectly preserved and were adjusted accordingly in sample receiving with NA mL of circle one: H2SO4, HNO3, HCl, NaOH using SR # NA.
Time of preservation NA. If more than one preservative is needed, please note in the comments below.

Sample(s) NA were received with bubbles >6 mm in diameter.

Samples(s) NA were received with TRC > 0.5 mg/L (If #19 is *no*) and were adjusted accordingly in sample receiving with sodium thiosulfate ($Na_2S_2O_3$) with Shealy ID: NA.

SR barcode labels applied by: JRG2 Date: 09/28/2021

Comments:

Report of Analysis

Arcadis U.S., Inc.
630 Plaza Drive
Suite 600
Highlands Ranch, CO 80129
Attention: Joseph Quinnan

Project Name: Eielson AFB

Project Number: ISM

Lot Number:**WJ07031**

Date Completed:11/12/2021
Revision Date: 10/21/2021

11/12/2021 1:25 PM
Approved and released by:
Project Manager II: **Kathy E. Smith**

The electronic signature above is the equivalent of a handwritten signature.
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Pace Analytical Services, LLC (*formerly Shealy Environmental Services, Inc.*)
106 Vantage Point Drive West Columbia, SC 29172
Tel: 803-791-9700 Fax: 803-791-9111 www.pacelabs.com

Case Narrative
Arcadis U.S., Inc.
Lot Number: WJ07031

This Report of Analysis contains the analytical result(s) for the sample(s) listed on the Sample Summary following this Case Narrative. The sample receiving date is documented in the header information associated with each sample.

All results listed in this report relate only to the samples that are contained within this report.

Sample receipt, sample analysis, and data review have been performed in accordance with the Pace Quality Assurance Management Plan (QAMP), applicable Shealy standard operating procedures (SOPs), the 2003 NELAC standard, and Shealy policies. Additionally, the DoD QSM version 5.3 has been followed for these samples, and specifically Table B-15 was followed for all PFAS samples. Any exceptions to the QAMP, SOPs, NELAC standards, the DoD QSM, or policies are qualified on the results page or discussed below.

All QC associated with these samples was in compliance with DOD QSM 5.3 table B-15 and our PFAS SOP.

Correction factors (CF) are used to calculate the original sample concentration. The CF is the inverse of the concentration factor (sample volume / extract final volume) times the dilution factor (DF). For undiluted analysis. For undiluted analysis, the extract is prepared for injection by adding 182 uL of sample extract + 8 uL of reagent water + 10 uL of internal standard solution to a polypropylene autosampler vial. An extra correction factor of 0.91 (182 uL / 200 uL = 0.91) applies. The CF is calculated as follows:

CF = DF * FV / Vo

FV is volume of extract (mL)
Vo is initial sample volume (mL)
DF is dilution factor. For undiluted analysis, DF = 1/0.91.

Sample concentration for aqueous samples:
Concentration (ng/L) = Cs*CF,

$$C_s = \frac{\left(\frac{(A_s x C_{is})}{A_{is}}\right) - B}{M1}$$

Where

C_s is on column concentration of target analyte in the sample (ng/L)
C_{is} is concentration of internal standard in the sample (ng/L)
A_s is peak response of target analyte in the sample
A_{is} is peak response of internal standard in the sample
M1 is the average RF from ICAL or the slope from linear regression ICAL
B is the y-intercept from the ICAL

Pace is a TNI accredited laboratory; however, the following analyses are currently not listed on our TNI scope of accreditation:

Biological Tissue: All, Non-Potable Water: SGT-HEM EPA 1664B, Silica EPA 200.7, Boron, Calcium, Silicon, Strontium EPA 200.8, Bicarbonate, Carbonate, and Hydroxide Alkalinity SM 2320 B-2011, Fecal Coliform SM 9221 C E-2006 & SM 9222D-2006, Strontium SW-846 6010D, VOC SM 6200 B-2011, Drinking Water: VOC (excluding BTEX, MTBE, Naphthalene, & 1,2-dichloroethane) EPA 524.2, Solid Chemical Material: TOC Walkley-Black.

Where applicable, all soil sample results (including LOQ and DL if requested) are corrected for dry weight unless flagged with a "W" qualifier.

If you have any questions regarding this report please contact the Pace Project Manager listed on the cover page.

The method blank associated with prep batch 18071 contained analytes: 6:2 FTS was greater than method criteria. The following samples were affected: WJ07031-001, WJ07031-002, WJ07031-003, WJ07031-004, WJ07031-005, WJ07031-006, WJ07031-007, WJ07031-008, WJ07031-009. The data has been reported.

The MS/MSD associated with sample WJ07031-001 had multiple analytes recovered outside of the acceptance limits. The LCS was recovered within the required acceptance limits; therefore, this demonstrates a matrix effect and data quality is not impacted.

Samples for SPLP PFAS were prepped and analyzed outside of holding time.

Sample Summary

Arcadis U.S., Inc.

Lot Number: WJ07031

Project Name: Eielson AFB

Project Number: ISM

Sample Number	Sample ID	Matrix	Date Sampled	Date Received
001	ISM-393-1-UTa	Solid	09/23/2021 1430	10/07/2021
002	ISM-393-1-Utb	Solid	09/23/2021 1430	10/07/2021
003	ISM-393-1-Utc	Solid	09/23/2021 1430	10/07/2021
004	ISM-393-1-Ga	Solid	09/23/2021 1530	10/07/2021
005	ISM-393-1-Gb	Solid	09/23/2021 1530	10/07/2021
006	ISM-393-1-Gc	Solid	09/23/2021 1530	10/07/2021
007	ISM-393-1-Sa	Solid	09/23/2021 1630	10/07/2021
008	ISM-393-1-Sb	Solid	09/23/2021 1630	10/07/2021
009	ISM-393-1-Sc	Solid	09/23/2021 1630	10/07/2021

(9 samples)

Detection Summary

Arcadis U.S., Inc.

Lot Number: WJ07031

Project Name: Eielson AFB

Project Number: ISM

Sample	Sample ID	Matrix	Parameter	Method	Result	Q	Units	Page
001	ISM-393-1-UTa	Solid	8:2 FTS	PFAS by ID	23	S	ug/kg	12
001	ISM-393-1-UTa	Solid	6:2 FTS	PFAS by ID	6.2	BS	ug/kg	12
001	ISM-393-1-UTa	Solid	PFBS	PFAS by ID	1.1		ug/kg	12
001	ISM-393-1-UTa	Solid	PFDS	PFAS by ID	2.7		ug/kg	12
001	ISM-393-1-UTa	Solid	PFHpS	PFAS by ID	0.48	J	ug/kg	12
001	ISM-393-1-UTa	Solid	PFNS	PFAS by ID	3.8		ug/kg	12
001	ISM-393-1-UTa	Solid	PFOSA	PFAS by ID	16	S	ug/kg	12
001	ISM-393-1-UTa	Solid	PFPeS	PFAS by ID	1.4		ug/kg	12
001	ISM-393-1-UTa	Solid	PFHxS	PFAS by ID	21	S	ug/kg	12
001	ISM-393-1-UTa	Solid	PFBA	PFAS by ID	0.69	J	ug/kg	12
001	ISM-393-1-UTa	Solid	PFDA	PFAS by ID	1.7		ug/kg	12
001	ISM-393-1-UTa	Solid	PFDoA	PFAS by ID	0.63	J	ug/kg	12
001	ISM-393-1-UTa	Solid	PFHpA	PFAS by ID	1.2		ug/kg	12
001	ISM-393-1-UTa	Solid	PFHxA	PFAS by ID	5.9	S	ug/kg	12
001	ISM-393-1-UTa	Solid	PFNA	PFAS by ID	0.63	J	ug/kg	12
001	ISM-393-1-UTa	Solid	PFOA	PFAS by ID	4.8	S	ug/kg	12
001	ISM-393-1-UTa	Solid	PFPeA	PFAS by ID	2.2		ug/kg	12
001	ISM-393-1-UTa	Solid	PFUdA	PFAS by ID	0.75	J	ug/kg	12
001	ISM-393-1-UTa	Solid	PFOS	PFAS by ID	420		ug/kg	12
001	ISM-393-1-UTa	Solid	8:2 FTS	PFAS by ID	570	H	ng/L	14
001	ISM-393-1-UTa	Solid	6:2 FTS	PFAS by ID	340	H	ng/L	14
001	ISM-393-1-UTa	Solid	PFBS	PFAS by ID	52	H	ng/L	14
001	ISM-393-1-UTa	Solid	PFHpS	PFAS by ID	26	HJ	ng/L	14
001	ISM-393-1-UTa	Solid	PFNS	PFAS by ID	75	H	ng/L	14
001	ISM-393-1-UTa	Solid	PFOSA	PFAS by ID	600	H	ng/L	14
001	ISM-393-1-UTa	Solid	PFPeS	PFAS by ID	68	H	ng/L	14
001	ISM-393-1-UTa	Solid	PFHxS	PFAS by ID	1100	H	ng/L	14
001	ISM-393-1-UTa	Solid	PFBA	PFAS by ID	39	HJ	ng/L	14
001	ISM-393-1-UTa	Solid	PFDA	PFAS by ID	59	H	ng/L	14
001	ISM-393-1-UTa	Solid	PFHpA	PFAS by ID	65	H	ng/L	14
001	ISM-393-1-UTa	Solid	PFHxA	PFAS by ID	370	H	ng/L	14
001	ISM-393-1-UTa	Solid	PFNA	PFAS by ID	32	HJ	ng/L	14
001	ISM-393-1-UTa	Solid	PFOA	PFAS by ID	280	H	ng/L	14
001	ISM-393-1-UTa	Solid	PFPeA	PFAS by ID	130	H	ng/L	14
001	ISM-393-1-UTa	Solid	PFUdA	PFAS by ID	14	HJ	ng/L	14
001	ISM-393-1-UTa	Solid	PFOS	PFAS by ID	21000		ng/L	14
002	ISM-393-1-Utb	Solid	8:2 FTS	PFAS by ID	28		ug/kg	16
002	ISM-393-1-Utb	Solid	6:2 FTS	PFAS by ID	7.0	B	ug/kg	16
002	ISM-393-1-Utb	Solid	PFBS	PFAS by ID	1.4		ug/kg	16
002	ISM-393-1-Utb	Solid	PFDS	PFAS by ID	3.3		ug/kg	16
002	ISM-393-1-Utb	Solid	PFHpS	PFAS by ID	0.66	J	ug/kg	16
002	ISM-393-1-Utb	Solid	PFNS	PFAS by ID	4.7		ug/kg	16
002	ISM-393-1-Utb	Solid	PFOSA	PFAS by ID	19		ug/kg	16

Sample	Sample ID	Matrix	Parameter	Method	Result	Q	Units	Page
002	ISM-393-1-Utb	Solid	PFPeS	PFAS by ID	1.8		ug/kg	16
002	ISM-393-1-Utb	Solid	PFHxS	PFAS by ID	27		ug/kg	16
002	ISM-393-1-Utb	Solid	PFBA	PFAS by ID	0.75	J	ug/kg	16
002	ISM-393-1-Utb	Solid	PFDA	PFAS by ID	2.3		ug/kg	16
002	ISM-393-1-Utb	Solid	PFDoA	PFAS by ID	0.74	J	ug/kg	16
002	ISM-393-1-Utb	Solid	PFHpA	PFAS by ID	1.4		ug/kg	16
002	ISM-393-1-Utb	Solid	PFHxA	PFAS by ID	7.1		ug/kg	16
002	ISM-393-1-Utb	Solid	PFNA	PFAS by ID	0.84	J	ug/kg	16
002	ISM-393-1-Utb	Solid	PFOA	PFAS by ID	6.1		ug/kg	16
002	ISM-393-1-Utb	Solid	PFPeA	PFAS by ID	2.7		ug/kg	16
002	ISM-393-1-Utb	Solid	PFTeDA	PFAS by ID	0.19	J	ug/kg	16
002	ISM-393-1-Utb	Solid	PFTrDA	PFAS by ID	0.21	J	ug/kg	16
002	ISM-393-1-Utb	Solid	PFUdA	PFAS by ID	1.1		ug/kg	16
002	ISM-393-1-Utb	Solid	PFOS	PFAS by ID	520		ug/kg	16
002	ISM-393-1-Utb	Solid	8:2 FTS	PFAS by ID	900	H	ng/L	18
002	ISM-393-1-Utb	Solid	6:2 FTS	PFAS by ID	400	H	ng/L	18
002	ISM-393-1-Utb	Solid	PFBS	PFAS by ID	63	H	ng/L	18
002	ISM-393-1-Utb	Solid	PFHpS	PFAS by ID	32	HJ	ng/L	18
002	ISM-393-1-Utb	Solid	PFNS	PFAS by ID	82	H	ng/L	18
002	ISM-393-1-Utb	Solid	PFOSA	PFAS by ID	710	H	ng/L	18
002	ISM-393-1-Utb	Solid	PFPeS	PFAS by ID	88	H	ng/L	18
002	ISM-393-1-Utb	Solid	PFHxS	PFAS by ID	1300	H	ng/L	18
002	ISM-393-1-Utb	Solid	PFBA	PFAS by ID	44	H	ng/L	18
002	ISM-393-1-Utb	Solid	PFDA	PFAS by ID	83	H	ng/L	18
002	ISM-393-1-Utb	Solid	PFDoA	PFAS by ID	11	HJ	ng/L	18
002	ISM-393-1-Utb	Solid	PFHpA	PFAS by ID	74	H	ng/L	18
002	ISM-393-1-Utb	Solid	PFHxA	PFAS by ID	430	H	ng/L	18
002	ISM-393-1-Utb	Solid	PFNA	PFAS by ID	38	HJ	ng/L	18
002	ISM-393-1-Utb	Solid	PFOA	PFAS by ID	300	H	ng/L	18
002	ISM-393-1-Utb	Solid	PFPeA	PFAS by ID	150	H	ng/L	18
002	ISM-393-1-Utb	Solid	PFUdA	PFAS by ID	21	HJ	ng/L	18
002	ISM-393-1-Utb	Solid	PFOS	PFAS by ID	28000		ng/L	18
003	ISM-393-1-Utc	Solid	8:2 FTS	PFAS by ID	32		ug/kg	20
003	ISM-393-1-Utc	Solid	6:2 FTS	PFAS by ID	8.6	B	ug/kg	20
003	ISM-393-1-Utc	Solid	PFBS	PFAS by ID	1.6		ug/kg	20
003	ISM-393-1-Utc	Solid	PFDS	PFAS by ID	3.5		ug/kg	20
003	ISM-393-1-Utc	Solid	PFHpS	PFAS by ID	0.96		ug/kg	20
003	ISM-393-1-Utc	Solid	PFNS	PFAS by ID	5.2		ug/kg	20
003	ISM-393-1-Utc	Solid	PFOSA	PFAS by ID	21		ug/kg	20
003	ISM-393-1-Utc	Solid	PFPeS	PFAS by ID	2.2		ug/kg	20
003	ISM-393-1-Utc	Solid	PFHxS	PFAS by ID	32		ug/kg	20
003	ISM-393-1-Utc	Solid	PFBA	PFAS by ID	0.91	J	ug/kg	20
003	ISM-393-1-Utc	Solid	PFDA	PFAS by ID	2.4		ug/kg	20
003	ISM-393-1-Utc	Solid	PFDoA	PFAS by ID	0.88	J	ug/kg	20
003	ISM-393-1-Utc	Solid	PFHpA	PFAS by ID	1.6		ug/kg	20
003	ISM-393-1-Utc	Solid	PFHxA	PFAS by ID	8.6		ug/kg	20
003	ISM-393-1-Utc	Solid	PFNA	PFAS by ID	0.88	J	ug/kg	20
003	ISM-393-1-Utc	Solid	PFOA	PFAS by ID	7.1		ug/kg	20

Sample	Sample ID	Matrix	Parameter	Method	Result	Q	Units	Page
003	ISM-393-1-Utc	Solid	PFPeA	PFAS by ID	3.2		ug/kg	20
003	ISM-393-1-Utc	Solid	PFTrDA	PFAS by ID	0.24	J	ug/kg	20
003	ISM-393-1-Utc	Solid	PFUdA	PFAS by ID	1.3		ug/kg	20
003	ISM-393-1-Utc	Solid	PFOS	PFAS by ID	740		ug/kg	20
003	ISM-393-1-Utc	Solid	8:2 FTS	PFAS by ID	540	H	ng/L	22
003	ISM-393-1-Utc	Solid	6:2 FTS	PFAS by ID	180	H	ng/L	22
003	ISM-393-1-Utc	Solid	PFBS	PFAS by ID	32	HJ	ng/L	22
003	ISM-393-1-Utc	Solid	PFHpS	PFAS by ID	16	HJ	ng/L	22
003	ISM-393-1-Utc	Solid	PFNS	PFAS by ID	44	H	ng/L	22
003	ISM-393-1-Utc	Solid	PFOSA	PFAS by ID	450	H	ng/L	22
003	ISM-393-1-Utc	Solid	PFPeS	PFAS by ID	49	H	ng/L	22
003	ISM-393-1-Utc	Solid	PFHxS	PFAS by ID	670	H	ng/L	22
003	ISM-393-1-Utc	Solid	PFBA	PFAS by ID	25	HJ	ng/L	22
003	ISM-393-1-Utc	Solid	PFDA	PFAS by ID	45	H	ng/L	22
003	ISM-393-1-Utc	Solid	PFHpA	PFAS by ID	41	H	ng/L	22
003	ISM-393-1-Utc	Solid	PFHxA	PFAS by ID	250	H	ng/L	22
003	ISM-393-1-Utc	Solid	PFNA	PFAS by ID	20	HJ	ng/L	22
003	ISM-393-1-Utc	Solid	PFOA	PFAS by ID	150	H	ng/L	22
003	ISM-393-1-Utc	Solid	PFPeA	PFAS by ID	85	H	ng/L	22
003	ISM-393-1-Utc	Solid	PFUdA	PFAS by ID	11	HJ	ng/L	22
003	ISM-393-1-Utc	Solid	PFOS	PFAS by ID	17000		ng/L	22
004	ISM-393-1-Ga	Solid	8:2 FTS	PFAS by ID	0.72	J	ug/kg	24
004	ISM-393-1-Ga	Solid	PFDS	PFAS by ID	0.19	J	ug/kg	24
004	ISM-393-1-Ga	Solid	PFOSA	PFAS by ID	0.67	J	ug/kg	24
004	ISM-393-1-Ga	Solid	PFHxS	PFAS by ID	1.0		ug/kg	24
004	ISM-393-1-Ga	Solid	PFHxA	PFAS by ID	0.62	J	ug/kg	24
004	ISM-393-1-Ga	Solid	PFOA	PFAS by ID	0.20	J	ug/kg	24
004	ISM-393-1-Ga	Solid	PFPeA	PFAS by ID	0.19	J	ug/kg	24
004	ISM-393-1-Ga	Solid	PFOS	PFAS by ID	30		ug/kg	24
004	ISM-393-1-Ga	Solid	8:2 FTS	PFAS by ID	530	H	ng/L	26
004	ISM-393-1-Ga	Solid	6:2 FTS	PFAS by ID	210	H	ng/L	26
004	ISM-393-1-Ga	Solid	PFBS	PFAS by ID	38	HJ	ng/L	26
004	ISM-393-1-Ga	Solid	PFHpS	PFAS by ID	16	HJ	ng/L	26
004	ISM-393-1-Ga	Solid	PFNS	PFAS by ID	52	H	ng/L	26
004	ISM-393-1-Ga	Solid	PFOSA	PFAS by ID	410	H	ng/L	26
004	ISM-393-1-Ga	Solid	PFPeS	PFAS by ID	51	H	ng/L	26
004	ISM-393-1-Ga	Solid	PFHxS	PFAS by ID	640	H	ng/L	26
004	ISM-393-1-Ga	Solid	PFBA	PFAS by ID	27	HJ	ng/L	26
004	ISM-393-1-Ga	Solid	PFDA	PFAS by ID	41	H	ng/L	26
004	ISM-393-1-Ga	Solid	PFHpA	PFAS by ID	41	H	ng/L	26
004	ISM-393-1-Ga	Solid	PFHxA	PFAS by ID	240	H	ng/L	26
004	ISM-393-1-Ga	Solid	PFNA	PFAS by ID	18	HJ	ng/L	26
004	ISM-393-1-Ga	Solid	PFOA	PFAS by ID	160	H	ng/L	26
004	ISM-393-1-Ga	Solid	PFPeA	PFAS by ID	89	H	ng/L	26
004	ISM-393-1-Ga	Solid	PFUdA	PFAS by ID	11	HJ	ng/L	26
004	ISM-393-1-Ga	Solid	PFOS	PFAS by ID	15000		ng/L	26
005	ISM-393-1-Gb	Solid	8:2 FTS	PFAS by ID	0.56	J	ug/kg	28
005	ISM-393-1-Gb	Solid	PFOSA	PFAS by ID	0.83	J	ug/kg	28

Sample	Sample ID	Matrix	Parameter	Method	Result	Q	Units	Page
005	ISM-393-1-Gb	Solid	PFHxS	PFAS by ID	1.3		ug/kg	28
005	ISM-393-1-Gb	Solid	PFHxA	PFAS by ID	0.55	J	ug/kg	28
005	ISM-393-1-Gb	Solid	PFOA	PFAS by ID	0.22	J	ug/kg	28
005	ISM-393-1-Gb	Solid	PFPeA	PFAS by ID	0.20	J	ug/kg	28
005	ISM-393-1-Gb	Solid	PFOS	PFAS by ID	29		ug/kg	28
005	ISM-393-1-Gb	Solid	8:2 FTS	PFAS by ID	56	HJ	ng/L	30
005	ISM-393-1-Gb	Solid	6:2 FTS	PFAS by ID	39	HJ	ng/L	30
005	ISM-393-1-Gb	Solid	PFNS	PFAS by ID	10	HJ	ng/L	30
005	ISM-393-1-Gb	Solid	PFOSA	PFAS by ID	60	H	ng/L	30
005	ISM-393-1-Gb	Solid	PFHxS	PFAS by ID	72	H	ng/L	30
005	ISM-393-1-Gb	Solid	PFHxA	PFAS by ID	53	H	ng/L	30
005	ISM-393-1-Gb	Solid	PFOA	PFAS by ID	14	HJ	ng/L	30
005	ISM-393-1-Gb	Solid	PFPeA	PFAS by ID	16	HJ	ng/L	30
005	ISM-393-1-Gb	Solid	PFOS	PFAS by ID	1700	H	ng/L	30
006	ISM-393-1-Gc	Solid	8:2 FTS	PFAS by ID	0.88	J	ug/kg	32
006	ISM-393-1-Gc	Solid	PFDS	PFAS by ID	0.28	J	ug/kg	32
006	ISM-393-1-Gc	Solid	PFNS	PFAS by ID	0.20	J	ug/kg	32
006	ISM-393-1-Gc	Solid	PFOSA	PFAS by ID	1.1		ug/kg	32
006	ISM-393-1-Gc	Solid	PFHxS	PFAS by ID	1.6		ug/kg	32
006	ISM-393-1-Gc	Solid	PFHxA	PFAS by ID	0.75	J	ug/kg	32
006	ISM-393-1-Gc	Solid	PFOA	PFAS by ID	0.74	J	ug/kg	32
006	ISM-393-1-Gc	Solid	PFPeA	PFAS by ID	0.26	J	ug/kg	32
006	ISM-393-1-Gc	Solid	PFOS	PFAS by ID	32		ug/kg	32
006	ISM-393-1-Gc	Solid	8:2 FTS	PFAS by ID	42	HJ	ng/L	34
006	ISM-393-1-Gc	Solid	6:2 FTS	PFAS by ID	24	HJ	ng/L	34
006	ISM-393-1-Gc	Solid	PFOSA	PFAS by ID	48	H	ng/L	34
006	ISM-393-1-Gc	Solid	PFHxS	PFAS by ID	61	H	ng/L	34
006	ISM-393-1-Gc	Solid	PFHxA	PFAS by ID	51	H	ng/L	34
006	ISM-393-1-Gc	Solid	PFOA	PFAS by ID	23	HJ	ng/L	34
006	ISM-393-1-Gc	Solid	PFPeA	PFAS by ID	18	HJ	ng/L	34
006	ISM-393-1-Gc	Solid	PFOS	PFAS by ID	1300	H	ng/L	34
007	ISM-393-1-Sa	Solid	8:2 FTS	PFAS by ID	1.0	J	ug/kg	36
007	ISM-393-1-Sa	Solid	PFDS	PFAS by ID	0.42	J	ug/kg	36
007	ISM-393-1-Sa	Solid	PFOSA	PFAS by ID	1.3		ug/kg	36
007	ISM-393-1-Sa	Solid	PFHxS	PFAS by ID	2.2		ug/kg	36
007	ISM-393-1-Sa	Solid	PFHxA	PFAS by ID	0.72	J	ug/kg	36
007	ISM-393-1-Sa	Solid	PFOA	PFAS by ID	0.40	J	ug/kg	36
007	ISM-393-1-Sa	Solid	PFOS	PFAS by ID	30		ug/kg	36
007	ISM-393-1-Sa	Solid	8:2 FTS	PFAS by ID	52	HJ	ng/L	38
007	ISM-393-1-Sa	Solid	PFHxS	PFAS by ID	67	H	ng/L	38
007	ISM-393-1-Sa	Solid	PFBA	PFAS by ID	11	HJ	ng/L	38
007	ISM-393-1-Sa	Solid	PFHxA	PFAS by ID	46	H	ng/L	38
007	ISM-393-1-Sa	Solid	PFOA	PFAS by ID	31	HJ	ng/L	38
007	ISM-393-1-Sa	Solid	PFOS	PFAS by ID	800	H	ng/L	38
008	ISM-393-1-Sb	Solid	8:2 FTS	PFAS by ID	1.1	J	ug/kg	40
008	ISM-393-1-Sb	Solid	6:2 FTS	PFAS by ID	0.60	BJ	ug/kg	40
008	ISM-393-1-Sb	Solid	PFDS	PFAS by ID	0.33	J	ug/kg	40
008	ISM-393-1-Sb	Solid	PFOSA	PFAS by ID	1.2		ug/kg	40

Sample	Sample ID	Matrix	Parameter	Method	Result	Q	Units	Page
008	ISM-393-1-Sb	Solid	PFHxS	PFAS by ID	2.2		ug/kg	40
008	ISM-393-1-Sb	Solid	PFHxA	PFAS by ID	0.73	J	ug/kg	40
008	ISM-393-1-Sb	Solid	PFOA	PFAS by ID	0.44	J	ug/kg	40
008	ISM-393-1-Sb	Solid	PFOS	PFAS by ID	32		ug/kg	40
008	ISM-393-1-Sb	Solid	8:2 FTS	PFAS by ID	35	HJ	ng/L	42
008	ISM-393-1-Sb	Solid	6:2 FTS	PFAS by ID	36	HJ	ng/L	42
008	ISM-393-1-Sb	Solid	PFOSA	PFAS by ID	45	H	ng/L	42
008	ISM-393-1-Sb	Solid	PFHxS	PFAS by ID	67	H	ng/L	42
008	ISM-393-1-Sb	Solid	PFHxA	PFAS by ID	49	H	ng/L	42
008	ISM-393-1-Sb	Solid	PFOA	PFAS by ID	34	HJ	ng/L	42
008	ISM-393-1-Sb	Solid	PFOS	PFAS by ID	920	H	ng/L	42
009	ISM-393-1-Sc	Solid	8:2 FTS	PFAS by ID	1.4	J	ug/kg	44
009	ISM-393-1-Sc	Solid	6:2 FTS	PFAS by ID	0.88	BJ	ug/kg	44
009	ISM-393-1-Sc	Solid	PFDS	PFAS by ID	0.52	J	ug/kg	44
009	ISM-393-1-Sc	Solid	PFOSA	PFAS by ID	1.3		ug/kg	44
009	ISM-393-1-Sc	Solid	PFHxS	PFAS by ID	2.2		ug/kg	44
009	ISM-393-1-Sc	Solid	PFHxA	PFAS by ID	0.93		ug/kg	44
009	ISM-393-1-Sc	Solid	PFOA	PFAS by ID	0.40	J	ug/kg	44
009	ISM-393-1-Sc	Solid	PFOS	PFAS by ID	32		ug/kg	44
009	ISM-393-1-Sc	Solid	8:2 FTS	PFAS by ID	41	HJ	ng/L	46
009	ISM-393-1-Sc	Solid	6:2 FTS	PFAS by ID	35	HJ	ng/L	46
009	ISM-393-1-Sc	Solid	PFOSA	PFAS by ID	48	H	ng/L	46
009	ISM-393-1-Sc	Solid	PFHxS	PFAS by ID	67	H	ng/L	46
009	ISM-393-1-Sc	Solid	PFHxA	PFAS by ID	51	H	ng/L	46
009	ISM-393-1-Sc	Solid	PFOA	PFAS by ID	30	HJ	ng/L	46
009	ISM-393-1-Sc	Solid	PFPeA	PFAS by ID	10	HJ	ng/L	46
009	ISM-393-1-Sc	Solid	PFOS	PFAS by ID	800	H	ng/L	46

(214 detections)

PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: WJ07031-001
Description: ISM-393-1-UTa | Matrix: Solid
Date Sampled: 09/23/2021 1430 | Project Name: Eielson AFB | % Solids: 99.5 10/07/2021 2131
Date Received: 10/07/2021 | Project Number: ISM

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch
1	SOP SPE	PFAS by ID SOP QSM B-15	1	10/08/2021 2037	NK1	10/07/2021 1828	18071
2	SOP SPE	PFAS by ID SOP QSM B-15	5	10/15/2021 1123	MMM	10/07/2021 1828	18071

Parameter	CAS Number	Analytical Method	Result	Q	LOQ	LOD	DL	Units	Run
1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS)	39108-34-4	PFAS by ID SOP	23	S	1.9	0.95	0.48	ug/kg	1
1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS)	27619-97-2	PFAS by ID SOP	6.2	BS	1.9	0.95	0.48	ug/kg	1
1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS)	757124-72-4	PFAS by ID SOP	0.95	U	1.9	0.95	0.48	ug/kg	1
N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA)	2991-50-6	PFAS by ID SOP	0.95	U	1.9	0.95	0.48	ug/kg	1
N-methylperfluoro-1-octanesulfonamide (MeFOSA)	31506-32-8	PFAS by ID SOP	0.95	U	1.9	0.95	0.48	ug/kg	1
N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA)	2355-31-9	PFAS by ID SOP	0.95	U	1.9	0.95	0.48	ug/kg	1
Perfluoro-1-butanesulfonic acid (PFBS)	375-73-5	PFAS by ID SOP	1.1		0.96	0.48	0.19	ug/kg	1
Perfluoro-1-decanesulfonic acid (PFDS)	335-77-3	PFAS by ID SOP	2.7		0.96	0.48	0.19	ug/kg	1
Perfluoro-1-heptanesulfonic acid (PFHpS)	375-92-8	PFAS by ID SOP	0.48	J	0.96	0.48	0.19	ug/kg	1
Perfluoro-1-nonanesulfonic acid (PFNS)	68259-12-1	PFAS by ID SOP	3.8		0.96	0.48	0.19	ug/kg	1
Perfluoro-1-octanesulfonamide (PFOSA)	754-91-6	PFAS by ID SOP	16	S	0.96	0.48	0.19	ug/kg	1
Perfluoro-1-pentanesulfonic acid (PFPeS)	2706-91-4	PFAS by ID SOP	1.4		0.96	0.48	0.19	ug/kg	1
Perfluorohexanesulfonic acid (PFHxS)	355-46-4	PFAS by ID SOP	21	S	0.96	0.48	0.19	ug/kg	1
Perfluoro-n-butanoic acid (PFBA)	375-22-4	PFAS by ID SOP	0.69	J	0.96	0.48	0.19	ug/kg	1
Perfluoro-n-decanoic acid (PFDA)	335-76-2	PFAS by ID SOP	1.7		0.96	0.48	0.19	ug/kg	1
Perfluoro-n-dodecanoic acid (PFDoA)	307-55-1	PFAS by ID SOP	0.63	J	0.96	0.48	0.19	ug/kg	1
Perfluoro-n-heptanoic acid (PFHpA)	375-85-9	PFAS by ID SOP	1.2		0.96	0.48	0.19	ug/kg	1
Perfluoro-n-hexanoic acid (PFHxA)	307-24-4	PFAS by ID SOP	5.9	S	0.96	0.48	0.19	ug/kg	1
Perfluoro-n-nonanoic acid (PFNA)	375-95-1	PFAS by ID SOP	0.63	J	0.96	0.48	0.19	ug/kg	1
Perfluoro-n-octanoic acid (PFOA)	335-67-1	PFAS by ID SOP	4.8	S	0.96	0.48	0.19	ug/kg	1
Perfluoro-n-pentanoic acid (PFPeA)	2706-90-3	PFAS by ID SOP	2.2		0.96	0.48	0.19	ug/kg	1
Perfluoro-n-tetradecanoic acid (PFTeDA)	376-06-7	PFAS by ID SOP	0.48	U	0.96	0.48	0.19	ug/kg	1
Perfluoro-n-tridecanoic acid (PFTrDA)	72629-94-8	PFAS by ID SOP	0.48	U	0.96	0.48	0.19	ug/kg	1
Perfluoro-n-undecanoic acid (PFUdA)	2058-94-8	PFAS by ID SOP	0.75	J	0.96	0.48	0.19	ug/kg	1
Perfluorooctanesulfonic acid (PFOS)	1763-23-1	PFAS by ID SOP	420		4.8	2.4	0.96	ug/kg	2

Surrogate	Run 1 Q	Run 1 % Recovery	Run 1 Acceptance Limits	Run 2 Q	Run 2 % Recovery	Run 2 Acceptance Limits
13C2_4:2FTS		79	50-150		93	50-150
13C2_6:2FTS		82	50-150		89	50-150
13C2_8:2FTS		76	50-150		89	50-150
13C2_PFDoA		78	50-150		92	50-150
13C2_PFTeDA		79	50-150		95	50-150
13C3_PFBS		77	50-150		92	50-150
13C3_PFHxS		75	50-150		94	50-150
13C4_PFBA		79	50-150		94	50-150
13C4_PFHpA		75	50-150		91	50-150
13C5_PFHxA		77	50-150		90	50-150
13C5_PFPeA		79	50-150		95	50-150
13C6_PFDA		74	50-150		91	50-150
13C7_PFUdA		78	50-150		104	50-150
13C8_PFOA		73	50-150		97	50-150
13C8_PFOS		67	50-150		88	50-150
13C8_PFOSA		75	50-150		83	50-150

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

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PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.		Laboratory ID: WJ07031-001	
Description: ISM-393-1-UTa		Matrix: Solid	
Date Sampled: 09/23/2021 1430	Project Name: Eielson AFB	% Solids: 99.5	10/07/2021 2131
Date Received: 10/07/2021	Project Number: ISM		

Surrogate	Q	Run 1 % Recovery	Acceptance Limits	Q	Run 2 % Recovery	Acceptance Limits
13C9_PFNA		72	50-150		97	50-150
d5-EtFOSAA		83	50-150		91	50-150
d-MeFOSA		78	50-150		97	50-150
d3-MeFOSAA		79	50-150		90	50-150

LOQ = Limit of Quantitation	B = Detected in the method blank	E = Quantitation of compound exceeded the calibration range	DL = Detection Limit	Q = Surrogate failure
U = Not detected at or above the LOQ	N = Recovery is out of criteria	P = The RPD between two GC columns exceeds 40%	J = Estimated result < LOQ and ≥ DL	L = LCS/LCSD failure
H = Out of holding time	W = Reported on wet weight basis	LOD = Limit of Detection		S = MS/MSD failure

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SPLP PFAS

Client: Arcadis U.S., Inc. | Laboratory ID: WJ07031-001
Description: ISM-393-1-UTa | Matrix: Solid
Date Sampled: 09/23/2021 1430 | Project Name: Eielson AFB | % Solids: 99.5 10/07/2021 2131
Date Received: 10/07/2021 | Project Number: ISM

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch	Leachate Date
1	1312/PFAS	PFAS by ID SOP QSM B-15	1	11/05/2021 2042	MMM	11/04/2021 1300	21287	10/29/2021 1851
2	1312/PFAS	PFAS by ID SOP QSM B-15	5	11/06/2021 2225	MMM	11/04/2021 1300	21287	10/29/2021 1851

Parameter	CAS Number	Analytical Method	Result	Q	LOQ	LOD	DL	Units	Run
1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS)	39108-34-4	PFAS by ID SOP	570	H	80	40	20	ng/L	1
1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS)	27619-97-2	PFAS by ID SOP	340	H	80	40	20	ng/L	1
1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS)	757124-72-4	PFAS by ID SOP	40	UH	80	40	20	ng/L	1
N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA)	2991-50-6	PFAS by ID SOP	40	UH	80	40	20	ng/L	1
N-methylperfluoro-1-octanesulfonamide (MeFOSA)	31506-32-8	PFAS by ID SOP	80	UH	160	80	40	ng/L	1
N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA)	2355-31-9	PFAS by ID SOP	40	UH	80	40	20	ng/L	1
Perfluoro-1-butanesulfonic acid (PFBS)	375-73-5	PFAS by ID SOP	52	H	40	20	10	ng/L	1
Perfluoro-1-decanesulfonic acid (PFDS)	335-77-3	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-1-heptanesulfonic acid (PFHpS)	375-92-8	PFAS by ID SOP	26	HJ	40	20	10	ng/L	1
Perfluoro-1-nonanesulfonic acid (PFNS)	68259-12-1	PFAS by ID SOP	75	H	40	20	10	ng/L	1
Perfluoro-1-octanesulfonamide (PFOSA)	754-91-6	PFAS by ID SOP	600	H	40	20	10	ng/L	1
Perfluoro-1-pentanesulfonic acid (PFPeS)	2706-91-4	PFAS by ID SOP	68	H	40	20	10	ng/L	1
Perfluorohexanesulfonic acid (PFHxS)	355-46-4	PFAS by ID SOP	1100	H	40	20	10	ng/L	1
Perfluoro-n-butanoic acid (PFBA)	375-22-4	PFAS by ID SOP	39	HJ	40	20	10	ng/L	1
Perfluoro-n-decanoic acid (PFDA)	335-76-2	PFAS by ID SOP	59	H	40	20	10	ng/L	1
Perfluoro-n-dodecanoic acid (PFDoA)	307-55-1	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-heptanoic acid (PFHpA)	375-85-9	PFAS by ID SOP	65	H	40	20	10	ng/L	1
Perfluoro-n-hexanoic acid (PFHxA)	307-24-4	PFAS by ID SOP	370	H	40	20	10	ng/L	1
Perfluoro-n-nonanoic acid (PFNA)	375-95-1	PFAS by ID SOP	32	HJ	40	20	10	ng/L	1
Perfluoro-n-octanoic acid (PFOA)	335-67-1	PFAS by ID SOP	280	H	40	20	10	ng/L	1
Perfluoro-n-pentanoic acid (PFPeA)	2706-90-3	PFAS by ID SOP	130	H	40	20	10	ng/L	1
Perfluoro-n-tetradecanoic acid (PFTeDA)	376-06-7	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-tridecanoic acid (PFTrDA)	72629-94-8	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-undecanoic acid (PFUdA)	2058-94-8	PFAS by ID SOP	14	HJ	40	20	10	ng/L	1
Perfluorooctanesulfonic acid (PFOS)	1763-23-1	PFAS by ID SOP	21000		200	100	50	ng/L	2

Surrogate	Run 1 Q	Run 1 % Recovery	Run 1 Acceptance Limits	Run 2 Q	Run 2 % Recovery	Run 2 Acceptance Limits
13C2_4:2FTS	H	110	50-150		103	50-150
13C2_6:2FTS	H	111	50-150		102	50-150
13C2_8:2FTS	H	110	50-150		110	50-150
13C2_PFDoA	H	105	50-150		108	50-150
13C2_PFTeDA	H	82	50-150		116	50-150
13C3_PFBS	H	106	50-150		104	50-150
13C3_PFHxS	H	100	50-150		110	50-150
13C4_PFBA	H	102	50-150		108	50-150
13C4_PFHpA	H	101	50-150		104	50-150
13C5_PFHxA	H	103	50-150		110	50-150
13C5_PFPeA	H	102	50-150		109	50-150
13C6_PFDA	H	101	50-150		102	50-150
13C7_PFUdA	H	101	50-150		115	50-150
13C8_PFOA	H	98	50-150		111	50-150
13C8_PFOS	H	88	50-150		103	50-150
13C8_PFOSA	H	106	50-150		115	50-150

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

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SPLP PFAS

Client: Arcadis U.S., Inc.		Laboratory ID: WJ07031-001	
Description: ISM-393-1-UTa		Matrix: Solid	
Date Sampled: 09/23/2021 1430	Project Name: Eielson AFB	% Solids: 99.5	10/07/2021 2131
Date Received: 10/07/2021	Project Number: ISM		

Surrogate	Q	Run 1 % Recovery	Acceptance Limits	Q	Run 2 % Recovery	Acceptance Limits
13C9_PFNA	H	86	50-150		107	50-150
d5-EtFOSAA	H	110	50-150		121	50-150
d-MeFOSA	H	109	50-150		104	50-150
d3-MeFOSAA	H	116	50-150		119	50-150

LOQ = Limit of Quantitation	B = Detected in the method blank	E = Quantitation of compound exceeded the calibration range	DL = Detection Limit	Q = Surrogate failure
U = Not detected at or above the LOQ	N = Recovery is out of criteria	P = The RPD between two GC columns exceeds 40%	J = Estimated result < LOQ and ≥ DL	L = LCS/LCSD failure
H = Out of holding time	W = Reported on wet weight basis	LOD = Limit of Detection		S = MS/MSD failure

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PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: WJ07031-002
Description: ISM-393-1-Utb | Matrix: Solid
Date Sampled: 09/23/2021 1430 | Project Name: Eielson AFB | % Solids: 99.4 10/07/2021 2131
Date Received: 10/07/2021 | Project Number: ISM

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch
1	SOP SPE	PFAS by ID SOP QSM B-15	1	10/08/2021 2115	NK1	10/07/2021 1828	18071
2	SOP SPE	PFAS by ID SOP QSM B-15	5	10/15/2021 1134	MMM	10/07/2021 1828	18071

Parameter	CAS Number	Analytical Method	Result	Q	LOQ	LOD	DL	Units	Run
1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS)	39108-34-4	PFAS by ID SOP	28		1.9	0.95	0.48	ug/kg	1
1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS)	27619-97-2	PFAS by ID SOP	7.0	B	1.9	0.95	0.48	ug/kg	1
1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS)	757124-72-4	PFAS by ID SOP	0.95	U	1.9	0.95	0.48	ug/kg	1
N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA)	2991-50-6	PFAS by ID SOP	0.95	U	1.9	0.95	0.48	ug/kg	1
N-methylperfluoro-1-octanesulfonamide (MeFOSA)	31506-32-8	PFAS by ID SOP	0.95	U	1.9	0.95	0.48	ug/kg	1
N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA)	2355-31-9	PFAS by ID SOP	0.95	U	1.9	0.95	0.48	ug/kg	1
Perfluoro-1-butanesulfonic acid (PFBS)	375-73-5	PFAS by ID SOP	1.4		0.96	0.48	0.19	ug/kg	1
Perfluoro-1-decanesulfonic acid (PFDS)	335-77-3	PFAS by ID SOP	3.3		0.96	0.48	0.19	ug/kg	1
Perfluoro-1-heptanesulfonic acid (PFHpS)	375-92-8	PFAS by ID SOP	0.66	J	0.96	0.48	0.19	ug/kg	1
Perfluoro-1-nonanesulfonic acid (PFNS)	68259-12-1	PFAS by ID SOP	4.7		0.96	0.48	0.19	ug/kg	1
Perfluoro-1-octanesulfonamide (PFOSA)	754-91-6	PFAS by ID SOP	19		0.96	0.48	0.19	ug/kg	1
Perfluoro-1-pentanesulfonic acid (PFPeS)	2706-91-4	PFAS by ID SOP	1.8		0.96	0.48	0.19	ug/kg	1
Perfluorohexanesulfonic acid (PFHxS)	355-46-4	PFAS by ID SOP	27		0.96	0.48	0.19	ug/kg	1
Perfluoro-n-butanoic acid (PFBA)	375-22-4	PFAS by ID SOP	0.75	J	0.96	0.48	0.19	ug/kg	1
Perfluoro-n-decanoic acid (PFDA)	335-76-2	PFAS by ID SOP	2.3		0.96	0.48	0.19	ug/kg	1
Perfluoro-n-dodecanoic acid (PFDoA)	307-55-1	PFAS by ID SOP	0.74	J	0.96	0.48	0.19	ug/kg	1
Perfluoro-n-heptanoic acid (PFHpA)	375-85-9	PFAS by ID SOP	1.4		0.96	0.48	0.19	ug/kg	1
Perfluoro-n-hexanoic acid (PFHxA)	307-24-4	PFAS by ID SOP	7.1		0.96	0.48	0.19	ug/kg	1
Perfluoro-n-nonanoic acid (PFNA)	375-95-1	PFAS by ID SOP	0.84	J	0.96	0.48	0.19	ug/kg	1
Perfluoro-n-octanoic acid (PFOA)	335-67-1	PFAS by ID SOP	6.1		0.96	0.48	0.19	ug/kg	1
Perfluoro-n-pentanoic acid (PFPeA)	2706-90-3	PFAS by ID SOP	2.7		0.96	0.48	0.19	ug/kg	1
Perfluoro-n-tetradecanoic acid (PFTeDA)	376-06-7	PFAS by ID SOP	0.19	J	0.96	0.48	0.19	ug/kg	1
Perfluoro-n-tridecanoic acid (PFTrDA)	72629-94-8	PFAS by ID SOP	0.21	J	0.96	0.48	0.19	ug/kg	1
Perfluoro-n-undecanoic acid (PFUdA)	2058-94-8	PFAS by ID SOP	1.1		0.96	0.48	0.19	ug/kg	1
Perfluorooctanesulfonic acid (PFOS)	1763-23-1	PFAS by ID SOP	520		4.8	2.4	0.96	ug/kg	2

Surrogate	Run 1 Q	Run 1 % Recovery	Run 1 Acceptance Limits	Run 2 Q	Run 2 % Recovery	Run 2 Acceptance Limits
13C2_4:2FTS		74	50-150		82	50-150
13C2_6:2FTS		75	50-150		85	50-150
13C2_8:2FTS		70	50-150		80	50-150
13C2_PFDoA		75	50-150		85	50-150
13C2_PFTeDA		73	50-150		92	50-150
13C3_PFBS		70	50-150		89	50-150
13C3_PFHxS		67	50-150		92	50-150
13C4_PFBA		73	50-150		90	50-150
13C4_PFHpA		67	50-150		85	50-150
13C5_PFHxA		73	50-150		88	50-150
13C5_PFPeA		72	50-150		89	50-150
13C6_PFDA		68	50-150		85	50-150
13C7_PFUdA		73	50-150		105	50-150
13C8_PFOA		68	50-150		90	50-150
13C8_PFOS		62	50-150		79	50-150
13C8_PFOSA		70	50-150		84	50-150

LOQ = Limit of Quantitation | B = Detected in the method blank | E = Quantitation of compound exceeded the calibration range | DL = Detection Limit | Q = Surrogate failure
U = Not detected at or above the LOQ | N = Recovery is out of criteria | P = The RPD between two GC columns exceeds 40% | J = Estimated result < LOQ and ≥ DL | L = LCS/LCSD failure
H = Out of holding time | W = Reported on wet weight basis | LOD = Limit of Detection | S = MS/MSD failure

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PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.		Laboratory ID: WJ07031-002	
Description: ISM-393-1-Utb		Matrix: Solid	
Date Sampled: 09/23/2021 1430	Project Name: Eielson AFB	% Solids: 99.4	10/07/2021 2131
Date Received: 10/07/2021	Project Number: ISM		

Surrogate	Q	Run 1 % Recovery	Acceptance Limits	Q	Run 2 % Recovery	Acceptance Limits
13C9_PFNA		65	50-150		85	50-150
d5-EtFOSAA		80	50-150		91	50-150
d-MeFOSA		74	50-150		95	50-150
d3-MeFOSAA		78	50-150		89	50-150

LOQ = Limit of Quantitation	B = Detected in the method blank	E = Quantitation of compound exceeded the calibration range	DL = Detection Limit	Q = Surrogate failure
U = Not detected at or above the LOQ	N = Recovery is out of criteria	P = The RPD between two GC columns exceeds 40%	J = Estimated result < LOQ and ≥ DL	L = LCS/LCSD failure
H = Out of holding time	W = Reported on wet weight basis	LOD = Limit of Detection		S = MS/MSD failure

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SPLP PFAS

Client: Arcadis U.S., Inc. | Laboratory ID: WJ07031-002
Description: ISM-393-1-Utb | Matrix: Solid
Date Sampled: 09/23/2021 1430 | Project Name: Eielson AFB | % Solids: 99.4 10/07/2021 2131
Date Received: 10/07/2021 | Project Number: ISM

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch	Leachate Date
1	1312/PFAS	PFAS by ID SOP QSM B-15	1	11/05/2021 2052	MMM	11/04/2021 1300	21287	10/29/2021 1851
2	1312/PFAS	PFAS by ID SOP QSM B-15	5	11/06/2021 2236	MMM	11/04/2021 1300	21287	10/29/2021 1851

Parameter	CAS Number	Analytical Method	Result	Q	LOQ	LOD	DL	Units	Run
1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS)	39108-34-4	PFAS by ID SOP	900	H	80	40	20	ng/L	1
1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS)	27619-97-2	PFAS by ID SOP	400	H	80	40	20	ng/L	1
1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS)	757124-72-4	PFAS by ID SOP	40	UH	80	40	20	ng/L	1
N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA)	2991-50-6	PFAS by ID SOP	40	UH	80	40	20	ng/L	1
N-methylperfluoro-1-octanesulfonamide (MeFOSA)	31506-32-8	PFAS by ID SOP	80	UH	160	80	40	ng/L	1
N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA)	2355-31-9	PFAS by ID SOP	40	UH	80	40	20	ng/L	1
Perfluoro-1-butanesulfonic acid (PFBS)	375-73-5	PFAS by ID SOP	63	H	40	20	10	ng/L	1
Perfluoro-1-decanesulfonic acid (PFDS)	335-77-3	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-1-heptanesulfonic acid (PFHpS)	375-92-8	PFAS by ID SOP	32	HJ	40	20	10	ng/L	1
Perfluoro-1-nonanesulfonic acid (PFNS)	68259-12-1	PFAS by ID SOP	82	H	40	20	10	ng/L	1
Perfluoro-1-octanesulfonamide (PFOSA)	754-91-6	PFAS by ID SOP	710	H	40	20	10	ng/L	1
Perfluoro-1-pentanesulfonic acid (PFPeS)	2706-91-4	PFAS by ID SOP	88	H	40	20	10	ng/L	1
Perfluorohexanesulfonic acid (PFHxS)	355-46-4	PFAS by ID SOP	1300	H	40	20	10	ng/L	1
Perfluoro-n-butanoic acid (PFBA)	375-22-4	PFAS by ID SOP	44	H	40	20	10	ng/L	1
Perfluoro-n-decanoic acid (PFDA)	335-76-2	PFAS by ID SOP	83	H	40	20	10	ng/L	1
Perfluoro-n-dodecanoic acid (PFDoA)	307-55-1	PFAS by ID SOP	11	HJ	40	20	10	ng/L	1
Perfluoro-n-heptanoic acid (PFHpA)	375-85-9	PFAS by ID SOP	74	H	40	20	10	ng/L	1
Perfluoro-n-hexanoic acid (PFHxA)	307-24-4	PFAS by ID SOP	430	H	40	20	10	ng/L	1
Perfluoro-n-nonanoic acid (PFNA)	375-95-1	PFAS by ID SOP	38	HJ	40	20	10	ng/L	1
Perfluoro-n-octanoic acid (PFOA)	335-67-1	PFAS by ID SOP	300	H	40	20	10	ng/L	1
Perfluoro-n-pentanoic acid (PFPeA)	2706-90-3	PFAS by ID SOP	150	H	40	20	10	ng/L	1
Perfluoro-n-tetradecanoic acid (PFTeDA)	376-06-7	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-tridecanoic acid (PFTrDA)	72629-94-8	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-undecanoic acid (PFUdA)	2058-94-8	PFAS by ID SOP	21	HJ	40	20	10	ng/L	1
Perfluorooctanesulfonic acid (PFOS)	1763-23-1	PFAS by ID SOP	28000		200	100	50	ng/L	2

Surrogate	Run 1 Q	Run 1 % Recovery	Run 1 Acceptance Limits	Run 2 Q	Run 2 % Recovery	Run 2 Acceptance Limits
13C2_4:2FTS	H	120	50-150		104	50-150
13C2_6:2FTS	H	110	50-150		104	50-150
13C2_8:2FTS	H	112	50-150		99	50-150
13C2_PFDoA	H	106	50-150		113	50-150
13C2_PFTeDA	H	84	50-150		109	50-150
13C3_PFBS	H	109	50-150		111	50-150
13C3_PFHxS	H	101	50-150		109	50-150
13C4_PFBA	H	102	50-150		108	50-150
13C4_PFHpA	H	104	50-150		108	50-150
13C5_PFHxA	H	104	50-150		111	50-150
13C5_PFPeA	H	106	50-150		106	50-150
13C6_PFDA	H	102	50-150		98	50-150
13C7_PFUdA	H	100	50-150		107	50-150
13C8_PFOA	H	99	50-150		110	50-150
13C8_PFOS	H	91	50-150		101	50-150
13C8_PFOSA	H	113	50-150		111	50-150

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

SPLP PFAS

Client: Arcadis U.S., Inc.		Laboratory ID: WJ07031-002	
Description: ISM-393-1-Utb		Matrix: Solid	
Date Sampled: 09/23/2021 1430	Project Name: Eielson AFB	% Solids: 99.4	10/07/2021 2131
Date Received: 10/07/2021	Project Number: ISM		

Surrogate	Q	Run 1 % Recovery	Acceptance Limits	Q	Run 2 % Recovery	Acceptance Limits
13C9_PFNA	H	84	50-150		105	50-150
d5-EtFOSAA	H	111	50-150		122	50-150
d-MeFOSA	H	103	50-150		110	50-150
d3-MeFOSAA	H	116	50-150		121	50-150

LOQ = Limit of Quantitation	B = Detected in the method blank	E = Quantitation of compound exceeded the calibration range	DL = Detection Limit	Q = Surrogate failure
U = Not detected at or above the LOQ	N = Recovery is out of criteria	P = The RPD between two GC columns exceeds 40%	J = Estimated result < LOQ and ≥ DL	L = LCS/LCSD failure
H = Out of holding time	W = Reported on wet weight basis	LOD = Limit of Detection		S = MS/MSD failure

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PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: WJ07031-003
Description: ISM-393-1-Utc | Matrix: Solid
Date Sampled: 09/23/2021 1430 | Project Name: Eielson AFB | % Solids: 99.3 10/07/2021 2131
Date Received: 10/07/2021 | Project Number: ISM

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch
1	SOP SPE	PFAS by ID SOP QSM B-15	1	10/08/2021 2128	NK1	10/07/2021 1828	18071
2	SOP SPE	PFAS by ID SOP QSM B-15	5	10/15/2021 1144	MMM	10/07/2021 1828	18071

Parameter	CAS Number	Analytical Method	Result	Q	LOQ	LOD	DL	Units	Run
1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS)	39108-34-4	PFAS by ID SOP	32		1.9	0.95	0.47	ug/kg	1
1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS)	27619-97-2	PFAS by ID SOP	8.6	B	1.9	0.95	0.47	ug/kg	1
1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS)	757124-72-4	PFAS by ID SOP	0.95	U	1.9	0.95	0.47	ug/kg	1
N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA)	2991-50-6	PFAS by ID SOP	0.95	U	1.9	0.95	0.47	ug/kg	1
N-methylperfluoro-1-octanesulfonamide (MeFOSA)	31506-32-8	PFAS by ID SOP	0.95	U	1.9	0.95	0.47	ug/kg	1
N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA)	2355-31-9	PFAS by ID SOP	0.95	U	1.9	0.95	0.47	ug/kg	1
Perfluoro-1-butanesulfonic acid (PFBS)	375-73-5	PFAS by ID SOP	1.6		0.95	0.48	0.19	ug/kg	1
Perfluoro-1-decanesulfonic acid (PFDS)	335-77-3	PFAS by ID SOP	3.5		0.95	0.48	0.19	ug/kg	1
Perfluoro-1-heptanesulfonic acid (PFHpS)	375-92-8	PFAS by ID SOP	0.96		0.95	0.48	0.19	ug/kg	1
Perfluoro-1-nonanesulfonic acid (PFNS)	68259-12-1	PFAS by ID SOP	5.2		0.95	0.48	0.19	ug/kg	1
Perfluoro-1-octanesulfonamide (PFOSA)	754-91-6	PFAS by ID SOP	21		0.95	0.48	0.19	ug/kg	1
Perfluoro-1-pentanesulfonic acid (PFPeS)	2706-91-4	PFAS by ID SOP	2.2		0.95	0.48	0.19	ug/kg	1
Perfluorohexanesulfonic acid (PFHxS)	355-46-4	PFAS by ID SOP	32		0.95	0.48	0.19	ug/kg	1
Perfluoro-n-butanoic acid (PFBA)	375-22-4	PFAS by ID SOP	0.91	J	0.95	0.48	0.19	ug/kg	1
Perfluoro-n-decanoic acid (PFDA)	335-76-2	PFAS by ID SOP	2.4		0.95	0.48	0.19	ug/kg	1
Perfluoro-n-dodecanoic acid (PFDoA)	307-55-1	PFAS by ID SOP	0.88	J	0.95	0.48	0.19	ug/kg	1
Perfluoro-n-heptanoic acid (PFHpA)	375-85-9	PFAS by ID SOP	1.6		0.95	0.48	0.19	ug/kg	1
Perfluoro-n-hexanoic acid (PFHxA)	307-24-4	PFAS by ID SOP	8.6		0.95	0.48	0.19	ug/kg	1
Perfluoro-n-nonanoic acid (PFNA)	375-95-1	PFAS by ID SOP	0.88	J	0.95	0.48	0.19	ug/kg	1
Perfluoro-n-octanoic acid (PFOA)	335-67-1	PFAS by ID SOP	7.1		0.95	0.48	0.19	ug/kg	1
Perfluoro-n-pentanoic acid (PFPeA)	2706-90-3	PFAS by ID SOP	3.2		0.95	0.48	0.19	ug/kg	1
Perfluoro-n-tetradecanoic acid (PFTeDA)	376-06-7	PFAS by ID SOP	0.48	U	0.95	0.48	0.19	ug/kg	1
Perfluoro-n-tridecanoic acid (PFTrDA)	72629-94-8	PFAS by ID SOP	0.24	J	0.95	0.48	0.19	ug/kg	1
Perfluoro-n-undecanoic acid (PFUdA)	2058-94-8	PFAS by ID SOP	1.3		0.95	0.48	0.19	ug/kg	1
Perfluorooctanesulfonic acid (PFOS)	1763-23-1	PFAS by ID SOP	740		4.7	2.4	0.95	ug/kg	2

Surrogate	Q	Run 1 % Recovery	Run 1 Acceptance Limits	Q	Run 2 % Recovery	Run 2 Acceptance Limits
13C2_4:2FTS		93	50-150		84	50-150
13C2_6:2FTS		95	50-150		92	50-150
13C2_8:2FTS		93	50-150		85	50-150
13C2_PFDoA		93	50-150		92	50-150
13C2_PFTeDA		97	50-150		95	50-150
13C3_PFBS		90	50-150		100	50-150
13C3_PFHxS		91	50-150		90	50-150
13C4_PFBA		93	50-150		92	50-150
13C4_PFHpA		90	50-150		86	50-150
13C5_PFHxA		91	50-150		93	50-150
13C5_PFPeA		94	50-150		95	50-150
13C6_PFDA		91	50-150		88	50-150
13C7_PFUdA		90	50-150		107	50-150
13C8_PFOA		87	50-150		97	50-150
13C8_PFOS		79	50-150		80	50-150
13C8_PFOSA		94	50-150		87	50-150

LOQ = Limit of Quantitation | B = Detected in the method blank | E = Quantitation of compound exceeded the calibration range | DL = Detection Limit | Q = Surrogate failure
U = Not detected at or above the LOQ | N = Recovery is out of criteria | P = The RPD between two GC columns exceeds 40% | J = Estimated result < LOQ and ≥ DL | L = LCS/LCSD failure
H = Out of holding time | W = Reported on wet weight basis | LOD = Limit of Detection | S = MS/MSD failure

PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.		Laboratory ID: WJ07031-003	
Description: ISM-393-1-Utc		Matrix: Solid	
Date Sampled: 09/23/2021 1430	Project Name: Eielson AFB	% Solids: 99.3	10/07/2021 2131
Date Received: 10/07/2021	Project Number: ISM		

Surrogate	Q	Run 1 % Recovery	Acceptance Limits	Q	Run 2 % Recovery	Acceptance Limits
13C9_PFNA		83	50-150		89	50-150
d5-EtFOSAA		98	50-150		92	50-150
d-MeFOSA		93	50-150		95	50-150
d3-MeFOSAA		94	50-150		93	50-150

LOQ = Limit of Quantitation	B = Detected in the method blank	E = Quantitation of compound exceeded the calibration range	DL = Detection Limit	Q = Surrogate failure
U = Not detected at or above the LOQ	N = Recovery is out of criteria	P = The RPD between two GC columns exceeds 40%	J = Estimated result < LOQ and ≥ DL	L = LCS/LCSD failure
H = Out of holding time	W = Reported on wet weight basis	LOD = Limit of Detection		S = MS/MSD failure

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SPLP PFAS

Client: Arcadis U.S., Inc. | Laboratory ID: WJ07031-003
Description: ISM-393-1-Utc | Matrix: Solid
Date Sampled: 09/23/2021 1430 | Project Name: Eielson AFB | % Solids: 99.3 10/07/2021 2131
Date Received: 10/07/2021 | Project Number: ISM

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch	Leachate Date
1	1312/PFAS	PFAS by ID SOP QSM B-15	1	11/05/2021 2103	MMM	11/04/2021 1300	21287	10/29/2021 1851
2	1312/PFAS	PFAS by ID SOP QSM B-15	5	11/06/2021 2246	MMM	11/04/2021 1300	21287	10/29/2021 1851

Parameter	CAS Number	Analytical Method	Result	Q	LOQ	LOD	DL	Units	Run
1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS)	39108-34-4	PFAS by ID SOP	540	H	80	40	20	ng/L	1
1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS)	27619-97-2	PFAS by ID SOP	180	H	80	40	20	ng/L	1
1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS)	757124-72-4	PFAS by ID SOP	40	UH	80	40	20	ng/L	1
N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA)	2991-50-6	PFAS by ID SOP	40	UH	80	40	20	ng/L	1
N-methylperfluoro-1-octanesulfonamide (MeFOSA)	31506-32-8	PFAS by ID SOP	80	UH	160	80	40	ng/L	1
N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA)	2355-31-9	PFAS by ID SOP	40	UH	80	40	20	ng/L	1
Perfluoro-1-butanesulfonic acid (PFBS)	375-73-5	PFAS by ID SOP	32	HJ	40	20	10	ng/L	1
Perfluoro-1-decanesulfonic acid (PFDS)	335-77-3	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-1-heptanesulfonic acid (PFHpS)	375-92-8	PFAS by ID SOP	16	HJ	40	20	10	ng/L	1
Perfluoro-1-nonanesulfonic acid (PFNS)	68259-12-1	PFAS by ID SOP	44	H	40	20	10	ng/L	1
Perfluoro-1-octanesulfonamide (PFOSA)	754-91-6	PFAS by ID SOP	450	H	40	20	10	ng/L	1
Perfluoro-1-pentanesulfonic acid (PFPeS)	2706-91-4	PFAS by ID SOP	49	H	40	20	10	ng/L	1
Perfluorohexanesulfonic acid (PFHxS)	355-46-4	PFAS by ID SOP	670	H	40	20	10	ng/L	1
Perfluoro-n-butanoic acid (PFBA)	375-22-4	PFAS by ID SOP	25	HJ	40	20	10	ng/L	1
Perfluoro-n-decanoic acid (PFDA)	335-76-2	PFAS by ID SOP	45	H	40	20	10	ng/L	1
Perfluoro-n-dodecanoic acid (PFDoA)	307-55-1	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-heptanoic acid (PFHpA)	375-85-9	PFAS by ID SOP	41	H	40	20	10	ng/L	1
Perfluoro-n-hexanoic acid (PFHxA)	307-24-4	PFAS by ID SOP	250	H	40	20	10	ng/L	1
Perfluoro-n-nonanoic acid (PFNA)	375-95-1	PFAS by ID SOP	20	HJ	40	20	10	ng/L	1
Perfluoro-n-octanoic acid (PFOA)	335-67-1	PFAS by ID SOP	150	H	40	20	10	ng/L	1
Perfluoro-n-pentanoic acid (PFPeA)	2706-90-3	PFAS by ID SOP	85	H	40	20	10	ng/L	1
Perfluoro-n-tetradecanoic acid (PFTeDA)	376-06-7	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-tridecanoic acid (PFTrDA)	72629-94-8	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-undecanoic acid (PFUdA)	2058-94-8	PFAS by ID SOP	11	HJ	40	20	10	ng/L	1
Perfluorooctanesulfonic acid (PFOS)	1763-23-1	PFAS by ID SOP	17000		200	100	50	ng/L	2

Surrogate	Run 1 Q	Run 1 % Recovery	Run 1 Acceptance Limits	Run 2 Q	Run 2 % Recovery	Run 2 Acceptance Limits
13C2_4:2FTS	H	107	50-150		102	50-150
13C2_6:2FTS	H	106	50-150		91	50-150
13C2_8:2FTS	H	102	50-150		102	50-150
13C2_PFDoA	H	98	50-150		104	50-150
13C2_PFTeDA	H	80	50-150		105	50-150
13C3_PFBS	H	103	50-150		103	50-150
13C3_PFHxS	H	97	50-150		104	50-150
13C4_PFBA	H	98	50-150		101	50-150
13C4_PFHpA	H	91	50-150		101	50-150
13C5_PFHxA	H	97	50-150		105	50-150
13C5_PFPeA	H	98	50-150		97	50-150
13C6_PFDA	H	98	50-150		100	50-150
13C7_PFUdA	H	96	50-150		104	50-150
13C8_PFOA	H	103	50-150		104	50-150
13C8_PFOS	H	91	50-150		98	50-150
13C8_PFOSA	H	103	50-150		106	50-150

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

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SPLP PFAS

Client: Arcadis U.S., Inc.		Laboratory ID: WJ07031-003	
Description: ISM-393-1-Utc		Matrix: Solid	
Date Sampled: 09/23/2021 1430	Project Name: Eielson AFB	% Solids: 99.3	10/07/2021 2131
Date Received: 10/07/2021	Project Number: ISM		

Surrogate	Q	Run 1 % Recovery	Acceptance Limits	Q	Run 2 % Recovery	Acceptance Limits
13C9_PFNA	H	89	50-150		93	50-150
d5-EtFOSAA	H	108	50-150		113	50-150
d-MeFOSA	H	104	50-150		106	50-150
d3-MeFOSAA	H	111	50-150		110	50-150

LOQ = Limit of Quantitation	B = Detected in the method blank	E = Quantitation of compound exceeded the calibration range	DL = Detection Limit	Q = Surrogate failure
U = Not detected at or above the LOQ	N = Recovery is out of criteria	P = The RPD between two GC columns exceeds 40%	J = Estimated result < LOQ and ≥ DL	L = LCS/LCSD failure
H = Out of holding time	W = Reported on wet weight basis	LOD = Limit of Detection		S = MS/MSD failure

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PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: WJ07031-004
Description: ISM-393-1-Ga | Matrix: Solid
Date Sampled: 09/23/2021 1530 | Project Name: Eielson AFB | % Solids: 99.6 10/07/2021 2131
Date Received: 10/07/2021 | Project Number: ISM

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch
1	SOP SPE	PFAS by ID SOP QSM B-15	1	10/08/2021 2140	NK1	10/07/2021 1828	18071

Parameter	CAS Number	Analytical Method	Result	Q	LOQ	LOD	DL	Units	Run
1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS)	39108-34-4	PFAS by ID SOP	0.72	J	1.9	0.95	0.46	ug/kg	1
1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS)	27619-97-2	PFAS by ID SOP	0.95	U	1.9	0.95	0.46	ug/kg	1
1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS)	757124-72-4	PFAS by ID SOP	0.95	U	1.9	0.95	0.46	ug/kg	1
N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA)	2991-50-6	PFAS by ID SOP	0.95	U	1.9	0.95	0.46	ug/kg	1
N-methylperfluoro-1-octanesulfonamide (MeFOSA)	31506-32-8	PFAS by ID SOP	0.95	U	1.9	0.95	0.46	ug/kg	1
N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA)	2355-31-9	PFAS by ID SOP	0.95	U	1.9	0.95	0.46	ug/kg	1
Perfluoro-1-butanesulfonic acid (PFBS)	375-73-5	PFAS by ID SOP	0.47	U	0.93	0.47	0.19	ug/kg	1
Perfluoro-1-decanesulfonic acid (PFDS)	335-77-3	PFAS by ID SOP	0.19	J	0.93	0.47	0.19	ug/kg	1
Perfluoro-1-heptanesulfonic acid (PFHpS)	375-92-8	PFAS by ID SOP	0.47	U	0.93	0.47	0.19	ug/kg	1
Perfluoro-1-nonanesulfonic acid (PFNS)	68259-12-1	PFAS by ID SOP	0.47	U	0.93	0.47	0.19	ug/kg	1
Perfluoro-1-octanesulfonamide (PFOSA)	754-91-6	PFAS by ID SOP	0.67	J	0.93	0.47	0.19	ug/kg	1
Perfluoro-1-pentanesulfonic acid (PFPeS)	2706-91-4	PFAS by ID SOP	0.47	U	0.93	0.47	0.19	ug/kg	1
Perfluorohexanesulfonic acid (PFHxS)	355-46-4	PFAS by ID SOP	1.0		0.93	0.47	0.19	ug/kg	1
Perfluoro-n-butanoic acid (PFBA)	375-22-4	PFAS by ID SOP	0.47	U	0.93	0.47	0.19	ug/kg	1
Perfluoro-n-decanoic acid (PFDA)	335-76-2	PFAS by ID SOP	0.47	U	0.93	0.47	0.19	ug/kg	1
Perfluoro-n-dodecanoic acid (PFDoA)	307-55-1	PFAS by ID SOP	0.47	U	0.93	0.47	0.19	ug/kg	1
Perfluoro-n-heptanoic acid (PFHpA)	375-85-9	PFAS by ID SOP	0.47	U	0.93	0.47	0.19	ug/kg	1
Perfluoro-n-hexanoic acid (PFHxA)	307-24-4	PFAS by ID SOP	0.62	J	0.93	0.47	0.19	ug/kg	1
Perfluoro-n-nonanoic acid (PFNA)	375-95-1	PFAS by ID SOP	0.47	U	0.93	0.47	0.19	ug/kg	1
Perfluoro-n-octanoic acid (PFOA)	335-67-1	PFAS by ID SOP	0.20	J	0.93	0.47	0.19	ug/kg	1
Perfluoro-n-pentanoic acid (PFPeA)	2706-90-3	PFAS by ID SOP	0.19	J	0.93	0.47	0.19	ug/kg	1
Perfluoro-n-tetradecanoic acid (PFTeDA)	376-06-7	PFAS by ID SOP	0.47	U	0.93	0.47	0.19	ug/kg	1
Perfluoro-n-tridecanoic acid (PFTrDA)	72629-94-8	PFAS by ID SOP	0.47	U	0.93	0.47	0.19	ug/kg	1
Perfluoro-n-undecanoic acid (PFUdA)	2058-94-8	PFAS by ID SOP	0.47	U	0.93	0.47	0.19	ug/kg	1
Perfluorooctanesulfonic acid (PFOS)	1763-23-1	PFAS by ID SOP	30		0.93	0.47	0.19	ug/kg	1

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
13C2_4:2FTS		69	50-150
13C2_6:2FTS		66	50-150
13C2_8:2FTS		65	50-150
13C2_PFDoA		61	50-150
13C2_PFTeDA		60	50-150
13C3_PFBS		62	50-150
13C3_PFHxS		61	50-150
13C4_PFBA		64	50-150
13C4_PFHpA		60	50-150
13C5_PFHxA		61	50-150
13C5_PFPeA		64	50-150
13C6_PFDA		61	50-150
13C7_PFUdA		63	50-150
13C8_PFOA		57	50-150
13C8_PFOS		58	50-150
13C8_PFOSA		64	50-150
13C9_PFNA		61	50-150

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

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PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.		Laboratory ID: WJ07031-004
Description: ISM-393-1-Ga		Matrix: Solid
Date Sampled: 09/23/2021 1530	Project Name: Eielson AFB	% Solids: 99.6 10/07/2021 2131
Date Received: 10/07/2021	Project Number: ISM	

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
d5-EtFOSAA		72	50-150
d-MeFOSA		61	50-150
d3-MeFOSAA		75	50-150

LOQ = Limit of Quantitation	B = Detected in the method blank	E = Quantitation of compound exceeded the calibration range	DL = Detection Limit	Q = Surrogate failure
U = Not detected at or above the LOQ	N = Recovery is out of criteria	P = The RPD between two GC columns exceeds 40%	J = Estimated result < LOQ and ≥ DL	L = LCS/LCSD failure
H = Out of holding time	W = Reported on wet weight basis	LOD = Limit of Detection		S = MS/MSD failure

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SPLP PFAS

Client: Arcadis U.S., Inc. | Laboratory ID: WJ07031-004
Description: ISM-393-1-Ga | Matrix: Solid
Date Sampled: 09/23/2021 1530 | Project Name: Eielson AFB | % Solids: 99.6 10/07/2021 2131
Date Received: 10/07/2021 | Project Number: ISM

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch	Leachate Date
1	1312/PFAS	PFAS by ID SOP QSM B-15	1	11/05/2021 2114	MMM	11/04/2021 1300	21287	10/29/2021 1851
2	1312/PFAS	PFAS by ID SOP QSM B-15	5	11/06/2021 2257	MMM	11/04/2021 1300	21287	10/29/2021 1851

Parameter	CAS Number	Analytical Method	Result	Q	LOQ	LOD	DL	Units	Run
1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS)	39108-34-4	PFAS by ID SOP	530	H	80	40	20	ng/L	1
1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS)	27619-97-2	PFAS by ID SOP	210	H	80	40	20	ng/L	1
1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS)	757124-72-4	PFAS by ID SOP	40	UH	80	40	20	ng/L	1
N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA)	2991-50-6	PFAS by ID SOP	40	UH	80	40	20	ng/L	1
N-methylperfluoro-1-octanesulfonamide (MeFOSA)	31506-32-8	PFAS by ID SOP	80	UH	160	80	40	ng/L	1
N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA)	2355-31-9	PFAS by ID SOP	40	UH	80	40	20	ng/L	1
Perfluoro-1-butanesulfonic acid (PFBS)	375-73-5	PFAS by ID SOP	38	HJ	40	20	10	ng/L	1
Perfluoro-1-decanesulfonic acid (PFDS)	335-77-3	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-1-heptanesulfonic acid (PFHpS)	375-92-8	PFAS by ID SOP	16	HJ	40	20	10	ng/L	1
Perfluoro-1-nonanesulfonic acid (PFNS)	68259-12-1	PFAS by ID SOP	52	H	40	20	10	ng/L	1
Perfluoro-1-octanesulfonamide (PFOSA)	754-91-6	PFAS by ID SOP	410	H	40	20	10	ng/L	1
Perfluoro-1-pentanesulfonic acid (PFPeS)	2706-91-4	PFAS by ID SOP	51	H	40	20	10	ng/L	1
Perfluorohexanesulfonic acid (PFHxS)	355-46-4	PFAS by ID SOP	640	H	40	20	10	ng/L	1
Perfluoro-n-butanoic acid (PFBA)	375-22-4	PFAS by ID SOP	27	HJ	40	20	10	ng/L	1
Perfluoro-n-decanoic acid (PFDA)	335-76-2	PFAS by ID SOP	41	H	40	20	10	ng/L	1
Perfluoro-n-dodecanoic acid (PFDoA)	307-55-1	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-heptanoic acid (PFHpA)	375-85-9	PFAS by ID SOP	41	H	40	20	10	ng/L	1
Perfluoro-n-hexanoic acid (PFHxA)	307-24-4	PFAS by ID SOP	240	H	40	20	10	ng/L	1
Perfluoro-n-nonanoic acid (PFNA)	375-95-1	PFAS by ID SOP	18	HJ	40	20	10	ng/L	1
Perfluoro-n-octanoic acid (PFOA)	335-67-1	PFAS by ID SOP	160	H	40	20	10	ng/L	1
Perfluoro-n-pentanoic acid (PFPeA)	2706-90-3	PFAS by ID SOP	89	H	40	20	10	ng/L	1
Perfluoro-n-tetradecanoic acid (PFTeDA)	376-06-7	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-tridecanoic acid (PFTrDA)	72629-94-8	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-undecanoic acid (PFUdA)	2058-94-8	PFAS by ID SOP	11	HJ	40	20	10	ng/L	1
Perfluorooctanesulfonic acid (PFOS)	1763-23-1	PFAS by ID SOP	15000		200	100	50	ng/L	2

Surrogate	Run 1 Q	Run 1 % Recovery	Run 1 Acceptance Limits	Run 2 Q	Run 2 % Recovery	Run 2 Acceptance Limits
13C2_4:2FTS	H	117	50-150		101	50-150
13C2_6:2FTS	H	111	50-150		102	50-150
13C2_8:2FTS	H	107	50-150		110	50-150
13C2_PFDoA	H	111	50-150		107	50-150
13C2_PFTeDA	H	86	50-150		108	50-150
13C3_PFBS	H	108	50-150		108	50-150
13C3_PFHxS	H	102	50-150		119	50-150
13C4_PFBA	H	99	50-150		106	50-150
13C4_PFHpA	H	104	50-150		106	50-150
13C5_PFHxA	H	102	50-150		107	50-150
13C5_PFPeA	H	103	50-150		102	50-150
13C6_PFDA	H	101	50-150		95	50-150
13C7_PFUdA	H	105	50-150		107	50-150
13C8_PFOA	H	101	50-150		111	50-150
13C8_PFOS	H	97	50-150		98	50-150
13C8_PFOSA	H	106	50-150		109	50-150

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

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SPLP PFAS

Client: Arcadis U.S., Inc.		Laboratory ID: WJ07031-004	
Description: ISM-393-1-Ga		Matrix: Solid	
Date Sampled: 09/23/2021 1530	Project Name: Eielson AFB	% Solids: 99.6	10/07/2021 2131
Date Received: 10/07/2021	Project Number: ISM		

Surrogate	Q	Run 1 % Recovery	Acceptance Limits	Q	Run 2 % Recovery	Acceptance Limits
13C9_PFNA	H	97	50-150		100	50-150
d5-EtFOSAA	H	111	50-150		117	50-150
d-MeFOSA	H	103	50-150		114	50-150
d3-MeFOSAA	H	114	50-150		117	50-150

LOQ = Limit of Quantitation	B = Detected in the method blank	E = Quantitation of compound exceeded the calibration range	DL = Detection Limit	Q = Surrogate failure
U = Not detected at or above the LOQ	N = Recovery is out of criteria	P = The RPD between two GC columns exceeds 40%	J = Estimated result < LOQ and ≥ DL	L = LCS/LCSD failure
H = Out of holding time	W = Reported on wet weight basis	LOD = Limit of Detection		S = MS/MSD failure

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PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.		Laboratory ID: WJ07031-005	
Description: ISM-393-1-Gb		Matrix: Solid	
Date Sampled: 09/23/2021 1530	Project Name: Eielson AFB	% Solids: 99.7	10/07/2021 2131
Date Received: 10/07/2021	Project Number: ISM		

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch
1	SOP SPE	PFAS by ID SOP QSM B-15	1	10/08/2021 2153	NK1	10/07/2021 1828	18071

Parameter	CAS Number	Analytical Method	Result	Q	LOQ	LOD	DL	Units	Run
1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS)	39108-34-4	PFAS by ID SOP	0.56	J	1.9	0.95	0.46	ug/kg	1
1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS)	27619-97-2	PFAS by ID SOP	0.95	U	1.9	0.95	0.46	ug/kg	1
1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS)	757124-72-4	PFAS by ID SOP	0.95	U	1.9	0.95	0.46	ug/kg	1
N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA)	2991-50-6	PFAS by ID SOP	0.95	U	1.9	0.95	0.46	ug/kg	1
N-methylperfluoro-1-octanesulfonamide (MeFOSA)	31506-32-8	PFAS by ID SOP	0.95	U	1.9	0.95	0.46	ug/kg	1
N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA)	2355-31-9	PFAS by ID SOP	0.95	U	1.9	0.95	0.46	ug/kg	1
Perfluoro-1-butanesulfonic acid (PFBS)	375-73-5	PFAS by ID SOP	0.47	U	0.93	0.47	0.19	ug/kg	1
Perfluoro-1-decanesulfonic acid (PFDS)	335-77-3	PFAS by ID SOP	0.47	U	0.93	0.47	0.19	ug/kg	1
Perfluoro-1-heptanesulfonic acid (PFHpS)	375-92-8	PFAS by ID SOP	0.47	U	0.93	0.47	0.19	ug/kg	1
Perfluoro-1-nonanesulfonic acid (PFNS)	68259-12-1	PFAS by ID SOP	0.47	U	0.93	0.47	0.19	ug/kg	1
Perfluoro-1-octanesulfonamide (PFOSA)	754-91-6	PFAS by ID SOP	0.83	J	0.93	0.47	0.19	ug/kg	1
Perfluoro-1-pentanesulfonic acid (PFPeS)	2706-91-4	PFAS by ID SOP	0.47	U	0.93	0.47	0.19	ug/kg	1
Perfluorohexanesulfonic acid (PFHxS)	355-46-4	PFAS by ID SOP	1.3		0.93	0.47	0.19	ug/kg	1
Perfluoro-n-butanoic acid (PFBA)	375-22-4	PFAS by ID SOP	0.47	U	0.93	0.47	0.19	ug/kg	1
Perfluoro-n-decanoic acid (PFDA)	335-76-2	PFAS by ID SOP	0.47	U	0.93	0.47	0.19	ug/kg	1
Perfluoro-n-dodecanoic acid (PFDoA)	307-55-1	PFAS by ID SOP	0.47	U	0.93	0.47	0.19	ug/kg	1
Perfluoro-n-heptanoic acid (PFHpA)	375-85-9	PFAS by ID SOP	0.47	U	0.93	0.47	0.19	ug/kg	1
Perfluoro-n-hexanoic acid (PFHxA)	307-24-4	PFAS by ID SOP	0.55	J	0.93	0.47	0.19	ug/kg	1
Perfluoro-n-nonanoic acid (PFNA)	375-95-1	PFAS by ID SOP	0.47	U	0.93	0.47	0.19	ug/kg	1
Perfluoro-n-octanoic acid (PFOA)	335-67-1	PFAS by ID SOP	0.22	J	0.93	0.47	0.19	ug/kg	1
Perfluoro-n-pentanoic acid (PFPeA)	2706-90-3	PFAS by ID SOP	0.20	J	0.93	0.47	0.19	ug/kg	1
Perfluoro-n-tetradecanoic acid (PFTeDA)	376-06-7	PFAS by ID SOP	0.47	U	0.93	0.47	0.19	ug/kg	1
Perfluoro-n-tridecanoic acid (PFTrDA)	72629-94-8	PFAS by ID SOP	0.47	U	0.93	0.47	0.19	ug/kg	1
Perfluoro-n-undecanoic acid (PFUdA)	2058-94-8	PFAS by ID SOP	0.47	U	0.93	0.47	0.19	ug/kg	1
Perfluorooctanesulfonic acid (PFOS)	1763-23-1	PFAS by ID SOP	29		0.93	0.47	0.19	ug/kg	1

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
13C2_4:2FTS		66	50-150
13C2_6:2FTS		66	50-150
13C2_8:2FTS		61	50-150
13C2_PFDoA		61	50-150
13C2_PFTeDA		60	50-150
13C3_PFBS		62	50-150
13C3_PFHxS		59	50-150
13C4_PFBA		63	50-150
13C4_PFHpA		61	50-150
13C5_PFHxA		63	50-150
13C5_PFPeA		64	50-150
13C6_PFDA		59	50-150
13C7_PFUdA		60	50-150
13C8_PFOA		58	50-150
13C8_PFOS		57	50-150
13C8_PFOSA		61	50-150
13C9_PFNA		60	50-150

LOQ = Limit of Quantitation	B = Detected in the method blank	E = Quantitation of compound exceeded the calibration range	DL = Detection Limit	Q = Surrogate failure
U = Not detected at or above the LOQ	N = Recovery is out of criteria	P = The RPD between two GC columns exceeds 40%	J = Estimated result < LOQ and ≥ DL	L = LCS/LCSD failure
H = Out of holding time	W = Reported on wet weight basis	LOD = Limit of Detection		S = MS/MSD failure

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PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.		Laboratory ID: WJ07031-005	
Description: ISM-393-1-Gb		Matrix: Solid	
Date Sampled: 09/23/2021 1530	Project Name: Eielson AFB	% Solids: 99.7	10/07/2021 2131
Date Received: 10/07/2021	Project Number: ISM		

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
d5-EtFOSAA		74	50-150
d-MeFOSA		63	50-150
d3-MeFOSAA		74	50-150

LOQ = Limit of Quantitation	B = Detected in the method blank	E = Quantitation of compound exceeded the calibration range	DL = Detection Limit	Q = Surrogate failure
U = Not detected at or above the LOQ	N = Recovery is out of criteria	P = The RPD between two GC columns exceeds 40%	J = Estimated result < LOQ and ≥ DL	L = LCS/LCSD failure
H = Out of holding time	W = Reported on wet weight basis	LOD = Limit of Detection		S = MS/MSD failure

SPLP PFAS

Client: Arcadis U.S., Inc. | Laboratory ID: WJ07031-005
Description: ISM-393-1-Gb | Matrix: Solid
Date Sampled: 09/23/2021 1530 | Project Name: Eielson AFB | % Solids: 99.7 10/07/2021 2131
Date Received: 10/07/2021 | Project Number: ISM

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch	Leachate Date
1	1312/PFAS	PFAS by ID SOP QSM B-15	1	11/05/2021 2124	MMM	11/04/2021 1300	21287	10/29/2021 1851

Parameter	CAS Number	Analytical Method	Result	Q	LOQ	LOD	DL	Units	Run
1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS)	39108-34-4	PFAS by ID SOP	56	HJ	80	40	20	ng/L	1
1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS)	27619-97-2	PFAS by ID SOP	39	HJ	80	40	20	ng/L	1
1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS)	757124-72-4	PFAS by ID SOP	40	UH	80	40	20	ng/L	1
N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA)	2991-50-6	PFAS by ID SOP	40	UH	80	40	20	ng/L	1
N-methylperfluoro-1-octanesulfonamide (MeFOSA)	31506-32-8	PFAS by ID SOP	80	UH	160	80	40	ng/L	1
N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA)	2355-31-9	PFAS by ID SOP	40	UH	80	40	20	ng/L	1
Perfluoro-1-butanesulfonic acid (PFBS)	375-73-5	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-1-decanesulfonic acid (PFDS)	335-77-3	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-1-heptanesulfonic acid (PFHpS)	375-92-8	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-1-nonanesulfonic acid (PFNS)	68259-12-1	PFAS by ID SOP	10	HJ	40	20	10	ng/L	1
Perfluoro-1-octanesulfonamide (PFOSA)	754-91-6	PFAS by ID SOP	60	H	40	20	10	ng/L	1
Perfluoro-1-pentanesulfonic acid (PFPeS)	2706-91-4	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluorohexanesulfonic acid (PFHxS)	355-46-4	PFAS by ID SOP	72	H	40	20	10	ng/L	1
Perfluoro-n-butanoic acid (PFBA)	375-22-4	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-decanoic acid (PFDA)	335-76-2	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-dodecanoic acid (PFDoA)	307-55-1	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-heptanoic acid (PFHpA)	375-85-9	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-hexanoic acid (PFHxA)	307-24-4	PFAS by ID SOP	53	H	40	20	10	ng/L	1
Perfluoro-n-nonanoic acid (PFNA)	375-95-1	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-octanoic acid (PFOA)	335-67-1	PFAS by ID SOP	14	HJ	40	20	10	ng/L	1
Perfluoro-n-pentanoic acid (PFPeA)	2706-90-3	PFAS by ID SOP	16	HJ	40	20	10	ng/L	1
Perfluoro-n-tetradecanoic acid (PFTeDA)	376-06-7	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-tridecanoic acid (PFTrDA)	72629-94-8	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-undecanoic acid (PFUdA)	2058-94-8	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluorooctanesulfonic acid (PFOS)	1763-23-1	PFAS by ID SOP	1700	H	40	20	10	ng/L	1

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
13C2_4:2FTS	H	117	50-150
13C2_6:2FTS	H	108	50-150
13C2_8:2FTS	H	106	50-150
13C2_PFDoA	H	94	50-150
13C2_PFTeDA	H	82	50-150
13C3_PFBS	H	100	50-150
13C3_PFHxS	H	100	50-150
13C4_PFBA	H	98	50-150
13C4_PFHpA	H	101	50-150
13C5_PFHxA	H	101	50-150
13C5_PFPeA	H	97	50-150
13C6_PFDA	H	104	50-150
13C7_PFUdA	H	94	50-150
13C8_PFOA	H	101	50-150
13C8_PFOS	H	100	50-150
13C8_PFOSA	H	101	50-150
13C9_PFNA	H	103	50-150

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

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SPLP PFAS

Client: Arcadis U.S., Inc.		Laboratory ID: WJ07031-005
Description: ISM-393-1-Gb		Matrix: Solid
Date Sampled: 09/23/2021 1530	Project Name: Eielson AFB	% Solids: 99.7 10/07/2021 2131
Date Received: 10/07/2021	Project Number: ISM	

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
d5-EtFOSAA	H	107	50-150
d-MeFOSA	H	96	50-150
d3-MeFOSAA	H	106	50-150

LOQ = Limit of Quantitation	B = Detected in the method blank	E = Quantitation of compound exceeded the calibration range	DL = Detection Limit	Q = Surrogate failure
U = Not detected at or above the LOQ	N = Recovery is out of criteria	P = The RPD between two GC columns exceeds 40%	J = Estimated result < LOQ and ≥ DL	L = LCS/LCSD failure
H = Out of holding time	W = Reported on wet weight basis	LOD = Limit of Detection		S = MS/MSD failure

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PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: WJ07031-006
Description: ISM-393-1-Gc | Matrix: Solid
Date Sampled: 09/23/2021 1530 | Project Name: Eielson AFB | % Solids: 99.8 10/07/2021 2131
Date Received: 10/07/2021 | Project Number: ISM

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch
1	SOP SPE	PFAS by ID SOP QSM B-15	1	10/08/2021 2206	NK1	10/07/2021 1828	18071

Parameter	CAS Number	Analytical Method	Result	Q	LOQ	LOD	DL	Units	Run
1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS)	39108-34-4	PFAS by ID SOP	0.88	J	2.0	1.0	0.50	ug/kg	1
1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS)	27619-97-2	PFAS by ID SOP	1.0	U	2.0	1.0	0.50	ug/kg	1
1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS)	757124-72-4	PFAS by ID SOP	1.0	U	2.0	1.0	0.50	ug/kg	1
N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA)	2991-50-6	PFAS by ID SOP	1.0	U	2.0	1.0	0.50	ug/kg	1
N-methylperfluoro-1-octanesulfonamide (MeFOSA)	31506-32-8	PFAS by ID SOP	1.0	U	2.0	1.0	0.50	ug/kg	1
N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA)	2355-31-9	PFAS by ID SOP	1.0	U	2.0	1.0	0.50	ug/kg	1
Perfluoro-1-butanesulfonic acid (PFBS)	375-73-5	PFAS by ID SOP	0.50	U	1.0	0.50	0.20	ug/kg	1
Perfluoro-1-decanesulfonic acid (PFDS)	335-77-3	PFAS by ID SOP	0.28	J	1.0	0.50	0.20	ug/kg	1
Perfluoro-1-heptanesulfonic acid (PFHpS)	375-92-8	PFAS by ID SOP	0.50	U	1.0	0.50	0.20	ug/kg	1
Perfluoro-1-nonanesulfonic acid (PFNS)	68259-12-1	PFAS by ID SOP	0.20	J	1.0	0.50	0.20	ug/kg	1
Perfluoro-1-octanesulfonamide (PFOSA)	754-91-6	PFAS by ID SOP	1.1		1.0	0.50	0.20	ug/kg	1
Perfluoro-1-pentanesulfonic acid (PFPeS)	2706-91-4	PFAS by ID SOP	0.50	U	1.0	0.50	0.20	ug/kg	1
Perfluorohexanesulfonic acid (PFHxS)	355-46-4	PFAS by ID SOP	1.6		1.0	0.50	0.20	ug/kg	1
Perfluoro-n-butanoic acid (PFBA)	375-22-4	PFAS by ID SOP	0.50	U	1.0	0.50	0.20	ug/kg	1
Perfluoro-n-decanoic acid (PFDA)	335-76-2	PFAS by ID SOP	0.50	U	1.0	0.50	0.20	ug/kg	1
Perfluoro-n-dodecanoic acid (PFDoA)	307-55-1	PFAS by ID SOP	0.50	U	1.0	0.50	0.20	ug/kg	1
Perfluoro-n-heptanoic acid (PFHpA)	375-85-9	PFAS by ID SOP	0.50	U	1.0	0.50	0.20	ug/kg	1
Perfluoro-n-hexanoic acid (PFHxA)	307-24-4	PFAS by ID SOP	0.75	J	1.0	0.50	0.20	ug/kg	1
Perfluoro-n-nonanoic acid (PFNA)	375-95-1	PFAS by ID SOP	0.50	U	1.0	0.50	0.20	ug/kg	1
Perfluoro-n-octanoic acid (PFOA)	335-67-1	PFAS by ID SOP	0.74	J	1.0	0.50	0.20	ug/kg	1
Perfluoro-n-pentanoic acid (PFPeA)	2706-90-3	PFAS by ID SOP	0.26	J	1.0	0.50	0.20	ug/kg	1
Perfluoro-n-tetradecanoic acid (PFTeDA)	376-06-7	PFAS by ID SOP	0.50	U	1.0	0.50	0.20	ug/kg	1
Perfluoro-n-tridecanoic acid (PFTrDA)	72629-94-8	PFAS by ID SOP	0.50	U	1.0	0.50	0.20	ug/kg	1
Perfluoro-n-undecanoic acid (PFUdA)	2058-94-8	PFAS by ID SOP	0.50	U	1.0	0.50	0.20	ug/kg	1
Perfluorooctanesulfonic acid (PFOS)	1763-23-1	PFAS by ID SOP	32		1.0	0.50	0.20	ug/kg	1

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
13C2_4:2FTS		70	50-150
13C2_6:2FTS		69	50-150
13C2_8:2FTS		64	50-150
13C2_PFDoA		66	50-150
13C2_PFTeDA		67	50-150
13C3_PFBS		67	50-150
13C3_PFHxS		64	50-150
13C4_PFBA		69	50-150
13C4_PFHpA		66	50-150
13C5_PFHxA		66	50-150
13C5_PFPeA		68	50-150
13C6_PFDA		64	50-150
13C7_PFUdA		67	50-150
13C8_PFOA		65	50-150
13C8_PFOS		63	50-150
13C8_PFOSA		68	50-150
13C9_PFNA		66	50-150

LOQ = Limit of Quantitation | B = Detected in the method blank | E = Quantitation of compound exceeded the calibration range | DL = Detection Limit | Q = Surrogate failure
U = Not detected at or above the LOQ | N = Recovery is out of criteria | P = The RPD between two GC columns exceeds 40% | J = Estimated result < LOQ and ≥ DL | L = LCS/LCSD failure
H = Out of holding time | W = Reported on wet weight basis | LOD = Limit of Detection | S = MS/MSD failure

PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.		Laboratory ID: WJ07031-006
Description: ISM-393-1-Gc		Matrix: Solid
Date Sampled: 09/23/2021 1530	Project Name: Eielson AFB	% Solids: 99.8 10/07/2021 2131
Date Received: 10/07/2021	Project Number: ISM	

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
d5-EtFOSAA		72	50-150
d-MeFOSA		71	50-150
d3-MeFOSAA		72	50-150

LOQ = Limit of Quantitation	B = Detected in the method blank	E = Quantitation of compound exceeded the calibration range	DL = Detection Limit	Q = Surrogate failure
U = Not detected at or above the LOQ	N = Recovery is out of criteria	P = The RPD between two GC columns exceeds 40%	J = Estimated result < LOQ and ≥ DL	L = LCS/LCSD failure
H = Out of holding time	W = Reported on wet weight basis	LOD = Limit of Detection		S = MS/MSD failure

SPLP PFAS

Client: Arcadis U.S., Inc. | Laboratory ID: WJ07031-006
Description: ISM-393-1-Gc | Matrix: Solid
Date Sampled: 09/23/2021 1530 | Project Name: Eielson AFB | % Solids: 99.8 10/07/2021 2131
Date Received: 10/07/2021 | Project Number: ISM

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch	Leachate Date
1	1312/PFAS	PFAS by ID SOP QSM B-15	1	11/07/2021 0001	MMM	11/05/2021 1045	21420	10/29/2021 1851

Parameter	CAS Number	Analytical Method	Result	Q	LOQ	LOD	DL	Units	Run
1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS)	39108-34-4	PFAS by ID SOP	42	HJ	80	40	20	ng/L	1
1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS)	27619-97-2	PFAS by ID SOP	24	HJ	80	40	20	ng/L	1
1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS)	757124-72-4	PFAS by ID SOP	40	UH	80	40	20	ng/L	1
N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA)	2991-50-6	PFAS by ID SOP	40	UH	80	40	20	ng/L	1
N-methylperfluoro-1-octanesulfonamide (MeFOSA)	31506-32-8	PFAS by ID SOP	80	UH	160	80	40	ng/L	1
N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA)	2355-31-9	PFAS by ID SOP	40	UH	80	40	20	ng/L	1
Perfluoro-1-butanesulfonic acid (PFBS)	375-73-5	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-1-decanesulfonic acid (PFDS)	335-77-3	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-1-heptanesulfonic acid (PFHpS)	375-92-8	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-1-nonanesulfonic acid (PFNS)	68259-12-1	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-1-octanesulfonamide (PFOSA)	754-91-6	PFAS by ID SOP	48	H	40	20	10	ng/L	1
Perfluoro-1-pentanesulfonic acid (PFPeS)	2706-91-4	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluorohexanesulfonic acid (PFHxS)	355-46-4	PFAS by ID SOP	61	H	40	20	10	ng/L	1
Perfluoro-n-butanoic acid (PFBA)	375-22-4	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-decanoic acid (PFDA)	335-76-2	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-dodecanoic acid (PFDoA)	307-55-1	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-heptanoic acid (PFHpA)	375-85-9	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-hexanoic acid (PFHxA)	307-24-4	PFAS by ID SOP	51	H	40	20	10	ng/L	1
Perfluoro-n-nonanoic acid (PFNA)	375-95-1	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-octanoic acid (PFOA)	335-67-1	PFAS by ID SOP	23	HJ	40	20	10	ng/L	1
Perfluoro-n-pentanoic acid (PFPeA)	2706-90-3	PFAS by ID SOP	18	HJ	40	20	10	ng/L	1
Perfluoro-n-tetradecanoic acid (PFTeDA)	376-06-7	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-tridecanoic acid (PFTrDA)	72629-94-8	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-undecanoic acid (PFUdA)	2058-94-8	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluorooctanesulfonic acid (PFOS)	1763-23-1	PFAS by ID SOP	1300	H	40	20	10	ng/L	1

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
13C2_4:2FTS	H	126	50-150
13C2_6:2FTS	H	116	50-150
13C2_8:2FTS	H	111	50-150
13C2_PFDoA	H	119	50-150
13C2_PFTeDA	H	110	50-150
13C3_PFBS	H	118	50-150
13C3_PFHxS	H	116	50-150
13C4_PFBA	H	121	50-150
13C4_PFHpA	H	117	50-150
13C5_PFHxA	H	120	50-150
13C5_PFPeA	H	115	50-150
13C6_PFDA	H	107	50-150
13C7_PFUdA	H	117	50-150
13C8_PFOA	H	120	50-150
13C8_PFOS	H	120	50-150
13C8_PFOSA	H	119	50-150
13C9_PFNA	H	122	50-150

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

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SPLP PFAS

Client: Arcadis U.S., Inc.		Laboratory ID: WJ07031-006
Description: ISM-393-1-Gc		Matrix: Solid
Date Sampled: 09/23/2021 1530	Project Name: Eielson AFB	% Solids: 99.8 10/07/2021 2131
Date Received: 10/07/2021	Project Number: ISM	

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
d5-EtFOSAA	H	124	50-150
d-MeFOSA	H	94	50-150
d3-MeFOSAA	H	130	50-150

LOQ = Limit of Quantitation	B = Detected in the method blank	E = Quantitation of compound exceeded the calibration range	DL = Detection Limit	Q = Surrogate failure
U = Not detected at or above the LOQ	N = Recovery is out of criteria	P = The RPD between two GC columns exceeds 40%	J = Estimated result < LOQ and ≥ DL	L = LCS/LCSD failure
H = Out of holding time	W = Reported on wet weight basis	LOD = Limit of Detection		S = MS/MSD failure

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PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: WJ07031-007
Description: ISM-393-1-Sa | Matrix: Solid
Date Sampled: 09/23/2021 1630 | Project Name: Eielson AFB | % Solids: 99.4 10/07/2021 2131
Date Received: 10/07/2021 | Project Number: ISM

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch
1	SOP SPE	PFAS by ID SOP QSM B-15	1	10/08/2021 2218	NK1	10/07/2021 1828	18071

Parameter	CAS Number	Analytical Method	Result	Q	LOQ	LOD	DL	Units	Run
1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS)	39108-34-4	PFAS by ID SOP	1.0	J	2.0	1.0	0.49	ug/kg	1
1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS)	27619-97-2	PFAS by ID SOP	1.0	U	2.0	1.0	0.49	ug/kg	1
1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS)	757124-72-4	PFAS by ID SOP	1.0	U	2.0	1.0	0.49	ug/kg	1
N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA)	2991-50-6	PFAS by ID SOP	1.0	U	2.0	1.0	0.49	ug/kg	1
N-methylperfluoro-1-octanesulfonamide (MeFOSA)	31506-32-8	PFAS by ID SOP	1.0	U	2.0	1.0	0.49	ug/kg	1
N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA)	2355-31-9	PFAS by ID SOP	1.0	U	2.0	1.0	0.49	ug/kg	1
Perfluoro-1-butanesulfonic acid (PFBS)	375-73-5	PFAS by ID SOP	0.49	U	0.98	0.49	0.20	ug/kg	1
Perfluoro-1-decanesulfonic acid (PFDS)	335-77-3	PFAS by ID SOP	0.42	J	0.98	0.49	0.20	ug/kg	1
Perfluoro-1-heptanesulfonic acid (PFHpS)	375-92-8	PFAS by ID SOP	0.49	U	0.98	0.49	0.20	ug/kg	1
Perfluoro-1-nonanesulfonic acid (PFNS)	68259-12-1	PFAS by ID SOP	0.49	U	0.98	0.49	0.20	ug/kg	1
Perfluoro-1-octanesulfonamide (PFOSA)	754-91-6	PFAS by ID SOP	1.3		0.98	0.49	0.20	ug/kg	1
Perfluoro-1-pentanesulfonic acid (PFPeS)	2706-91-4	PFAS by ID SOP	0.49	U	0.98	0.49	0.20	ug/kg	1
Perfluorohexanesulfonic acid (PFHxS)	355-46-4	PFAS by ID SOP	2.2		0.98	0.49	0.20	ug/kg	1
Perfluoro-n-butanoic acid (PFBA)	375-22-4	PFAS by ID SOP	0.49	U	0.98	0.49	0.20	ug/kg	1
Perfluoro-n-decanoic acid (PFDA)	335-76-2	PFAS by ID SOP	0.49	U	0.98	0.49	0.20	ug/kg	1
Perfluoro-n-dodecanoic acid (PFDoA)	307-55-1	PFAS by ID SOP	0.49	U	0.98	0.49	0.20	ug/kg	1
Perfluoro-n-heptanoic acid (PFHpA)	375-85-9	PFAS by ID SOP	0.49	U	0.98	0.49	0.20	ug/kg	1
Perfluoro-n-hexanoic acid (PFHxA)	307-24-4	PFAS by ID SOP	0.72	J	0.98	0.49	0.20	ug/kg	1
Perfluoro-n-nonanoic acid (PFNA)	375-95-1	PFAS by ID SOP	0.49	U	0.98	0.49	0.20	ug/kg	1
Perfluoro-n-octanoic acid (PFOA)	335-67-1	PFAS by ID SOP	0.40	J	0.98	0.49	0.20	ug/kg	1
Perfluoro-n-pentanoic acid (PFPeA)	2706-90-3	PFAS by ID SOP	0.49	U	0.98	0.49	0.20	ug/kg	1
Perfluoro-n-tetradecanoic acid (PFTeDA)	376-06-7	PFAS by ID SOP	0.49	U	0.98	0.49	0.20	ug/kg	1
Perfluoro-n-tridecanoic acid (PFTrDA)	72629-94-8	PFAS by ID SOP	0.49	U	0.98	0.49	0.20	ug/kg	1
Perfluoro-n-undecanoic acid (PFUdA)	2058-94-8	PFAS by ID SOP	0.49	U	0.98	0.49	0.20	ug/kg	1
Perfluorooctanesulfonic acid (PFOS)	1763-23-1	PFAS by ID SOP	30		0.98	0.49	0.20	ug/kg	1

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
13C2_4:2FTS		93	50-150
13C2_6:2FTS		95	50-150
13C2_8:2FTS		87	50-150
13C2_PFDoA		94	50-150
13C2_PFTeDA		94	50-150
13C3_PFBS		92	50-150
13C3_PFHxS		92	50-150
13C4_PFBA		91	50-150
13C4_PFHpA		88	50-150
13C5_PFHxA		91	50-150
13C5_PFPeA		94	50-150
13C6_PFDA		90	50-150
13C7_PFUdA		93	50-150
13C8_PFOA		88	50-150
13C8_PFOS		88	50-150
13C8_PFOSA		94	50-150
13C9_PFNA		91	50-150

LOQ = Limit of Quantitation | B = Detected in the method blank | E = Quantitation of compound exceeded the calibration range | DL = Detection Limit | Q = Surrogate failure
U = Not detected at or above the LOQ | N = Recovery is out of criteria | P = The RPD between two GC columns exceeds 40% | J = Estimated result < LOQ and ≥ DL | L = LCS/LCSD failure
H = Out of holding time | W = Reported on wet weight basis | LOD = Limit of Detection | S = MS/MSD failure

PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.		Laboratory ID: WJ07031-007	
Description: ISM-393-1-Sa		Matrix: Solid	
Date Sampled: 09/23/2021 1630	Project Name: Eielson AFB	% Solids: 99.4	10/07/2021 2131
Date Received: 10/07/2021	Project Number: ISM		

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
d5-EtFOSAA		97	50-150
d-MeFOSA		95	50-150
d3-MeFOSAA		95	50-150

LOQ = Limit of Quantitation	B = Detected in the method blank	E = Quantitation of compound exceeded the calibration range	DL = Detection Limit	Q = Surrogate failure
U = Not detected at or above the LOQ	N = Recovery is out of criteria	P = The RPD between two GC columns exceeds 40%	J = Estimated result < LOQ and ≥ DL	L = LCS/LCSD failure
H = Out of holding time	W = Reported on wet weight basis	LOD = Limit of Detection		S = MS/MSD failure

SPLP PFAS

Client: Arcadis U.S., Inc. | Laboratory ID: WJ07031-007
Description: ISM-393-1-Sa | Matrix: Solid
Date Sampled: 09/23/2021 1630 | Project Name: Eielson AFB | % Solids: 99.4 10/07/2021 2131
Date Received: 10/07/2021 | Project Number: ISM

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch	Leachate Date
1	1312/PFAS	PFAS by ID SOP QSM B-15	1	11/07/2021 0012	MMM	11/05/2021 1045	21420	10/29/2021 1851

Parameter	CAS Number	Analytical Method	Result	Q	LOQ	LOD	DL	Units	Run
1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS)	39108-34-4	PFAS by ID SOP	52	HJ	80	40	20	ng/L	1
1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS)	27619-97-2	PFAS by ID SOP	40	UH	80	40	20	ng/L	1
1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS)	757124-72-4	PFAS by ID SOP	40	UH	80	40	20	ng/L	1
N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA)	2991-50-6	PFAS by ID SOP	40	UH	80	40	20	ng/L	1
N-methylperfluoro-1-octanesulfonamide (MeFOSA)	31506-32-8	PFAS by ID SOP	80	UH	160	80	40	ng/L	1
N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA)	2355-31-9	PFAS by ID SOP	40	UHQ	80	40	20	ng/L	1
Perfluoro-1-butanesulfonic acid (PFBS)	375-73-5	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-1-decanesulfonic acid (PFDS)	335-77-3	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-1-heptanesulfonic acid (PFHpS)	375-92-8	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-1-nonanesulfonic acid (PFNS)	68259-12-1	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-1-octanesulfonamide (PFOSA)	754-91-6	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-1-pentanesulfonic acid (PFPeS)	2706-91-4	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluorohexanesulfonic acid (PFHxS)	355-46-4	PFAS by ID SOP	67	H	40	20	10	ng/L	1
Perfluoro-n-butanoic acid (PFBA)	375-22-4	PFAS by ID SOP	11	HJ	40	20	10	ng/L	1
Perfluoro-n-decanoic acid (PFDA)	335-76-2	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-dodecanoic acid (PFDoA)	307-55-1	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-heptanoic acid (PFHpA)	375-85-9	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-hexanoic acid (PFHxA)	307-24-4	PFAS by ID SOP	46	H	40	20	10	ng/L	1
Perfluoro-n-nonanoic acid (PFNA)	375-95-1	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-octanoic acid (PFOA)	335-67-1	PFAS by ID SOP	31	HJ	40	20	10	ng/L	1
Perfluoro-n-pentanoic acid (PFPeA)	2706-90-3	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-tetradecanoic acid (PFTeDA)	376-06-7	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-tridecanoic acid (PFTrDA)	72629-94-8	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-undecanoic acid (PFUdA)	2058-94-8	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluorooctanesulfonic acid (PFOS)	1763-23-1	PFAS by ID SOP	800	H	40	20	10	ng/L	1

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
13C2_4:2FTS	H	116	50-150
13C2_6:2FTS	H	110	50-150
13C2_8:2FTS	H	111	50-150
13C2_PFDoA	H	117	50-150
13C2_PFTeDA	H	105	50-150
13C3_PFBS	H	113	50-150
13C3_PFHxS	H	117	50-150
13C4_PFBA	H	115	50-150
13C4_PFHpA	H	113	50-150
13C5_PFHxA	H	113	50-150
13C5_PFPeA	H	115	50-150
13C6_PFDA	H	113	50-150
13C7_PFUdA	H	110	50-150
13C8_PFOA	H	109	50-150
13C8_PFOS	H	118	50-150
13C8_PFOSA	H	114	50-150
13C9_PFNA	H	119	50-150

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

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SPLP PFAS

Client: Arcadis U.S., Inc.		Laboratory ID: WJ07031-007
Description: ISM-393-1-Sa		Matrix: Solid
Date Sampled: 09/23/2021 1630	Project Name: Eielson AFB	% Solids: 99.4 10/07/2021 2131
Date Received: 10/07/2021	Project Number: ISM	

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
d5-EtFOSAA	H	125	50-150
d-MeFOSA	H	88	50-150
d3-MeFOSAA	HN	163	50-150

LOQ = Limit of Quantitation	B = Detected in the method blank	E = Quantitation of compound exceeded the calibration range	DL = Detection Limit	Q = Surrogate failure
U = Not detected at or above the LOQ	N = Recovery is out of criteria	P = The RPD between two GC columns exceeds 40%	J = Estimated result < LOQ and ≥ DL	L = LCS/LCSD failure
H = Out of holding time	W = Reported on wet weight basis	LOD = Limit of Detection		S = MS/MSD failure

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PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: WJ07031-008
Description: ISM-393-1-Sb | Matrix: Solid
Date Sampled: 09/23/2021 1630 | Project Name: Eielson AFB | % Solids: 99.6 10/07/2021 2131
Date Received: 10/07/2021 | Project Number: ISM

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch
1	SOP SPE	PFAS by ID SOP QSM B-15	1	10/08/2021 2231	NK1	10/07/2021 1828	18071

Parameter	CAS Number	Analytical Method	Result	Q	LOQ	LOD	DL	Units	Run
1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS)	39108-34-4	PFAS by ID SOP	1.1	J	2.0	1.0	0.50	ug/kg	1
1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS)	27619-97-2	PFAS by ID SOP	0.60	BJ	2.0	1.0	0.50	ug/kg	1
1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS)	757124-72-4	PFAS by ID SOP	1.0	U	2.0	1.0	0.50	ug/kg	1
N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA)	2991-50-6	PFAS by ID SOP	1.0	U	2.0	1.0	0.50	ug/kg	1
N-methylperfluoro-1-octanesulfonamide (MeFOSA)	31506-32-8	PFAS by ID SOP	1.0	U	2.0	1.0	0.50	ug/kg	1
N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA)	2355-31-9	PFAS by ID SOP	1.0	U	2.0	1.0	0.50	ug/kg	1
Perfluoro-1-butanesulfonic acid (PFBS)	375-73-5	PFAS by ID SOP	0.50	U	0.99	0.50	0.20	ug/kg	1
Perfluoro-1-decanesulfonic acid (PFDS)	335-77-3	PFAS by ID SOP	0.33	J	0.99	0.50	0.20	ug/kg	1
Perfluoro-1-heptanesulfonic acid (PFHpS)	375-92-8	PFAS by ID SOP	0.50	U	0.99	0.50	0.20	ug/kg	1
Perfluoro-1-nonanesulfonic acid (PFNS)	68259-12-1	PFAS by ID SOP	0.50	U	0.99	0.50	0.20	ug/kg	1
Perfluoro-1-octanesulfonamide (PFOSA)	754-91-6	PFAS by ID SOP	1.2		0.99	0.50	0.20	ug/kg	1
Perfluoro-1-pentanesulfonic acid (PFPeS)	2706-91-4	PFAS by ID SOP	0.50	U	0.99	0.50	0.20	ug/kg	1
Perfluorohexanesulfonic acid (PFHxS)	355-46-4	PFAS by ID SOP	2.2		0.99	0.50	0.20	ug/kg	1
Perfluoro-n-butanoic acid (PFBA)	375-22-4	PFAS by ID SOP	0.50	U	0.99	0.50	0.20	ug/kg	1
Perfluoro-n-decanoic acid (PFDA)	335-76-2	PFAS by ID SOP	0.50	U	0.99	0.50	0.20	ug/kg	1
Perfluoro-n-dodecanoic acid (PFDoA)	307-55-1	PFAS by ID SOP	0.50	U	0.99	0.50	0.20	ug/kg	1
Perfluoro-n-heptanoic acid (PFHpA)	375-85-9	PFAS by ID SOP	0.50	U	0.99	0.50	0.20	ug/kg	1
Perfluoro-n-hexanoic acid (PFHxA)	307-24-4	PFAS by ID SOP	0.73	J	0.99	0.50	0.20	ug/kg	1
Perfluoro-n-nonanoic acid (PFNA)	375-95-1	PFAS by ID SOP	0.50	U	0.99	0.50	0.20	ug/kg	1
Perfluoro-n-octanoic acid (PFOA)	335-67-1	PFAS by ID SOP	0.44	J	0.99	0.50	0.20	ug/kg	1
Perfluoro-n-pentanoic acid (PFPeA)	2706-90-3	PFAS by ID SOP	0.50	U	0.99	0.50	0.20	ug/kg	1
Perfluoro-n-tetradecanoic acid (PFTeDA)	376-06-7	PFAS by ID SOP	0.50	U	0.99	0.50	0.20	ug/kg	1
Perfluoro-n-tridecanoic acid (PFTrDA)	72629-94-8	PFAS by ID SOP	0.50	U	0.99	0.50	0.20	ug/kg	1
Perfluoro-n-undecanoic acid (PFUdA)	2058-94-8	PFAS by ID SOP	0.50	U	0.99	0.50	0.20	ug/kg	1
Perfluorooctanesulfonic acid (PFOS)	1763-23-1	PFAS by ID SOP	32		0.99	0.50	0.20	ug/kg	1

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
13C2_4:2FTS		86	50-150
13C2_6:2FTS		88	50-150
13C2_8:2FTS		80	50-150
13C2_PFDoA		84	50-150
13C2_PFTeDA		83	50-150
13C3_PFBS		85	50-150
13C3_PFHxS		81	50-150
13C4_PFBA		83	50-150
13C4_PFHpA		79	50-150
13C5_PFHxA		82	50-150
13C5_PFPeA		83	50-150
13C6_PFDA		83	50-150
13C7_PFUdA		82	50-150
13C8_PFOA		80	50-150
13C8_PFOS		79	50-150
13C8_PFOSA		86	50-150
13C9_PFNA		83	50-150

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

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PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.		Laboratory ID: WJ07031-008
Description: ISM-393-1-Sb		Matrix: Solid
Date Sampled: 09/23/2021 1630	Project Name: Eielson AFB	% Solids: 99.6 10/07/2021 2131
Date Received: 10/07/2021	Project Number: ISM	

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
d5-EtFOSAA		90	50-150
d-MeFOSA		87	50-150
d3-MeFOSAA		86	50-150

LOQ = Limit of Quantitation	B = Detected in the method blank	E = Quantitation of compound exceeded the calibration range	DL = Detection Limit	Q = Surrogate failure
U = Not detected at or above the LOQ	N = Recovery is out of criteria	P = The RPD between two GC columns exceeds 40%	J = Estimated result < LOQ and ≥ DL	L = LCS/LCSD failure
H = Out of holding time	W = Reported on wet weight basis	LOD = Limit of Detection		S = MS/MSD failure

SPLP PFAS

Client: Arcadis U.S., Inc. | Laboratory ID: WJ07031-008
Description: ISM-393-1-Sb | Matrix: Solid
Date Sampled: 09/23/2021 1630 | Project Name: Eielson AFB | % Solids: 99.6 10/07/2021 2131
Date Received: 10/07/2021 | Project Number: ISM

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch	Leachate Date
1	1312/PFAS	PFAS by ID SOP QSM B-15	1	11/07/2021 0022	MMM	11/05/2021 1045	21420	10/29/2021 1851

Parameter	CAS Number	Analytical Method	Result	Q	LOQ	LOD	DL	Units	Run
1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS)	39108-34-4	PFAS by ID SOP	35	HJ	80	40	20	ng/L	1
1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS)	27619-97-2	PFAS by ID SOP	36	HJ	80	40	20	ng/L	1
1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS)	757124-72-4	PFAS by ID SOP	40	UH	80	40	20	ng/L	1
N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA)	2991-50-6	PFAS by ID SOP	40	UH	80	40	20	ng/L	1
N-methylperfluoro-1-octanesulfonamide (MeFOSA)	31506-32-8	PFAS by ID SOP	80	UH	160	80	40	ng/L	1
N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA)	2355-31-9	PFAS by ID SOP	40	UH	80	40	20	ng/L	1
Perfluoro-1-butanesulfonic acid (PFBS)	375-73-5	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-1-decanesulfonic acid (PFDS)	335-77-3	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-1-heptanesulfonic acid (PFHpS)	375-92-8	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-1-nonanesulfonic acid (PFNS)	68259-12-1	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-1-octanesulfonamide (PFOSA)	754-91-6	PFAS by ID SOP	45	H	40	20	10	ng/L	1
Perfluoro-1-pentanesulfonic acid (PFPeS)	2706-91-4	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluorohexanesulfonic acid (PFHxS)	355-46-4	PFAS by ID SOP	67	H	40	20	10	ng/L	1
Perfluoro-n-butanoic acid (PFBA)	375-22-4	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-decanoic acid (PFDA)	335-76-2	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-dodecanoic acid (PFDoA)	307-55-1	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-heptanoic acid (PFHpA)	375-85-9	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-hexanoic acid (PFHxA)	307-24-4	PFAS by ID SOP	49	H	40	20	10	ng/L	1
Perfluoro-n-nonanoic acid (PFNA)	375-95-1	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-octanoic acid (PFOA)	335-67-1	PFAS by ID SOP	34	HJ	40	20	10	ng/L	1
Perfluoro-n-pentanoic acid (PFPeA)	2706-90-3	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-tetradecanoic acid (PFTeDA)	376-06-7	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-tridecanoic acid (PFTrDA)	72629-94-8	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-undecanoic acid (PFUdA)	2058-94-8	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluorooctanesulfonic acid (PFOS)	1763-23-1	PFAS by ID SOP	920	H	40	20	10	ng/L	1

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
13C2_4:2FTS	H	125	50-150
13C2_6:2FTS	H	116	50-150
13C2_8:2FTS	H	126	50-150
13C2_PFDoA	H	114	50-150
13C2_PFTeDA	H	110	50-150
13C3_PFBS	H	118	50-150
13C3_PFHxS	H	125	50-150
13C4_PFBA	H	122	50-150
13C4_PFHpA	H	124	50-150
13C5_PFHxA	H	115	50-150
13C5_PFPeA	H	121	50-150
13C6_PFDA	H	116	50-150
13C7_PFUdA	H	120	50-150
13C8_PFOA	H	127	50-150
13C8_PFOS	H	124	50-150
13C8_PFOSA	H	122	50-150
13C9_PFNA	H	126	50-150

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

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SPLP PFAS

Client: Arcadis U.S., Inc.		Laboratory ID: WJ07031-008
Description: ISM-393-1-Sb		Matrix: Solid
Date Sampled: 09/23/2021 1630	Project Name: Eielson AFB	% Solids: 99.6 10/07/2021 2131
Date Received: 10/07/2021	Project Number: ISM	

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
d5-EtFOSAA	H	131	50-150
d-MeFOSA	H	91	50-150
d3-MeFOSAA	H	135	50-150

LOQ = Limit of Quantitation	B = Detected in the method blank	E = Quantitation of compound exceeded the calibration range	DL = Detection Limit	Q = Surrogate failure
U = Not detected at or above the LOQ	N = Recovery is out of criteria	P = The RPD between two GC columns exceeds 40%	J = Estimated result < LOQ and ≥ DL	L = LCS/LCSD failure
H = Out of holding time	W = Reported on wet weight basis	LOD = Limit of Detection		S = MS/MSD failure

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PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: WJ07031-009
Description: ISM-393-1-Sc | Matrix: Solid
Date Sampled: 09/23/2021 1630 | Project Name: Eielson AFB | % Solids: 99.4 10/07/2021 2131
Date Received: 10/07/2021 | Project Number: ISM

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch
1	SOP SPE	PFAS by ID SOP QSM B-15	1	10/08/2021 2244	NK1	10/07/2021 1828	18071

Parameter	CAS Number	Analytical Method	Result	Q	LOQ	LOD	DL	Units	Run
1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS)	39108-34-4	PFAS by ID SOP	1.4	J	1.7	0.85	0.43	ug/kg	1
1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS)	27619-97-2	PFAS by ID SOP	0.88	BJ	1.7	0.85	0.43	ug/kg	1
1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS)	757124-72-4	PFAS by ID SOP	0.85	U	1.7	0.85	0.43	ug/kg	1
N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA)	2991-50-6	PFAS by ID SOP	0.85	U	1.7	0.85	0.43	ug/kg	1
N-methylperfluoro-1-octanesulfonamide (MeFOSA)	31506-32-8	PFAS by ID SOP	0.85	U	1.7	0.85	0.43	ug/kg	1
N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA)	2355-31-9	PFAS by ID SOP	0.85	U	1.7	0.85	0.43	ug/kg	1
Perfluoro-1-butanesulfonic acid (PFBS)	375-73-5	PFAS by ID SOP	0.43	U	0.86	0.43	0.17	ug/kg	1
Perfluoro-1-decanesulfonic acid (PFDS)	335-77-3	PFAS by ID SOP	0.52	J	0.86	0.43	0.17	ug/kg	1
Perfluoro-1-heptanesulfonic acid (PFHpS)	375-92-8	PFAS by ID SOP	0.43	U	0.86	0.43	0.17	ug/kg	1
Perfluoro-1-nonanesulfonic acid (PFNS)	68259-12-1	PFAS by ID SOP	0.43	U	0.86	0.43	0.17	ug/kg	1
Perfluoro-1-octanesulfonamide (PFOSA)	754-91-6	PFAS by ID SOP	1.3		0.86	0.43	0.17	ug/kg	1
Perfluoro-1-pentanesulfonic acid (PFPeS)	2706-91-4	PFAS by ID SOP	0.43	U	0.86	0.43	0.17	ug/kg	1
Perfluorohexanesulfonic acid (PFHxS)	355-46-4	PFAS by ID SOP	2.2		0.86	0.43	0.17	ug/kg	1
Perfluoro-n-butanoic acid (PFBA)	375-22-4	PFAS by ID SOP	0.43	U	0.86	0.43	0.17	ug/kg	1
Perfluoro-n-decanoic acid (PFDA)	335-76-2	PFAS by ID SOP	0.43	U	0.86	0.43	0.17	ug/kg	1
Perfluoro-n-dodecanoic acid (PFDoA)	307-55-1	PFAS by ID SOP	0.43	U	0.86	0.43	0.17	ug/kg	1
Perfluoro-n-heptanoic acid (PFHpA)	375-85-9	PFAS by ID SOP	0.43	U	0.86	0.43	0.17	ug/kg	1
Perfluoro-n-hexanoic acid (PFHxA)	307-24-4	PFAS by ID SOP	0.93		0.86	0.43	0.17	ug/kg	1
Perfluoro-n-nonanoic acid (PFNA)	375-95-1	PFAS by ID SOP	0.43	U	0.86	0.43	0.17	ug/kg	1
Perfluoro-n-octanoic acid (PFOA)	335-67-1	PFAS by ID SOP	0.40	J	0.86	0.43	0.17	ug/kg	1
Perfluoro-n-pentanoic acid (PFPeA)	2706-90-3	PFAS by ID SOP	0.43	U	0.86	0.43	0.17	ug/kg	1
Perfluoro-n-tetradecanoic acid (PFTeDA)	376-06-7	PFAS by ID SOP	0.43	U	0.86	0.43	0.17	ug/kg	1
Perfluoro-n-tridecanoic acid (PFTrDA)	72629-94-8	PFAS by ID SOP	0.43	U	0.86	0.43	0.17	ug/kg	1
Perfluoro-n-undecanoic acid (PFUdA)	2058-94-8	PFAS by ID SOP	0.43	U	0.86	0.43	0.17	ug/kg	1
Perfluorooctanesulfonic acid (PFOS)	1763-23-1	PFAS by ID SOP	32		0.86	0.43	0.17	ug/kg	1

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
13C2_4:2FTS		76	50-150
13C2_6:2FTS		77	50-150
13C2_8:2FTS		74	50-150
13C2_PFDoA		73	50-150
13C2_PFTeDA		74	50-150
13C3_PFBS		75	50-150
13C3_PFHxS		72	50-150
13C4_PFBA		76	50-150
13C4_PFHpA		74	50-150
13C5_PFHxA		73	50-150
13C5_PFPeA		76	50-150
13C6_PFDA		71	50-150
13C7_PFUdA		74	50-150
13C8_PFOA		73	50-150
13C8_PFOS		70	50-150
13C8_PFOSA		75	50-150
13C9_PFNA		75	50-150

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

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PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.		Laboratory ID: WJ07031-009	
Description: ISM-393-1-Sc		Matrix: Solid	
Date Sampled: 09/23/2021 1630	Project Name: Eielson AFB	% Solids: 99.4	10/07/2021 2131
Date Received: 10/07/2021	Project Number: ISM		

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
d5-EtFOSAA		76	50-150
d-MeFOSA		79	50-150
d3-MeFOSAA		75	50-150

LOQ = Limit of Quantitation	B = Detected in the method blank	E = Quantitation of compound exceeded the calibration range	DL = Detection Limit	Q = Surrogate failure
U = Not detected at or above the LOQ	N = Recovery is out of criteria	P = The RPD between two GC columns exceeds 40%	J = Estimated result < LOQ and ≥ DL	L = LCS/LCSD failure
H = Out of holding time	W = Reported on wet weight basis	LOD = Limit of Detection		S = MS/MSD failure

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SPLP PFAS

Client: Arcadis U.S., Inc. | Laboratory ID: WJ07031-009
Description: ISM-393-1-Sc | Matrix: Solid
Date Sampled: 09/23/2021 1630 | Project Name: Eielson AFB | % Solids: 99.4 10/07/2021 2131
Date Received: 10/07/2021 | Project Number: ISM

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch	Leachate Date
1	1312/PFAS	PFAS by ID SOP QSM B-15	1	11/07/2021 0033	MMM	11/05/2021 1045	21420	10/29/2021 1851

Parameter	CAS Number	Analytical Method	Result	Q	LOQ	LOD	DL	Units	Run
1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS)	39108-34-4	PFAS by ID SOP	41	HJ	80	40	20	ng/L	1
1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS)	27619-97-2	PFAS by ID SOP	35	HJ	80	40	20	ng/L	1
1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS)	757124-72-4	PFAS by ID SOP	40	UH	80	40	20	ng/L	1
N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA)	2991-50-6	PFAS by ID SOP	40	UH	80	40	20	ng/L	1
N-methylperfluoro-1-octanesulfonamide (MeFOSA)	31506-32-8	PFAS by ID SOP	80	UH	160	80	40	ng/L	1
N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA)	2355-31-9	PFAS by ID SOP	40	UH	80	40	20	ng/L	1
Perfluoro-1-butanesulfonic acid (PFBS)	375-73-5	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-1-decanesulfonic acid (PFDS)	335-77-3	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-1-heptanesulfonic acid (PFHpS)	375-92-8	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-1-nonanesulfonic acid (PFNS)	68259-12-1	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-1-octanesulfonamide (PFOSA)	754-91-6	PFAS by ID SOP	48	H	40	20	10	ng/L	1
Perfluoro-1-pentanesulfonic acid (PFPeS)	2706-91-4	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluorohexanesulfonic acid (PFHxS)	355-46-4	PFAS by ID SOP	67	H	40	20	10	ng/L	1
Perfluoro-n-butanoic acid (PFBA)	375-22-4	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-decanoic acid (PFDA)	335-76-2	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-dodecanoic acid (PFDoA)	307-55-1	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-heptanoic acid (PFHpA)	375-85-9	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-hexanoic acid (PFHxA)	307-24-4	PFAS by ID SOP	51	H	40	20	10	ng/L	1
Perfluoro-n-nonanoic acid (PFNA)	375-95-1	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-octanoic acid (PFOA)	335-67-1	PFAS by ID SOP	30	HJ	40	20	10	ng/L	1
Perfluoro-n-pentanoic acid (PFPeA)	2706-90-3	PFAS by ID SOP	10	HJ	40	20	10	ng/L	1
Perfluoro-n-tetradecanoic acid (PFTeDA)	376-06-7	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-tridecanoic acid (PFTrDA)	72629-94-8	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-undecanoic acid (PFUdA)	2058-94-8	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluorooctanesulfonic acid (PFOS)	1763-23-1	PFAS by ID SOP	800	H	40	20	10	ng/L	1

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
13C2_4:2FTS	H	121	50-150
13C2_6:2FTS	H	108	50-150
13C2_8:2FTS	H	111	50-150
13C2_PFDoA	H	117	50-150
13C2_PFTeDA	H	112	50-150
13C3_PFBS	H	111	50-150
13C3_PFHxS	H	118	50-150
13C4_PFBA	H	120	50-150
13C4_PFHpA	H	116	50-150
13C5_PFHxA	H	123	50-150
13C5_PFPeA	H	112	50-150
13C6_PFDA	H	120	50-150
13C7_PFUdA	H	111	50-150
13C8_PFOA	H	120	50-150
13C8_PFOS	H	117	50-150
13C8_PFOSA	H	108	50-150
13C9_PFNA	H	116	50-150

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

SPLP PFAS

Client: Arcadis U.S., Inc.		Laboratory ID: WJ07031-009
Description: ISM-393-1-Sc		Matrix: Solid
Date Sampled: 09/23/2021 1630	Project Name: Eielson AFB	% Solids: 99.4 10/07/2021 2131
Date Received: 10/07/2021	Project Number: ISM	

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
d5-EtFOSAA	H	124	50-150
d-MeFOSA	H	75	50-150
d3-MeFOSAA	H	128	50-150

LOQ = Limit of Quantitation	B = Detected in the method blank	E = Quantitation of compound exceeded the calibration range	DL = Detection Limit	Q = Surrogate failure
U = Not detected at or above the LOQ	N = Recovery is out of criteria	P = The RPD between two GC columns exceeds 40%	J = Estimated result < LOQ and ≥ DL	L = LCS/LCSD failure
H = Out of holding time	W = Reported on wet weight basis	LOD = Limit of Detection		S = MS/MSD failure

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QC Summary

PFAS by LC/MS/MS - MB

Sample ID: WQ18071-001
Batch: 18071
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Solid
Prep Method: SOP SPE
Prep Date: 10/07/2021 1828

Parameter	Result	Q	Dil	LOQ	LOD	DL	Units	Analysis Date
8:2 FTS	1.0	U	1	2.0	1.0	0.50	ug/kg	10/18/2021 1543
6:2 FTS	1.1	J	1	2.0	1.0	0.50	ug/kg	10/18/2021 1543
4:2 FTS	1.0	U	1	2.0	1.0	0.50	ug/kg	10/18/2021 1543
EtFOSAA	1.0	U	1	2.0	1.0	0.50	ug/kg	10/18/2021 1543
MeFOSA	1.0	U	1	2.0	1.0	0.50	ug/kg	10/18/2021 1543
MeFOSAA	1.0	U	1	2.0	1.0	0.50	ug/kg	10/18/2021 1543
PFBS	0.50	U	1	1.0	0.50	0.20	ug/kg	10/18/2021 1543
PFDS	0.50	U	1	1.0	0.50	0.20	ug/kg	10/18/2021 1543
PFHpS	0.50	U	1	1.0	0.50	0.20	ug/kg	10/18/2021 1543
PFNS	0.50	U	1	1.0	0.50	0.20	ug/kg	10/18/2021 1543
PFOSA	0.50	U	1	1.0	0.50	0.20	ug/kg	10/18/2021 1543
PFPeS	0.50	U	1	1.0	0.50	0.20	ug/kg	10/18/2021 1543
PFHxS	0.50	U	1	1.0	0.50	0.20	ug/kg	10/18/2021 1543
PFBA	0.50	U	1	1.0	0.50	0.20	ug/kg	10/18/2021 1543
PFDA	0.50	U	1	1.0	0.50	0.20	ug/kg	10/18/2021 1543
PFDoA	0.50	U	1	1.0	0.50	0.20	ug/kg	10/18/2021 1543
PFHpA	0.50	U	1	1.0	0.50	0.20	ug/kg	10/18/2021 1543
PFHxA	0.50	U	1	1.0	0.50	0.20	ug/kg	10/18/2021 1543
PFNA	0.50	U	1	1.0	0.50	0.20	ug/kg	10/18/2021 1543
PFOA	0.50	U	1	1.0	0.50	0.20	ug/kg	10/18/2021 1543
PFPeA	0.50	U	1	1.0	0.50	0.20	ug/kg	10/18/2021 1543
PFTeDA	0.50	U	1	1.0	0.50	0.20	ug/kg	10/18/2021 1543
PFTrDA	0.50	U	1	1.0	0.50	0.20	ug/kg	10/18/2021 1543
PFUdA	0.50	U	1	1.0	0.50	0.20	ug/kg	10/18/2021 1543
PFOS	0.50	U	1	1.0	0.50	0.20	ug/kg	10/18/2021 1543

Surrogate	Q	% Rec	Acceptance Limit
13C2_4:2FTS		93	50-150
13C2_6:2FTS		87	50-150
13C2_8:2FTS		93	50-150
13C2_PFDoA		88	50-150
13C2_PFTeDA		95	50-150
13C3_PFBS		86	50-150
13C3_PFHxS		90	50-150
13C4_PFBA		87	50-150
13C4_PFHpA		90	50-150
13C5_PFHxA		87	50-150
13C5_PFPeA		89	50-150
13C6_PFDA		86	50-150
13C7_PFUdA		90	50-150
13C8_PFOA		88	50-150

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

PFAS by LC/MS/MS - MB

Sample ID: WQ18071-001
Batch: 18071
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Solid
Prep Method: SOP SPE
Prep Date: 10/07/2021 1828

Surrogate	Q	% Rec	Acceptance Limit
13C8_PFOS		88	50-150
13C8_PFOSA		93	50-150
13C9_PFNA		87	50-150
d5-EtFOSAA		97	50-150
d-MeFOSA		101	50-150
d3-MeFOSAA		102	50-150

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

PFAS by LC/MS/MS - LCS

Sample ID: WQ18071-002
Batch: 18071
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Solid
Prep Method: SOP SPE
Prep Date: 10/07/2021 1828

Parameter	Spike Amount (ug/kg)	Result (ug/kg)	Q	Dil	% Rec	%Rec Limit	Analysis Date
8:2 FTS	1.9	1.4		1	74	65-137	10/08/2021 2024
6:2 FTS	1.9	1.9		1	100	64-140	10/08/2021 2024
4:2 FTS	1.9	1.7		1	92	62-145	10/08/2021 2024
EtFOSAA	2.0	1.9		1	95	61-139	10/08/2021 2024
MeFOSA	2.0	1.9		1	93	70-150	10/08/2021 2024
MeFOSAA	2.0	1.8		1	88	63-144	10/08/2021 2024
PFBS	1.8	1.6		1	89	72-128	10/08/2021 2024
PFDS	1.9	1.9		1	97	59-134	10/08/2021 2024
PFHpS	1.9	1.6		1	84	70-132	10/08/2021 2024
PFNS	1.9	1.7		1	89	69-125	10/08/2021 2024
PFOSA	2.0	2.0		1	98	67-137	10/08/2021 2024
PFPeS	1.9	1.8		1	96	73-123	10/08/2021 2024
PFHxS	1.8	1.7		1	91	67-130	10/08/2021 2024
PFBA	2.0	1.9		1	93	71-135	10/08/2021 2024
PFDA	2.0	1.9		1	97	69-133	10/08/2021 2024
PFDoA	2.0	2.0		1	100	69-135	10/08/2021 2024
PFHpA	2.0	2.1		1	107	71-131	10/08/2021 2024
PFHxA	2.0	1.9		1	95	70-132	10/08/2021 2024
PFNA	2.0	2.0		1	102	72-129	10/08/2021 2024
PFOA	2.0	1.9		1	94	69-133	10/08/2021 2024
PFPeA	2.0	2.0		1	99	69-132	10/08/2021 2024
PFTeDA	2.0	2.0		1	101	69-133	10/08/2021 2024
PFTrDA	2.0	1.9		1	93	66-139	10/08/2021 2024
PFUdA	2.0	1.8		1	90	64-136	10/08/2021 2024
PFOS	1.9	1.9		1	101	68-136	10/08/2021 2024

Surrogate	Q	% Rec	Acceptance Limit
13C2_4:2FTS		92	50-150
13C2_6:2FTS		90	50-150
13C2_8:2FTS		84	50-150
13C2_PFDoA		85	50-150
13C2_PFTeDA		83	50-150
13C3_PFBS		90	50-150
13C3_PFHxS		85	50-150
13C4_PFBA		90	50-150
13C4_PFHpA		85	50-150
13C5_PFHxA		87	50-150
13C5_PFPeA		88	50-150
13C6_PFDA		86	50-150
13C7_PFUdA		87	50-150
13C8_PFOA		85	50-150

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

PFAS by LC/MS/MS - LCS

Sample ID: WQ18071-002
Batch: 18071
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Solid
Prep Method: SOP SPE
Prep Date: 10/07/2021 1828

Surrogate	Q	% Rec	Acceptance Limit
13C8_PFOS		82	50-150
13C8_PFOSA		89	50-150
13C9_PFNA		87	50-150
d5-EtFOSAA		91	50-150
d-MeFOSA		90	50-150
d3-MeFOSAA		89	50-150

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

PFAS by LC/MS/MS - MS

Sample ID: WJ07031-001MS
Batch: 18071
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Solid
Prep Method: SOP SPE
Prep Date: 10/07/2021 1828

Parameter	Sample Amount (ug/kg)	Spike Amount (ug/kg)	Result (ug/kg)	Q	Dil	% Rec	%Rec Limit	Analysis Date
8:2 FTS	23	1.8	30	N	1	386	65-137	10/08/2021 2050
6:2 FTS	6.2	1.8	9.1	N	1	164	64-140	10/08/2021 2050
4:2 FTS	ND	1.7	1.7		1	98	62-145	10/08/2021 2050
EtFOSAA	ND	1.9	1.9		1	103	61-139	10/08/2021 2050
MeFOSA	ND	1.9	1.9		1	103	70-150	10/08/2021 2050
MeFOSAA	ND	1.9	2.1		1	115	63-144	10/08/2021 2050
PFBS	1.1	1.7	2.9		1	106	72-128	10/08/2021 2050
PFDS	2.7	1.8	5.0		1	123	59-134	10/08/2021 2050
PFHpS	0.48	1.8	2.2		1	96	70-132	10/08/2021 2050
PFNS	3.8	1.8	6.0		1	124	69-125	10/08/2021 2050
PFOSA	16	1.9	19	N	1	159	67-137	10/08/2021 2050
PFPeS	1.4	1.8	3.2		1	102	73-123	10/08/2021 2050
PFHxS	21	1.7	26	N	1	277	67-130	10/08/2021 2050
PFBA	0.69	1.9	2.6		1	103	71-135	10/08/2021 2050
PFDA	1.7	1.9	3.8		1	112	69-133	10/08/2021 2050
PFDoA	0.63	1.9	2.7		1	110	69-135	10/08/2021 2050
PFHpA	1.2	1.9	3.3		1	115	71-131	10/08/2021 2050
PFHxA	5.9	1.9	8.9	N	1	164	70-132	10/08/2021 2050
PFNA	0.63	1.9	2.7		1	113	72-129	10/08/2021 2050
PFOA	4.8	1.9	7.8	N	1	160	69-133	10/08/2021 2050
PFPeA	2.2	1.9	4.5		1	124	69-132	10/08/2021 2050
PFTeDA	ND	1.9	2.1		1	114	69-133	10/08/2021 2050
PFTrDA	ND	1.9	2.1		1	111	66-139	10/08/2021 2050
PFUdA	0.75	1.9	2.7		1	104	64-136	10/08/2021 2050
PFOS	480	1.7	530	N	1	3350	68-136	10/08/2021 2050

Surrogate	Q	% Rec	Acceptance Limit
13C2_4:2FTS		86	50-150
13C2_6:2FTS		88	50-150
13C2_8:2FTS		84	50-150
13C2_PFDoA		89	50-150
13C2_PFTeDA		88	50-150
13C3_PFBS		86	50-150
13C3_PFHxS		83	50-150
13C4_PFBA		86	50-150
13C4_PFHpA		83	50-150
13C5_PFHxA		84	50-150
13C5_PFPeA		85	50-150
13C6_PFDA		83	50-150
13C7_PFUdA		87	50-150
13C8_PFOA		83	50-150

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

PFAS by LC/MS/MS - MS

Sample ID: WJ07031-001MS
Batch: 18071
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Solid
Prep Method: SOP SPE
Prep Date: 10/07/2021 1828

Surrogate	Q	% Rec	Acceptance Limit
13C8_PFOS		76	50-150
13C8_PFOSA		86	50-150
13C9_PFNA		81	50-150
d5-EtFOSAA		89	50-150
d-MeFOSA		93	50-150
d3-MeFOSAA		86	50-150

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

PFAS by LC/MS/MS - MSD

Sample ID: WJ07031-001MD
Batch: 18071
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Solid
Prep Method: SOP SPE
Prep Date: 10/07/2021 1828

Parameter	Sample Amount (ug/kg)	Spike Amount (ug/kg)	Result (ug/kg)	Q	Dil	% Rec	% RPD	%Rec Limit	% RPD Limit	Analysis Date
8:2 FTS	23	1.9	30	N	1	384	1.4	65-137	30	10/08/2021 2102
6:2 FTS	6.2	1.9	8.9	N	1	142	2.4	64-140	30	10/08/2021 2102
4:2 FTS	ND	1.9	1.9		1	104	12	62-145	30	10/08/2021 2102
EtFOSAA	ND	2.0	2.2		1	108	12	61-139	30	10/08/2021 2102
MeFOSA	ND	2.0	2.1		1	104	7.5	70-150	30	10/08/2021 2102
MeFOSAA	ND	2.0	2.2		1	110	3.2	63-144	30	10/08/2021 2102
PFBS	1.1	1.8	2.9		1	103	2.2	72-128	30	10/08/2021 2102
PFDS	2.7	1.9	5.3		1	132	6.5	59-134	30	10/08/2021 2102
PFHpS	0.48	1.9	2.3		1	97	6.2	70-132	30	10/08/2021 2102
PFNS	3.8	1.9	6.1		1	122	1.9	69-125	30	10/08/2021 2102
PFOSA	16	2.0	19	N	1	154	0.61	67-137	30	10/08/2021 2102
PFPeS	1.4	1.9	3.3		1	102	4.2	73-123	30	10/08/2021 2102
PFHxS	21	1.8	25	N	1	198	4.4	67-130	30	10/08/2021 2102
PFBA	0.69	2.0	2.7		1	101	3.9	71-135	30	10/08/2021 2102
PFDA	1.7	2.0	3.8		1	105	0.43	69-133	30	10/08/2021 2102
PFDoA	0.63	2.0	2.8		1	109	4.9	69-135	30	10/08/2021 2102
PFHpA	1.2	2.0	3.5		1	113	3.8	71-131	30	10/08/2021 2102
PFHxA	5.9	2.0	8.9	N	1	153	0.22	70-132	30	10/08/2021 2102
PFNA	0.63	2.0	2.9		1	110	4.1	72-129	30	10/08/2021 2102
PFOA	4.8	2.0	7.6	N	1	140	2.1	69-133	30	10/08/2021 2102
PFPeA	2.2	2.0	4.5		1	114	0.43	69-132	30	10/08/2021 2102
PFTeDA	ND	2.0	2.3		1	116	9.0	69-133	30	10/08/2021 2102
PFTrDA	ND	2.0	2.1		1	107	3.8	66-139	30	10/08/2021 2102
PFUdA	0.75	2.0	2.9		1	106	6.3	64-136	30	10/08/2021 2102
PFOS	480	1.9	530	N	1	2960	0.60	68-136	30	10/08/2021 2102

Surrogate	Q	% Rec	Acceptance Limit
13C2_4:2FTS		86	50-150
13C2_6:2FTS		89	50-150
13C2_8:2FTS		82	50-150
13C2_PFDoA		86	50-150
13C2_PFTeDA		85	50-150
13C3_PFBS		86	50-150
13C3_PFHxS		84	50-150
13C4_PFBA		87	50-150
13C4_PFHpA		84	50-150
13C5_PFHxA		86	50-150
13C5_PFPeA		89	50-150
13C6_PFDA		85	50-150
13C7_PFUdA		90	50-150
13C8_PFOA		84	50-150

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

PFAS by LC/MS/MS - MSD

Sample ID: WJ07031-001MD
Batch: 18071
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Solid
Prep Method: SOP SPE
Prep Date: 10/07/2021 1828

Surrogate	Q	% Rec	Acceptance Limit
13C8_PFOS		76	50-150
13C8_PFOSA		86	50-150
13C9_PFNA		81	50-150
d5-EtFOSAA		88	50-150
d-MeFOSA		91	50-150
d3-MeFOSAA		87	50-150

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

SPLP PFAS - MB

Sample ID: WQ21287-001
Batch: 21287
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Solid
Prep Method: 1312/PFAS
Prep Date: 11/04/2021 1300 Leachate Date: 10/29/2021 1851

Parameter	Result	Q	Dil	LOQ	LOD	DL	Units	Analysis Date
8:2 FTS	40	U	1	80	40	20	ng/L	11/05/2021 1659
6:2 FTS	40	U	1	80	40	20	ng/L	11/05/2021 1659
4:2 FTS	40	U	1	80	40	20	ng/L	11/05/2021 1659
EtFOSAA	40	U	1	80	40	20	ng/L	11/05/2021 1659
MeFOSA	80	U	1	160	80	40	ng/L	11/05/2021 1659
MeFOSAA	40	U	1	80	40	20	ng/L	11/05/2021 1659
PFBS	20	U	1	40	20	10	ng/L	11/05/2021 1659
PFDS	20	U	1	40	20	10	ng/L	11/05/2021 1659
PFHpS	20	U	1	40	20	10	ng/L	11/05/2021 1659
PFNS	20	U	1	40	20	10	ng/L	11/05/2021 1659
PFOSA	20	U	1	40	20	10	ng/L	11/05/2021 1659
PFPeS	20	U	1	40	20	10	ng/L	11/05/2021 1659
PFHxS	20	U	1	40	20	10	ng/L	11/05/2021 1659
PFBA	20	U	1	40	20	10	ng/L	11/05/2021 1659
PFDA	20	U	1	40	20	10	ng/L	11/05/2021 1659
PFDoA	20	U	1	40	20	10	ng/L	11/05/2021 1659
PFHpA	20	U	1	40	20	10	ng/L	11/05/2021 1659
PFHxA	20	U	1	40	20	10	ng/L	11/05/2021 1659
PFNA	20	U	1	40	20	10	ng/L	11/05/2021 1659
PFOA	20	U	1	40	20	10	ng/L	11/05/2021 1659
PFPeA	20	U	1	40	20	10	ng/L	11/05/2021 1659
PFTeDA	20	U	1	40	20	10	ng/L	11/05/2021 1659
PFTrDA	20	U	1	40	20	10	ng/L	11/05/2021 1659
PFUdA	20	U	1	40	20	10	ng/L	11/05/2021 1659
PFOS	20	U	1	40	20	10	ng/L	11/05/2021 1659

Surrogate	Q	% Rec	Acceptance Limit
13C2_4:2FTS		124	50-150
13C2_6:2FTS		116	50-150
13C2_8:2FTS		107	50-150
13C2_PFDoA		107	50-150
13C2_PFTeDA		75	50-150
13C3_PFBS		109	50-150
13C3_PFHxS		108	50-150
13C4_PFBA		103	50-150
13C4_PFHpA		105	50-150
13C5_PFHxA		106	50-150
13C5_PFPeA		102	50-150
13C6_PFDA		104	50-150
13C7_PFUdA		107	50-150
13C8_PFOA		101	50-150

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

SPLP PFAS - MB

Sample ID: WQ21287-001
Batch: 21287
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Solid
Prep Method: 1312/PFAS
Prep Date: 11/04/2021 1300 Leachate Date: 10/29/2021 1851

Surrogate	Q	% Rec	Acceptance Limit
13C8_PFOS		101	50-150
13C8_PFOSA		107	50-150
13C9_PFNA		103	50-150
d5-EtFOSAA		113	50-150
d-MeFOSA		100	50-150
d3-MeFOSAA		115	50-150

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

SPLP PFAS - LCS

Sample ID: WQ21287-002
Batch: 21287
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Solid
Prep Method: 1312/PFAS
Prep Date: 11/04/2021 1300 Leachate Date: 10/29/2021 1851

Parameter	Spike Amount (ng/L)	Result (ng/L)	Q	Dil	% Rec	%Rec Limit	Analysis Date
8:2 FTS	150	160		1	105	67-138	11/05/2021 1710
6:2 FTS	150	180		1	117	64-140	11/05/2021 1710
4:2 FTS	150	140		1	97	63-143	11/05/2021 1710
EtFOSAA	160	140		1	90	61-135	11/05/2021 1710
MeFOSA	160	190		1	116	68-141	11/05/2021 1710
MeFOSAA	160	150		1	95	65-136	11/05/2021 1710
PFBS	140	130		1	93	72-130	11/05/2021 1710
PFDS	150	150		1	96	53-142	11/05/2021 1710
PFHpS	150	160		1	105	69-134	11/05/2021 1710
PFNS	150	170		1	109	69-127	11/05/2021 1710
PFOSA	160	150		1	94	67-137	11/05/2021 1710
PFPeS	150	150		1	98	71-127	11/05/2021 1710
PFHxS	150	150		1	102	68-131	11/05/2021 1710
PFBA	160	160		1	97	73-129	11/05/2021 1710
PFDA	160	160		1	99	71-129	11/05/2021 1710
PFDoA	160	170		1	106	72-134	11/05/2021 1710
PFHpA	160	160		1	99	72-130	11/05/2021 1710
PFHxA	160	160		1	102	72-129	11/05/2021 1710
PFNA	160	170		1	104	69-130	11/05/2021 1710
PFOA	160	160		1	99	71-133	11/05/2021 1710
PFPeA	160	160		1	100	72-129	11/05/2021 1710
PFTeDA	160	160		1	98	71-132	11/05/2021 1710
PFTrDA	160	160		1	101	65-144	11/05/2021 1710
PFUdA	160	180		1	115	69-133	11/05/2021 1710
PFOS	150	150		1	102	65-140	11/05/2021 1710

Surrogate	Q	% Rec	Acceptance Limit
13C2_4:2FTS		115	50-150
13C2_6:2FTS		113	50-150
13C2_8:2FTS		109	50-150
13C2_PFDoA		106	50-150
13C2_PFTeDA		88	50-150
13C3_PFBS		108	50-150
13C3_PFHxS		101	50-150
13C4_PFBA		102	50-150
13C4_PFHpA		108	50-150
13C5_PFHxA		105	50-150
13C5_PFPeA		104	50-150
13C6_PFDA		109	50-150
13C7_PFUdA		97	50-150
13C8_PFOA		111	50-150

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

SPLP PFAS - LCS

Sample ID: WQ21287-002
Batch: 21287
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Solid
Prep Method: 1312/PFAS
Prep Date: 11/04/2021 1300 Leachate Date: 10/29/2021 1851

Surrogate	Q	% Rec	Acceptance Limit
13C8_PFOS		107	50-150
13C8_PFOSA		109	50-150
13C9_PFNA		103	50-150
d5-EtFOSAA		113	50-150
d-MeFOSA		101	50-150
d3-MeFOSAA		112	50-150

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

SPLP PFAS - MB

Sample ID: WQ21420-001
Batch: 21420
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Solid
Prep Method: 1312/PFAS
Prep Date: 11/05/2021 1045 Leachate Date: 10/29/2021 1851

Parameter	Result	Q	Dil	LOQ	LOD	DL	Units	Analysis Date
8:2 FTS	40	U	1	80	40	20	ng/L	11/06/2021 2329
6:2 FTS	40	U	1	80	40	20	ng/L	11/06/2021 2329
4:2 FTS	40	U	1	80	40	20	ng/L	11/06/2021 2329
EtFOSAA	40	U	1	80	40	20	ng/L	11/06/2021 2329
MeFOSA	80	U	1	160	80	40	ng/L	11/06/2021 2329
MeFOSAA	40	U	1	80	40	20	ng/L	11/06/2021 2329
PFBS	20	U	1	40	20	10	ng/L	11/06/2021 2329
PFDS	20	U	1	40	20	10	ng/L	11/06/2021 2329
PFHpS	20	U	1	40	20	10	ng/L	11/06/2021 2329
PFNS	20	U	1	40	20	10	ng/L	11/06/2021 2329
PFOSA	20	U	1	40	20	10	ng/L	11/06/2021 2329
PFPeS	20	U	1	40	20	10	ng/L	11/06/2021 2329
PFHxS	20	U	1	40	20	10	ng/L	11/06/2021 2329
PFBA	20	U	1	40	20	10	ng/L	11/06/2021 2329
PFDA	20	U	1	40	20	10	ng/L	11/06/2021 2329
PFDoA	20	U	1	40	20	10	ng/L	11/06/2021 2329
PFHpA	20	U	1	40	20	10	ng/L	11/06/2021 2329
PFHxA	20	U	1	40	20	10	ng/L	11/06/2021 2329
PFNA	20	U	1	40	20	10	ng/L	11/06/2021 2329
PFOA	20	U	1	40	20	10	ng/L	11/06/2021 2329
PFPeA	20	U	1	40	20	10	ng/L	11/06/2021 2329
PFTeDA	20	U	1	40	20	10	ng/L	11/06/2021 2329
PFTrDA	20	U	1	40	20	10	ng/L	11/06/2021 2329
PFUdA	20	U	1	40	20	10	ng/L	11/06/2021 2329
PFOS	20	U	1	40	20	10	ng/L	11/06/2021 2329

Surrogate	Q	% Rec	Acceptance Limit
13C2_4:2FTS		130	50-150
13C2_6:2FTS		116	50-150
13C2_8:2FTS		118	50-150
13C2_PFDoA		113	50-150
13C2_PFTeDA		117	50-150
13C3_PFBS		123	50-150
13C3_PFHxS		122	50-150
13C4_PFBA		125	50-150
13C4_PFHpA		123	50-150
13C5_PFHxA		126	50-150
13C5_PFPeA		127	50-150
13C6_PFDA		123	50-150
13C7_PFUdA		122	50-150
13C8_PFOA		126	50-150

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

SPLP PFAS - MB

Sample ID: WQ21420-001
Batch: 21420
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Solid
Prep Method: 1312/PFAS
Prep Date: 11/05/2021 1045 Leachate Date: 10/29/2021 1851

Surrogate	Q	% Rec	Acceptance Limit
13C8_PFOS		125	50-150
13C8_PFOSA		127	50-150
13C9_PFNA		133	50-150
d5-EtFOSAA		128	50-150
d-MeFOSA		99	50-150
d3-MeFOSAA		129	50-150

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

SPLP PFAS - LCS

Sample ID: WQ21420-002
Batch: 21420
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Solid
Prep Method: 1312/PFAS
Prep Date: 11/05/2021 1045 Leachate Date: 10/29/2021 1851

Parameter	Spike Amount (ng/L)	Result (ng/L)	Q	Dil	% Rec	%Rec Limit	Analysis Date
8:2 FTS	150	150		1	101	67-138	11/06/2021 2350
6:2 FTS	150	140		1	90	64-140	11/06/2021 2350
4:2 FTS	150	160		1	106	63-143	11/06/2021 2350
EtFOSAA	160	130		1	84	61-135	11/06/2021 2350
MeFOSA	160	160		1	103	68-141	11/06/2021 2350
MeFOSAA	160	160		1	102	65-136	11/06/2021 2350
PFBS	140	130		1	91	72-130	11/06/2021 2350
PFDS	150	130		1	85	53-142	11/06/2021 2350
PFHpS	150	150		1	96	69-134	11/06/2021 2350
PFNS	150	150		1	100	69-127	11/06/2021 2350
PFOSA	160	160		1	100	67-137	11/06/2021 2350
PFPeS	150	140		1	96	71-127	11/06/2021 2350
PFHxS	150	140		1	98	68-131	11/06/2021 2350
PFBA	160	150		1	96	73-129	11/06/2021 2350
PFDA	160	140		1	89	71-129	11/06/2021 2350
PFDoA	160	170		1	105	72-134	11/06/2021 2350
PFHpA	160	150		1	96	72-130	11/06/2021 2350
PFHxA	160	160		1	97	72-129	11/06/2021 2350
PFNA	160	150		1	97	69-130	11/06/2021 2350
PFOA	160	170		1	109	71-133	11/06/2021 2350
PFPeA	160	160		1	98	72-129	11/06/2021 2350
PFTeDA	160	170		1	106	71-132	11/06/2021 2350
PFTrDA	160	160		1	98	65-144	11/06/2021 2350
PFUdA	160	160		1	101	69-133	11/06/2021 2350
PFOS	150	160		1	107	65-140	11/06/2021 2350

Surrogate	Q	% Rec	Acceptance Limit
13C2_4:2FTS		116	50-150
13C2_6:2FTS		116	50-150
13C2_8:2FTS		114	50-150
13C2_PFDoA		111	50-150
13C2_PFTeDA		111	50-150
13C3_PFBS		117	50-150
13C3_PFHxS		121	50-150
13C4_PFBA		123	50-150
13C4_PFHpA		120	50-150
13C5_PFHxA		119	50-150
13C5_PFPeA		118	50-150
13C6_PFDA		122	50-150
13C7_PFUdA		117	50-150
13C8_PFOA		124	50-150

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

SPLP PFAS - LCS

Sample ID: WQ21420-002
Batch: 21420
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Solid
Prep Method: 1312/PFAS
Prep Date: 11/05/2021 1045 Leachate Date: 10/29/2021 1851

Surrogate	Q	% Rec	Acceptance Limit
13C8_PFOS		121	50-150
13C8_PFOSA		118	50-150
13C9_PFNA		128	50-150
d5-EtFOSAA		132	50-150
d-MeFOSA		99	50-150
d3-MeFOSAA		134	50-150

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

Chain of Custody

and

Miscellaneous Documents

Client ID: 4367 - Pace Analytical Services
SDG: 221093038
PM: EPM

Pace Analytical

Chain of Custody

Workorder: ISM Workorder Name: Eielson Owner Received Date: ###### Results Requested By: 10/8/2021

Report To:	Subcontract To:
Kathy Smith Pace Analytical 106 Vantage Point Drive Columbia SC, 29223 803-227-2704 kathy.smith@pacelabs.com	Pace Gulf Coast 7979 Innovation Park Drive, Baton Rouge, LA 70820

WJ07031

KE62

Item	Sample ID	Sample Type	Collect Date/Time	Lab ID	Matrix	Preserved Containers: NON	ISM Prep	LAB USE ONLY
1	ISM-393-1-UTa		9/23/2021 1430			x	x	1
2	ISM-393-1-Utb		9/23/2021 1430			x	x	2
3	ISM-393-1-Utc		9/23/2021 1430			x	x	3
4	ISM-393-1-Ga		9/23/2021 1530			X	X	4
5	ISM-393-1-Gb		9/23/2021 1530			X	X	5
6	ISM-393-1-Gc		9/23/2021 1530			X	X	6
7	ISM-393-1-Sa		9/23/2021 1630			X	X	7
8	ISM-393-1-Sb		9/23/2021 1630			X	X	8
9	ISM-393-1-Sc		9/23/2021 1630			X	X	9
14	**Send samples to SC for analysis after ISM Prep							

Requested Analysis

Transfers	Released By	Date/Time	Received By	Date/Time	Comments
1					
2					
3	FedEx	10/7/21 0955	Amy Bonnivier	10/7/21 0958	3842 Acct# 5902

Cooler Temperature on Receipt 0.7 °C E34 Custody Seal Y or N Received on Ice Y or N Sample Intact Y or N

***In order to maintain client confidentiality, location/name of the sampling site, sampler's name and signature may not be provided on this COC
This chain of custody is considered complete as is since this information is available in the owner laboratory.

Ts 4.1°C

Friday, June 17, 2015 11:01:34 AM FMT-ALL-C-002rev.00 24March2009 Page 1 of 1

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106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

PaceAnalytical

Samples Receipt Checklist (SRC) (ME0018C-15)
Issuing Authority: Pace ENV - WCOL

Revised:9/29/2020

Sample Receipt Checklist (SRC)

Client: ARCADIS Cooler Inspected by/date: JRG2 / 10/07/2021 Lot #: WJ07031

Means of receipt: ☐ Pace ☐ Client ☐ UPS ☑ FedEx ☐ Other: _____

☐ Yes	☑ No		1. Were custody seals present on the cooler?
☐ Yes	☐ No	☑ NA	2. If custody seals were present, were they intact and unbroken?

pH Strip ID: NA Chlorine Strip ID: NA Tested by: NA

Original temperature upon receipt / Derived (Corrected) temperature upon receipt %Solid Snap-Cup ID: 21-1928

4.1 / 4.1 °C NA / NA °C NA / NA °C NA / NA °C

Method: ☐ Temperature Blank ☑ Against Bottles IR Gun ID: 5 IR Gun Correction Factor: 0 °C

Method of coolant: ☑ Wet Ice ☐ Ice Packs ☐ Dry Ice ☐ None

☐ Yes	☐ No	☑ NA	3. If temperature of any cooler exceeded 6.0°C, was Project Manager Notified? PM was Notified by: phone / email / face-to-face (circle one).
☑ Yes	☐ No	☐ NA	4. Is the commercial courier's packing slip attached to this form?
☑ Yes	☐ No		5. Were proper custody procedures (relinquished/received) followed?
☑ Yes	☐ No		6. Were sample IDs listed on the COC?
☑ Yes	☐ No		7. Were sample IDs listed on all sample containers?
☑ Yes	☐ No		8. Was collection date & time listed on the COC?
☑ Yes	☐ No		9. Was collection date & time listed on all sample containers?
☑ Yes	☐ No		10. Did all container label information (ID, date, time) agree with the COC?
☑ Yes	☐ No		11. Were tests to be performed listed on the COC?
☑ Yes	☐ No		12. Did all samples arrive in the proper containers for each test and/or in good condition (unbroken, lids on, etc.)? _____
☑ Yes	☐ No		13. Was adequate sample volume available?
☐ Yes	☑ No		14. Were all samples received within ½ the holding time or 48 hours, whichever comes first?
☐ Yes	☑ No		15. Were any samples containers missing/excess (circle one) samples Not listed on COC?
☐ Yes	☐ No	☑ NA	16. For VOA and RSK-175 samples, were bubbles present >"pea-size" (¼"or 6mm in diameter) in any of the VOA vials?
☐ Yes	☐ No	☑ NA	17. Were all DRO/metals/nutrient samples received at a pH of < 2?
☐ Yes	☐ No	☑ NA	18. Were all cyanide samples received at a pH > 12 and sulfide samples received at a pH > 9?
☐ Yes	☐ No	☑ NA	19. Were all applicable NH_3/TKN/cyanide/phenol/625.1/608.3 (< 0.5mg/L) samples free of residual chlorine?
☐ Yes	☐ No	☑ NA	20. Were client remarks/requests (i.e. requested dilutions, MS/MSD designations, etc…) correctly transcribed from the COC into the comment section in LIMS?
☐ Yes	☑ No		21. Was the quote number listed on the container label? If yes, Quote #

Sample Preservation (Must be completed for any sample(s) incorrectly preserved or with headspace.)

Sample(s) NA were received incorrectly preserved and were adjusted accordingly in sample receiving with NA mL of circle one: H2SO4, HNO3, HCl, NaOH using SR # NA. Time of preservation NA. If more than one preservative is needed, please note in the comments below.

Sample(s) NA were received with bubbles >6 mm in diameter.

Samples(s) NA were received with TRC > 0.5 mg/L (If #19 is ***no***) and were adjusted accordingly in sample receiving with sodium thiosulfate ($Na_2S_2O_3$) with Shealy ID: NA.

SR barcode labels applied by: JRG2 Date: 10/07/2021

Comments:

Report of Analysis

Arcadis U.S., Inc.
630 Plaza Drive
Suite 600
Highlands Ranch, CO 80129
Attention: Joseph Quinnan

Project Name: Eielson AFB

Project Number: ISM

Lot Number:**WJ07033**

Date Completed:11/09/2021
Revision Date: 10/21/2021

11/10/2021 10:13 AM
Approved and released by:
Project Manager II: **Kathy E. Smith**

The electronic signature above is the equivalent of a handwritten signature.
This report shall not be reproduced, except in its entirety, without the written approval of Pace Analytical Services, LLC.

Pace Analytical Services, LLC (*formerly Shealy Environmental Services, Inc.*)
106 Vantage Point Drive West Columbia, SC 29172
Tel: 803-791-9700 Fax: 803-791-9111 www.pacelabs.com

Case Narrative
Arcadis U.S., Inc.
Lot Number: WJ07033

This Report of Analysis contains the analytical result(s) for the sample(s) listed on the Sample Summary following this Case Narrative. The sample receiving date is documented in the header information associated with each sample.

All results listed in this report relate only to the samples that are contained within this report.

Sample receipt, sample analysis, and data review have been performed in accordance with the Pace Quality Assurance Management Plan (QAMP), applicable Shealy standard operating procedures (SOPs), the 2003 NELAC standard, and Shealy policies. Additionally, the DoD QSM version 5.3 has been followed for these samples, and specifically Table B-15 was followed for all PFAS samples. Any exceptions to the QAMP, SOPs, NELAC standards, the DoD QSM, or policies are qualified on the results page or discussed below.

All QC associated with these samples was in compliance with DOD QSM 5.3 table B-15 and our PFAS SOP.

Correction factors (CF) are used to calculate the original sample concentration. The CF is the inverse of the concentration factor (sample volume / extract final volume) times the dilution factor (DF). For undiluted analysis. For undiluted analysis, the extract is prepared for injection by adding 182 uL of sample extract + 8 uL of reagent water + 10 uL of internal standard solution to a polypropylene autosampler vial. An extra correction factor of 0.91 (182 uL / 200 uL = 0.91) applies. The CF is calculated as follows:

CF = DF * FV / Vo

FV is volume of extract (mL)
Vo is initial sample volume (mL)
DF is dilution factor. For undiluted analysis, DF = 1/0.91.

Sample concentration for aqueous samples:
Concentration (ng/L) = Cs*CF,

$$C_s = \frac{\left(\frac{(A_s x C_{is})}{A_{is}}\right) - B}{M1}$$

Where

C_s is on column concentration of target analyte in the sample (ng/L)
C_{is} is concentration of internal standard in the sample (ng/L)
A_s is peak response of target analyte in the sample
A_{is} is peak response of internal standard in the sample
M1 is the average RF from ICAL or the slope from linear regression ICAL
B is the y-intercept from the ICAL

Pace is a TNI accredited laboratory; however, the following analyses are currently not listed on our TNI scope of accreditation:

Biological Tissue: All, Non-Potable Water: SGT-HEM EPA 1664B, Silica EPA 200.7, Boron, Calcium, Silicon, Strontium EPA 200.8, Bicarbonate, Carbonate, and Hydroxide Alkalinity SM 2320 B-2011, Fecal Coliform SM 9221 C E-2006 & SM 9222D-2006, Strontium SW-846 6010D, VOC SM 6200 B-2011, Drinking Water: VOC (excluding BTEX, MTBE, Naphthalene, & 1,2-dichloroethane) EPA 524.2, Solid Chemical Material: TOC Walkley-Black.

Where applicable, all soil sample results (including LOQ and DL if requested) are corrected for dry weight unless flagged with a "W" qualifier.

If you have any questions regarding this report please contact the Pace Project Manager listed on the cover page.

Samples for SPLP PFAS were leached and analyzed outside of holding time. Data has been flagged with an H data qualifier.

Sample Summary

Arcadis U.S., Inc.

Lot Number: WJ07033

Project Name: Eielson AFB

Project Number: ISM

Sample Number	Sample ID	Matrix	Date Sampled	Date Received
001	385-4-Fa	Solid	09/22/2021 1030	10/07/2021
002	385-4-Fb	Solid	09/22/2021 1030	10/07/2021
003	385-4-Fc	Solid	09/22/2021 1030	10/07/2021

(3 samples)

Detection Summary

Arcadis U.S., Inc.

Lot Number: WJ07033

Project Name: Eielson AFB

Project Number: ISM

Sample	Sample ID	Matrix	Parameter	Method	Result	Q	Units	Page
001	385-4-Fa	Solid	PFOSA	PFAS by ID	0.31	J	ug/kg	6
001	385-4-Fa	Solid	PFHxS	PFAS by ID	2.3		ug/kg	6
001	385-4-Fa	Solid	PFOS	PFAS by ID	7.6		ug/kg	6
001	385-4-Fa	Solid	PFHxS	PFAS by ID	60	BH	ng/L	8
001	385-4-Fa	Solid	PFBA	PFAS by ID	10	BHJ	ng/L	8
001	385-4-Fa	Solid	PFOA	PFAS by ID	15	BHJ	ng/L	8
001	385-4-Fa	Solid	PFOS	PFAS by ID	150	BH	ng/L	8
002	385-4-Fb	Solid	PFDS	PFAS by ID	0.21	J	ug/kg	10
002	385-4-Fb	Solid	PFOSA	PFAS by ID	0.36	J	ug/kg	10
002	385-4-Fb	Solid	PFHxS	PFAS by ID	2.2		ug/kg	10
002	385-4-Fb	Solid	PFHxA	PFAS by ID	0.20	J	ug/kg	10
002	385-4-Fb	Solid	PFOA	PFAS by ID	0.20	J	ug/kg	10
002	385-4-Fb	Solid	PFOS	PFAS by ID	11		ug/kg	10
002	385-4-Fb	Solid	PFOSA	PFAS by ID	11	BHJ	ng/L	12
002	385-4-Fb	Solid	PFHxS	PFAS by ID	71	BH	ng/L	12
002	385-4-Fb	Solid	PFHxA	PFAS by ID	15	BHJ	ng/L	12
002	385-4-Fb	Solid	PFOA	PFAS by ID	16	BHJ	ng/L	12
002	385-4-Fb	Solid	PFOS	PFAS by ID	390	BH	ng/L	12
003	385-4-Fc	Solid	PFOSA	PFAS by ID	0.37	J	ug/kg	14
003	385-4-Fc	Solid	PFHxS	PFAS by ID	2.2		ug/kg	14
003	385-4-Fc	Solid	PFOA	PFAS by ID	0.28	J	ug/kg	14
003	385-4-Fc	Solid	PFOS	PFAS by ID	8.0		ug/kg	14
003	385-4-Fc	Solid	PFHxS	PFAS by ID	56	BH	ng/L	16
003	385-4-Fc	Solid	PFHxA	PFAS by ID	10	BHJ	ng/L	16
003	385-4-Fc	Solid	PFOA	PFAS by ID	17	BHJ	ng/L	16
003	385-4-Fc	Solid	PFOS	PFAS by ID	190	BH	ng/L	16

(26 detections)

PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: WJ07033-001
Description: 385-4-Fa | Matrix: Solid
Date Sampled: 09/22/2021 1030 | Project Name: Eielson AFB | % Solids: 97.0 10/07/2021 2131
Date Received: 10/07/2021 | Project Number: ISM

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch
1	SOP SPE	PFAS by ID SOP QSM B-15	1	10/08/2021 2257	NK1	10/07/2021 1828	18071

Parameter	CAS Number	Analytical Method	Result	Q	LOQ	LOD	DL	Units	Run
1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS)	39108-34-4	PFAS by ID SOP	1.1	U	2.1	1.1	0.52	ug/kg	1
1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS)	27619-97-2	PFAS by ID SOP	1.1	U	2.1	1.1	0.52	ug/kg	1
1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS)	757124-72-4	PFAS by ID SOP	1.1	U	2.1	1.1	0.52	ug/kg	1
N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA)	2991-50-6	PFAS by ID SOP	1.1	U	2.1	1.1	0.52	ug/kg	1
N-methylperfluoro-1-octanesulfonamide (MeFOSA)	31506-32-8	PFAS by ID SOP	1.1	U	2.1	1.1	0.52	ug/kg	1
N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA)	2355-31-9	PFAS by ID SOP	1.1	U	2.1	1.1	0.52	ug/kg	1
Perfluoro-1-butanesulfonic acid (PFBS)	375-73-5	PFAS by ID SOP	0.50	U	1.0	0.50	0.21	ug/kg	1
Perfluoro-1-decanesulfonic acid (PFDS)	335-77-3	PFAS by ID SOP	0.50	U	1.0	0.50	0.21	ug/kg	1
Perfluoro-1-heptanesulfonic acid (PFHpS)	375-92-8	PFAS by ID SOP	0.50	U	1.0	0.50	0.21	ug/kg	1
Perfluoro-1-nonanesulfonic acid (PFNS)	68259-12-1	PFAS by ID SOP	0.50	U	1.0	0.50	0.21	ug/kg	1
Perfluoro-1-octanesulfonamide (PFOSA)	754-91-6	PFAS by ID SOP	0.31	J	1.0	0.50	0.21	ug/kg	1
Perfluoro-1-pentanesulfonic acid (PFPeS)	2706-91-4	PFAS by ID SOP	0.50	U	1.0	0.50	0.21	ug/kg	1
Perfluorohexanesulfonic acid (PFHxS)	355-46-4	PFAS by ID SOP	2.3		1.0	0.50	0.21	ug/kg	1
Perfluoro-n-butanoic acid (PFBA)	375-22-4	PFAS by ID SOP	0.50	U	1.0	0.50	0.21	ug/kg	1
Perfluoro-n-decanoic acid (PFDA)	335-76-2	PFAS by ID SOP	0.50	U	1.0	0.50	0.21	ug/kg	1
Perfluoro-n-dodecanoic acid (PFDoA)	307-55-1	PFAS by ID SOP	0.50	U	1.0	0.50	0.21	ug/kg	1
Perfluoro-n-heptanoic acid (PFHpA)	375-85-9	PFAS by ID SOP	0.50	U	1.0	0.50	0.21	ug/kg	1
Perfluoro-n-hexanoic acid (PFHxA)	307-24-4	PFAS by ID SOP	0.50	U	1.0	0.50	0.21	ug/kg	1
Perfluoro-n-nonanoic acid (PFNA)	375-95-1	PFAS by ID SOP	0.50	U	1.0	0.50	0.21	ug/kg	1
Perfluoro-n-octanoic acid (PFOA)	335-67-1	PFAS by ID SOP	0.50	U	1.0	0.50	0.21	ug/kg	1
Perfluoro-n-pentanoic acid (PFPeA)	2706-90-3	PFAS by ID SOP	0.50	U	1.0	0.50	0.21	ug/kg	1
Perfluoro-n-tetradecanoic acid (PFTeDA)	376-06-7	PFAS by ID SOP	0.50	U	1.0	0.50	0.21	ug/kg	1
Perfluoro-n-tridecanoic acid (PFTrDA)	72629-94-8	PFAS by ID SOP	0.50	U	1.0	0.50	0.21	ug/kg	1
Perfluoro-n-undecanoic acid (PFUdA)	2058-94-8	PFAS by ID SOP	0.50	U	1.0	0.50	0.21	ug/kg	1
Perfluorooctanesulfonic acid (PFOS)	1763-23-1	PFAS by ID SOP	7.6		1.0	0.50	0.21	ug/kg	1

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
13C2_4:2FTS		78	50-150
13C2_6:2FTS		82	50-150
13C2_8:2FTS		81	50-150
13C2_PFDoA		74	50-150
13C2_PFTeDA		71	50-150
13C3_PFBS		77	50-150
13C3_PFHxS		71	50-150
13C4_PFBA		78	50-150
13C4_PFHpA		72	50-150
13C5_PFHxA		75	50-150
13C5_PFPeA		77	50-150
13C6_PFDA		70	50-150
13C7_PFUdA		76	50-150
13C8_PFOA		71	50-150
13C8_PFOS		69	50-150
13C8_PFOSA		75	50-150
13C9_PFNA		74	50-150

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

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106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.		Laboratory ID: WJ07033-001	
Description: 385-4-Fa		Matrix: Solid	
Date Sampled: 09/22/2021 1030	Project Name: Eielson AFB	% Solids: 97.0	10/07/2021 2131
Date Received: 10/07/2021	Project Number: ISM		

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
d5-EtFOSAA		90	50-150
d-MeFOSA		73	50-150
d3-MeFOSAA		84	50-150

LOQ = Limit of Quantitation	B = Detected in the method blank	E = Quantitation of compound exceeded the calibration range	DL = Detection Limit	Q = Surrogate failure
U = Not detected at or above the LOQ	N = Recovery is out of criteria	P = The RPD between two GC columns exceeds 40%	J = Estimated result < LOQ and ≥ DL	L = LCS/LCSD failure
H = Out of holding time	W = Reported on wet weight basis	LOD = Limit of Detection		S = MS/MSD failure

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106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

SPLP PFAS

Client: Arcadis U.S., Inc. | Laboratory ID: WJ07033-001
Description: 385-4-Fa | Matrix: Solid
Date Sampled: 09/22/2021 1030 | Project Name: Eielson AFB | % Solids: 97.0 10/07/2021 2131
Date Received: 10/07/2021 | Project Number: ISM

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch	Leachate Date
1	1312/PFAS	PFAS by ID SOP QSM B-15	1	11/07/2021 0043	MMM	11/05/2021 1045	21420	10/29/2021 1851

Parameter	CAS Number	Analytical Method	Result	Q	LOQ	LOD	DL	Units	Run
1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS)	39108-34-4	PFAS by ID SOP	40	UH	80	40	20	ng/L	1
1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS)	27619-97-2	PFAS by ID SOP	40	UH	80	40	20	ng/L	1
1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS)	757124-72-4	PFAS by ID SOP	40	UH	80	40	20	ng/L	1
N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA)	2991-50-6	PFAS by ID SOP	40	UH	80	40	20	ng/L	1
N-methylperfluoro-1-octanesulfonamide (MeFOSA)	31506-32-8	PFAS by ID SOP	80	UH	160	80	40	ng/L	1
N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA)	2355-31-9	PFAS by ID SOP	40	UH	80	40	20	ng/L	1
Perfluoro-1-butanesulfonic acid (PFBS)	375-73-5	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-1-decanesulfonic acid (PFDS)	335-77-3	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-1-heptanesulfonic acid (PFHpS)	375-92-8	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-1-nonanesulfonic acid (PFNS)	68259-12-1	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-1-octanesulfonamide (PFOSA)	754-91-6	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-1-pentanesulfonic acid (PFPeS)	2706-91-4	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluorohexanesulfonic acid (PFHxS)	355-46-4	PFAS by ID SOP	60	BH	40	20	10	ng/L	1
Perfluoro-n-butanoic acid (PFBA)	375-22-4	PFAS by ID SOP	10	BHJ	40	20	10	ng/L	1
Perfluoro-n-decanoic acid (PFDA)	335-76-2	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-dodecanoic acid (PFDoA)	307-55-1	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-heptanoic acid (PFHpA)	375-85-9	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-hexanoic acid (PFHxA)	307-24-4	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-nonanoic acid (PFNA)	375-95-1	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-octanoic acid (PFOA)	335-67-1	PFAS by ID SOP	15	BHJ	40	20	10	ng/L	1
Perfluoro-n-pentanoic acid (PFPeA)	2706-90-3	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-tetradecanoic acid (PFTeDA)	376-06-7	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-tridecanoic acid (PFTrDA)	72629-94-8	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-undecanoic acid (PFUdA)	2058-94-8	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluorooctanesulfonic acid (PFOS)	1763-23-1	PFAS by ID SOP	150	BH	40	20	10	ng/L	1

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
13C2_4:2FTS	H	116	50-150
13C2_6:2FTS	H	105	50-150
13C2_8:2FTS	H	110	50-150
13C2_PFDoA	H	112	50-150
13C2_PFTeDA	H	109	50-150
13C3_PFBS	H	110	50-150
13C3_PFHxS	H	111	50-150
13C4_PFBA	H	117	50-150
13C4_PFHpA	H	114	50-150
13C5_PFHxA	H	113	50-150
13C5_PFPeA	H	112	50-150
13C6_PFDA	H	109	50-150
13C7_PFUdA	H	106	50-150
13C8_PFOA	H	117	50-150
13C8_PFOS	H	118	50-150
13C8_PFOSA	H	118	50-150
13C9_PFNA	H	123	50-150

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

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SPLP PFAS

Client: Arcadis U.S., Inc.		Laboratory ID: WJ07033-001
Description: 385-4-Fa		Matrix: Solid
Date Sampled: 09/22/2021 1030	Project Name: Eielson AFB	% Solids: 97.0 10/07/2021 2131
Date Received: 10/07/2021	Project Number: ISM	

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
d5-EtFOSAA	H	123	50-150
d-MeFOSA	H	99	50-150
d3-MeFOSAA	H	125	50-150

LOQ = Limit of Quantitation	B = Detected in the method blank	E = Quantitation of compound exceeded the calibration range	DL = Detection Limit	Q = Surrogate failure
U = Not detected at or above the LOQ	N = Recovery is out of criteria	P = The RPD between two GC columns exceeds 40%	J = Estimated result < LOQ and ≥ DL	L = LCS/LCSD failure
H = Out of holding time	W = Reported on wet weight basis	LOD = Limit of Detection		S = MS/MSD failure

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PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: WJ07033-002
Description: 385-4-Fb | Matrix: Solid
Date Sampled: 09/22/2021 1030 | Project Name: Eielson AFB | % Solids: 94.9 10/07/2021 2131
Date Received: 10/07/2021 | Project Number: ISM

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch
1	SOP SPE	PFAS by ID SOP QSM B-15	1	10/08/2021 2335	NK1	10/07/2021 1828	18071

Parameter	CAS Number	Analytical Method	Result	Q	LOQ	LOD	DL	Units	Run
1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS)	39108-34-4	PFAS by ID SOP	1.0	U	2.0	1.0	0.51	ug/kg	1
1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS)	27619-97-2	PFAS by ID SOP	1.0	U	2.0	1.0	0.51	ug/kg	1
1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS)	757124-72-4	PFAS by ID SOP	1.0	U	2.0	1.0	0.51	ug/kg	1
N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA)	2991-50-6	PFAS by ID SOP	1.0	U	2.0	1.0	0.51	ug/kg	1
N-methylperfluoro-1-octanesulfonamide (MeFOSA)	31506-32-8	PFAS by ID SOP	1.0	U	2.0	1.0	0.51	ug/kg	1
N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA)	2355-31-9	PFAS by ID SOP	1.0	U	2.0	1.0	0.51	ug/kg	1
Perfluoro-1-butanesulfonic acid (PFBS)	375-73-5	PFAS by ID SOP	0.50	U	1.0	0.50	0.20	ug/kg	1
Perfluoro-1-decanesulfonic acid (PFDS)	335-77-3	PFAS by ID SOP	0.21	J	1.0	0.50	0.20	ug/kg	1
Perfluoro-1-heptanesulfonic acid (PFHpS)	375-92-8	PFAS by ID SOP	0.50	U	1.0	0.50	0.20	ug/kg	1
Perfluoro-1-nonanesulfonic acid (PFNS)	68259-12-1	PFAS by ID SOP	0.50	U	1.0	0.50	0.20	ug/kg	1
Perfluoro-1-octanesulfonamide (PFOSA)	754-91-6	PFAS by ID SOP	0.36	J	1.0	0.50	0.20	ug/kg	1
Perfluoro-1-pentanesulfonic acid (PFPeS)	2706-91-4	PFAS by ID SOP	0.50	U	1.0	0.50	0.20	ug/kg	1
Perfluorohexanesulfonic acid (PFHxS)	355-46-4	PFAS by ID SOP	2.2		1.0	0.50	0.20	ug/kg	1
Perfluoro-n-butanoic acid (PFBA)	375-22-4	PFAS by ID SOP	0.50	U	1.0	0.50	0.20	ug/kg	1
Perfluoro-n-decanoic acid (PFDA)	335-76-2	PFAS by ID SOP	0.50	U	1.0	0.50	0.20	ug/kg	1
Perfluoro-n-dodecanoic acid (PFDoA)	307-55-1	PFAS by ID SOP	0.50	U	1.0	0.50	0.20	ug/kg	1
Perfluoro-n-heptanoic acid (PFHpA)	375-85-9	PFAS by ID SOP	0.50	U	1.0	0.50	0.20	ug/kg	1
Perfluoro-n-hexanoic acid (PFHxA)	307-24-4	PFAS by ID SOP	0.20	J	1.0	0.50	0.20	ug/kg	1
Perfluoro-n-nonanoic acid (PFNA)	375-95-1	PFAS by ID SOP	0.50	U	1.0	0.50	0.20	ug/kg	1
Perfluoro-n-octanoic acid (PFOA)	335-67-1	PFAS by ID SOP	0.20	J	1.0	0.50	0.20	ug/kg	1
Perfluoro-n-pentanoic acid (PFPeA)	2706-90-3	PFAS by ID SOP	0.50	U	1.0	0.50	0.20	ug/kg	1
Perfluoro-n-tetradecanoic acid (PFTeDA)	376-06-7	PFAS by ID SOP	0.50	U	1.0	0.50	0.20	ug/kg	1
Perfluoro-n-tridecanoic acid (PFTrDA)	72629-94-8	PFAS by ID SOP	0.50	U	1.0	0.50	0.20	ug/kg	1
Perfluoro-n-undecanoic acid (PFUdA)	2058-94-8	PFAS by ID SOP	0.50	U	1.0	0.50	0.20	ug/kg	1
Perfluorooctanesulfonic acid (PFOS)	1763-23-1	PFAS by ID SOP	11		1.0	0.50	0.20	ug/kg	1

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
13C2_4:2FTS		88	50-150
13C2_6:2FTS		86	50-150
13C2_8:2FTS		84	50-150
13C2_PFDoA		69	50-150
13C2_PFTeDA		70	50-150
13C3_PFBS		83	50-150
13C3_PFHxS		78	50-150
13C4_PFBA		83	50-150
13C4_PFHpA		75	50-150
13C5_PFHxA		82	50-150
13C5_PFPeA		83	50-150
13C6_PFDA		73	50-150
13C7_PFUdA		70	50-150
13C8_PFOA		75	50-150
13C8_PFOS		73	50-150
13C8_PFOSA		78	50-150
13C9_PFNA		76	50-150

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

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PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.		Laboratory ID: WJ07033-002	
Description: 385-4-Fb		Matrix: Solid	
Date Sampled: 09/22/2021 1030	Project Name: Eielson AFB	% Solids: 94.9	10/07/2021 2131
Date Received: 10/07/2021	Project Number: ISM		

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
d5-EtFOSAA		96	50-150
d-MeFOSA		69	50-150
d3-MeFOSAA		88	50-150

LOQ = Limit of Quantitation	B = Detected in the method blank	E = Quantitation of compound exceeded the calibration range	DL = Detection Limit	Q = Surrogate failure
U = Not detected at or above the LOQ	N = Recovery is out of criteria	P = The RPD between two GC columns exceeds 40%	J = Estimated result < LOQ and ≥ DL	L = LCS/LCSD failure
H = Out of holding time	W = Reported on wet weight basis	LOD = Limit of Detection		S = MS/MSD failure

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SPLP PFAS

Client: Arcadis U.S., Inc. | Laboratory ID: WJ07033-002
Description: 385-4-Fb | Matrix: Solid
Date Sampled: 09/22/2021 1030 | Project Name: Eielson AFB | % Solids: 94.9 10/07/2021 2131
Date Received: 10/07/2021 | Project Number: ISM

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch	Leachate Date
1	1312/PFAS	PFAS by ID SOP QSM B-15	1	11/07/2021 0054	MMM	11/05/2021 1045	21420	10/29/2021 1851

Parameter	CAS Number	Analytical Method	Result	Q	LOQ	LOD	DL	Units	Run
1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS)	39108-34-4	PFAS by ID SOP	40	UH	80	40	20	ng/L	1
1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS)	27619-97-2	PFAS by ID SOP	40	UH	80	40	20	ng/L	1
1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS)	757124-72-4	PFAS by ID SOP	40	UH	80	40	20	ng/L	1
N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA)	2991-50-6	PFAS by ID SOP	40	UH	80	40	20	ng/L	1
N-methylperfluoro-1-octanesulfonamide (MeFOSA)	31506-32-8	PFAS by ID SOP	80	UH	160	80	40	ng/L	1
N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA)	2355-31-9	PFAS by ID SOP	40	UH	80	40	20	ng/L	1
Perfluoro-1-butanesulfonic acid (PFBS)	375-73-5	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-1-decanesulfonic acid (PFDS)	335-77-3	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-1-heptanesulfonic acid (PFHpS)	375-92-8	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-1-nonanesulfonic acid (PFNS)	68259-12-1	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-1-octanesulfonamide (PFOSA)	754-91-6	PFAS by ID SOP	11	BHJ	40	20	10	ng/L	1
Perfluoro-1-pentanesulfonic acid (PFPeS)	2706-91-4	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluorohexanesulfonic acid (PFHxS)	355-46-4	PFAS by ID SOP	71	BH	40	20	10	ng/L	1
Perfluoro-n-butanoic acid (PFBA)	375-22-4	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-decanoic acid (PFDA)	335-76-2	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-dodecanoic acid (PFDoA)	307-55-1	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-heptanoic acid (PFHpA)	375-85-9	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-hexanoic acid (PFHxA)	307-24-4	PFAS by ID SOP	15	BHJ	40	20	10	ng/L	1
Perfluoro-n-nonanoic acid (PFNA)	375-95-1	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-octanoic acid (PFOA)	335-67-1	PFAS by ID SOP	16	BHJ	40	20	10	ng/L	1
Perfluoro-n-pentanoic acid (PFPeA)	2706-90-3	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-tetradecanoic acid (PFTeDA)	376-06-7	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-tridecanoic acid (PFTrDA)	72629-94-8	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-undecanoic acid (PFUdA)	2058-94-8	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluorooctanesulfonic acid (PFOS)	1763-23-1	PFAS by ID SOP	390	BH	40	20	10	ng/L	1

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
13C2_4:2FTS	H	122	50-150
13C2_6:2FTS	H	116	50-150
13C2_8:2FTS	H	117	50-150
13C2_PFDoA	H	116	50-150
13C2_PFTeDA	H	116	50-150
13C3_PFBS	H	119	50-150
13C3_PFHxS	H	117	50-150
13C4_PFBA	H	120	50-150
13C4_PFHpA	H	117	50-150
13C5_PFHxA	H	122	50-150
13C5_PFPeA	H	116	50-150
13C6_PFDA	H	114	50-150
13C7_PFUdA	H	119	50-150
13C8_PFOA	H	128	50-150
13C8_PFOS	H	122	50-150
13C8_PFOSA	H	117	50-150
13C9_PFNA	H	122	50-150

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

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SPLP PFAS

Client: Arcadis U.S., Inc.		Laboratory ID: WJ07033-002	
Description: 385-4-Fb		Matrix: Solid	
Date Sampled: 09/22/2021 1030	Project Name: Eielson AFB	% Solids: 94.9	10/07/2021 2131
Date Received: 10/07/2021	Project Number: ISM		

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
d5-EtFOSAA	H	124	50-150
d-MeFOSA	H	100	50-150
d3-MeFOSAA	H	132	50-150

LOQ = Limit of Quantitation	B = Detected in the method blank	E = Quantitation of compound exceeded the calibration range	DL = Detection Limit	Q = Surrogate failure
U = Not detected at or above the LOQ	N = Recovery is out of criteria	P = The RPD between two GC columns exceeds 40%	J = Estimated result < LOQ and ≥ DL	L = LCS/LCSD failure
H = Out of holding time	W = Reported on wet weight basis	LOD = Limit of Detection		S = MS/MSD failure

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PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: WJ07033-003
Description: 385-4-Fc | Matrix: Solid
Date Sampled: 09/22/2021 1030 | Project Name: Eielson AFB | % Solids: 96.3 10/07/2021 2131
Date Received: 10/07/2021 | Project Number: ISM

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch
1	SOP SPE	PFAS by ID SOP QSM B-15	1	10/08/2021 2347	NK1	10/07/2021 1828	18071

Parameter	CAS Number	Analytical Method	Result	Q	LOQ	LOD	DL	Units	Run
1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS)	39108-34-4	PFAS by ID SOP	0.90	U	1.8	0.90	0.44	ug/kg	1
1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS)	27619-97-2	PFAS by ID SOP	0.90	U	1.8	0.90	0.44	ug/kg	1
1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS)	757124-72-4	PFAS by ID SOP	0.90	U	1.8	0.90	0.44	ug/kg	1
N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA)	2991-50-6	PFAS by ID SOP	0.90	U	1.8	0.90	0.44	ug/kg	1
N-methylperfluoro-1-octanesulfonamide (MeFOSA)	31506-32-8	PFAS by ID SOP	0.90	U	1.8	0.90	0.44	ug/kg	1
N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA)	2355-31-9	PFAS by ID SOP	0.90	U	1.8	0.90	0.44	ug/kg	1
Perfluoro-1-butanesulfonic acid (PFBS)	375-73-5	PFAS by ID SOP	0.45	U	0.89	0.45	0.18	ug/kg	1
Perfluoro-1-decanesulfonic acid (PFDS)	335-77-3	PFAS by ID SOP	0.45	U	0.89	0.45	0.18	ug/kg	1
Perfluoro-1-heptanesulfonic acid (PFHpS)	375-92-8	PFAS by ID SOP	0.45	U	0.89	0.45	0.18	ug/kg	1
Perfluoro-1-nonanesulfonic acid (PFNS)	68259-12-1	PFAS by ID SOP	0.45	U	0.89	0.45	0.18	ug/kg	1
Perfluoro-1-octanesulfonamide (PFOSA)	754-91-6	PFAS by ID SOP	0.37	J	0.89	0.45	0.18	ug/kg	1
Perfluoro-1-pentanesulfonic acid (PFPeS)	2706-91-4	PFAS by ID SOP	0.45	U	0.89	0.45	0.18	ug/kg	1
Perfluorohexanesulfonic acid (PFHxS)	355-46-4	PFAS by ID SOP	2.2		0.89	0.45	0.18	ug/kg	1
Perfluoro-n-butanoic acid (PFBA)	375-22-4	PFAS by ID SOP	0.45	U	0.89	0.45	0.18	ug/kg	1
Perfluoro-n-decanoic acid (PFDA)	335-76-2	PFAS by ID SOP	0.45	U	0.89	0.45	0.18	ug/kg	1
Perfluoro-n-dodecanoic acid (PFDoA)	307-55-1	PFAS by ID SOP	0.45	U	0.89	0.45	0.18	ug/kg	1
Perfluoro-n-heptanoic acid (PFHpA)	375-85-9	PFAS by ID SOP	0.45	U	0.89	0.45	0.18	ug/kg	1
Perfluoro-n-hexanoic acid (PFHxA)	307-24-4	PFAS by ID SOP	0.45	U	0.89	0.45	0.18	ug/kg	1
Perfluoro-n-nonanoic acid (PFNA)	375-95-1	PFAS by ID SOP	0.45	U	0.89	0.45	0.18	ug/kg	1
Perfluoro-n-octanoic acid (PFOA)	335-67-1	PFAS by ID SOP	0.28	J	0.89	0.45	0.18	ug/kg	1
Perfluoro-n-pentanoic acid (PFPeA)	2706-90-3	PFAS by ID SOP	0.45	U	0.89	0.45	0.18	ug/kg	1
Perfluoro-n-tetradecanoic acid (PFTeDA)	376-06-7	PFAS by ID SOP	0.45	U	0.89	0.45	0.18	ug/kg	1
Perfluoro-n-tridecanoic acid (PFTrDA)	72629-94-8	PFAS by ID SOP	0.45	U	0.89	0.45	0.18	ug/kg	1
Perfluoro-n-undecanoic acid (PFUdA)	2058-94-8	PFAS by ID SOP	0.45	U	0.89	0.45	0.18	ug/kg	1
Perfluorooctanesulfonic acid (PFOS)	1763-23-1	PFAS by ID SOP	8.0		0.89	0.45	0.18	ug/kg	1

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
13C2_4:2FTS		83	50-150
13C2_6:2FTS		85	50-150
13C2_8:2FTS		91	50-150
13C2_PFDoA		78	50-150
13C2_PFTeDA		78	50-150
13C3_PFBS		78	50-150
13C3_PFHxS		75	50-150
13C4_PFBA		80	50-150
13C4_PFHpA		73	50-150
13C5_PFHxA		76	50-150
13C5_PFPeA		77	50-150
13C6_PFDA		73	50-150
13C7_PFUdA		74	50-150
13C8_PFOA		73	50-150
13C8_PFOS		73	50-150
13C8_PFOSA		77	50-150
13C9_PFNA		77	50-150

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

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PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.		Laboratory ID: WJ07033-003
Description: 385-4-Fc		Matrix: Solid
Date Sampled: 09/22/2021 1030	Project Name: Eielson AFB	% Solids: 96.3 10/07/2021 2131
Date Received: 10/07/2021	Project Number: ISM	

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
d5-EtFOSAA		94	50-150
d-MeFOSA		75	50-150
d3-MeFOSAA		88	50-150

LOQ = Limit of Quantitation	B = Detected in the method blank	E = Quantitation of compound exceeded the calibration range	DL = Detection Limit	Q = Surrogate failure
U = Not detected at or above the LOQ	N = Recovery is out of criteria	P = The RPD between two GC columns exceeds 40%	J = Estimated result < LOQ and ≥ DL	L = LCS/LCSD failure
H = Out of holding time	W = Reported on wet weight basis	LOD = Limit of Detection		S = MS/MSD failure

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SPLP PFAS

Client: Arcadis U.S., Inc. | Laboratory ID: WJ07033-003
Description: 385-4-Fc | Matrix: Solid
Date Sampled: 09/22/2021 1030 | Project Name: Eielson AFB | % Solids: 96.3 10/07/2021 2131
Date Received: 10/07/2021 | Project Number: ISM

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch	Leachate Date
1	1312/PFAS	PFAS by ID SOP QSM B-15	1	11/07/2021 0104	MMM	11/05/2021 1045	21420	10/29/2021 1851

Parameter	CAS Number	Analytical Method	Result	Q	LOQ	LOD	DL	Units	Run
1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS)	39108-34-4	PFAS by ID SOP	40	UH	80	40	20	ng/L	1
1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS)	27619-97-2	PFAS by ID SOP	40	UH	80	40	20	ng/L	1
1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS)	757124-72-4	PFAS by ID SOP	40	UH	80	40	20	ng/L	1
N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA)	2991-50-6	PFAS by ID SOP	40	UH	80	40	20	ng/L	1
N-methylperfluoro-1-octanesulfonamide (MeFOSA)	31506-32-8	PFAS by ID SOP	80	UH	160	80	40	ng/L	1
N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA)	2355-31-9	PFAS by ID SOP	40	UH	80	40	20	ng/L	1
Perfluoro-1-butanesulfonic acid (PFBS)	375-73-5	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-1-decanesulfonic acid (PFDS)	335-77-3	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-1-heptanesulfonic acid (PFHpS)	375-92-8	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-1-nonanesulfonic acid (PFNS)	68259-12-1	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-1-octanesulfonamide (PFOSA)	754-91-6	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-1-pentanesulfonic acid (PFPeS)	2706-91-4	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluorohexanesulfonic acid (PFHxS)	355-46-4	PFAS by ID SOP	56	BH	40	20	10	ng/L	1
Perfluoro-n-butanoic acid (PFBA)	375-22-4	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-decanoic acid (PFDA)	335-76-2	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-dodecanoic acid (PFDoA)	307-55-1	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-heptanoic acid (PFHpA)	375-85-9	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-hexanoic acid (PFHxA)	307-24-4	PFAS by ID SOP	10	BHJ	40	20	10	ng/L	1
Perfluoro-n-nonanoic acid (PFNA)	375-95-1	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-octanoic acid (PFOA)	335-67-1	PFAS by ID SOP	17	BHJ	40	20	10	ng/L	1
Perfluoro-n-pentanoic acid (PFPeA)	2706-90-3	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-tetradecanoic acid (PFTeDA)	376-06-7	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-tridecanoic acid (PFTrDA)	72629-94-8	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-undecanoic acid (PFUdA)	2058-94-8	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluorooctanesulfonic acid (PFOS)	1763-23-1	PFAS by ID SOP	190	BH	40	20	10	ng/L	1

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
13C2_4:2FTS	H	119	50-150
13C2_6:2FTS	H	116	50-150
13C2_8:2FTS	H	104	50-150
13C2_PFDoA	H	115	50-150
13C2_PFTeDA	H	112	50-150
13C3_PFBS	H	119	50-150
13C3_PFHxS	H	114	50-150
13C4_PFBA	H	118	50-150
13C4_PFHpA	H	118	50-150
13C5_PFHxA	H	116	50-150
13C5_PFPeA	H	117	50-150
13C6_PFDA	H	112	50-150
13C7_PFUdA	H	119	50-150
13C8_PFOA	H	120	50-150
13C8_PFOS	H	123	50-150
13C8_PFOSA	H	117	50-150
13C9_PFNA	H	118	50-150

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

SPLP PFAS

Client: Arcadis U.S., Inc.		Laboratory ID: WJ07033-003
Description: 385-4-Fc		Matrix: Solid
Date Sampled: 09/22/2021 1030	Project Name: Eielson AFB	% Solids: 96.3 10/07/2021 2131
Date Received: 10/07/2021	Project Number: ISM	

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
d5-EtFOSAA	H	121	50-150
d-MeFOSA	H	98	50-150
d3-MeFOSAA	H	125	50-150

LOQ = Limit of Quantitation	B = Detected in the method blank	E = Quantitation of compound exceeded the calibration range	DL = Detection Limit	Q = Surrogate failure
U = Not detected at or above the LOQ	N = Recovery is out of criteria	P = The RPD between two GC columns exceeds 40%	J = Estimated result < LOQ and ≥ DL	L = LCS/LCSD failure
H = Out of holding time	W = Reported on wet weight basis	LOD = Limit of Detection		S = MS/MSD failure

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QC Summary

PFAS by LC/MS/MS - MB

Sample ID: WQ18071-001
Batch: 18071
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Solid
Prep Method: SOP SPE
Prep Date: 10/07/2021 1828

Parameter	Result	Q	Dil	LOQ	LOD	DL	Units	Analysis Date
8:2 FTS	1.0	U	1	2.0	1.0	0.50	ug/kg	10/18/2021 1543
6:2 FTS	1.1	J	1	2.0	1.0	0.50	ug/kg	10/18/2021 1543
4:2 FTS	1.0	U	1	2.0	1.0	0.50	ug/kg	10/18/2021 1543
EtFOSAA	1.0	U	1	2.0	1.0	0.50	ug/kg	10/18/2021 1543
MeFOSA	1.0	U	1	2.0	1.0	0.50	ug/kg	10/18/2021 1543
MeFOSAA	1.0	U	1	2.0	1.0	0.50	ug/kg	10/18/2021 1543
PFBS	0.50	U	1	1.0	0.50	0.20	ug/kg	10/18/2021 1543
PFDS	0.50	U	1	1.0	0.50	0.20	ug/kg	10/18/2021 1543
PFHpS	0.50	U	1	1.0	0.50	0.20	ug/kg	10/18/2021 1543
PFNS	0.50	U	1	1.0	0.50	0.20	ug/kg	10/18/2021 1543
PFOSA	0.50	U	1	1.0	0.50	0.20	ug/kg	10/18/2021 1543
PFPeS	0.50	U	1	1.0	0.50	0.20	ug/kg	10/18/2021 1543
PFHxS	0.50	U	1	1.0	0.50	0.20	ug/kg	10/18/2021 1543
PFBA	0.50	U	1	1.0	0.50	0.20	ug/kg	10/18/2021 1543
PFDA	0.50	U	1	1.0	0.50	0.20	ug/kg	10/18/2021 1543
PFDoA	0.50	U	1	1.0	0.50	0.20	ug/kg	10/18/2021 1543
PFHpA	0.50	U	1	1.0	0.50	0.20	ug/kg	10/18/2021 1543
PFHxA	0.50	U	1	1.0	0.50	0.20	ug/kg	10/18/2021 1543
PFNA	0.50	U	1	1.0	0.50	0.20	ug/kg	10/18/2021 1543
PFOA	0.50	U	1	1.0	0.50	0.20	ug/kg	10/18/2021 1543
PFPeA	0.50	U	1	1.0	0.50	0.20	ug/kg	10/18/2021 1543
PFTeDA	0.50	U	1	1.0	0.50	0.20	ug/kg	10/18/2021 1543
PFTrDA	0.50	U	1	1.0	0.50	0.20	ug/kg	10/18/2021 1543
PFUdA	0.50	U	1	1.0	0.50	0.20	ug/kg	10/18/2021 1543
PFOS	0.50	U	1	1.0	0.50	0.20	ug/kg	10/18/2021 1543

Surrogate	Q	% Rec	Acceptance Limit
13C2_4:2FTS		93	50-150
13C2_6:2FTS		87	50-150
13C2_8:2FTS		93	50-150
13C2_PFDoA		88	50-150
13C2_PFTeDA		95	50-150
13C3_PFBS		86	50-150
13C3_PFHxS		90	50-150
13C4_PFBA		87	50-150
13C4_PFHpA		90	50-150
13C5_PFHxA		87	50-150
13C5_PFPeA		89	50-150
13C6_PFDA		86	50-150
13C7_PFUdA		90	50-150
13C8_PFOA		88	50-150

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

PFAS by LC/MS/MS - MB

Sample ID: WQ18071-001
Batch: 18071
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Solid
Prep Method: SOP SPE
Prep Date: 10/07/2021 1828

Surrogate	Q	% Rec	Acceptance Limit
13C8_PFOS		88	50-150
13C8_PFOSA		93	50-150
13C9_PFNA		87	50-150
d5-EtFOSAA		97	50-150
d-MeFOSA		101	50-150
d3-MeFOSAA		102	50-150

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

PFAS by LC/MS/MS - LCS

Sample ID: WQ18071-002
Batch: 18071
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Solid
Prep Method: SOP SPE
Prep Date: 10/07/2021 1828

Parameter	Spike Amount (ug/kg)	Result (ug/kg)	Q	Dil	% Rec	%Rec Limit	Analysis Date
8:2 FTS	1.9	1.4		1	74	65-137	10/08/2021 2024
6:2 FTS	1.9	1.9		1	100	64-140	10/08/2021 2024
4:2 FTS	1.9	1.7		1	92	62-145	10/08/2021 2024
EtFOSAA	2.0	1.9		1	95	61-139	10/08/2021 2024
MeFOSA	2.0	1.9		1	93	70-150	10/08/2021 2024
MeFOSAA	2.0	1.8		1	88	63-144	10/08/2021 2024
PFBS	1.8	1.6		1	89	72-128	10/08/2021 2024
PFDS	1.9	1.9		1	97	59-134	10/08/2021 2024
PFHpS	1.9	1.6		1	84	70-132	10/08/2021 2024
PFNS	1.9	1.7		1	89	69-125	10/08/2021 2024
PFOSA	2.0	2.0		1	98	67-137	10/08/2021 2024
PFPeS	1.9	1.8		1	96	73-123	10/08/2021 2024
PFHxS	1.8	1.7		1	91	67-130	10/08/2021 2024
PFBA	2.0	1.9		1	93	71-135	10/08/2021 2024
PFDA	2.0	1.9		1	97	69-133	10/08/2021 2024
PFDoA	2.0	2.0		1	100	69-135	10/08/2021 2024
PFHpA	2.0	2.1		1	107	71-131	10/08/2021 2024
PFHxA	2.0	1.9		1	95	70-132	10/08/2021 2024
PFNA	2.0	2.0		1	102	72-129	10/08/2021 2024
PFOA	2.0	1.9		1	94	69-133	10/08/2021 2024
PFPeA	2.0	2.0		1	99	69-132	10/08/2021 2024
PFTeDA	2.0	2.0		1	101	69-133	10/08/2021 2024
PFTrDA	2.0	1.9		1	93	66-139	10/08/2021 2024
PFUdA	2.0	1.8		1	90	64-136	10/08/2021 2024
PFOS	1.9	1.9		1	101	68-136	10/08/2021 2024

Surrogate	Q	% Rec	Acceptance Limit
13C2_4:2FTS		92	50-150
13C2_6:2FTS		90	50-150
13C2_8:2FTS		84	50-150
13C2_PFDoA		85	50-150
13C2_PFTeDA		83	50-150
13C3_PFBS		90	50-150
13C3_PFHxS		85	50-150
13C4_PFBA		90	50-150
13C4_PFHpA		85	50-150
13C5_PFHxA		87	50-150
13C5_PFPeA		88	50-150
13C6_PFDA		86	50-150
13C7_PFUdA		87	50-150
13C8_PFOA		85	50-150

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

PFAS by LC/MS/MS - LCS

Sample ID: WQ18071-002
Batch: 18071
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Solid
Prep Method: SOP SPE
Prep Date: 10/07/2021 1828

Surrogate	Q	% Rec	Acceptance Limit
13C8_PFOS		82	50-150
13C8_PFOSA		89	50-150
13C9_PFNA		87	50-150
d5-EtFOSAA		91	50-150
d-MeFOSA		90	50-150
d3-MeFOSAA		89	50-150

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

SPLP PFAS - MB

Sample ID: WQ21420-001
Batch: 21420
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Solid
Prep Method: 1312/PFAS
Prep Date: 11/05/2021 1045 Leachate Date: 10/29/2021 1851

Parameter	Result	Q	Dil	LOQ	LOD	DL	Units	Analysis Date
8:2 FTS	290		1	80	40	20	ng/L	11/06/2021 2329
6:2 FTS	290		1	80	40	20	ng/L	11/06/2021 2329
4:2 FTS	290		1	80	40	20	ng/L	11/06/2021 2329
EtFOSAA	290		1	80	40	20	ng/L	11/06/2021 2329
MeFOSA	290		1	160	80	40	ng/L	11/06/2021 2329
MeFOSAA	290		1	80	40	20	ng/L	11/06/2021 2329
PFBS	290		1	40	20	10	ng/L	11/06/2021 2329
PFDS	290		1	40	20	10	ng/L	11/06/2021 2329
PFHpS	290		1	40	20	10	ng/L	11/06/2021 2329
PFNS	290		1	40	20	10	ng/L	11/06/2021 2329
PFOSA	290		1	40	20	10	ng/L	11/06/2021 2329
PFPeS	290		1	40	20	10	ng/L	11/06/2021 2329
PFHxS	290		1	40	20	10	ng/L	11/06/2021 2329
PFBA	290		1	40	20	10	ng/L	11/06/2021 2329
PFDA	290		1	40	20	10	ng/L	11/06/2021 2329
PFDoA	290		1	40	20	10	ng/L	11/06/2021 2329
PFHpA	290		1	40	20	10	ng/L	11/06/2021 2329
PFHxA	290		1	40	20	10	ng/L	11/06/2021 2329
PFNA	290		1	40	20	10	ng/L	11/06/2021 2329
PFOA	290		1	40	20	10	ng/L	11/06/2021 2329
PFPeA	290		1	40	20	10	ng/L	11/06/2021 2329
PFTeDA	290		1	40	20	10	ng/L	11/06/2021 2329
PFTrDA	290		1	40	20	10	ng/L	11/06/2021 2329
PFUdA	290		1	40	20	10	ng/L	11/06/2021 2329
PFOS	290		1	40	20	10	ng/L	11/06/2021 2329

Surrogate	Q	% Rec	Acceptance Limit
13C2_4:2FTS		130	50-150
13C2_6:2FTS		116	50-150
13C2_8:2FTS		118	50-150
13C2_PFDoA		113	50-150
13C2_PFTeDA		117	50-150
13C3_PFBS		123	50-150
13C3_PFHxS		122	50-150
13C4_PFBA		125	50-150
13C4_PFHpA		123	50-150
13C5_PFHxA		126	50-150
13C5_PFPeA		127	50-150
13C6_PFDA		123	50-150
13C7_PFUdA		122	50-150
13C8_PFOA		126	50-150

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

SPLP PFAS - MB

Sample ID: WQ21420-001
Batch: 21420
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Solid
Prep Method: 1312/PFAS
Prep Date: 11/05/2021 1045 Leachate Date: 10/29/2021 1851

Surrogate	Q	% Rec	Acceptance Limit
13C8_PFOS		125	50-150
13C8_PFOSA		127	50-150
13C9_PFNA		133	50-150
d5-EtFOSAA		128	50-150
d-MeFOSA		99	50-150
d3-MeFOSAA		129	50-150

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

SPLP PFAS - LCS

Sample ID: WQ21420-002
Batch: 21420
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Solid
Prep Method: 1312/PFAS
Prep Date: 11/05/2021 1045 Leachate Date: 10/29/2021 1851

Parameter	Spike Amount (ng/L)	Result (ng/L)	Q	Dil	% Rec	%Rec Limit	Analysis Date
8:2 FTS	150	150		1	101	67-138	11/06/2021 2350
6:2 FTS	150	140		1	90	64-140	11/06/2021 2350
4:2 FTS	150	160		1	106	63-143	11/06/2021 2350
EtFOSAA	160	130		1	84	61-135	11/06/2021 2350
MeFOSA	160	160		1	103	68-141	11/06/2021 2350
MeFOSAA	160	160		1	102	65-136	11/06/2021 2350
PFBS	140	130		1	91	72-130	11/06/2021 2350
PFDS	150	130		1	85	53-142	11/06/2021 2350
PFHpS	150	150		1	96	69-134	11/06/2021 2350
PFNS	150	150		1	100	69-127	11/06/2021 2350
PFOSA	160	160		1	100	67-137	11/06/2021 2350
PFPeS	150	140		1	96	71-127	11/06/2021 2350
PFHxS	150	140		1	98	68-131	11/06/2021 2350
PFBA	160	150		1	96	73-129	11/06/2021 2350
PFDA	160	140		1	89	71-129	11/06/2021 2350
PFDoA	160	170		1	105	72-134	11/06/2021 2350
PFHpA	160	150		1	96	72-130	11/06/2021 2350
PFHxA	160	160		1	97	72-129	11/06/2021 2350
PFNA	160	150		1	97	69-130	11/06/2021 2350
PFOA	160	170		1	109	71-133	11/06/2021 2350
PFPeA	160	160		1	98	72-129	11/06/2021 2350
PFTeDA	160	170		1	106	71-132	11/06/2021 2350
PFTrDA	160	160		1	98	65-144	11/06/2021 2350
PFUdA	160	160		1	101	69-133	11/06/2021 2350
PFOS	150	160		1	107	65-140	11/06/2021 2350

Surrogate	Q	% Rec	Acceptance Limit
13C2_4:2FTS		116	50-150
13C2_6:2FTS		116	50-150
13C2_8:2FTS		114	50-150
13C2_PFDoA		111	50-150
13C2_PFTeDA		111	50-150
13C3_PFBS		117	50-150
13C3_PFHxS		121	50-150
13C4_PFBA		123	50-150
13C4_PFHpA		120	50-150
13C5_PFHxA		119	50-150
13C5_PFPeA		118	50-150
13C6_PFDA		122	50-150
13C7_PFUdA		117	50-150
13C8_PFOA		124	50-150

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

SPLP PFAS - LCS

Sample ID: WQ21420-002
Batch: 21420
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Solid
Prep Method: 1312/PFAS
Prep Date: 11/05/2021 1045 Leachate Date: 10/29/2021 1851

Surrogate	Q	% Rec	Acceptance Limit
13C8_PFOS		121	50-150
13C8_PFOSA		118	50-150
13C9_PFNA		128	50-150
d5-EtFOSAA		132	50-150
d-MeFOSA		99	50-150
d3-MeFOSAA		134	50-150

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

SPLP PFAS - MS

Sample ID: WJ07033-003MS
Batch: 21420
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Solid
Prep Method: 1312/PFAS
Prep Date: 11/05/2021 1045 Leachate Date: 10/29/2021 1851

Parameter	Sample Amount (ng/L)	Spike Amount (ng/L)	Result (ng/L)	Q	Dil	% Rec	%Rec Limit	Analysis Date
8:2 FTS	ND	150	180		1	115	67-138	11/07/2021 0115
6:2 FTS	ND	150	150		1	98	64-140	11/07/2021 0115
4:2 FTS	ND	150	150		1	98	63-143	11/07/2021 0115
EtFOSAA	ND	160	170		1	109	61-135	11/07/2021 0115
MeFOSA	ND	160	200		1	125	68-141	11/07/2021 0115
MeFOSAA	ND	160	150		1	95	65-136	11/07/2021 0115
PFBS	ND	140	130		1	92	72-130	11/07/2021 0115
PFDS	ND	150	94		1	61	53-142	11/07/2021 0115
PFHpS	ND	150	160		1	106	69-134	11/07/2021 0115
PFNS	ND	150	130		1	86	69-127	11/07/2021 0115
PFOSA	ND	160	160		1	98	67-137	11/07/2021 0115
PFPeS	ND	150	140		1	96	71-127	11/07/2021 0115
PFHxS	56	150	210		1	108	68-131	11/07/2021 0115
PFBA	ND	160	170		1	106	73-129	11/07/2021 0115
PFDA	ND	160	150		1	95	71-129	11/07/2021 0115
PFDoA	ND	160	160		1	103	72-134	11/07/2021 0115
PFHpA	ND	160	150		1	94	72-130	11/07/2021 0115
PFHxA	10	160	160		1	93	72-129	11/07/2021 0115
PFNA	ND	160	150		1	94	69-130	11/07/2021 0115
PFOA	17	160	170		1	98	71-133	11/07/2021 0115
PFPeA	ND	160	160		1	102	72-129	11/07/2021 0115
PFTeDA	ND	160	170		1	107	71-132	11/07/2021 0115
PFTrDA	ND	160	140		1	85	65-144	11/07/2021 0115
PFUdA	ND	160	150		1	94	69-133	11/07/2021 0115
PFOS	190	150	330		1	93	65-140	11/07/2021 0115

Surrogate	Q	% Rec	Acceptance Limit
13C2_4:2FTS		122	50-150
13C2_6:2FTS		106	50-150
13C2_8:2FTS		104	50-150
13C2_PFDoA		66	50-150
13C2_PFTeDA		61	50-150
13C3_PFBS		114	50-150
13C3_PFHxS		109	50-150
13C4_PFBA		112	50-150
13C4_PFHpA		114	50-150
13C5_PFHxA		116	50-150
13C5_PFPeA		107	50-150
13C6_PFDA		109	50-150
13C7_PFUdA		91	50-150
13C8_PFOA		112	50-150

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

SPLP PFAS - MS

Sample ID: WJ07033-003MS
Batch: 21420
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Solid
Prep Method: 1312/PFAS
Prep Date: 11/05/2021 1045 Leachate Date: 10/29/2021 1851

Surrogate	Q	% Rec	Acceptance Limit
13C8_PFOS		120	50-150
13C8_PFOSA		106	50-150
13C9_PFNA		121	50-150
d5-EtFOSAA		86	50-150
d-MeFOSA		69	50-150
d3-MeFOSAA		111	50-150

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

SPLP PFAS - MSD

Sample ID: WJ07033-003MD
Batch: 21420
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Solid
Prep Method: 1312/PFAS
Prep Date: 11/05/2021 1045 Leachate Date: 10/29/2021 1851

Parameter	Sample Amount (ng/L)	Spike Amount (ng/L)	Result (ng/L)	Q	Dil	% Rec	% RPD	%Rec Limit	% RPD Limit	Analysis Date
8:2 FTS	ND	150	160		1	104	9.9	67-138	30	11/07/2021 0126
6:2 FTS	ND	150	140		1	93	6.2	64-140	30	11/07/2021 0126
4:2 FTS	ND	150	140		1	97	0.96	63-143	30	11/07/2021 0126
EtFOSAA	ND	160	140		1	88	21	61-135	30	11/07/2021 0126
MeFOSA	ND	160	160		1	99	24	68-141	30	11/07/2021 0126
MeFOSAA	ND	160	160		1	97	1.8	65-136	30	11/07/2021 0126
PFBS	ND	140	130		1	89	2.7	72-130	30	11/07/2021 0126
PFDS	ND	150	140	+	1	88	36	53-142	30	11/07/2021 0126
PFHpS	ND	150	150		1	96	9.7	69-134	30	11/07/2021 0126
PFNS	ND	150	160		1	102	16	69-127	30	11/07/2021 0126
PFOSA	ND	160	160		1	101	2.9	67-137	30	11/07/2021 0126
PFPeS	ND	150	160		1	105	8.9	71-127	30	11/07/2021 0126
PFHxS	56	150	180		1	88	14	68-131	30	11/07/2021 0126
PFBA	ND	160	160		1	101	4.7	73-129	30	11/07/2021 0126
PFDA	ND	160	160		1	97	1.6	71-129	30	11/07/2021 0126
PFDoA	ND	160	150		1	94	9.1	72-134	30	11/07/2021 0126
PFHpA	ND	160	140		1	91	4.2	72-130	30	11/07/2021 0126
PFHxA	10	160	170		1	98	5.4	72-129	30	11/07/2021 0126
PFNA	ND	160	150		1	94	0.34	69-130	30	11/07/2021 0126
PFOA	17	160	170		1	99	1.0	71-133	30	11/07/2021 0126
PFPeA	ND	160	150		1	92	10	72-129	30	11/07/2021 0126
PFTeDA	ND	160	160		1	100	7.1	71-132	30	11/07/2021 0126
PFTrDA	ND	160	140		1	90	5.2	65-144	30	11/07/2021 0126
PFUdA	ND	160	150		1	96	2.2	69-133	30	11/07/2021 0126
PFOS	190	150	350		1	106	5.6	65-140	30	11/07/2021 0126

Surrogate	Q	% Rec	Acceptance Limit
13C2_4:2FTS		131	50-150
13C2_6:2FTS		114	50-150
13C2_8:2FTS		112	50-150
13C2_PFDoA		117	50-150
13C2_PFTeDA		113	50-150
13C3_PFBS		118	50-150
13C3_PFHxS		122	50-150
13C4_PFBA		120	50-150
13C4_PFHpA		119	50-150
13C5_PFHxA		117	50-150
13C5_PFPeA		121	50-150
13C6_PFDA		114	50-150
13C7_PFUdA		114	50-150
13C8_PFOA		119	50-150

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

SPLP PFAS - MSD

Sample ID: WJ07033-003MD
Batch: 21420
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Solid
Prep Method: 1312/PFAS
Prep Date: 11/05/2021 1045 Leachate Date: 10/29/2021 1851

Surrogate	Q	% Rec	Acceptance Limit
13C8_PFOS		117	50-150
13C8_PFOSA		118	50-150
13C9_PFNA		121	50-150
d5-EtFOSAA		130	50-150
d-MeFOSA		104	50-150
d3-MeFOSAA		134	50-150

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

Chain of Custody

and

Miscellaneous Documents

Client ID: 4367 - Pace Analytical Services

SDG: 221093037

PM: EPM

Pace Analytical

Chain of Custody

Workorder: ISM Workorder Name: Elelson Owner Received Date: 9/28/2021 Requested By: 10/8/2021

Report To: Subcontract To: Requested Analysis

Kathy Smith
Pace Analytical
106 Vantage Point Drive
Columbia SC, 29223
803-227-2704
kathy.smith@pacelabs.com

Pace Golf Coast
7979 Innovation Park Drive,
Baton Rouge, LA 70820

Preserved Containers: NON

ISM Prep

WJ07033

Kits:2

LAB USE ONLY

| Item | Sample ID | Sample Type | Collect Date/Time | Lab ID | Matrix | | |

Pace Analytical

Samples Receipt Checklist (SRC) (ME0018C-15)
Issuing Authority: Pace ENV - WCOL

Revised:9/29/2020
Page 1 of 1

Sample Receipt Checklist (SRC)

Client: ARCADIS Cooler Inspected by/date: JRG2 / 10/07/2021 Lot #: WJ07033

Means of receipt: ☐ Pace ☐ Client ☐ UPS ☑ FedEx ☐ Other:

☐ Yes	☑ No		1. Were custody seals present on the cooler?
☐ Yes	☐ No	☑ NA	2. If custody seals were present, were they intact and unbroken?

pH Strip ID: NA Chlorine Strip ID: NA Tested by: NA

Original temperature upon receipt / Derived (Corrected) temperature upon receipt %Solid Snap-Cup ID: 21-1928

4.1 / 4.1 °C NA / NA °C NA / NA °C NA / NA °C

Method: ☐ Temperature Blank ☑ Against Bottles IR Gun ID: 5 IR Gun Correction Factor: 0 °C

Method of coolant: ☑ Wet Ice ☐ Ice Packs ☐ Dry Ice ☐ None

☐ Yes	☐ No	☑ NA	3. If temperature of any cooler exceeded 6.0°C, was Project Manager Notified? PM was Notified by: phone / email / face-to-face (circle one).
☑ Yes	☐ No	☐ NA	4. Is the commercial courier's packing slip attached to this form?
☑ Yes	☐ No		5. Were proper custody procedures (relinquished/received) followed?
☑ Yes	☐ No		6. Were sample IDs listed on the COC?
☑ Yes	☐ No		7. Were sample IDs listed on all sample containers?
☑ Yes	☐ No		8. Was collection date & time listed on the COC?
☑ Yes	☐ No		9. Was collection date & time listed on all sample containers?
☑ Yes	☐ No		10. Did all container label information (ID, date, time) agree with the COC?
☑ Yes	☐ No		11. Were tests to be performed listed on the COC?
☑ Yes	☐ No		12. Did all samples arrive in the proper containers for each test and/or in good condition (unbroken, lids on, etc.)?
☑ Yes	☐ No		13. Was adequate sample volume available?
☐ Yes	☑ No		14. Were all samples received within ½ the holding time or 48 hours, whichever comes first?
☐ Yes	☑ No		15. Were any samples containers missing/excess (circle one) samples Not listed on COC?
☐ Yes	☐ No	☑ NA	16. For VOA and RSK-175 samples, were bubbles present >"pea-size" (¼"or 6mm in diameter) in any of the VOA vials?
☐ Yes	☐ No	☑ NA	17. Were all DRO/metals/nutrient samples received at a pH of < 2?
☐ Yes	☐ No	☑ NA	18. Were all cyanide samples received at a pH > 12 and sulfide samples received at a pH > 9?
☐ Yes	☐ No	☑ NA	19. Were all applicable NH_3/TKN/cyanide/phenol/625.1/608.3 (< 0.5mg/L) samples free of residual chlorine?
☐ Yes	☐ No	☑ NA	20. Were client remarks/requests (i.e. requested dilutions, MS/MSD designations, etc…) correctly transcribed from the COC into the comment section in LIMS?
☐ Yes	☑ No		21. Was the quote number listed on the container label? If yes, Quote #

Sample Preservation (Must be completed for any sample(s) incorrectly preserved or with headspace.)

Sample(s) NA were received incorrectly preserved and were adjusted accordingly in sample receiving with NA mL of circle one: H2SO4, HNO3, HCl, NaOH using SR # NA.
Time of preservation NA. If more than one preservative is needed, please note in the comments below.

Sample(s) NA were received with bubbles >6 mm in diameter.

Samples(s) NA were received with TRC > 0.5 mg/L (If #19 is *no*) and were adjusted accordingly in sample receiving with sodium thiosulfate ($Na_2S_2O_3$) with Shealy ID: NA.

SR barcode labels applied by: JRG2 Date: 10/07/2021

Comments:

Report of Analysis

Arcadis U.S., Inc.
630 Plaza Drive
Suite 600
Highlands Ranch, CO 80129
Attention: Joseph Quinnan

Project Name: Eielson AFB

Project Number: 30030317

Lot Number:**WK18026**

Date Completed:11/30/2021

12/01/2021 9:38 AM
Approved and released by:
Project Manager II: **Kathy E. Smith**

The electronic signature above is the equivalent of a handwritten signature.
This report shall not be reproduced, except in its entirety, without the written approval of Pace Analytical Services, LLC.

Pace Analytical Services, LLC (*formerly Shealy Environmental Services, Inc.*)
106 Vantage Point Drive West Columbia, SC 29172
Tel: 803-791-9700 Fax: 803-791-9111 www.pacelabs.com

Case Narrative
Arcadis U.S., Inc.
Lot Number: WK18026

This Report of Analysis contains the analytical result(s) for the sample(s) listed on the Sample Summary following this Case Narrative. The sample receiving date is documented in the header information associated with each sample.

All results listed in this report relate only to the samples that are contained within this report.

Sample receipt, sample analysis, and data review have been performed in accordance with the Pace Quality Assurance Management Plan (QAMP), applicable Shealy standard operating procedures (SOPs), the 2003 NELAC standard, and Shealy policies. Additionally, the DoD QSM version 5.3 has been followed for these samples, and specifically Table B-15 was followed for all PFAS samples. Any exceptions to the QAMP, SOPs, NELAC standards, the DoD QSM, or policies are qualified on the results page or discussed below.

All QC associated with these samples was in compliance with DOD QSM 5.3 table B-15 and our PFAS SOP.

Correction factors (CF) are used to calculate the original sample concentration. The CF is the inverse of the concentration factor (sample volume / extract final volume) times the dilution factor (DF). For undiluted analysis. For undiluted analysis, the extract is prepared for injection by adding 182 uL of sample extract + 8 uL of reagent water + 10 uL of internal standard solution to a polypropylene autosampler vial. An extra correction factor of 0.91 (182 uL / 200 uL = 0.91) applies. The CF is calculated as follows:

CF = DF * FV / Vo

FV is volume of extract (mL)
Vo is initial sample volume (mL)
DF is dilution factor. For undiluted analysis, DF = 1/0.91.

Sample concentration for aqueous samples:
Concentration (ng/L) = Cs*CF,

$$C_s = \frac{\left(\frac{(A_s x C_{is})}{A_{is}}\right) - B}{M1}$$

Where

C_s is on column concentration of target analyte in the sample (ng/L)
C_{is} is concentration of internal standard in the sample (ng/L)
A_s is peak response of target analyte in the sample
A_{is} is peak response of internal standard in the sample
M1 is the average RF from ICAL or the slope from linear regression ICAL
B is the y-intercept from the ICAL

Pace is a TNI accredited laboratory; however, the following analyses are currently not listed on our TNI scope of accreditation:

Biological Tissue: All, Non-Potable Water: SGT-HEM EPA 1664B, Silica EPA 200.7, Boron, Calcium, Silicon, Strontium EPA 200.8, Bicarbonate, Carbonate, and Hydroxide Alkalinity SM 2320 B-2011, Fecal Coliform SM 9221 C E-2006 & SM 9222D-2006, Strontium SW-846 6010D, VOC SM 6200 B-2011, Drinking Water: VOC (excluding BTEX, MTBE, Naphthalene, & 1,2-dichloroethane) EPA 524.2, Solid Chemical Material: TOC Walkley-Black.

Where applicable, all soil sample results (including LOQ and DL if requested) are corrected for dry weight unless flagged with a "W" qualifier.

If you have any questions regarding this report please contact the Pace Project Manager listed on the cover page.

The MS/MSD associated with sample WK18026-003 had multiple compounds recovered outside of the acceptance limits. The LCS was recovered within the required acceptance limits; therefore, this demonstrates a matrix effect and data quality is not impacted.

Sample Summary

Arcadis U.S., Inc.

Lot Number: WK18026

Project Name: Eielson AFB

Project Number: 30030317

Sample Number	Sample ID	Matrix	Date Sampled	Date Received
001	ISM-393-Fa	Solid	09/29/2021 1615	11/17/2021
002	ISM-393-Fb	Solid	09/29/2021 1645	11/17/2021
003	ISM-393-Fc	Solid	09/29/2021 1655	11/17/2021

(3 samples)

Detection Summary

Arcadis U.S., Inc.

Lot Number: WK18026

Project Name: Eielson AFB

Project Number: 30030317

Sample	Sample ID	Matrix	Parameter	Method	Result	Q	Units	Page
001	ISM-393-Fa	Solid	8:2 FTS	PFAS by ID	16	H	ug/kg	7
001	ISM-393-Fa	Solid	6:2 FTS	PFAS by ID	3.1	H	ug/kg	7
001	ISM-393-Fa	Solid	PFBS	PFAS by ID	0.72	HJ	ug/kg	7
001	ISM-393-Fa	Solid	PFDS	PFAS by ID	7.0	H	ug/kg	7
001	ISM-393-Fa	Solid	PFHpS	PFAS by ID	0.79	HJ	ug/kg	7
001	ISM-393-Fa	Solid	PFNS	PFAS by ID	7.1	H	ug/kg	7
001	ISM-393-Fa	Solid	PFOSA	PFAS by ID	8.5	H	ug/kg	7
001	ISM-393-Fa	Solid	PFPeS	PFAS by ID	0.98	HJ	ug/kg	7
001	ISM-393-Fa	Solid	PFHxS	PFAS by ID	14	H	ug/kg	7
001	ISM-393-Fa	Solid	PFDA	PFAS by ID	1.3	H	ug/kg	7
001	ISM-393-Fa	Solid	PFDoA	PFAS by ID	1.6	H	ug/kg	7
001	ISM-393-Fa	Solid	PFHpA	PFAS by ID	0.36	HJ	ug/kg	7
001	ISM-393-Fa	Solid	PFHxA	PFAS by ID	2.7	H	ug/kg	7
001	ISM-393-Fa	Solid	PFNA	PFAS by ID	0.23	HJ	ug/kg	7
001	ISM-393-Fa	Solid	PFOA	PFAS by ID	1.9	H	ug/kg	7
001	ISM-393-Fa	Solid	PFPeA	PFAS by ID	0.44	HJ	ug/kg	7
001	ISM-393-Fa	Solid	PFTeDA	PFAS by ID	0.39	HJ	ug/kg	7
001	ISM-393-Fa	Solid	PFTrDA	PFAS by ID	0.57	HJ	ug/kg	7
001	ISM-393-Fa	Solid	PFUdA	PFAS by ID	2.0	H	ug/kg	7
001	ISM-393-Fa	Solid	PFOS	PFAS by ID	300		ug/kg	7
001	ISM-393-Fa	Solid	8:2 FTS	PFAS by ID	660	H	ng/L	9
001	ISM-393-Fa	Solid	6:2 FTS	PFAS by ID	140	H	ng/L	9
001	ISM-393-Fa	Solid	PFBS	PFAS by ID	13	HJ	ng/L	9
001	ISM-393-Fa	Solid	PFDS	PFAS by ID	19	HJ	ng/L	9
001	ISM-393-Fa	Solid	PFHpS	PFAS by ID	10	HJ	ng/L	9
001	ISM-393-Fa	Solid	PFNS	PFAS by ID	110	H	ng/L	9
001	ISM-393-Fa	Solid	PFOSA	PFAS by ID	290	H	ng/L	9
001	ISM-393-Fa	Solid	PFPeS	PFAS by ID	28	HJ	ng/L	9
001	ISM-393-Fa	Solid	PFHxS	PFAS by ID	420	H	ng/L	9
001	ISM-393-Fa	Solid	PFDA	PFAS by ID	39	HJ	ng/L	9
001	ISM-393-Fa	Solid	PFHpA	PFAS by ID	16	HJ	ng/L	9
001	ISM-393-Fa	Solid	PFHxA	PFAS by ID	140	H	ng/L	9
001	ISM-393-Fa	Solid	PFNA	PFAS by ID	11	HJ	ng/L	9
001	ISM-393-Fa	Solid	PFOA	PFAS by ID	84	H	ng/L	9
001	ISM-393-Fa	Solid	PFPeA	PFAS by ID	21	HJ	ng/L	9
001	ISM-393-Fa	Solid	PFUdA	PFAS by ID	24	HJ	ng/L	9
001	ISM-393-Fa	Solid	PFOS	PFAS by ID	12000		ng/L	9
002	ISM-393-Fb	Solid	8:2 FTS	PFAS by ID	15	H	ug/kg	11
002	ISM-393-Fb	Solid	6:2 FTS	PFAS by ID	2.4	H	ug/kg	11
002	ISM-393-Fb	Solid	PFBS	PFAS by ID	0.64	HJ	ug/kg	11
002	ISM-393-Fb	Solid	PFDS	PFAS by ID	6.7	H	ug/kg	11
002	ISM-393-Fb	Solid	PFHpS	PFAS by ID	0.57	HJ	ug/kg	11
002	ISM-393-Fb	Solid	PFNS	PFAS by ID	6.5	H	ug/kg	11

Sample	Sample ID	Matrix	Parameter	Method	Result	Q	Units	Page
002	ISM-393-Fb	Solid	PFOSA	PFAS by ID	8.3	H	ug/kg	11
002	ISM-393-Fb	Solid	PFPeS	PFAS by ID	0.95	HJ	ug/kg	11
002	ISM-393-Fb	Solid	PFHxS	PFAS by ID	13	H	ug/kg	11
002	ISM-393-Fb	Solid	PFDA	PFAS by ID	1.2	H	ug/kg	11
002	ISM-393-Fb	Solid	PFDoA	PFAS by ID	1.6	H	ug/kg	11
002	ISM-393-Fb	Solid	PFHpA	PFAS by ID	0.35	HJ	ug/kg	11
002	ISM-393-Fb	Solid	PFHxA	PFAS by ID	2.6	H	ug/kg	11
002	ISM-393-Fb	Solid	PFNA	PFAS by ID	0.24	HJ	ug/kg	11
002	ISM-393-Fb	Solid	PFOA	PFAS by ID	1.9	H	ug/kg	11
002	ISM-393-Fb	Solid	PFPeA	PFAS by ID	0.43	HJ	ug/kg	11
002	ISM-393-Fb	Solid	PFTeDA	PFAS by ID	0.36	HJ	ug/kg	11
002	ISM-393-Fb	Solid	PFTrDA	PFAS by ID	0.47	HJ	ug/kg	11
002	ISM-393-Fb	Solid	PFUdA	PFAS by ID	1.9	H	ug/kg	11
002	ISM-393-Fb	Solid	PFOS	PFAS by ID	260		ug/kg	11
002	ISM-393-Fb	Solid	8:2 FTS	PFAS by ID	600	H	ng/L	13
002	ISM-393-Fb	Solid	6:2 FTS	PFAS by ID	110	H	ng/L	13
002	ISM-393-Fb	Solid	PFBS	PFAS by ID	11	HJ	ng/L	13
002	ISM-393-Fb	Solid	PFDS	PFAS by ID	25	HJ	ng/L	13
002	ISM-393-Fb	Solid	PFHpS	PFAS by ID	11	HJ	ng/L	13
002	ISM-393-Fb	Solid	PFNS	PFAS by ID	120	H	ng/L	13
002	ISM-393-Fb	Solid	PFOSA	PFAS by ID	290	H	ng/L	13
002	ISM-393-Fb	Solid	PFPeS	PFAS by ID	23	HJ	ng/L	13
002	ISM-393-Fb	Solid	PFHxS	PFAS by ID	380	H	ng/L	13
002	ISM-393-Fb	Solid	PFDA	PFAS by ID	40	H	ng/L	13
002	ISM-393-Fb	Solid	PFDoA	PFAS by ID	15	HJ	ng/L	13
002	ISM-393-Fb	Solid	PFHpA	PFAS by ID	14	HJ	ng/L	13
002	ISM-393-Fb	Solid	PFHxA	PFAS by ID	120	H	ng/L	13
002	ISM-393-Fb	Solid	PFOA	PFAS by ID	79	H	ng/L	13
002	ISM-393-Fb	Solid	PFPeA	PFAS by ID	19	HJ	ng/L	13
002	ISM-393-Fb	Solid	PFUdA	PFAS by ID	26	HJ	ng/L	13
002	ISM-393-Fb	Solid	PFOS	PFAS by ID	11000		ng/L	13
003	ISM-393-Fc	Solid	8:2 FTS	PFAS by ID	26	H	ug/kg	15
003	ISM-393-Fc	Solid	6:2 FTS	PFAS by ID	3.6	H	ug/kg	15
003	ISM-393-Fc	Solid	EtFOSAA	PFAS by ID	0.62	HJ	ug/kg	15
003	ISM-393-Fc	Solid	PFBS	PFAS by ID	0.80	HJ	ug/kg	15
003	ISM-393-Fc	Solid	PFDS	PFAS by ID	11	H	ug/kg	15
003	ISM-393-Fc	Solid	PFHpS	PFAS by ID	0.79	HJ	ug/kg	15
003	ISM-393-Fc	Solid	PFNS	PFAS by ID	11	H	ug/kg	15
003	ISM-393-Fc	Solid	PFOSA	PFAS by ID	12	H	ug/kg	15
003	ISM-393-Fc	Solid	PFPeS	PFAS by ID	1.3	H	ug/kg	15
003	ISM-393-Fc	Solid	PFHxS	PFAS by ID	18	H	ug/kg	15
003	ISM-393-Fc	Solid	PFBA	PFAS by ID	0.23	HJ	ug/kg	15
003	ISM-393-Fc	Solid	PFDA	PFAS by ID	1.9	H	ug/kg	15
003	ISM-393-Fc	Solid	PFDoA	PFAS by ID	2.5	H	ug/kg	15
003	ISM-393-Fc	Solid	PFHpA	PFAS by ID	0.45	HJ	ug/kg	15
003	ISM-393-Fc	Solid	PFHxA	PFAS by ID	3.6	H	ug/kg	15
003	ISM-393-Fc	Solid	PFNA	PFAS by ID	0.35	HJ	ug/kg	15
003	ISM-393-Fc	Solid	PFOA	PFAS by ID	2.7	H	ug/kg	15

Sample	Sample ID	Matrix	Parameter	Method	Result	Q	Units	Page
003	ISM-393-Fc	Solid	PFPeA	PFAS by ID	0.57	HJ	ug/kg	15
003	ISM-393-Fc	Solid	PFTeDA	PFAS by ID	0.52	HJ	ug/kg	15
003	ISM-393-Fc	Solid	PFTrDA	PFAS by ID	0.75	HJ	ug/kg	15
003	ISM-393-Fc	Solid	PFUdA	PFAS by ID	2.5	H	ug/kg	15
003	ISM-393-Fc	Solid	PFOS	PFAS by ID	430		ug/kg	15
003	ISM-393-Fc	Solid	8:2 FTS	PFAS by ID	770	HS	ng/L	17
003	ISM-393-Fc	Solid	6:2 FTS	PFAS by ID	150	H	ng/L	17
003	ISM-393-Fc	Solid	PFBS	PFAS by ID	13	HJ	ng/L	17
003	ISM-393-Fc	Solid	PFDS	PFAS by ID	27	HJ	ng/L	17
003	ISM-393-Fc	Solid	PFHpS	PFAS by ID	11	HJ	ng/L	17
003	ISM-393-Fc	Solid	PFNS	PFAS by ID	160	H	ng/L	17
003	ISM-393-Fc	Solid	PFOSA	PFAS by ID	400	H	ng/L	17
003	ISM-393-Fc	Solid	PFPeS	PFAS by ID	28	HJ	ng/L	17
003	ISM-393-Fc	Solid	PFHxS	PFAS by ID	460	HS	ng/L	17
003	ISM-393-Fc	Solid	PFBA	PFAS by ID	13	HJ	ng/L	17
003	ISM-393-Fc	Solid	PFDA	PFAS by ID	64	H	ng/L	17
003	ISM-393-Fc	Solid	PFHpA	PFAS by ID	19	HJ	ng/L	17
003	ISM-393-Fc	Solid	PFHxA	PFAS by ID	150	H	ng/L	17
003	ISM-393-Fc	Solid	PFNA	PFAS by ID	15	HJ	ng/L	17
003	ISM-393-Fc	Solid	PFOA	PFAS by ID	100	H	ng/L	17
003	ISM-393-Fc	Solid	PFPeA	PFAS by ID	22	HJ	ng/L	17
003	ISM-393-Fc	Solid	PFUdA	PFAS by ID	28	HJ	ng/L	17
003	ISM-393-Fc	Solid	PFOS	PFAS by ID	15000		ng/L	17

(114 detections)

PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: WK18026-001
Description: ISM-393-Fa | Matrix: Solid
Date Sampled: 09/29/2021 1615 | Project Name: Eielson AFB | % Solids: 98.3 11/29/2021 2339
Date Received: 11/17/2021 | Project Number: 30030317

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch
1	SOP SPE	PFAS by ID SOP QSM B-15	1	11/21/2021 2139	JJG	11/19/2021 1133	23092
2	SOP SPE	PFAS by ID SOP QSM B-15	5	11/22/2021 1702	JJG	11/19/2021 1133	23092

Parameter	CAS Number	Analytical Method	Result	Q	LOQ	LOD	DL	Units	Run
1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS)	39108-34-4	PFAS by ID SOP	16	H	2.0	1.0	0.50	ug/kg	1
1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS)	27619-97-2	PFAS by ID SOP	3.1	H	2.0	1.0	0.50	ug/kg	1
1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS)	757124-72-4	PFAS by ID SOP	1.0	UH	2.0	1.0	0.50	ug/kg	1
N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA)	2991-50-6	PFAS by ID SOP	1.0	UH	2.0	1.0	0.50	ug/kg	1
N-methylperfluoro-1-octanesulfonamide (MeFOSA)	31506-32-8	PFAS by ID SOP	1.0	UH	2.0	1.0	0.50	ug/kg	1
N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA)	2355-31-9	PFAS by ID SOP	1.0	UH	2.0	1.0	0.50	ug/kg	1
Perfluoro-1-butanesulfonic acid (PFBS)	375-73-5	PFAS by ID SOP	0.72	HJ	1.0	0.50	0.20	ug/kg	1
Perfluoro-1-decanesulfonic acid (PFDS)	335-77-3	PFAS by ID SOP	7.0	H	1.0	0.50	0.20	ug/kg	1
Perfluoro-1-heptanesulfonic acid (PFHpS)	375-92-8	PFAS by ID SOP	0.79	HJ	1.0	0.50	0.20	ug/kg	1
Perfluoro-1-nonanesulfonic acid (PFNS)	68259-12-1	PFAS by ID SOP	7.1	H	1.0	0.50	0.20	ug/kg	1
Perfluoro-1-octanesulfonamide (PFOSA)	754-91-6	PFAS by ID SOP	8.5	H	1.0	0.50	0.20	ug/kg	1
Perfluoro-1-pentanesulfonic acid (PFPeS)	2706-91-4	PFAS by ID SOP	0.98	HJ	1.0	0.50	0.20	ug/kg	1
Perfluorohexanesulfonic acid (PFHxS)	355-46-4	PFAS by ID SOP	14	H	1.0	0.50	0.20	ug/kg	1
Perfluoro-n-butanoic acid (PFBA)	375-22-4	PFAS by ID SOP	0.50	UH	1.0	0.50	0.20	ug/kg	1
Perfluoro-n-decanoic acid (PFDA)	335-76-2	PFAS by ID SOP	1.3	H	1.0	0.50	0.20	ug/kg	1
Perfluoro-n-dodecanoic acid (PFDoA)	307-55-1	PFAS by ID SOP	1.6	H	1.0	0.50	0.20	ug/kg	1
Perfluoro-n-heptanoic acid (PFHpA)	375-85-9	PFAS by ID SOP	0.36	HJ	1.0	0.50	0.20	ug/kg	1
Perfluoro-n-hexanoic acid (PFHxA)	307-24-4	PFAS by ID SOP	2.7	H	1.0	0.50	0.20	ug/kg	1
Perfluoro-n-nonanoic acid (PFNA)	375-95-1	PFAS by ID SOP	0.23	HJ	1.0	0.50	0.20	ug/kg	1
Perfluoro-n-octanoic acid (PFOA)	335-67-1	PFAS by ID SOP	1.9	H	1.0	0.50	0.20	ug/kg	1
Perfluoro-n-pentanoic acid (PFPeA)	2706-90-3	PFAS by ID SOP	0.44	HJ	1.0	0.50	0.20	ug/kg	1
Perfluoro-n-tetradecanoic acid (PFTeDA)	376-06-7	PFAS by ID SOP	0.39	HJ	1.0	0.50	0.20	ug/kg	1
Perfluoro-n-tridecanoic acid (PFTrDA)	72629-94-8	PFAS by ID SOP	0.57	HJ	1.0	0.50	0.20	ug/kg	1
Perfluoro-n-undecanoic acid (PFUdA)	2058-94-8	PFAS by ID SOP	2.0	H	1.0	0.50	0.20	ug/kg	1
Perfluorooctanesulfonic acid (PFOS)	1763-23-1	PFAS by ID SOP	300		5.0	2.5	1.0	ug/kg	2

Surrogate	Run 1 Q	Run 1 % Recovery	Run 1 Acceptance Limits	Run 2 Q	Run 2 % Recovery	Run 2 Acceptance Limits
13C2_4:2FTS	H	103	50-150		101	50-150
13C2_6:2FTS	H	89	50-150		102	50-150
13C2_8:2FTS	H	114	50-150		100	50-150
13C2_PFDoA	H	86	50-150		97	50-150
13C2_PFTeDA	H	84	50-150		99	50-150
13C3_PFBS	H	98	50-150		100	50-150
13C3_PFHxS	H	102	50-150		109	50-150
13C4_PFBA	H	94	50-150		98	50-150
13C4_PFHpA	H	91	50-150		97	50-150
13C5_PFHxA	H	90	50-150		100	50-150
13C5_PFPeA	H	92	50-150		102	50-150
13C6_PFDA	H	91	50-150		96	50-150
13C7_PFUdA	H	91	50-150		105	50-150
13C8_PFOA	H	90	50-150		97	50-150
13C8_PFOS	H	86	50-150		97	50-150
13C8_PFOSA	H	101	50-150		107	50-150

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

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PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.		Laboratory ID: WK18026-001	
Description: ISM-393-Fa		Matrix: Solid	
Date Sampled: 09/29/2021 1615	Project Name: Eielson AFB	% Solids: 98.3	11/29/2021 2339
Date Received: 11/17/2021	Project Number: 30030317		

Surrogate	Q	Run 1 % Recovery	Acceptance Limits	Q	Run 2 % Recovery	Acceptance Limits
13C9_PFNA	H	86	50-150		101	50-150
d5-EtFOSAA	H	94	50-150		102	50-150
d-MeFOSA	H	84	50-150		90	50-150
d3-MeFOSAA	H	99	50-150		118	50-150

LOQ = Limit of Quantitation	B = Detected in the method blank	E = Quantitation of compound exceeded the calibration range	DL = Detection Limit	Q = Surrogate failure
U = Not detected at or above the LOQ	N = Recovery is out of criteria	P = The RPD between two GC columns exceeds 40%	J = Estimated result < LOQ and ≥ DL	L = LCS/LCSD failure
H = Out of holding time	W = Reported on wet weight basis	LOD = Limit of Detection		S = MS/MSD failure

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SPLP PFAS

Client: Arcadis U.S., Inc. | Laboratory ID: WK18026-001
Description: ISM-393-Fa | Matrix: Solid
Date Sampled: 09/29/2021 1615 | Project Name: Eielson AFB | % Solids: 98.3 11/29/2021 2339
Date Received: 11/17/2021 | Project Number: 30030317

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch	Leachate Date
1	1312/PFAS	PFAS by ID SOP QSM B-15	1	11/25/2021 0105	MMM	11/23/2021 1731	23518	11/19/2021 1700
2	1312/PFAS	PFAS by ID SOP QSM B-15	5	11/27/2021 1045	MMM	11/23/2021 1731	23518	11/19/2021 1700

Parameter	CAS Number	Analytical Method	Result	Q	LOQ	LOD	DL	Units	Run
1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS)	39108-34-4	PFAS by ID SOP	660	H	80	40	20	ng/L	1
1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS)	27619-97-2	PFAS by ID SOP	140	H	80	40	20	ng/L	1
1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS)	757124-72-4	PFAS by ID SOP	40	UH	80	40	20	ng/L	1
N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA)	2991-50-6	PFAS by ID SOP	40	UH	80	40	20	ng/L	1
N-methylperfluoro-1-octanesulfonamide (MeFOSA)	31506-32-8	PFAS by ID SOP	80	UH	160	80	40	ng/L	1
N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA)	2355-31-9	PFAS by ID SOP	40	UH	80	40	20	ng/L	1
Perfluoro-1-butanesulfonic acid (PFBS)	375-73-5	PFAS by ID SOP	13	HJ	40	20	10	ng/L	1
Perfluoro-1-decanesulfonic acid (PFDS)	335-77-3	PFAS by ID SOP	19	HJ	40	20	10	ng/L	1
Perfluoro-1-heptanesulfonic acid (PFHpS)	375-92-8	PFAS by ID SOP	10	HJ	40	20	10	ng/L	1
Perfluoro-1-nonanesulfonic acid (PFNS)	68259-12-1	PFAS by ID SOP	110	H	40	20	10	ng/L	1
Perfluoro-1-octanesulfonamide (PFOSA)	754-91-6	PFAS by ID SOP	290	H	40	20	10	ng/L	1
Perfluoro-1-pentanesulfonic acid (PFPeS)	2706-91-4	PFAS by ID SOP	28	HJ	40	20	10	ng/L	1
Perfluorohexanesulfonic acid (PFHxS)	355-46-4	PFAS by ID SOP	420	H	40	20	10	ng/L	1
Perfluoro-n-butanoic acid (PFBA)	375-22-4	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-decanoic acid (PFDA)	335-76-2	PFAS by ID SOP	39	HJ	40	20	10	ng/L	1
Perfluoro-n-dodecanoic acid (PFDoA)	307-55-1	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-heptanoic acid (PFHpA)	375-85-9	PFAS by ID SOP	16	HJ	40	20	10	ng/L	1
Perfluoro-n-hexanoic acid (PFHxA)	307-24-4	PFAS by ID SOP	140	H	40	20	10	ng/L	1
Perfluoro-n-nonanoic acid (PFNA)	375-95-1	PFAS by ID SOP	11	HJ	40	20	10	ng/L	1
Perfluoro-n-octanoic acid (PFOA)	335-67-1	PFAS by ID SOP	84	H	40	20	10	ng/L	1
Perfluoro-n-pentanoic acid (PFPeA)	2706-90-3	PFAS by ID SOP	21	HJ	40	20	10	ng/L	1
Perfluoro-n-tetradecanoic acid (PFTeDA)	376-06-7	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-tridecanoic acid (PFTrDA)	72629-94-8	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-undecanoic acid (PFUdA)	2058-94-8	PFAS by ID SOP	24	HJ	40	20	10	ng/L	1
Perfluorooctanesulfonic acid (PFOS)	1763-23-1	PFAS by ID SOP	12000		200	100	50	ng/L	2

Surrogate	Run 1 Q	Run 1 % Recovery	Run 1 Acceptance Limits	Run 2 Q	Run 2 % Recovery	Run 2 Acceptance Limits
13C2_4:2FTS	H	108	50-150		114	50-150
13C2_6:2FTS	H	103	50-150		99	50-150
13C2_8:2FTS	H	107	50-150		115	50-150
13C2_PFDoA	H	102	50-150		101	50-150
13C2_PFTeDA	H	89	50-150		105	50-150
13C3_PFBS	H	102	50-150		114	50-150
13C3_PFHxS	H	98	50-150		113	50-150
13C4_PFBA	H	101	50-150		111	50-150
13C4_PFHpA	H	104	50-150		119	50-150
13C5_PFHxA	H	96	50-150		106	50-150
13C5_PFPeA	H	100	50-150		111	50-150
13C6_PFDA	H	101	50-150		116	50-150
13C7_PFUdA	H	98	50-150		121	50-150
13C8_PFOA	H	101	50-150		113	50-150
13C8_PFOS	H	93	50-150		106	50-150
13C8_PFOSA	H	109	50-150		111	50-150

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

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SPLP PFAS

Client: Arcadis U.S., Inc.		Laboratory ID: WK18026-001	
Description: ISM-393-Fa		Matrix: Solid	
Date Sampled: 09/29/2021 1615	Project Name: Eielson AFB	% Solids: 98.3	11/29/2021 2339
Date Received: 11/17/2021	Project Number: 30030317		

Surrogate	Q	Run 1 % Recovery	Acceptance Limits	Q	Run 2 % Recovery	Acceptance Limits
13C9_PFNA	H	89	50-150		109	50-150
d5-EtFOSAA	H	105	50-150		93	50-150
d-MeFOSA	H	65	50-150		113	50-150
d3-MeFOSAA	H	103	50-150		111	50-150

LOQ = Limit of Quantitation	B = Detected in the method blank	E = Quantitation of compound exceeded the calibration range	DL = Detection Limit	Q = Surrogate failure
U = Not detected at or above the LOQ	N = Recovery is out of criteria	P = The RPD between two GC columns exceeds 40%	J = Estimated result < LOQ and ≥ DL	L = LCS/LCSD failure
H = Out of holding time	W = Reported on wet weight basis	LOD = Limit of Detection		S = MS/MSD failure

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PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: WK18026-002
Description: ISM-393-Fb | Matrix: Solid
Date Sampled: 09/29/2021 1645 | Project Name: Eielson AFB | % Solids: 99.1 11/29/2021 2339
Date Received: 11/17/2021 | Project Number: 30030317

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch
1	SOP SPE	PFAS by ID SOP QSM B-15	1	11/21/2021 2150	JJG	11/19/2021 1133	23092
2	SOP SPE	PFAS by ID SOP QSM B-15	5	11/22/2021 1713	JJG	11/19/2021 1133	23092

Parameter	CAS Number	Analytical Method	Result	Q	LOQ	LOD	DL	Units	Run
1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS)	39108-34-4	PFAS by ID SOP	15	H	2.0	1.0	0.49	ug/kg	1
1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS)	27619-97-2	PFAS by ID SOP	2.4	H	2.0	1.0	0.49	ug/kg	1
1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS)	757124-72-4	PFAS by ID SOP	1.0	UH	2.0	1.0	0.49	ug/kg	1
N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA)	2991-50-6	PFAS by ID SOP	1.0	UH	2.0	1.0	0.49	ug/kg	1
N-methylperfluoro-1-octanesulfonamide (MeFOSA)	31506-32-8	PFAS by ID SOP	1.0	UH	2.0	1.0	0.49	ug/kg	1
N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA)	2355-31-9	PFAS by ID SOP	1.0	UH	2.0	1.0	0.49	ug/kg	1
Perfluoro-1-butanesulfonic acid (PFBS)	375-73-5	PFAS by ID SOP	0.64	HJ	0.99	0.50	0.20	ug/kg	1
Perfluoro-1-decanesulfonic acid (PFDS)	335-77-3	PFAS by ID SOP	6.7	H	0.99	0.50	0.20	ug/kg	1
Perfluoro-1-heptanesulfonic acid (PFHpS)	375-92-8	PFAS by ID SOP	0.57	HJ	0.99	0.50	0.20	ug/kg	1
Perfluoro-1-nonanesulfonic acid (PFNS)	68259-12-1	PFAS by ID SOP	6.5	H	0.99	0.50	0.20	ug/kg	1
Perfluoro-1-octanesulfonamide (PFOSA)	754-91-6	PFAS by ID SOP	8.3	H	0.99	0.50	0.20	ug/kg	1
Perfluoro-1-pentanesulfonic acid (PFPeS)	2706-91-4	PFAS by ID SOP	0.95	HJ	0.99	0.50	0.20	ug/kg	1
Perfluorohexanesulfonic acid (PFHxS)	355-46-4	PFAS by ID SOP	13	H	0.99	0.50	0.20	ug/kg	1
Perfluoro-n-butanoic acid (PFBA)	375-22-4	PFAS by ID SOP	0.50	UH	0.99	0.50	0.20	ug/kg	1
Perfluoro-n-decanoic acid (PFDA)	335-76-2	PFAS by ID SOP	1.2	H	0.99	0.50	0.20	ug/kg	1
Perfluoro-n-dodecanoic acid (PFDoA)	307-55-1	PFAS by ID SOP	1.6	H	0.99	0.50	0.20	ug/kg	1
Perfluoro-n-heptanoic acid (PFHpA)	375-85-9	PFAS by ID SOP	0.35	HJ	0.99	0.50	0.20	ug/kg	1
Perfluoro-n-hexanoic acid (PFHxA)	307-24-4	PFAS by ID SOP	2.6	H	0.99	0.50	0.20	ug/kg	1
Perfluoro-n-nonanoic acid (PFNA)	375-95-1	PFAS by ID SOP	0.24	HJ	0.99	0.50	0.20	ug/kg	1
Perfluoro-n-octanoic acid (PFOA)	335-67-1	PFAS by ID SOP	1.9	H	0.99	0.50	0.20	ug/kg	1
Perfluoro-n-pentanoic acid (PFPeA)	2706-90-3	PFAS by ID SOP	0.43	HJ	0.99	0.50	0.20	ug/kg	1
Perfluoro-n-tetradecanoic acid (PFTeDA)	376-06-7	PFAS by ID SOP	0.36	HJ	0.99	0.50	0.20	ug/kg	1
Perfluoro-n-tridecanoic acid (PFTrDA)	72629-94-8	PFAS by ID SOP	0.47	HJ	0.99	0.50	0.20	ug/kg	1
Perfluoro-n-undecanoic acid (PFUdA)	2058-94-8	PFAS by ID SOP	1.9	H	0.99	0.50	0.20	ug/kg	1
Perfluorooctanesulfonic acid (PFOS)	1763-23-1	PFAS by ID SOP	260		4.9	2.5	0.99	ug/kg	2

Surrogate	Run 1 Q	Run 1 % Recovery	Run 1 Acceptance Limits	Run 2 Q	Run 2 % Recovery	Run 2 Acceptance Limits
13C2_4:2FTS	H	92	50-150		100	50-150
13C2_6:2FTS	H	84	50-150		104	50-150
13C2_8:2FTS	H	98	50-150		102	50-150
13C2_PFDoA	H	78	50-150		98	50-150
13C2_PFTeDA	H	77	50-150		96	50-150
13C3_PFBS	H	86	50-150		100	50-150
13C3_PFHxS	H	91	50-150		103	50-150
13C4_PFBA	H	86	50-150		100	50-150
13C4_PFHpA	H	83	50-150		98	50-150
13C5_PFHxA	H	79	50-150		101	50-150
13C5_PFPeA	H	87	50-150		99	50-150
13C6_PFDA	H	84	50-150		100	50-150
13C7_PFUdA	H	82	50-150		104	50-150
13C8_PFOA	H	81	50-150		97	50-150
13C8_PFOS	H	81	50-150		101	50-150
13C8_PFOSA	H	91	50-150		113	50-150

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

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PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.		Laboratory ID: WK18026-002	
Description: ISM-393-Fb		Matrix: Solid	
Date Sampled: 09/29/2021 1645	Project Name: Eielson AFB	% Solids: 99.1	11/29/2021 2339
Date Received: 11/17/2021	Project Number: 30030317		

Surrogate	Q	Run 1 % Recovery	Acceptance Limits	Q	Run 2 % Recovery	Acceptance Limits
13C9_PFNA	H	80	50-150		101	50-150
d5-EtFOSAA	H	95	50-150		106	50-150
d-MeFOSA	H	82	50-150		98	50-150
d3-MeFOSAA	H	96	50-150		115	50-150

LOQ = Limit of Quantitation	B = Detected in the method blank	E = Quantitation of compound exceeded the calibration range	DL = Detection Limit	Q = Surrogate failure
U = Not detected at or above the LOQ	N = Recovery is out of criteria	P = The RPD between two GC columns exceeds 40%	J = Estimated result < LOQ and ≥ DL	L = LCS/LCSD failure
H = Out of holding time	W = Reported on wet weight basis	LOD = Limit of Detection		S = MS/MSD failure

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SPLP PFAS

Client: Arcadis U.S., Inc. | Laboratory ID: WK18026-002
Description: ISM-393-Fb | Matrix: Solid
Date Sampled: 09/29/2021 1645 | Project Name: Eielson AFB | % Solids: 99.1 11/29/2021 2339
Date Received: 11/17/2021 | Project Number: 30030317

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch	Leachate Date
1	1312/PFAS	PFAS by ID SOP QSM B-15	1	11/25/2021 0116	MMM	11/23/2021 1731	23518	11/19/2021 1700
2	1312/PFAS	PFAS by ID SOP QSM B-15	5	11/27/2021 1055	MMM	11/23/2021 1731	23518	11/19/2021 1700

Parameter	CAS Number	Analytical Method	Result	Q	LOQ	LOD	DL	Units	Run
1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS)	39108-34-4	PFAS by ID SOP	600	H	80	40	20	ng/L	1
1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS)	27619-97-2	PFAS by ID SOP	110	H	80	40	20	ng/L	1
1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS)	757124-72-4	PFAS by ID SOP	40	UH	80	40	20	ng/L	1
N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA)	2991-50-6	PFAS by ID SOP	40	UH	80	40	20	ng/L	1
N-methylperfluoro-1-octanesulfonamide (MeFOSA)	31506-32-8	PFAS by ID SOP	80	UH	160	80	40	ng/L	1
N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA)	2355-31-9	PFAS by ID SOP	40	UH	80	40	20	ng/L	1
Perfluoro-1-butanesulfonic acid (PFBS)	375-73-5	PFAS by ID SOP	11	HJ	40	20	10	ng/L	1
Perfluoro-1-decanesulfonic acid (PFDS)	335-77-3	PFAS by ID SOP	25	HJ	40	20	10	ng/L	1
Perfluoro-1-heptanesulfonic acid (PFHpS)	375-92-8	PFAS by ID SOP	11	HJ	40	20	10	ng/L	1
Perfluoro-1-nonanesulfonic acid (PFNS)	68259-12-1	PFAS by ID SOP	120	H	40	20	10	ng/L	1
Perfluoro-1-octanesulfonamide (PFOSA)	754-91-6	PFAS by ID SOP	290	H	40	20	10	ng/L	1
Perfluoro-1-pentanesulfonic acid (PFPeS)	2706-91-4	PFAS by ID SOP	23	HJ	40	20	10	ng/L	1
Perfluorohexanesulfonic acid (PFHxS)	355-46-4	PFAS by ID SOP	380	H	40	20	10	ng/L	1
Perfluoro-n-butanoic acid (PFBA)	375-22-4	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-decanoic acid (PFDA)	335-76-2	PFAS by ID SOP	40	H	40	20	10	ng/L	1
Perfluoro-n-dodecanoic acid (PFDoA)	307-55-1	PFAS by ID SOP	15	HJ	40	20	10	ng/L	1
Perfluoro-n-heptanoic acid (PFHpA)	375-85-9	PFAS by ID SOP	14	HJ	40	20	10	ng/L	1
Perfluoro-n-hexanoic acid (PFHxA)	307-24-4	PFAS by ID SOP	120	H	40	20	10	ng/L	1
Perfluoro-n-nonanoic acid (PFNA)	375-95-1	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-octanoic acid (PFOA)	335-67-1	PFAS by ID SOP	79	H	40	20	10	ng/L	1
Perfluoro-n-pentanoic acid (PFPeA)	2706-90-3	PFAS by ID SOP	19	HJ	40	20	10	ng/L	1
Perfluoro-n-tetradecanoic acid (PFTeDA)	376-06-7	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-tridecanoic acid (PFTrDA)	72629-94-8	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-undecanoic acid (PFUdA)	2058-94-8	PFAS by ID SOP	26	HJ	40	20	10	ng/L	1
Perfluorooctanesulfonic acid (PFOS)	1763-23-1	PFAS by ID SOP	11000		200	100	50	ng/L	2

Surrogate	Run 1 Q	Run 1 % Recovery	Run 1 Acceptance Limits	Run 2 Q	Run 2 % Recovery	Run 2 Acceptance Limits
13C2_4:2FTS	H	105	50-150		113	50-150
13C2_6:2FTS	H	109	50-150		103	50-150
13C2_8:2FTS	H	104	50-150		106	50-150
13C2_PFDoA	H	97	50-150		102	50-150
13C2_PFTeDA	H	96	50-150		109	50-150
13C3_PFBS	H	102	50-150		110	50-150
13C3_PFHxS	H	98	50-150		108	50-150
13C4_PFBA	H	104	50-150		109	50-150
13C4_PFHpA	H	107	50-150		115	50-150
13C5_PFHxA	H	105	50-150		107	50-150
13C5_PFPeA	H	97	50-150		110	50-150
13C6_PFDA	H	109	50-150		110	50-150
13C7_PFUdA	H	103	50-150		115	50-150
13C8_PFOA	H	95	50-150		112	50-150
13C8_PFOS	H	98	50-150		107	50-150
13C8_PFOSA	H	108	50-150		114	50-150

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

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SPLP PFAS

Client: Arcadis U.S., Inc.		Laboratory ID: WK18026-002	
Description: ISM-393-Fb		Matrix: Solid	
Date Sampled: 09/29/2021 1645	Project Name: Eielson AFB	% Solids: 99.1	11/29/2021 2339
Date Received: 11/17/2021	Project Number: 30030317		

Surrogate	Q	Run 1 % Recovery	Acceptance Limits	Q	Run 2 % Recovery	Acceptance Limits
13C9_PFNA	H	90	50-150		98	50-150
d5-EtFOSAA	H	103	50-150		96	50-150
d-MeFOSA	H	68	50-150		110	50-150
d3-MeFOSAA	H	106	50-150		109	50-150

LOQ = Limit of Quantitation	B = Detected in the method blank	E = Quantitation of compound exceeded the calibration range	DL = Detection Limit	Q = Surrogate failure
U = Not detected at or above the LOQ	N = Recovery is out of criteria	P = The RPD between two GC columns exceeds 40%	J = Estimated result < LOQ and ≥ DL	L = LCS/LCSD failure
H = Out of holding time	W = Reported on wet weight basis	LOD = Limit of Detection		S = MS/MSD failure

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PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: WK18026-003
Description: ISM-393-Fc | Matrix: Solid
Date Sampled: 09/29/2021 1655 | Project Name: Eielson AFB | % Solids: 98.6 11/29/2021 2339
Date Received: 11/17/2021 | Project Number: 30030317

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch
1	SOP SPE	PFAS by ID SOP QSM B-15	1	11/21/2021 2200	JJG	11/19/2021 1133	23092
2	SOP SPE	PFAS by ID SOP QSM B-15	10	11/22/2021 1816	JJG	11/19/2021 1133	23092

Parameter	CAS Number	Analytical Method	Result	Q	LOQ	LOD	DL	Units	Run
1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS)	39108-34-4	PFAS by ID SOP	26	H	2.0	1.0	0.49	ug/kg	1
1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS)	27619-97-2	PFAS by ID SOP	3.6	H	2.0	1.0	0.49	ug/kg	1
1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS)	757124-72-4	PFAS by ID SOP	1.0	UH	2.0	1.0	0.49	ug/kg	1
N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA)	2991-50-6	PFAS by ID SOP	0.62	HJ	2.0	1.0	0.49	ug/kg	1
N-methylperfluoro-1-octanesulfonamide (MeFOSA)	31506-32-8	PFAS by ID SOP	1.0	UH	2.0	1.0	0.49	ug/kg	1
N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA)	2355-31-9	PFAS by ID SOP	1.0	UH	2.0	1.0	0.49	ug/kg	1
Perfluoro-1-butanesulfonic acid (PFBS)	375-73-5	PFAS by ID SOP	0.80	HJ	0.98	0.49	0.20	ug/kg	1
Perfluoro-1-decanesulfonic acid (PFDS)	335-77-3	PFAS by ID SOP	11	H	0.98	0.49	0.20	ug/kg	1
Perfluoro-1-heptanesulfonic acid (PFHpS)	375-92-8	PFAS by ID SOP	0.79	HJ	0.98	0.49	0.20	ug/kg	1
Perfluoro-1-nonanesulfonic acid (PFNS)	68259-12-1	PFAS by ID SOP	11	H	0.98	0.49	0.20	ug/kg	1
Perfluoro-1-octanesulfonamide (PFOSA)	754-91-6	PFAS by ID SOP	12	H	0.98	0.49	0.20	ug/kg	1
Perfluoro-1-pentanesulfonic acid (PFPeS)	2706-91-4	PFAS by ID SOP	1.3	H	0.98	0.49	0.20	ug/kg	1
Perfluorohexanesulfonic acid (PFHxS)	355-46-4	PFAS by ID SOP	18	H	0.98	0.49	0.20	ug/kg	1
Perfluoro-n-butanoic acid (PFBA)	375-22-4	PFAS by ID SOP	0.23	HJ	0.98	0.49	0.20	ug/kg	1
Perfluoro-n-decanoic acid (PFDA)	335-76-2	PFAS by ID SOP	1.9	H	0.98	0.49	0.20	ug/kg	1
Perfluoro-n-dodecanoic acid (PFDoA)	307-55-1	PFAS by ID SOP	2.5	H	0.98	0.49	0.20	ug/kg	1
Perfluoro-n-heptanoic acid (PFHpA)	375-85-9	PFAS by ID SOP	0.45	HJ	0.98	0.49	0.20	ug/kg	1
Perfluoro-n-hexanoic acid (PFHxA)	307-24-4	PFAS by ID SOP	3.6	H	0.98	0.49	0.20	ug/kg	1
Perfluoro-n-nonanoic acid (PFNA)	375-95-1	PFAS by ID SOP	0.35	HJ	0.98	0.49	0.20	ug/kg	1
Perfluoro-n-octanoic acid (PFOA)	335-67-1	PFAS by ID SOP	2.7	H	0.98	0.49	0.20	ug/kg	1
Perfluoro-n-pentanoic acid (PFPeA)	2706-90-3	PFAS by ID SOP	0.57	HJ	0.98	0.49	0.20	ug/kg	1
Perfluoro-n-tetradecanoic acid (PFTeDA)	376-06-7	PFAS by ID SOP	0.52	HJ	0.98	0.49	0.20	ug/kg	1
Perfluoro-n-tridecanoic acid (PFTrDA)	72629-94-8	PFAS by ID SOP	0.75	HJ	0.98	0.49	0.20	ug/kg	1
Perfluoro-n-undecanoic acid (PFUdA)	2058-94-8	PFAS by ID SOP	2.5	H	0.98	0.49	0.20	ug/kg	1
Perfluorooctanesulfonic acid (PFOS)	1763-23-1	PFAS by ID SOP	430		9.8	4.9	2.0	ug/kg	2

Surrogate	Q	Run 1 % Recovery	Acceptance Limits	Q	Run 2 % Recovery	Acceptance Limits
13C2_4:2FTS	H	98	50-150		99	50-150
13C2_6:2FTS	H	94	50-150		97	50-150
13C2_8:2FTS	H	109	50-150		94	50-150
13C2_PFDoA	H	83	50-150		90	50-150
13C2_PFTeDA	H	79	50-150		93	50-150
13C3_PFBS	H	95	50-150		97	50-150
13C3_PFHxS	H	94	50-150		103	50-150
13C4_PFBA	H	89	50-150		94	50-150
13C4_PFHpA	H	86	50-150		97	50-150
13C5_PFHxA	H	86	50-150		101	50-150
13C5_PFPeA	H	89	50-150		95	50-150
13C6_PFDA	H	91	50-150		97	50-150
13C7_PFUdA	H	99	50-150		99	50-150
13C8_PFOA	H	85	50-150		93	50-150
13C8_PFOS	H	79	50-150		96	50-150
13C8_PFOSA	H	99	50-150		107	50-150

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

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PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.		Laboratory ID: WK18026-003	
Description: ISM-393-Fc		Matrix: Solid	
Date Sampled: 09/29/2021 1655	Project Name: Eielson AFB	% Solids: 98.6	11/29/2021 2339
Date Received: 11/17/2021	Project Number: 30030317		

Surrogate	Q	Run 1 % Recovery	Acceptance Limits	Q	Run 2 % Recovery	Acceptance Limits
13C9_PFNA	H	80	50-150		100	50-150
d5-EtFOSAA	H	94	50-150		98	50-150
d-MeFOSA	H	83	50-150		90	50-150
d3-MeFOSAA	H	105	50-150		113	50-150

LOQ = Limit of Quantitation	B = Detected in the method blank	E = Quantitation of compound exceeded the calibration range	DL = Detection Limit	Q = Surrogate failure
U = Not detected at or above the LOQ	N = Recovery is out of criteria	P = The RPD between two GC columns exceeds 40%	J = Estimated result < LOQ and ≥ DL	L = LCS/LCSD failure
H = Out of holding time	W = Reported on wet weight basis	LOD = Limit of Detection		S = MS/MSD failure

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SPLP PFAS

Client: Arcadis U.S., Inc. | Laboratory ID: WK18026-003
Description: ISM-393-Fc | Matrix: Solid
Date Sampled: 09/29/2021 1655 | Project Name: Eielson AFB | % Solids: 98.6 11/29/2021 2339
Date Received: 11/17/2021 | Project Number: 30030317

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch	Leachate Date
1	1312/PFAS	PFAS by ID SOP QSM B-15	1	11/25/2021 0127	MMM	11/23/2021 1731	23518	11/19/2021 1700
2	1312/PFAS	PFAS by ID SOP QSM B-15	5	11/27/2021 1106	MMM	11/23/2021 1731	23518	11/19/2021 1700

Parameter	CAS Number	Analytical Method	Result	Q	LOQ	LOD	DL	Units	Run
1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS)	39108-34-4	PFAS by ID SOP	770	HS	80	40	20	ng/L	1
1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS)	27619-97-2	PFAS by ID SOP	150	H	80	40	20	ng/L	1
1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS)	757124-72-4	PFAS by ID SOP	40	UH	80	40	20	ng/L	1
N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA)	2991-50-6	PFAS by ID SOP	40	UH	80	40	20	ng/L	1
N-methylperfluoro-1-octanesulfonamide (MeFOSA)	31506-32-8	PFAS by ID SOP	80	UH	160	80	40	ng/L	1
N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA)	2355-31-9	PFAS by ID SOP	40	UH	80	40	20	ng/L	1
Perfluoro-1-butanesulfonic acid (PFBS)	375-73-5	PFAS by ID SOP	13	HJ	40	20	10	ng/L	1
Perfluoro-1-decanesulfonic acid (PFDS)	335-77-3	PFAS by ID SOP	27	HJ	40	20	10	ng/L	1
Perfluoro-1-heptanesulfonic acid (PFHpS)	375-92-8	PFAS by ID SOP	11	HJ	40	20	10	ng/L	1
Perfluoro-1-nonanesulfonic acid (PFNS)	68259-12-1	PFAS by ID SOP	160	H	40	20	10	ng/L	1
Perfluoro-1-octanesulfonamide (PFOSA)	754-91-6	PFAS by ID SOP	400	H	40	20	10	ng/L	1
Perfluoro-1-pentanesulfonic acid (PFPeS)	2706-91-4	PFAS by ID SOP	28	HJ	40	20	10	ng/L	1
Perfluorohexanesulfonic acid (PFHxS)	355-46-4	PFAS by ID SOP	460	HS	40	20	10	ng/L	1
Perfluoro-n-butanoic acid (PFBA)	375-22-4	PFAS by ID SOP	13	HJ	40	20	10	ng/L	1
Perfluoro-n-decanoic acid (PFDA)	335-76-2	PFAS by ID SOP	64	H	40	20	10	ng/L	1
Perfluoro-n-dodecanoic acid (PFDoA)	307-55-1	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-heptanoic acid (PFHpA)	375-85-9	PFAS by ID SOP	19	HJ	40	20	10	ng/L	1
Perfluoro-n-hexanoic acid (PFHxA)	307-24-4	PFAS by ID SOP	150	H	40	20	10	ng/L	1
Perfluoro-n-nonanoic acid (PFNA)	375-95-1	PFAS by ID SOP	15	HJ	40	20	10	ng/L	1
Perfluoro-n-octanoic acid (PFOA)	335-67-1	PFAS by ID SOP	100	H	40	20	10	ng/L	1
Perfluoro-n-pentanoic acid (PFPeA)	2706-90-3	PFAS by ID SOP	22	HJ	40	20	10	ng/L	1
Perfluoro-n-tetradecanoic acid (PFTeDA)	376-06-7	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-tridecanoic acid (PFTrDA)	72629-94-8	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-undecanoic acid (PFUdA)	2058-94-8	PFAS by ID SOP	28	HJ	40	20	10	ng/L	1
Perfluorooctanesulfonic acid (PFOS)	1763-23-1	PFAS by ID SOP	15000		200	100	50	ng/L	2

Surrogate	Run 1 Q	Run 1 % Recovery	Run 1 Acceptance Limits	Run 2 Q	Run 2 % Recovery	Run 2 Acceptance Limits
13C2_4:2FTS	H	115	50-150		116	50-150
13C2_6:2FTS	H	104	50-150		106	50-150
13C2_8:2FTS	H	114	50-150		115	50-150
13C2_PFDoA	H	101	50-150		104	50-150
13C2_PFTeDA	H	93	50-150		99	50-150
13C3_PFBS	H	103	50-150		106	50-150
13C3_PFHxS	H	104	50-150		114	50-150
13C4_PFBA	H	104	50-150		107	50-150
13C4_PFHpA	H	103	50-150		112	50-150
13C5_PFHxA	H	101	50-150		102	50-150
13C5_PFPeA	H	101	50-150		106	50-150
13C6_PFDA	H	99	50-150		110	50-150
13C7_PFUdA	H	102	50-150		113	50-150
13C8_PFOA	H	100	50-150		110	50-150
13C8_PFOS	H	88	50-150		106	50-150
13C8_PFOSA	H	105	50-150		109	50-150

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

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106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

SPLP PFAS

Client: Arcadis U.S., Inc.		Laboratory ID: WK18026-003	
Description: ISM-393-Fc		Matrix: Solid	
Date Sampled: 09/29/2021 1655	Project Name: Eielson AFB	% Solids: 98.6	11/29/2021 2339
Date Received: 11/17/2021	Project Number: 30030317		

Surrogate	Q	Run 1 % Recovery	Acceptance Limits	Q	Run 2 % Recovery	Acceptance Limits
13C9_PFNA	H	84	50-150		103	50-150
d5-EtFOSAA	H	104	50-150		94	50-150
d-MeFOSA	H	64	50-150		108	50-150
d3-MeFOSAA	H	103	50-150		108	50-150

LOQ = Limit of Quantitation	B = Detected in the method blank	E = Quantitation of compound exceeded the calibration range	DL = Detection Limit	Q = Surrogate failure
U = Not detected at or above the LOQ	N = Recovery is out of criteria	P = The RPD between two GC columns exceeds 40%	J = Estimated result < LOQ and ≥ DL	L = LCS/LCSD failure
H = Out of holding time	W = Reported on wet weight basis	LOD = Limit of Detection		S = MS/MSD failure

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QC Summary

PFAS by LC/MS/MS - MB

Sample ID: WQ23092-001
Batch: 23092
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Solid
Prep Method: SOP SPE
Prep Date: 11/19/2021 1133

Parameter	Result	Q	Dil	LOQ	LOD	DL	Units	Analysis Date
8:2 FTS	1.0	U	1	2.0	1.0	0.50	ug/kg	11/21/2021 1819
6:2 FTS	1.0	U	1	2.0	1.0	0.50	ug/kg	11/21/2021 1819
4:2 FTS	1.0	U	1	2.0	1.0	0.50	ug/kg	11/21/2021 1819
EtFOSAA	1.0	U	1	2.0	1.0	0.50	ug/kg	11/21/2021 1819
MeFOSA	1.0	U	1	2.0	1.0	0.50	ug/kg	11/21/2021 1819
MeFOSAA	1.0	U	1	2.0	1.0	0.50	ug/kg	11/21/2021 1819
PFBS	0.50	U	1	1.0	0.50	0.20	ug/kg	11/21/2021 1819
PFDS	0.50	U	1	1.0	0.50	0.20	ug/kg	11/21/2021 1819
PFHpS	0.50	U	1	1.0	0.50	0.20	ug/kg	11/21/2021 1819
PFNS	0.50	U	1	1.0	0.50	0.20	ug/kg	11/21/2021 1819
PFOSA	0.50	U	1	1.0	0.50	0.20	ug/kg	11/21/2021 1819
PFPeS	0.50	U	1	1.0	0.50	0.20	ug/kg	11/21/2021 1819
PFHxS	0.50	U	1	1.0	0.50	0.20	ug/kg	11/21/2021 1819
PFBA	0.50	U	1	1.0	0.50	0.20	ug/kg	11/21/2021 1819
PFDA	0.50	U	1	1.0	0.50	0.20	ug/kg	11/21/2021 1819
PFDoA	0.50	U	1	1.0	0.50	0.20	ug/kg	11/21/2021 1819
PFHpA	0.50	U	1	1.0	0.50	0.20	ug/kg	11/21/2021 1819
PFHxA	0.50	U	1	1.0	0.50	0.20	ug/kg	11/21/2021 1819
PFNA	0.50	U	1	1.0	0.50	0.20	ug/kg	11/21/2021 1819
PFOA	0.50	U	1	1.0	0.50	0.20	ug/kg	11/21/2021 1819
PFPeA	0.50	U	1	1.0	0.50	0.20	ug/kg	11/21/2021 1819
PFTeDA	0.50	U	1	1.0	0.50	0.20	ug/kg	11/21/2021 1819
PFTrDA	0.50	U	1	1.0	0.50	0.20	ug/kg	11/21/2021 1819
PFUdA	0.50	U	1	1.0	0.50	0.20	ug/kg	11/21/2021 1819
PFOS	0.50	U	1	1.0	0.50	0.20	ug/kg	11/21/2021 1819

Surrogate	Q	% Rec	Acceptance Limit
13C2_4:2FTS		98	50-150
13C2_6:2FTS		105	50-150
13C2_8:2FTS		98	50-150
13C2_PFDoA		90	50-150
13C2_PFTeDA		93	50-150
13C3_PFBS		100	50-150
13C3_PFHxS		110	50-150
13C4_PFBA		97	50-150
13C4_PFHpA		94	50-150
13C5_PFHxA		91	50-150
13C5_PFPeA		98	50-150
13C6_PFDA		93	50-150
13C7_PFUdA		92	50-150
13C8_PFOA		97	50-150

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

PFAS by LC/MS/MS - MB

Sample ID: WQ23092-001
Batch: 23092
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Solid
Prep Method: SOP SPE
Prep Date: 11/19/2021 1133

Surrogate	Q	% Rec	Acceptance Limit
13C8_PFOS		102	50-150
13C8_PFOSA		111	50-150
13C9_PFNA		96	50-150
d5-EtFOSAA		97	50-150
d-MeFOSA		83	50-150
d3-MeFOSAA		102	50-150

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

PFAS by LC/MS/MS - LCS

Sample ID: WQ23092-002
Batch: 23092
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Solid
Prep Method: SOP SPE
Prep Date: 11/19/2021 1133

Parameter	Spike Amount (ug/kg)	Result (ug/kg)	Q	Dil	% Rec	%Rec Limit	Analysis Date
8:2 FTS	1.9	1.7		1	87	65-137	11/21/2021 1830
6:2 FTS	1.9	1.8		1	96	64-140	11/21/2021 1830
4:2 FTS	1.9	1.8		1	97	62-145	11/21/2021 1830
EtFOSAA	2.0	1.9		1	97	61-139	11/21/2021 1830
MeFOSA	2.0	2.2		1	112	70-150	11/21/2021 1830
MeFOSAA	2.0	1.7		1	85	63-144	11/21/2021 1830
PFBS	1.8	1.8		1	102	72-128	11/21/2021 1830
PFDS	1.9	2.1		1	109	59-134	11/21/2021 1830
PFHpS	1.9	2.0		1	103	70-132	11/21/2021 1830
PFNS	1.9	1.7		1	88	69-125	11/21/2021 1830
PFOSA	2.0	1.6		1	82	67-137	11/21/2021 1830
PFPeS	1.9	1.8		1	98	73-123	11/21/2021 1830
PFHxS	1.8	1.9		1	102	67-130	11/21/2021 1830
PFBA	2.0	2.0		1	99	71-135	11/21/2021 1830
PFDA	2.0	2.2		1	110	69-133	11/21/2021 1830
PFDoA	2.0	2.1		1	104	69-135	11/21/2021 1830
PFHpA	2.0	2.0		1	100	71-131	11/21/2021 1830
PFHxA	2.0	1.9		1	96	70-132	11/21/2021 1830
PFNA	2.0	1.9		1	94	72-129	11/21/2021 1830
PFOA	2.0	2.1		1	107	69-133	11/21/2021 1830
PFPeA	2.0	2.0		1	101	69-132	11/21/2021 1830
PFTeDA	2.0	1.9		1	96	69-133	11/21/2021 1830
PFTrDA	2.0	2.1		1	104	66-139	11/21/2021 1830
PFUdA	2.0	2.1		1	104	64-136	11/21/2021 1830
PFOS	1.9	2.0		1	106	68-136	11/21/2021 1830

Surrogate	Q	% Rec	Acceptance Limit
13C2_4:2FTS		94	50-150
13C2_6:2FTS		101	50-150
13C2_8:2FTS		104	50-150
13C2_PFDoA		82	50-150
13C2_PFTeDA		88	50-150
13C3_PFBS		98	50-150
13C3_PFHxS		105	50-150
13C4_PFBA		95	50-150
13C4_PFHpA		95	50-150
13C5_PFHxA		95	50-150
13C5_PFPeA		99	50-150
13C6_PFDA		89	50-150
13C7_PFUdA		93	50-150
13C8_PFOA		94	50-150

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

PFAS by LC/MS/MS - LCS

Sample ID: WQ23092-002
Batch: 23092
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Solid
Prep Method: SOP SPE
Prep Date: 11/19/2021 1133

Surrogate	Q	% Rec	Acceptance Limit
13C8_PFOS		94	50-150
13C8_PFOSA		108	50-150
13C9_PFNA		96	50-150
d5-EtFOSAA		90	50-150
d-MeFOSA		87	50-150
d3-MeFOSAA		100	50-150

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

SPLP PFAS - MB

Sample ID: WQ23518-001
Batch: 23518
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Solid
Prep Method: 1312/PFAS
Prep Date: 11/23/2021 1731 Leachate Date: 11/19/2021 1700

Parameter	Result	Q	Dil	LOQ	LOD	DL	Units	Analysis Date
8:2 FTS	40	U	1	80	40	20	ng/L	11/25/2021 0033
6:2 FTS	40	U	1	80	40	20	ng/L	11/25/2021 0033
4:2 FTS	40	U	1	80	40	20	ng/L	11/25/2021 0033
EtFOSAA	40	U	1	80	40	20	ng/L	11/25/2021 0033
MeFOSA	80	U	1	160	80	40	ng/L	11/25/2021 0033
MeFOSAA	40	U	1	80	40	20	ng/L	11/25/2021 0033
PFBS	20	U	1	40	20	10	ng/L	11/25/2021 0033
PFDS	20	U	1	40	20	10	ng/L	11/25/2021 0033
PFHpS	20	U	1	40	20	10	ng/L	11/25/2021 0033
PFNS	20	U	1	40	20	10	ng/L	11/25/2021 0033
PFOSA	20	U	1	40	20	10	ng/L	11/25/2021 0033
PFPeS	20	U	1	40	20	10	ng/L	11/25/2021 0033
PFHxS	20	U	1	40	20	10	ng/L	11/25/2021 0033
PFBA	20	U	1	40	20	10	ng/L	11/25/2021 0033
PFDA	20	U	1	40	20	10	ng/L	11/25/2021 0033
PFDoA	20	U	1	40	20	10	ng/L	11/25/2021 0033
PFHpA	20	U	1	40	20	10	ng/L	11/25/2021 0033
PFHxA	20	U	1	40	20	10	ng/L	11/25/2021 0033
PFNA	20	U	1	40	20	10	ng/L	11/25/2021 0033
PFOA	20	U	1	40	20	10	ng/L	11/25/2021 0033
PFPeA	20	U	1	40	20	10	ng/L	11/25/2021 0033
PFTeDA	20	U	1	40	20	10	ng/L	11/25/2021 0033
PFTrDA	20	U	1	40	20	10	ng/L	11/25/2021 0033
PFUdA	20	U	1	40	20	10	ng/L	11/25/2021 0033
PFOS	20	U	1	40	20	10	ng/L	11/25/2021 0033

Surrogate	Q	% Rec	Acceptance Limit
13C2_4:2FTS		117	50-150
13C2_6:2FTS		125	50-150
13C2_8:2FTS		120	50-150
13C2_PFDoA		104	50-150
13C2_PFTeDA		99	50-150
13C3_PFBS		108	50-150
13C3_PFHxS		109	50-150
13C4_PFBA		111	50-150
13C4_PFHpA		109	50-150
13C5_PFHxA		110	50-150
13C5_PFPeA		105	50-150
13C6_PFDA		103	50-150
13C7_PFUdA		110	50-150
13C8_PFOA		111	50-150

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

SPLP PFAS - MB

Sample ID: WQ23518-001
Batch: 23518
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Solid
Prep Method: 1312/PFAS
Prep Date: 11/23/2021 1731 Leachate Date: 11/19/2021 1700

Surrogate	Q	% Rec	Acceptance Limit
13C8_PFOS		102	50-150
13C8_PFOSA		107	50-150
13C9_PFNA		107	50-150
d5-EtFOSAA		108	50-150
d-MeFOSA		72	50-150
d3-MeFOSAA		108	50-150

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

SPLP PFAS - LCS

Sample ID: WQ23518-002
Batch: 23518
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Solid
Prep Method: 1312/PFAS
Prep Date: 11/23/2021 1731 Leachate Date: 11/19/2021 1700

Parameter	Spike Amount (ng/L)	Result (ng/L)	Q	Dil	% Rec	%Rec Limit	Analysis Date
8:2 FTS	150	160		1	105	67-138	11/27/2021 2235
6:2 FTS	150	180		1	118	64-140	11/27/2021 2235
4:2 FTS	150	170		1	111	63-143	11/27/2021 2235
EtFOSAA	160	140		1	88	61-135	11/27/2021 2235
MeFOSA	160	190		1	120	68-141	11/27/2021 2235
MeFOSAA	160	140		1	86	65-136	11/27/2021 2235
PFBS	140	130		1	90	72-130	11/27/2021 2235
PFDS	150	140		1	91	53-142	11/27/2021 2235
PFHpS	150	140		1	92	69-134	11/27/2021 2235
PFNS	150	140		1	91	69-127	11/27/2021 2235
PFOSA	160	160		1	103	67-137	11/27/2021 2235
PFPeS	150	150		1	100	71-127	11/27/2021 2235
PFHxS	150	150		1	100	68-131	11/27/2021 2235
PFBA	160	160		1	98	73-129	11/27/2021 2235
PFDA	160	150		1	96	71-129	11/27/2021 2235
PFDoA	160	160		1	99	72-134	11/27/2021 2235
PFHpA	160	150		1	96	72-130	11/27/2021 2235
PFHxA	160	160		1	97	72-129	11/27/2021 2235
PFNA	160	160		1	100	69-130	11/27/2021 2235
PFOA	160	170		1	105	71-133	11/27/2021 2235
PFPeA	160	160		1	99	72-129	11/27/2021 2235
PFTeDA	160	170		1	106	71-132	11/27/2021 2235
PFTrDA	160	130		1	83	65-144	11/27/2021 2235
PFUdA	160	170		1	106	69-133	11/27/2021 2235
PFOS	150	170		1	116	65-140	11/27/2021 2235

Surrogate	Q	% Rec	Acceptance Limit
13C2_4:2FTS		129	50-150
13C2_6:2FTS	N	151	50-150
13C2_8:2FTS		138	50-150
13C2_PFDoA		107	50-150
13C2_PFTeDA		96	50-150
13C3_PFBS		114	50-150
13C3_PFHxS		112	50-150
13C4_PFBA		112	50-150
13C4_PFHpA		118	50-150
13C5_PFHxA		109	50-150
13C5_PFPeA		112	50-150
13C6_PFDA		116	50-150
13C7_PFUdA		106	50-150
13C8_PFOA		118	50-150

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

SPLP PFAS - LCS

Sample ID: WQ23518-002
Batch: 23518
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Solid
Prep Method: 1312/PFAS
Prep Date: 11/23/2021 1731 Leachate Date: 11/19/2021 1700

Surrogate	Q	% Rec	Acceptance Limit
13C8_PFOS		119	50-150
13C8_PFOSA		112	50-150
13C9_PFNA		112	50-150
d5-EtFOSAA		100	50-150
d-MeFOSA		88	50-150
d3-MeFOSAA		118	50-150

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

SPLP PFAS - MS

Sample ID: WK18026-003MS
Batch: 23518
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Solid
Prep Method: 1312/PFAS
Prep Date: 11/23/2021 1731 Leachate Date: 11/19/2021 1700

Parameter	Sample Amount (ng/L)	Spike Amount (ng/L)	Result (ng/L)	Q	Dil	% Rec	%Rec Limit	Analysis Date
8:2 FTS	770	150	900		1	85	67-138	11/25/2021 0137
6:2 FTS	150	150	290		1	96	64-140	11/25/2021 0137
4:2 FTS	ND	150	160		1	105	63-143	11/25/2021 0137
EtFOSAA	ND	160	150		1	95	61-135	11/25/2021 0137
MeFOSA	ND	160	190		1	120	68-141	11/25/2021 0137
MeFOSAA	ND	160	160		1	100	65-136	11/25/2021 0137
PFBS	13	140	140		1	92	72-130	11/25/2021 0137
PFDS	27	150	180		1	98	53-142	11/25/2021 0137
PFHpS	11	150	150		1	89	69-134	11/25/2021 0137
PFNS	160	150	300		1	91	69-127	11/25/2021 0137
PFOSA	400	160	550		1	94	67-137	11/25/2021 0137
PFPeS	28	150	170		1	96	71-127	11/25/2021 0137
PFHxS	460	150	650	N	1	134	68-131	11/25/2021 0137
PFBA	13	160	170		1	97	73-129	11/25/2021 0137
PFDA	64	160	190		1	76	71-129	11/25/2021 0137
PFDoA	ND	160	190		1	117	72-134	11/25/2021 0137
PFHpA	19	160	170		1	95	72-130	11/25/2021 0137
PFHxA	150	160	300		1	97	72-129	11/25/2021 0137
PFNA	15	160	170		1	95	69-130	11/25/2021 0137
PFOA	100	160	250		1	91	71-133	11/25/2021 0137
PFPeA	22	160	180		1	99	72-129	11/25/2021 0137
PFTeDA	ND	160	170		1	107	71-132	11/25/2021 0137
PFTrDA	ND	160	170		1	107	65-144	11/25/2021 0137
PFUdA	28	160	190		1	100	69-133	11/25/2021 0137
PFOS	13000	150	13000		1	119	65-140	11/25/2021 0137

Surrogate	Q	% Rec	Acceptance Limit
13C2_4:2FTS		108	50-150
13C2_6:2FTS		106	50-150
13C2_8:2FTS		106	50-150
13C2_PFDoA		93	50-150
13C2_PFTeDA		102	50-150
13C3_PFBS		108	50-150
13C3_PFHxS		107	50-150
13C4_PFBA		107	50-150
13C4_PFHpA		113	50-150
13C5_PFHxA		105	50-150
13C5_PFPeA		104	50-150
13C6_PFDA		122	50-150
13C7_PFUdA		104	50-150
13C8_PFOA		106	50-150

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

SPLP PFAS - MS

Sample ID: WK18026-003MS
Batch: 23518
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Solid
Prep Method: 1312/PFAS
Prep Date: 11/23/2021 1731 Leachate Date: 11/19/2021 1700

Surrogate	Q	% Rec	Acceptance Limit
13C8_PFOS		95	50-150
13C8_PFOSA		108	50-150
13C9_PFNA		95	50-150
d5-EtFOSAA		112	50-150
d-MeFOSA		69	50-150
d3-MeFOSAA		110	50-150

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

SPLP PFAS - MSD

Sample ID: WK18026-003MD
Batch: 23518
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Solid
Prep Method: 1312/PFAS
Prep Date: 11/23/2021 1731 Leachate Date: 11/19/2021 1700

Parameter	Sample Amount (ng/L)	Spike Amount (ng/L)	Result (ng/L)	Q	Dil	% Rec	% RPD	%Rec Limit	% RPD Limit	Analysis Date
8:2 FTS	770	150	1100	N	1	196	17	67-138	30	11/25/2021 0148
6:2 FTS	150	150	280		1	85	5.7	64-140	30	11/25/2021 0148
4:2 FTS	ND	150	150		1	98	6.8	63-143	30	11/25/2021 0148
EtFOSAA	ND	160	150		1	92	3.0	61-135	30	11/25/2021 0148
MeFOSA	ND	160	180		1	115	4.4	68-141	30	11/25/2021 0148
MeFOSAA	ND	160	180		1	115	14	65-136	30	11/25/2021 0148
PFBS	13	140	150		1	96	4.2	72-130	30	11/25/2021 0148
PFDS	27	150	180		1	100	1.8	53-142	30	11/25/2021 0148
PFHpS	11	150	150		1	88	1.1	69-134	30	11/25/2021 0148
PFNS	160	150	280		1	79	6.3	69-127	30	11/25/2021 0148
PFOSA	400	160	560		1	104	3.1	67-137	30	11/25/2021 0148
PFPeS	28	150	180		1	100	3.0	71-127	30	11/25/2021 0148
PFHxS	460	150	630		1	120	3.2	68-131	30	11/25/2021 0148
PFBA	13	160	170		1	98	1.6	73-129	30	11/25/2021 0148
PFDA	64	160	210		1	94	14	71-129	30	11/25/2021 0148
PFDoA	ND	160	170		1	107	8.6	72-134	30	11/25/2021 0148
PFHpA	19	160	170		1	95	0.14	72-130	30	11/25/2021 0148
PFHxA	150	160	290		1	89	4.5	72-129	30	11/25/2021 0148
PFNA	15	160	160		1	93	2.0	69-130	30	11/25/2021 0148
PFOA	100	160	250		1	94	1.8	71-133	30	11/25/2021 0148
PFPeA	22	160	180		1	100	0.084	72-129	30	11/25/2021 0148
PFTeDA	ND	160	170		1	105	2.0	71-132	30	11/25/2021 0148
PFTrDA	ND	160	180		1	113	5.1	65-144	30	11/25/2021 0148
PFUdA	28	160	190		1	104	3.4	69-133	30	11/25/2021 0148
PFOS	13000	150	12000	N	1	-760	10	65-140	30	11/25/2021 0148

Surrogate	Q	% Rec	Acceptance Limit
13C2_4:2FTS		102	50-150
13C2_6:2FTS		113	50-150
13C2_8:2FTS		107	50-150
13C2_PFDoA		99	50-150
13C2_PFTeDA		98	50-150
13C3_PFBS		99	50-150
13C3_PFHxS		107	50-150
13C4_PFBA		102	50-150
13C4_PFHpA		108	50-150
13C5_PFHxA		106	50-150
13C5_PFPeA		99	50-150
13C6_PFDA		103	50-150
13C7_PFUdA		96	50-150
13C8_PFOA		107	50-150

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Note: Calculations are performed before rounding to avoid round-off errors in calculated results

SPLP PFAS - MSD

Sample ID: WK18026-003MD
Batch: 23518
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Solid
Prep Method: 1312/PFAS
Prep Date: 11/23/2021 1731 Leachate Date: 11/19/2021 1700

Surrogate	Q	% Rec	Acceptance Limit
13C8_PFOS		92	50-150
13C8_PFOSA		113	50-150
13C9_PFNA		90	50-150
d5-EtFOSAA		105	50-150
d-MeFOSA		72	50-150
d3-MeFOSAA		98	50-150

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
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N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

Chain of Custody

and

Miscellaneous Documents

Client ID: 4367 - Pace Analytical Services
SDG: 221100448
PM: EPM

Chain of Custody 10/13 ish

Pace Analytical

Workorder: ISM Workorder Name: Elelson Owner Received Date: 10/6/2021 Requested By: 10/12/2021

Report To:	Subcontract To	Requested Analysis
Kathy Smith Pace Analytical 106 Vantage Point Drive Columbia SC, 29223 803-227-2704 kathy.smith@pacelabs.com	Pace Golf Coast 7979 Innovation Park Drive, Baton Rouge, LA 70820	WK18026 KE92

Item	Sample ID	Sample Type	Collect Date/Time	Lab ID	Matrix	Preserved Containers: NON	ISM Prep	LAB USE ONLY
1	ISM-393-Fa		9/29/2021 1615			X	X	1
2	ISM-393-Fb		9/29/2021 1645			X	X	2
3	ISM-393-Fc		9/29/2021 1655			X	X	3
4								
5								
6								
7								
8								
9								
14	**Send samples to SC for analysis after ISM Prep							

Transfers:	Released By	Date/Time	Received By	Date/Time	Comments
1		11/16/21 1700			
2					
3	FedEx	11/17/21 0730		11/17/21 0845	2843 9198 0036

Cooler Temperature on Receipt 1.0 °C E34 Custody Seal Y or N Received on Ice Y or N

***In order to maintain client confidentiality, location/name of the sampling site, sampler's name and signature may not be provided on this COC
This chain of custody is considered complete as is since this information is available in the owner laboratory.

T=3.2°C

Pace Analytical Services, LLC (formerly Shealy Environmental Services, Inc.)
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

Pace Analytical®

PACE ANALYTICAL SERVICES, LLC
106 Vantage Point Drive • West Columbia, SC 29172
Telephone No. 803-791-9700 Fax No. 803-791-9111
www.pacelabs.com

Number 122668

Client: Arcadis	Report to Contact: Nathan Nagle	Telephone No. / E-mail: Nathan.Nagle@arcadis.com
Address: 10 Friends Lane, Ste 100	Sampler's Signature: X	Quote No.
City: Newtown / State: PA / Zip Code: 18940	Printed Name: Jacob Schenk	Page 1 of 1
Project Name: Eidson Soil Washing		Lot # Bar Code (lab use only)
Project No.: 30030317	P.O. No.	

Sample ID / Description (Containers for each sample may be combined on one line.)	Collection Date(s)	Collection Time (Military)	Grab/Comp	Matrix: Product	Soil	Air/Water	No. of Containers by Preservative Type: Unpres.	HNO3	H2SO4	HCl	NaOH	ZnAc/NaOH	Other	PFAS QSM Table 15	Remarks / Cooler I.D.
ISM-393-1-Fa	9/29/21	1615	C		X		X							1	1
ISM-393-1-Fb	9/29/21	1645	C		X		X							1	<3 ppb 2
ISM-393-1-Fc	9/29/21	1655	C		X		X							1	expected 3

Client ID: 4367 - Pace Analytical Services
SDG: 221100448
PM: EPM

Turn Around Time Required (Prior lab approval required for expedited TAT.): ☐ Standard ☑ Rush (Specify) 5 day TAT

Sample Disposal: ☐ Return to Client ☑ Disposal by Lab

Possible Hazard Identification: ☐ Non-Hazard ☐ Flammable ☐ Skin Irritant ☐ Poison ☐ Unknown

QC Requirements (Specify)

	Date	Time		Date	Time
1. Relinquished by	9/30/21	1200	1. Received by		
2. Relinquished by: FedEx	10/1/21	1022	2. Received by: DodieMcCune	10-1-21	10:22
3. Relinquished by			3. Received by		
4. Relinquished by			4. Laboratory received by		

Note: All samples are retained for four weeks from receipt unless other arrangements are made.

LAB USE ONLY
Received on ice (Circle) Yes No Ice Pack
Receipt Temp: 1.0 E34 °C
Temp Blank ☐ Y ☐ N

DISTRIBUTION: WHITE & YELLOW-Return to laboratory with Sample(s); PINK-Field/Client Copy

2143 9198 0036

Document Number: ME-005N2-01

PACE ANALYTICAL SERVICES, LLC

Pace Analytical

Samples Receipt Checklist (SRC) (ME0018C-15)
Issuing Authority: Pace ENV - WCOL

Revised:9/29/2020
Page 1 of 1

Sample Receipt Checklist (SRC)

Client: Pace Cooler Inspected by/date: JRG2 / 11/18/2021 Lot #: WK18026

Means of receipt: ☐ Pace ☐ Client ☐ UPS ☑ FedEx ☐ Other: _____

☐ Yes	☑ No		1. Were custody seals present on the cooler?
☐ Yes	☐ No	☑ NA	2. If custody seals were present, were they intact and unbroken?

pH Strip ID: NA Chlorine Strip ID: NA Tested by: NA

Original temperature upon receipt / Derived (Corrected) temperature upon receipt %Solid Snap-Cup ID: 21-2661

3.2 / 3.2 °C NA / NA °C NA / NA °C NA / NA °C

Method: ☐ Temperature Blank ☑ Against Bottles IR Gun ID: 6 IR Gun Correction Factor: 0 °C

Method of coolant: ☑ Wet Ice ☐ Ice Packs ☐ Dry Ice ☐ None

☐ Yes	☐ No	☑ NA	3. If temperature of any cooler exceeded 6.0°C, was Project Manager Notified? PM was Notified by: phone / email / face-to-face (circle one).
☐ Yes	☐ No	☑ NA	4. Is the commercial courier's packing slip attached to this form?
☑ Yes	☐ No		5. Were proper custody procedures (relinquished/received) followed?
☑ Yes	☐ No		6. Were sample IDs listed on the COC?
☐ Yes	☑ No		7. Were sample IDs listed on all sample containers?
☑ Yes	☐ No		8. Was collection date & time listed on the COC?
☐ Yes	☑ No		9. Was collection date & time listed on all sample containers?
☑ Yes	☐ No		10. Did all container label information (ID, date, time) agree with the COC?
☑ Yes	☐ No		11. Were tests to be performed listed on the COC?
☑ Yes	☐ No		12. Did all samples arrive in the proper containers for each test and/or in good condition (unbroken, lids on, etc.)?
☑ Yes	☐ No		13. Was adequate sample volume available?
☐ Yes	☑ No		14. Were all samples received within ½ the holding time or 48 hours, whichever comes first?
☐ Yes	☑ No		15. Were any samples containers missing/excess (circle one) samples Not listed on COC?
☐ Yes	☐ No	☑ NA	16. For VOA and RSK-175 samples, were bubbles present >"pea-size" (¼"or 6mm in diameter) in any of the VOA vials?
☐ Yes	☐ No	☑ NA	17. Were all DRO/metals/nutrient samples received at a pH of < 2?
☐ Yes	☐ No	☑ NA	18. Were all cyanide samples received at a pH > 12 and sulfide samples received at a pH > 9?
☐ Yes	☐ No	☑ NA	19. Were all applicable NH_3/TKN/cyanide/phenol/625.1/608.3 (< 0.5mg/L) samples free of residual chlorine?
☐ Yes	☐ No	☑ NA	20. Were client remarks/requests (i.e. requested dilutions, MS/MSD designations, etc…) correctly transcribed from the COC into the comment section in LIMS?
☐ Yes	☑ No		21. Was the quote number listed on the container label? If yes, Quote #

Sample Preservation (Must be completed for any sample(s) incorrectly preserved or with headspace.)

Sample(s) NA were received incorrectly preserved and were adjusted accordingly in sample receiving with NA mL of circle one: H2SO4, HNO3, HCl, NaOH using SR # NA.
Time of preservation NA. If more than one preservative is needed, please note in the comments below.

Sample(s) NA were received with bubbles >6 mm in diameter.

Samples(s) NA were received with TRC > 0.5 mg/L (If #19 is *no*) and were adjusted accordingly in sample receiving with sodium thiosulfate ($Na_2S_2O_3$) with Shealy ID: NA.

SR barcode labels applied by: JRG2 Date: 11/18/2021

Comments:

Report of Analysis

Arcadis U.S., Inc.
630 Plaza Drive
Suite 600
Highlands Ranch, CO 80129
Attention: Joseph Quinnan

Project Name: Eielson AFB

Lot Number:**WI17055**

Date Completed:11/09/2021
Revision Date: 10/21/2021

11/10/2021 10:08 AM
Approved and released by:
Project Manager II: **Kathy E. Smith**

The electronic signature above is the equivalent of a handwritten signature.
This report shall not be reproduced, except in its entirety, without the written approval of Pace Analytical Services, LLC.

Pace Analytical Services, LLC (*formerly Shealy Environmental Services, Inc.*)
106 Vantage Point Drive West Columbia, SC 29172
Tel: 803-791-9700 Fax: 803-791-9111 www.pacelabs.com

Case Narrative
Arcadis U.S., Inc.
Lot Number: WI17055

This Report of Analysis contains the analytical result(s) for the sample(s) listed on the Sample Summary following this Case Narrative. The sample receiving date is documented in the header information associated with each sample.

All results listed in this report relate only to the samples that are contained within this report.

Sample receipt, sample analysis, and data review have been performed in accordance with the most current approved The NELAC Institute (TNI) standards, the Pace Analytical Services, LLC ("Pace") Laboratory Quality Manual, standard operating procedures (SOPs), and Pace policies. Additionally, the DoD QSM version 5.3 has been followed for these samples, and specifically Table B-15 was followed for all PFAS samples. Any exceptions to the TNI standards, the Laboratory Quality Manual, SOPs, the DoD QSM, or policies are qualified on the results page or discussed below.

Correction factors (CF) are used to calculate the original sample concentration. The CF is the inverse of the concentration factor (sample volume / extract final volume) times the dilution factor (DF). For undiluted analysis. For undiluted analysis, the extract is prepared for injection by adding 182 uL of sample extract + 8 uL of reagent water + 10 uL of internal standard solution to a polypropylene autosampler vial. An extra correction factor of 0.91 (182 uL / 200 uL = 0.91) applies. The CF is calculated as follows:

CF = DF * FV / Vo

FV is volume of extract (mL)
Vo is initial sample volume (mL)
DF is dilution factor. For undiluted analysis, DF = 1/0.91.

Sample concentration for aqueous samples:
Concentration (ng/L) = Cs*CF,

$$C_s = \frac{\left(\frac{(A_s x C_{is})}{A_{is}}\right) - B}{M1}$$

Where

C_s is on column concentration of target analyte in the sample (ng/L)
C_{is} is concentration of internal standard in the sample (ng/L)
A_s is peak response of target analyte in the sample
A_{is} is peak response of internal standard in the sample
M1 is the average RF from ICAL or the slope from linear regression ICAL
B is the y-intercept from the ICAL

Pace is a TNI accredited laboratory; however, the following reported analyses are currently not listed on our TNI scope of accreditation:

Biological Tissue: All, Non-Potable Water: SGT-HEM EPA 1664B, Silica EPA 200.7, Boron, Calcium, Silicon, Strontium EPA 200.8, Bicarbonate, Carbonate, and Hydroxide Alkalinity SM 2320 B-2011, Fecal Coliform SM 9221 C E-2006 & SM 9222D-2006, Strontium SW-846 6010D, VOC SM 6200 B-2011, Drinking Water: VOC (excluding BTEX, MTBE, Naphthalene, & 1,2-dichloroethane) EPA 524.2, Solid Chemical Material: TOC Walkley-Black.

Where applicable, all soil sample results (including LOQ and DL if requested) are corrected for dry weight unless flagged with a "W" qualifier.

If you have any questions regarding this report please contact the Pace Project Manager listed on the cover page.

The method blank associated with prep batch 16138 contained 8:2 FTS surrogate greater than method criteria. The following samples were affected: WI17055-001, WI17055-002, WI17055-003, WI17055-004, WI17055-005, WI17055-006, WI17055-007, WI17055-008, WI17055-009, WI17055-010, WI17055-011, WI17055-012. The data has been reported.

Samples for SPLP PFAS were leached and analyzed outside of holding time. Data has been flagged with an H data qualifier.

Sample Summary

Arcadis U.S., Inc.

Lot Number: WI17055

Project Name: Eielson AFB

Project Number:

Sample Number	Sample ID	Matrix	Date Sampled	Date Received
001	ISM-382-5-Uta	Solid	09/08/2021	09/17/2021
002	ISM-382-5-Utb	Solid	09/08/2021	09/17/2021
003	ISM-382-5-Utc	Solid	09/08/2021	09/17/2021
004	ISM-382-5-Sa	Solid	09/07/2021	09/17/2021
005	ISM-382-5-Sb	Solid	09/07/2021	09/17/2021
006	ISM-382-5-Sc	Solid	09/07/2021	09/17/2021
007	ISM-382-5-Fa	Solid	09/08/2021	09/17/2021
008	ISM-382-5-Fb	Solid	09/08/2021	09/17/2021
009	ISM-382-5-Fc	Solid	09/08/2021	09/17/2021
010	ISM-382-5-Ga	Solid	09/08/2021	09/17/2021
011	ISM-382-5-Gb	Solid	09/08/2021	09/17/2021
012	ISM-382-5-Gc	Solid	09/08/2021	09/17/2021

(12 samples)

Detection Summary

Arcadis U.S., Inc.

Lot Number: WI17055

Project Name: Eielson AFB

Project Number:

Sample	Sample ID	Matrix	Parameter	Method	Result	Q	Units	Page
001	ISM-382-5-Uta	Solid	PFHxS	PFAS by ID	1.7		ug/kg	8
001	ISM-382-5-Uta	Solid	PFOA	PFAS by ID	0.23	J	ug/kg	8
001	ISM-382-5-Uta	Solid	PFOS	PFAS by ID	5.1		ug/kg	8
001	ISM-382-5-Uta	Solid	6:2 FTS	PFAS by ID	27	HJ	ng/L	10
001	ISM-382-5-Uta	Solid	PFHxS	PFAS by ID	86	H	ng/L	10
001	ISM-382-5-Uta	Solid	PFOA	PFAS by ID	14	HJ	ng/L	10
001	ISM-382-5-Uta	Solid	PFOS	PFAS by ID	200	H	ng/L	10
002	ISM-382-5-Utb	Solid	PFHxS	PFAS by ID	1.5		ug/kg	12
002	ISM-382-5-Utb	Solid	PFOS	PFAS by ID	4.6		ug/kg	12
002	ISM-382-5-Utb	Solid	PFHxS	PFAS by ID	100	H	ng/L	14
002	ISM-382-5-Utb	Solid	PFOA	PFAS by ID	11	HJ	ng/L	14
002	ISM-382-5-Utb	Solid	PFOS	PFAS by ID	190	H	ng/L	14
003	ISM-382-5-Utc	Solid	PFHxS	PFAS by ID	1.2		ug/kg	16
003	ISM-382-5-Utc	Solid	PFOA	PFAS by ID	0.28	J	ug/kg	16
003	ISM-382-5-Utc	Solid	PFOS	PFAS by ID	3.9		ug/kg	16
003	ISM-382-5-Utc	Solid	6:2 FTS	PFAS by ID	28	HJ	ng/L	18
003	ISM-382-5-Utc	Solid	PFHxS	PFAS by ID	87	H	ng/L	18
003	ISM-382-5-Utc	Solid	PFOS	PFAS by ID	190	H	ng/L	18
004	ISM-382-5-Sa	Solid	PFOS	PFAS by ID	0.29	J	ug/kg	20
004	ISM-382-5-Sa	Solid	6:2 FTS	PFAS by ID	110	H	ng/L	22
005	ISM-382-5-Sb	Solid	6:2 FTS	PFAS by ID	29	HJ	ng/L	26
007	ISM-382-5-Fa	Solid	PFHxS	PFAS by ID	0.45	J	ug/kg	32
007	ISM-382-5-Fa	Solid	PFOS	PFAS by ID	1.4		ug/kg	32
007	ISM-382-5-Fa	Solid	6:2 FTS	PFAS by ID	32	HJ	ng/L	34
007	ISM-382-5-Fa	Solid	PFHxS	PFAS by ID	29	HJ	ng/L	34
007	ISM-382-5-Fa	Solid	PFOS	PFAS by ID	58	H	ng/L	34
008	ISM-382-5-Fb	Solid	PFHxS	PFAS by ID	0.45	J	ug/kg	36
008	ISM-382-5-Fb	Solid	PFOS	PFAS by ID	1.9		ug/kg	36
008	ISM-382-5-Fb	Solid	6:2 FTS	PFAS by ID	51	HJ	ng/L	38
008	ISM-382-5-Fb	Solid	PFHxS	PFAS by ID	21	HJ	ng/L	38
008	ISM-382-5-Fb	Solid	PFOS	PFAS by ID	66	H	ng/L	38
009	ISM-382-5-Fc	Solid	PFHxS	PFAS by ID	0.55	J	ug/kg	40
009	ISM-382-5-Fc	Solid	PFOS	PFAS by ID	1.9		ug/kg	40
009	ISM-382-5-Fc	Solid	PFHxS	PFAS by ID	15	HJ	ng/L	42
009	ISM-382-5-Fc	Solid	PFOS	PFAS by ID	44	H	ng/L	42
010	ISM-382-5-Ga	Solid	PFBA	PFAS by ID	0.76	J	ug/kg	44

(36 detections)

PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: WI17055-001
Description: ISM-382-5-Uta | Matrix: Solid
Date Sampled: 09/08/2021 | Project Name: Eielson AFB | % Solids: 91.7 09/18/2021 1903
Date Received: 09/17/2021 | Project Number:

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch
1	SOP SPE	PFAS by ID SOP QSM B-15	1	09/20/2021 1545	JJG	09/19/2021 1515	15796
2	SOP SPE	PFAS by ID SOP QSM B-15	1	09/23/2021 1607	NK1	09/22/2021 1232	16138

Parameter	CAS Number	Analytical Method	Result	Q	LOQ	LOD	DL	Units	Run
1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS)	39108-34-4	PFAS by ID SOP	0.95	U	1.9	0.95	0.49	ug/kg	1
1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS)	27619-97-2	PFAS by ID SOP	0.95	U	1.9	0.95	0.47	ug/kg	2
1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS)	757124-72-4	PFAS by ID SOP	0.95	U	1.9	0.95	0.49	ug/kg	1
N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA)	2991-50-6	PFAS by ID SOP	0.95	U	1.9	0.95	0.49	ug/kg	1
N-methylperfluoro-1-octanesulfonamide (MeFOSA)	31506-32-8	PFAS by ID SOP	0.95	U	1.9	0.95	0.49	ug/kg	1
N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA)	2355-31-9	PFAS by ID SOP	0.95	U	1.9	0.95	0.49	ug/kg	1
Perfluoro-1-butanesulfonic acid (PFBS)	375-73-5	PFAS by ID SOP	0.49	U	0.97	0.49	0.19	ug/kg	1
Perfluoro-1-decanesulfonic acid (PFDS)	335-77-3	PFAS by ID SOP	0.49	U	0.97	0.49	0.19	ug/kg	1
Perfluoro-1-heptanesulfonic acid (PFHpS)	375-92-8	PFAS by ID SOP	0.49	U	0.97	0.49	0.19	ug/kg	1
Perfluoro-1-nonanesulfonic acid (PFNS)	68259-12-1	PFAS by ID SOP	0.49	U	0.97	0.49	0.19	ug/kg	1
Perfluoro-1-octanesulfonamide (PFOSA)	754-91-6	PFAS by ID SOP	0.49	U	0.97	0.49	0.19	ug/kg	1
Perfluoro-1-pentanesulfonic acid (PFPeS)	2706-91-4	PFAS by ID SOP	0.49	U	0.97	0.49	0.19	ug/kg	1
Perfluorohexanesulfonic acid (PFHxS)	355-46-4	PFAS by ID SOP	1.7		0.97	0.49	0.19	ug/kg	1
Perfluoro-n-butanoic acid (PFBA)	375-22-4	PFAS by ID SOP	0.49	U	0.97	0.49	0.19	ug/kg	1
Perfluoro-n-decanoic acid (PFDA)	335-76-2	PFAS by ID SOP	0.49	U	0.97	0.49	0.19	ug/kg	1
Perfluoro-n-dodecanoic acid (PFDoA)	307-55-1	PFAS by ID SOP	0.49	U	0.97	0.49	0.19	ug/kg	1
Perfluoro-n-heptanoic acid (PFHpA)	375-85-9	PFAS by ID SOP	0.49	U	0.97	0.49	0.19	ug/kg	1
Perfluoro-n-hexanoic acid (PFHxA)	307-24-4	PFAS by ID SOP	0.49	U	0.97	0.49	0.19	ug/kg	1
Perfluoro-n-nonanoic acid (PFNA)	375-95-1	PFAS by ID SOP	0.49	U	0.97	0.49	0.19	ug/kg	1
Perfluoro-n-octanoic acid (PFOA)	335-67-1	PFAS by ID SOP	0.23	J	0.97	0.49	0.19	ug/kg	1
Perfluoro-n-pentanoic acid (PFPeA)	2706-90-3	PFAS by ID SOP	0.49	U	0.97	0.49	0.19	ug/kg	1
Perfluoro-n-tetradecanoic acid (PFTeDA)	376-06-7	PFAS by ID SOP	0.49	U	0.97	0.49	0.19	ug/kg	1
Perfluoro-n-tridecanoic acid (PFTrDA)	72629-94-8	PFAS by ID SOP	0.49	U	0.97	0.49	0.19	ug/kg	1
Perfluoro-n-undecanoic acid (PFUdA)	2058-94-8	PFAS by ID SOP	0.49	U	0.97	0.49	0.19	ug/kg	1
Perfluorooctanesulfonic acid (PFOS)	1763-23-1	PFAS by ID SOP	5.1		0.97	0.49	0.19	ug/kg	1

Surrogate	Run 1 Q	Run 1 % Recovery	Run 1 Acceptance Limits	Run 2 Q	Run 2 % Recovery	Run 2 Acceptance Limits
13C2_4:2FTS		92	50-150		108	50-150
13C2_6:2FTS		89	50-150		103	50-150
13C2_8:2FTS		90	50-150		112	50-150
13C2_PFDoA		93	50-150		98	50-150
13C2_PFTeDA		87	50-150		105	50-150
13C3_PFBS		89	50-150		100	50-150
13C3_PFHxS		94	50-150		98	50-150
13C4_PFBA		87	50-150		99	50-150
13C4_PFHpA		88	50-150		98	50-150
13C5_PFHxA		87	50-150		104	50-150
13C5_PFPeA		90	50-150		96	50-150
13C6_PFDA		87	50-150		93	50-150
13C7_PFUdA		88	50-150		99	50-150
13C8_PFOA		86	50-150		99	50-150
13C8_PFOS		92	50-150		102	50-150
13C8_PFOSA		85	50-150		104	50-150

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

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PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.		Laboratory ID: WI17055-001	
Description: ISM-382-5-Uta		Matrix: Solid	
Date Sampled: 09/08/2021	Project Name: Eielson AFB	% Solids: 91.7	09/18/2021 1903
Date Received: 09/17/2021	Project Number:		

Surrogate	Q	Run 1 % Recovery	Acceptance Limits	Q	Run 2 % Recovery	Acceptance Limits
13C9_PFNA		90	50-150		102	50-150
d5-EtFOSAA		85	50-150		100	50-150
d-MeFOSA		96	50-150		94	50-150
d3-MeFOSAA		92	50-150		99	50-150

LOQ = Limit of Quantitation	B = Detected in the method blank	E = Quantitation of compound exceeded the calibration range	DL = Detection Limit	Q = Surrogate failure
U = Not detected at or above the LOQ	N = Recovery is out of criteria	P = The RPD between two GC columns exceeds 40%	J = Estimated result < LOQ and ≥ DL	L = LCS/LCSD failure
H = Out of holding time	W = Reported on wet weight basis	LOD = Limit of Detection		S = MS/MSD failure

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SPLP PFAS

Client: Arcadis U.S., Inc. | Laboratory ID: WI17055-001
Description: ISM-382-5-Uta | Matrix: Solid
Date Sampled: 09/08/2021 | Project Name: Eielson AFB | % Solids: 91.7 09/18/2021 1903
Date Received: 09/17/2021 | Project Number:

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch	Leachate Date
1	1312/PFAS	PFAS by ID SOP QSM B-15	1	11/04/2021 2242	JJG	11/03/2021 1313	21123	10/27/2021 0213

Parameter	CAS Number	Analytical Method	Result	Q	LOQ	LOD	DL	Units	Run
1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS)	39108-34-4	PFAS by ID SOP	40	UH	80	40	20	ng/L	1
1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS)	27619-97-2	PFAS by ID SOP	27	HJ	80	40	20	ng/L	1
1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS)	757124-72-4	PFAS by ID SOP	40	UH	80	40	20	ng/L	1
N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA)	2991-50-6	PFAS by ID SOP	40	UH	80	40	20	ng/L	1
N-methylperfluoro-1-octanesulfonamide (MeFOSA)	31506-32-8	PFAS by ID SOP	80	UHL	160	80	40	ng/L	1
N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA)	2355-31-9	PFAS by ID SOP	40	UH	80	40	20	ng/L	1
Perfluoro-1-butanesulfonic acid (PFBS)	375-73-5	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-1-decanesulfonic acid (PFDS)	335-77-3	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-1-heptanesulfonic acid (PFHpS)	375-92-8	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-1-nonanesulfonic acid (PFNS)	68259-12-1	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-1-octanesulfonamide (PFOSA)	754-91-6	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-1-pentanesulfonic acid (PFPeS)	2706-91-4	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluorohexanesulfonic acid (PFHxS)	355-46-4	PFAS by ID SOP	86	H	40	20	10	ng/L	1
Perfluoro-n-butanoic acid (PFBA)	375-22-4	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-decanoic acid (PFDA)	335-76-2	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-dodecanoic acid (PFDoA)	307-55-1	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-heptanoic acid (PFHpA)	375-85-9	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-hexanoic acid (PFHxA)	307-24-4	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-nonanoic acid (PFNA)	375-95-1	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-octanoic acid (PFOA)	335-67-1	PFAS by ID SOP	14	HJ	40	20	10	ng/L	1
Perfluoro-n-pentanoic acid (PFPeA)	2706-90-3	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-tetradecanoic acid (PFTeDA)	376-06-7	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-tridecanoic acid (PFTrDA)	72629-94-8	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-undecanoic acid (PFUdA)	2058-94-8	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluorooctanesulfonic acid (PFOS)	1763-23-1	PFAS by ID SOP	200	H	40	20	10	ng/L	1

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
13C2_4:2FTS	H	104	50-150
13C2_6:2FTS	H	100	50-150
13C2_8:2FTS	H	98	50-150
13C2_PFDoA	H	87	50-150
13C2_PFTeDA	H	91	50-150
13C3_PFBS	H	91	50-150
13C3_PFHxS	H	91	50-150
13C4_PFBA	H	97	50-150
13C4_PFHpA	H	93	50-150
13C5_PFHxA	H	90	50-150
13C5_PFPeA	H	92	50-150
13C6_PFDA	H	93	50-150
13C7_PFUdA	H	95	50-150
13C8_PFOA	H	85	50-150
13C8_PFOS	H	86	50-150
13C8_PFOSA	H	98	50-150
13C9_PFNA	H	89	50-150

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

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SPLP PFAS

Client: Arcadis U.S., Inc.		Laboratory ID: WI17055-001
Description: ISM-382-5-Uta		Matrix: Solid
Date Sampled: 09/08/2021	Project Name: Eielson AFB	% Solids: 91.7 09/18/2021 1903
Date Received: 09/17/2021	Project Number:	

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
d5-EtFOSAA	H	110	50-150
d-MeFOSA	H	86	50-150
d3-MeFOSAA	H	107	50-150

LOQ = Limit of Quantitation	B = Detected in the method blank	E = Quantitation of compound exceeded the calibration range	DL = Detection Limit	Q = Surrogate failure
U = Not detected at or above the LOQ	N = Recovery is out of criteria	P = The RPD between two GC columns exceeds 40%	J = Estimated result < LOQ and ≥ DL	L = LCS/LCSD failure
H = Out of holding time	W = Reported on wet weight basis	LOD = Limit of Detection		S = MS/MSD failure

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PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: WI17055-002
Description: ISM-382-5-Utb | Matrix: Solid
Date Sampled: 09/08/2021 | Project Name: Eielson AFB | % Solids: 90.8 09/18/2021 1903
Date Received: 09/17/2021 | Project Number:

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch
1	SOP SPE	PFAS by ID SOP QSM B-15	1	09/20/2021 1555	JJG	09/19/2021 1515	15796
2	SOP SPE	PFAS by ID SOP QSM B-15	1	09/23/2021 1620	NK1	09/22/2021 1232	16138

Parameter	CAS Number	Analytical Method	Result	Q	LOQ	LOD	DL	Units	Run
1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS)	39108-34-4	PFAS by ID SOP	1.1	U	2.2	1.1	0.54	ug/kg	1
1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS)	27619-97-2	PFAS by ID SOP	1.1	U	2.1	1.1	0.52	ug/kg	2
1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS)	757124-72-4	PFAS by ID SOP	1.1	U	2.2	1.1	0.54	ug/kg	1
N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA)	2991-50-6	PFAS by ID SOP	1.1	U	2.2	1.1	0.54	ug/kg	1
N-methylperfluoro-1-octanesulfonamide (MeFOSA)	31506-32-8	PFAS by ID SOP	1.1	U	2.2	1.1	0.54	ug/kg	1
N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA)	2355-31-9	PFAS by ID SOP	1.1	U	2.2	1.1	0.54	ug/kg	1
Perfluoro-1-butanesulfonic acid (PFBS)	375-73-5	PFAS by ID SOP	0.55	U	1.1	0.55	0.22	ug/kg	1
Perfluoro-1-decanesulfonic acid (PFDS)	335-77-3	PFAS by ID SOP	0.55	U	1.1	0.55	0.22	ug/kg	1
Perfluoro-1-heptanesulfonic acid (PFHpS)	375-92-8	PFAS by ID SOP	0.55	U	1.1	0.55	0.22	ug/kg	1
Perfluoro-1-nonanesulfonic acid (PFNS)	68259-12-1	PFAS by ID SOP	0.55	U	1.1	0.55	0.22	ug/kg	1
Perfluoro-1-octanesulfonamide (PFOSA)	754-91-6	PFAS by ID SOP	0.55	U	1.1	0.55	0.22	ug/kg	1
Perfluoro-1-pentanesulfonic acid (PFPeS)	2706-91-4	PFAS by ID SOP	0.55	U	1.1	0.55	0.22	ug/kg	1
Perfluorohexanesulfonic acid (PFHxS)	355-46-4	PFAS by ID SOP	1.5		1.1	0.55	0.22	ug/kg	1
Perfluoro-n-butanoic acid (PFBA)	375-22-4	PFAS by ID SOP	0.55	U	1.1	0.55	0.22	ug/kg	1
Perfluoro-n-decanoic acid (PFDA)	335-76-2	PFAS by ID SOP	0.55	U	1.1	0.55	0.22	ug/kg	1
Perfluoro-n-dodecanoic acid (PFDoA)	307-55-1	PFAS by ID SOP	0.55	U	1.1	0.55	0.22	ug/kg	1
Perfluoro-n-heptanoic acid (PFHpA)	375-85-9	PFAS by ID SOP	0.55	U	1.1	0.55	0.22	ug/kg	1
Perfluoro-n-hexanoic acid (PFHxA)	307-24-4	PFAS by ID SOP	0.55	U	1.1	0.55	0.22	ug/kg	1
Perfluoro-n-nonanoic acid (PFNA)	375-95-1	PFAS by ID SOP	0.55	U	1.1	0.55	0.22	ug/kg	1
Perfluoro-n-octanoic acid (PFOA)	335-67-1	PFAS by ID SOP	0.55	U	1.1	0.55	0.22	ug/kg	1
Perfluoro-n-pentanoic acid (PFPeA)	2706-90-3	PFAS by ID SOP	0.55	U	1.1	0.55	0.22	ug/kg	1
Perfluoro-n-tetradecanoic acid (PFTeDA)	376-06-7	PFAS by ID SOP	0.55	U	1.1	0.55	0.22	ug/kg	1
Perfluoro-n-tridecanoic acid (PFTrDA)	72629-94-8	PFAS by ID SOP	0.55	U	1.1	0.55	0.22	ug/kg	1
Perfluoro-n-undecanoic acid (PFUdA)	2058-94-8	PFAS by ID SOP	0.55	U	1.1	0.55	0.22	ug/kg	1
Perfluorooctanesulfonic acid (PFOS)	1763-23-1	PFAS by ID SOP	4.6		1.1	0.55	0.22	ug/kg	1

Surrogate	Run 1 Q	Run 1 % Recovery	Run 1 Acceptance Limits	Run 2 Q	Run 2 % Recovery	Run 2 Acceptance Limits
13C2_4:2FTS		78	50-150		109	50-150
13C2_6:2FTS		79	50-150		113	50-150
13C2_8:2FTS		72	50-150		118	50-150
13C2_PFDoA		70	50-150		96	50-150
13C2_PFTeDA		69	50-150		108	50-150
13C3_PFBS		76	50-150		104	50-150
13C3_PFHxS		77	50-150		94	50-150
13C4_PFBA		75	50-150		102	50-150
13C4_PFHpA		75	50-150		99	50-150
13C5_PFHxA		79	50-150		109	50-150
13C5_PFPeA		76	50-150		97	50-150
13C6_PFDA		72	50-150		98	50-150
13C7_PFUdA		70	50-150		103	50-150
13C8_PFOA		73	50-150		108	50-150
13C8_PFOS		72	50-150		103	50-150
13C8_PFOSA		69	50-150		101	50-150

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

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PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.		Laboratory ID: WI17055-002	
Description: ISM-382-5-Utb		Matrix: Solid	
Date Sampled: 09/08/2021	Project Name: Eielson AFB	% Solids: 90.8	09/18/2021 1903
Date Received: 09/17/2021	Project Number:		

Surrogate	Q	Run 1 % Recovery	Acceptance Limits	Q	Run 2 % Recovery	Acceptance Limits
13C9_PFNA		71	50-150		104	50-150
d5-EtFOSAA		84	50-150		110	50-150
d-MeFOSA		78	50-150		104	50-150
d3-MeFOSAA		79	50-150		104	50-150

LOQ = Limit of Quantitation	B = Detected in the method blank	E = Quantitation of compound exceeded the calibration range	DL = Detection Limit	Q = Surrogate failure
U = Not detected at or above the LOQ	N = Recovery is out of criteria	P = The RPD between two GC columns exceeds 40%	J = Estimated result < LOQ and ≥ DL	L = LCS/LCSD failure
H = Out of holding time	W = Reported on wet weight basis	LOD = Limit of Detection		S = MS/MSD failure

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SPLP PFAS

Client: Arcadis U.S., Inc. | Laboratory ID: WI17055-002
Description: ISM-382-5-Utb | Matrix: Solid
Date Sampled: 09/08/2021 | Project Name: Eielson AFB | % Solids: 90.8 09/18/2021 1903
Date Received: 09/17/2021 | Project Number:

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch	Leachate Date
1	1312/PFAS	PFAS by ID SOP QSM B-15	1	11/04/2021 2253	JJG	11/03/2021 1313	21123	10/27/2021 0213

Parameter	CAS Number	Analytical Method	Result	Q	LOQ	LOD	DL	Units	Run
1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS)	39108-34-4	PFAS by ID SOP	40	UH	80	40	20	ng/L	1
1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS)	27619-97-2	PFAS by ID SOP	40	UH	80	40	20	ng/L	1
1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS)	757124-72-4	PFAS by ID SOP	40	UH	80	40	20	ng/L	1
N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA)	2991-50-6	PFAS by ID SOP	40	UH	80	40	20	ng/L	1
N-methylperfluoro-1-octanesulfonamide (MeFOSA)	31506-32-8	PFAS by ID SOP	80	UHL	160	80	40	ng/L	1
N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA)	2355-31-9	PFAS by ID SOP	40	UH	80	40	20	ng/L	1
Perfluoro-1-butanesulfonic acid (PFBS)	375-73-5	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-1-decanesulfonic acid (PFDS)	335-77-3	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-1-heptanesulfonic acid (PFHpS)	375-92-8	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-1-nonanesulfonic acid (PFNS)	68259-12-1	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-1-octanesulfonamide (PFOSA)	754-91-6	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-1-pentanesulfonic acid (PFPeS)	2706-91-4	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluorohexanesulfonic acid (PFHxS)	355-46-4	PFAS by ID SOP	100	H	40	20	10	ng/L	1
Perfluoro-n-butanoic acid (PFBA)	375-22-4	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-decanoic acid (PFDA)	335-76-2	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-dodecanoic acid (PFDoA)	307-55-1	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-heptanoic acid (PFHpA)	375-85-9	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-hexanoic acid (PFHxA)	307-24-4	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-nonanoic acid (PFNA)	375-95-1	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-octanoic acid (PFOA)	335-67-1	PFAS by ID SOP	11	HJ	40	20	10	ng/L	1
Perfluoro-n-pentanoic acid (PFPeA)	2706-90-3	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-tetradecanoic acid (PFTeDA)	376-06-7	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-tridecanoic acid (PFTrDA)	72629-94-8	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-undecanoic acid (PFUdA)	2058-94-8	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluorooctanesulfonic acid (PFOS)	1763-23-1	PFAS by ID SOP	190	H	40	20	10	ng/L	1

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
13C2_4:2FTS	H	116	50-150
13C2_6:2FTS	H	98	50-150
13C2_8:2FTS	H	108	50-150
13C2_PFDoA	H	91	50-150
13C2_PFTeDA	H	95	50-150
13C3_PFBS	H	96	50-150
13C3_PFHxS	H	95	50-150
13C4_PFBA	H	101	50-150
13C4_PFHpA	H	99	50-150
13C5_PFHxA	H	93	50-150
13C5_PFPeA	H	99	50-150
13C6_PFDA	H	94	50-150
13C7_PFUdA	H	104	50-150
13C8_PFOA	H	93	50-150
13C8_PFOS	H	101	50-150
13C8_PFOSA	H	107	50-150
13C9_PFNA	H	93	50-150

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

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SPLP PFAS

Client: Arcadis U.S., Inc.		Laboratory ID: WI17055-002
Description: ISM-382-5-Utb		Matrix: Solid
Date Sampled: 09/08/2021	Project Name: Eielson AFB	% Solids: 90.8 09/18/2021 1903
Date Received: 09/17/2021	Project Number:	

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
d5-EtFOSAA	H	114	50-150
d-MeFOSA	H	95	50-150
d3-MeFOSAA	H	119	50-150

LOQ = Limit of Quantitation	B = Detected in the method blank	E = Quantitation of compound exceeded the calibration range	DL = Detection Limit	Q = Surrogate failure
U = Not detected at or above the LOQ	N = Recovery is out of criteria	P = The RPD between two GC columns exceeds 40%	J = Estimated result < LOQ and ≥ DL	L = LCS/LCSD failure
H = Out of holding time	W = Reported on wet weight basis	LOD = Limit of Detection		S = MS/MSD failure

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PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: WI17055-003
Description: ISM-382-5-Utc | Matrix: Solid
Date Sampled: 09/08/2021 | Project Name: Eielson AFB | % Solids: 90.2 09/18/2021 1903
Date Received: 09/17/2021 | Project Number:

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch
1	SOP SPE	PFAS by ID SOP QSM B-15	1	09/20/2021 1606	JJG	09/19/2021 1515	15796
2	SOP SPE	PFAS by ID SOP QSM B-15	1	09/23/2021 1632	NK1	09/22/2021 1232	16138

Parameter	CAS Number	Analytical Method	Result	Q	LOQ	LOD	DL	Units	Run
1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS)	39108-34-4	PFAS by ID SOP	0.95	U	1.9	0.95	0.48	ug/kg	1
1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS)	27619-97-2	PFAS by ID SOP	1.1	U	2.2	1.1	0.54	ug/kg	2
1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS)	757124-72-4	PFAS by ID SOP	0.95	U	1.9	0.95	0.48	ug/kg	1
N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA)	2991-50-6	PFAS by ID SOP	0.95	U	1.9	0.95	0.48	ug/kg	1
N-methylperfluoro-1-octanesulfonamide (MeFOSA)	31506-32-8	PFAS by ID SOP	0.95	U	1.9	0.95	0.48	ug/kg	1
N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA)	2355-31-9	PFAS by ID SOP	0.95	U	1.9	0.95	0.48	ug/kg	1
Perfluoro-1-butanesulfonic acid (PFBS)	375-73-5	PFAS by ID SOP	0.48	U	0.96	0.48	0.19	ug/kg	1
Perfluoro-1-decanesulfonic acid (PFDS)	335-77-3	PFAS by ID SOP	0.48	U	0.96	0.48	0.19	ug/kg	1
Perfluoro-1-heptanesulfonic acid (PFHpS)	375-92-8	PFAS by ID SOP	0.48	U	0.96	0.48	0.19	ug/kg	1
Perfluoro-1-nonanesulfonic acid (PFNS)	68259-12-1	PFAS by ID SOP	0.48	U	0.96	0.48	0.19	ug/kg	1
Perfluoro-1-octanesulfonamide (PFOSA)	754-91-6	PFAS by ID SOP	0.48	U	0.96	0.48	0.19	ug/kg	1
Perfluoro-1-pentanesulfonic acid (PFPeS)	2706-91-4	PFAS by ID SOP	0.48	U	0.96	0.48	0.19	ug/kg	1
Perfluorohexanesulfonic acid (PFHxS)	355-46-4	PFAS by ID SOP	1.2		0.96	0.48	0.19	ug/kg	1
Perfluoro-n-butanoic acid (PFBA)	375-22-4	PFAS by ID SOP	0.48	U	0.96	0.48	0.19	ug/kg	1
Perfluoro-n-decanoic acid (PFDA)	335-76-2	PFAS by ID SOP	0.48	U	0.96	0.48	0.19	ug/kg	1
Perfluoro-n-dodecanoic acid (PFDoA)	307-55-1	PFAS by ID SOP	0.48	U	0.96	0.48	0.19	ug/kg	1
Perfluoro-n-heptanoic acid (PFHpA)	375-85-9	PFAS by ID SOP	0.48	U	0.96	0.48	0.19	ug/kg	1
Perfluoro-n-hexanoic acid (PFHxA)	307-24-4	PFAS by ID SOP	0.48	U	0.96	0.48	0.19	ug/kg	1
Perfluoro-n-nonanoic acid (PFNA)	375-95-1	PFAS by ID SOP	0.48	U	0.96	0.48	0.19	ug/kg	1
Perfluoro-n-octanoic acid (PFOA)	335-67-1	PFAS by ID SOP	0.28	J	0.96	0.48	0.19	ug/kg	1
Perfluoro-n-pentanoic acid (PFPeA)	2706-90-3	PFAS by ID SOP	0.48	U	0.96	0.48	0.19	ug/kg	1
Perfluoro-n-tetradecanoic acid (PFTeDA)	376-06-7	PFAS by ID SOP	0.48	U	0.96	0.48	0.19	ug/kg	1
Perfluoro-n-tridecanoic acid (PFTrDA)	72629-94-8	PFAS by ID SOP	0.48	U	0.96	0.48	0.19	ug/kg	1
Perfluoro-n-undecanoic acid (PFUdA)	2058-94-8	PFAS by ID SOP	0.48	U	0.96	0.48	0.19	ug/kg	1
Perfluorooctanesulfonic acid (PFOS)	1763-23-1	PFAS by ID SOP	3.9		0.96	0.48	0.19	ug/kg	1

Surrogate	Run 1 Q	Run 1 % Recovery	Run 1 Acceptance Limits	Run 2 Q	Run 2 % Recovery	Run 2 Acceptance Limits
13C2_4:2FTS		82	50-150		105	50-150
13C2_6:2FTS		64	50-150		101	50-150
13C2_8:2FTS		73	50-150		117	50-150
13C2_PFDoA		75	50-150		99	50-150
13C2_PFTeDA		74	50-150		109	50-150
13C3_PFBS		78	50-150		102	50-150
13C3_PFHxS		82	50-150		99	50-150
13C4_PFBA		79	50-150		99	50-150
13C4_PFHpA		82	50-150		101	50-150
13C5_PFHxA		81	50-150		105	50-150
13C5_PFPeA		76	50-150		95	50-150
13C6_PFDA		80	50-150		103	50-150
13C7_PFUdA		82	50-150		97	50-150
13C8_PFOA		64	50-150		102	50-150
13C8_PFOS		81	50-150		104	50-150
13C8_PFOSA		72	50-150		101	50-150

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

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PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.		Laboratory ID: WI17055-003	
Description: ISM-382-5-Utc		Matrix: Solid	
Date Sampled: 09/08/2021	Project Name: Eielson AFB	% Solids: 90.2	09/18/2021 1903
Date Received: 09/17/2021	Project Number:		

Surrogate	Q	Run 1 % Recovery	Acceptance Limits	Q	Run 2 % Recovery	Acceptance Limits
13C9_PFNA		75	50-150		110	50-150
d5-EtFOSAA		87	50-150		109	50-150
d-MeFOSA		76	50-150		96	50-150
d3-MeFOSAA		87	50-150		105	50-150

LOQ = Limit of Quantitation	B = Detected in the method blank	E = Quantitation of compound exceeded the calibration range	DL = Detection Limit	Q = Surrogate failure
U = Not detected at or above the LOQ	N = Recovery is out of criteria	P = The RPD between two GC columns exceeds 40%	J = Estimated result < LOQ and ≥ DL	L = LCS/LCSD failure
H = Out of holding time	W = Reported on wet weight basis	LOD = Limit of Detection		S = MS/MSD failure

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SPLP PFAS

Client: Arcadis U.S., Inc. | Laboratory ID: WI17055-003
Description: ISM-382-5-Utc | Matrix: Solid
Date Sampled: 09/08/2021 | Project Name: Eielson AFB | % Solids: 90.2 09/18/2021 1903
Date Received: 09/17/2021 | Project Number:

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch	Leachate Date
1	1312/PFAS	PFAS by ID SOP QSM B-15	1	11/04/2021 2303	JJG	11/03/2021 1313	21123	10/27/2021 0213

Parameter	CAS Number	Analytical Method	Result	Q	LOQ	LOD	DL	Units	Run
1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS)	39108-34-4	PFAS by ID SOP	40	UH	80	40	20	ng/L	1
1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS)	27619-97-2	PFAS by ID SOP	28	HJ	80	40	20	ng/L	1
1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS)	757124-72-4	PFAS by ID SOP	40	UH	80	40	20	ng/L	1
N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA)	2991-50-6	PFAS by ID SOP	40	UH	80	40	20	ng/L	1
N-methylperfluoro-1-octanesulfonamide (MeFOSA)	31506-32-8	PFAS by ID SOP	80	UHL	160	80	40	ng/L	1
N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA)	2355-31-9	PFAS by ID SOP	40	UH	80	40	20	ng/L	1
Perfluoro-1-butanesulfonic acid (PFBS)	375-73-5	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-1-decanesulfonic acid (PFDS)	335-77-3	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-1-heptanesulfonic acid (PFHpS)	375-92-8	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-1-nonanesulfonic acid (PFNS)	68259-12-1	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-1-octanesulfonamide (PFOSA)	754-91-6	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-1-pentanesulfonic acid (PFPeS)	2706-91-4	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluorohexanesulfonic acid (PFHxS)	355-46-4	PFAS by ID SOP	87	H	40	20	10	ng/L	1
Perfluoro-n-butanoic acid (PFBA)	375-22-4	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-decanoic acid (PFDA)	335-76-2	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-dodecanoic acid (PFDoA)	307-55-1	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-heptanoic acid (PFHpA)	375-85-9	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-hexanoic acid (PFHxA)	307-24-4	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-nonanoic acid (PFNA)	375-95-1	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-octanoic acid (PFOA)	335-67-1	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-pentanoic acid (PFPeA)	2706-90-3	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-tetradecanoic acid (PFTeDA)	376-06-7	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-tridecanoic acid (PFTrDA)	72629-94-8	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-undecanoic acid (PFUdA)	2058-94-8	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluorooctanesulfonic acid (PFOS)	1763-23-1	PFAS by ID SOP	190	H	40	20	10	ng/L	1

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
13C2_4:2FTS	H	107	50-150
13C2_6:2FTS	H	104	50-150
13C2_8:2FTS	H	111	50-150
13C2_PFDoA	H	92	50-150
13C2_PFTeDA	H	96	50-150
13C3_PFBS	H	97	50-150
13C3_PFHxS	H	96	50-150
13C4_PFBA	H	100	50-150
13C4_PFHpA	H	96	50-150
13C5_PFHxA	H	93	50-150
13C5_PFPeA	H	96	50-150
13C6_PFDA	H	98	50-150
13C7_PFUdA	H	101	50-150
13C8_PFOA	H	92	50-150
13C8_PFOS	H	98	50-150
13C8_PFOSA	H	109	50-150
13C9_PFNA	H	96	50-150

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

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SPLP PFAS

Client: Arcadis U.S., Inc.		Laboratory ID: WI17055-003	
Description: ISM-382-5-Utc		Matrix: Solid	
Date Sampled: 09/08/2021	Project Name: Eielson AFB	% Solids: 90.2	09/18/2021 1903
Date Received: 09/17/2021	Project Number:		

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
d5-EtFOSAA	H	121	50-150
d-MeFOSA	H	96	50-150
d3-MeFOSAA	H	114	50-150

LOQ = Limit of Quantitation	B = Detected in the method blank	E = Quantitation of compound exceeded the calibration range	DL = Detection Limit	Q = Surrogate failure
U = Not detected at or above the LOQ	N = Recovery is out of criteria	P = The RPD between two GC columns exceeds 40%	J = Estimated result < LOQ and ≥ DL	L = LCS/LCSD failure
H = Out of holding time	W = Reported on wet weight basis	LOD = Limit of Detection		S = MS/MSD failure

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PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: WI17055-004
Description: ISM-382-5-Sa | Matrix: Solid
Date Sampled: 09/07/2021 | Project Name: Eielson AFB | % Solids: 86.9 09/18/2021 1903
Date Received: 09/17/2021 | Project Number:

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch
1	SOP SPE	PFAS by ID SOP QSM B-15	1	09/20/2021 1616	JJG	09/19/2021 1515	15796
2	SOP SPE	PFAS by ID SOP QSM B-15	1	09/23/2021 1645	NK1	09/22/2021 1232	16138

Parameter	CAS Number	Analytical Method	Result	Q	LOQ	LOD	DL	Units	Run
1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS)	39108-34-4	PFAS by ID SOP	1.2	U	2.3	1.2	0.56	ug/kg	1
1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS)	27619-97-2	PFAS by ID SOP	1.0	U	2.0	1.0	0.49	ug/kg	2
1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS)	757124-72-4	PFAS by ID SOP	1.2	U	2.3	1.2	0.56	ug/kg	1
N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA)	2991-50-6	PFAS by ID SOP	1.2	U	2.3	1.2	0.56	ug/kg	1
N-methylperfluoro-1-octanesulfonamide (MeFOSA)	31506-32-8	PFAS by ID SOP	1.2	U	2.3	1.2	0.56	ug/kg	1
N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA)	2355-31-9	PFAS by ID SOP	1.2	U	2.3	1.2	0.56	ug/kg	1
Perfluoro-1-butanesulfonic acid (PFBS)	375-73-5	PFAS by ID SOP	0.55	U	1.1	0.55	0.23	ug/kg	1
Perfluoro-1-decanesulfonic acid (PFDS)	335-77-3	PFAS by ID SOP	0.55	U	1.1	0.55	0.23	ug/kg	1
Perfluoro-1-heptanesulfonic acid (PFHpS)	375-92-8	PFAS by ID SOP	0.55	U	1.1	0.55	0.23	ug/kg	1
Perfluoro-1-nonanesulfonic acid (PFNS)	68259-12-1	PFAS by ID SOP	0.55	U	1.1	0.55	0.23	ug/kg	1
Perfluoro-1-octanesulfonamide (PFOSA)	754-91-6	PFAS by ID SOP	0.55	U	1.1	0.55	0.23	ug/kg	1
Perfluoro-1-pentanesulfonic acid (PFPeS)	2706-91-4	PFAS by ID SOP	0.55	U	1.1	0.55	0.23	ug/kg	1
Perfluorohexanesulfonic acid (PFHxS)	355-46-4	PFAS by ID SOP	0.55	U	1.1	0.55	0.23	ug/kg	1
Perfluoro-n-butanoic acid (PFBA)	375-22-4	PFAS by ID SOP	0.55	U	1.1	0.55	0.23	ug/kg	1
Perfluoro-n-decanoic acid (PFDA)	335-76-2	PFAS by ID SOP	0.55	U	1.1	0.55	0.23	ug/kg	1
Perfluoro-n-dodecanoic acid (PFDoA)	307-55-1	PFAS by ID SOP	0.55	U	1.1	0.55	0.23	ug/kg	1
Perfluoro-n-heptanoic acid (PFHpA)	375-85-9	PFAS by ID SOP	0.55	U	1.1	0.55	0.23	ug/kg	1
Perfluoro-n-hexanoic acid (PFHxA)	307-24-4	PFAS by ID SOP	0.55	U	1.1	0.55	0.23	ug/kg	1
Perfluoro-n-nonanoic acid (PFNA)	375-95-1	PFAS by ID SOP	0.55	U	1.1	0.55	0.23	ug/kg	1
Perfluoro-n-octanoic acid (PFOA)	335-67-1	PFAS by ID SOP	0.55	U	1.1	0.55	0.23	ug/kg	1
Perfluoro-n-pentanoic acid (PFPeA)	2706-90-3	PFAS by ID SOP	0.55	U	1.1	0.55	0.23	ug/kg	1
Perfluoro-n-tetradecanoic acid (PFTeDA)	376-06-7	PFAS by ID SOP	0.55	U	1.1	0.55	0.23	ug/kg	1
Perfluoro-n-tridecanoic acid (PFTrDA)	72629-94-8	PFAS by ID SOP	0.55	U	1.1	0.55	0.23	ug/kg	1
Perfluoro-n-undecanoic acid (PFUdA)	2058-94-8	PFAS by ID SOP	0.55	U	1.1	0.55	0.23	ug/kg	1
Perfluorooctanesulfonic acid (PFOS)	1763-23-1	PFAS by ID SOP	0.29	J	1.1	0.55	0.23	ug/kg	1

Surrogate	Run 1 Q	Run 1 % Recovery	Run 1 Acceptance Limits	Run 2 Q	Run 2 % Recovery	Run 2 Acceptance Limits
13C2_4:2FTS		79	50-150		100	50-150
13C2_6:2FTS		79	50-150		99	50-150
13C2_8:2FTS		74	50-150		110	50-150
13C2_PFDoA		77	50-150		89	50-150
13C2_PFTeDA		71	50-150		97	50-150
13C3_PFBS		78	50-150		96	50-150
13C3_PFHxS		83	50-150		93	50-150
13C4_PFBA		75	50-150		94	50-150
13C4_PFHpA		77	50-150		97	50-150
13C5_PFHxA		77	50-150		98	50-150
13C5_PFPeA		75	50-150		96	50-150
13C6_PFDA		76	50-150		92	50-150
13C7_PFUdA		76	50-150		93	50-150
13C8_PFOA		75	50-150		98	50-150
13C8_PFOS		78	50-150		95	50-150
13C8_PFOSA		76	50-150		93	50-150

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

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PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.		Laboratory ID: WI17055-004	
Description: ISM-382-5-Sa		Matrix: Solid	
Date Sampled: 09/07/2021	Project Name: Eielson AFB	% Solids: 86.9	09/18/2021 1903
Date Received: 09/17/2021	Project Number:		

Surrogate	Q	Run 1 % Recovery	Acceptance Limits	Q	Run 2 % Recovery	Acceptance Limits
13C9_PFNA		79	50-150		101	50-150
d5-EtFOSAA		81	50-150		102	50-150
d-MeFOSA		78	50-150		93	50-150
d3-MeFOSAA		77	50-150		102	50-150

LOQ = Limit of Quantitation	B = Detected in the method blank	E = Quantitation of compound exceeded the calibration range	DL = Detection Limit	Q = Surrogate failure
U = Not detected at or above the LOQ	N = Recovery is out of criteria	P = The RPD between two GC columns exceeds 40%	J = Estimated result < LOQ and ≥ DL	L = LCS/LCSD failure
H = Out of holding time	W = Reported on wet weight basis	LOD = Limit of Detection		S = MS/MSD failure

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SPLP PFAS

Client: Arcadis U.S., Inc. | Laboratory ID: WI17055-004
Description: ISM-382-5-Sa | Matrix: Solid
Date Sampled: 09/07/2021 | Project Name: Eielson AFB | % Solids: 86.9 09/18/2021 1903
Date Received: 09/17/2021 | Project Number:

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch	Leachate Date
1	1312/PFAS	PFAS by ID SOP QSM B-15	1	11/04/2021 2314	JJG	11/03/2021 1313	21123	10/27/2021 0213

Parameter	CAS Number	Analytical Method	Result	Q	LOQ	LOD	DL	Units	Run
1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS)	39108-34-4	PFAS by ID SOP	40	UH	80	40	20	ng/L	1
1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS)	27619-97-2	PFAS by ID SOP	110	H	80	40	20	ng/L	1
1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS)	757124-72-4	PFAS by ID SOP	40	UH	80	40	20	ng/L	1
N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA)	2991-50-6	PFAS by ID SOP	40	UH	80	40	20	ng/L	1
N-methylperfluoro-1-octanesulfonamide (MeFOSA)	31506-32-8	PFAS by ID SOP	80	UHL	160	80	40	ng/L	1
N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA)	2355-31-9	PFAS by ID SOP	40	UH	80	40	20	ng/L	1
Perfluoro-1-butanesulfonic acid (PFBS)	375-73-5	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-1-decanesulfonic acid (PFDS)	335-77-3	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-1-heptanesulfonic acid (PFHpS)	375-92-8	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-1-nonanesulfonic acid (PFNS)	68259-12-1	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-1-octanesulfonamide (PFOSA)	754-91-6	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-1-pentanesulfonic acid (PFPeS)	2706-91-4	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluorohexanesulfonic acid (PFHxS)	355-46-4	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-butanoic acid (PFBA)	375-22-4	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-decanoic acid (PFDA)	335-76-2	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-dodecanoic acid (PFDoA)	307-55-1	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-heptanoic acid (PFHpA)	375-85-9	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-hexanoic acid (PFHxA)	307-24-4	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-nonanoic acid (PFNA)	375-95-1	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-octanoic acid (PFOA)	335-67-1	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-pentanoic acid (PFPeA)	2706-90-3	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-tetradecanoic acid (PFTeDA)	376-06-7	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-tridecanoic acid (PFTrDA)	72629-94-8	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-undecanoic acid (PFUdA)	2058-94-8	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluorooctanesulfonic acid (PFOS)	1763-23-1	PFAS by ID SOP	20	UH	40	20	10	ng/L	1

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
13C2_4:2FTS	H	111	50-150
13C2_6:2FTS	H	114	50-150
13C2_8:2FTS	H	119	50-150
13C2_PFDoA	H	100	50-150
13C2_PFTeDA	H	102	50-150
13C3_PFBS	H	105	50-150
13C3_PFHxS	H	105	50-150
13C4_PFBA	H	105	50-150
13C4_PFHpA	H	104	50-150
13C5_PFHxA	H	101	50-150
13C5_PFPeA	H	102	50-150
13C6_PFDA	H	103	50-150
13C7_PFUdA	H	105	50-150
13C8_PFOA	H	103	50-150
13C8_PFOS	H	106	50-150
13C8_PFOSA	H	113	50-150
13C9_PFNA	H	103	50-150

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

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SPLP PFAS

Client: Arcadis U.S., Inc.		Laboratory ID: WI17055-004
Description: ISM-382-5-Sa		Matrix: Solid
Date Sampled: 09/07/2021	Project Name: Eielson AFB	% Solids: 86.9 09/18/2021 1903
Date Received: 09/17/2021	Project Number:	

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
d5-EtFOSAA	H	120	50-150
d-MeFOSA	H	101	50-150
d3-MeFOSAA	H	117	50-150

LOQ = Limit of Quantitation	B = Detected in the method blank	E = Quantitation of compound exceeded the calibration range	DL = Detection Limit	Q = Surrogate failure
U = Not detected at or above the LOQ	N = Recovery is out of criteria	P = The RPD between two GC columns exceeds 40%	J = Estimated result < LOQ and ≥ DL	L = LCS/LCSD failure
H = Out of holding time	W = Reported on wet weight basis	LOD = Limit of Detection		S = MS/MSD failure

PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: WI17055-005
Description: ISM-382-5-Sb | Matrix: Solid
Date Sampled: 09/07/2021 | Project Name: Eielson AFB | % Solids: 86.3 09/18/2021 1903
Date Received: 09/17/2021 | Project Number:

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch
1	SOP SPE	PFAS by ID SOP QSM B-15	1	09/21/2021 1345	JJG	09/19/2021 1515	15796
2	SOP SPE	PFAS by ID SOP QSM B-15	1	09/23/2021 1723	NK1	09/22/2021 1232	16138

Parameter	CAS Number	Analytical Method	Result	Q	LOQ	LOD	DL	Units	Run
1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS)	39108-34-4	PFAS by ID SOP	0.95	U	1.9	0.95	0.48	ug/kg	1
1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS)	27619-97-2	PFAS by ID SOP	1.1	U	2.1	1.1	0.53	ug/kg	2
1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS)	757124-72-4	PFAS by ID SOP	0.95	U	1.9	0.95	0.48	ug/kg	1
N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA)	2991-50-6	PFAS by ID SOP	0.95	U	1.9	0.95	0.48	ug/kg	1
N-methylperfluoro-1-octanesulfonamide (MeFOSA)	31506-32-8	PFAS by ID SOP	0.95	U	1.9	0.95	0.48	ug/kg	1
N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA)	2355-31-9	PFAS by ID SOP	0.95	U	1.9	0.95	0.48	ug/kg	1
Perfluoro-1-butanesulfonic acid (PFBS)	375-73-5	PFAS by ID SOP	0.49	U	0.97	0.49	0.19	ug/kg	1
Perfluoro-1-decanesulfonic acid (PFDS)	335-77-3	PFAS by ID SOP	0.49	U	0.97	0.49	0.19	ug/kg	1
Perfluoro-1-heptanesulfonic acid (PFHpS)	375-92-8	PFAS by ID SOP	0.49	U	0.97	0.49	0.19	ug/kg	1
Perfluoro-1-nonanesulfonic acid (PFNS)	68259-12-1	PFAS by ID SOP	0.49	U	0.97	0.49	0.19	ug/kg	1
Perfluoro-1-octanesulfonamide (PFOSA)	754-91-6	PFAS by ID SOP	0.49	U	0.97	0.49	0.19	ug/kg	1
Perfluoro-1-pentanesulfonic acid (PFPeS)	2706-91-4	PFAS by ID SOP	0.49	U	0.97	0.49	0.19	ug/kg	1
Perfluorohexanesulfonic acid (PFHxS)	355-46-4	PFAS by ID SOP	0.49	U	0.97	0.49	0.19	ug/kg	1
Perfluoro-n-butanoic acid (PFBA)	375-22-4	PFAS by ID SOP	0.49	U	0.97	0.49	0.19	ug/kg	1
Perfluoro-n-decanoic acid (PFDA)	335-76-2	PFAS by ID SOP	0.49	U	0.97	0.49	0.19	ug/kg	1
Perfluoro-n-dodecanoic acid (PFDoA)	307-55-1	PFAS by ID SOP	0.49	U	0.97	0.49	0.19	ug/kg	1
Perfluoro-n-heptanoic acid (PFHpA)	375-85-9	PFAS by ID SOP	0.49	U	0.97	0.49	0.19	ug/kg	1
Perfluoro-n-hexanoic acid (PFHxA)	307-24-4	PFAS by ID SOP	0.49	U	0.97	0.49	0.19	ug/kg	1
Perfluoro-n-nonanoic acid (PFNA)	375-95-1	PFAS by ID SOP	0.49	U	0.97	0.49	0.19	ug/kg	1
Perfluoro-n-octanoic acid (PFOA)	335-67-1	PFAS by ID SOP	0.49	U	0.97	0.49	0.19	ug/kg	1
Perfluoro-n-pentanoic acid (PFPeA)	2706-90-3	PFAS by ID SOP	0.49	U	0.97	0.49	0.19	ug/kg	1
Perfluoro-n-tetradecanoic acid (PFTeDA)	376-06-7	PFAS by ID SOP	0.49	U	0.97	0.49	0.19	ug/kg	1
Perfluoro-n-tridecanoic acid (PFTrDA)	72629-94-8	PFAS by ID SOP	0.49	U	0.97	0.49	0.19	ug/kg	1
Perfluoro-n-undecanoic acid (PFUdA)	2058-94-8	PFAS by ID SOP	0.49	U	0.97	0.49	0.19	ug/kg	1
Perfluorooctanesulfonic acid (PFOS)	1763-23-1	PFAS by ID SOP	0.49	U	0.97	0.49	0.19	ug/kg	1

Surrogate	Run 1 Q	Run 1 % Recovery	Run 1 Acceptance Limits	Run 2 Q	Run 2 % Recovery	Run 2 Acceptance Limits
13C2_4:2FTS		86	50-150		105	50-150
13C2_6:2FTS		75	50-150		104	50-150
13C2_8:2FTS		92	50-150		108	50-150
13C2_PFDoA		81	50-150		93	50-150
13C2_PFTeDA		80	50-150		98	50-150
13C3_PFBS		90	50-150		100	50-150
13C3_PFHxS		92	50-150		92	50-150
13C4_PFBA		86	50-150		97	50-150
13C4_PFHpA		93	50-150		94	50-150
13C5_PFHxA		89	50-150		99	50-150
13C5_PFPeA		90	50-150		93	50-150
13C6_PFDA		87	50-150		94	50-150
13C7_PFUdA		88	50-150		92	50-150
13C8_PFOA		90	50-150		96	50-150
13C8_PFOS		88	50-150		96	50-150
13C8_PFOSA		86	50-150		95	50-150

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

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PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.
Laboratory ID: WI17055-005
Description: ISM-382-5-Sb
Matrix: Solid
Date Sampled: 09/07/2021
Project Name: Eielson AFB
% Solids: 86.3 09/18/2021 1903
Date Received: 09/17/2021
Project Number:

Surrogate	Q	Run 1 % Recovery	Acceptance Limits	Q	Run 2 % Recovery	Acceptance Limits
13C9_PFNA		84	50-150		102	50-150
d5-EtFOSAA		79	50-150		99	50-150
d-MeFOSA		80	50-150		95	50-150
d3-MeFOSAA		84	50-150		97	50-150

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
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L = LCS/LCSD failure
S = MS/MSD failure

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SPLP PFAS

Client: Arcadis U.S., Inc. | Laboratory ID: WI17055-005
Description: ISM-382-5-Sb | Matrix: Solid
Date Sampled: 09/07/2021 | Project Name: Eielson AFB | % Solids: 86.3 09/18/2021 1903
Date Received: 09/17/2021 | Project Number:

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch	Leachate Date
1	1312/PFAS	PFAS by ID SOP QSM B-15	1	11/04/2021 2324	JJG	11/03/2021 1313	21123	10/27/2021 0213

Parameter	CAS Number	Analytical Method	Result	Q	LOQ	LOD	DL	Units	Run
1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS)	39108-34-4	PFAS by ID SOP	40	UH	80	40	20	ng/L	1
1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS)	27619-97-2	PFAS by ID SOP	29	HJ	80	40	20	ng/L	1
1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS)	757124-72-4	PFAS by ID SOP	40	UH	80	40	20	ng/L	1
N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA)	2991-50-6	PFAS by ID SOP	40	UH	80	40	20	ng/L	1
N-methylperfluoro-1-octanesulfonamide (MeFOSA)	31506-32-8	PFAS by ID SOP	80	UHL	160	80	40	ng/L	1
N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA)	2355-31-9	PFAS by ID SOP	40	UH	80	40	20	ng/L	1
Perfluoro-1-butanesulfonic acid (PFBS)	375-73-5	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-1-decanesulfonic acid (PFDS)	335-77-3	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-1-heptanesulfonic acid (PFHpS)	375-92-8	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-1-nonanesulfonic acid (PFNS)	68259-12-1	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-1-octanesulfonamide (PFOSA)	754-91-6	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-1-pentanesulfonic acid (PFPeS)	2706-91-4	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluorohexanesulfonic acid (PFHxS)	355-46-4	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-butanoic acid (PFBA)	375-22-4	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-decanoic acid (PFDA)	335-76-2	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-dodecanoic acid (PFDoA)	307-55-1	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-heptanoic acid (PFHpA)	375-85-9	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-hexanoic acid (PFHxA)	307-24-4	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-nonanoic acid (PFNA)	375-95-1	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-octanoic acid (PFOA)	335-67-1	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-pentanoic acid (PFPeA)	2706-90-3	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-tetradecanoic acid (PFTeDA)	376-06-7	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-tridecanoic acid (PFTrDA)	72629-94-8	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-undecanoic acid (PFUdA)	2058-94-8	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluorooctanesulfonic acid (PFOS)	1763-23-1	PFAS by ID SOP	20	UH	40	20	10	ng/L	1

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
13C2_4:2FTS	H	115	50-150
13C2_6:2FTS	H	101	50-150
13C2_8:2FTS	H	113	50-150
13C2_PFDoA	H	91	50-150
13C2_PFTeDA	H	98	50-150
13C3_PFBS	H	93	50-150
13C3_PFHxS	H	98	50-150
13C4_PFBA	H	100	50-150
13C4_PFHpA	H	96	50-150
13C5_PFHxA	H	97	50-150
13C5_PFPeA	H	98	50-150
13C6_PFDA	H	97	50-150
13C7_PFUdA	H	104	50-150
13C8_PFOA	H	96	50-150
13C8_PFOS	H	89	50-150
13C8_PFOSA	H	113	50-150
13C9_PFNA	H	94	50-150

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

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SPLP PFAS

Client: Arcadis U.S., Inc.		Laboratory ID: WI17055-005
Description: ISM-382-5-Sb		Matrix: Solid
Date Sampled: 09/07/2021	Project Name: Eielson AFB	% Solids: 86.3 09/18/2021 1903
Date Received: 09/17/2021	Project Number:	

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
d5-EtFOSAA	H	114	50-150
d-MeFOSA	H	90	50-150
d3-MeFOSAA	H	116	50-150

LOQ = Limit of Quantitation	B = Detected in the method blank	E = Quantitation of compound exceeded the calibration range	DL = Detection Limit	Q = Surrogate failure
U = Not detected at or above the LOQ	N = Recovery is out of criteria	P = The RPD between two GC columns exceeds 40%	J = Estimated result < LOQ and ≥ DL	L = LCS/LCSD failure
H = Out of holding time	W = Reported on wet weight basis	LOD = Limit of Detection		S = MS/MSD failure

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PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: WI17055-006
Description: ISM-382-5-Sc | Matrix: Solid
Date Sampled: 09/07/2021 | Project Name: Eielson AFB | % Solids: 97.7 09/18/2021 1903
Date Received: 09/17/2021 | Project Number:

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch
1	SOP SPE	PFAS by ID SOP QSM B-15	1	09/20/2021 1659	JJG	09/19/2021 1515	15796
2	SOP SPE	PFAS by ID SOP QSM B-15	1	09/23/2021 1736	NK1	09/22/2021 1232	16138

Parameter	CAS Number	Analytical Method	Result	Q	LOQ	LOD	DL	Units	Run
1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS)	39108-34-4	PFAS by ID SOP	0.90	U	1.8	0.90	0.45	ug/kg	1
1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS)	27619-97-2	PFAS by ID SOP	0.85	U	1.7	0.85	0.43	ug/kg	2
1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS)	757124-72-4	PFAS by ID SOP	0.90	U	1.8	0.90	0.45	ug/kg	1
N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA)	2991-50-6	PFAS by ID SOP	0.90	U	1.8	0.90	0.45	ug/kg	1
N-methylperfluoro-1-octanesulfonamide (MeFOSA)	31506-32-8	PFAS by ID SOP	0.90	U	1.8	0.90	0.45	ug/kg	1
N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA)	2355-31-9	PFAS by ID SOP	0.90	U	1.8	0.90	0.45	ug/kg	1
Perfluoro-1-butanesulfonic acid (PFBS)	375-73-5	PFAS by ID SOP	0.45	U	0.90	0.45	0.18	ug/kg	1
Perfluoro-1-decanesulfonic acid (PFDS)	335-77-3	PFAS by ID SOP	0.45	U	0.90	0.45	0.18	ug/kg	1
Perfluoro-1-heptanesulfonic acid (PFHpS)	375-92-8	PFAS by ID SOP	0.45	U	0.90	0.45	0.18	ug/kg	1
Perfluoro-1-nonanesulfonic acid (PFNS)	68259-12-1	PFAS by ID SOP	0.45	U	0.90	0.45	0.18	ug/kg	1
Perfluoro-1-octanesulfonamide (PFOSA)	754-91-6	PFAS by ID SOP	0.45	U	0.90	0.45	0.18	ug/kg	1
Perfluoro-1-pentanesulfonic acid (PFPeS)	2706-91-4	PFAS by ID SOP	0.45	U	0.90	0.45	0.18	ug/kg	1
Perfluorohexanesulfonic acid (PFHxS)	355-46-4	PFAS by ID SOP	0.45	U	0.90	0.45	0.18	ug/kg	1
Perfluoro-n-butanoic acid (PFBA)	375-22-4	PFAS by ID SOP	0.45	U	0.90	0.45	0.18	ug/kg	1
Perfluoro-n-decanoic acid (PFDA)	335-76-2	PFAS by ID SOP	0.45	U	0.90	0.45	0.18	ug/kg	1
Perfluoro-n-dodecanoic acid (PFDoA)	307-55-1	PFAS by ID SOP	0.45	U	0.90	0.45	0.18	ug/kg	1
Perfluoro-n-heptanoic acid (PFHpA)	375-85-9	PFAS by ID SOP	0.45	U	0.90	0.45	0.18	ug/kg	1
Perfluoro-n-hexanoic acid (PFHxA)	307-24-4	PFAS by ID SOP	0.45	U	0.90	0.45	0.18	ug/kg	1
Perfluoro-n-nonanoic acid (PFNA)	375-95-1	PFAS by ID SOP	0.45	U	0.90	0.45	0.18	ug/kg	1
Perfluoro-n-octanoic acid (PFOA)	335-67-1	PFAS by ID SOP	0.45	U	0.90	0.45	0.18	ug/kg	1
Perfluoro-n-pentanoic acid (PFPeA)	2706-90-3	PFAS by ID SOP	0.45	U	0.90	0.45	0.18	ug/kg	1
Perfluoro-n-tetradecanoic acid (PFTeDA)	376-06-7	PFAS by ID SOP	0.45	U	0.90	0.45	0.18	ug/kg	1
Perfluoro-n-tridecanoic acid (PFTrDA)	72629-94-8	PFAS by ID SOP	0.45	U	0.90	0.45	0.18	ug/kg	1
Perfluoro-n-undecanoic acid (PFUdA)	2058-94-8	PFAS by ID SOP	0.45	U	0.90	0.45	0.18	ug/kg	1
Perfluorooctanesulfonic acid (PFOS)	1763-23-1	PFAS by ID SOP	0.45	U	0.90	0.45	0.18	ug/kg	1

Surrogate	Run 1 Q	Run 1 % Recovery	Run 1 Acceptance Limits	Run 2 Q	Run 2 % Recovery	Run 2 Acceptance Limits
13C2_4:2FTS		65	50-150		75	50-150
13C2_6:2FTS		59	50-150		73	50-150
13C2_8:2FTS		57	50-150		76	50-150
13C2_PFDoA		59	50-150		65	50-150
13C2_PFTeDA		61	50-150		67	50-150
13C3_PFBS		60	50-150		68	50-150
13C3_PFHxS		63	50-150		67	50-150
13C4_PFBA		60	50-150		70	50-150
13C4_PFHpA		63	50-150		66	50-150
13C5_PFHxA		65	50-150		69	50-150
13C5_PFPeA		60	50-150		67	50-150
13C6_PFDA		61	50-150		67	50-150
13C7_PFUdA		61	50-150		65	50-150
13C8_PFOA		62	50-150		68	50-150
13C8_PFOS		65	50-150		68	50-150
13C8_PFOSA		60	50-150		65	50-150

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.
Laboratory ID: WI17055-006
Description: ISM-382-5-Sc
Matrix: Solid
Date Sampled: 09/07/2021
Project Name: Eielson AFB
% Solids: 97.7 09/18/2021 1903
Date Received: 09/17/2021
Project Number:

Surrogate	Q	Run 1 % Recovery	Acceptance Limits	Q	Run 2 % Recovery	Acceptance Limits
13C9_PFNA		61	50-150		69	50-150
d5-EtFOSAA		69	50-150		75	50-150
d-MeFOSA		64	50-150		66	50-150
d3-MeFOSAA		68	50-150		71	50-150

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
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SPLP PFAS

Client: Arcadis U.S., Inc. | Laboratory ID: WI17055-006
Description: ISM-382-5-Sc | Matrix: Solid
Date Sampled: 09/07/2021 | Project Name: Eielson AFB | % Solids: 97.7 09/18/2021 1903
Date Received: 09/17/2021 | Project Number:

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch	Leachate Date
1	1312/PFAS	PFAS by ID SOP QSM B-15	1	11/04/2021 2335	JJG	11/03/2021 1313	21123	10/27/2021 0213

Parameter	CAS Number	Analytical Method	Result	Q	LOQ	LOD	DL	Units	Run
1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS)	39108-34-4	PFAS by ID SOP	40	UH	80	40	20	ng/L	1
1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS)	27619-97-2	PFAS by ID SOP	40	UH	80	40	20	ng/L	1
1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS)	757124-72-4	PFAS by ID SOP	40	UH	80	40	20	ng/L	1
N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA)	2991-50-6	PFAS by ID SOP	40	UH	80	40	20	ng/L	1
N-methylperfluoro-1-octanesulfonamide (MeFOSA)	31506-32-8	PFAS by ID SOP	80	UHL	160	80	40	ng/L	1
N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA)	2355-31-9	PFAS by ID SOP	40	UH	80	40	20	ng/L	1
Perfluoro-1-butanesulfonic acid (PFBS)	375-73-5	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-1-decanesulfonic acid (PFDS)	335-77-3	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-1-heptanesulfonic acid (PFHpS)	375-92-8	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-1-nonanesulfonic acid (PFNS)	68259-12-1	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-1-octanesulfonamide (PFOSA)	754-91-6	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-1-pentanesulfonic acid (PFPeS)	2706-91-4	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluorohexanesulfonic acid (PFHxS)	355-46-4	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-butanoic acid (PFBA)	375-22-4	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-decanoic acid (PFDA)	335-76-2	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-dodecanoic acid (PFDoA)	307-55-1	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-heptanoic acid (PFHpA)	375-85-9	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-hexanoic acid (PFHxA)	307-24-4	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-nonanoic acid (PFNA)	375-95-1	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-octanoic acid (PFOA)	335-67-1	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-pentanoic acid (PFPeA)	2706-90-3	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-tetradecanoic acid (PFTeDA)	376-06-7	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-tridecanoic acid (PFTrDA)	72629-94-8	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-undecanoic acid (PFUdA)	2058-94-8	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluorooctanesulfonic acid (PFOS)	1763-23-1	PFAS by ID SOP	20	UH	40	20	10	ng/L	1

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
13C2_4:2FTS	H	112	50-150
13C2_6:2FTS	H	102	50-150
13C2_8:2FTS	H	105	50-150
13C2_PFDoA	H	88	50-150
13C2_PFTeDA	H	93	50-150
13C3_PFBS	H	93	50-150
13C3_PFHxS	H	98	50-150
13C4_PFBA	H	101	50-150
13C4_PFHpA	H	93	50-150
13C5_PFHxA	H	90	50-150
13C5_PFPeA	H	96	50-150
13C6_PFDA	H	92	50-150
13C7_PFUdA	H	99	50-150
13C8_PFOA	H	93	50-150
13C8_PFOS	H	95	50-150
13C8_PFOSA	H	110	50-150
13C9_PFNA	H	101	50-150

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

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SPLP PFAS

Client: Arcadis U.S., Inc.		Laboratory ID: WI17055-006	
Description: ISM-382-5-Sc		Matrix: Solid	
Date Sampled: 09/07/2021	Project Name: Eielson AFB	% Solids: 97.7	09/18/2021 1903
Date Received: 09/17/2021	Project Number:		

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
d5-EtFOSAA	H	118	50-150
d-MeFOSA	H	94	50-150
d3-MeFOSAA	H	113	50-150

LOQ = Limit of Quantitation	B = Detected in the method blank	E = Quantitation of compound exceeded the calibration range	DL = Detection Limit	Q = Surrogate failure
U = Not detected at or above the LOQ	N = Recovery is out of criteria	P = The RPD between two GC columns exceeds 40%	J = Estimated result < LOQ and ≥ DL	L = LCS/LCSD failure
H = Out of holding time	W = Reported on wet weight basis	LOD = Limit of Detection		S = MS/MSD failure

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PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: WI17055-007
Description: ISM-382-5-Fa | Matrix: Solid
Date Sampled: 09/08/2021 | Project Name: Eielson AFB | % Solids: 96.1 09/18/2021 1903
Date Received: 09/17/2021 | Project Number:

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch
1	SOP SPE	PFAS by ID SOP QSM B-15	1	09/20/2021 1709	JJG	09/19/2021 1515	15796
2	SOP SPE	PFAS by ID SOP QSM B-15	1	09/23/2021 1814	NK1	09/22/2021 1232	16138

Parameter	CAS Number	Analytical Method	Result	Q	LOQ	LOD	DL	Units	Run
1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS)	39108-34-4	PFAS by ID SOP	0.90	U	1.8	0.90	0.45	ug/kg	1
1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS)	27619-97-2	PFAS by ID SOP	0.85	U	1.7	0.85	0.43	ug/kg	2
1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS)	757124-72-4	PFAS by ID SOP	0.90	U	1.8	0.90	0.45	ug/kg	1
N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA)	2991-50-6	PFAS by ID SOP	0.90	U	1.8	0.90	0.45	ug/kg	1
N-methylperfluoro-1-octanesulfonamide (MeFOSA)	31506-32-8	PFAS by ID SOP	0.90	U	1.8	0.90	0.45	ug/kg	1
N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA)	2355-31-9	PFAS by ID SOP	0.90	U	1.8	0.90	0.45	ug/kg	1
Perfluoro-1-butanesulfonic acid (PFBS)	375-73-5	PFAS by ID SOP	0.46	U	0.91	0.46	0.18	ug/kg	1
Perfluoro-1-decanesulfonic acid (PFDS)	335-77-3	PFAS by ID SOP	0.46	U	0.91	0.46	0.18	ug/kg	1
Perfluoro-1-heptanesulfonic acid (PFHpS)	375-92-8	PFAS by ID SOP	0.46	U	0.91	0.46	0.18	ug/kg	1
Perfluoro-1-nonanesulfonic acid (PFNS)	68259-12-1	PFAS by ID SOP	0.46	U	0.91	0.46	0.18	ug/kg	1
Perfluoro-1-octanesulfonamide (PFOSA)	754-91-6	PFAS by ID SOP	0.46	U	0.91	0.46	0.18	ug/kg	1
Perfluoro-1-pentanesulfonic acid (PFPeS)	2706-91-4	PFAS by ID SOP	0.46	U	0.91	0.46	0.18	ug/kg	1
Perfluorohexanesulfonic acid (PFHxS)	355-46-4	PFAS by ID SOP	0.45	J	0.91	0.46	0.18	ug/kg	1
Perfluoro-n-butanoic acid (PFBA)	375-22-4	PFAS by ID SOP	0.46	U	0.91	0.46	0.18	ug/kg	1
Perfluoro-n-decanoic acid (PFDA)	335-76-2	PFAS by ID SOP	0.46	U	0.91	0.46	0.18	ug/kg	1
Perfluoro-n-dodecanoic acid (PFDoA)	307-55-1	PFAS by ID SOP	0.46	U	0.91	0.46	0.18	ug/kg	1
Perfluoro-n-heptanoic acid (PFHpA)	375-85-9	PFAS by ID SOP	0.46	U	0.91	0.46	0.18	ug/kg	1
Perfluoro-n-hexanoic acid (PFHxA)	307-24-4	PFAS by ID SOP	0.46	U	0.91	0.46	0.18	ug/kg	1
Perfluoro-n-nonanoic acid (PFNA)	375-95-1	PFAS by ID SOP	0.46	U	0.91	0.46	0.18	ug/kg	1
Perfluoro-n-octanoic acid (PFOA)	335-67-1	PFAS by ID SOP	0.46	U	0.91	0.46	0.18	ug/kg	1
Perfluoro-n-pentanoic acid (PFPeA)	2706-90-3	PFAS by ID SOP	0.46	U	0.91	0.46	0.18	ug/kg	1
Perfluoro-n-tetradecanoic acid (PFTeDA)	376-06-7	PFAS by ID SOP	0.46	U	0.91	0.46	0.18	ug/kg	1
Perfluoro-n-tridecanoic acid (PFTrDA)	72629-94-8	PFAS by ID SOP	0.46	U	0.91	0.46	0.18	ug/kg	1
Perfluoro-n-undecanoic acid (PFUdA)	2058-94-8	PFAS by ID SOP	0.46	U	0.91	0.46	0.18	ug/kg	1
Perfluorooctanesulfonic acid (PFOS)	1763-23-1	PFAS by ID SOP	1.4		0.91	0.46	0.18	ug/kg	1

Surrogate	Run 1 Q	Run 1 % Recovery	Run 1 Acceptance Limits	Run 2 Q	Run 2 % Recovery	Run 2 Acceptance Limits
13C2_4:2FTS		95	50-150		110	50-150
13C2_6:2FTS		91	50-150		107	50-150
13C2_8:2FTS		98	50-150		119	50-150
13C2_PFDoA		87	50-150		93	50-150
13C2_PFTeDA		87	50-150		97	50-150
13C3_PFBS		89	50-150		100	50-150
13C3_PFHxS		93	50-150		96	50-150
13C4_PFBA		92	50-150		98	50-150
13C4_PFHpA		93	50-150		94	50-150
13C5_PFHxA		90	50-150		103	50-150
13C5_PFPeA		93	50-150		95	50-150
13C6_PFDA		89	50-150		91	50-150
13C7_PFUdA		91	50-150		89	50-150
13C8_PFOA		86	50-150		98	50-150
13C8_PFOS		88	50-150		94	50-150
13C8_PFOSA		84	50-150		92	50-150

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

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PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.		Laboratory ID: WI17055-007	
Description: ISM-382-5-Fa		Matrix: Solid	
Date Sampled: 09/08/2021	Project Name: Eielson AFB	% Solids: 96.1	09/18/2021 1903
Date Received: 09/17/2021	Project Number:		

Surrogate	Q	Run 1 % Recovery	Acceptance Limits	Q	Run 2 % Recovery	Acceptance Limits
13C9_PFNA		93	50-150		99	50-150
d5-EtFOSAA		98	50-150		109	50-150
d-MeFOSA		87	50-150		86	50-150
d3-MeFOSAA		97	50-150		104	50-150

LOQ = Limit of Quantitation	B = Detected in the method blank	E = Quantitation of compound exceeded the calibration range	DL = Detection Limit	Q = Surrogate failure
U = Not detected at or above the LOQ	N = Recovery is out of criteria	P = The RPD between two GC columns exceeds 40%	J = Estimated result < LOQ and ≥ DL	L = LCS/LCSD failure
H = Out of holding time	W = Reported on wet weight basis	LOD = Limit of Detection		S = MS/MSD failure

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SPLP PFAS

Client: Arcadis U.S., Inc. | Laboratory ID: WI17055-007
Description: ISM-382-5-Fa | Matrix: Solid
Date Sampled: 09/08/2021 | Project Name: Eielson AFB | % Solids: 96.1 09/18/2021 1903
Date Received: 09/17/2021 | Project Number:

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch	Leachate Date
1	1312/PFAS	PFAS by ID SOP QSM B-15	1	11/04/2021 2346	JJG	11/03/2021 1313	21123	10/27/2021 0213

Parameter	CAS Number	Analytical Method	Result	Q	LOQ	LOD	DL	Units	Run
1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS)	39108-34-4	PFAS by ID SOP	40	UH	80	40	20	ng/L	1
1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS)	27619-97-2	PFAS by ID SOP	32	HJ	80	40	20	ng/L	1
1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS)	757124-72-4	PFAS by ID SOP	40	UH	80	40	20	ng/L	1
N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA)	2991-50-6	PFAS by ID SOP	40	UH	80	40	20	ng/L	1
N-methylperfluoro-1-octanesulfonamide (MeFOSA)	31506-32-8	PFAS by ID SOP	80	UHL	160	80	40	ng/L	1
N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA)	2355-31-9	PFAS by ID SOP	40	UH	80	40	20	ng/L	1
Perfluoro-1-butanesulfonic acid (PFBS)	375-73-5	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-1-decanesulfonic acid (PFDS)	335-77-3	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-1-heptanesulfonic acid (PFHpS)	375-92-8	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-1-nonanesulfonic acid (PFNS)	68259-12-1	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-1-octanesulfonamide (PFOSA)	754-91-6	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-1-pentanesulfonic acid (PFPeS)	2706-91-4	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluorohexanesulfonic acid (PFHxS)	355-46-4	PFAS by ID SOP	29	HJ	40	20	10	ng/L	1
Perfluoro-n-butanoic acid (PFBA)	375-22-4	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-decanoic acid (PFDA)	335-76-2	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-dodecanoic acid (PFDoA)	307-55-1	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-heptanoic acid (PFHpA)	375-85-9	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-hexanoic acid (PFHxA)	307-24-4	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-nonanoic acid (PFNA)	375-95-1	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-octanoic acid (PFOA)	335-67-1	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-pentanoic acid (PFPeA)	2706-90-3	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-tetradecanoic acid (PFTeDA)	376-06-7	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-tridecanoic acid (PFTrDA)	72629-94-8	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-undecanoic acid (PFUdA)	2058-94-8	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluorooctanesulfonic acid (PFOS)	1763-23-1	PFAS by ID SOP	58	H	40	20	10	ng/L	1

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
13C2_4:2FTS	H	120	50-150
13C2_6:2FTS	H	110	50-150
13C2_8:2FTS	H	109	50-150
13C2_PFDoA	H	94	50-150
13C2_PFTeDA	H	93	50-150
13C3_PFBS	H	103	50-150
13C3_PFHxS	H	92	50-150
13C4_PFBA	H	109	50-150
13C4_PFHpA	H	95	50-150
13C5_PFHxA	H	96	50-150
13C5_PFPeA	H	100	50-150
13C6_PFDA	H	95	50-150
13C7_PFUdA	H	104	50-150
13C8_PFOA	H	95	50-150
13C8_PFOS	H	97	50-150
13C8_PFOSA	H	111	50-150
13C9_PFNA	H	98	50-150

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

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SPLP PFAS

Client: Arcadis U.S., Inc.		Laboratory ID: WI17055-007
Description: ISM-382-5-Fa		Matrix: Solid
Date Sampled: 09/08/2021	Project Name: Eielson AFB	% Solids: 96.1 09/18/2021 1903
Date Received: 09/17/2021	Project Number:	

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
d5-EtFOSAA	H	113	50-150
d-MeFOSA	H	98	50-150
d3-MeFOSAA	H	115	50-150

LOQ = Limit of Quantitation	B = Detected in the method blank	E = Quantitation of compound exceeded the calibration range	DL = Detection Limit	Q = Surrogate failure
U = Not detected at or above the LOQ	N = Recovery is out of criteria	P = The RPD between two GC columns exceeds 40%	J = Estimated result < LOQ and ≥ DL	L = LCS/LCSD failure
H = Out of holding time	W = Reported on wet weight basis	LOD = Limit of Detection		S = MS/MSD failure

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PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: WI17055-008
Description: ISM-382-5-Fb | Matrix: Solid
Date Sampled: 09/08/2021 | Project Name: Eielson AFB | % Solids: 96.1 09/18/2021 1903
Date Received: 09/17/2021 | Project Number:

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch
1	SOP SPE	PFAS by ID SOP QSM B-15	1	09/20/2021 1720	JJG	09/19/2021 1515	15796
2	SOP SPE	PFAS by ID SOP QSM B-15	1	09/23/2021 1826	NK1	09/22/2021 1232	16138

Parameter	CAS Number	Analytical Method	Result	Q	LOQ	LOD	DL	Units	Run
1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS)	39108-34-4	PFAS by ID SOP	0.95	U	1.9	0.95	0.47	ug/kg	1
1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS)	27619-97-2	PFAS by ID SOP	1.0	U	2.0	1.0	0.50	ug/kg	2
1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS)	757124-72-4	PFAS by ID SOP	0.95	U	1.9	0.95	0.47	ug/kg	1
N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA)	2991-50-6	PFAS by ID SOP	0.95	U	1.9	0.95	0.47	ug/kg	1
N-methylperfluoro-1-octanesulfonamide (MeFOSA)	31506-32-8	PFAS by ID SOP	0.95	U	1.9	0.95	0.47	ug/kg	1
N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA)	2355-31-9	PFAS by ID SOP	0.95	U	1.9	0.95	0.47	ug/kg	1
Perfluoro-1-butanesulfonic acid (PFBS)	375-73-5	PFAS by ID SOP	0.47	U	0.94	0.47	0.19	ug/kg	1
Perfluoro-1-decanesulfonic acid (PFDS)	335-77-3	PFAS by ID SOP	0.47	U	0.94	0.47	0.19	ug/kg	1
Perfluoro-1-heptanesulfonic acid (PFHpS)	375-92-8	PFAS by ID SOP	0.47	U	0.94	0.47	0.19	ug/kg	1
Perfluoro-1-nonanesulfonic acid (PFNS)	68259-12-1	PFAS by ID SOP	0.47	U	0.94	0.47	0.19	ug/kg	1
Perfluoro-1-octanesulfonamide (PFOSA)	754-91-6	PFAS by ID SOP	0.47	U	0.94	0.47	0.19	ug/kg	1
Perfluoro-1-pentanesulfonic acid (PFPeS)	2706-91-4	PFAS by ID SOP	0.47	U	0.94	0.47	0.19	ug/kg	1
Perfluorohexanesulfonic acid (PFHxS)	355-46-4	PFAS by ID SOP	0.45	J	0.94	0.47	0.19	ug/kg	1
Perfluoro-n-butanoic acid (PFBA)	375-22-4	PFAS by ID SOP	0.47	U	0.94	0.47	0.19	ug/kg	1
Perfluoro-n-decanoic acid (PFDA)	335-76-2	PFAS by ID SOP	0.47	U	0.94	0.47	0.19	ug/kg	1
Perfluoro-n-dodecanoic acid (PFDoA)	307-55-1	PFAS by ID SOP	0.47	U	0.94	0.47	0.19	ug/kg	1
Perfluoro-n-heptanoic acid (PFHpA)	375-85-9	PFAS by ID SOP	0.47	U	0.94	0.47	0.19	ug/kg	1
Perfluoro-n-hexanoic acid (PFHxA)	307-24-4	PFAS by ID SOP	0.47	U	0.94	0.47	0.19	ug/kg	1
Perfluoro-n-nonanoic acid (PFNA)	375-95-1	PFAS by ID SOP	0.47	U	0.94	0.47	0.19	ug/kg	1
Perfluoro-n-octanoic acid (PFOA)	335-67-1	PFAS by ID SOP	0.47	U	0.94	0.47	0.19	ug/kg	1
Perfluoro-n-pentanoic acid (PFPeA)	2706-90-3	PFAS by ID SOP	0.47	U	0.94	0.47	0.19	ug/kg	1
Perfluoro-n-tetradecanoic acid (PFTeDA)	376-06-7	PFAS by ID SOP	0.47	U	0.94	0.47	0.19	ug/kg	1
Perfluoro-n-tridecanoic acid (PFTrDA)	72629-94-8	PFAS by ID SOP	0.47	U	0.94	0.47	0.19	ug/kg	1
Perfluoro-n-undecanoic acid (PFUdA)	2058-94-8	PFAS by ID SOP	0.47	U	0.94	0.47	0.19	ug/kg	1
Perfluorooctanesulfonic acid (PFOS)	1763-23-1	PFAS by ID SOP	1.9		0.94	0.47	0.19	ug/kg	1

Surrogate	Run 1 Q	Run 1 % Recovery	Run 1 Acceptance Limits	Run 2 Q	Run 2 % Recovery	Run 2 Acceptance Limits
13C2_4:2FTS		67	50-150		94	50-150
13C2_6:2FTS		68	50-150		100	50-150
13C2_8:2FTS		76	50-150		99	50-150
13C2_PFDoA		65	50-150		86	50-150
13C2_PFTeDA		65	50-150		95	50-150
13C3_PFBS		64	50-150		87	50-150
13C3_PFHxS		69	50-150		80	50-150
13C4_PFBA		66	50-150		90	50-150
13C4_PFHpA		65	50-150		85	50-150
13C5_PFHxA		68	50-150		90	50-150
13C5_PFPeA		67	50-150		86	50-150
13C6_PFDA		66	50-150		86	50-150
13C7_PFUdA		67	50-150		85	50-150
13C8_PFOA		65	50-150		86	50-150
13C8_PFOS		68	50-150		85	50-150
13C8_PFOSA		65	50-150		82	50-150

LOQ = Limit of Quantitation
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E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
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DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
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PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.
Laboratory ID: WI17055-008
Description: ISM-382-5-Fb
Matrix: Solid
Date Sampled: 09/08/2021
Project Name: Eielson AFB
% Solids: 96.1 09/18/2021 1903
Date Received: 09/17/2021
Project Number:

Surrogate	Q	Run 1 % Recovery	Acceptance Limits	Q	Run 2 % Recovery	Acceptance Limits
13C9_PFNA		66	50-150		92	50-150
d5-EtFOSAA		84	50-150		104	50-150
d-MeFOSA		81	50-150		80	50-150
d3-MeFOSAA		84	50-150		99	50-150

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
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SPLP PFAS

Client: Arcadis U.S., Inc. | Laboratory ID: WI17055-008
Description: ISM-382-5-Fb | Matrix: Solid
Date Sampled: 09/08/2021 | Project Name: Eielson AFB | % Solids: 96.1 09/18/2021 1903
Date Received: 09/17/2021 | Project Number:

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch	Leachate Date
1	1312/PFAS	PFAS by ID SOP QSM B-15	1	11/05/2021 1731	MMM	11/04/2021 1300	21287	10/27/2021 0213

Parameter	CAS Number	Analytical Method	Result	Q	LOQ	LOD	DL	Units	Run
1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS)	39108-34-4	PFAS by ID SOP	40	UH	80	40	20	ng/L	1
1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS)	27619-97-2	PFAS by ID SOP	51	HJ	80	40	20	ng/L	1
1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS)	757124-72-4	PFAS by ID SOP	40	UH	80	40	20	ng/L	1
N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA)	2991-50-6	PFAS by ID SOP	40	UH	80	40	20	ng/L	1
N-methylperfluoro-1-octanesulfonamide (MeFOSA)	31506-32-8	PFAS by ID SOP	80	UH	160	80	40	ng/L	1
N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA)	2355-31-9	PFAS by ID SOP	40	UH	80	40	20	ng/L	1
Perfluoro-1-butanesulfonic acid (PFBS)	375-73-5	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-1-decanesulfonic acid (PFDS)	335-77-3	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-1-heptanesulfonic acid (PFHpS)	375-92-8	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-1-nonanesulfonic acid (PFNS)	68259-12-1	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-1-octanesulfonamide (PFOSA)	754-91-6	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-1-pentanesulfonic acid (PFPeS)	2706-91-4	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluorohexanesulfonic acid (PFHxS)	355-46-4	PFAS by ID SOP	21	HJ	40	20	10	ng/L	1
Perfluoro-n-butanoic acid (PFBA)	375-22-4	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-decanoic acid (PFDA)	335-76-2	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-dodecanoic acid (PFDoA)	307-55-1	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-heptanoic acid (PFHpA)	375-85-9	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-hexanoic acid (PFHxA)	307-24-4	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-nonanoic acid (PFNA)	375-95-1	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-octanoic acid (PFOA)	335-67-1	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-pentanoic acid (PFPeA)	2706-90-3	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-tetradecanoic acid (PFTeDA)	376-06-7	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-tridecanoic acid (PFTrDA)	72629-94-8	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-undecanoic acid (PFUdA)	2058-94-8	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluorooctanesulfonic acid (PFOS)	1763-23-1	PFAS by ID SOP	66	H	40	20	10	ng/L	1

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
13C2_4:2FTS	H	116	50-150
13C2_6:2FTS	H	103	50-150
13C2_8:2FTS	H	101	50-150
13C2_PFDoA	H	100	50-150
13C2_PFTeDA	H	83	50-150
13C3_PFBS	H	102	50-150
13C3_PFHxS	H	102	50-150
13C4_PFBA	H	105	50-150
13C4_PFHpA	H	100	50-150
13C5_PFHxA	H	98	50-150
13C5_PFPeA	H	102	50-150
13C6_PFDA	H	97	50-150
13C7_PFUdA	H	96	50-150
13C8_PFOA	H	99	50-150
13C8_PFOS	H	103	50-150
13C8_PFOSA	H	112	50-150
13C9_PFNA	H	94	50-150

LOQ = Limit of Quantitation
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N = Recovery is out of criteria
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E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
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J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

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SPLP PFAS

Client: Arcadis U.S., Inc.		Laboratory ID: WI17055-008
Description: ISM-382-5-Fb		Matrix: Solid
Date Sampled: 09/08/2021	Project Name: Eielson AFB	% Solids: 96.1 09/18/2021 1903
Date Received: 09/17/2021	Project Number:	

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
d5-EtFOSAA	H	106	50-150
d-MeFOSA	H	91	50-150
d3-MeFOSAA	H	106	50-150

LOQ = Limit of Quantitation	B = Detected in the method blank	E = Quantitation of compound exceeded the calibration range	DL = Detection Limit	Q = Surrogate failure
U = Not detected at or above the LOQ	N = Recovery is out of criteria	P = The RPD between two GC columns exceeds 40%	J = Estimated result < LOQ and ≥ DL	L = LCS/LCSD failure
H = Out of holding time	W = Reported on wet weight basis	LOD = Limit of Detection		S = MS/MSD failure

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PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: WI17055-009
Description: ISM-382-5-Fc | Matrix: Solid
Date Sampled: 09/08/2021 | Project Name: Eielson AFB | % Solids: 79.1 09/18/2021 1903
Date Received: 09/17/2021 | Project Number:

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch
1	SOP SPE	PFAS by ID SOP QSM B-15	1	09/20/2021 1731	JJG	09/19/2021 1515	15796
2	SOP SPE	PFAS by ID SOP QSM B-15	1	09/23/2021 1839	NK1	09/22/2021 1232	16138

Parameter	CAS Number	Analytical Method	Result	Q	LOQ	LOD	DL	Units	Run
1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS)	39108-34-4	PFAS by ID SOP	1.3	U	2.5	1.3	0.63	ug/kg	1
1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS)	27619-97-2	PFAS by ID SOP	1.3	U	2.5	1.3	0.61	ug/kg	2
1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS)	757124-72-4	PFAS by ID SOP	1.3	U	2.5	1.3	0.63	ug/kg	1
N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA)	2991-50-6	PFAS by ID SOP	1.3	U	2.5	1.3	0.63	ug/kg	1
N-methylperfluoro-1-octanesulfonamide (MeFOSA)	31506-32-8	PFAS by ID SOP	1.3	U	2.5	1.3	0.63	ug/kg	1
N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA)	2355-31-9	PFAS by ID SOP	1.3	U	2.5	1.3	0.63	ug/kg	1
Perfluoro-1-butanesulfonic acid (PFBS)	375-73-5	PFAS by ID SOP	0.65	U	1.3	0.65	0.25	ug/kg	1
Perfluoro-1-decanesulfonic acid (PFDS)	335-77-3	PFAS by ID SOP	0.65	U	1.3	0.65	0.25	ug/kg	1
Perfluoro-1-heptanesulfonic acid (PFHpS)	375-92-8	PFAS by ID SOP	0.65	U	1.3	0.65	0.25	ug/kg	1
Perfluoro-1-nonanesulfonic acid (PFNS)	68259-12-1	PFAS by ID SOP	0.65	U	1.3	0.65	0.25	ug/kg	1
Perfluoro-1-octanesulfonamide (PFOSA)	754-91-6	PFAS by ID SOP	0.65	U	1.3	0.65	0.25	ug/kg	1
Perfluoro-1-pentanesulfonic acid (PFPeS)	2706-91-4	PFAS by ID SOP	0.65	U	1.3	0.65	0.25	ug/kg	1
Perfluorohexanesulfonic acid (PFHxS)	355-46-4	PFAS by ID SOP	0.55	J	1.3	0.65	0.25	ug/kg	1
Perfluoro-n-butanoic acid (PFBA)	375-22-4	PFAS by ID SOP	0.65	U	1.3	0.65	0.25	ug/kg	1
Perfluoro-n-decanoic acid (PFDA)	335-76-2	PFAS by ID SOP	0.65	U	1.3	0.65	0.25	ug/kg	1
Perfluoro-n-dodecanoic acid (PFDoA)	307-55-1	PFAS by ID SOP	0.65	U	1.3	0.65	0.25	ug/kg	1
Perfluoro-n-heptanoic acid (PFHpA)	375-85-9	PFAS by ID SOP	0.65	U	1.3	0.65	0.25	ug/kg	1
Perfluoro-n-hexanoic acid (PFHxA)	307-24-4	PFAS by ID SOP	0.65	U	1.3	0.65	0.25	ug/kg	1
Perfluoro-n-nonanoic acid (PFNA)	375-95-1	PFAS by ID SOP	0.65	U	1.3	0.65	0.25	ug/kg	1
Perfluoro-n-octanoic acid (PFOA)	335-67-1	PFAS by ID SOP	0.65	U	1.3	0.65	0.25	ug/kg	1
Perfluoro-n-pentanoic acid (PFPeA)	2706-90-3	PFAS by ID SOP	0.65	U	1.3	0.65	0.25	ug/kg	1
Perfluoro-n-tetradecanoic acid (PFTeDA)	376-06-7	PFAS by ID SOP	0.65	U	1.3	0.65	0.25	ug/kg	1
Perfluoro-n-tridecanoic acid (PFTrDA)	72629-94-8	PFAS by ID SOP	0.65	U	1.3	0.65	0.25	ug/kg	1
Perfluoro-n-undecanoic acid (PFUdA)	2058-94-8	PFAS by ID SOP	0.65	U	1.3	0.65	0.25	ug/kg	1
Perfluorooctanesulfonic acid (PFOS)	1763-23-1	PFAS by ID SOP	1.9		1.3	0.65	0.25	ug/kg	1

Surrogate	Run 1 Q	Run 1 % Recovery	Run 1 Acceptance Limits	Run 2 Q	Run 2 % Recovery	Run 2 Acceptance Limits
13C2_4:2FTS		96	50-150		95	50-150
13C2_6:2FTS		84	50-150		103	50-150
13C2_8:2FTS		96	50-150		110	50-150
13C2_PFDoA		91	50-150		93	50-150
13C2_PFTeDA		84	50-150		100	50-150
13C3_PFBS		83	50-150		91	50-150
13C3_PFHxS		88	50-150		87	50-150
13C4_PFBA		85	50-150		92	50-150
13C4_PFHpA		87	50-150		92	50-150
13C5_PFHxA		85	50-150		93	50-150
13C5_PFPeA		86	50-150		89	50-150
13C6_PFDA		90	50-150		96	50-150
13C7_PFUdA		93	50-150		91	50-150
13C8_PFOA		85	50-150		88	50-150
13C8_PFOS		97	50-150		93	50-150
13C8_PFOSA		89	50-150		89	50-150

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

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PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.		Laboratory ID: WI17055-009	
Description: ISM-382-5-Fc		Matrix: Solid	
Date Sampled: 09/08/2021	Project Name: Eielson AFB	% Solids: 79.1	09/18/2021 1903
Date Received: 09/17/2021	Project Number:		

Surrogate	Q	Run 1 % Recovery	Acceptance Limits	Q	Run 2 % Recovery	Acceptance Limits
13C9_PFNA		87	50-150		100	50-150
d5-EtFOSAA		102	50-150		104	50-150
d-MeFOSA		87	50-150		90	50-150
d3-MeFOSAA		94	50-150		96	50-150

LOQ = Limit of Quantitation	B = Detected in the method blank	E = Quantitation of compound exceeded the calibration range	DL = Detection Limit	Q = Surrogate failure
U = Not detected at or above the LOQ	N = Recovery is out of criteria	P = The RPD between two GC columns exceeds 40%	J = Estimated result < LOQ and ≥ DL	L = LCS/LCSD failure
H = Out of holding time	W = Reported on wet weight basis	LOD = Limit of Detection		S = MS/MSD failure

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SPLP PFAS

Client: Arcadis U.S., Inc. | Laboratory ID: WI17055-009
Description: ISM-382-5-Fc | Matrix: Solid
Date Sampled: 09/08/2021 | Project Name: Eielson AFB | % Solids: 79.1 09/18/2021 1903
Date Received: 09/17/2021 | Project Number:

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch	Leachate Date
1	1312/PFAS	PFAS by ID SOP QSM B-15	1	11/05/2021 1742	MMM	11/04/2021 1300	21287	10/27/2021 0213

Parameter	CAS Number	Analytical Method	Result	Q	LOQ	LOD	DL	Units	Run
1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS)	39108-34-4	PFAS by ID SOP	40	UH	80	40	20	ng/L	1
1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS)	27619-97-2	PFAS by ID SOP	40	UH	80	40	20	ng/L	1
1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS)	757124-72-4	PFAS by ID SOP	40	UH	80	40	20	ng/L	1
N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA)	2991-50-6	PFAS by ID SOP	40	UH	80	40	20	ng/L	1
N-methylperfluoro-1-octanesulfonamide (MeFOSA)	31506-32-8	PFAS by ID SOP	80	UH	160	80	40	ng/L	1
N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA)	2355-31-9	PFAS by ID SOP	40	UH	80	40	20	ng/L	1
Perfluoro-1-butanesulfonic acid (PFBS)	375-73-5	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-1-decanesulfonic acid (PFDS)	335-77-3	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-1-heptanesulfonic acid (PFHpS)	375-92-8	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-1-nonanesulfonic acid (PFNS)	68259-12-1	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-1-octanesulfonamide (PFOSA)	754-91-6	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-1-pentanesulfonic acid (PFPeS)	2706-91-4	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluorohexanesulfonic acid (PFHxS)	355-46-4	PFAS by ID SOP	15	HJ	40	20	10	ng/L	1
Perfluoro-n-butanoic acid (PFBA)	375-22-4	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-decanoic acid (PFDA)	335-76-2	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-dodecanoic acid (PFDoA)	307-55-1	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-heptanoic acid (PFHpA)	375-85-9	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-hexanoic acid (PFHxA)	307-24-4	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-nonanoic acid (PFNA)	375-95-1	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-octanoic acid (PFOA)	335-67-1	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-pentanoic acid (PFPeA)	2706-90-3	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-tetradecanoic acid (PFTeDA)	376-06-7	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-tridecanoic acid (PFTrDA)	72629-94-8	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-undecanoic acid (PFUdA)	2058-94-8	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluorooctanesulfonic acid (PFOS)	1763-23-1	PFAS by ID SOP	44	H	40	20	10	ng/L	1

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
13C2_4:2FTS	H	114	50-150
13C2_6:2FTS	H	103	50-150
13C2_8:2FTS	H	101	50-150
13C2_PFDoA	H	101	50-150
13C2_PFTeDA	H	80	50-150
13C3_PFBS	H	105	50-150
13C3_PFHxS	H	100	50-150
13C4_PFBA	H	98	50-150
13C4_PFHpA	H	102	50-150
13C5_PFHxA	H	97	50-150
13C5_PFPeA	H	99	50-150
13C6_PFDA	H	95	50-150
13C7_PFUdA	H	93	50-150
13C8_PFOA	H	96	50-150
13C8_PFOS	H	99	50-150
13C8_PFOSA	H	96	50-150
13C9_PFNA	H	101	50-150

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

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SPLP PFAS

Client: Arcadis U.S., Inc.		Laboratory ID: WI17055-009
Description: ISM-382-5-Fc		Matrix: Solid
Date Sampled: 09/08/2021	Project Name: Eielson AFB	% Solids: 79.1 09/18/2021 1903
Date Received: 09/17/2021	Project Number:	

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
d5-EtFOSAA	H	109	50-150
d-MeFOSA	H	105	50-150
d3-MeFOSAA	H	114	50-150

LOQ = Limit of Quantitation	B = Detected in the method blank	E = Quantitation of compound exceeded the calibration range	DL = Detection Limit	Q = Surrogate failure
U = Not detected at or above the LOQ	N = Recovery is out of criteria	P = The RPD between two GC columns exceeds 40%	J = Estimated result < LOQ and ≥ DL	L = LCS/LCSD failure
H = Out of holding time	W = Reported on wet weight basis	LOD = Limit of Detection		S = MS/MSD failure

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PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: WI17055-010
Description: ISM-382-5-Ga | Matrix: Solid
Date Sampled: 09/08/2021 | Project Name: Eielson AFB | % Solids: 99.8 09/18/2021 1903
Date Received: 09/17/2021 | Project Number:

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch
1	SOP SPE	PFAS by ID SOP QSM B-15	1	09/20/2021 1741	JJG	09/19/2021 1515	15796
2	SOP SPE	PFAS by ID SOP QSM B-15	1	09/23/2021 1852	NK1	09/22/2021 1232	16138

Parameter	CAS Number	Analytical Method	Result	Q	LOQ	LOD	DL	Units	Run
1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS)	39108-34-4	PFAS by ID SOP	0.85	U	1.7	0.85	0.43	ug/kg	1
1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS)	27619-97-2	PFAS by ID SOP	0.85	U	1.7	0.85	0.43	ug/kg	2
1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS)	757124-72-4	PFAS by ID SOP	0.85	U	1.7	0.85	0.43	ug/kg	1
N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA)	2991-50-6	PFAS by ID SOP	0.85	U	1.7	0.85	0.43	ug/kg	1
N-methylperfluoro-1-octanesulfonamide (MeFOSA)	31506-32-8	PFAS by ID SOP	0.85	U	1.7	0.85	0.43	ug/kg	1
N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA)	2355-31-9	PFAS by ID SOP	0.85	U	1.7	0.85	0.43	ug/kg	1
Perfluoro-1-butanesulfonic acid (PFBS)	375-73-5	PFAS by ID SOP	0.43	U	0.86	0.43	0.17	ug/kg	1
Perfluoro-1-decanesulfonic acid (PFDS)	335-77-3	PFAS by ID SOP	0.43	U	0.86	0.43	0.17	ug/kg	1
Perfluoro-1-heptanesulfonic acid (PFHpS)	375-92-8	PFAS by ID SOP	0.43	U	0.86	0.43	0.17	ug/kg	1
Perfluoro-1-nonanesulfonic acid (PFNS)	68259-12-1	PFAS by ID SOP	0.43	U	0.86	0.43	0.17	ug/kg	1
Perfluoro-1-octanesulfonamide (PFOSA)	754-91-6	PFAS by ID SOP	0.43	U	0.86	0.43	0.17	ug/kg	1
Perfluoro-1-pentanesulfonic acid (PFPeS)	2706-91-4	PFAS by ID SOP	0.43	U	0.86	0.43	0.17	ug/kg	1
Perfluorohexanesulfonic acid (PFHxS)	355-46-4	PFAS by ID SOP	0.43	U	0.86	0.43	0.17	ug/kg	1
Perfluoro-n-butanoic acid (PFBA)	375-22-4	PFAS by ID SOP	0.76	J	0.86	0.43	0.17	ug/kg	1
Perfluoro-n-decanoic acid (PFDA)	335-76-2	PFAS by ID SOP	0.43	U	0.86	0.43	0.17	ug/kg	1
Perfluoro-n-dodecanoic acid (PFDoA)	307-55-1	PFAS by ID SOP	0.43	U	0.86	0.43	0.17	ug/kg	1
Perfluoro-n-heptanoic acid (PFHpA)	375-85-9	PFAS by ID SOP	0.43	U	0.86	0.43	0.17	ug/kg	1
Perfluoro-n-hexanoic acid (PFHxA)	307-24-4	PFAS by ID SOP	0.43	U	0.86	0.43	0.17	ug/kg	1
Perfluoro-n-nonanoic acid (PFNA)	375-95-1	PFAS by ID SOP	0.43	U	0.86	0.43	0.17	ug/kg	1
Perfluoro-n-octanoic acid (PFOA)	335-67-1	PFAS by ID SOP	0.43	U	0.86	0.43	0.17	ug/kg	1
Perfluoro-n-pentanoic acid (PFPeA)	2706-90-3	PFAS by ID SOP	0.43	U	0.86	0.43	0.17	ug/kg	1
Perfluoro-n-tetradecanoic acid (PFTeDA)	376-06-7	PFAS by ID SOP	0.43	U	0.86	0.43	0.17	ug/kg	1
Perfluoro-n-tridecanoic acid (PFTrDA)	72629-94-8	PFAS by ID SOP	0.43	U	0.86	0.43	0.17	ug/kg	1
Perfluoro-n-undecanoic acid (PFUdA)	2058-94-8	PFAS by ID SOP	0.43	U	0.86	0.43	0.17	ug/kg	1
Perfluorooctanesulfonic acid (PFOS)	1763-23-1	PFAS by ID SOP	0.43	U	0.86	0.43	0.17	ug/kg	1

Surrogate	Run 1 Q	Run 1 % Recovery	Run 1 Acceptance Limits	Run 2 Q	Run 2 % Recovery	Run 2 Acceptance Limits
13C2_4:2FTS		79	50-150		110	50-150
13C2_6:2FTS		81	50-150		109	50-150
13C2_8:2FTS		87	50-150		109	50-150
13C2_PFDoA		80	50-150		90	50-150
13C2_PFTeDA		79	50-150		89	50-150
13C3_PFBS		76	50-150		89	50-150
13C3_PFHxS		82	50-150		88	50-150
13C4_PFBA		76	50-150		91	50-150
13C4_PFHpA		79	50-150		91	50-150
13C5_PFHxA		81	50-150		95	50-150
13C5_PFPeA		78	50-150		87	50-150
13C6_PFDA		80	50-150		93	50-150
13C7_PFUdA		80	50-150		91	50-150
13C8_PFOA		76	50-150		92	50-150
13C8_PFOS		77	50-150		90	50-150
13C8_PFOSA		74	50-150		94	50-150

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

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PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.
Laboratory ID: WI17055-010
Description: ISM-382-5-Ga
Matrix: Solid
Date Sampled: 09/08/2021
Project Name: Eielson AFB
% Solids: 99.8 09/18/2021 1903
Date Received: 09/17/2021
Project Number:

Surrogate	Q	Run 1 % Recovery	Acceptance Limits	Q	Run 2 % Recovery	Acceptance Limits
13C9_PFNA		79	50-150		99	50-150
d5-EtFOSAA		88	50-150		103	50-150
d-MeFOSA		83	50-150		88	50-150
d3-MeFOSAA		91	50-150		102	50-150

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

SPLP PFAS

Client: Arcadis U.S., Inc. | Laboratory ID: WI17055-010
Description: ISM-382-5-Ga | Matrix: Solid
Date Sampled: 09/08/2021 | Project Name: Eielson AFB | % Solids: 99.8 09/18/2021 1903
Date Received: 09/17/2021 | Project Number:

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch	Leachate Date
1	1312/PFAS	PFAS by ID SOP QSM B-15	1	11/05/2021 1752	MMM	11/04/2021 1300	21287	10/27/2021 0213

Parameter	CAS Number	Analytical Method	Result	Q	LOQ	LOD	DL	Units	Run
1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS)	39108-34-4	PFAS by ID SOP	40	UH	80	40	20	ng/L	1
1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS)	27619-97-2	PFAS by ID SOP	40	UH	80	40	20	ng/L	1
1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS)	757124-72-4	PFAS by ID SOP	40	UH	80	40	20	ng/L	1
N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA)	2991-50-6	PFAS by ID SOP	40	UH	80	40	20	ng/L	1
N-methylperfluoro-1-octanesulfonamide (MeFOSA)	31506-32-8	PFAS by ID SOP	80	UH	160	80	40	ng/L	1
N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA)	2355-31-9	PFAS by ID SOP	40	UH	80	40	20	ng/L	1
Perfluoro-1-butanesulfonic acid (PFBS)	375-73-5	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-1-decanesulfonic acid (PFDS)	335-77-3	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-1-heptanesulfonic acid (PFHpS)	375-92-8	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-1-nonanesulfonic acid (PFNS)	68259-12-1	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-1-octanesulfonamide (PFOSA)	754-91-6	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-1-pentanesulfonic acid (PFPeS)	2706-91-4	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluorohexanesulfonic acid (PFHxS)	355-46-4	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-butanoic acid (PFBA)	375-22-4	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-decanoic acid (PFDA)	335-76-2	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-dodecanoic acid (PFDoA)	307-55-1	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-heptanoic acid (PFHpA)	375-85-9	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-hexanoic acid (PFHxA)	307-24-4	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-nonanoic acid (PFNA)	375-95-1	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-octanoic acid (PFOA)	335-67-1	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-pentanoic acid (PFPeA)	2706-90-3	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-tetradecanoic acid (PFTeDA)	376-06-7	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-tridecanoic acid (PFTrDA)	72629-94-8	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-undecanoic acid (PFUdA)	2058-94-8	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluorooctanesulfonic acid (PFOS)	1763-23-1	PFAS by ID SOP	20	UH	40	20	10	ng/L	1

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
13C2_4:2FTS	H	108	50-150
13C2_6:2FTS	H	118	50-150
13C2_8:2FTS	H	106	50-150
13C2_PFDoA	H	106	50-150
13C2_PFTeDA	H	86	50-150
13C3_PFBS	H	110	50-150
13C3_PFHxS	H	105	50-150
13C4_PFBA	H	102	50-150
13C4_PFHpA	H	105	50-150
13C5_PFHxA	H	102	50-150
13C5_PFPeA	H	102	50-150
13C6_PFDA	H	105	50-150
13C7_PFUdA	H	103	50-150
13C8_PFOA	H	109	50-150
13C8_PFOS	H	109	50-150
13C8_PFOSA	H	106	50-150
13C9_PFNA	H	107	50-150

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

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SPLP PFAS

Client: Arcadis U.S., Inc.		Laboratory ID: WI17055-010	
Description: ISM-382-5-Ga		Matrix: Solid	
Date Sampled: 09/08/2021	Project Name: Eielson AFB	% Solids: 99.8	09/18/2021 1903
Date Received: 09/17/2021	Project Number:		

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
d5-EtFOSAA	H	119	50-150
d-MeFOSA	H	110	50-150
d3-MeFOSAA	H	118	50-150

LOQ = Limit of Quantitation	B = Detected in the method blank	E = Quantitation of compound exceeded the calibration range	DL = Detection Limit	Q = Surrogate failure
U = Not detected at or above the LOQ	N = Recovery is out of criteria	P = The RPD between two GC columns exceeds 40%	J = Estimated result < LOQ and ≥ DL	L = LCS/LCSD failure
H = Out of holding time	W = Reported on wet weight basis	LOD = Limit of Detection		S = MS/MSD failure

PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: WI17055-011
Description: ISM-382-5-Gb | Matrix: Solid
Date Sampled: 09/08/2021 | Project Name: Eielson AFB | % Solids: 99.4 09/18/2021 1903
Date Received: 09/17/2021 | Project Number:

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch
1	SOP SPE	PFAS by ID SOP QSM B-15	1	09/20/2021 1752	JJG	09/19/2021 1515	15796
2	SOP SPE	PFAS by ID SOP QSM B-15	1	09/23/2021 1904	NK1	09/22/2021 1232	16138

Parameter	CAS Number	Analytical Method	Result	Q	LOQ	LOD	DL	Units	Run
1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS)	39108-34-4	PFAS by ID SOP	0.85	U	1.7	0.85	0.42	ug/kg	1
1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS)	27619-97-2	PFAS by ID SOP	1.0	U	2.0	1.0	0.50	ug/kg	2
1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS)	757124-72-4	PFAS by ID SOP	0.85	U	1.7	0.85	0.42	ug/kg	1
N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA)	2991-50-6	PFAS by ID SOP	0.85	U	1.7	0.85	0.42	ug/kg	1
N-methylperfluoro-1-octanesulfonamide (MeFOSA)	31506-32-8	PFAS by ID SOP	0.85	U	1.7	0.85	0.42	ug/kg	1
N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA)	2355-31-9	PFAS by ID SOP	0.85	U	1.7	0.85	0.42	ug/kg	1
Perfluoro-1-butanesulfonic acid (PFBS)	375-73-5	PFAS by ID SOP	0.43	U	0.85	0.43	0.17	ug/kg	1
Perfluoro-1-decanesulfonic acid (PFDS)	335-77-3	PFAS by ID SOP	0.43	U	0.85	0.43	0.17	ug/kg	1
Perfluoro-1-heptanesulfonic acid (PFHpS)	375-92-8	PFAS by ID SOP	0.43	U	0.85	0.43	0.17	ug/kg	1
Perfluoro-1-nonanesulfonic acid (PFNS)	68259-12-1	PFAS by ID SOP	0.43	U	0.85	0.43	0.17	ug/kg	1
Perfluoro-1-octanesulfonamide (PFOSA)	754-91-6	PFAS by ID SOP	0.43	U	0.85	0.43	0.17	ug/kg	1
Perfluoro-1-pentanesulfonic acid (PFPeS)	2706-91-4	PFAS by ID SOP	0.43	U	0.85	0.43	0.17	ug/kg	1
Perfluorohexanesulfonic acid (PFHxS)	355-46-4	PFAS by ID SOP	0.43	U	0.85	0.43	0.17	ug/kg	1
Perfluoro-n-butanoic acid (PFBA)	375-22-4	PFAS by ID SOP	0.43	U	0.85	0.43	0.17	ug/kg	1
Perfluoro-n-decanoic acid (PFDA)	335-76-2	PFAS by ID SOP	0.43	U	0.85	0.43	0.17	ug/kg	1
Perfluoro-n-dodecanoic acid (PFDoA)	307-55-1	PFAS by ID SOP	0.43	U	0.85	0.43	0.17	ug/kg	1
Perfluoro-n-heptanoic acid (PFHpA)	375-85-9	PFAS by ID SOP	0.43	U	0.85	0.43	0.17	ug/kg	1
Perfluoro-n-hexanoic acid (PFHxA)	307-24-4	PFAS by ID SOP	0.43	U	0.85	0.43	0.17	ug/kg	1
Perfluoro-n-nonanoic acid (PFNA)	375-95-1	PFAS by ID SOP	0.43	U	0.85	0.43	0.17	ug/kg	1
Perfluoro-n-octanoic acid (PFOA)	335-67-1	PFAS by ID SOP	0.43	U	0.85	0.43	0.17	ug/kg	1
Perfluoro-n-pentanoic acid (PFPeA)	2706-90-3	PFAS by ID SOP	0.43	U	0.85	0.43	0.17	ug/kg	1
Perfluoro-n-tetradecanoic acid (PFTeDA)	376-06-7	PFAS by ID SOP	0.43	U	0.85	0.43	0.17	ug/kg	1
Perfluoro-n-tridecanoic acid (PFTrDA)	72629-94-8	PFAS by ID SOP	0.43	U	0.85	0.43	0.17	ug/kg	1
Perfluoro-n-undecanoic acid (PFUdA)	2058-94-8	PFAS by ID SOP	0.43	U	0.85	0.43	0.17	ug/kg	1
Perfluorooctanesulfonic acid (PFOS)	1763-23-1	PFAS by ID SOP	0.43	U	0.85	0.43	0.17	ug/kg	1

Surrogate	Run 1 Q	Run 1 % Recovery	Run 1 Acceptance Limits	Run 2 Q	Run 2 % Recovery	Run 2 Acceptance Limits
13C2_4:2FTS		57	50-150		105	50-150
13C2_6:2FTS		61	50-150		102	50-150
13C2_8:2FTS		55	50-150		108	50-150
13C2_PFDoA		58	50-150		94	50-150
13C2_PFTeDA		61	50-150		95	50-150
13C3_PFBS		62	50-150		96	50-150
13C3_PFHxS		65	50-150		94	50-150
13C4_PFBA		59	50-150		97	50-150
13C4_PFHpA		60	50-150		96	50-150
13C5_PFHxA		60	50-150		101	50-150
13C5_PFPeA		59	50-150		93	50-150
13C6_PFDA		60	50-150		95	50-150
13C7_PFUdA		59	50-150		90	50-150
13C8_PFOA		61	50-150		95	50-150
13C8_PFOS		62	50-150		96	50-150
13C8_PFOSA		56	50-150		96	50-150

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

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PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.		Laboratory ID: WI17055-011	
Description: ISM-382-5-Gb		Matrix: Solid	
Date Sampled: 09/08/2021	Project Name: Eielson AFB	% Solids: 99.4	09/18/2021 1903
Date Received: 09/17/2021	Project Number:		

Surrogate	Q	Run 1 % Recovery	Acceptance Limits	Q	Run 2 % Recovery	Acceptance Limits
13C9_PFNA		62	50-150		99	50-150
d5-EtFOSAA		58	50-150		99	50-150
d-MeFOSA		66	50-150		96	50-150
d3-MeFOSAA		56	50-150		94	50-150

LOQ = Limit of Quantitation	B = Detected in the method blank	E = Quantitation of compound exceeded the calibration range	DL = Detection Limit	Q = Surrogate failure
U = Not detected at or above the LOQ	N = Recovery is out of criteria	P = The RPD between two GC columns exceeds 40%	J = Estimated result < LOQ and ≥ DL	L = LCS/LCSD failure
H = Out of holding time	W = Reported on wet weight basis	LOD = Limit of Detection		S = MS/MSD failure

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SPLP PFAS

Client: Arcadis U.S., Inc. | Laboratory ID: WI17055-011
Description: ISM-382-5-Gb | Matrix: Solid
Date Sampled: 09/08/2021 | Project Name: Eielson AFB | % Solids: 99.4 09/18/2021 1903
Date Received: 09/17/2021 | Project Number:

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch	Leachate Date
1	1312/PFAS	PFAS by ID SOP QSM B-15	1	11/05/2021 1803	MMM	11/04/2021 1300	21287	10/27/2021 0213

Parameter	CAS Number	Analytical Method	Result	Q	LOQ	LOD	DL	Units	Run
1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS)	39108-34-4	PFAS by ID SOP	40	UH	80	40	20	ng/L	1
1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS)	27619-97-2	PFAS by ID SOP	40	UH	80	40	20	ng/L	1
1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS)	757124-72-4	PFAS by ID SOP	40	UH	80	40	20	ng/L	1
N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA)	2991-50-6	PFAS by ID SOP	40	UH	80	40	20	ng/L	1
N-methylperfluoro-1-octanesulfonamide (MeFOSA)	31506-32-8	PFAS by ID SOP	80	UH	160	80	40	ng/L	1
N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA)	2355-31-9	PFAS by ID SOP	40	UH	80	40	20	ng/L	1
Perfluoro-1-butanesulfonic acid (PFBS)	375-73-5	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-1-decanesulfonic acid (PFDS)	335-77-3	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-1-heptanesulfonic acid (PFHpS)	375-92-8	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-1-nonanesulfonic acid (PFNS)	68259-12-1	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-1-octanesulfonamide (PFOSA)	754-91-6	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-1-pentanesulfonic acid (PFPeS)	2706-91-4	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluorohexanesulfonic acid (PFHxS)	355-46-4	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-butanoic acid (PFBA)	375-22-4	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-decanoic acid (PFDA)	335-76-2	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-dodecanoic acid (PFDoA)	307-55-1	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-heptanoic acid (PFHpA)	375-85-9	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-hexanoic acid (PFHxA)	307-24-4	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-nonanoic acid (PFNA)	375-95-1	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-octanoic acid (PFOA)	335-67-1	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-pentanoic acid (PFPeA)	2706-90-3	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-tetradecanoic acid (PFTeDA)	376-06-7	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-tridecanoic acid (PFTrDA)	72629-94-8	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-undecanoic acid (PFUdA)	2058-94-8	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluorooctanesulfonic acid (PFOS)	1763-23-1	PFAS by ID SOP	20	UH	40	20	10	ng/L	1

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
13C2_4:2FTS	H	115	50-150
13C2_6:2FTS	H	110	50-150
13C2_8:2FTS	H	100	50-150
13C2_PFDoA	H	106	50-150
13C2_PFTeDA	H	86	50-150
13C3_PFBS	H	106	50-150
13C3_PFHxS	H	104	50-150
13C4_PFBA	H	103	50-150
13C4_PFHpA	H	104	50-150
13C5_PFHxA	H	101	50-150
13C5_PFPeA	H	105	50-150
13C6_PFDA	H	102	50-150
13C7_PFUdA	H	103	50-150
13C8_PFOA	H	99	50-150
13C8_PFOS	H	111	50-150
13C8_PFOSA	H	108	50-150
13C9_PFNA	H	107	50-150

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

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SPLP PFAS

Client: Arcadis U.S., Inc.		Laboratory ID: WI17055-011	
Description: ISM-382-5-Gb		Matrix: Solid	
Date Sampled: 09/08/2021	Project Name: Eielson AFB	% Solids: 99.4	09/18/2021 1903
Date Received: 09/17/2021	Project Number:		

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
d5-EtFOSAA	H	116	50-150
d-MeFOSA	H	107	50-150
d3-MeFOSAA	H	119	50-150

LOQ = Limit of Quantitation	B = Detected in the method blank	E = Quantitation of compound exceeded the calibration range	DL = Detection Limit	Q = Surrogate failure
U = Not detected at or above the LOQ	N = Recovery is out of criteria	P = The RPD between two GC columns exceeds 40%	J = Estimated result < LOQ and ≥ DL	L = LCS/LCSD failure
H = Out of holding time	W = Reported on wet weight basis	LOD = Limit of Detection		S = MS/MSD failure

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PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: WI17055-012
Description: ISM-382-5-Gc | Matrix: Solid
Date Sampled: 09/08/2021 | Project Name: Eielson AFB | % Solids: 99.8 09/18/2021 1903
Date Received: 09/17/2021 | Project Number:

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch
1	SOP SPE	PFAS by ID SOP QSM B-15	1	09/20/2021 1802	JJG	09/19/2021 1515	15796
2	SOP SPE	PFAS by ID SOP QSM B-15	1	09/23/2021 1917	NK1	09/22/2021 1232	16138

Parameter	CAS Number	Analytical Method	Result	Q	LOQ	LOD	DL	Units	Run
1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS)	39108-34-4	PFAS by ID SOP	0.95	U	1.9	0.95	0.48	ug/kg	1
1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS)	27619-97-2	PFAS by ID SOP	0.90	U	1.8	0.90	0.45	ug/kg	2
1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS)	757124-72-4	PFAS by ID SOP	0.95	U	1.9	0.95	0.48	ug/kg	1
N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA)	2991-50-6	PFAS by ID SOP	0.95	U	1.9	0.95	0.48	ug/kg	1
N-methylperfluoro-1-octanesulfonamide (MeFOSA)	31506-32-8	PFAS by ID SOP	0.95	U	1.9	0.95	0.48	ug/kg	1
N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA)	2355-31-9	PFAS by ID SOP	0.95	U	1.9	0.95	0.48	ug/kg	1
Perfluoro-1-butanesulfonic acid (PFBS)	375-73-5	PFAS by ID SOP	0.48	U	0.95	0.48	0.19	ug/kg	1
Perfluoro-1-decanesulfonic acid (PFDS)	335-77-3	PFAS by ID SOP	0.48	U	0.95	0.48	0.19	ug/kg	1
Perfluoro-1-heptanesulfonic acid (PFHpS)	375-92-8	PFAS by ID SOP	0.48	U	0.95	0.48	0.19	ug/kg	1
Perfluoro-1-nonanesulfonic acid (PFNS)	68259-12-1	PFAS by ID SOP	0.48	U	0.95	0.48	0.19	ug/kg	1
Perfluoro-1-octanesulfonamide (PFOSA)	754-91-6	PFAS by ID SOP	0.48	U	0.95	0.48	0.19	ug/kg	1
Perfluoro-1-pentanesulfonic acid (PFPeS)	2706-91-4	PFAS by ID SOP	0.48	U	0.95	0.48	0.19	ug/kg	1
Perfluorohexanesulfonic acid (PFHxS)	355-46-4	PFAS by ID SOP	0.48	U	0.95	0.48	0.19	ug/kg	1
Perfluoro-n-butanoic acid (PFBA)	375-22-4	PFAS by ID SOP	0.48	U	0.95	0.48	0.19	ug/kg	1
Perfluoro-n-decanoic acid (PFDA)	335-76-2	PFAS by ID SOP	0.48	U	0.95	0.48	0.19	ug/kg	1
Perfluoro-n-dodecanoic acid (PFDoA)	307-55-1	PFAS by ID SOP	0.48	U	0.95	0.48	0.19	ug/kg	1
Perfluoro-n-heptanoic acid (PFHpA)	375-85-9	PFAS by ID SOP	0.48	U	0.95	0.48	0.19	ug/kg	1
Perfluoro-n-hexanoic acid (PFHxA)	307-24-4	PFAS by ID SOP	0.48	U	0.95	0.48	0.19	ug/kg	1
Perfluoro-n-nonanoic acid (PFNA)	375-95-1	PFAS by ID SOP	0.48	U	0.95	0.48	0.19	ug/kg	1
Perfluoro-n-octanoic acid (PFOA)	335-67-1	PFAS by ID SOP	0.48	U	0.95	0.48	0.19	ug/kg	1
Perfluoro-n-pentanoic acid (PFPeA)	2706-90-3	PFAS by ID SOP	0.48	U	0.95	0.48	0.19	ug/kg	1
Perfluoro-n-tetradecanoic acid (PFTeDA)	376-06-7	PFAS by ID SOP	0.48	U	0.95	0.48	0.19	ug/kg	1
Perfluoro-n-tridecanoic acid (PFTrDA)	72629-94-8	PFAS by ID SOP	0.48	U	0.95	0.48	0.19	ug/kg	1
Perfluoro-n-undecanoic acid (PFUdA)	2058-94-8	PFAS by ID SOP	0.48	U	0.95	0.48	0.19	ug/kg	1
Perfluorooctanesulfonic acid (PFOS)	1763-23-1	PFAS by ID SOP	0.48	U	0.95	0.48	0.19	ug/kg	1

Surrogate	Run 1 Q	Run 1 % Recovery	Run 1 Acceptance Limits	Run 2 Q	Run 2 % Recovery	Run 2 Acceptance Limits
13C2_4:2FTS		74	50-150		102	50-150
13C2_6:2FTS		71	50-150		104	50-150
13C2_8:2FTS		67	50-150		106	50-150
13C2_PFDoA		63	50-150		76	50-150
13C2_PFTeDA		67	50-150		86	50-150
13C3_PFBS		64	50-150		82	50-150
13C3_PFHxS		65	50-150		83	50-150
13C4_PFBA		66	50-150		85	50-150
13C4_PFHpA		64	50-150		86	50-150
13C5_PFHxA		65	50-150		90	50-150
13C5_PFPeA		65	50-150		82	50-150
13C6_PFDA		67	50-150		83	50-150
13C7_PFUdA		68	50-150		81	50-150
13C8_PFOA		63	50-150		88	50-150
13C8_PFOS		65	50-150		86	50-150
13C8_PFOSA		65	50-150		87	50-150

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

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PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.		Laboratory ID: WI17055-012	
Description: ISM-382-5-Gc		Matrix: Solid	
Date Sampled: 09/08/2021	Project Name: Eielson AFB	% Solids: 99.8	09/18/2021 1903
Date Received: 09/17/2021	Project Number:		

Surrogate	Q	Run 1 % Recovery	Acceptance Limits	Q	Run 2 % Recovery	Acceptance Limits
13C9_PFNA		64	50-150		90	50-150
d5-EtFOSAA		82	50-150		105	50-150
d-MeFOSA		65	50-150		81	50-150
d3-MeFOSAA		76	50-150		104	50-150

LOQ = Limit of Quantitation	B = Detected in the method blank	E = Quantitation of compound exceeded the calibration range	DL = Detection Limit	Q = Surrogate failure
U = Not detected at or above the LOQ	N = Recovery is out of criteria	P = The RPD between two GC columns exceeds 40%	J = Estimated result < LOQ and ≥ DL	L = LCS/LCSD failure
H = Out of holding time	W = Reported on wet weight basis	LOD = Limit of Detection		S = MS/MSD failure

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SPLP PFAS

Client: Arcadis U.S., Inc. | Laboratory ID: WI17055-012
Description: ISM-382-5-Gc | Matrix: Solid
Date Sampled: 09/08/2021 | Project Name: Eielson AFB | % Solids: 99.8 09/18/2021 1903
Date Received: 09/17/2021 | Project Number:

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch	Leachate Date
1	1312/PFAS	PFAS by ID SOP QSM B-15	1	11/05/2021 1813	MMM	11/04/2021 1300	21287	10/27/2021 0213

Parameter	CAS Number	Analytical Method	Result	Q	LOQ	LOD	DL	Units	Run
1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS)	39108-34-4	PFAS by ID SOP	40	UH	80	40	20	ng/L	1
1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS)	27619-97-2	PFAS by ID SOP	40	UH	80	40	20	ng/L	1
1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS)	757124-72-4	PFAS by ID SOP	40	UH	80	40	20	ng/L	1
N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA)	2991-50-6	PFAS by ID SOP	40	UH	80	40	20	ng/L	1
N-methylperfluoro-1-octanesulfonamide (MeFOSA)	31506-32-8	PFAS by ID SOP	80	UH	160	80	40	ng/L	1
N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA)	2355-31-9	PFAS by ID SOP	40	UH	80	40	20	ng/L	1
Perfluoro-1-butanesulfonic acid (PFBS)	375-73-5	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-1-decanesulfonic acid (PFDS)	335-77-3	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-1-heptanesulfonic acid (PFHpS)	375-92-8	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-1-nonanesulfonic acid (PFNS)	68259-12-1	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-1-octanesulfonamide (PFOSA)	754-91-6	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-1-pentanesulfonic acid (PFPeS)	2706-91-4	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluorohexanesulfonic acid (PFHxS)	355-46-4	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-butanoic acid (PFBA)	375-22-4	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-decanoic acid (PFDA)	335-76-2	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-dodecanoic acid (PFDoA)	307-55-1	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-heptanoic acid (PFHpA)	375-85-9	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-hexanoic acid (PFHxA)	307-24-4	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-nonanoic acid (PFNA)	375-95-1	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-octanoic acid (PFOA)	335-67-1	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-pentanoic acid (PFPeA)	2706-90-3	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-tetradecanoic acid (PFTeDA)	376-06-7	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-tridecanoic acid (PFTrDA)	72629-94-8	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-undecanoic acid (PFUdA)	2058-94-8	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluorooctanesulfonic acid (PFOS)	1763-23-1	PFAS by ID SOP	20	UH	40	20	10	ng/L	1

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
13C2_4:2FTS	H	112	50-150
13C2_6:2FTS	H	111	50-150
13C2_8:2FTS	H	101	50-150
13C2_PFDoA	H	111	50-150
13C2_PFTeDA	H	88	50-150
13C3_PFBS	H	109	50-150
13C3_PFHxS	H	101	50-150
13C4_PFBA	H	104	50-150
13C4_PFHpA	H	106	50-150
13C5_PFHxA	H	98	50-150
13C5_PFPeA	H	103	50-150
13C6_PFDA	H	105	50-150
13C7_PFUdA	H	102	50-150
13C8_PFOA	H	104	50-150
13C8_PFOS	H	111	50-150
13C8_PFOSA	H	123	50-150
13C9_PFNA	H	101	50-150

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

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SPLP PFAS

Client: Arcadis U.S., Inc.		Laboratory ID: WI17055-012
Description: ISM-382-5-Gc		Matrix: Solid
Date Sampled: 09/08/2021	Project Name: Eielson AFB	% Solids: 99.8 09/18/2021 1903
Date Received: 09/17/2021	Project Number:	

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
d5-EtFOSAA	H	110	50-150
d-MeFOSA	H	106	50-150
d3-MeFOSAA	H	117	50-150

LOQ = Limit of Quantitation	B = Detected in the method blank	E = Quantitation of compound exceeded the calibration range	DL = Detection Limit	Q = Surrogate failure
U = Not detected at or above the LOQ	N = Recovery is out of criteria	P = The RPD between two GC columns exceeds 40%	J = Estimated result < LOQ and ≥ DL	L = LCS/LCSD failure
H = Out of holding time	W = Reported on wet weight basis	LOD = Limit of Detection		S = MS/MSD failure

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QC Summary

PFAS by LC/MS/MS - MB

Sample ID: WQ15796-001
Batch: 15796
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Solid
Prep Method: SOP SPE
Prep Date: 09/19/2021 1515

Parameter	Result	Q	Dil	LOQ	LOD	DL	Units	Analysis Date
8:2 FTS	1.0	U	1	2.0	1.0	0.50	ug/kg	09/20/2021 1358
4:2 FTS	1.0	U	1	2.0	1.0	0.50	ug/kg	09/20/2021 1358
EtFOSAA	1.0	U	1	2.0	1.0	0.50	ug/kg	09/20/2021 1358
MeFOSA	1.0	U	1	2.0	1.0	0.50	ug/kg	09/20/2021 1358
MeFOSAA	1.0	U	1	2.0	1.0	0.50	ug/kg	09/20/2021 1358
PFBS	0.50	U	1	1.0	0.50	0.20	ug/kg	09/20/2021 1358
PFDS	0.50	U	1	1.0	0.50	0.20	ug/kg	09/20/2021 1358
PFHpS	0.50	U	1	1.0	0.50	0.20	ug/kg	09/20/2021 1358
PFNS	0.50	U	1	1.0	0.50	0.20	ug/kg	09/20/2021 1358
PFOSA	0.50	U	1	1.0	0.50	0.20	ug/kg	09/20/2021 1358
PFPeS	0.50	U	1	1.0	0.50	0.20	ug/kg	09/20/2021 1358
PFHxS	0.50	U	1	1.0	0.50	0.20	ug/kg	09/20/2021 1358
PFBA	0.50	U	1	1.0	0.50	0.20	ug/kg	09/20/2021 1358
PFDA	0.50	U	1	1.0	0.50	0.20	ug/kg	09/20/2021 1358
PFDoA	0.50	U	1	1.0	0.50	0.20	ug/kg	09/20/2021 1358
PFHpA	0.50	U	1	1.0	0.50	0.20	ug/kg	09/20/2021 1358
PFHxA	0.50	U	1	1.0	0.50	0.20	ug/kg	09/20/2021 1358
PFNA	0.50	U	1	1.0	0.50	0.20	ug/kg	09/20/2021 1358
PFOA	0.50	U	1	1.0	0.50	0.20	ug/kg	09/20/2021 1358
PFPeA	0.50	U	1	1.0	0.50	0.20	ug/kg	09/20/2021 1358
PFTeDA	0.50	U	1	1.0	0.50	0.20	ug/kg	09/20/2021 1358
PFTrDA	0.50	U	1	1.0	0.50	0.20	ug/kg	09/20/2021 1358
PFUdA	0.50	U	1	1.0	0.50	0.20	ug/kg	09/20/2021 1358
PFOS	0.50	U	1	1.0	0.50	0.20	ug/kg	09/20/2021 1358

Surrogate	Q	% Rec	Acceptance Limit
13C2_4:2FTS		91	50-150
13C2_6:2FTS		95	50-150
13C2_8:2FTS		96	50-150
13C2_PFDoA		95	50-150
13C2_PFTeDA		96	50-150
13C3_PFBS		91	50-150
13C3_PFHxS		100	50-150
13C4_PFBA		95	50-150
13C4_PFHpA		97	50-150
13C5_PFHxA		94	50-150
13C5_PFPeA		94	50-150
13C6_PFDA		99	50-150
13C7_PFUdA		104	50-150
13C8_PFOA		97	50-150
13C8_PFOS		99	50-150

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

PFAS by LC/MS/MS - MB

Sample ID: WQ15796-001
Batch: 15796
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Solid
Prep Method: SOP SPE
Prep Date: 09/19/2021 1515

Surrogate	Q	% Rec	Acceptance Limit
13C8_PFOSA		92	50-150
13C9_PFNA		98	50-150
d5-EtFOSAA		103	50-150
d-MeFOSA		100	50-150
d3-MeFOSAA		104	50-150

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

PFAS by LC/MS/MS - LCS

Sample ID: WQ15796-002
Batch: 15796
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Solid
Prep Method: SOP SPE
Prep Date: 09/19/2021 1515

Parameter	Spike Amount (ug/kg)	Result (ug/kg)	Q	Dil	% Rec	%Rec Limit	Analysis Date
8:2 FTS	1.9	1.7		1	90	65-137	09/20/2021 1409
4:2 FTS	1.9	1.9		1	104	62-145	09/20/2021 1409
EtFOSAA	2.0	1.4		1	70	61-139	09/20/2021 1409
MeFOSA	2.0	1.7		1	84	70-150	09/20/2021 1409
MeFOSAA	2.0	1.9		1	93	63-144	09/20/2021 1409
PFBS	1.8	1.5		1	83	72-128	09/20/2021 1409
PFDS	1.9	2.0		1	102	59-134	09/20/2021 1409
PFHpS	1.9	1.6		1	86	70-132	09/20/2021 1409
PFNS	1.9	1.7		1	87	69-125	09/20/2021 1409
PFOSA	2.0	2.0		1	100	67-137	09/20/2021 1409
PFPeS	1.9	1.6		1	86	73-123	09/20/2021 1409
PFHxS	1.8	1.9		1	104	67-130	09/20/2021 1409
PFBA	2.0	1.8		1	91	71-135	09/20/2021 1409
PFDA	2.0	2.0		1	98	69-133	09/20/2021 1409
PFDoA	2.0	2.0		1	101	69-135	09/20/2021 1409
PFHpA	2.0	1.9		1	93	71-131	09/20/2021 1409
PFHxA	2.0	1.8		1	92	70-132	09/20/2021 1409
PFNA	2.0	1.8		1	90	72-129	09/20/2021 1409
PFOA	2.0	1.8		1	89	69-133	09/20/2021 1409
PFPeA	2.0	1.8		1	91	69-132	09/20/2021 1409
PFTeDA	2.0	1.8		1	92	69-133	09/20/2021 1409
PFTrDA	2.0	1.9		1	94	66-139	09/20/2021 1409
PFUdA	2.0	1.9		1	94	64-136	09/20/2021 1409
PFOS	1.9	1.5		1	79	68-136	09/20/2021 1409

Surrogate	Q	% Rec	Acceptance Limit
13C2_4:2FTS		92	50-150
13C2_6:2FTS		89	50-150
13C2_8:2FTS		91	50-150
13C2_PFDoA		88	50-150
13C2_PFTeDA		92	50-150
13C3_PFBS		91	50-150
13C3_PFHxS		96	50-150
13C4_PFBA		91	50-150
13C4_PFHpA		91	50-150
13C5_PFHxA		94	50-150
13C5_PFPeA		92	50-150
13C6_PFDA		88	50-150
13C7_PFUdA		84	50-150
13C8_PFOA		91	50-150
13C8_PFOS		92	50-150

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

PFAS by LC/MS/MS - LCS

Sample ID: WQ15796-002
Batch: 15796
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Solid
Prep Method: SOP SPE
Prep Date: 09/19/2021 1515

Surrogate	Q	% Rec	Acceptance Limit
13C8_PFOSA		88	50-150
13C9_PFNA		95	50-150
d5-EtFOSAA		97	50-150
d-MeFOSA		92	50-150
d3-MeFOSAA		95	50-150

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

PFAS by LC/MS/MS - MB

Sample ID: WQ16138-001
Batch: 16138
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Solid
Prep Method: SOP SPE
Prep Date: 09/22/2021 1232

Parameter	Result	Q	Dil	LOQ	LOD	DL	Units	Analysis Date
6:2 FTS	1.0	U	1	2.0	1.0	0.50	ug/kg	09/23/2021 1451

Surrogate	Q	% Rec	Acceptance Limit
13C2_4:2FTS		124	50-150
13C2_6:2FTS		145	50-150
13C2_8:2FTS	N	210	50-150
13C2_PFDoA		105	50-150
13C2_PFTeDA		112	50-150
13C3_PFBS		106	50-150
13C3_PFHxS		104	50-150
13C4_PFBA		108	50-150
13C4_PFHpA		102	50-150
13C5_PFHxA		111	50-150
13C5_PFPeA		102	50-150
13C6_PFDA		117	50-150
13C7_PFUdA		111	50-150
13C8_PFOA		114	50-150
13C8_PFOS		109	50-150
13C8_PFOSA		105	50-150
13C9_PFNA		115	50-150
d5-EtFOSAA		108	50-150
d-MeFOSA		100	50-150
d3-MeFOSAA		99	50-150

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

PFAS by LC/MS/MS - LCS

Sample ID: WQ16138-002
Batch: 16138
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Solid
Prep Method: SOP SPE
Prep Date: 09/22/2021 1232

Parameter	Spike Amount (ug/kg)	Result (ug/kg)	Q	Dil	% Rec	%Rec Limit	Analysis Date
6:2 FTS	1.9	1.4		1	72	64-140	09/23/2021 1503

Surrogate	Q	% Rec	Acceptance Limit
13C2_4:2FTS		105	50-150
13C2_6:2FTS		103	50-150
13C2_8:2FTS		105	50-150
13C2_PFDoA		99	50-150
13C2_PFTeDA		103	50-150
13C3_PFBS		103	50-150
13C3_PFHxS		101	50-150
13C4_PFBA		101	50-150
13C4_PFHpA		97	50-150
13C5_PFHxA		106	50-150
13C5_PFPeA		98	50-150
13C6_PFDA		103	50-150
13C7_PFUdA		99	50-150
13C8_PFOA		102	50-150
13C8_PFOS		108	50-150
13C8_PFOSA		99	50-150
13C9_PFNA		110	50-150
d5-EtFOSAA		107	50-150
d-MeFOSA		105	50-150
d3-MeFOSAA		99	50-150

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

PFAS by LC/MS/MS - MS

Sample ID: WI17055-004MS
Batch: 16138
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Solid
Prep Method: SOP SPE
Prep Date: 09/22/2021 1232

Parameter	Sample Amount (ug/kg)	Spike Amount (ug/kg)	Result (ug/kg)	Q	Dil	% Rec	%Rec Limit	Analysis Date
6:2 FTS	ND	1.9	1.2		1	65	64-140	09/23/2021 1658

Surrogate	Q	% Rec	Acceptance Limit
13C2_4:2FTS		102	50-150
13C2_6:2FTS		102	50-150
13C2_8:2FTS		107	50-150
13C2_PFDoA		95	50-150
13C2_PFTeDA		93	50-150
13C3_PFBS		94	50-150
13C3_PFHxS		95	50-150
13C4_PFBA		97	50-150
13C4_PFHpA		94	50-150
13C5_PFHxA		103	50-150
13C5_PFPeA		91	50-150
13C6_PFDA		90	50-150
13C7_PFUdA		91	50-150
13C8_PFOA		98	50-150
13C8_PFOS		97	50-150
13C8_PFOSA		94	50-150
13C9_PFNA		100	50-150
d5-EtFOSAA		102	50-150
d-MeFOSA		87	50-150
d3-MeFOSAA		102	50-150

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

PFAS by LC/MS/MS - MSD

Sample ID: WI17055-004MD
Batch: 16138
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Solid
Prep Method: SOP SPE
Prep Date: 09/22/2021 1232

Parameter	Sample Amount (ug/kg)	Spike Amount (ug/kg)	Result (ug/kg)	Q	Dil	% Rec	% RPD	%Rec Limit	% RPD Limit	Analysis Date
6:2 FTS	ND	2.1	1.6		1	77	27	64-140	30	09/23/2021 1710

Surrogate	Q	% Rec	Acceptance Limit
13C2_4:2FTS		101	50-150
13C2_6:2FTS		103	50-150
13C2_8:2FTS		104	50-150
13C2_PFDoA		100	50-150
13C2_PFTeDA		101	50-150
13C3_PFBS		94	50-150
13C3_PFHxS		99	50-150
13C4_PFBA		100	50-150
13C4_PFHpA		98	50-150
13C5_PFHxA		100	50-150
13C5_PFPeA		94	50-150
13C6_PFDA		101	50-150
13C7_PFUdA		92	50-150
13C8_PFOA		95	50-150
13C8_PFOS		102	50-150
13C8_PFOSA		99	50-150
13C9_PFNA		108	50-150
d5-EtFOSAA		102	50-150
d-MeFOSA		93	50-150
d3-MeFOSAA		101	50-150

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

SPLP PFAS - MB

Sample ID: WQ21123-001
Batch: 21123
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Solid
Prep Method: 1312/PFAS
Prep Date: 11/03/2021 1313 Leachate Date: 10/27/2021 0213

Parameter	Result	Q	Dil	LOQ	LOD	DL	Units	Analysis Date
8:2 FTS	40	U	1	80	40	20	ng/L	11/04/2021 2211
6:2 FTS	40	U	1	80	40	20	ng/L	11/04/2021 2211
4:2 FTS	40	U	1	80	40	20	ng/L	11/04/2021 2211
EtFOSAA	40	U	1	80	40	20	ng/L	11/04/2021 2211
MeFOSA	80	U	1	160	80	40	ng/L	11/04/2021 2211
MeFOSAA	40	U	1	80	40	20	ng/L	11/04/2021 2211
PFBS	20	U	1	40	20	10	ng/L	11/04/2021 2211
PFDS	20	U	1	40	20	10	ng/L	11/04/2021 2211
PFHpS	20	U	1	40	20	10	ng/L	11/04/2021 2211
PFNS	20	U	1	40	20	10	ng/L	11/04/2021 2211
PFOSA	20	U	1	40	20	10	ng/L	11/04/2021 2211
PFPeS	20	U	1	40	20	10	ng/L	11/04/2021 2211
PFHxS	20	U	1	40	20	10	ng/L	11/04/2021 2211
PFBA	20	U	1	40	20	10	ng/L	11/04/2021 2211
PFDA	20	U	1	40	20	10	ng/L	11/04/2021 2211
PFDoA	20	U	1	40	20	10	ng/L	11/04/2021 2211
PFHpA	20	U	1	40	20	10	ng/L	11/04/2021 2211
PFHxA	20	U	1	40	20	10	ng/L	11/04/2021 2211
PFNA	20	U	1	40	20	10	ng/L	11/04/2021 2211
PFOA	20	U	1	40	20	10	ng/L	11/04/2021 2211
PFPeA	20	U	1	40	20	10	ng/L	11/04/2021 2211
PFTeDA	20	U	1	40	20	10	ng/L	11/04/2021 2211
PFTrDA	20	U	1	40	20	10	ng/L	11/04/2021 2211
PFUdA	20	U	1	40	20	10	ng/L	11/04/2021 2211
PFOS	20	U	1	40	20	10	ng/L	11/04/2021 2211

Surrogate	Q	% Rec	Acceptance Limit
13C2_4:2FTS		124	50-150
13C2_6:2FTS		103	50-150
13C2_8:2FTS		115	50-150
13C2_PFDoA		95	50-150
13C2_PFTeDA		93	50-150
13C3_PFBS		102	50-150
13C3_PFHxS		100	50-150
13C4_PFBA		106	50-150
13C4_PFHpA		100	50-150
13C5_PFHxA		102	50-150
13C5_PFPeA		102	50-150
13C6_PFDA		99	50-150
13C7_PFUdA		106	50-150
13C8_PFOA		100	50-150

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

SPLP PFAS - MB

Sample ID: WQ21123-001
Batch: 21123
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Solid
Prep Method: 1312/PFAS
Prep Date: 11/03/2021 1313 Leachate Date: 10/27/2021 0213

Surrogate	Q	% Rec	Acceptance Limit
13C8_PFOS		94	50-150
13C8_PFOSA		107	50-150
13C9_PFNA		98	50-150
d5-EtFOSAA		115	50-150
d-MeFOSA		92	50-150
d3-MeFOSAA		117	50-150

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

SPLP PFAS - LCS

Sample ID: WQ21123-002
Batch: 21123
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Solid
Prep Method: 1312/PFAS
Prep Date: 11/03/2021 1313 Leachate Date: 10/27/2021 0213

Parameter	Spike Amount (ng/L)	Result (ng/L)	Q	Dil	% Rec	%Rec Limit	Analysis Date
8:2 FTS	150	150		1	100	67-138	11/04/2021 2232
6:2 FTS	150	190		1	127	64-140	11/04/2021 2232
4:2 FTS	150	120		1	83	63-143	11/04/2021 2232
EtFOSAA	160	140		1	90	61-135	11/04/2021 2232
MeFOSA	160	240	N	1	148	68-141	11/04/2021 2232
MeFOSAA	160	140		1	85	65-136	11/04/2021 2232
PFBS	140	150		1	103	72-130	11/04/2021 2232
PFDS	150	150		1	95	53-142	11/04/2021 2232
PFHpS	150	150		1	98	69-134	11/04/2021 2232
PFNS	150	160		1	102	69-127	11/04/2021 2232
PFOSA	160	160		1	98	67-137	11/04/2021 2232
PFPeS	150	160		1	105	71-127	11/04/2021 2232
PFHxS	150	160		1	110	68-131	11/04/2021 2232
PFBA	160	160		1	102	73-129	11/04/2021 2232
PFDA	160	160		1	101	71-129	11/04/2021 2232
PFDoA	160	170		1	104	72-134	11/04/2021 2232
PFHpA	160	160		1	98	72-130	11/04/2021 2232
PFHxA	160	160		1	100	72-129	11/04/2021 2232
PFNA	160	180		1	111	69-130	11/04/2021 2232
PFOA	160	160		1	103	71-133	11/04/2021 2232
PFPeA	160	160		1	102	72-129	11/04/2021 2232
PFTeDA	160	170		1	105	71-132	11/04/2021 2232
PFTrDA	160	170		1	103	65-144	11/04/2021 2232
PFUdA	160	170		1	108	69-133	11/04/2021 2232
PFOS	150	150		1	104	65-140	11/04/2021 2232

Surrogate	Q	% Rec	Acceptance Limit
13C2_4:2FTS		115	50-150
13C2_6:2FTS		105	50-150
13C2_8:2FTS		104	50-150
13C2_PFDoA		94	50-150
13C2_PFTeDA		89	50-150
13C3_PFBS		93	50-150
13C3_PFHxS		97	50-150
13C4_PFBA		101	50-150
13C4_PFHpA		99	50-150
13C5_PFHxA		95	50-150
13C5_PFPeA		99	50-150
13C6_PFDA		97	50-150
13C7_PFUdA		99	50-150
13C8_PFOA		94	50-150

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

SPLP PFAS - LCS

Sample ID: WQ21123-002
Batch: 21123
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Solid
Prep Method: 1312/PFAS
Prep Date: 11/03/2021 1313 Leachate Date: 10/27/2021 0213

Surrogate	Q	% Rec	Acceptance Limit
13C8_PFOS		91	50-150
13C8_PFOSA		103	50-150
13C9_PFNA		92	50-150
d5-EtFOSAA		117	50-150
d-MeFOSA		90	50-150
d3-MeFOSAA		113	50-150

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

SPLP PFAS - MS

Sample ID: WI17055-007MS
Batch: 21123
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Solid
Prep Method: 1312/PFAS
Prep Date: 11/03/2021 1313 Leachate Date: 10/27/2021 0213

Parameter	Sample Amount (ng/L)	Spike Amount (ng/L)	Result (ng/L)	Q	Dil	% Rec	%Rec Limit	Analysis Date
8:2 FTS	ND	150	150		1	99	67-138	11/04/2021 2356
6:2 FTS	32	150	180		1	97	64-140	11/04/2021 2356
4:2 FTS	ND	150	140		1	91	63-143	11/04/2021 2356
EtFOSAA	ND	160	150		1	95	61-135	11/04/2021 2356
MeFOSA	ND	160	190		1	119	68-141	11/04/2021 2356
MeFOSAA	ND	160	160		1	98	65-136	11/04/2021 2356
PFBS	ND	140	150		1	103	72-130	11/04/2021 2356
PFDS	ND	150	140		1	89	53-142	11/04/2021 2356
PFHpS	ND	150	150		1	96	69-134	11/04/2021 2356
PFNS	ND	150	140		1	90	69-127	11/04/2021 2356
PFOSA	ND	160	150		1	95	67-137	11/04/2021 2356
PFPeS	ND	150	160		1	104	71-127	11/04/2021 2356
PFHxS	29	150	170		1	94	68-131	11/04/2021 2356
PFBA	ND	160	160		1	102	73-129	11/04/2021 2356
PFDA	ND	160	160		1	99	71-129	11/04/2021 2356
PFDoA	ND	160	160		1	103	72-134	11/04/2021 2356
PFHpA	ND	160	160		1	101	72-130	11/04/2021 2356
PFHxA	ND	160	160		1	101	72-129	11/04/2021 2356
PFNA	ND	160	160		1	101	69-130	11/04/2021 2356
PFOA	ND	160	170		1	104	71-133	11/04/2021 2356
PFPeA	ND	160	160		1	100	72-129	11/04/2021 2356
PFTeDA	ND	160	170		1	103	71-132	11/04/2021 2356
PFTrDA	ND	160	160		1	102	65-144	11/04/2021 2356
PFUdA	ND	160	160		1	101	69-133	11/04/2021 2356
PFOS	58	150	180		1	83	65-140	11/04/2021 2356

Surrogate	Q	% Rec	Acceptance Limit
13C2_4:2FTS		116	50-150
13C2_6:2FTS		114	50-150
13C2_8:2FTS		116	50-150
13C2_PFDoA		100	50-150
13C2_PFTeDA		101	50-150
13C3_PFBS		101	50-150
13C3_PFHxS		104	50-150
13C4_PFBA		113	50-150
13C4_PFHpA		102	50-150
13C5_PFHxA		100	50-150
13C5_PFPeA		100	50-150
13C6_PFDA		101	50-150
13C7_PFUdA		105	50-150
13C8_PFOA		97	50-150

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

SPLP PFAS - MS

Sample ID: WI17055-007MS
Batch: 21123
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Solid
Prep Method: 1312/PFAS
Prep Date: 11/03/2021 1313 Leachate Date: 10/27/2021 0213

Surrogate	Q	% Rec	Acceptance Limit
13C8_PFOS		106	50-150
13C8_PFOSA		113	50-150
13C9_PFNA		101	50-150
d5-EtFOSAA		120	50-150
d-MeFOSA		94	50-150
d3-MeFOSAA		120	50-150

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

SPLP PFAS - MSD

Sample ID: WI17055-007MD
Batch: 21123
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Solid
Prep Method: 1312/PFAS
Prep Date: 11/03/2021 1313 Leachate Date: 10/27/2021 0213

Parameter	Sample Amount (ng/L)	Spike Amount (ng/L)	Result (ng/L)	Q	Dil	% Rec	% RPD	%Rec Limit	% RPD Limit	Analysis Date
8:2 FTS	ND	150	170		1	111	11	67-138	30	11/05/2021 0007
6:2 FTS	32	150	170		1	89	7.0	64-140	30	11/05/2021 0007
4:2 FTS	ND	150	140		1	95	4.5	63-143	30	11/05/2021 0007
EtFOSAA	ND	160	150		1	96	0.59	61-135	30	11/05/2021 0007
MeFOSA	ND	160	180		1	112	6.2	68-141	30	11/05/2021 0007
MeFOSAA	ND	160	160		1	99	1.4	65-136	30	11/05/2021 0007
PFBS	ND	140	140		1	99	3.6	72-130	30	11/05/2021 0007
PFDS	ND	150	140		1	93	4.2	53-142	30	11/05/2021 0007
PFHpS	ND	150	150		1	96	0.076	69-134	30	11/05/2021 0007
PFNS	ND	150	150		1	95	5.6	69-127	30	11/05/2021 0007
PFOSA	ND	160	150		1	95	0.22	67-137	30	11/05/2021 0007
PFPeS	ND	150	150		1	97	6.4	71-127	30	11/05/2021 0007
PFHxS	29	150	170		1	96	1.4	68-131	30	11/05/2021 0007
PFBA	ND	160	160		1	101	0.50	73-129	30	11/05/2021 0007
PFDA	ND	160	160		1	100	0.77	71-129	30	11/05/2021 0007
PFDoA	ND	160	170		1	107	3.6	72-134	30	11/05/2021 0007
PFHpA	ND	160	160		1	100	0.46	72-130	30	11/05/2021 0007
PFHxA	ND	160	160		1	98	3.8	72-129	30	11/05/2021 0007
PFNA	ND	160	160		1	101	0.18	69-130	30	11/05/2021 0007
PFOA	ND	160	170		1	106	1.8	71-133	30	11/05/2021 0007
PFPeA	ND	160	160		1	99	0.96	72-129	30	11/05/2021 0007
PFTeDA	ND	160	160		1	99	4.4	71-132	30	11/05/2021 0007
PFTrDA	ND	160	160		1	102	0.23	65-144	30	11/05/2021 0007
PFUdA	ND	160	150		1	94	7.4	69-133	30	11/05/2021 0007
PFOS	58	150	200		1	98	12	65-140	30	11/05/2021 0007

Surrogate	Q	% Rec	Acceptance Limit
13C2_4:2FTS		117	50-150
13C2_6:2FTS		106	50-150
13C2_8:2FTS		122	50-150
13C2_PFDoA		99	50-150
13C2_PFTeDA		99	50-150
13C3_PFBS		103	50-150
13C3_PFHxS		100	50-150
13C4_PFBA		111	50-150
13C4_PFHpA		95	50-150
13C5_PFHxA		95	50-150
13C5_PFPeA		103	50-150
13C6_PFDA		102	50-150
13C7_PFUdA		112	50-150
13C8_PFOA		97	50-150

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

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SPLP PFAS - MSD

Sample ID: WI17055-007MD
Batch: 21123
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Solid
Prep Method: 1312/PFAS
Prep Date: 11/03/2021 1313 Leachate Date: 10/27/2021 0213

Surrogate	Q	% Rec	Acceptance Limit
13C8_PFOS		96	50-150
13C8_PFOSA		111	50-150
13C9_PFNA		104	50-150
d5-EtFOSAA		129	50-150
d-MeFOSA		98	50-150
d3-MeFOSAA		135	50-150

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

SPLP PFAS - MB

Sample ID: WQ21287-001
Batch: 21287
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Solid
Prep Method: 1312/PFAS
Prep Date: 11/04/2021 1300 Leachate Date: 10/27/2021 0213

Parameter	Result	Q	Dil	LOQ	LOD	DL	Units	Analysis Date
8:2 FTS	40	U	1	80	40	20	ng/L	11/05/2021 1659
6:2 FTS	40	U	1	80	40	20	ng/L	11/05/2021 1659
4:2 FTS	40	U	1	80	40	20	ng/L	11/05/2021 1659
EtFOSAA	40	U	1	80	40	20	ng/L	11/05/2021 1659
MeFOSA	80	U	1	160	80	40	ng/L	11/05/2021 1659
MeFOSAA	40	U	1	80	40	20	ng/L	11/05/2021 1659
PFBS	20	U	1	40	20	10	ng/L	11/05/2021 1659
PFDS	20	U	1	40	20	10	ng/L	11/05/2021 1659
PFHpS	20	U	1	40	20	10	ng/L	11/05/2021 1659
PFNS	20	U	1	40	20	10	ng/L	11/05/2021 1659
PFOSA	20	U	1	40	20	10	ng/L	11/05/2021 1659
PFPeS	20	U	1	40	20	10	ng/L	11/05/2021 1659
PFHxS	20	U	1	40	20	10	ng/L	11/05/2021 1659
PFBA	20	U	1	40	20	10	ng/L	11/05/2021 1659
PFDA	20	U	1	40	20	10	ng/L	11/05/2021 1659
PFDoA	20	U	1	40	20	10	ng/L	11/05/2021 1659
PFHpA	20	U	1	40	20	10	ng/L	11/05/2021 1659
PFHxA	20	U	1	40	20	10	ng/L	11/05/2021 1659
PFNA	20	U	1	40	20	10	ng/L	11/05/2021 1659
PFOA	20	U	1	40	20	10	ng/L	11/05/2021 1659
PFPeA	20	U	1	40	20	10	ng/L	11/05/2021 1659
PFTeDA	20	U	1	40	20	10	ng/L	11/05/2021 1659
PFTrDA	20	U	1	40	20	10	ng/L	11/05/2021 1659
PFUdA	20	U	1	40	20	10	ng/L	11/05/2021 1659
PFOS	20	U	1	40	20	10	ng/L	11/05/2021 1659

Surrogate	Q	% Rec	Acceptance Limit
13C2_4:2FTS		124	50-150
13C2_6:2FTS		116	50-150
13C2_8:2FTS		107	50-150
13C2_PFDoA		107	50-150
13C2_PFTeDA		75	50-150
13C3_PFBS		109	50-150
13C3_PFHxS		108	50-150
13C4_PFBA		103	50-150
13C4_PFHpA		105	50-150
13C5_PFHxA		106	50-150
13C5_PFPeA		102	50-150
13C6_PFDA		104	50-150
13C7_PFUdA		107	50-150
13C8_PFOA		101	50-150

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

SPLP PFAS - MB

Sample ID: WQ21287-001
Batch: 21287
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Solid
Prep Method: 1312/PFAS
Prep Date: 11/04/2021 1300 Leachate Date: 10/27/2021 0213

Surrogate	Q	% Rec	Acceptance Limit
13C8_PFOS		101	50-150
13C8_PFOSA		107	50-150
13C9_PFNA		103	50-150
d5-EtFOSAA		113	50-150
d-MeFOSA		100	50-150
d3-MeFOSAA		115	50-150

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

SPLP PFAS - LCS

Sample ID: WQ21287-002
Batch: 21287
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Solid
Prep Method: 1312/PFAS
Prep Date: 11/04/2021 1300 Leachate Date: 10/27/2021 0213

Parameter	Spike Amount (ng/L)	Result (ng/L)	Q	Dil	% Rec	%Rec Limit	Analysis Date
8:2 FTS	150	160		1	105	67-138	11/05/2021 1710
6:2 FTS	150	180		1	117	64-140	11/05/2021 1710
4:2 FTS	150	140		1	97	63-143	11/05/2021 1710
EtFOSAA	160	140		1	90	61-135	11/05/2021 1710
MeFOSA	160	190		1	116	68-141	11/05/2021 1710
MeFOSAA	160	150		1	95	65-136	11/05/2021 1710
PFBS	140	130		1	93	72-130	11/05/2021 1710
PFDS	150	150		1	96	53-142	11/05/2021 1710
PFHpS	150	160		1	105	69-134	11/05/2021 1710
PFNS	150	170		1	109	69-127	11/05/2021 1710
PFOSA	160	150		1	94	67-137	11/05/2021 1710
PFPeS	150	150		1	98	71-127	11/05/2021 1710
PFHxS	150	150		1	102	68-131	11/05/2021 1710
PFBA	160	160		1	97	73-129	11/05/2021 1710
PFDA	160	160		1	99	71-129	11/05/2021 1710
PFDoA	160	170		1	106	72-134	11/05/2021 1710
PFHpA	160	160		1	99	72-130	11/05/2021 1710
PFHxA	160	160		1	102	72-129	11/05/2021 1710
PFNA	160	170		1	104	69-130	11/05/2021 1710
PFOA	160	160		1	99	71-133	11/05/2021 1710
PFPeA	160	160		1	100	72-129	11/05/2021 1710
PFTeDA	160	160		1	98	71-132	11/05/2021 1710
PFTrDA	160	160		1	101	65-144	11/05/2021 1710
PFUdA	160	180		1	115	69-133	11/05/2021 1710
PFOS	150	150		1	102	65-140	11/05/2021 1710

Surrogate	Q	% Rec	Acceptance Limit
13C2_4:2FTS		115	50-150
13C2_6:2FTS		113	50-150
13C2_8:2FTS		109	50-150
13C2_PFDoA		106	50-150
13C2_PFTeDA		88	50-150
13C3_PFBS		108	50-150
13C3_PFHxS		101	50-150
13C4_PFBA		102	50-150
13C4_PFHpA		108	50-150
13C5_PFHxA		105	50-150
13C5_PFPeA		104	50-150
13C6_PFDA		109	50-150
13C7_PFUdA		97	50-150
13C8_PFOA		111	50-150

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

SPLP PFAS - LCS

Sample ID: WQ21287-002
Batch: 21287
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Solid
Prep Method: 1312/PFAS
Prep Date: 11/04/2021 1300 Leachate Date: 10/27/2021 0213

Surrogate	Q	% Rec	Acceptance Limit
13C8_PFOS		107	50-150
13C8_PFOSA		109	50-150
13C9_PFNA		103	50-150
d5-EtFOSAA		113	50-150
d-MeFOSA		101	50-150
d3-MeFOSAA		112	50-150

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

Chain of Custody
and
Miscellaneous Documents

Chain of Custody

Workorder: ISM | Workorder Name: Fielson | Owner Received Date: 9/13/2021

Pace Analytical

WI17055

KES2

Report To:	Subcontract To:	Requested Ana
Kathy Smith Pace Analytical 106 Vantage Point Drive Columbia SC, 29223 803-227-2704 kathy.smith@pacelabs.com	Pace Golf Coast 7979 Innovation Park Drive, Baton Rouge, LA 70820	

Item	Sample ID	Sample Type	Collect Date/Time	Lab ID	Matrix	Preserved Containers: NON					ISM Prep							LAB USE ONLY
1	ISM-382-5-Uta		9/8/2021			x					x							
2	ISM-382-5-Utb		9/8/2021			x					x							
3	ISM-382-5-Utc		9/8/2021			x					x							
4	ISM-382-5-Sa		9/7/2021			X					X							
5	ISM-382-5-Sb		9/7/2021			X					X							
6	ISM-382-5-Sc		9/7/2021			X					X							
7	ISM-382-5-Fa		9/8/2021			X					X							
8	ISM-382-5-Fb		9/8/2021			X					X							
9	ISM-382-5-Fc		9/8/2021			X					X							
10	ISM-382-5-Ga		9/8/2021			X					X							
11	ISM-382-5-Gb		9/8/2021			X					X							
12	ISM-382-5-Gc		9/8/2021			X					X							
14	**Send samples to SC for analysis after ISM Prep																	

Transfers	Released By	Date/Time	Received By	Date/Time	Comments
1					
2					
3	FEDEX 9/7/21 @ 1025			9-7-21 @ 1025	

Cooler Temperature on Receipt 2.3 °C | Custody Seal Y or N | Received on Ice Y or N

***In order to maintain client confidentiality, location/name of the sampling site, sampler's name and signature may not be provided on this This chain of custody is considered complete as is since this information is available in the owner laboratory.

Friday, June 17, 2016 11:01:34 AM FMT-ALL-C-002rev.00 24March2009 Page 1 of 1

Pace Analytical Services, LLC (formerly Shealy Environmental Services, Inc.)
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

PACE ANALYTICAL SERVICES, LLC
106 Vantage Point Drive · West Columbia, SC 29172
Telephone No. 803-791-9700 Fax No. 803-791-9111
www.pacelabs.com

Client ID: 4367 - Pace Analytical Services
SDG: 22109120?
PM: EPM

Att

Client: Arcadis	Report to Client: Nathan Daigle	Telephone No. / Email: nathan.daigle@arcadis.com	Quote No.: 25048
Address: 10 Friends Ln, Suite 100	Sampler's Signature: Lindsay Powell	Analysis (Attach list if more space is needed)	Page: 1 of 2
City: Newtown State: PA Zip Code: 18940	Printed Name: Lindsay Powell		
Project Name: Ericson Soil Washing			
Project No.: 30030317	PO No.:		

WI17055

Sample ID / Description (Container for each sample may be combined on one line.)	Collection Date(s)	Collection Time (Military)	Sample Composition	Matrix: Drinking Water	Matrix: Solid / Soil / Sediment	No. of Containers by Preservative Type: Unpres.	HCl	HNO3	H2SO4	NaOH	Other	Total Number	PFAS Short List									Remarks / Container ID
ISM-382-5-UTa	8/23-9/8/21		C		X	X							X									up to 100 ppb 2
ISM-382-5-UTb	8/23-9/8/21		C		X	X							X									3
ISM-382-5-UTc	8/23-9/8/21		C		X	X							X									4
ISM-382-5-Sa	9/4-9/8/21		C		X	X							X									< 5 ppb 5
ISM-382-5-Sb	9/4-9/8/21		C		X	X							X									6
ISM-382-5-Sc	9/4-9/8/21		C		X	X							X									7
ISM-382-5-Fa	9/8/21		C		X	X							X									8
ISM-382-5-Fb	9/8/21		C		X	X							X									9
ISM-382-5-Fc	9/8/21		C		X	X							X									10
ISM-382-5-Ga	9/1-9/8/21		C		X	X							X									

Turn Around Time Required (Prior lab approval required for expedited TAT.): ☐ Standard ☐ Rush (Specify) 5 DAY TAT

Sample Disposal: ☐ Return to Client ☐ Disposal by Lab

Possible Hazard Identification: ☒ Non-Hazard ☐ Flammable ☐ Skin Irritant ☐ Poison ☐ Unknown

QC Requirements (Specify)

	Date	Time		Date	Time
1. Relinquished by: Lindsay Powell	9/9/21	0800	1. Received by		
2. Relinquished by			2. Received by		
3. Relinquished by: fedex	9/10/21	1100	3. Received by	9/10/21	1100
4. Relinquished by			4. Laboratory received by		

Note: All samples are retained for four weeks from receipt unless other arrangements are made.

LAB USE ONLY
Received on ice (Circle): Yes No Ice Pack
Receipt Temp: 2.4/2.5 °C
Temp Blank: ☐ Y ☐ N

2835 0855 5984-1

DISTRIBUTION: WHITE & YELLOW-Return to laboratory with Sample(s); PINK-Field/Client Copy

Document Number: ME003N2-01

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Client ID: 4367 - Pace Analytical Services
SDG: 221391237
PM: EPM

Client: Arcadis
Address: 10 Friends Ln. Suite 100
City: Newtown | State | Zip Code:
Project Name: Ericson Soil Washing
Project No: 30043317
PO No.:
Report to Contact: Nathan Nagle
Sampler's Signature: Lindsay Powell
Printed Name: Lindsay Powell
Telephone Nr: nathan.nagle@arcadis.com 25048
Analysis (Attach list if more space is needed)
Page 2 of 2
Lot # Set Code (lab use only)
WI17055
KLS2

Sample ID / Description (Customer for each sample day to be combined on one line.)	Collection Date(s)	Collection Time (Military)	Sample Condition (Lab use)	Matrix: Solid	Matrix: Aqueous	No. of Containers by Preservation Type: Unpres	HNO3	H2SO4	HCl	NaOH	Na2S2O3	Methanol	Other	Analysis: PFAS Short Chain
ISM-382-5-G1b	9/1-9/8/21		C	X		X								X
ISM-382-5-G1c	9/1-9/8/21		C	X		X								X
END OF RECORD														

< 5 ppb ↓ 17

JP 9/9/21

Turn Around Time Required (Prior lab approval required for expedited TAT.): ☐ Standard ☐ Rush (Specify)

Sample Disposal: ☐ Return to Client ☐ Disposal by Lab

Possible Hazard Identification: ☒ Non-Hazard ☐ Flammable ☐ Skin Irritant ☐ Poison ☐ Unknown

QC Requirements (Specify)

	Date	Time		Date	Time
1. Relinquished by: Lindsay Powell	9/10/21	0800	1. Received by		
2. Relinquished by: [illegible]	9/10/21	1200	2. Received by: [illegible]	9/10/21	1200
3. Relinquished by	Date	Time	3. Received by	Date	Time
4. Relinquished by	Date	Time	4. Laboratory received by	Date	Time

Note: All samples are retained for four weeks from receipt unless other arrangements are made.

LAB USE ONLY
Received on Ice (Circle) Yes No Ice Pack
Receipt Temp: 2.4 (-0.3) 2.1°C
Temp Blank ☐ Y ☐ N

2855 0350 3464

DISTRIBUTION: WHITE & YELLOW-Return to laboratory with Sample(s); PINK-Field/Client Copy

Document Number: MED0SN2-01

Pace Analytical

Samples Receipt Checklist (SRC) (ME0018C-15)
Issuing Authority: Pace ENV - WCOL

Revised:9/29/2020
Page 1 of 1

Sample Receipt Checklist (SRC)

Client: Arcadis Cooler Inspected by/date: ECL 9/17/21 Lot #: WT17055

Means of receipt: ☐ Pace ☐ Client ☐ UPS ☑ FedEx ☐ Other: _____

☑ Yes	☐ No		1. Were custody seals present on the cooler?
☑ Yes	☐ No	☐ NA	2. If custody seals were present, were they intact and unbroken?

pH Strip ID: _____ Chlorine Strip ID: _____ Tested by: _____

Original temperature upon receipt / Derived (Corrected) temperature upon receipt %Solid Snap-Cup ID: 21 1428

2.3 / 2.3 °C ___ / ___ °C ___ / ___ °C ___ / ___ °C

Method: ☐ Temperature Blank ☑ Against Bottles IR Gun ID: 5 IR Gun Correction Factor: 0 °C

Method of coolant: ☐ Wet Ice ☑ Ice Packs ☐ Dry Ice ☐ None

☐ Yes	☐ No	☑ NA	3. If temperature of any cooler exceeded 6.0°C, was Project Manager Notified? PM was Notified by: phone / email / face-to-face (circle one).
☑ Yes	☐ No	☐ NA	4. Is the commercial courier's packing slip attached to this form?
☑ Yes	☐ No		5. Were proper custody procedures (relinquished/received) followed?
☑ Yes	☐ No		6. Were sample IDs listed on the COC?
☑ Yes	☐ No		7. Were sample IDs listed on all sample containers?
☑ Yes	☐ No		8. Was collection date & time listed on the COC?
☑ Yes	☐ No		9. Was collection date & time listed on all sample containers?
☑ Yes	☐ No		10. Did all container label information (ID, date, time) agree with the COC?
☑ Yes	☐ No		11. Were tests to be performed listed on the COC?
☑ Yes	☐ No		12. Did all samples arrive in the proper containers for each test and/or in good condition (unbroken, lids on, etc.)? _____
☑ Yes	☐ No		13. Was adequate sample volume available?
☐ Yes	☑ No		14. Were all samples received within ½ the holding time or 48 hours, whichever comes first?
☐ Yes	☑ No		15. Were any samples containers missing/excess (circle one) samples Not listed on COC?
☐ Yes	☐ No	☑ NA	16. For VOA and RSK-175 samples, were bubbles present >"pea-size" (¼"or 6mm in diameter) in any of the VOA vials?
☐ Yes	☐ No	☑ NA	17. Were all DRO/metals/nutrient samples received at a pH of < 2?
☐ Yes	☐ No	☑ NA	18. Were all cyanide samples received at a pH > 12 and sulfide samples received at a pH > 9?
☐ Yes	☐ No	☑ NA	19. Were all applicable NH_3/TKN/cyanide/phenol/625.1/608.3 (< 0.5mg/L) samples free of residual chlorine?
☐ Yes	☐ No	☑ NA	20. Were client remarks/requests (i.e. requested dilutions, MS/MSD designations, etc...) correctly transcribed from the COC into the comment section in LIMS?
☐ Yes	☐ No		21. Was the quote number listed on the container label? If yes, Quote # _____

Sample Preservation (Must be completed for any sample(s) incorrectly preserved or with headspace.)

Sample(s) NA were received incorrectly preserved and were adjusted accordingly in sample receiving with NA mL of circle one: H2SO4, HNO3, HCl, NaOH using SR # NA.
Time of preservation NA. If more than one preservative is needed, please note in the comments below.

Sample(s) _____ were received with bubbles >6 mm in diameter.

Samples(s) NA were received with TRC > 0.5 mg/L (If #19 is *no*) and were adjusted accordingly in sample receiving with sodium thiosulfate ($Na_2S_2O_3$) with Shealy ID: NA.

SR barcode labels applied by: ECL Date: 9/17/21

Comments:

Report of Analysis

Arcadis U.S., Inc.
630 Plaza Drive
Suite 600
Highlands Ranch, CO 80129
Attention: Joseph Quinnan

Project Name: Eielson AFB

Project Number: 30030317

Lot Number:**WJ01056**

Date Completed:11/09/2021
Revision Date: 10/21/2021

11/10/2021 10:16 AM
Approved and released by:
Project Manager II: **Kathy E. Smith**

The electronic signature above is the equivalent of a handwritten signature.
This report shall not be reproduced, except in its entirety, without the written approval of Pace Analytical Services, LLC.

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Tel: 803-791-9700 Fax: 803-791-9111 www.pacelabs.com

Case Narrative
Arcadis U.S., Inc.
Lot Number: WJ01056

This Report of Analysis contains the analytical result(s) for the sample(s) listed on the Sample Summary following this Case Narrative. The sample receiving date is documented in the header information associated with each sample.

All results listed in this report relate only to the samples that are contained within this report.

Sample receipt, sample analysis, and data review have been performed in accordance with the Pace Quality Assurance Management Plan (QAMP), applicable Shealy standard operating procedures (SOPs), the 2003 NELAC standard, and Shealy policies. Additionally, the DoD QSM version 5.3 has been followed for these samples, and specifically Table B-15 was followed for all PFAS samples. Any exceptions to the QAMP, SOPs, NELAC standards, the DoD QSM, or policies are qualified on the results page or discussed below.

Correction factors (CF) are used to calculate the original sample concentration. The CF is the inverse of the concentration factor (sample volume / extract final volume) times the dilution factor (DF). For undiluted analysis. The extract is prepared for injection by adding 182 uL of sample extract + 8 uL of reagent water + 10 uL of internal standard solution to a polypropylene autosampler vial. An extra correction factor of 0.91 (182 uL / 200 uL = 0.91) applies. The CF is calculated as follows:

For solid samples:

CF = DF * FV / Ws/S/1000

FV is volume of extract (mL)
Ws is initial sample weight (gram)
S is %Solids
DF is dilution factor. For undiluted analysis, DF = 1/0.91.

Concentration (ug/kg) = Cs*CF,

$$C_s = \frac{\left(\frac{(A_s x C_{is})}{A_{is}}\right) - B}{M1}$$

Where

C_s is on column concentration of target analyte in the sample (ng/L)
C_{is} is concentration of internal standard in the sample (ng/L)
A_s is peak response of target analyte in the sample
A_{is} is peak response of internal standard in the sample
M1 is the average RF from ICAL or the slope from linear regression ICAL
B is the y-intercept from the ICAL

Pace is a TNI accredited laboratory; however, the following analyses are currently not listed on our TNI scope of accreditation:

Biological Tissue: All, Non-Potable Water: SGT-HEM EPA 1664B, Silica EPA 200.7, Boron, Calcium, Silicon, Strontium EPA 200.8, Bicarbonate, Carbonate, and Hydroxide Alkalinity SM 2320 B-2011, Fecal Coliform SM 9221 C E-2006 & SM 9222D-2006, Strontium SW-846 6010D, VOC SM 6200 B-2011, Drinking Water: VOC (excluding BTEX, MTBE, Naphthalene, & 1,2-dichloroethane) EPA 524.2, Solid Chemical Material: TOC Walkley-Black.

Where applicable, all soil sample results (including LOQ and DL if requested) are corrected for dry weight unless flagged with a "W" qualifier.

If you have any questions regarding this report please contact the Pace Project Manager listed on the cover page.

Samples for SPLP PFAS were leached and analyzed outside of holding time. Data has been flagged with an H data qualifier.

Sample Summary

Arcadis U.S., Inc.

Lot Number: WJ01056

Project Name: Eielson AFB

Project Number: 30030317

Sample Number	Sample ID	Matrix	Date Sampled	Date Received
001	385-4-Sa	Solid	09/18/2021 1726	10/01/2021
002	385-4-Sb	Solid	09/18/2021 1726	10/01/2021
003	385-4-Sc	Solid	09/18/2021 1726	10/01/2021
004	385-4-Gb	Solid	09/18/2021 1702	10/01/2021
005	385-4-Gc	Solid	09/18/2021 1702	10/01/2021
006	385-4-Uta	Solid	09/18/2021 1645	10/01/2021
007	385-4-Utb	Solid	09/18/2021 1645	10/01/2021
008	385-4-Utc	Solid	09/18/2021 1645	10/01/2021
009	385-4-Ga	Solid	09/18/2021 1702	10/01/2021

(9 samples)

Detection Summary

Arcadis U.S., Inc.

Lot Number: WJ01056

Project Name: Eielson AFB

Project Number: 30030317

Sample	Sample ID	Matrix	Parameter	Method	Result	Q	Units	Page
001	385-4-Sa	Solid	PFHxS	PFAS by ID	0.37	J	ug/kg	6
001	385-4-Sa	Solid	PFOS	PFAS by ID	1.1		ug/kg	6
001	385-4-Sa	Solid	6:2 FTS	PFAS by ID	100	H	ng/L	8
001	385-4-Sa	Solid	PFHxS	PFAS by ID	12	HJ	ng/L	8
001	385-4-Sa	Solid	PFOS	PFAS by ID	11	HJ	ng/L	8
002	385-4-Sb	Solid	PFHxS	PFAS by ID	0.41	J	ug/kg	10
002	385-4-Sb	Solid	PFOS	PFAS by ID	0.85	J	ug/kg	10
002	385-4-Sb	Solid	PFHxS	PFAS by ID	15	HJ	ng/L	12
002	385-4-Sb	Solid	PFOS	PFAS by ID	15	HJ	ng/L	12
003	385-4-Sc	Solid	PFHxS	PFAS by ID	0.35	J	ug/kg	14
003	385-4-Sc	Solid	PFOS	PFAS by ID	0.87	J	ug/kg	14
003	385-4-Sc	Solid	PFHxS	PFAS by ID	11	HJ	ng/L	16
003	385-4-Sc	Solid	PFOS	PFAS by ID	14	HJ	ng/L	16
004	385-4-Gb	Solid	PFOS	PFAS by ID	0.23	J	ug/kg	18
004	385-4-Gb	Solid	6:2 FTS	PFAS by ID	32	HJ	ng/L	20
006	385-4-Uta	Solid	PFDS	PFAS by ID	0.28	J	ug/kg	26
006	385-4-Uta	Solid	PFHxS	PFAS by ID	3.5		ug/kg	26
006	385-4-Uta	Solid	PFHpA	PFAS by ID	0.35	J	ug/kg	26
006	385-4-Uta	Solid	PFHxA	PFAS by ID	0.46	J	ug/kg	26
006	385-4-Uta	Solid	PFOA	PFAS by ID	0.61	J	ug/kg	26
006	385-4-Uta	Solid	PFPeA	PFAS by ID	0.22	J	ug/kg	26
006	385-4-Uta	Solid	PFOS	PFAS by ID	6.7		ug/kg	26
006	385-4-Uta	Solid	PFBS	PFAS by ID	12	HJ	ng/L	28
006	385-4-Uta	Solid	PFHxS	PFAS by ID	270	H	ng/L	28
006	385-4-Uta	Solid	PFBA	PFAS by ID	13	HJ	ng/L	28
006	385-4-Uta	Solid	PFHpA	PFAS by ID	31	HJ	ng/L	28
006	385-4-Uta	Solid	PFHxA	PFAS by ID	42	H	ng/L	28
006	385-4-Uta	Solid	PFOA	PFAS by ID	51	H	ng/L	28
006	385-4-Uta	Solid	PFPeA	PFAS by ID	24	HJ	ng/L	28
006	385-4-Uta	Solid	PFOS	PFAS by ID	430	H	ng/L	28
007	385-4-Utb	Solid	PFBS	PFAS by ID	0.22	J	ug/kg	30
007	385-4-Utb	Solid	PFPeS	PFAS by ID	0.19	J	ug/kg	30
007	385-4-Utb	Solid	PFHxS	PFAS by ID	4.5		ug/kg	30
007	385-4-Utb	Solid	PFBA	PFAS by ID	0.18	J	ug/kg	30
007	385-4-Utb	Solid	PFDA	PFAS by ID	0.19	J	ug/kg	30
007	385-4-Utb	Solid	PFHpA	PFAS by ID	0.50	J	ug/kg	30
007	385-4-Utb	Solid	PFHxA	PFAS by ID	0.74	J	ug/kg	30
007	385-4-Utb	Solid	PFOA	PFAS by ID	0.81	J	ug/kg	30
007	385-4-Utb	Solid	PFPeA	PFAS by ID	0.33	J	ug/kg	30
007	385-4-Utb	Solid	PFOS	PFAS by ID	8.9		ug/kg	30
007	385-4-Utb	Solid	PFBS	PFAS by ID	11	HJ	ng/L	32
007	385-4-Utb	Solid	PFHxS	PFAS by ID	260	H	ng/L	32
007	385-4-Utb	Solid	PFBA	PFAS by ID	11	HJ	ng/L	32

Sample	Sample ID	Matrix	Parameter	Method	Result	Q	Units	Page
007	385-4-Utb	Solid	PFHpA	PFAS by ID	31	HJ	ng/L	32
007	385-4-Utb	Solid	PFHxA	PFAS by ID	38	HJ	ng/L	32
007	385-4-Utb	Solid	PFOA	PFAS by ID	50	H	ng/L	32
007	385-4-Utb	Solid	PFPeA	PFAS by ID	22	HJ	ng/L	32
007	385-4-Utb	Solid	PFOS	PFAS by ID	440	H	ng/L	32
008	385-4-Utc	Solid	PFBS	PFAS by ID	0.22	J	ug/kg	34
008	385-4-Utc	Solid	PFOSA	PFAS by ID	0.20	J	ug/kg	34
008	385-4-Utc	Solid	PFPeS	PFAS by ID	0.20	J	ug/kg	34
008	385-4-Utc	Solid	PFHxS	PFAS by ID	5.0		ug/kg	34
008	385-4-Utc	Solid	PFHpA	PFAS by ID	0.58	J	ug/kg	34
008	385-4-Utc	Solid	PFHxA	PFAS by ID	0.71	J	ug/kg	34
008	385-4-Utc	Solid	PFNA	PFAS by ID	0.19	J	ug/kg	34
008	385-4-Utc	Solid	PFOA	PFAS by ID	0.94	J	ug/kg	34
008	385-4-Utc	Solid	PFPeA	PFAS by ID	0.34	J	ug/kg	34
008	385-4-Utc	Solid	PFOS	PFAS by ID	9.1		ug/kg	34
008	385-4-Utc	Solid	PFBS	PFAS by ID	12	HJ	ng/L	36
008	385-4-Utc	Solid	PFHxS	PFAS by ID	230	H	ng/L	36
008	385-4-Utc	Solid	PFBA	PFAS by ID	11	HJ	ng/L	36
008	385-4-Utc	Solid	PFHpA	PFAS by ID	32	HJ	ng/L	36
008	385-4-Utc	Solid	PFHxA	PFAS by ID	35	HJ	ng/L	36
008	385-4-Utc	Solid	PFOA	PFAS by ID	48	H	ng/L	36
008	385-4-Utc	Solid	PFPeA	PFAS by ID	21	HJ	ng/L	36
008	385-4-Utc	Solid	PFOS	PFAS by ID	420	H	ng/L	36

(66 detections)

PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: WJ01056-001
Description: 385-4-Sa | Matrix: Solid
Date Sampled: 09/18/2021 1726 | Project Name: Eielson AFB | % Solids: 99.1 10/02/2021 1447
Date Received: 10/01/2021 | Project Number: 30030317

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch
1	SOP SPE	PFAS by ID SOP QSM B-15	1	10/04/2021 1528	JJG	10/03/2021 1401	17485

Parameter	CAS Number	Analytical Method	Result	Q	LOQ	LOD	DL	Units	Run
1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS)	39108-34-4	PFAS by ID SOP	1.0	U	2.0	1.0	0.49	ug/kg	1
1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS)	27619-97-2	PFAS by ID SOP	1.0	U	2.0	1.0	0.49	ug/kg	1
1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS)	757124-72-4	PFAS by ID SOP	1.0	U	2.0	1.0	0.49	ug/kg	1
N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA)	2991-50-6	PFAS by ID SOP	1.0	U	2.0	1.0	0.49	ug/kg	1
N-methylperfluoro-1-octanesulfonamide (MeFOSA)	31506-32-8	PFAS by ID SOP	1.0	U	2.0	1.0	0.49	ug/kg	1
N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA)	2355-31-9	PFAS by ID SOP	1.0	U	2.0	1.0	0.49	ug/kg	1
Perfluoro-1-butanesulfonic acid (PFBS)	375-73-5	PFAS by ID SOP	0.49	U	0.98	0.49	0.20	ug/kg	1
Perfluoro-1-decanesulfonic acid (PFDS)	335-77-3	PFAS by ID SOP	0.49	U	0.98	0.49	0.20	ug/kg	1
Perfluoro-1-heptanesulfonic acid (PFHpS)	375-92-8	PFAS by ID SOP	0.49	U	0.98	0.49	0.20	ug/kg	1
Perfluoro-1-nonanesulfonic acid (PFNS)	68259-12-1	PFAS by ID SOP	0.49	U	0.98	0.49	0.20	ug/kg	1
Perfluoro-1-octanesulfonamide (PFOSA)	754-91-6	PFAS by ID SOP	0.49	U	0.98	0.49	0.20	ug/kg	1
Perfluoro-1-pentanesulfonic acid (PFPeS)	2706-91-4	PFAS by ID SOP	0.49	U	0.98	0.49	0.20	ug/kg	1
Perfluorohexanesulfonic acid (PFHxS)	355-46-4	PFAS by ID SOP	0.37	J	0.98	0.49	0.20	ug/kg	1
Perfluoro-n-butanoic acid (PFBA)	375-22-4	PFAS by ID SOP	0.49	U	0.98	0.49	0.20	ug/kg	1
Perfluoro-n-decanoic acid (PFDA)	335-76-2	PFAS by ID SOP	0.49	U	0.98	0.49	0.20	ug/kg	1
Perfluoro-n-dodecanoic acid (PFDoA)	307-55-1	PFAS by ID SOP	0.49	U	0.98	0.49	0.20	ug/kg	1
Perfluoro-n-heptanoic acid (PFHpA)	375-85-9	PFAS by ID SOP	0.49	U	0.98	0.49	0.20	ug/kg	1
Perfluoro-n-hexanoic acid (PFHxA)	307-24-4	PFAS by ID SOP	0.49	U	0.98	0.49	0.20	ug/kg	1
Perfluoro-n-nonanoic acid (PFNA)	375-95-1	PFAS by ID SOP	0.49	U	0.98	0.49	0.20	ug/kg	1
Perfluoro-n-octanoic acid (PFOA)	335-67-1	PFAS by ID SOP	0.49	U	0.98	0.49	0.20	ug/kg	1
Perfluoro-n-pentanoic acid (PFPeA)	2706-90-3	PFAS by ID SOP	0.49	U	0.98	0.49	0.20	ug/kg	1
Perfluoro-n-tetradecanoic acid (PFTeDA)	376-06-7	PFAS by ID SOP	0.49	U	0.98	0.49	0.20	ug/kg	1
Perfluoro-n-tridecanoic acid (PFTrDA)	72629-94-8	PFAS by ID SOP	0.49	U	0.98	0.49	0.20	ug/kg	1
Perfluoro-n-undecanoic acid (PFUdA)	2058-94-8	PFAS by ID SOP	0.49	U	0.98	0.49	0.20	ug/kg	1
Perfluorooctanesulfonic acid (PFOS)	1763-23-1	PFAS by ID SOP	1.1		0.98	0.49	0.20	ug/kg	1

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
13C2_4:2FTS		104	50-150
13C2_6:2FTS		106	50-150
13C2_8:2FTS		104	50-150
13C2_PFDoA		89	50-150
13C2_PFTeDA		88	50-150
13C3_PFBS		93	50-150
13C3_PFHxS		88	50-150
13C4_PFBA		91	50-150
13C4_PFHpA		90	50-150
13C5_PFHxA		88	50-150
13C5_PFPeA		88	50-150
13C6_PFDA		92	50-150
13C7_PFUdA		88	50-150
13C8_PFOA		93	50-150
13C8_PFOS		95	50-150
13C8_PFOSA		101	50-150
13C9_PFNA		89	50-150

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.		Laboratory ID: WJ01056-001
Description: 385-4-Sa		Matrix: Solid
Date Sampled: 09/18/2021 1726	Project Name: Eielson AFB	% Solids: 99.1 10/02/2021 1447
Date Received: 10/01/2021	Project Number: 30030317	

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
d5-EtFOSAA		103	50-150
d-MeFOSA		110	50-150
d3-MeFOSAA		97	50-150

LOQ = Limit of Quantitation	B = Detected in the method blank	E = Quantitation of compound exceeded the calibration range	DL = Detection Limit	Q = Surrogate failure
U = Not detected at or above the LOQ	N = Recovery is out of criteria	P = The RPD between two GC columns exceeds 40%	J = Estimated result < LOQ and ≥ DL	L = LCS/LCSD failure
H = Out of holding time	W = Reported on wet weight basis	LOD = Limit of Detection		S = MS/MSD failure

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SPLP PFAS

Client: Arcadis U.S., Inc. | Laboratory ID: WJ01056-001
Description: 385-4-Sa | Matrix: Solid
Date Sampled: 09/18/2021 1726 | Project Name: Eielson AFB | % Solids: 99.1 10/02/2021 1447
Date Received: 10/01/2021 | Project Number: 30030317

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch	Leachate Date
1	1312/PFAS	PFAS by ID SOP QSM B-15	1	11/05/2021 1824	MMM	11/04/2021 1300	21287	10/27/2021 0213

Parameter	CAS Number	Analytical Method	Result	Q	LOQ	LOD	DL	Units	Run
1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS)	39108-34-4	PFAS by ID SOP	40	UH	80	40	20	ng/L	1
1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS)	27619-97-2	PFAS by ID SOP	100	H	80	40	20	ng/L	1
1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS)	757124-72-4	PFAS by ID SOP	40	UH	80	40	20	ng/L	1
N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA)	2991-50-6	PFAS by ID SOP	40	UH	80	40	20	ng/L	1
N-methylperfluoro-1-octanesulfonamide (MeFOSA)	31506-32-8	PFAS by ID SOP	80	UH	160	80	40	ng/L	1
N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA)	2355-31-9	PFAS by ID SOP	40	UH	80	40	20	ng/L	1
Perfluoro-1-butanesulfonic acid (PFBS)	375-73-5	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-1-decanesulfonic acid (PFDS)	335-77-3	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-1-heptanesulfonic acid (PFHpS)	375-92-8	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-1-nonanesulfonic acid (PFNS)	68259-12-1	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-1-octanesulfonamide (PFOSA)	754-91-6	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-1-pentanesulfonic acid (PFPeS)	2706-91-4	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluorohexanesulfonic acid (PFHxS)	355-46-4	PFAS by ID SOP	12	HJ	40	20	10	ng/L	1
Perfluoro-n-butanoic acid (PFBA)	375-22-4	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-decanoic acid (PFDA)	335-76-2	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-dodecanoic acid (PFDoA)	307-55-1	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-heptanoic acid (PFHpA)	375-85-9	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-hexanoic acid (PFHxA)	307-24-4	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-nonanoic acid (PFNA)	375-95-1	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-octanoic acid (PFOA)	335-67-1	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-pentanoic acid (PFPeA)	2706-90-3	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-tetradecanoic acid (PFTeDA)	376-06-7	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-tridecanoic acid (PFTrDA)	72629-94-8	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-undecanoic acid (PFUdA)	2058-94-8	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluorooctanesulfonic acid (PFOS)	1763-23-1	PFAS by ID SOP	11	HJ	40	20	10	ng/L	1

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
13C2_4:2FTS	H	125	50-150
13C2_6:2FTS	H	116	50-150
13C2_8:2FTS	H	109	50-150
13C2_PFDoA	H	104	50-150
13C2_PFTeDA	H	86	50-150
13C3_PFBS	H	108	50-150
13C3_PFHxS	H	100	50-150
13C4_PFBA	H	100	50-150
13C4_PFHpA	H	103	50-150
13C5_PFHxA	H	96	50-150
13C5_PFPeA	H	102	50-150
13C6_PFDA	H	103	50-150
13C7_PFUdA	H	93	50-150
13C8_PFOA	H	110	50-150
13C8_PFOS	H	111	50-150
13C8_PFOSA	H	103	50-150
13C9_PFNA	H	105	50-150

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

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SPLP PFAS

Client: Arcadis U.S., Inc.		Laboratory ID: WJ01056-001	
Description: 385-4-Sa		Matrix: Solid	
Date Sampled: 09/18/2021 1726	Project Name: Eielson AFB	% Solids: 99.1	10/02/2021 1447
Date Received: 10/01/2021	Project Number: 30030317		

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
d5-EtFOSAA	H	108	50-150
d-MeFOSA	H	106	50-150
d3-MeFOSAA	H	115	50-150

LOQ = Limit of Quantitation	B = Detected in the method blank	E = Quantitation of compound exceeded the calibration range	DL = Detection Limit	Q = Surrogate failure
U = Not detected at or above the LOQ	N = Recovery is out of criteria	P = The RPD between two GC columns exceeds 40%	J = Estimated result < LOQ and ≥ DL	L = LCS/LCSD failure
H = Out of holding time	W = Reported on wet weight basis	LOD = Limit of Detection		S = MS/MSD failure

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PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: WJ01056-002
Description: 385-4-Sb | Matrix: Solid
Date Sampled: 09/18/2021 1726 | Project Name: Eielson AFB | % Solids: 99.5 10/02/2021 1447
Date Received: 10/01/2021 | Project Number: 30030317

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch
1	SOP SPE	PFAS by ID SOP QSM B-15	1	10/04/2021 1539	JJG	10/03/2021 1401	17485

Parameter	CAS Number	Analytical Method	Result	Q	LOQ	LOD	DL	Units	Run
1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS)	39108-34-4	PFAS by ID SOP	0.90	U	1.8	0.90	0.44	ug/kg	1
1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS)	27619-97-2	PFAS by ID SOP	0.90	U	1.8	0.90	0.44	ug/kg	1
1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS)	757124-72-4	PFAS by ID SOP	0.90	U	1.8	0.90	0.44	ug/kg	1
N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA)	2991-50-6	PFAS by ID SOP	0.90	U	1.8	0.90	0.44	ug/kg	1
N-methylperfluoro-1-octanesulfonamide (MeFOSA)	31506-32-8	PFAS by ID SOP	0.90	U	1.8	0.90	0.44	ug/kg	1
N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA)	2355-31-9	PFAS by ID SOP	0.90	U	1.8	0.90	0.44	ug/kg	1
Perfluoro-1-butanesulfonic acid (PFBS)	375-73-5	PFAS by ID SOP	0.44	U	0.88	0.44	0.18	ug/kg	1
Perfluoro-1-decanesulfonic acid (PFDS)	335-77-3	PFAS by ID SOP	0.44	U	0.88	0.44	0.18	ug/kg	1
Perfluoro-1-heptanesulfonic acid (PFHpS)	375-92-8	PFAS by ID SOP	0.44	U	0.88	0.44	0.18	ug/kg	1
Perfluoro-1-nonanesulfonic acid (PFNS)	68259-12-1	PFAS by ID SOP	0.44	U	0.88	0.44	0.18	ug/kg	1
Perfluoro-1-octanesulfonamide (PFOSA)	754-91-6	PFAS by ID SOP	0.44	U	0.88	0.44	0.18	ug/kg	1
Perfluoro-1-pentanesulfonic acid (PFPeS)	2706-91-4	PFAS by ID SOP	0.44	U	0.88	0.44	0.18	ug/kg	1
Perfluorohexanesulfonic acid (PFHxS)	355-46-4	PFAS by ID SOP	0.41	J	0.88	0.44	0.18	ug/kg	1
Perfluoro-n-butanoic acid (PFBA)	375-22-4	PFAS by ID SOP	0.44	U	0.88	0.44	0.18	ug/kg	1
Perfluoro-n-decanoic acid (PFDA)	335-76-2	PFAS by ID SOP	0.44	U	0.88	0.44	0.18	ug/kg	1
Perfluoro-n-dodecanoic acid (PFDoA)	307-55-1	PFAS by ID SOP	0.44	U	0.88	0.44	0.18	ug/kg	1
Perfluoro-n-heptanoic acid (PFHpA)	375-85-9	PFAS by ID SOP	0.44	U	0.88	0.44	0.18	ug/kg	1
Perfluoro-n-hexanoic acid (PFHxA)	307-24-4	PFAS by ID SOP	0.44	U	0.88	0.44	0.18	ug/kg	1
Perfluoro-n-nonanoic acid (PFNA)	375-95-1	PFAS by ID SOP	0.44	U	0.88	0.44	0.18	ug/kg	1
Perfluoro-n-octanoic acid (PFOA)	335-67-1	PFAS by ID SOP	0.44	U	0.88	0.44	0.18	ug/kg	1
Perfluoro-n-pentanoic acid (PFPeA)	2706-90-3	PFAS by ID SOP	0.44	U	0.88	0.44	0.18	ug/kg	1
Perfluoro-n-tetradecanoic acid (PFTeDA)	376-06-7	PFAS by ID SOP	0.44	U	0.88	0.44	0.18	ug/kg	1
Perfluoro-n-tridecanoic acid (PFTrDA)	72629-94-8	PFAS by ID SOP	0.44	U	0.88	0.44	0.18	ug/kg	1
Perfluoro-n-undecanoic acid (PFUdA)	2058-94-8	PFAS by ID SOP	0.44	U	0.88	0.44	0.18	ug/kg	1
Perfluorooctanesulfonic acid (PFOS)	1763-23-1	PFAS by ID SOP	0.85	J	0.88	0.44	0.18	ug/kg	1

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
13C2_4:2FTS		104	50-150
13C2_6:2FTS		101	50-150
13C2_8:2FTS		97	50-150
13C2_PFDoA		85	50-150
13C2_PFTeDA		86	50-150
13C3_PFBS		88	50-150
13C3_PFHxS		84	50-150
13C4_PFBA		88	50-150
13C4_PFHpA		82	50-150
13C5_PFHxA		84	50-150
13C5_PFPeA		85	50-150
13C6_PFDA		87	50-150
13C7_PFUdA		86	50-150
13C8_PFOA		88	50-150
13C8_PFOS		91	50-150
13C8_PFOSA		96	50-150
13C9_PFNA		87	50-150

LOQ = Limit of Quantitation | B = Detected in the method blank | E = Quantitation of compound exceeded the calibration range | DL = Detection Limit | Q = Surrogate failure
U = Not detected at or above the LOQ | N = Recovery is out of criteria | P = The RPD between two GC columns exceeds 40% | J = Estimated result < LOQ and ≥ DL | L = LCS/LCSD failure
H = Out of holding time | W = Reported on wet weight basis | LOD = Limit of Detection | S = MS/MSD failure

PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.		Laboratory ID: WJ01056-002	
Description: 385-4-Sb		Matrix: Solid	
Date Sampled: 09/18/2021 1726	Project Name: Eielson AFB	% Solids: 99.5	10/02/2021 1447
Date Received: 10/01/2021	Project Number: 30030317		

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
d5-EtFOSAA		104	50-150
d-MeFOSA		106	50-150
d3-MeFOSAA		96	50-150

LOQ = Limit of Quantitation	B = Detected in the method blank	E = Quantitation of compound exceeded the calibration range	DL = Detection Limit	Q = Surrogate failure
U = Not detected at or above the LOQ	N = Recovery is out of criteria	P = The RPD between two GC columns exceeds 40%	J = Estimated result < LOQ and ≥ DL	L = LCS/LCSD failure
H = Out of holding time	W = Reported on wet weight basis	LOD = Limit of Detection		S = MS/MSD failure

SPLP PFAS

Client: Arcadis U.S., Inc. | Laboratory ID: WJ01056-002
Description: 385-4-Sb | Matrix: Solid
Date Sampled: 09/18/2021 1726 | Project Name: Eielson AFB | % Solids: 99.5 10/02/2021 1447
Date Received: 10/01/2021 | Project Number: 30030317

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch	Leachate Date
1	1312/PFAS	PFAS by ID SOP QSM B-15	1	11/05/2021 1835	MMM	11/04/2021 1300	21287	10/27/2021 0213

Parameter	CAS Number	Analytical Method	Result	Q	LOQ	LOD	DL	Units	Run
1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS)	39108-34-4	PFAS by ID SOP	40	UH	80	40	20	ng/L	1
1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS)	27619-97-2	PFAS by ID SOP	40	UHS	80	40	20	ng/L	1
1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS)	757124-72-4	PFAS by ID SOP	40	UH	80	40	20	ng/L	1
N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA)	2991-50-6	PFAS by ID SOP	40	UH	80	40	20	ng/L	1
N-methylperfluoro-1-octanesulfonamide (MeFOSA)	31506-32-8	PFAS by ID SOP	80	UH	160	80	40	ng/L	1
N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA)	2355-31-9	PFAS by ID SOP	40	UH	80	40	20	ng/L	1
Perfluoro-1-butanesulfonic acid (PFBS)	375-73-5	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-1-decanesulfonic acid (PFDS)	335-77-3	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-1-heptanesulfonic acid (PFHpS)	375-92-8	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-1-nonanesulfonic acid (PFNS)	68259-12-1	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-1-octanesulfonamide (PFOSA)	754-91-6	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-1-pentanesulfonic acid (PFPeS)	2706-91-4	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluorohexanesulfonic acid (PFHxS)	355-46-4	PFAS by ID SOP	15	HJ	40	20	10	ng/L	1
Perfluoro-n-butanoic acid (PFBA)	375-22-4	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-decanoic acid (PFDA)	335-76-2	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-dodecanoic acid (PFDoA)	307-55-1	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-heptanoic acid (PFHpA)	375-85-9	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-hexanoic acid (PFHxA)	307-24-4	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-nonanoic acid (PFNA)	375-95-1	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-octanoic acid (PFOA)	335-67-1	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-pentanoic acid (PFPeA)	2706-90-3	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-tetradecanoic acid (PFTeDA)	376-06-7	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-tridecanoic acid (PFTrDA)	72629-94-8	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-undecanoic acid (PFUdA)	2058-94-8	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluorooctanesulfonic acid (PFOS)	1763-23-1	PFAS by ID SOP	15	HJ	40	20	10	ng/L	1

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
13C2_4:2FTS	H	115	50-150
13C2_6:2FTS	H	119	50-150
13C2_8:2FTS	H	104	50-150
13C2_PFDoA	H	104	50-150
13C2_PFTeDA	H	83	50-150
13C3_PFBS	H	108	50-150
13C3_PFHxS	H	103	50-150
13C4_PFBA	H	101	50-150
13C4_PFHpA	H	107	50-150
13C5_PFHxA	H	102	50-150
13C5_PFPeA	H	105	50-150
13C6_PFDA	H	104	50-150
13C7_PFUdA	H	106	50-150
13C8_PFOA	H	110	50-150
13C8_PFOS	H	102	50-150
13C8_PFOSA	H	103	50-150
13C9_PFNA	H	107	50-150

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

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SPLP PFAS

Client: Arcadis U.S., Inc.		Laboratory ID: WJ01056-002
Description: 385-4-Sb		Matrix: Solid
Date Sampled: 09/18/2021 1726	Project Name: Eielson AFB	% Solids: 99.5 10/02/2021 1447
Date Received: 10/01/2021	Project Number: 30030317	

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
d5-EtFOSAA	H	112	50-150
d-MeFOSA	H	92	50-150
d3-MeFOSAA	H	115	50-150

LOQ = Limit of Quantitation	B = Detected in the method blank	E = Quantitation of compound exceeded the calibration range	DL = Detection Limit	Q = Surrogate failure
U = Not detected at or above the LOQ	N = Recovery is out of criteria	P = The RPD between two GC columns exceeds 40%	J = Estimated result < LOQ and ≥ DL	L = LCS/LCSD failure
H = Out of holding time	W = Reported on wet weight basis	LOD = Limit of Detection		S = MS/MSD failure

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PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: WJ01056-003
Description: 385-4-Sc | Matrix: Solid
Date Sampled: 09/18/2021 1726 | Project Name: Eielson AFB | % Solids: 99.5 10/02/2021 1447
Date Received: 10/01/2021 | Project Number: 30030317

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch
1	SOP SPE	PFAS by ID SOP QSM B-15	1	10/04/2021 1549	JJG	10/03/2021 1401	17485

Parameter	CAS Number	Analytical Method	Result	Q	LOQ	LOD	DL	Units	Run
1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS)	39108-34-4	PFAS by ID SOP	0.90	U	1.8	0.90	0.45	ug/kg	1
1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS)	27619-97-2	PFAS by ID SOP	0.90	U	1.8	0.90	0.45	ug/kg	1
1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS)	757124-72-4	PFAS by ID SOP	0.90	U	1.8	0.90	0.45	ug/kg	1
N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA)	2991-50-6	PFAS by ID SOP	0.90	U	1.8	0.90	0.45	ug/kg	1
N-methylperfluoro-1-octanesulfonamide (MeFOSA)	31506-32-8	PFAS by ID SOP	0.90	U	1.8	0.90	0.45	ug/kg	1
N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA)	2355-31-9	PFAS by ID SOP	0.90	U	1.8	0.90	0.45	ug/kg	1
Perfluoro-1-butanesulfonic acid (PFBS)	375-73-5	PFAS by ID SOP	0.45	U	0.90	0.45	0.18	ug/kg	1
Perfluoro-1-decanesulfonic acid (PFDS)	335-77-3	PFAS by ID SOP	0.45	U	0.90	0.45	0.18	ug/kg	1
Perfluoro-1-heptanesulfonic acid (PFHpS)	375-92-8	PFAS by ID SOP	0.45	U	0.90	0.45	0.18	ug/kg	1
Perfluoro-1-nonanesulfonic acid (PFNS)	68259-12-1	PFAS by ID SOP	0.45	U	0.90	0.45	0.18	ug/kg	1
Perfluoro-1-octanesulfonamide (PFOSA)	754-91-6	PFAS by ID SOP	0.45	U	0.90	0.45	0.18	ug/kg	1
Perfluoro-1-pentanesulfonic acid (PFPeS)	2706-91-4	PFAS by ID SOP	0.45	U	0.90	0.45	0.18	ug/kg	1
Perfluorohexanesulfonic acid (PFHxS)	355-46-4	PFAS by ID SOP	0.35	J	0.90	0.45	0.18	ug/kg	1
Perfluoro-n-butanoic acid (PFBA)	375-22-4	PFAS by ID SOP	0.45	U	0.90	0.45	0.18	ug/kg	1
Perfluoro-n-decanoic acid (PFDA)	335-76-2	PFAS by ID SOP	0.45	U	0.90	0.45	0.18	ug/kg	1
Perfluoro-n-dodecanoic acid (PFDoA)	307-55-1	PFAS by ID SOP	0.45	U	0.90	0.45	0.18	ug/kg	1
Perfluoro-n-heptanoic acid (PFHpA)	375-85-9	PFAS by ID SOP	0.45	U	0.90	0.45	0.18	ug/kg	1
Perfluoro-n-hexanoic acid (PFHxA)	307-24-4	PFAS by ID SOP	0.45	U	0.90	0.45	0.18	ug/kg	1
Perfluoro-n-nonanoic acid (PFNA)	375-95-1	PFAS by ID SOP	0.45	U	0.90	0.45	0.18	ug/kg	1
Perfluoro-n-octanoic acid (PFOA)	335-67-1	PFAS by ID SOP	0.45	U	0.90	0.45	0.18	ug/kg	1
Perfluoro-n-pentanoic acid (PFPeA)	2706-90-3	PFAS by ID SOP	0.45	U	0.90	0.45	0.18	ug/kg	1
Perfluoro-n-tetradecanoic acid (PFTeDA)	376-06-7	PFAS by ID SOP	0.45	U	0.90	0.45	0.18	ug/kg	1
Perfluoro-n-tridecanoic acid (PFTrDA)	72629-94-8	PFAS by ID SOP	0.45	U	0.90	0.45	0.18	ug/kg	1
Perfluoro-n-undecanoic acid (PFUdA)	2058-94-8	PFAS by ID SOP	0.45	U	0.90	0.45	0.18	ug/kg	1
Perfluorooctanesulfonic acid (PFOS)	1763-23-1	PFAS by ID SOP	0.87	J	0.90	0.45	0.18	ug/kg	1

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
13C2_4:2FTS		86	50-150
13C2_6:2FTS		99	50-150
13C2_8:2FTS		94	50-150
13C2_PFDoA		69	50-150
13C2_PFTeDA		73	50-150
13C3_PFBS		73	50-150
13C3_PFHxS		69	50-150
13C4_PFBA		73	50-150
13C4_PFHpA		73	50-150
13C5_PFHxA		72	50-150
13C5_PFPeA		74	50-150
13C6_PFDA		75	50-150
13C7_PFUdA		75	50-150
13C8_PFOA		77	50-150
13C8_PFOS		74	50-150
13C8_PFOSA		77	50-150
13C9_PFNA		79	50-150

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

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PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.		Laboratory ID: WJ01056-003
Description: 385-4-Sc		Matrix: Solid
Date Sampled: 09/18/2021 1726	Project Name: Eielson AFB	% Solids: 99.5 10/02/2021 1447
Date Received: 10/01/2021	Project Number: 30030317	

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
d5-EtFOSAA		96	50-150
d-MeFOSA		82	50-150
d3-MeFOSAA		93	50-150

LOQ = Limit of Quantitation	B = Detected in the method blank	E = Quantitation of compound exceeded the calibration range	DL = Detection Limit	Q = Surrogate failure
U = Not detected at or above the LOQ	N = Recovery is out of criteria	P = The RPD between two GC columns exceeds 40%	J = Estimated result < LOQ and ≥ DL	L = LCS/LCSD failure
H = Out of holding time	W = Reported on wet weight basis	LOD = Limit of Detection		S = MS/MSD failure

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SPLP PFAS

Client: Arcadis U.S., Inc. | Laboratory ID: WJ01056-003
Description: 385-4-Sc | Matrix: Solid
Date Sampled: 09/18/2021 1726 | Project Name: Eielson AFB | % Solids: 99.5 10/02/2021 1447
Date Received: 10/01/2021 | Project Number: 30030317

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch	Leachate Date
1	1312/PFAS	PFAS by ID SOP QSM B-15	1	11/05/2021 1906	MMM	11/04/2021 1300	21287	10/27/2021 0213

Parameter	CAS Number	Analytical Method	Result	Q	LOQ	LOD	DL	Units	Run
1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS)	39108-34-4	PFAS by ID SOP	40	UH	80	40	20	ng/L	1
1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS)	27619-97-2	PFAS by ID SOP	40	UH	80	40	20	ng/L	1
1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS)	757124-72-4	PFAS by ID SOP	40	UH	80	40	20	ng/L	1
N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA)	2991-50-6	PFAS by ID SOP	40	UH	80	40	20	ng/L	1
N-methylperfluoro-1-octanesulfonamide (MeFOSA)	31506-32-8	PFAS by ID SOP	80	UH	160	80	40	ng/L	1
N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA)	2355-31-9	PFAS by ID SOP	40	UH	80	40	20	ng/L	1
Perfluoro-1-butanesulfonic acid (PFBS)	375-73-5	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-1-decanesulfonic acid (PFDS)	335-77-3	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-1-heptanesulfonic acid (PFHpS)	375-92-8	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-1-nonanesulfonic acid (PFNS)	68259-12-1	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-1-octanesulfonamide (PFOSA)	754-91-6	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-1-pentanesulfonic acid (PFPeS)	2706-91-4	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluorohexanesulfonic acid (PFHxS)	355-46-4	PFAS by ID SOP	11	HJ	40	20	10	ng/L	1
Perfluoro-n-butanoic acid (PFBA)	375-22-4	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-decanoic acid (PFDA)	335-76-2	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-dodecanoic acid (PFDoA)	307-55-1	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-heptanoic acid (PFHpA)	375-85-9	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-hexanoic acid (PFHxA)	307-24-4	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-nonanoic acid (PFNA)	375-95-1	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-octanoic acid (PFOA)	335-67-1	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-pentanoic acid (PFPeA)	2706-90-3	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-tetradecanoic acid (PFTeDA)	376-06-7	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-tridecanoic acid (PFTrDA)	72629-94-8	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-undecanoic acid (PFUdA)	2058-94-8	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluorooctanesulfonic acid (PFOS)	1763-23-1	PFAS by ID SOP	14	HJ	40	20	10	ng/L	1

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
13C2_4:2FTS	H	111	50-150
13C2_6:2FTS	H	114	50-150
13C2_8:2FTS	H	113	50-150
13C2_PFDoA	H	112	50-150
13C2_PFTeDA	H	90	50-150
13C3_PFBS	H	107	50-150
13C3_PFHxS	H	104	50-150
13C4_PFBA	H	99	50-150
13C4_PFHpA	H	104	50-150
13C5_PFHxA	H	99	50-150
13C5_PFPeA	H	105	50-150
13C6_PFDA	H	105	50-150
13C7_PFUdA	H	99	50-150
13C8_PFOA	H	107	50-150
13C8_PFOS	H	111	50-150
13C8_PFOSA	H	106	50-150
13C9_PFNA	H	98	50-150

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

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SPLP PFAS

Client: Arcadis U.S., Inc.		Laboratory ID: WJ01056-003
Description: 385-4-Sc		Matrix: Solid
Date Sampled: 09/18/2021 1726	Project Name: Eielson AFB	% Solids: 99.5 10/02/2021 1447
Date Received: 10/01/2021	Project Number: 30030317	

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
d5-EtFOSAA	H	107	50-150
d-MeFOSA	H	103	50-150
d3-MeFOSAA	H	113	50-150

LOQ = Limit of Quantitation	B = Detected in the method blank	E = Quantitation of compound exceeded the calibration range	DL = Detection Limit	Q = Surrogate failure
U = Not detected at or above the LOQ	N = Recovery is out of criteria	P = The RPD between two GC columns exceeds 40%	J = Estimated result < LOQ and ≥ DL	L = LCS/LCSD failure
H = Out of holding time	W = Reported on wet weight basis	LOD = Limit of Detection		S = MS/MSD failure

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PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.		Laboratory ID: WJ01056-004	
Description: 385-4-Gb		Matrix: Solid	
Date Sampled: 09/18/2021 1702	Project Name: Eielson AFB	% Solids: 99.7	10/02/2021 1447
Date Received: 10/01/2021	Project Number: 30030317		

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch
1	SOP SPE	PFAS by ID SOP QSM B-15	1	10/04/2021 1600	JJG	10/03/2021 1401	17485

Parameter	CAS Number	Analytical Method	Result	Q	LOQ	LOD	DL	Units	Run
1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS)	39108-34-4	PFAS by ID SOP	0.85	U	1.7	0.85	0.42	ug/kg	1
1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS)	27619-97-2	PFAS by ID SOP	0.85	U	1.7	0.85	0.42	ug/kg	1
1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS)	757124-72-4	PFAS by ID SOP	0.85	U	1.7	0.85	0.42	ug/kg	1
N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA)	2991-50-6	PFAS by ID SOP	0.85	U	1.7	0.85	0.42	ug/kg	1
N-methylperfluoro-1-octanesulfonamide (MeFOSA)	31506-32-8	PFAS by ID SOP	0.85	U	1.7	0.85	0.42	ug/kg	1
N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA)	2355-31-9	PFAS by ID SOP	0.85	U	1.7	0.85	0.42	ug/kg	1
Perfluoro-1-butanesulfonic acid (PFBS)	375-73-5	PFAS by ID SOP	0.42	U	0.84	0.42	0.17	ug/kg	1
Perfluoro-1-decanesulfonic acid (PFDS)	335-77-3	PFAS by ID SOP	0.42	U	0.84	0.42	0.17	ug/kg	1
Perfluoro-1-heptanesulfonic acid (PFHpS)	375-92-8	PFAS by ID SOP	0.42	U	0.84	0.42	0.17	ug/kg	1
Perfluoro-1-nonanesulfonic acid (PFNS)	68259-12-1	PFAS by ID SOP	0.42	U	0.84	0.42	0.17	ug/kg	1
Perfluoro-1-octanesulfonamide (PFOSA)	754-91-6	PFAS by ID SOP	0.42	U	0.84	0.42	0.17	ug/kg	1
Perfluoro-1-pentanesulfonic acid (PFPeS)	2706-91-4	PFAS by ID SOP	0.42	U	0.84	0.42	0.17	ug/kg	1
Perfluorohexanesulfonic acid (PFHxS)	355-46-4	PFAS by ID SOP	0.42	U	0.84	0.42	0.17	ug/kg	1
Perfluoro-n-butanoic acid (PFBA)	375-22-4	PFAS by ID SOP	0.42	U	0.84	0.42	0.17	ug/kg	1
Perfluoro-n-decanoic acid (PFDA)	335-76-2	PFAS by ID SOP	0.42	U	0.84	0.42	0.17	ug/kg	1
Perfluoro-n-dodecanoic acid (PFDoA)	307-55-1	PFAS by ID SOP	0.42	U	0.84	0.42	0.17	ug/kg	1
Perfluoro-n-heptanoic acid (PFHpA)	375-85-9	PFAS by ID SOP	0.42	U	0.84	0.42	0.17	ug/kg	1
Perfluoro-n-hexanoic acid (PFHxA)	307-24-4	PFAS by ID SOP	0.42	U	0.84	0.42	0.17	ug/kg	1
Perfluoro-n-nonanoic acid (PFNA)	375-95-1	PFAS by ID SOP	0.42	U	0.84	0.42	0.17	ug/kg	1
Perfluoro-n-octanoic acid (PFOA)	335-67-1	PFAS by ID SOP	0.42	U	0.84	0.42	0.17	ug/kg	1
Perfluoro-n-pentanoic acid (PFPeA)	2706-90-3	PFAS by ID SOP	0.42	U	0.84	0.42	0.17	ug/kg	1
Perfluoro-n-tetradecanoic acid (PFTeDA)	376-06-7	PFAS by ID SOP	0.42	U	0.84	0.42	0.17	ug/kg	1
Perfluoro-n-tridecanoic acid (PFTrDA)	72629-94-8	PFAS by ID SOP	0.42	U	0.84	0.42	0.17	ug/kg	1
Perfluoro-n-undecanoic acid (PFUdA)	2058-94-8	PFAS by ID SOP	0.42	U	0.84	0.42	0.17	ug/kg	1
Perfluorooctanesulfonic acid (PFOS)	1763-23-1	PFAS by ID SOP	0.23	J	0.84	0.42	0.17	ug/kg	1

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
13C2_4:2FTS		106	50-150
13C2_6:2FTS		108	50-150
13C2_8:2FTS		94	50-150
13C2_PFDoA		90	50-150
13C2_PFTeDA		92	50-150
13C3_PFBS		95	50-150
13C3_PFHxS		93	50-150
13C4_PFBA		94	50-150
13C4_PFHpA		96	50-150
13C5_PFHxA		90	50-150
13C5_PFPeA		96	50-150
13C6_PFDA		97	50-150
13C7_PFUdA		93	50-150
13C8_PFOA		96	50-150
13C8_PFOS		87	50-150
13C8_PFOSA		112	50-150
13C9_PFNA		102	50-150

LOQ = Limit of Quantitation	B = Detected in the method blank	E = Quantitation of compound exceeded the calibration range	DL = Detection Limit	Q = Surrogate failure
U = Not detected at or above the LOQ	N = Recovery is out of criteria	P = The RPD between two GC columns exceeds 40%	J = Estimated result < LOQ and ≥ DL	L = LCS/LCSD failure
H = Out of holding time	W = Reported on wet weight basis	LOD = Limit of Detection		S = MS/MSD failure

PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.		Laboratory ID: WJ01056-004	
Description: 385-4-Gb		Matrix: Solid	
Date Sampled: 09/18/2021 1702	Project Name: Eielson AFB	% Solids: 99.7	10/02/2021 1447
Date Received: 10/01/2021	Project Number: 30030317		

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
d5-EtFOSAA		110	50-150
d-MeFOSA		112	50-150
d3-MeFOSAA		95	50-150

LOQ = Limit of Quantitation	B = Detected in the method blank	E = Quantitation of compound exceeded the calibration range	DL = Detection Limit	Q = Surrogate failure
U = Not detected at or above the LOQ	N = Recovery is out of criteria	P = The RPD between two GC columns exceeds 40%	J = Estimated result < LOQ and ≥ DL	L = LCS/LCSD failure
H = Out of holding time	W = Reported on wet weight basis	LOD = Limit of Detection		S = MS/MSD failure

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SPLP PFAS

Client: Arcadis U.S., Inc. | Laboratory ID: WJ01056-004
Description: 385-4-Gb | Matrix: Solid
Date Sampled: 09/18/2021 1702 | Project Name: Eielson AFB | % Solids: 99.7 10/02/2021 1447
Date Received: 10/01/2021 | Project Number: 30030317

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch	Leachate Date
1	1312/PFAS	PFAS by ID SOP QSM B-15	1	11/05/2021 1917	MMM	11/04/2021 1300	21287	10/27/2021 0213

Parameter	CAS Number	Analytical Method	Result	Q	LOQ	LOD	DL	Units	Run
1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS)	39108-34-4	PFAS by ID SOP	40	UH	80	40	20	ng/L	1
1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS)	27619-97-2	PFAS by ID SOP	32	HJ	80	40	20	ng/L	1
1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS)	757124-72-4	PFAS by ID SOP	40	UH	80	40	20	ng/L	1
N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA)	2991-50-6	PFAS by ID SOP	40	UH	80	40	20	ng/L	1
N-methylperfluoro-1-octanesulfonamide (MeFOSA)	31506-32-8	PFAS by ID SOP	80	UH	160	80	40	ng/L	1
N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA)	2355-31-9	PFAS by ID SOP	40	UH	80	40	20	ng/L	1
Perfluoro-1-butanesulfonic acid (PFBS)	375-73-5	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-1-decanesulfonic acid (PFDS)	335-77-3	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-1-heptanesulfonic acid (PFHpS)	375-92-8	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-1-nonanesulfonic acid (PFNS)	68259-12-1	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-1-octanesulfonamide (PFOSA)	754-91-6	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-1-pentanesulfonic acid (PFPeS)	2706-91-4	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluorohexanesulfonic acid (PFHxS)	355-46-4	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-butanoic acid (PFBA)	375-22-4	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-decanoic acid (PFDA)	335-76-2	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-dodecanoic acid (PFDoA)	307-55-1	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-heptanoic acid (PFHpA)	375-85-9	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-hexanoic acid (PFHxA)	307-24-4	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-nonanoic acid (PFNA)	375-95-1	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-octanoic acid (PFOA)	335-67-1	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-pentanoic acid (PFPeA)	2706-90-3	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-tetradecanoic acid (PFTeDA)	376-06-7	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-tridecanoic acid (PFTrDA)	72629-94-8	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-undecanoic acid (PFUdA)	2058-94-8	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluorooctanesulfonic acid (PFOS)	1763-23-1	PFAS by ID SOP	20	UH	40	20	10	ng/L	1

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
13C2_4:2FTS	H	112	50-150
13C2_6:2FTS	H	110	50-150
13C2_8:2FTS	H	104	50-150
13C2_PFDoA	H	102	50-150
13C2_PFTeDA	H	85	50-150
13C3_PFBS	H	103	50-150
13C3_PFHxS	H	98	50-150
13C4_PFBA	H	99	50-150
13C4_PFHpA	H	97	50-150
13C5_PFHxA	H	92	50-150
13C5_PFPeA	H	99	50-150
13C6_PFDA	H	96	50-150
13C7_PFUdA	H	98	50-150
13C8_PFOA	H	100	50-150
13C8_PFOS	H	104	50-150
13C8_PFOSA	H	94	50-150
13C9_PFNA	H	104	50-150

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

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SPLP PFAS

Client: Arcadis U.S., Inc.		Laboratory ID: WJ01056-004
Description: 385-4-Gb		Matrix: Solid
Date Sampled: 09/18/2021 1702	Project Name: Eielson AFB	% Solids: 99.7 10/02/2021 1447
Date Received: 10/01/2021	Project Number: 30030317	

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
d5-EtFOSAA	H	112	50-150
d-MeFOSA	H	90	50-150
d3-MeFOSAA	H	112	50-150

LOQ = Limit of Quantitation	B = Detected in the method blank	E = Quantitation of compound exceeded the calibration range	DL = Detection Limit	Q = Surrogate failure
U = Not detected at or above the LOQ	N = Recovery is out of criteria	P = The RPD between two GC columns exceeds 40%	J = Estimated result < LOQ and ≥ DL	L = LCS/LCSD failure
H = Out of holding time	W = Reported on wet weight basis	LOD = Limit of Detection		S = MS/MSD failure

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PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: WJ01056-005
Description: 385-4-Gc | Matrix: Solid
Date Sampled: 09/18/2021 1702 | Project Name: Eielson AFB | % Solids: 99.7 10/02/2021 1447
Date Received: 10/01/2021 | Project Number: 30030317

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch
1	SOP SPE	PFAS by ID SOP QSM B-15	1	10/04/2021 1611	JJG	10/03/2021 1401	17485

Parameter	CAS Number	Analytical Method	Result	Q	LOQ	LOD	DL	Units	Run
1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS)	39108-34-4	PFAS by ID SOP	1.0	U	2.0	1.0	0.50	ug/kg	1
1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS)	27619-97-2	PFAS by ID SOP	1.0	U	2.0	1.0	0.50	ug/kg	1
1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS)	757124-72-4	PFAS by ID SOP	1.0	U	2.0	1.0	0.50	ug/kg	1
N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA)	2991-50-6	PFAS by ID SOP	1.0	U	2.0	1.0	0.50	ug/kg	1
N-methylperfluoro-1-octanesulfonamide (MeFOSA)	31506-32-8	PFAS by ID SOP	1.0	U	2.0	1.0	0.50	ug/kg	1
N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA)	2355-31-9	PFAS by ID SOP	1.0	U	2.0	1.0	0.50	ug/kg	1
Perfluoro-1-butanesulfonic acid (PFBS)	375-73-5	PFAS by ID SOP	0.50	U	0.99	0.50	0.20	ug/kg	1
Perfluoro-1-decanesulfonic acid (PFDS)	335-77-3	PFAS by ID SOP	0.50	U	0.99	0.50	0.20	ug/kg	1
Perfluoro-1-heptanesulfonic acid (PFHpS)	375-92-8	PFAS by ID SOP	0.50	U	0.99	0.50	0.20	ug/kg	1
Perfluoro-1-nonanesulfonic acid (PFNS)	68259-12-1	PFAS by ID SOP	0.50	U	0.99	0.50	0.20	ug/kg	1
Perfluoro-1-octanesulfonamide (PFOSA)	754-91-6	PFAS by ID SOP	0.50	U	0.99	0.50	0.20	ug/kg	1
Perfluoro-1-pentanesulfonic acid (PFPeS)	2706-91-4	PFAS by ID SOP	0.50	U	0.99	0.50	0.20	ug/kg	1
Perfluorohexanesulfonic acid (PFHxS)	355-46-4	PFAS by ID SOP	0.50	U	0.99	0.50	0.20	ug/kg	1
Perfluoro-n-butanoic acid (PFBA)	375-22-4	PFAS by ID SOP	0.50	U	0.99	0.50	0.20	ug/kg	1
Perfluoro-n-decanoic acid (PFDA)	335-76-2	PFAS by ID SOP	0.50	U	0.99	0.50	0.20	ug/kg	1
Perfluoro-n-dodecanoic acid (PFDoA)	307-55-1	PFAS by ID SOP	0.50	U	0.99	0.50	0.20	ug/kg	1
Perfluoro-n-heptanoic acid (PFHpA)	375-85-9	PFAS by ID SOP	0.50	U	0.99	0.50	0.20	ug/kg	1
Perfluoro-n-hexanoic acid (PFHxA)	307-24-4	PFAS by ID SOP	0.50	U	0.99	0.50	0.20	ug/kg	1
Perfluoro-n-nonanoic acid (PFNA)	375-95-1	PFAS by ID SOP	0.50	U	0.99	0.50	0.20	ug/kg	1
Perfluoro-n-octanoic acid (PFOA)	335-67-1	PFAS by ID SOP	0.50	U	0.99	0.50	0.20	ug/kg	1
Perfluoro-n-pentanoic acid (PFPeA)	2706-90-3	PFAS by ID SOP	0.50	U	0.99	0.50	0.20	ug/kg	1
Perfluoro-n-tetradecanoic acid (PFTeDA)	376-06-7	PFAS by ID SOP	0.50	U	0.99	0.50	0.20	ug/kg	1
Perfluoro-n-tridecanoic acid (PFTrDA)	72629-94-8	PFAS by ID SOP	0.50	U	0.99	0.50	0.20	ug/kg	1
Perfluoro-n-undecanoic acid (PFUdA)	2058-94-8	PFAS by ID SOP	0.50	U	0.99	0.50	0.20	ug/kg	1
Perfluorooctanesulfonic acid (PFOS)	1763-23-1	PFAS by ID SOP	0.50	U	0.99	0.50	0.20	ug/kg	1

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
13C2_4:2FTS		98	50-150
13C2_6:2FTS		103	50-150
13C2_8:2FTS		88	50-150
13C2_PFDoA		73	50-150
13C2_PFTeDA		80	50-150
13C3_PFBS		76	50-150
13C3_PFHxS		73	50-150
13C4_PFBA		79	50-150
13C4_PFHpA		76	50-150
13C5_PFHxA		74	50-150
13C5_PFPeA		79	50-150
13C6_PFDA		81	50-150
13C7_PFUdA		74	50-150
13C8_PFOA		78	50-150
13C8_PFOS		76	50-150
13C8_PFOSA		84	50-150
13C9_PFNA		80	50-150

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

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PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.		Laboratory ID: WJ01056-005
Description: 385-4-Gc		Matrix: Solid
Date Sampled: 09/18/2021 1702	Project Name: Eielson AFB	% Solids: 99.7 10/02/2021 1447
Date Received: 10/01/2021	Project Number: 30030317	

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
d5-EtFOSAA		102	50-150
d-MeFOSA		75	50-150
d3-MeFOSAA		94	50-150

LOQ = Limit of Quantitation	B = Detected in the method blank	E = Quantitation of compound exceeded the calibration range	DL = Detection Limit	Q = Surrogate failure
U = Not detected at or above the LOQ	N = Recovery is out of criteria	P = The RPD between two GC columns exceeds 40%	J = Estimated result < LOQ and ≥ DL	L = LCS/LCSD failure
H = Out of holding time	W = Reported on wet weight basis	LOD = Limit of Detection		S = MS/MSD failure

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SPLP PFAS

Client: Arcadis U.S., Inc. | Laboratory ID: WJ01056-005
Description: 385-4-Gc | Matrix: Solid
Date Sampled: 09/18/2021 1702 | Project Name: Eielson AFB | % Solids: 99.7 10/02/2021 1447
Date Received: 10/01/2021 | Project Number: 30030317

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch	Leachate Date
1	1312/PFAS	PFAS by ID SOP QSM B-15	1	11/05/2021 1949	MMM	11/04/2021 1300	21287	10/27/2021 0213

Parameter	CAS Number	Analytical Method	Result	Q	LOQ	LOD	DL	Units	Run
1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS)	39108-34-4	PFAS by ID SOP	40	UH	80	40	20	ng/L	1
1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS)	27619-97-2	PFAS by ID SOP	40	UH	80	40	20	ng/L	1
1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS)	757124-72-4	PFAS by ID SOP	40	UH	80	40	20	ng/L	1
N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA)	2991-50-6	PFAS by ID SOP	40	UH	80	40	20	ng/L	1
N-methylperfluoro-1-octanesulfonamide (MeFOSA)	31506-32-8	PFAS by ID SOP	80	UH	160	80	40	ng/L	1
N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA)	2355-31-9	PFAS by ID SOP	40	UH	80	40	20	ng/L	1
Perfluoro-1-butanesulfonic acid (PFBS)	375-73-5	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-1-decanesulfonic acid (PFDS)	335-77-3	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-1-heptanesulfonic acid (PFHpS)	375-92-8	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-1-nonanesulfonic acid (PFNS)	68259-12-1	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-1-octanesulfonamide (PFOSA)	754-91-6	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-1-pentanesulfonic acid (PFPeS)	2706-91-4	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluorohexanesulfonic acid (PFHxS)	355-46-4	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-butanoic acid (PFBA)	375-22-4	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-decanoic acid (PFDA)	335-76-2	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-dodecanoic acid (PFDoA)	307-55-1	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-heptanoic acid (PFHpA)	375-85-9	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-hexanoic acid (PFHxA)	307-24-4	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-nonanoic acid (PFNA)	375-95-1	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-octanoic acid (PFOA)	335-67-1	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-pentanoic acid (PFPeA)	2706-90-3	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-tetradecanoic acid (PFTeDA)	376-06-7	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-tridecanoic acid (PFTrDA)	72629-94-8	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-undecanoic acid (PFUdA)	2058-94-8	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluorooctanesulfonic acid (PFOS)	1763-23-1	PFAS by ID SOP	20	UH	40	20	10	ng/L	1

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
13C2_4:2FTS	H	117	50-150
13C2_6:2FTS	H	123	50-150
13C2_8:2FTS	H	108	50-150
13C2_PFDoA	H	108	50-150
13C2_PFTeDA	H	88	50-150
13C3_PFBS	H	110	50-150
13C3_PFHxS	H	104	50-150
13C4_PFBA	H	105	50-150
13C4_PFHpA	H	105	50-150
13C5_PFHxA	H	111	50-150
13C5_PFPeA	H	104	50-150
13C6_PFDA	H	100	50-150
13C7_PFUdA	H	109	50-150
13C8_PFOA	H	109	50-150
13C8_PFOS	H	114	50-150
13C8_PFOSA	H	112	50-150
13C9_PFNA	H	112	50-150

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

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SPLP PFAS

Client: Arcadis U.S., Inc.		Laboratory ID: WJ01056-005
Description: 385-4-Gc		Matrix: Solid
Date Sampled: 09/18/2021 1702	Project Name: Eielson AFB	% Solids: 99.7 10/02/2021 1447
Date Received: 10/01/2021	Project Number: 30030317	

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
d5-EtFOSAA	H	119	50-150
d-MeFOSA	H	123	50-150
d3-MeFOSAA	H	108	50-150

LOQ = Limit of Quantitation	B = Detected in the method blank	E = Quantitation of compound exceeded the calibration range	DL = Detection Limit	Q = Surrogate failure
U = Not detected at or above the LOQ	N = Recovery is out of criteria	P = The RPD between two GC columns exceeds 40%	J = Estimated result < LOQ and ≥ DL	L = LCS/LCSD failure
H = Out of holding time	W = Reported on wet weight basis	LOD = Limit of Detection		S = MS/MSD failure

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PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: WJ01056-006
Description: 385-4-Uta | Matrix: Solid
Date Sampled: 09/18/2021 1645 | Project Name: Eielson AFB | % Solids: 99.5 10/02/2021 1447
Date Received: 10/01/2021 | Project Number: 30030317

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch
1	SOP SPE	PFAS by ID SOP QSM B-15	1	10/04/2021 1621	JJG	10/03/2021 1401	17485

Parameter	CAS Number	Analytical Method	Result	Q	LOQ	LOD	DL	Units	Run
1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS)	39108-34-4	PFAS by ID SOP	0.90	U	1.8	0.90	0.46	ug/kg	1
1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS)	27619-97-2	PFAS by ID SOP	0.90	U	1.8	0.90	0.46	ug/kg	1
1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS)	757124-72-4	PFAS by ID SOP	0.90	U	1.8	0.90	0.46	ug/kg	1
N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA)	2991-50-6	PFAS by ID SOP	0.90	U	1.8	0.90	0.46	ug/kg	1
N-methylperfluoro-1-octanesulfonamide (MeFOSA)	31506-32-8	PFAS by ID SOP	0.90	U	1.8	0.90	0.46	ug/kg	1
N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA)	2355-31-9	PFAS by ID SOP	0.90	U	1.8	0.90	0.46	ug/kg	1
Perfluoro-1-butanesulfonic acid (PFBS)	375-73-5	PFAS by ID SOP	0.46	U	0.91	0.46	0.18	ug/kg	1
Perfluoro-1-decanesulfonic acid (PFDS)	335-77-3	PFAS by ID SOP	0.28	J	0.91	0.46	0.18	ug/kg	1
Perfluoro-1-heptanesulfonic acid (PFHpS)	375-92-8	PFAS by ID SOP	0.46	U	0.91	0.46	0.18	ug/kg	1
Perfluoro-1-nonanesulfonic acid (PFNS)	68259-12-1	PFAS by ID SOP	0.46	U	0.91	0.46	0.18	ug/kg	1
Perfluoro-1-octanesulfonamide (PFOSA)	754-91-6	PFAS by ID SOP	0.46	U	0.91	0.46	0.18	ug/kg	1
Perfluoro-1-pentanesulfonic acid (PFPeS)	2706-91-4	PFAS by ID SOP	0.46	U	0.91	0.46	0.18	ug/kg	1
Perfluorohexanesulfonic acid (PFHxS)	355-46-4	PFAS by ID SOP	3.5		0.91	0.46	0.18	ug/kg	1
Perfluoro-n-butanoic acid (PFBA)	375-22-4	PFAS by ID SOP	0.46	U	0.91	0.46	0.18	ug/kg	1
Perfluoro-n-decanoic acid (PFDA)	335-76-2	PFAS by ID SOP	0.46	U	0.91	0.46	0.18	ug/kg	1
Perfluoro-n-dodecanoic acid (PFDoA)	307-55-1	PFAS by ID SOP	0.46	U	0.91	0.46	0.18	ug/kg	1
Perfluoro-n-heptanoic acid (PFHpA)	375-85-9	PFAS by ID SOP	0.35	J	0.91	0.46	0.18	ug/kg	1
Perfluoro-n-hexanoic acid (PFHxA)	307-24-4	PFAS by ID SOP	0.46	J	0.91	0.46	0.18	ug/kg	1
Perfluoro-n-nonanoic acid (PFNA)	375-95-1	PFAS by ID SOP	0.46	U	0.91	0.46	0.18	ug/kg	1
Perfluoro-n-octanoic acid (PFOA)	335-67-1	PFAS by ID SOP	0.61	J	0.91	0.46	0.18	ug/kg	1
Perfluoro-n-pentanoic acid (PFPeA)	2706-90-3	PFAS by ID SOP	0.22	J	0.91	0.46	0.18	ug/kg	1
Perfluoro-n-tetradecanoic acid (PFTeDA)	376-06-7	PFAS by ID SOP	0.46	U	0.91	0.46	0.18	ug/kg	1
Perfluoro-n-tridecanoic acid (PFTrDA)	72629-94-8	PFAS by ID SOP	0.46	U	0.91	0.46	0.18	ug/kg	1
Perfluoro-n-undecanoic acid (PFUdA)	2058-94-8	PFAS by ID SOP	0.46	U	0.91	0.46	0.18	ug/kg	1
Perfluorooctanesulfonic acid (PFOS)	1763-23-1	PFAS by ID SOP	6.7		0.91	0.46	0.18	ug/kg	1

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
13C2_4:2FTS		92	50-150
13C2_6:2FTS		92	50-150
13C2_8:2FTS		91	50-150
13C2_PFDoA		75	50-150
13C2_PFTeDA		76	50-150
13C3_PFBS		76	50-150
13C3_PFHxS		74	50-150
13C4_PFBA		78	50-150
13C4_PFHpA		71	50-150
13C5_PFHxA		71	50-150
13C5_PFPeA		75	50-150
13C6_PFDA		80	50-150
13C7_PFUdA		78	50-150
13C8_PFOA		78	50-150
13C8_PFOS		73	50-150
13C8_PFOSA		81	50-150
13C9_PFNA		81	50-150

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.		Laboratory ID: WJ01056-006
Description: 385-4-Uta		Matrix: Solid
Date Sampled: 09/18/2021 1645	Project Name: Eielson AFB	% Solids: 99.5 10/02/2021 1447
Date Received: 10/01/2021	Project Number: 30030317	

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
d5-EtFOSAA		95	50-150
d-MeFOSA		77	50-150
d3-MeFOSAA		95	50-150

LOQ = Limit of Quantitation	B = Detected in the method blank	E = Quantitation of compound exceeded the calibration range	DL = Detection Limit	Q = Surrogate failure
U = Not detected at or above the LOQ	N = Recovery is out of criteria	P = The RPD between two GC columns exceeds 40%	J = Estimated result < LOQ and ≥ DL	L = LCS/LCSD failure
H = Out of holding time	W = Reported on wet weight basis	LOD = Limit of Detection		S = MS/MSD failure

SPLP PFAS

Client: Arcadis U.S., Inc. | Laboratory ID: WJ01056-006
Description: 385-4-Uta | Matrix: Solid
Date Sampled: 09/18/2021 1645 | Project Name: Eielson AFB | % Solids: 99.5 10/02/2021 1447
Date Received: 10/01/2021 | Project Number: 30030317

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch	Leachate Date
1	1312/PFAS	PFAS by ID SOP QSM B-15	1	11/05/2021 1959	MMM	11/04/2021 1300	21287	10/27/2021 0213

Parameter	CAS Number	Analytical Method	Result	Q	LOQ	LOD	DL	Units	Run
1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS)	39108-34-4	PFAS by ID SOP	40	UH	80	40	20	ng/L	1
1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS)	27619-97-2	PFAS by ID SOP	40	UH	80	40	20	ng/L	1
1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS)	757124-72-4	PFAS by ID SOP	40	UH	80	40	20	ng/L	1
N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA)	2991-50-6	PFAS by ID SOP	40	UH	80	40	20	ng/L	1
N-methylperfluoro-1-octanesulfonamide (MeFOSA)	31506-32-8	PFAS by ID SOP	80	UH	160	80	40	ng/L	1
N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA)	2355-31-9	PFAS by ID SOP	40	UH	80	40	20	ng/L	1
Perfluoro-1-butanesulfonic acid (PFBS)	375-73-5	PFAS by ID SOP	12	HJ	40	20	10	ng/L	1
Perfluoro-1-decanesulfonic acid (PFDS)	335-77-3	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-1-heptanesulfonic acid (PFHpS)	375-92-8	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-1-nonanesulfonic acid (PFNS)	68259-12-1	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-1-octanesulfonamide (PFOSA)	754-91-6	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-1-pentanesulfonic acid (PFPeS)	2706-91-4	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluorohexanesulfonic acid (PFHxS)	355-46-4	PFAS by ID SOP	270	H	40	20	10	ng/L	1
Perfluoro-n-butanoic acid (PFBA)	375-22-4	PFAS by ID SOP	13	HJ	40	20	10	ng/L	1
Perfluoro-n-decanoic acid (PFDA)	335-76-2	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-dodecanoic acid (PFDoA)	307-55-1	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-heptanoic acid (PFHpA)	375-85-9	PFAS by ID SOP	31	HJ	40	20	10	ng/L	1
Perfluoro-n-hexanoic acid (PFHxA)	307-24-4	PFAS by ID SOP	42	H	40	20	10	ng/L	1
Perfluoro-n-nonanoic acid (PFNA)	375-95-1	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-octanoic acid (PFOA)	335-67-1	PFAS by ID SOP	51	H	40	20	10	ng/L	1
Perfluoro-n-pentanoic acid (PFPeA)	2706-90-3	PFAS by ID SOP	24	HJ	40	20	10	ng/L	1
Perfluoro-n-tetradecanoic acid (PFTeDA)	376-06-7	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-tridecanoic acid (PFTrDA)	72629-94-8	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-undecanoic acid (PFUdA)	2058-94-8	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluorooctanesulfonic acid (PFOS)	1763-23-1	PFAS by ID SOP	430	H	40	20	10	ng/L	1

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
13C2_4:2FTS	H	104	50-150
13C2_6:2FTS	H	106	50-150
13C2_8:2FTS	H	103	50-150
13C2_PFDoA	H	98	50-150
13C2_PFTeDA	H	78	50-150
13C3_PFBS	H	98	50-150
13C3_PFHxS	H	96	50-150
13C4_PFBA	H	97	50-150
13C4_PFHpA	H	100	50-150
13C5_PFHxA	H	91	50-150
13C5_PFPeA	H	95	50-150
13C6_PFDA	H	96	50-150
13C7_PFUdA	H	98	50-150
13C8_PFOA	H	98	50-150
13C8_PFOS	H	95	50-150
13C8_PFOSA	H	117	50-150
13C9_PFNA	H	98	50-150

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

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SPLP PFAS

Client: Arcadis U.S., Inc.		Laboratory ID: WJ01056-006
Description: 385-4-Uta		Matrix: Solid
Date Sampled: 09/18/2021 1645	Project Name: Eielson AFB	% Solids: 99.5 10/02/2021 1447
Date Received: 10/01/2021	Project Number: 30030317	

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
d5-EtFOSAA	H	106	50-150
d-MeFOSA	H	91	50-150
d3-MeFOSAA	H	99	50-150

LOQ = Limit of Quantitation	B = Detected in the method blank	E = Quantitation of compound exceeded the calibration range	DL = Detection Limit	Q = Surrogate failure
U = Not detected at or above the LOQ	N = Recovery is out of criteria	P = The RPD between two GC columns exceeds 40%	J = Estimated result < LOQ and ≥ DL	L = LCS/LCSD failure
H = Out of holding time	W = Reported on wet weight basis	LOD = Limit of Detection		S = MS/MSD failure

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PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: WJ01056-007
Description: 385-4-Utb | Matrix: Solid
Date Sampled: 09/18/2021 1645 | Project Name: Eielson AFB | % Solids: 99.1 10/02/2021 1447
Date Received: 10/01/2021 | Project Number: 30030317

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch
1	SOP SPE	PFAS by ID SOP QSM B-15	1	10/04/2021 1632	JJG	10/03/2021 1401	17485

Parameter	CAS Number	Analytical Method	Result	Q	LOQ	LOD	DL	Units	Run
1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS)	39108-34-4	PFAS by ID SOP	0.90	U	1.8	0.90	0.45	ug/kg	1
1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS)	27619-97-2	PFAS by ID SOP	0.90	U	1.8	0.90	0.45	ug/kg	1
1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS)	757124-72-4	PFAS by ID SOP	0.90	U	1.8	0.90	0.45	ug/kg	1
N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA)	2991-50-6	PFAS by ID SOP	0.90	U	1.8	0.90	0.45	ug/kg	1
N-methylperfluoro-1-octanesulfonamide (MeFOSA)	31506-32-8	PFAS by ID SOP	0.90	U	1.8	0.90	0.45	ug/kg	1
N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA)	2355-31-9	PFAS by ID SOP	0.90	U	1.8	0.90	0.45	ug/kg	1
Perfluoro-1-butanesulfonic acid (PFBS)	375-73-5	PFAS by ID SOP	0.22	J	0.90	0.45	0.18	ug/kg	1
Perfluoro-1-decanesulfonic acid (PFDS)	335-77-3	PFAS by ID SOP	0.45	U	0.90	0.45	0.18	ug/kg	1
Perfluoro-1-heptanesulfonic acid (PFHpS)	375-92-8	PFAS by ID SOP	0.45	U	0.90	0.45	0.18	ug/kg	1
Perfluoro-1-nonanesulfonic acid (PFNS)	68259-12-1	PFAS by ID SOP	0.45	U	0.90	0.45	0.18	ug/kg	1
Perfluoro-1-octanesulfonamide (PFOSA)	754-91-6	PFAS by ID SOP	0.45	U	0.90	0.45	0.18	ug/kg	1
Perfluoro-1-pentanesulfonic acid (PFPeS)	2706-91-4	PFAS by ID SOP	0.19	J	0.90	0.45	0.18	ug/kg	1
Perfluorohexanesulfonic acid (PFHxS)	355-46-4	PFAS by ID SOP	4.5		0.90	0.45	0.18	ug/kg	1
Perfluoro-n-butanoic acid (PFBA)	375-22-4	PFAS by ID SOP	0.18	J	0.90	0.45	0.18	ug/kg	1
Perfluoro-n-decanoic acid (PFDA)	335-76-2	PFAS by ID SOP	0.19	J	0.90	0.45	0.18	ug/kg	1
Perfluoro-n-dodecanoic acid (PFDoA)	307-55-1	PFAS by ID SOP	0.45	U	0.90	0.45	0.18	ug/kg	1
Perfluoro-n-heptanoic acid (PFHpA)	375-85-9	PFAS by ID SOP	0.50	J	0.90	0.45	0.18	ug/kg	1
Perfluoro-n-hexanoic acid (PFHxA)	307-24-4	PFAS by ID SOP	0.74	J	0.90	0.45	0.18	ug/kg	1
Perfluoro-n-nonanoic acid (PFNA)	375-95-1	PFAS by ID SOP	0.45	U	0.90	0.45	0.18	ug/kg	1
Perfluoro-n-octanoic acid (PFOA)	335-67-1	PFAS by ID SOP	0.81	J	0.90	0.45	0.18	ug/kg	1
Perfluoro-n-pentanoic acid (PFPeA)	2706-90-3	PFAS by ID SOP	0.33	J	0.90	0.45	0.18	ug/kg	1
Perfluoro-n-tetradecanoic acid (PFTeDA)	376-06-7	PFAS by ID SOP	0.45	U	0.90	0.45	0.18	ug/kg	1
Perfluoro-n-tridecanoic acid (PFTrDA)	72629-94-8	PFAS by ID SOP	0.45	U	0.90	0.45	0.18	ug/kg	1
Perfluoro-n-undecanoic acid (PFUdA)	2058-94-8	PFAS by ID SOP	0.45	U	0.90	0.45	0.18	ug/kg	1
Perfluorooctanesulfonic acid (PFOS)	1763-23-1	PFAS by ID SOP	8.9		0.90	0.45	0.18	ug/kg	1

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
13C2_4:2FTS		106	50-150
13C2_6:2FTS		112	50-150
13C2_8:2FTS		109	50-150
13C2_PFDoA		88	50-150
13C2_PFTeDA		87	50-150
13C3_PFBS		91	50-150
13C3_PFHxS		92	50-150
13C4_PFBA		91	50-150
13C4_PFHpA		87	50-150
13C5_PFHxA		86	50-150
13C5_PFPeA		90	50-150
13C6_PFDA		92	50-150
13C7_PFUdA		92	50-150
13C8_PFOA		93	50-150
13C8_PFOS		95	50-150
13C8_PFOSA		99	50-150
13C9_PFNA		93	50-150

LOQ = Limit of Quantitation | B = Detected in the method blank | E = Quantitation of compound exceeded the calibration range | DL = Detection Limit | Q = Surrogate failure
U = Not detected at or above the LOQ | N = Recovery is out of criteria | P = The RPD between two GC columns exceeds 40% | J = Estimated result < LOQ and ≥ DL | L = LCS/LCSD failure
H = Out of holding time | W = Reported on wet weight basis | LOD = Limit of Detection | S = MS/MSD failure

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PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.		Laboratory ID: WJ01056-007
Description: 385-4-Utb		Matrix: Solid
Date Sampled: 09/18/2021 1645	Project Name: Eielson AFB	% Solids: 99.1 10/02/2021 1447
Date Received: 10/01/2021	Project Number: 30030317	

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
d5-EtFOSAA		115	50-150
d-MeFOSA		103	50-150
d3-MeFOSAA		103	50-150

LOQ = Limit of Quantitation	B = Detected in the method blank	E = Quantitation of compound exceeded the calibration range	DL = Detection Limit	Q = Surrogate failure
U = Not detected at or above the LOQ	N = Recovery is out of criteria	P = The RPD between two GC columns exceeds 40%	J = Estimated result < LOQ and ≥ DL	L = LCS/LCSD failure
H = Out of holding time	W = Reported on wet weight basis	LOD = Limit of Detection		S = MS/MSD failure

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SPLP PFAS

Client: Arcadis U.S., Inc. | Laboratory ID: WJ01056-007
Description: 385-4-Utb | Matrix: Solid
Date Sampled: 09/18/2021 1645 | Project Name: Eielson AFB | % Solids: 99.1 | 10/02/2021 1447
Date Received: 10/01/2021 | Project Number: 30030317

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch	Leachate Date
1	1312/PFAS	PFAS by ID SOP QSM B-15	1	11/05/2021 2010	MMM	11/04/2021 1300	21287	10/27/2021 0213

Parameter	CAS Number	Analytical Method	Result	Q	LOQ	LOD	DL	Units	Run
1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS)	39108-34-4	PFAS by ID SOP	40	UH	80	40	20	ng/L	1
1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS)	27619-97-2	PFAS by ID SOP	40	UH	80	40	20	ng/L	1
1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS)	757124-72-4	PFAS by ID SOP	40	UH	80	40	20	ng/L	1
N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA)	2991-50-6	PFAS by ID SOP	40	UH	80	40	20	ng/L	1
N-methylperfluoro-1-octanesulfonamide (MeFOSA)	31506-32-8	PFAS by ID SOP	80	UH	160	80	40	ng/L	1
N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA)	2355-31-9	PFAS by ID SOP	40	UH	80	40	20	ng/L	1
Perfluoro-1-butanesulfonic acid (PFBS)	375-73-5	PFAS by ID SOP	11	HJ	40	20	10	ng/L	1
Perfluoro-1-decanesulfonic acid (PFDS)	335-77-3	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-1-heptanesulfonic acid (PFHpS)	375-92-8	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-1-nonanesulfonic acid (PFNS)	68259-12-1	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-1-octanesulfonamide (PFOSA)	754-91-6	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-1-pentanesulfonic acid (PFPeS)	2706-91-4	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluorohexanesulfonic acid (PFHxS)	355-46-4	PFAS by ID SOP	260	H	40	20	10	ng/L	1
Perfluoro-n-butanoic acid (PFBA)	375-22-4	PFAS by ID SOP	11	HJ	40	20	10	ng/L	1
Perfluoro-n-decanoic acid (PFDA)	335-76-2	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-dodecanoic acid (PFDoA)	307-55-1	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-heptanoic acid (PFHpA)	375-85-9	PFAS by ID SOP	31	HJ	40	20	10	ng/L	1
Perfluoro-n-hexanoic acid (PFHxA)	307-24-4	PFAS by ID SOP	38	HJ	40	20	10	ng/L	1
Perfluoro-n-nonanoic acid (PFNA)	375-95-1	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-octanoic acid (PFOA)	335-67-1	PFAS by ID SOP	50	H	40	20	10	ng/L	1
Perfluoro-n-pentanoic acid (PFPeA)	2706-90-3	PFAS by ID SOP	22	HJ	40	20	10	ng/L	1
Perfluoro-n-tetradecanoic acid (PFTeDA)	376-06-7	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-tridecanoic acid (PFTrDA)	72629-94-8	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-undecanoic acid (PFUdA)	2058-94-8	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluorooctanesulfonic acid (PFOS)	1763-23-1	PFAS by ID SOP	440	H	40	20	10	ng/L	1

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
13C2_4:2FTS	H	121	50-150
13C2_6:2FTS	H	118	50-150
13C2_8:2FTS	H	117	50-150
13C2_PFDoA	H	107	50-150
13C2_PFTeDA	H	84	50-150
13C3_PFBS	H	110	50-150
13C3_PFHxS	H	104	50-150
13C4_PFBA	H	105	50-150
13C4_PFHpA	H	108	50-150
13C5_PFHxA	H	108	50-150
13C5_PFPeA	H	107	50-150
13C6_PFDA	H	104	50-150
13C7_PFUdA	H	108	50-150
13C8_PFOA	H	107	50-150
13C8_PFOS	H	103	50-150
13C8_PFOSA	H	113	50-150
13C9_PFNA	H	113	50-150

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

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SPLP PFAS

Client: Arcadis U.S., Inc.		Laboratory ID: WJ01056-007
Description: 385-4-Utb		Matrix: Solid
Date Sampled: 09/18/2021 1645	Project Name: Eielson AFB	% Solids: 99.1 10/02/2021 1447
Date Received: 10/01/2021	Project Number: 30030317	

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
d5-EtFOSAA	H	115	50-150
d-MeFOSA	H	110	50-150
d3-MeFOSAA	H	124	50-150

LOQ = Limit of Quantitation	B = Detected in the method blank	E = Quantitation of compound exceeded the calibration range	DL = Detection Limit	Q = Surrogate failure
U = Not detected at or above the LOQ	N = Recovery is out of criteria	P = The RPD between two GC columns exceeds 40%	J = Estimated result < LOQ and ≥ DL	L = LCS/LCSD failure
H = Out of holding time	W = Reported on wet weight basis	LOD = Limit of Detection		S = MS/MSD failure

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PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: WJ01056-008
Description: 385-4-Utc | Matrix: Solid
Date Sampled: 09/18/2021 1645 | Project Name: Eielson AFB | % Solids: 99.0 10/02/2021 1447
Date Received: 10/01/2021 | Project Number: 30030317

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch
1	SOP SPE	PFAS by ID SOP QSM B-15	1	10/04/2021 1703	JJG	10/03/2021 1401	17485

Parameter	CAS Number	Analytical Method	Result	Q	LOQ	LOD	DL	Units	Run
1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS)	39108-34-4	PFAS by ID SOP	0.95	U	1.9	0.95	0.48	ug/kg	1
1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS)	27619-97-2	PFAS by ID SOP	0.95	U	1.9	0.95	0.48	ug/kg	1
1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS)	757124-72-4	PFAS by ID SOP	0.95	U	1.9	0.95	0.48	ug/kg	1
N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA)	2991-50-6	PFAS by ID SOP	0.95	U	1.9	0.95	0.48	ug/kg	1
N-methylperfluoro-1-octanesulfonamide (MeFOSA)	31506-32-8	PFAS by ID SOP	0.95	U	1.9	0.95	0.48	ug/kg	1
N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA)	2355-31-9	PFAS by ID SOP	0.95	U	1.9	0.95	0.48	ug/kg	1
Perfluoro-1-butanesulfonic acid (PFBS)	375-73-5	PFAS by ID SOP	0.22	J	0.95	0.48	0.19	ug/kg	1
Perfluoro-1-decanesulfonic acid (PFDS)	335-77-3	PFAS by ID SOP	0.48	U	0.95	0.48	0.19	ug/kg	1
Perfluoro-1-heptanesulfonic acid (PFHpS)	375-92-8	PFAS by ID SOP	0.48	U	0.95	0.48	0.19	ug/kg	1
Perfluoro-1-nonanesulfonic acid (PFNS)	68259-12-1	PFAS by ID SOP	0.48	U	0.95	0.48	0.19	ug/kg	1
Perfluoro-1-octanesulfonamide (PFOSA)	754-91-6	PFAS by ID SOP	0.20	J	0.95	0.48	0.19	ug/kg	1
Perfluoro-1-pentanesulfonic acid (PFPeS)	2706-91-4	PFAS by ID SOP	0.20	J	0.95	0.48	0.19	ug/kg	1
Perfluorohexanesulfonic acid (PFHxS)	355-46-4	PFAS by ID SOP	5.0		0.95	0.48	0.19	ug/kg	1
Perfluoro-n-butanoic acid (PFBA)	375-22-4	PFAS by ID SOP	0.48	U	0.95	0.48	0.19	ug/kg	1
Perfluoro-n-decanoic acid (PFDA)	335-76-2	PFAS by ID SOP	0.48	U	0.95	0.48	0.19	ug/kg	1
Perfluoro-n-dodecanoic acid (PFDoA)	307-55-1	PFAS by ID SOP	0.48	U	0.95	0.48	0.19	ug/kg	1
Perfluoro-n-heptanoic acid (PFHpA)	375-85-9	PFAS by ID SOP	0.58	J	0.95	0.48	0.19	ug/kg	1
Perfluoro-n-hexanoic acid (PFHxA)	307-24-4	PFAS by ID SOP	0.71	J	0.95	0.48	0.19	ug/kg	1
Perfluoro-n-nonanoic acid (PFNA)	375-95-1	PFAS by ID SOP	0.19	J	0.95	0.48	0.19	ug/kg	1
Perfluoro-n-octanoic acid (PFOA)	335-67-1	PFAS by ID SOP	0.94	J	0.95	0.48	0.19	ug/kg	1
Perfluoro-n-pentanoic acid (PFPeA)	2706-90-3	PFAS by ID SOP	0.34	J	0.95	0.48	0.19	ug/kg	1
Perfluoro-n-tetradecanoic acid (PFTeDA)	376-06-7	PFAS by ID SOP	0.48	U	0.95	0.48	0.19	ug/kg	1
Perfluoro-n-tridecanoic acid (PFTrDA)	72629-94-8	PFAS by ID SOP	0.48	U	0.95	0.48	0.19	ug/kg	1
Perfluoro-n-undecanoic acid (PFUdA)	2058-94-8	PFAS by ID SOP	0.48	U	0.95	0.48	0.19	ug/kg	1
Perfluorooctanesulfonic acid (PFOS)	1763-23-1	PFAS by ID SOP	9.1		0.95	0.48	0.19	ug/kg	1

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
13C2_4:2FTS		109	50-150
13C2_6:2FTS		120	50-150
13C2_8:2FTS		113	50-150
13C2_PFDoA		96	50-150
13C2_PFTeDA		93	50-150
13C3_PFBS		96	50-150
13C3_PFHxS		96	50-150
13C4_PFBA		96	50-150
13C4_PFHpA		91	50-150
13C5_PFHxA		92	50-150
13C5_PFPeA		98	50-150
13C6_PFDA		98	50-150
13C7_PFUdA		103	50-150
13C8_PFOA		95	50-150
13C8_PFOS		95	50-150
13C8_PFOSA		102	50-150
13C9_PFNA		99	50-150

LOQ = Limit of Quantitation | B = Detected in the method blank | E = Quantitation of compound exceeded the calibration range | DL = Detection Limit | Q = Surrogate failure
U = Not detected at or above the LOQ | N = Recovery is out of criteria | P = The RPD between two GC columns exceeds 40% | J = Estimated result < LOQ and ≥ DL | L = LCS/LCSD failure
H = Out of holding time | W = Reported on wet weight basis | LOD = Limit of Detection | S = MS/MSD failure

PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.		Laboratory ID: WJ01056-008
Description: 385-4-Utc		Matrix: Solid
Date Sampled: 09/18/2021 1645	Project Name: Eielson AFB	% Solids: 99.0 10/02/2021 1447
Date Received: 10/01/2021	Project Number: 30030317	

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
d5-EtFOSAA		108	50-150
d-MeFOSA		120	50-150
d3-MeFOSAA		102	50-150

LOQ = Limit of Quantitation	B = Detected in the method blank	E = Quantitation of compound exceeded the calibration range	DL = Detection Limit	Q = Surrogate failure
U = Not detected at or above the LOQ	N = Recovery is out of criteria	P = The RPD between two GC columns exceeds 40%	J = Estimated result < LOQ and ≥ DL	L = LCS/LCSD failure
H = Out of holding time	W = Reported on wet weight basis	LOD = Limit of Detection		S = MS/MSD failure

SPLP PFAS

Client: Arcadis U.S., Inc. | Laboratory ID: WJ01056-008
Description: 385-4-Utc | Matrix: Solid
Date Sampled: 09/18/2021 1645 | Project Name: Eielson AFB | % Solids: 99.0 10/02/2021 1447
Date Received: 10/01/2021 | Project Number: 30030317

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch	Leachate Date
1	1312/PFAS	PFAS by ID SOP QSM B-15	1	11/05/2021 2021	MMM	11/04/2021 1300	21287	10/29/2021 1851

Parameter	CAS Number	Analytical Method	Result	Q	LOQ	LOD	DL	Units	Run
1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS)	39108-34-4	PFAS by ID SOP	40	UH	80	40	20	ng/L	1
1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS)	27619-97-2	PFAS by ID SOP	40	UH	80	40	20	ng/L	1
1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS)	757124-72-4	PFAS by ID SOP	40	UH	80	40	20	ng/L	1
N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA)	2991-50-6	PFAS by ID SOP	40	UH	80	40	20	ng/L	1
N-methylperfluoro-1-octanesulfonamide (MeFOSA)	31506-32-8	PFAS by ID SOP	80	UH	160	80	40	ng/L	1
N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA)	2355-31-9	PFAS by ID SOP	40	UH	80	40	20	ng/L	1
Perfluoro-1-butanesulfonic acid (PFBS)	375-73-5	PFAS by ID SOP	12	HJ	40	20	10	ng/L	1
Perfluoro-1-decanesulfonic acid (PFDS)	335-77-3	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-1-heptanesulfonic acid (PFHpS)	375-92-8	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-1-nonanesulfonic acid (PFNS)	68259-12-1	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-1-octanesulfonamide (PFOSA)	754-91-6	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-1-pentanesulfonic acid (PFPeS)	2706-91-4	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluorohexanesulfonic acid (PFHxS)	355-46-4	PFAS by ID SOP	230	H	40	20	10	ng/L	1
Perfluoro-n-butanoic acid (PFBA)	375-22-4	PFAS by ID SOP	11	HJ	40	20	10	ng/L	1
Perfluoro-n-decanoic acid (PFDA)	335-76-2	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-dodecanoic acid (PFDoA)	307-55-1	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-heptanoic acid (PFHpA)	375-85-9	PFAS by ID SOP	32	HJ	40	20	10	ng/L	1
Perfluoro-n-hexanoic acid (PFHxA)	307-24-4	PFAS by ID SOP	35	HJ	40	20	10	ng/L	1
Perfluoro-n-nonanoic acid (PFNA)	375-95-1	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-octanoic acid (PFOA)	335-67-1	PFAS by ID SOP	48	H	40	20	10	ng/L	1
Perfluoro-n-pentanoic acid (PFPeA)	2706-90-3	PFAS by ID SOP	21	HJ	40	20	10	ng/L	1
Perfluoro-n-tetradecanoic acid (PFTeDA)	376-06-7	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-tridecanoic acid (PFTrDA)	72629-94-8	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-undecanoic acid (PFUdA)	2058-94-8	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluorooctanesulfonic acid (PFOS)	1763-23-1	PFAS by ID SOP	420	H	40	20	10	ng/L	1

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
13C2_4:2FTS	H	117	50-150
13C2_6:2FTS	H	103	50-150
13C2_8:2FTS	H	103	50-150
13C2_PFDoA	H	101	50-150
13C2_PFTeDA	H	77	50-150
13C3_PFBS	H	100	50-150
13C3_PFHxS	H	98	50-150
13C4_PFBA	H	100	50-150
13C4_PFHpA	H	101	50-150
13C5_PFHxA	H	100	50-150
13C5_PFPeA	H	101	50-150
13C6_PFDA	H	96	50-150
13C7_PFUdA	H	99	50-150
13C8_PFOA	H	104	50-150
13C8_PFOS	H	97	50-150
13C8_PFOSA	H	102	50-150
13C9_PFNA	H	100	50-150

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

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SPLP PFAS

Client: Arcadis U.S., Inc.		Laboratory ID: WJ01056-008
Description: 385-4-Utc		Matrix: Solid
Date Sampled: 09/18/2021 1645	Project Name: Eielson AFB	% Solids: 99.0 10/02/2021 1447
Date Received: 10/01/2021	Project Number: 30030317	

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
d5-EtFOSAA	H	111	50-150
d-MeFOSA	H	96	50-150
d3-MeFOSAA	H	111	50-150

LOQ = Limit of Quantitation	B = Detected in the method blank	E = Quantitation of compound exceeded the calibration range	DL = Detection Limit	Q = Surrogate failure
U = Not detected at or above the LOQ	N = Recovery is out of criteria	P = The RPD between two GC columns exceeds 40%	J = Estimated result < LOQ and ≥ DL	L = LCS/LCSD failure
H = Out of holding time	W = Reported on wet weight basis	LOD = Limit of Detection		S = MS/MSD failure

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PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: WJ01056-009
Description: 385-4-Ga | Matrix: Solid
Date Sampled: 09/18/2021 1702 | Project Name: Eielson AFB | % Solids: 99.6 10/02/2021 1447
Date Received: 10/01/2021 | Project Number: 30030317

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch
1	SOP SPE	PFAS by ID SOP QSM B-15	1	10/04/2021 1714	JJG	10/03/2021 1401	17485

Parameter	CAS Number	Analytical Method	Result	Q	LOQ	LOD	DL	Units	Run
1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS)	39108-34-4	PFAS by ID SOP	1.0	U	2.0	1.0	0.50	ug/kg	1
1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS)	27619-97-2	PFAS by ID SOP	1.0	U	2.0	1.0	0.50	ug/kg	1
1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS)	757124-72-4	PFAS by ID SOP	1.0	U	2.0	1.0	0.50	ug/kg	1
N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA)	2991-50-6	PFAS by ID SOP	1.0	U	2.0	1.0	0.50	ug/kg	1
N-methylperfluoro-1-octanesulfonamide (MeFOSA)	31506-32-8	PFAS by ID SOP	1.0	U	2.0	1.0	0.50	ug/kg	1
N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA)	2355-31-9	PFAS by ID SOP	1.0	U	2.0	1.0	0.50	ug/kg	1
Perfluoro-1-butanesulfonic acid (PFBS)	375-73-5	PFAS by ID SOP	0.50	U	0.99	0.50	0.20	ug/kg	1
Perfluoro-1-decanesulfonic acid (PFDS)	335-77-3	PFAS by ID SOP	0.50	U	0.99	0.50	0.20	ug/kg	1
Perfluoro-1-heptanesulfonic acid (PFHpS)	375-92-8	PFAS by ID SOP	0.50	U	0.99	0.50	0.20	ug/kg	1
Perfluoro-1-nonanesulfonic acid (PFNS)	68259-12-1	PFAS by ID SOP	0.50	U	0.99	0.50	0.20	ug/kg	1
Perfluoro-1-octanesulfonamide (PFOSA)	754-91-6	PFAS by ID SOP	0.50	U	0.99	0.50	0.20	ug/kg	1
Perfluoro-1-pentanesulfonic acid (PFPeS)	2706-91-4	PFAS by ID SOP	0.50	U	0.99	0.50	0.20	ug/kg	1
Perfluorohexanesulfonic acid (PFHxS)	355-46-4	PFAS by ID SOP	0.50	U	0.99	0.50	0.20	ug/kg	1
Perfluoro-n-butanoic acid (PFBA)	375-22-4	PFAS by ID SOP	0.50	U	0.99	0.50	0.20	ug/kg	1
Perfluoro-n-decanoic acid (PFDA)	335-76-2	PFAS by ID SOP	0.50	U	0.99	0.50	0.20	ug/kg	1
Perfluoro-n-dodecanoic acid (PFDoA)	307-55-1	PFAS by ID SOP	0.50	U	0.99	0.50	0.20	ug/kg	1
Perfluoro-n-heptanoic acid (PFHpA)	375-85-9	PFAS by ID SOP	0.50	U	0.99	0.50	0.20	ug/kg	1
Perfluoro-n-hexanoic acid (PFHxA)	307-24-4	PFAS by ID SOP	0.50	U	0.99	0.50	0.20	ug/kg	1
Perfluoro-n-nonanoic acid (PFNA)	375-95-1	PFAS by ID SOP	0.50	U	0.99	0.50	0.20	ug/kg	1
Perfluoro-n-octanoic acid (PFOA)	335-67-1	PFAS by ID SOP	0.50	U	0.99	0.50	0.20	ug/kg	1
Perfluoro-n-pentanoic acid (PFPeA)	2706-90-3	PFAS by ID SOP	0.50	U	0.99	0.50	0.20	ug/kg	1
Perfluoro-n-tetradecanoic acid (PFTeDA)	376-06-7	PFAS by ID SOP	0.50	U	0.99	0.50	0.20	ug/kg	1
Perfluoro-n-tridecanoic acid (PFTrDA)	72629-94-8	PFAS by ID SOP	0.50	U	0.99	0.50	0.20	ug/kg	1
Perfluoro-n-undecanoic acid (PFUdA)	2058-94-8	PFAS by ID SOP	0.50	U	0.99	0.50	0.20	ug/kg	1
Perfluorooctanesulfonic acid (PFOS)	1763-23-1	PFAS by ID SOP	0.50	U	0.99	0.50	0.20	ug/kg	1

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
13C2_4:2FTS		99	50-150
13C2_6:2FTS		109	50-150
13C2_8:2FTS		96	50-150
13C2_PFDoA		79	50-150
13C2_PFTeDA		86	50-150
13C3_PFBS		90	50-150
13C3_PFHxS		85	50-150
13C4_PFBA		89	50-150
13C4_PFHpA		85	50-150
13C5_PFHxA		84	50-150
13C5_PFPeA		92	50-150
13C6_PFDA		89	50-150
13C7_PFUdA		88	50-150
13C8_PFOA		94	50-150
13C8_PFOS		89	50-150
13C8_PFOSA		101	50-150
13C9_PFNA		90	50-150

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

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PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.		Laboratory ID: WJ01056-009
Description: 385-4-Ga		Matrix: Solid
Date Sampled: 09/18/2021 1702	Project Name: Eielson AFB	% Solids: 99.6 10/02/2021 1447
Date Received: 10/01/2021	Project Number: 30030317	

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
d5-EtFOSAA		100	50-150
d-MeFOSA		105	50-150
d3-MeFOSAA		88	50-150

LOQ = Limit of Quantitation	B = Detected in the method blank	E = Quantitation of compound exceeded the calibration range	DL = Detection Limit	Q = Surrogate failure
U = Not detected at or above the LOQ	N = Recovery is out of criteria	P = The RPD between two GC columns exceeds 40%	J = Estimated result < LOQ and ≥ DL	L = LCS/LCSD failure
H = Out of holding time	W = Reported on wet weight basis	LOD = Limit of Detection		S = MS/MSD failure

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SPLP PFAS

Client: Arcadis U.S., Inc. | Laboratory ID: WJ01056-009
Description: 385-4-Ga | Matrix: Solid
Date Sampled: 09/18/2021 1702 | Project Name: Eielson AFB | % Solids: 99.6 10/02/2021 1447
Date Received: 10/01/2021 | Project Number: 30030317

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch	Leachate Date
1	1312/PFAS	PFAS by ID SOP QSM B-15	1	11/05/2021 2031	MMM	11/04/2021 1300	21287	10/29/2021 1851

Parameter	CAS Number	Analytical Method	Result	Q	LOQ	LOD	DL	Units	Run
1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS)	39108-34-4	PFAS by ID SOP	40	UH	80	40	20	ng/L	1
1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS)	27619-97-2	PFAS by ID SOP	40	UH	80	40	20	ng/L	1
1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS)	757124-72-4	PFAS by ID SOP	40	UH	80	40	20	ng/L	1
N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA)	2991-50-6	PFAS by ID SOP	40	UH	80	40	20	ng/L	1
N-methylperfluoro-1-octanesulfonamide (MeFOSA)	31506-32-8	PFAS by ID SOP	80	UH	160	80	40	ng/L	1
N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA)	2355-31-9	PFAS by ID SOP	40	UH	80	40	20	ng/L	1
Perfluoro-1-butanesulfonic acid (PFBS)	375-73-5	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-1-decanesulfonic acid (PFDS)	335-77-3	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-1-heptanesulfonic acid (PFHpS)	375-92-8	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-1-nonanesulfonic acid (PFNS)	68259-12-1	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-1-octanesulfonamide (PFOSA)	754-91-6	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-1-pentanesulfonic acid (PFPeS)	2706-91-4	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluorohexanesulfonic acid (PFHxS)	355-46-4	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-butanoic acid (PFBA)	375-22-4	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-decanoic acid (PFDA)	335-76-2	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-dodecanoic acid (PFDoA)	307-55-1	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-heptanoic acid (PFHpA)	375-85-9	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-hexanoic acid (PFHxA)	307-24-4	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-nonanoic acid (PFNA)	375-95-1	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-octanoic acid (PFOA)	335-67-1	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-pentanoic acid (PFPeA)	2706-90-3	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-tetradecanoic acid (PFTeDA)	376-06-7	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-tridecanoic acid (PFTrDA)	72629-94-8	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluoro-n-undecanoic acid (PFUdA)	2058-94-8	PFAS by ID SOP	20	UH	40	20	10	ng/L	1
Perfluorooctanesulfonic acid (PFOS)	1763-23-1	PFAS by ID SOP	20	UH	40	20	10	ng/L	1

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
13C2_4:2FTS	H	111	50-150
13C2_6:2FTS	H	104	50-150
13C2_8:2FTS	H	97	50-150
13C2_PFDoA	H	98	50-150
13C2_PFTeDA	H	81	50-150
13C3_PFBS	H	106	50-150
13C3_PFHxS	H	105	50-150
13C4_PFBA	H	103	50-150
13C4_PFHpA	H	103	50-150
13C5_PFHxA	H	101	50-150
13C5_PFPeA	H	102	50-150
13C6_PFDA	H	102	50-150
13C7_PFUdA	H	95	50-150
13C8_PFOA	H	102	50-150
13C8_PFOS	H	99	50-150
13C8_PFOSA	H	103	50-150
13C9_PFNA	H	103	50-150

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

SPLP PFAS

Client: Arcadis U.S., Inc.		Laboratory ID: WJ01056-009
Description: 385-4-Ga		Matrix: Solid
Date Sampled: 09/18/2021 1702	Project Name: Eielson AFB	% Solids: 99.6 10/02/2021 1447
Date Received: 10/01/2021	Project Number: 30030317	

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
d5-EtFOSAA	H	102	50-150
d-MeFOSA	H	106	50-150
d3-MeFOSAA	H	108	50-150

LOQ = Limit of Quantitation	B = Detected in the method blank	E = Quantitation of compound exceeded the calibration range	DL = Detection Limit	Q = Surrogate failure
U = Not detected at or above the LOQ	N = Recovery is out of criteria	P = The RPD between two GC columns exceeds 40%	J = Estimated result < LOQ and ≥ DL	L = LCS/LCSD failure
H = Out of holding time	W = Reported on wet weight basis	LOD = Limit of Detection		S = MS/MSD failure

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QC Summary

PFAS by LC/MS/MS - MB

Sample ID: WQ17485-001
Batch: 17485
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Solid
Prep Method: SOP SPE
Prep Date: 10/03/2021 1401

Parameter	Result	Q	Dil	LOQ	LOD	DL	Units	Analysis Date
8:2 FTS	1.0	U	1	2.0	1.0	0.50	ug/kg	10/04/2021 1436
6:2 FTS	1.0	U	1	2.0	1.0	0.50	ug/kg	10/04/2021 1436
4:2 FTS	1.0	U	1	2.0	1.0	0.50	ug/kg	10/04/2021 1436
EtFOSAA	1.0	U	1	2.0	1.0	0.50	ug/kg	10/04/2021 1436
MeFOSA	1.0	U	1	2.0	1.0	0.50	ug/kg	10/04/2021 1436
MeFOSAA	1.0	U	1	2.0	1.0	0.50	ug/kg	10/04/2021 1436
PFBS	0.50	U	1	1.0	0.50	0.20	ug/kg	10/04/2021 1436
PFDS	0.50	U	1	1.0	0.50	0.20	ug/kg	10/04/2021 1436
PFHpS	0.50	U	1	1.0	0.50	0.20	ug/kg	10/04/2021 1436
PFNS	0.50	U	1	1.0	0.50	0.20	ug/kg	10/04/2021 1436
PFOSA	0.50	U	1	1.0	0.50	0.20	ug/kg	10/04/2021 1436
PFPeS	0.50	U	1	1.0	0.50	0.20	ug/kg	10/04/2021 1436
PFHxS	0.50	U	1	1.0	0.50	0.20	ug/kg	10/04/2021 1436
PFBA	0.50	U	1	1.0	0.50	0.20	ug/kg	10/04/2021 1436
PFDA	0.50	U	1	1.0	0.50	0.20	ug/kg	10/04/2021 1436
PFDoA	0.50	U	1	1.0	0.50	0.20	ug/kg	10/04/2021 1436
PFHpA	0.50	U	1	1.0	0.50	0.20	ug/kg	10/04/2021 1436
PFHxA	0.50	U	1	1.0	0.50	0.20	ug/kg	10/04/2021 1436
PFNA	0.50	U	1	1.0	0.50	0.20	ug/kg	10/04/2021 1436
PFOA	0.50	U	1	1.0	0.50	0.20	ug/kg	10/04/2021 1436
PFPeA	0.50	U	1	1.0	0.50	0.20	ug/kg	10/04/2021 1436
PFTeDA	0.50	U	1	1.0	0.50	0.20	ug/kg	10/04/2021 1436
PFTrDA	0.50	U	1	1.0	0.50	0.20	ug/kg	10/04/2021 1436
PFUdA	0.50	U	1	1.0	0.50	0.20	ug/kg	10/04/2021 1436
PFOS	0.50	U	1	1.0	0.50	0.20	ug/kg	10/04/2021 1436

Surrogate	Q	% Rec	Acceptance Limit
13C2_4:2FTS		97	50-150
13C2_6:2FTS		119	50-150
13C2_8:2FTS		86	50-150
13C2_PFDoA		87	50-150
13C2_PFTeDA		90	50-150
13C3_PFBS		91	50-150
13C3_PFHxS		88	50-150
13C4_PFBA		92	50-150
13C4_PFHpA		88	50-150
13C5_PFHxA		88	50-150
13C5_PFPeA		89	50-150
13C6_PFDA		98	50-150
13C7_PFUdA		90	50-150
13C8_PFOA		93	50-150

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

PFAS by LC/MS/MS - MB

Sample ID: WQ17485-001
Batch: 17485
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Solid
Prep Method: SOP SPE
Prep Date: 10/03/2021 1401

Surrogate	Q	% Rec	Acceptance Limit
13C8_PFOS		91	50-150
13C8_PFOSA		106	50-150
13C9_PFNA		94	50-150
d5-EtFOSAA		102	50-150
d-MeFOSA		109	50-150
d3-MeFOSAA		98	50-150

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

PFAS by LC/MS/MS - LCS

Sample ID: WQ17485-002
Batch: 17485
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Solid
Prep Method: SOP SPE
Prep Date: 10/03/2021 1401

Parameter	Spike Amount (ug/kg)	Result (ug/kg)	Q	Dil	% Rec	%Rec Limit	Analysis Date
8:2 FTS	1.9	2.4		1	125	65-137	10/04/2021 1446
6:2 FTS	1.9	2.6		1	140	64-140	10/04/2021 1446
4:2 FTS	1.9	1.8		1	99	62-145	10/04/2021 1446
EtFOSAA	2.0	1.9		1	93	61-139	10/04/2021 1446
MeFOSA	2.0	2.0		1	99	70-150	10/04/2021 1446
MeFOSAA	2.0	1.9		1	93	63-144	10/04/2021 1446
PFBS	1.8	1.6		1	91	72-128	10/04/2021 1446
PFDS	1.9	2.1		1	110	59-134	10/04/2021 1446
PFHpS	1.9	2.0		1	105	70-132	10/04/2021 1446
PFNS	1.9	2.4		1	123	69-125	10/04/2021 1446
PFOSA	2.0	1.8		1	88	67-137	10/04/2021 1446
PFPeS	1.9	1.8		1	99	73-123	10/04/2021 1446
PFHxS	1.8	1.6		1	89	67-130	10/04/2021 1446
PFBA	2.0	2.0		1	100	71-135	10/04/2021 1446
PFDA	2.0	2.2		1	111	69-133	10/04/2021 1446
PFDoA	2.0	1.9		1	95	69-135	10/04/2021 1446
PFHpA	2.0	1.9		1	96	71-131	10/04/2021 1446
PFHxA	2.0	2.0		1	100	70-132	10/04/2021 1446
PFNA	2.0	2.0		1	99	72-129	10/04/2021 1446
PFOA	2.0	2.0		1	102	69-133	10/04/2021 1446
PFPeA	2.0	1.9		1	95	69-132	10/04/2021 1446
PFTeDA	2.0	2.1		1	104	69-133	10/04/2021 1446
PFTrDA	2.0	1.9		1	96	66-139	10/04/2021 1446
PFUdA	2.0	1.9		1	97	64-136	10/04/2021 1446
PFOS	1.9	1.9		1	101	68-136	10/04/2021 1446

Surrogate	Q	% Rec	Acceptance Limit
13C2_4:2FTS		95	50-150
13C2_6:2FTS		103	50-150
13C2_8:2FTS		93	50-150
13C2_PFDoA		87	50-150
13C2_PFTeDA		89	50-150
13C3_PFBS		95	50-150
13C3_PFHxS		91	50-150
13C4_PFBA		93	50-150
13C4_PFHpA		87	50-150
13C5_PFHxA		85	50-150
13C5_PFPeA		94	50-150
13C6_PFDA		92	50-150
13C7_PFUdA		92	50-150
13C8_PFOA		92	50-150

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

PFAS by LC/MS/MS - LCS

Sample ID: WQ17485-002
Batch: 17485
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Solid
Prep Method: SOP SPE
Prep Date: 10/03/2021 1401

Surrogate	Q	% Rec	Acceptance Limit
13C8_PFOS		91	50-150
13C8_PFOSA		107	50-150
13C9_PFNA		97	50-150
d5-EtFOSAA		103	50-150
d-MeFOSA		101	50-150
d3-MeFOSAA		93	50-150

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

SPLP PFAS - MB

Sample ID: WQ21287-001
Batch: 21287
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Solid
Prep Method: 1312/PFAS
Prep Date: 11/04/2021 1300 Leachate Date: 10/27/2021 0213

Parameter	Result	Q	Dil	LOQ	LOD	DL	Units	Analysis Date
8:2 FTS	40	U	1	80	40	20	ng/L	11/05/2021 1659
6:2 FTS	40	U	1	80	40	20	ng/L	11/05/2021 1659
4:2 FTS	40	U	1	80	40	20	ng/L	11/05/2021 1659
EtFOSAA	40	U	1	80	40	20	ng/L	11/05/2021 1659
MeFOSA	80	U	1	160	80	40	ng/L	11/05/2021 1659
MeFOSAA	40	U	1	80	40	20	ng/L	11/05/2021 1659
PFBS	20	U	1	40	20	10	ng/L	11/05/2021 1659
PFDS	20	U	1	40	20	10	ng/L	11/05/2021 1659
PFHpS	20	U	1	40	20	10	ng/L	11/05/2021 1659
PFNS	20	U	1	40	20	10	ng/L	11/05/2021 1659
PFOSA	20	U	1	40	20	10	ng/L	11/05/2021 1659
PFPeS	20	U	1	40	20	10	ng/L	11/05/2021 1659
PFHxS	20	U	1	40	20	10	ng/L	11/05/2021 1659
PFBA	20	U	1	40	20	10	ng/L	11/05/2021 1659
PFDA	20	U	1	40	20	10	ng/L	11/05/2021 1659
PFDoA	20	U	1	40	20	10	ng/L	11/05/2021 1659
PFHpA	20	U	1	40	20	10	ng/L	11/05/2021 1659
PFHxA	20	U	1	40	20	10	ng/L	11/05/2021 1659
PFNA	20	U	1	40	20	10	ng/L	11/05/2021 1659
PFOA	20	U	1	40	20	10	ng/L	11/05/2021 1659
PFPeA	20	U	1	40	20	10	ng/L	11/05/2021 1659
PFTeDA	20	U	1	40	20	10	ng/L	11/05/2021 1659
PFTrDA	20	U	1	40	20	10	ng/L	11/05/2021 1659
PFUdA	20	U	1	40	20	10	ng/L	11/05/2021 1659
PFOS	20	U	1	40	20	10	ng/L	11/05/2021 1659

Surrogate	Q	% Rec	Acceptance Limit
13C2_4:2FTS		124	50-150
13C2_6:2FTS		116	50-150
13C2_8:2FTS		107	50-150
13C2_PFDoA		107	50-150
13C2_PFTeDA		75	50-150
13C3_PFBS		109	50-150
13C3_PFHxS		108	50-150
13C4_PFBA		103	50-150
13C4_PFHpA		105	50-150
13C5_PFHxA		106	50-150
13C5_PFPeA		102	50-150
13C6_PFDA		104	50-150
13C7_PFUdA		107	50-150
13C8_PFOA		101	50-150

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

SPLP PFAS - MB

Sample ID: WQ21287-001
Batch: 21287
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Solid
Prep Method: 1312/PFAS
Prep Date: 11/04/2021 1300 Leachate Date: 10/27/2021 0213

Surrogate	Q	% Rec	Acceptance Limit
13C8_PFOS		101	50-150
13C8_PFOSA		107	50-150
13C9_PFNA		103	50-150
d5-EtFOSAA		113	50-150
d-MeFOSA		100	50-150
d3-MeFOSAA		115	50-150

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

SPLP PFAS - LCS

Sample ID: WQ21287-002
Batch: 21287
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Solid
Prep Method: 1312/PFAS
Prep Date: 11/04/2021 1300 Leachate Date: 10/27/2021 0213

Parameter	Spike Amount (ng/L)	Result (ng/L)	Q	Dil	% Rec	%Rec Limit	Analysis Date
8:2 FTS	150	160		1	105	67-138	11/05/2021 1710
6:2 FTS	150	180		1	117	64-140	11/05/2021 1710
4:2 FTS	150	140		1	97	63-143	11/05/2021 1710
EtFOSAA	160	140		1	90	61-135	11/05/2021 1710
MeFOSA	160	190		1	116	68-141	11/05/2021 1710
MeFOSAA	160	150		1	95	65-136	11/05/2021 1710
PFBS	140	130		1	93	72-130	11/05/2021 1710
PFDS	150	150		1	96	53-142	11/05/2021 1710
PFHpS	150	160		1	105	69-134	11/05/2021 1710
PFNS	150	170		1	109	69-127	11/05/2021 1710
PFOSA	160	150		1	94	67-137	11/05/2021 1710
PFPeS	150	150		1	98	71-127	11/05/2021 1710
PFHxS	150	150		1	102	68-131	11/05/2021 1710
PFBA	160	160		1	97	73-129	11/05/2021 1710
PFDA	160	160		1	99	71-129	11/05/2021 1710
PFDoA	160	170		1	106	72-134	11/05/2021 1710
PFHpA	160	160		1	99	72-130	11/05/2021 1710
PFHxA	160	160		1	102	72-129	11/05/2021 1710
PFNA	160	170		1	104	69-130	11/05/2021 1710
PFOA	160	160		1	99	71-133	11/05/2021 1710
PFPeA	160	160		1	100	72-129	11/05/2021 1710
PFTeDA	160	160		1	98	71-132	11/05/2021 1710
PFTrDA	160	160		1	101	65-144	11/05/2021 1710
PFUdA	160	180		1	115	69-133	11/05/2021 1710
PFOS	150	150		1	102	65-140	11/05/2021 1710

Surrogate	Q	% Rec	Acceptance Limit
13C2_4:2FTS		115	50-150
13C2_6:2FTS		113	50-150
13C2_8:2FTS		109	50-150
13C2_PFDoA		106	50-150
13C2_PFTeDA		88	50-150
13C3_PFBS		108	50-150
13C3_PFHxS		101	50-150
13C4_PFBA		102	50-150
13C4_PFHpA		108	50-150
13C5_PFHxA		105	50-150
13C5_PFPeA		104	50-150
13C6_PFDA		109	50-150
13C7_PFUdA		97	50-150
13C8_PFOA		111	50-150

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

SPLP PFAS - LCS

Sample ID: WQ21287-002
Batch: 21287
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Solid
Prep Method: 1312/PFAS
Prep Date: 11/04/2021 1300 Leachate Date: 10/27/2021 0213

Surrogate	Q	% Rec	Acceptance Limit
13C8_PFOS		107	50-150
13C8_PFOSA		109	50-150
13C9_PFNA		103	50-150
d5-EtFOSAA		113	50-150
d-MeFOSA		101	50-150
d3-MeFOSAA		112	50-150

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

SPLP PFAS - MS

Sample ID: WJ01056-002MS
Batch: 21287
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Solid
Prep Method: 1312/PFAS
Prep Date: 11/04/2021 1300 Leachate Date: 10/27/2021 0213

Parameter	Sample Amount (ng/L)	Spike Amount (ng/L)	Result (ng/L)	Q	Dil	% Rec	%Rec Limit	Analysis Date
8:2 FTS	ND	150	160		1	106	67-138	11/05/2021 1845
6:2 FTS	ND	150	260	N	1	169	64-140	11/05/2021 1845
4:2 FTS	ND	150	140		1	96	63-143	11/05/2021 1845
EtFOSAA	ND	160	140		1	89	61-135	11/05/2021 1845
MeFOSA	ND	160	190		1	117	68-141	11/05/2021 1845
MeFOSAA	ND	160	160		1	99	65-136	11/05/2021 1845
PFBS	ND	140	130		1	89	72-130	11/05/2021 1845
PFDS	ND	150	160		1	103	53-142	11/05/2021 1845
PFHpS	ND	150	160		1	102	69-134	11/05/2021 1845
PFNS	ND	150	140		1	93	69-127	11/05/2021 1845
PFOSA	ND	160	160		1	100	67-137	11/05/2021 1845
PFPeS	ND	150	160		1	107	71-127	11/05/2021 1845
PFHxS	15	150	150		1	90	68-131	11/05/2021 1845
PFBA	ND	160	150		1	97	73-129	11/05/2021 1845
PFDA	ND	160	190		1	117	71-129	11/05/2021 1845
PFDoA	ND	160	200		1	125	72-134	11/05/2021 1845
PFHpA	ND	160	170		1	107	72-130	11/05/2021 1845
PFHxA	ND	160	160		1	101	72-129	11/05/2021 1845
PFNA	ND	160	150		1	97	69-130	11/05/2021 1845
PFOA	ND	160	150		1	93	71-133	11/05/2021 1845
PFPeA	ND	160	170		1	103	72-129	11/05/2021 1845
PFTeDA	ND	160	160		1	101	71-132	11/05/2021 1845
PFTrDA	ND	160	190		1	117	65-144	11/05/2021 1845
PFUdA	ND	160	180		1	110	69-133	11/05/2021 1845
PFOS	15	150	160		1	96	65-140	11/05/2021 1845

Surrogate	Q	% Rec	Acceptance Limit
13C2_4:2FTS		109	50-150
13C2_6:2FTS		105	50-150
13C2_8:2FTS		108	50-150
13C2_PFDoA		85	50-150
13C2_PFTeDA		82	50-150
13C3_PFBS		104	50-150
13C3_PFHxS		101	50-150
13C4_PFBA		100	50-150
13C4_PFHpA		96	50-150
13C5_PFHxA		96	50-150
13C5_PFPeA		98	50-150
13C6_PFDA		93	50-150
13C7_PFUdA		96	50-150
13C8_PFOA		106	50-150

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

SPLP PFAS - MS

Sample ID: WJ01056-002MS
Batch: 21287
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Solid
Prep Method: 1312/PFAS
Prep Date: 11/04/2021 1300 Leachate Date: 10/27/2021 0213

Surrogate	Q	% Rec	Acceptance Limit
13C8_PFOS		104	50-150
13C8_PFOSA		101	50-150
13C9_PFNA		103	50-150
d5-EtFOSAA		103	50-150
d-MeFOSA		100	50-150
d3-MeFOSAA		109	50-150

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

SPLP PFAS - MSD

Sample ID: WJ01056-002MD
Batch: 21287
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Solid
Prep Method: 1312/PFAS
Prep Date: 11/04/2021 1300 Leachate Date: 10/27/2021 0213

Parameter	Sample Amount (ng/L)	Spike Amount (ng/L)	Result (ng/L)	Q	Dil	% Rec	% RPD	%Rec Limit	% RPD Limit	Analysis Date
8:2 FTS	ND	150	130		1	85	22	67-138	30	11/05/2021 1856
6:2 FTS	ND	150	160	+	1	104	48	64-140	30	11/05/2021 1856
4:2 FTS	ND	150	140		1	91	5.6	63-143	30	11/05/2021 1856
EtFOSAA	ND	160	150		1	92	3.9	61-135	30	11/05/2021 1856
MeFOSA	ND	160	190		1	120	3.1	68-141	30	11/05/2021 1856
MeFOSAA	ND	160	150		1	95	3.9	65-136	30	11/05/2021 1856
PFBS	ND	140	140		1	101	13	72-130	30	11/05/2021 1856
PFDS	ND	150	150		1	95	8.2	53-142	30	11/05/2021 1856
PFHpS	ND	150	150		1	96	6.4	69-134	30	11/05/2021 1856
PFNS	ND	150	150		1	96	3.8	69-127	30	11/05/2021 1856
PFOSA	ND	160	150		1	97	3.1	67-137	30	11/05/2021 1856
PFPeS	ND	150	170		1	114	6.4	71-127	30	11/05/2021 1856
PFHxS	15	150	140		1	89	0.90	68-131	30	11/05/2021 1856
PFBA	ND	160	160		1	97	0.16	73-129	30	11/05/2021 1856
PFDA	ND	160	160		1	100	16	71-129	30	11/05/2021 1856
PFDoA	ND	160	160		1	102	20	72-134	30	11/05/2021 1856
PFHpA	ND	160	160		1	101	5.6	72-130	30	11/05/2021 1856
PFHxA	ND	160	150		1	94	7.0	72-129	30	11/05/2021 1856
PFNA	ND	160	160		1	102	5.9	69-130	30	11/05/2021 1856
PFOA	ND	160	160		1	99	6.9	71-133	30	11/05/2021 1856
PFPeA	ND	160	160		1	99	4.4	72-129	30	11/05/2021 1856
PFTeDA	ND	160	160		1	101	0.23	71-132	30	11/05/2021 1856
PFTrDA	ND	160	160		1	100	16	65-144	30	11/05/2021 1856
PFUdA	ND	160	160		1	97	13	69-133	30	11/05/2021 1856
PFOS	15	150	160		1	98	1.3	65-140	30	11/05/2021 1856

Surrogate	Q	% Rec	Acceptance Limit
13C2_4:2FTS		121	50-150
13C2_6:2FTS		116	50-150
13C2_8:2FTS		113	50-150
13C2_PFDoA		105	50-150
13C2_PFTeDA		82	50-150
13C3_PFBS		94	50-150
13C3_PFHxS		106	50-150
13C4_PFBA		100	50-150
13C4_PFHpA		107	50-150
13C5_PFHxA		104	50-150
13C5_PFPeA		99	50-150
13C6_PFDA		100	50-150
13C7_PFUdA		102	50-150
13C8_PFOA		106	50-150

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
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+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

SPLP PFAS - MSD

Sample ID: WJ01056-002MD
Batch: 21287
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Solid
Prep Method: 1312/PFAS
Prep Date: 11/04/2021 1300 Leachate Date: 10/27/2021 0213

Surrogate	Q	% Rec	Acceptance Limit
13C8_PFOS		104	50-150
13C8_PFOSA		104	50-150
13C9_PFNA		103	50-150
d5-EtFOSAA		113	50-150
d-MeFOSA		94	50-150
d3-MeFOSAA		114	50-150

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

Chain of Custody

and

Miscellaneous Documents

Chain of Custody

Pace Analytical®

Workorder: ISM Workorder Name: Elelson Owner Received Date: 9/22/2021 Results Requested By: 10/5/2021

Report To	Subcontract To	Requested Analysis
Kathy Smith Pace Analytical 106 Vantage Point Drive Columbia SC, 29223 803-227-2704 kathy.smith@pacelabs.com	Pace Golf Coast 7979 Innovation Park Drive, Baton Rouge, LA 70820	

WJ01056

KES2

Item	Sample ID	Sample Type	Collect Date/Time	Lab ID	Matrix	Preserved Containers: NON	ISM Prep	LAB USE ONLY
1	385-4-Sa		9/18/2021 1726			x	x	1
2	385-4-Sb		9/18/2021 1726			x	x	2
3	385-4-Sc		9/18/2021 1726			x	x	3
4	385-4-Ga		9/18/2021 1702			X	X	4
5	385-4-Gb		9/18/2021 1702			X	X	5
6	385-4-Gc		9/18/2021 1702			X	X	6
7	385-4-Uta		9/18/2021 1645			X	X	7
8	385-4-Utb		9/18/2021 1645			X	X	8
9	385-4-Utc		9/18/2021 1645			X	X	9
14	**Send samples to SC for analysis after ISM Prep							

Transfers	Released By	Date/Time	Received By	Date/Time	Comments
1	Cory Mize	9/20 1700			
2					
3	fed ex	10-21 920	[illegible]	10-1-21 920	2889 8155 3350 T=3.2°C

Cooler Temperature on Receipt 5.7, 1.5°C E34	Custody Seal Y or N	Received on Ice Y or N	Sample Intact Y or N

***In order to maintain client confidentiality, location/name of the sampling site, sampler's name and signature may not be provided on this COC

This chain of custody is considered complete as is since this information is available in the owner laboratory.

Friday, June 17, 2016 11:01:34 AM

Client ID: 4387 - Pace Analytical Services

SDG: 221092327

PM: EPM

Pace Analytical Services, LLC (formerly Shealy Environmental Services, Inc.)
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

PACE ANALYTICAL SERVICES, LLC

Pace Analytical®

PACE ANALYTICAL SERVICES, LLC
106 Vantage Point Drive • West Columbia, SC 29172
Telephone No. 803-791-9700 Fax No. 803-791-9111
www.pacelabs.com

Number 122667

Client: Aradis	Report to Contact: Nathan Nagle	Telephone No. / E-mail: Nathan.Nagle@aradis.com	Quote No.
Address: 10 Friend Ln, Ste 100	Sampler's Signature: X	Analysis (Attach list if more space is needed)	Page 1 of 1
City: Newtown / State: PA / Zip Code: 18940	Printed Name: Jacob Schenk		Lot # Bar Code (lab use only)
Project Name: Eielson Soil Washing			
Project No.: 30030317	P.O. No:		

Sample ID / Description (Containers for each sample may be combined on one line.)	Collection Date(s)	Collection Time (Military)	Grab/Composite	Matrix: Aqueous	Matrix: Solid	Matrix: Non-Aqueous	No. of Containers by Preservative Type: Unpres	H2SO4	HNO3	HCl	NaOH	Na2S2O3	Methanol	PFAS 8SM Table A-15	Remarks / Cooler I.D.
385-4-Sa	9/13/21 - 9/18/21	1726	C		X		X							1	1
385-4-Sb	9/13/21 - 9/18/21	1726												1	2
385-4-Sc	9/9/21 - 9/18/21	1726												1	3
385-4-Ga	9/9/21 - 9/18/21	1702												1	4
385-4-Gb	9/9/21 - 9/18/21	1702												1	5
385-4-Gc	9/9/21 - 9/18/21	1702												1	6
385-4-UTa	9/9/21 - 9/18/21	1645												1	7
385-4-UTb	9/9/21 - 9/18/21	1645	↓		↓		↓							1	8
385-4-UTc	9/9/21 - 9/18/21	1645	C		X		X							1	9

Turn Around Time Required (Prior lab approval required for expedited TAT.): ☒ Standard ☐ Rush (Specify)

Sample Disposal: ☐ Return to Client ☒ Disposal by Lab

Possible Hazard Identification: ☒ Non-Hazard ☐ Flammable ☐ Skin Irritant ☐ Poison ☐ Unknown

QC Requirements (Specify)

	Date	Time		Date	Time
1. Relinquished by: Jacob Schenk/Aradis	9/21/21	1200	1. Received by		
2. Relinquished by: FedEx	9/22/21	1225	2. Received by	9/22/21	1225
3. Relinquished by	Date	Time	3. Received by	Date	Time
4. Relinquished by	Date	Time	4. Laboratory received by	Date	Time

Note: All samples are retained for four weeks from receipt unless other arrangements are made.

LAB USE ONLY
Received on ice (Circle) Yes No Ice Pack

Client ID: 4367 - Pace Analytical Services
SDG: 221092327
PM: EPM

DISTRIBUTION: WHITE & YELLOW-Return to laboratory with Sample(s); PINK-Field/Client Copy

PACE ANALYTICAL SERVICES, LLC

PaceAnalytical

Samples Receipt Checklist (SRC) (ME0018C-15)
Issuing Authority: Pace ENV - WCOL

Revised:9/29/2020
Page 1 of 1

Sample Receipt Checklist (SRC)

Client: Pace Cooler Inspected by/date: KDRW / 10/01/2021 Lot #: WJ01056

Means of receipt: ☐ Pace ☐ Client ☑ UPS ☐ FedEx ☐ Other:			
☐ Yes	☑ No		1. Were custody seals present on the cooler?
☐ Yes	☐ No	☑ NA	2. If custody seals were present, were they intact and unbroken?

pH Strip ID: NA Chlorine Strip ID: NA Tested by: NA

Original temperature upon receipt / Derived (Corrected) temperature upon receipt %Solid Snap-Cup ID: 21-1928

3.2 / 3.2 °C NA / NA °C NA / NA °C NA / NA °C

Method: ☐ Temperature Blank ☑ Against Bottles IR Gun ID: 5 IR Gun Correction Factor: 0 °C

Method of coolant: ☑ Wet Ice ☐ Ice Packs ☐ Dry Ice ☐ None

☐ Yes	☐ No	☑ NA	3. If temperature of any cooler exceeded 6.0°C, was Project Manager Notified? PM was Notified by: phone / email / face-to-face (circle one).
☑ Yes	☐ No	☐ NA	4. Is the commercial courier's packing slip attached to this form?
☑ Yes	☐ No		5. Were proper custody procedures (relinquished/received) followed?
☑ Yes	☐ No		6. Were sample IDs listed on the COC?
☑ Yes	☐ No		7. Were sample IDs listed on all sample containers?
☑ Yes	☐ No		8. Was collection date & time listed on the COC?
☑ Yes	☐ No		9. Was collection date & time listed on all sample containers?
☑ Yes	☐ No		10. Did all container label information (ID, date, time) agree with the COC?
☑ Yes	☐ No		11. Were tests to be performed listed on the COC?
☑ Yes	☐ No		12. Did all samples arrive in the proper containers for each test and/or in good condition (unbroken, lids on, etc.)?
☑ Yes	☐ No		13. Was adequate sample volume available?
☐ Yes	☑ No		14. Were all samples received within ½ the holding time or 48 hours, whichever comes first?
☐ Yes	☑ No		15. Were any samples containers missing/excess (circle one) samples Not listed on COC?
☐ Yes	☐ No	☑ NA	16. For VOA and RSK-175 samples, were bubbles present >"pea-size" (¼"or 6mm in diameter) in any of the VOA vials?
☐ Yes	☐ No	☑ NA	17. Were all DRO/metals/nutrient samples received at a pH of < 2?
☐ Yes	☐ No	☑ NA	18. Were all cyanide samples received at a pH > 12 and sulfide samples received at a pH > 9?
☐ Yes	☐ No	☑ NA	19. Were all applicable NH_3/TKN/cyanide/phenol/625.1/608.3 (< 0.5mg/L) samples free of residual chlorine?
☐ Yes	☐ No	☑ NA	20. Were client remarks/requests (i.e. requested dilutions, MS/MSD designations, etc…) correctly transcribed from the COC into the comment section in LIMS?
☐ Yes	☑ No		21. Was the quote number listed on the container label? If yes, Quote #

Sample Preservation (Must be completed for any sample(s) incorrectly preserved or with headspace.)

Sample(s) NA were received incorrectly preserved and were adjusted accordingly in sample receiving with NA mL of circle one: H2SO4, HNO3, HCl, NaOH using SR # NA.
Time of preservation NA. If more than one preservative is needed, please note in the comments below.

Sample(s) NA were received with bubbles >6 mm in diameter.

Samples(s) NA were received with TRC > 0.5 mg/L (If #19 is *no*) and were adjusted accordingly in sample receiving with sodium thiosulfate ($Na_2S_2O_3$) with Shealy ID: NA.

SR barcode labels applied by: KDRW Date: 10/01/2021

Comments:

Report of Analysis

Arcadis U.S., Inc.
630 Plaza Drive
Suite 600
Highlands Ranch, CO 80129
Attention: Joseph Quinnan

Project Name: Eielson AFB

Project Number: 30030317

Lot Number:**WI28011**

Date Completed:10/07/2021

10/07/2021 4:30 PM
Approved and released by:
Project Manager II: **Kathy E. Smith**

The electronic signature above is the equivalent of a handwritten signature.
This report shall not be reproduced, except in its entirety, without the written approval of Pace Analytical Services, LLC.

Pace Analytical Services, LLC (*formerly Shealy Environmental Services, Inc.*)
106 Vantage Point Drive West Columbia, SC 29172
Tel: 803-791-9700 Fax: 803-791-9111 www.pacelabs.com

Case Narrative
Arcadis U.S., Inc.
Lot Number: WI28011

This Report of Analysis contains the analytical result(s) for the sample(s) listed on the Sample Summary following this Case Narrative. The sample receiving date is documented in the header information associated with each sample.

All results listed in this report relate only to the samples that are contained within this report.

Sample receipt, sample analysis, and data review have been performed in accordance with the Pace Quality Assurance Management Plan (QAMP), applicable Shealy standard operating procedures (SOPs), the 2003 NELAC standard, and Shealy policies. Additionally, the DoD QSM version 5.3 has been followed for these samples, and specifically Table B-15 was followed for all PFAS samples. Any exceptions to the QAMP, SOPs, NELAC standards, the DoD QSM, or policies are qualified on the results page or discussed below.

Correction factors (CF) are used to calculate the original sample concentration. The CF is the inverse of the concentration factor (sample volume / extract final volume) times the dilution factor (DF). For undiluted analysis. The extract is prepared for injection by adding 182 uL of sample extract + 8 uL of reagent water + 10 uL of internal standard solution to a polypropylene autosampler vial. An extra correction factor of 0.91 (182 uL / 200 uL = 0.91) applies. The CF is calculated as follows:

For solid samples:

CF = DF * FV / Ws/S/1000

FV is volume of extract (mL)
Ws is initial sample weight (gram)
S is %Solids
DF is dilution factor. For undiluted analysis, DF = 1/0.91.

Concentration (ug/kg) = Cs*CF,

$$C_s = \frac{\left(\frac{(A_s x C_{is})}{A_{is}}\right) - B}{M1}$$

Where

C_s is on column concentration of target analyte in the sample (ng/L)
C_{is} is concentration of internal standard in the sample (ng/L)
A_s is peak response of target analyte in the sample
A_{is} is peak response of internal standard in the sample
M1 is the average RF from ICAL or the slope from linear regression ICAL
B is the y-intercept from the ICAL

Pace is a TNI accredited laboratory; however, the following analyses are currently not listed on our TNI scope of accreditation:

Biological Tissue: All, Non-Potable Water: SGT-HEM EPA 1664B, Silica EPA 200.7, Boron, Calcium, Silicon, Strontium EPA 200.8, Bicarbonate, Carbonate, and Hydroxide Alkalinity SM 2320 B-2011, Fecal Coliform SM 9221 C E-2006 & SM 9222D-2006, Strontium SW-846 6010D, VOC SM 6200 B-2011, Drinking Water: VOC (excluding BTEX, MTBE, Naphthalene, & 1,2-dichloroethane) EPA 524.2, Solid Chemical Material: TOC Walkley-Black.

If you have any questions regarding this report please contact the Pace Project Manager listed on the cover page.

Samples WI28011-002 required centrifugation prior to extraction, due to excessive solids present in the samples. Centrifugation was performed following the PFAS Aqueous Centrifuge Protocol; samples were spiked with Surrogate (SUR; Extracted Internal Standard/EIS) and shaken vigorously before being poured into a conical bottle and centrifuged. The centrifuged aqueous sample was decanted back into the original sample bottle, off of the condensed solids remaining in the centrifuge bottle. Original sample bottle was rinsed as normal and centrifuge bottle was rinsed with 4mL of MeOH. Centrifuge bottle rinsate was added to the elution. Samples concentrated to <10mL and reconstituted to 10mL using MeOH by transfer pipet.

Surrogate recovery for the following samples was outside the upper control limit: WI28011-001, WI28011-003. This sample did not contain any target analytes; therefore, re-extraction and/or re-analysis was not performed.

Surrogate recovery for the following sample was outside control limits: WI28011-002. Evidence of matrix interference is present; therefore, re-extraction and/or re-analysis was not performed.

The laboratory control sample (LCS) and / or laboratory control sample duplicate (LCSD) for prep batch 16953 exceeded acceptance criteria for the following analytes: 6:2 FTS, PFDOA. These analytes were biased high and were not detected in the samples; the data has been reported.

Sample Summary

Arcadis U.S., Inc.

Lot Number: WI28011

Project Name: Eielson AFB

Project Number: 30030317

Sample Number	Sample ID	Matrix	Date Sampled	Date Received
001	393-1-T-W	Aqueous	09/23/2021 1700	09/28/2021
002	393-1-UT-W	Aqueous	09/23/2021 1730	09/28/2021
003	DUP-05	Aqueous	09/23/2021	09/28/2021

(3 samples)

Detection Summary

Arcadis U.S., Inc.

Lot Number: WI28011

Project Name: Eielson AFB

Project Number: 30030317

Sample	Sample ID	Matrix	Parameter	Method	Result	Q	Units	Page
001	393-1-T-W	Aqueous	PFDS	PFAS by ID	1.4	J	ng/L	7
001	393-1-T-W	Aqueous	PFHxS	PFAS by ID	1.6	J	ng/L	7
001	393-1-T-W	Aqueous	PFOS	PFAS by ID	25		ng/L	7
002	393-1-UT-W	Aqueous	8:2 FTS	PFAS by ID	1100		ng/L	10
002	393-1-UT-W	Aqueous	6:2 FTS	PFAS by ID	320	L	ng/L	10
002	393-1-UT-W	Aqueous	EtFOSAA	PFAS by ID	6.9	J	ng/L	10
002	393-1-UT-W	Aqueous	MeFOSAA	PFAS by ID	6.4	J	ng/L	10
002	393-1-UT-W	Aqueous	PFBS	PFAS by ID	86		ng/L	10
002	393-1-UT-W	Aqueous	PFDS	PFAS by ID	120	Q	ng/L	10
002	393-1-UT-W	Aqueous	PFHpS	PFAS by ID	23		ng/L	10
002	393-1-UT-W	Aqueous	PFNS	PFAS by ID	320	Q	ng/L	10
002	393-1-UT-W	Aqueous	PFOSA	PFAS by ID	680		ng/L	10
002	393-1-UT-W	Aqueous	PFPeS	PFAS by ID	110		ng/L	10
002	393-1-UT-W	Aqueous	PFHxS	PFAS by ID	1200		ng/L	10
002	393-1-UT-W	Aqueous	PFBA	PFAS by ID	51		ng/L	10
002	393-1-UT-W	Aqueous	PFDA	PFAS by ID	120		ng/L	10
002	393-1-UT-W	Aqueous	PFDoA	PFAS by ID	15	L	ng/L	10
002	393-1-UT-W	Aqueous	PFHpA	PFAS by ID	67		ng/L	10
002	393-1-UT-W	Aqueous	PFHxA	PFAS by ID	430		ng/L	10
002	393-1-UT-W	Aqueous	PFNA	PFAS by ID	38	Q	ng/L	10
002	393-1-UT-W	Aqueous	PFOA	PFAS by ID	200		ng/L	10
002	393-1-UT-W	Aqueous	PFPeA	PFAS by ID	180		ng/L	10
002	393-1-UT-W	Aqueous	PFTeDA	PFAS by ID	2.3	J	ng/L	10
002	393-1-UT-W	Aqueous	PFTrDA	PFAS by ID	3.3	J	ng/L	10
002	393-1-UT-W	Aqueous	PFUdA	PFAS by ID	34		ng/L	10
002	393-1-UT-W	Aqueous	PFOS	PFAS by ID	26000		ng/L	10
003	DUP-05	Aqueous	8:2 FTS	PFAS by ID	2.0	J	ng/L	13
003	DUP-05	Aqueous	PFDS	PFAS by ID	1.2	J	ng/L	13
003	DUP-05	Aqueous	PFHxS	PFAS by ID	1.9	J	ng/L	13
003	DUP-05	Aqueous	PFOS	PFAS by ID	26		ng/L	13

(30 detections)

Semivolatile Organic Compounds by GC/MS

Client: Arcadis U.S., Inc. | Laboratory ID: WI28011-001
Description: 393-1-T-W | Matrix: Aqueous
Date Sampled: 09/23/2021 1700 | Project Name: Eielson AFB
Date Received: 09/28/2021 | Project Number: 30030317

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch
1	3520C	8270E	1	10/01/2021 1914	SCD	09/30/2021 1630	17207

Parameter	CAS Number	Analytical Method	Result	Q	LOQ	LOD	DL	Units	Run
Acenaphthene	83-32-9	8270E	0.10	U	0.20	0.10	0.040	ug/L	1
Acenaphthylene	208-96-8	8270E	0.10	U	0.20	0.10	0.040	ug/L	1
Anthracene	120-12-7	8270E	0.10	U	0.20	0.10	0.040	ug/L	1
Benzo(a)anthracene	56-55-3	8270E	0.10	U	0.20	0.10	0.040	ug/L	1
Benzo(a)pyrene	50-32-8	8270E	0.10	U	0.20	0.10	0.040	ug/L	1
Benzo(b)fluoranthene	205-99-2	8270E	0.10	U	0.20	0.10	0.040	ug/L	1
Benzo(g,h,i)perylene	191-24-2	8270E	0.10	U	0.20	0.10	0.040	ug/L	1
Benzo(k)fluoranthene	207-08-9	8270E	0.10	U	0.20	0.10	0.040	ug/L	1
Chrysene	218-01-9	8270E	0.10	U	0.20	0.10	0.040	ug/L	1
Dibenzo(a,h)anthracene	53-70-3	8270E	0.10	U	0.20	0.10	0.040	ug/L	1
Fluoranthene	206-44-0	8270E	0.10	U	0.20	0.10	0.040	ug/L	1
Fluorene	86-73-7	8270E	0.10	U	0.20	0.10	0.040	ug/L	1
Indeno(1,2,3-c,d)pyrene	193-39-5	8270E	0.10	U	0.20	0.10	0.040	ug/L	1
1-Methylnaphthalene	90-12-0	8270E	0.10	U	0.20	0.10	0.040	ug/L	1
2-Methylnaphthalene	91-57-6	8270E	0.10	U	0.20	0.10	0.040	ug/L	1
Naphthalene	91-20-3	8270E	0.10	U	0.20	0.10	0.040	ug/L	1
Phenanthrene	85-01-8	8270E	0.10	U	0.20	0.10	0.040	ug/L	1
Pyrene	129-00-0	8270E	0.10	U	0.20	0.10	0.040	ug/L	1

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
2-Fluorobiphenyl		86	44-119
Nitrobenzene-d5		79	44-120
Terphenyl-d14		109	50-134

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

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PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: WI28011-001
Description: 393-1-T-W | Matrix: Aqueous
Date Sampled: 09/23/2021 1700 | Project Name: Eielson AFB
Date Received: 09/28/2021 | Project Number: 30030317

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch
1	SOP SPE	PFAS by ID SOP QSM B-15	1	09/30/2021 1155	MMM	09/29/2021 1219	16953

Parameter	CAS Number	Analytical Method	Result	Q	LOQ	LOD	DL	Units	Run
1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS)	39108-34-4	PFAS by ID SOP	3.4	U	6.8	3.4	1.7	ng/L	1
1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS)	27619-97-2	PFAS by ID SOP	3.4	UQL	6.8	3.4	1.7	ng/L	1
1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS)	757124-72-4	PFAS by ID SOP	3.4	U	6.8	3.4	1.7	ng/L	1
N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA)	2991-50-6	PFAS by ID SOP	3.4	U	6.8	3.4	1.7	ng/L	1
N-methylperfluoro-1-octanesulfonamide (MeFOSA)	31506-32-8	PFAS by ID SOP	7.0	U	14	7.0	3.4	ng/L	1
N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA)	2355-31-9	PFAS by ID SOP	3.4	U	6.8	3.4	1.7	ng/L	1
Perfluoro-1-butanesulfonic acid (PFBS)	375-73-5	PFAS by ID SOP	1.7	U	3.4	1.7	0.85	ng/L	1
Perfluoro-1-decanesulfonic acid (PFDS)	335-77-3	PFAS by ID SOP	1.4	J	3.4	1.7	0.85	ng/L	1
Perfluoro-1-heptanesulfonic acid (PFHpS)	375-92-8	PFAS by ID SOP	1.7	U	3.4	1.7	0.85	ng/L	1
Perfluoro-1-nonanesulfonic acid (PFNS)	68259-12-1	PFAS by ID SOP	1.7	U	3.4	1.7	0.85	ng/L	1
Perfluoro-1-octanesulfonamide (PFOSA)	754-91-6	PFAS by ID SOP	1.7	U	3.4	1.7	0.85	ng/L	1
Perfluoro-1-pentanesulfonic acid (PFPeS)	2706-91-4	PFAS by ID SOP	1.7	U	3.4	1.7	0.85	ng/L	1
Perfluorohexanesulfonic acid (PFHxS)	355-46-4	PFAS by ID SOP	1.6	J	3.4	1.7	0.85	ng/L	1
Perfluoro-n-butanoic acid (PFBA)	375-22-4	PFAS by ID SOP	1.7	U	3.4	1.7	0.85	ng/L	1
Perfluoro-n-decanoic acid (PFDA)	335-76-2	PFAS by ID SOP	1.7	U	3.4	1.7	0.85	ng/L	1
Perfluoro-n-dodecanoic acid (PFDoA)	307-55-1	PFAS by ID SOP	1.7	UL	3.4	1.7	0.85	ng/L	1
Perfluoro-n-heptanoic acid (PFHpA)	375-85-9	PFAS by ID SOP	1.7	U	3.4	1.7	0.85	ng/L	1
Perfluoro-n-hexanoic acid (PFHxA)	307-24-4	PFAS by ID SOP	1.7	U	3.4	1.7	0.85	ng/L	1
Perfluoro-n-nonanoic acid (PFNA)	375-95-1	PFAS by ID SOP	1.7	U	3.4	1.7	0.85	ng/L	1
Perfluoro-n-octanoic acid (PFOA)	335-67-1	PFAS by ID SOP	1.7	U	3.4	1.7	0.85	ng/L	1
Perfluoro-n-pentanoic acid (PFPeA)	2706-90-3	PFAS by ID SOP	1.7	U	3.4	1.7	0.85	ng/L	1
Perfluoro-n-tetradecanoic acid (PFTeDA)	376-06-7	PFAS by ID SOP	1.7	U	3.4	1.7	0.85	ng/L	1
Perfluoro-n-tridecanoic acid (PFTrDA)	72629-94-8	PFAS by ID SOP	1.7	U	3.4	1.7	0.85	ng/L	1
Perfluoro-n-undecanoic acid (PFUdA)	2058-94-8	PFAS by ID SOP	1.7	U	3.4	1.7	0.85	ng/L	1
Perfluorooctanesulfonic acid (PFOS)	1763-23-1	PFAS by ID SOP	25		3.4	1.7	0.85	ng/L	1

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
13C2_4:2FTS		103	50-150
13C2_6:2FTS	N	163	50-150
13C2_8:2FTS		90	50-150
13C2_PFDoA		66	50-150
13C2_PFTeDA		65	50-150
13C3_PFBS		96	50-150
13C3_PFHxS		99	50-150
13C4_PFBA		92	50-150
13C4_PFHpA		105	50-150
13C5_PFHxA		100	50-150
13C5_PFPeA		98	50-150
13C6_PFDA		90	50-150
13C7_PFUdA		79	50-150
13C8_PFOA		105	50-150
13C8_PFOS		88	50-150
13C8_PFOSA		107	50-150
13C9_PFNA		100	50-150

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

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PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.		Laboratory ID: WI28011-001	
Description: 393-1-T-W		Matrix: Aqueous	
Date Sampled: 09/23/2021 1700	Project Name: Eielson AFB		
Date Received: 09/28/2021	Project Number: 30030317		

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
d5-EtFOSAA		79	50-150
d-MeFOSA		93	50-150
d3-MeFOSAA		83	50-150

LOQ = Limit of Quantitation	B = Detected in the method blank	E = Quantitation of compound exceeded the calibration range	DL = Detection Limit	Q = Surrogate failure
U = Not detected at or above the LOQ	N = Recovery is out of criteria	P = The RPD between two GC columns exceeds 40%	J = Estimated result < LOQ and ≥ DL	L = LCS/LCSD failure
H = Out of holding time	W = Reported on wet weight basis	LOD = Limit of Detection		S = MS/MSD failure

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Semivolatile Organic Compounds by GC/MS

Client: Arcadis U.S., Inc. | Laboratory ID: WI28011-002
Description: 393-1-UT-W | Matrix: Aqueous
Date Sampled: 09/23/2021 1730 | Project Name: Eielson AFB
Date Received: 09/28/2021 | Project Number: 30030317

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch
1	3520C	8270E	1	10/01/2021 1938	SCD	09/30/2021 1630	17207

Parameter	CAS Number	Analytical Method	Result	Q	LOQ	LOD	DL	Units	Run
Acenaphthene	83-32-9	8270E	0.10	U	0.20	0.10	0.040	ug/L	1
Acenaphthylene	208-96-8	8270E	0.10	U	0.20	0.10	0.040	ug/L	1
Anthracene	120-12-7	8270E	0.10	U	0.20	0.10	0.040	ug/L	1
Benzo(a)anthracene	56-55-3	8270E	0.10	U	0.20	0.10	0.040	ug/L	1
Benzo(a)pyrene	50-32-8	8270E	0.10	U	0.20	0.10	0.040	ug/L	1
Benzo(b)fluoranthene	205-99-2	8270E	0.10	U	0.20	0.10	0.040	ug/L	1
Benzo(g,h,i)perylene	191-24-2	8270E	0.10	U	0.20	0.10	0.040	ug/L	1
Benzo(k)fluoranthene	207-08-9	8270E	0.10	U	0.20	0.10	0.040	ug/L	1
Chrysene	218-01-9	8270E	0.10	U	0.20	0.10	0.040	ug/L	1
Dibenzo(a,h)anthracene	53-70-3	8270E	0.10	U	0.20	0.10	0.040	ug/L	1
Fluoranthene	206-44-0	8270E	0.10	U	0.20	0.10	0.040	ug/L	1
Fluorene	86-73-7	8270E	0.10	U	0.20	0.10	0.040	ug/L	1
Indeno(1,2,3-c,d)pyrene	193-39-5	8270E	0.10	U	0.20	0.10	0.040	ug/L	1
1-Methylnaphthalene	90-12-0	8270E	0.10	U	0.20	0.10	0.040	ug/L	1
2-Methylnaphthalene	91-57-6	8270E	0.10	U	0.20	0.10	0.040	ug/L	1
Naphthalene	91-20-3	8270E	0.10	U	0.20	0.10	0.040	ug/L	1
Phenanthrene	85-01-8	8270E	0.10	U	0.20	0.10	0.040	ug/L	1
Pyrene	129-00-0	8270E	0.10	U	0.20	0.10	0.040	ug/L	1

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
2-Fluorobiphenyl		83	44-119
Nitrobenzene-d5		79	44-120
Terphenyl-d14		91	50-134

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
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PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: WI28011-002
Description: 393-1-UT-W | Matrix: Aqueous
Date Sampled: 09/23/2021 1730 | Project Name: Eielson AFB
Date Received: 09/28/2021 | Project Number: 30030317

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch
1	SOP SPE	PFAS by ID SOP QSM B-15	1	09/30/2021 1206	MMM	09/29/2021 1219	16953
2	SOP SPE	PFAS by ID SOP QSM B-15	100	09/30/2021 1724	MMM	09/29/2021 1219	16953

Parameter	CAS Number	Analytical Method	Result	Q	LOQ	LOD	DL	Units	Run
1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS)	39108-34-4	PFAS by ID SOP	1100		710	360	180	ng/L	2
1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS)	27619-97-2	PFAS by ID SOP	320	L	7.1	3.6	1.8	ng/L	1
1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS)	757124-72-4	PFAS by ID SOP	3.6	U	7.1	3.6	1.8	ng/L	1
N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA)	2991-50-6	PFAS by ID SOP	6.9	J	7.1	3.6	1.8	ng/L	1
N-methylperfluoro-1-octanesulfonamide (MeFOSA)	31506-32-8	PFAS by ID SOP	7.0	U	14	7.0	3.5	ng/L	1
N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA)	2355-31-9	PFAS by ID SOP	6.4	J	7.1	3.6	1.8	ng/L	1
Perfluoro-1-butanesulfonic acid (PFBS)	375-73-5	PFAS by ID SOP	86		3.5	1.8	0.88	ng/L	1
Perfluoro-1-decanesulfonic acid (PFDS)	335-77-3	PFAS by ID SOP	120	Q	3.5	1.8	0.88	ng/L	1
Perfluoro-1-heptanesulfonic acid (PFHpS)	375-92-8	PFAS by ID SOP	23		3.5	1.8	0.88	ng/L	1
Perfluoro-1-nonanesulfonic acid (PFNS)	68259-12-1	PFAS by ID SOP	320	Q	3.5	1.8	0.88	ng/L	1
Perfluoro-1-octanesulfonamide (PFOSA)	754-91-6	PFAS by ID SOP	680		3.5	1.8	0.88	ng/L	1
Perfluoro-1-pentanesulfonic acid (PFPeS)	2706-91-4	PFAS by ID SOP	110		3.5	1.8	0.88	ng/L	1
Perfluorohexanesulfonic acid (PFHxS)	355-46-4	PFAS by ID SOP	1200		350	180	88	ng/L	2
Perfluoro-n-butanoic acid (PFBA)	375-22-4	PFAS by ID SOP	51		3.5	1.8	0.88	ng/L	1
Perfluoro-n-decanoic acid (PFDA)	335-76-2	PFAS by ID SOP	120		3.5	1.8	0.88	ng/L	1
Perfluoro-n-dodecanoic acid (PFDoA)	307-55-1	PFAS by ID SOP	15	L	3.5	1.8	0.88	ng/L	1
Perfluoro-n-heptanoic acid (PFHpA)	375-85-9	PFAS by ID SOP	67		3.5	1.8	0.88	ng/L	1
Perfluoro-n-hexanoic acid (PFHxA)	307-24-4	PFAS by ID SOP	430		3.5	1.8	0.88	ng/L	1
Perfluoro-n-nonanoic acid (PFNA)	375-95-1	PFAS by ID SOP	38	Q	3.5	1.8	0.88	ng/L	1
Perfluoro-n-octanoic acid (PFOA)	335-67-1	PFAS by ID SOP	200		3.5	1.8	0.88	ng/L	1
Perfluoro-n-pentanoic acid (PFPeA)	2706-90-3	PFAS by ID SOP	180		3.5	1.8	0.88	ng/L	1
Perfluoro-n-tetradecanoic acid (PFTeDA)	376-06-7	PFAS by ID SOP	2.3	J	3.5	1.8	0.88	ng/L	1
Perfluoro-n-tridecanoic acid (PFTrDA)	72629-94-8	PFAS by ID SOP	3.3	J	3.5	1.8	0.88	ng/L	1
Perfluoro-n-undecanoic acid (PFUdA)	2058-94-8	PFAS by ID SOP	34		3.5	1.8	0.88	ng/L	1
Perfluorooctanesulfonic acid (PFOS)	1763-23-1	PFAS by ID SOP	26000		350	180	88	ng/L	2

Surrogate	Run 1 Q	Run 1 % Recovery	Run 1 Acceptance Limits	Run 2 Q	Run 2 % Recovery	Run 2 Acceptance Limits
13C2_4:2FTS		90	50-150		109	50-150
13C2_6:2FTS		96	50-150		111	50-150
13C2_8:2FTS		84	50-150		104	50-150
13C2_PFDoA		64	50-150		102	50-150
13C2_PFTeDA		56	50-150		118	50-150
13C3_PFBS		87	50-150		103	50-150
13C3_PFHxS		76	50-150		101	50-150
13C4_PFBA		92	50-150		98	50-150
13C4_PFHpA		91	50-150		109	50-150
13C5_PFHxA		93	50-150		100	50-150
13C5_PFPeA		92	50-150		103	50-150
13C6_PFDA		79	50-150		110	50-150
13C7_PFUdA		76	50-150		102	50-150
13C8_PFOA		88	50-150		105	50-150
13C8_PFOS	N	30	50-150		98	50-150
13C8_PFOSA		94	50-150		100	50-150

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

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PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.
Laboratory ID: WI28011-002
Description: 393-1-UT-W
Matrix: Aqueous
Date Sampled: 09/23/2021 1730
Project Name: Eielson AFB
Date Received: 09/28/2021
Project Number: 30030317

Surrogate	Q	Run 1 % Recovery	Acceptance Limits	Q	Run 2 % Recovery	Acceptance Limits
13C9_PFNA	N	35	50-150		96	50-150
d5-EtFOSAA		77	50-150		108	50-150
d-MeFOSA		90	50-150		98	50-150
d3-MeFOSAA		73	50-150		108	50-150

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

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Semivolatile Organic Compounds by GC/MS

Client: Arcadis U.S., Inc. | Laboratory ID: WI28011-003
Description: DUP-05 | Matrix: Aqueous
Date Sampled: 09/23/2021 | Project Name: Eielson AFB
Date Received: 09/28/2021 | Project Number: 30030317

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch
1	3520C	8270E	1	10/01/2021 2003	SCD	09/30/2021 1630	17207

Parameter	CAS Number	Analytical Method	Result	Q	LOQ	LOD	DL	Units	Run
Acenaphthene	83-32-9	8270E	0.10	U	0.20	0.10	0.040	ug/L	1
Acenaphthylene	208-96-8	8270E	0.10	U	0.20	0.10	0.040	ug/L	1
Anthracene	120-12-7	8270E	0.10	U	0.20	0.10	0.040	ug/L	1
Benzo(a)anthracene	56-55-3	8270E	0.10	U	0.20	0.10	0.040	ug/L	1
Benzo(a)pyrene	50-32-8	8270E	0.10	U	0.20	0.10	0.040	ug/L	1
Benzo(b)fluoranthene	205-99-2	8270E	0.10	U	0.20	0.10	0.040	ug/L	1
Benzo(g,h,i)perylene	191-24-2	8270E	0.10	U	0.20	0.10	0.040	ug/L	1
Benzo(k)fluoranthene	207-08-9	8270E	0.10	U	0.20	0.10	0.040	ug/L	1
Chrysene	218-01-9	8270E	0.10	U	0.20	0.10	0.040	ug/L	1
Dibenzo(a,h)anthracene	53-70-3	8270E	0.10	U	0.20	0.10	0.040	ug/L	1
Fluoranthene	206-44-0	8270E	0.10	U	0.20	0.10	0.040	ug/L	1
Fluorene	86-73-7	8270E	0.10	U	0.20	0.10	0.040	ug/L	1
Indeno(1,2,3-c,d)pyrene	193-39-5	8270E	0.10	U	0.20	0.10	0.040	ug/L	1
1-Methylnaphthalene	90-12-0	8270E	0.10	U	0.20	0.10	0.040	ug/L	1
2-Methylnaphthalene	91-57-6	8270E	0.10	U	0.20	0.10	0.040	ug/L	1
Naphthalene	91-20-3	8270E	0.10	U	0.20	0.10	0.040	ug/L	1
Phenanthrene	85-01-8	8270E	0.10	U	0.20	0.10	0.040	ug/L	1
Pyrene	129-00-0	8270E	0.10	U	0.20	0.10	0.040	ug/L	1

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
2-Fluorobiphenyl		77	44-119
Nitrobenzene-d5		72	44-120
Terphenyl-d14		101	50-134

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

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PFAS by LC/MS/MS

Client: Arcadis U.S., Inc. | Laboratory ID: WI28011-003
Description: DUP-05 | Matrix: Aqueous
Date Sampled: 09/23/2021 | Project Name: Eielson AFB
Date Received: 09/28/2021 | Project Number: 30030317

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch
1	SOP SPE	PFAS by ID SOP QSM B-15	1	09/30/2021 1216	MMM	09/29/2021 1219	16953

Parameter	CAS Number	Analytical Method	Result	Q	LOQ	LOD	DL	Units	Run
1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS)	39108-34-4	PFAS by ID SOP	2.0	J	7.2	3.6	1.8	ng/L	1
1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS)	27619-97-2	PFAS by ID SOP	3.6	UQL	7.2	3.6	1.8	ng/L	1
1H,1H,2H,2H-perfluorohexane sulfonic acid (4:2 FTS)	757124-72-4	PFAS by ID SOP	3.6	U	7.2	3.6	1.8	ng/L	1
N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA)	2991-50-6	PFAS by ID SOP	3.6	U	7.2	3.6	1.8	ng/L	1
N-methylperfluoro-1-octanesulfonamide (MeFOSA)	31506-32-8	PFAS by ID SOP	7.0	U	14	7.0	3.6	ng/L	1
N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA)	2355-31-9	PFAS by ID SOP	3.6	U	7.2	3.6	1.8	ng/L	1
Perfluoro-1-butanesulfonic acid (PFBS)	375-73-5	PFAS by ID SOP	1.8	U	3.6	1.8	0.91	ng/L	1
Perfluoro-1-decanesulfonic acid (PFDS)	335-77-3	PFAS by ID SOP	1.2	J	3.6	1.8	0.91	ng/L	1
Perfluoro-1-heptanesulfonic acid (PFHpS)	375-92-8	PFAS by ID SOP	1.8	U	3.6	1.8	0.91	ng/L	1
Perfluoro-1-nonanesulfonic acid (PFNS)	68259-12-1	PFAS by ID SOP	1.8	U	3.6	1.8	0.91	ng/L	1
Perfluoro-1-octanesulfonamide (PFOSA)	754-91-6	PFAS by ID SOP	1.8	U	3.6	1.8	0.91	ng/L	1
Perfluoro-1-pentanesulfonic acid (PFPeS)	2706-91-4	PFAS by ID SOP	1.8	U	3.6	1.8	0.91	ng/L	1
Perfluorohexanesulfonic acid (PFHxS)	355-46-4	PFAS by ID SOP	1.9	J	3.6	1.8	0.91	ng/L	1
Perfluoro-n-butanoic acid (PFBA)	375-22-4	PFAS by ID SOP	1.8	U	3.6	1.8	0.91	ng/L	1
Perfluoro-n-decanoic acid (PFDA)	335-76-2	PFAS by ID SOP	1.8	U	3.6	1.8	0.91	ng/L	1
Perfluoro-n-dodecanoic acid (PFDoA)	307-55-1	PFAS by ID SOP	1.8	UL	3.6	1.8	0.91	ng/L	1
Perfluoro-n-heptanoic acid (PFHpA)	375-85-9	PFAS by ID SOP	1.8	U	3.6	1.8	0.91	ng/L	1
Perfluoro-n-hexanoic acid (PFHxA)	307-24-4	PFAS by ID SOP	1.8	U	3.6	1.8	0.91	ng/L	1
Perfluoro-n-nonanoic acid (PFNA)	375-95-1	PFAS by ID SOP	1.8	U	3.6	1.8	0.91	ng/L	1
Perfluoro-n-octanoic acid (PFOA)	335-67-1	PFAS by ID SOP	1.8	U	3.6	1.8	0.91	ng/L	1
Perfluoro-n-pentanoic acid (PFPeA)	2706-90-3	PFAS by ID SOP	1.8	U	3.6	1.8	0.91	ng/L	1
Perfluoro-n-tetradecanoic acid (PFTeDA)	376-06-7	PFAS by ID SOP	1.8	U	3.6	1.8	0.91	ng/L	1
Perfluoro-n-tridecanoic acid (PFTrDA)	72629-94-8	PFAS by ID SOP	1.8	U	3.6	1.8	0.91	ng/L	1
Perfluoro-n-undecanoic acid (PFUdA)	2058-94-8	PFAS by ID SOP	1.8	U	3.6	1.8	0.91	ng/L	1
Perfluorooctanesulfonic acid (PFOS)	1763-23-1	PFAS by ID SOP	26		3.6	1.8	0.91	ng/L	1

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
13C2_4:2FTS		123	50-150
13C2_6:2FTS	N	160	50-150
13C2_8:2FTS		103	50-150
13C2_PFDoA		80	50-150
13C2_PFTeDA		80	50-150
13C3_PFBS		105	50-150
13C3_PFHxS		97	50-150
13C4_PFBA		100	50-150
13C4_PFHpA		106	50-150
13C5_PFHxA		102	50-150
13C5_PFPeA		107	50-150
13C6_PFDA		103	50-150
13C7_PFUdA		85	50-150
13C8_PFOA		118	50-150
13C8_PFOS		96	50-150
13C8_PFOSA		134	50-150
13C9_PFNA		106	50-150

LOQ = Limit of Quantitation
U = Not detected at or above the LOQ
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
LOD = Limit of Detection
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

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PFAS by LC/MS/MS

Client: Arcadis U.S., Inc.		Laboratory ID: WI28011-003	
Description: DUP-05		Matrix: Aqueous	
Date Sampled: 09/23/2021	Project Name: Eielson AFB		
Date Received: 09/28/2021	Project Number: 30030317		

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
d5-EtFOSAA		87	50-150
d-MeFOSA		99	50-150
d3-MeFOSAA		100	50-150

LOQ = Limit of Quantitation	B = Detected in the method blank	E = Quantitation of compound exceeded the calibration range	DL = Detection Limit	Q = Surrogate failure
U = Not detected at or above the LOQ	N = Recovery is out of criteria	P = The RPD between two GC columns exceeds 40%	J = Estimated result < LOQ and ≥ DL	L = LCS/LCSD failure
H = Out of holding time	W = Reported on wet weight basis	LOD = Limit of Detection		S = MS/MSD failure

QC Summary

Semivolatile Organic Compounds by GC/MS - MB

Sample ID: WQ17207-001
Batch: 17207
Analytical Method: 8270E

Matrix: Aqueous
Prep Method: 3520C
Prep Date: 09/30/2021 1630

Parameter	Result	Q	Dil	LOQ	LOD	DL	Units	Analysis Date
Acenaphthene	0.10	U	1	0.20	0.10	0.040	ug/L	10/01/2021 1824
Acenaphthylene	0.10	U	1	0.20	0.10	0.040	ug/L	10/01/2021 1824
Anthracene	0.10	U	1	0.20	0.10	0.040	ug/L	10/01/2021 1824
Benzo(a)anthracene	0.10	U	1	0.20	0.10	0.040	ug/L	10/01/2021 1824
Benzo(a)pyrene	0.10	U	1	0.20	0.10	0.040	ug/L	10/01/2021 1824
Benzo(b)fluoranthene	0.10	U	1	0.20	0.10	0.040	ug/L	10/01/2021 1824
Benzo(g,h,i)perylene	0.10	U	1	0.20	0.10	0.040	ug/L	10/01/2021 1824
Benzo(k)fluoranthene	0.10	U	1	0.20	0.10	0.040	ug/L	10/01/2021 1824
Chrysene	0.10	U	1	0.20	0.10	0.040	ug/L	10/01/2021 1824
Dibenzo(a,h)anthracene	0.10	U	1	0.20	0.10	0.040	ug/L	10/01/2021 1824
Fluoranthene	0.10	U	1	0.20	0.10	0.040	ug/L	10/01/2021 1824
Fluorene	0.10	U	1	0.20	0.10	0.040	ug/L	10/01/2021 1824
Indeno(1,2,3-c,d)pyrene	0.10	U	1	0.20	0.10	0.040	ug/L	10/01/2021 1824
1-Methylnaphthalene	0.10	U	1	0.20	0.10	0.040	ug/L	10/01/2021 1824
2-Methylnaphthalene	0.10	U	1	0.20	0.10	0.040	ug/L	10/01/2021 1824
Naphthalene	0.10	U	1	0.20	0.10	0.040	ug/L	10/01/2021 1824
Phenanthrene	0.10	U	1	0.20	0.10	0.040	ug/L	10/01/2021 1824
Pyrene	0.10	U	1	0.20	0.10	0.040	ug/L	10/01/2021 1824

Surrogate	Q	% Rec	Acceptance Limit
2-Fluorobiphenyl		91	44-119
Nitrobenzene-d5		87	44-120
Terphenyl-d14		115	50-134

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

Semivolatile Organic Compounds by GC/MS - LCS

Sample ID: WQ17207-002
Batch: 17207
Analytical Method: 8270E

Matrix: Aqueous
Prep Method: 3520C
Prep Date: 09/30/2021 1630

Parameter	Spike Amount (ug/L)	Result (ug/L)	Q	Dil	% Rec	%Rec Limit	Analysis Date
Acenaphthene	8.0	7.3		1	91	47-122	10/01/2021 1849
Acenaphthylene	8.0	7.9		1	98	41-130	10/01/2021 1849
Anthracene	8.0	7.4		1	93	57-123	10/01/2021 1849
Benzo(a)anthracene	8.0	7.4		1	93	58-125	10/01/2021 1849
Benzo(a)pyrene	8.0	7.4		1	92	54-128	10/01/2021 1849
Benzo(b)fluoranthene	8.0	7.6		1	95	53-131	10/01/2021 1849
Benzo(g,h,i)perylene	8.0	7.5		1	94	50-134	10/01/2021 1849
Benzo(k)fluoranthene	8.0	8.1		1	101	57-129	10/01/2021 1849
Chrysene	8.0	8.1		1	101	59-123	10/01/2021 1849
Dibenzo(a,h)anthracene	8.0	7.2		1	90	51-134	10/01/2021 1849
Fluoranthene	8.0	7.4		1	92	57-128	10/01/2021 1849
Fluorene	8.0	7.2		1	90	52-124	10/01/2021 1849
Indeno(1,2,3-c,d)pyrene	8.0	7.2		1	91	52-134	10/01/2021 1849
1-Methylnaphthalene	8.0	6.9		1	86	41-119	10/01/2021 1849
2-Methylnaphthalene	8.0	7.4		1	93	40-121	10/01/2021 1849
Naphthalene	8.0	7.3		1	91	40-121	10/01/2021 1849
Phenanthrene	8.0	7.2		1	90	59-120	10/01/2021 1849
Pyrene	8.0	7.9		1	98	57-126	10/01/2021 1849

Surrogate	Q	% Rec	Acceptance Limit
2-Fluorobiphenyl		94	44-119
Nitrobenzene-d5		94	44-120
Terphenyl-d14		103	50-134

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

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PFAS by LC/MS/MS - MB

Sample ID: WQ16953-001
Batch: 16953
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Aqueous
Prep Method: SOP SPE
Prep Date: 09/29/2021 1219

Parameter	Result	Q	Dil	LOQ	LOD	DL	Units	Analysis Date
8:2 FTS	4.0	U	1	8.0	4.0	2.0	ng/L	09/30/2021 1559
6:2 FTS	4.0	U	1	8.0	4.0	2.0	ng/L	09/30/2021 1559
4:2 FTS	4.0	U	1	8.0	4.0	2.0	ng/L	09/30/2021 1559
EtFOSAA	4.0	U	1	8.0	4.0	2.0	ng/L	09/30/2021 1559
MeFOSA	8.0	U	1	16	8.0	4.0	ng/L	09/30/2021 1559
MeFOSAA	4.0	U	1	8.0	4.0	2.0	ng/L	09/30/2021 1559
PFBS	2.0	U	1	4.0	2.0	1.0	ng/L	09/30/2021 1559
PFDS	2.0	U	1	4.0	2.0	1.0	ng/L	09/30/2021 1559
PFHpS	2.0	U	1	4.0	2.0	1.0	ng/L	09/30/2021 1559
PFNS	2.0	U	1	4.0	2.0	1.0	ng/L	09/30/2021 1559
PFOSA	2.0	U	1	4.0	2.0	1.0	ng/L	09/30/2021 1559
PFPeS	2.0	U	1	4.0	2.0	1.0	ng/L	09/30/2021 1559
PFHxS	2.0	U	1	4.0	2.0	1.0	ng/L	09/30/2021 1559
PFBA	2.0	U	1	4.0	2.0	1.0	ng/L	09/30/2021 1559
PFDA	2.0	U	1	4.0	2.0	1.0	ng/L	09/30/2021 1559
PFDoA	2.0	U	1	4.0	2.0	1.0	ng/L	09/30/2021 1559
PFHpA	2.0	U	1	4.0	2.0	1.0	ng/L	09/30/2021 1559
PFHxA	2.0	U	1	4.0	2.0	1.0	ng/L	09/30/2021 1559
PFNA	2.0	U	1	4.0	2.0	1.0	ng/L	09/30/2021 1559
PFOA	2.0	U	1	4.0	2.0	1.0	ng/L	09/30/2021 1559
PFPeA	2.0	U	1	4.0	2.0	1.0	ng/L	09/30/2021 1559
PFTeDA	2.0	U	1	4.0	2.0	1.0	ng/L	09/30/2021 1559
PFTrDA	2.0	U	1	4.0	2.0	1.0	ng/L	09/30/2021 1559
PFUdA	2.0	U	1	4.0	2.0	1.0	ng/L	09/30/2021 1559
PFOS	2.0	U	1	4.0	2.0	1.0	ng/L	09/30/2021 1559

Surrogate	Q	% Rec	Acceptance Limit
13C2_4:2FTS		105	50-150
13C2_6:2FTS		101	50-150
13C2_8:2FTS		95	50-150
13C2_PFDoA		98	50-150
13C2_PFTeDA		100	50-150
13C3_PFBS		88	50-150
13C3_PFHxS		86	50-150
13C4_PFBA		93	50-150
13C4_PFHpA		94	50-150
13C5_PFHxA		93	50-150
13C5_PFPeA		90	50-150
13C6_PFDA		95	50-150
13C7_PFUdA		88	50-150
13C8_PFOA		92	50-150

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

PFAS by LC/MS/MS - MB

Sample ID: WQ16953-001
Batch: 16953
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Aqueous
Prep Method: SOP SPE
Prep Date: 09/29/2021 1219

Surrogate	Q	% Rec	Acceptance Limit
13C8_PFOS		92	50-150
13C8_PFOSA		96	50-150
13C9_PFNA		93	50-150
d5-EtFOSAA		96	50-150
d-MeFOSA		78	50-150
d3-MeFOSAA		100	50-150

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

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PFAS by LC/MS/MS - LCS

Sample ID: WQ16953-002
Batch: 16953
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Aqueous
Prep Method: SOP SPE
Prep Date: 09/29/2021 1219

Parameter	Spike Amount (ng/L)	Result (ng/L)	Q	Dil	% Rec	%Rec Limit	Analysis Date
8:2 FTS	15	18		1	120	67-138	09/30/2021 1609
6:2 FTS	15	27	N	1	179	64-140	09/30/2021 1609
4:2 FTS	15	16		1	108	63-143	09/30/2021 1609
EtFOSAA	16	20		1	125	61-135	09/30/2021 1609
MeFOSA	16	19		1	118	68-141	09/30/2021 1609
MeFOSAA	16	19		1	120	65-136	09/30/2021 1609
PFBS	14	16		1	115	72-130	09/30/2021 1609
PFDS	15	18		1	116	53-142	09/30/2021 1609
PFHpS	15	18		1	116	69-134	09/30/2021 1609
PFNS	15	17		1	112	69-127	09/30/2021 1609
PFOSA	16	18		1	115	67-137	09/30/2021 1609
PFPeS	15	19		1	124	71-127	09/30/2021 1609
PFHxS	15	19		1	131	68-131	09/30/2021 1609
PFBA	16	21		1	129	73-129	09/30/2021 1609
PFDA	16	19		1	120	71-129	09/30/2021 1609
PFDoA	16	22	N	1	135	72-134	09/30/2021 1609
PFHpA	16	20		1	126	72-130	09/30/2021 1609
PFHxA	16	18		1	114	72-129	09/30/2021 1609
PFNA	16	20		1	123	69-130	09/30/2021 1609
PFOA	16	20		1	125	71-133	09/30/2021 1609
PFPeA	16	21		1	128	72-129	09/30/2021 1609
PFTeDA	16	20		1	125	71-132	09/30/2021 1609
PFTrDA	16	18		1	114	65-144	09/30/2021 1609
PFUdA	16	20		1	124	69-133	09/30/2021 1609
PFOS	15	19		1	131	65-140	09/30/2021 1609

Surrogate	Q	% Rec	Acceptance Limit
13C2_4:2FTS		77	50-150
13C2_6:2FTS		75	50-150
13C2_8:2FTS		74	50-150
13C2_PFDoA		72	50-150
13C2_PFTeDA		72	50-150
13C3_PFBS		70	50-150
13C3_PFHxS		69	50-150
13C4_PFBA		70	50-150
13C4_PFHpA		72	50-150
13C5_PFHxA		73	50-150
13C5_PFPeA		71	50-150
13C6_PFDA		77	50-150
13C7_PFUdA		70	50-150
13C8_PFOA		71	50-150

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

PFAS by LC/MS/MS - LCS

Sample ID: WQ16953-002
Batch: 16953
Analytical Method: PFAS by ID SOP QSM B-15

Matrix: Aqueous
Prep Method: SOP SPE
Prep Date: 09/29/2021 1219

Surrogate	Q	% Rec	Acceptance Limit
13C8_PFOS		71	50-150
13C8_PFOSA		69	50-150
13C9_PFNA		73	50-150
d5-EtFOSAA		72	50-150
d-MeFOSA		55	50-150
d3-MeFOSAA		76	50-150

LOQ = Limit of Quantitation
DL = Detection Limit
LOD = Limit of Detection

U = Not detected at or above the LOQ
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria

N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

Chain of Custody

and

Miscellaneous Documents

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Telephone No. 803-791-9700 Fax No. 803-791-9111
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Number 122688

Client: Arcadis	Report to Contact: Nathan Nagle	Telephone No. / E-mail: Nathan.Nagle@arcadis.com
Address: 10 Friends Lane, Ste 100	Sampler's Signature: X	Quote No.
City: Newtown / State: PA / Zip Code: 18940	Printed Name: Jacob Schenk	Page ___ of ___
Project Name: Erickson Soil washing		
Project No.: 30030317	P.O. No.	

Sample ID / Description (Containers for each sample may be combined on one line.)	Collection Date(s)	Collection Time (Military)	Composite / Grab	Matrix: Aqueous	Matrix: Solid	Matrix: Other	No. of Containers by Preservative Type: Unpres.	HNO3	H2SO4	HCl	NaOH	Na2S2O3	Field Filtered	PFAS QSM Table B-15	PAH	Remarks / Cooler I.D.
393-1-T-W	9/23/21	1700	G	X			X							2	2	
393-1-UT-W	9/23/21	1730	G	X			X							2	2	
~~393-1~~ DUP-05	9/23/21	—	G	X			X							2	2	

WI28011
KESZ

Turn Around Time Required (Prior lab approval required for expedited TAT.): ☐ Standard ☑ Rush (Specify) 24 hr TAT

Sample Disposal: ☐ Return to Client ☑ Disposal by Lab

Possible Hazard Identification: ☑ Non-Hazard ☐ Flammable ☐ Skin Irritant ☐ Poison ☐ Unknown

QC Requirements (Specify)

	Date	Time		Date	Time
1. Relinquished by	9/27/21	1200	1. Received by		
2. Relinquished by			2. Received by		
3. Relinquished by			3. Received by		
4. Relinquished by: Fedex	9/28/21	0945	4. Laboratory received by	9/28/21	0945

Note: All samples are retained for four weeks from receipt unless other arrangements are made.

LAB USE ONLY — Received on ice (Circle) (Yes) No — Ice Pack — Receipt Temp: 4.3 °C — Temp Blank ☐ Y ☐ N

DISTRIBUTION: WHITE & YELLOW-Return to laboratory with Sample(s); PINK-Field/Client Copy

Document Number: ME003N2-01

Pace Analytical

Samples Receipt Checklist (SRC) (ME0018C-15)
Issuing Authority: Pace ENV - WCOL

Revised:9/29/2020
Page 1 of 1

Sample Receipt Checklist (SRC)

Client: Arcadis Cooler Inspected by/date: JRG2 / 09/28/2021 Lot #: WI28011

Means of receipt: ☐ Pace ☐ Client ☐ UPS ☑ FedEx ☐ Other: _____

☑ Yes	☐ No		1. Were custody seals present on the cooler?
☑ Yes	☐ No	☐ NA	2. If custody seals were present, were they intact and unbroken?

pH Strip ID: NA Chlorine Strip ID: NA Tested by: NA

Original temperature upon receipt / Derived (Corrected) temperature upon receipt %Solid Snap-Cup ID: NA

4.3 / 4.3 °C NA / NA °C NA / NA °C NA / NA °C

Method: ☐ Temperature Blank ☑ Against Bottles IR Gun ID: 5 IR Gun Correction Factor: 0 °C

Method of coolant: ☑ Wet Ice ☐ Ice Packs ☐ Dry Ice ☐ None

☐ Yes	☐ No	☑ NA	3. If temperature of any cooler exceeded 6.0°C, was Project Manager Notified? PM was Notified by: phone / email / face-to-face (circle one).
☑ Yes	☐ No	☐ NA	4. Is the commercial courier's packing slip attached to this form?
☑ Yes	☐ No		5. Were proper custody procedures (relinquished/received) followed?
☑ Yes	☐ No		6. Were sample IDs listed on the COC?
☑ Yes	☐ No		7. Were sample IDs listed on all sample containers?
☑ Yes	☐ No		8. Was collection date & time listed on the COC?
☑ Yes	☐ No		9. Was collection date & time listed on all sample containers?
☑ Yes	☐ No		10. Did all container label information (ID, date, time) agree with the COC?
☑ Yes	☐ No		11. Were tests to be performed listed on the COC?
☑ Yes	☐ No		12. Did all samples arrive in the proper containers for each test and/or in good condition (unbroken, lids on, etc.)? _____
☑ Yes	☐ No		13. Was adequate sample volume available?
☑ Yes	☐ No		14. Were all samples received within ½ the holding time or 48 hours, whichever comes first?
☐ Yes	☑ No		15. Were any samples containers missing/excess (circle one) samples Not listed on COC?
☐ Yes	☐ No	☑ NA	16. For VOA and RSK-175 samples, were bubbles present >"pea-size" (¼"or 6mm in diameter) in any of the VOA vials?
☐ Yes	☐ No	☑ NA	17. Were all DRO/metals/nutrient samples received at a pH of < 2?
☐ Yes	☐ No	☑ NA	18. Were all cyanide samples received at a pH > 12 and sulfide samples received at a pH > 9?
☐ Yes	☐ No	☑ NA	19. Were all applicable NH_3/TKN/cyanide/phenol/625.1/608.3 (< 0.5mg/L) samples free of residual chlorine?
☐ Yes	☐ No	☑ NA	20. Were client remarks/requests (i.e. requested dilutions, MS/MSD designations, etc…) correctly transcribed from the COC into the comment section in LIMS?
☐ Yes	☑ No		21. Was the quote number listed on the container label? If yes, Quote #

Sample Preservation (Must be completed for any sample(s) incorrectly preserved or with headspace.)

Sample(s) NA _____ were received incorrectly preserved and were adjusted accordingly in sample receiving with NA mL of circle one: H_2SO_4, HNO_3, HCl, NaOH using SR # NA.

Time of preservation NA. If more than one preservative is needed, please note in the comments below.

Sample(s) NA _____ were received with bubbles >6 mm in diameter.

Samples(s) NA _____ were received with TRC > 0.5 mg/L (If #19 is *no*) and were adjusted accordingly in sample receiving with sodium thiosulfate ($Na_2S_2O_3$) with Shealy ID: NA.

SR barcode labels applied by: JRG2 Date: 09/28/2021

Comments:

Schnabel ENGINEERING

104 Corporate Boulevard, Suite 420
West Columbia, SC 29169
T/ 803-796-6240
F/ 803-796-6250

TRANSMITTAL

TO:	Kathy Smith	**DATE:**	10/15/21
COMPANY:	Pace Analytical	**SUBJECT:**	Lab Results
ADDRESS:	106 Vantage Point Drive West Columbia, South Carolina 29169	**PROJECT NAME/NO.:**	Pace Analytical–Federal Lab Testing Schnabel Reference Number: 08190058.01 Task no. 553 (WJ04017)
FROM:	Stephen Hahn	**CC:**	

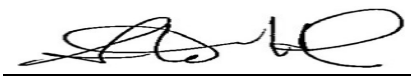
COPIES	DATE	NO.	DESCRIPTION
1	--	1	Gradation(s) and EDD for Eielson AFB

☒ AS REQUESTED ☐ FOR APPROVAL ☐ PLEASE REPLY ☐ FOR YOUR USE

Attached, please find our lab result(s) for sample(s):

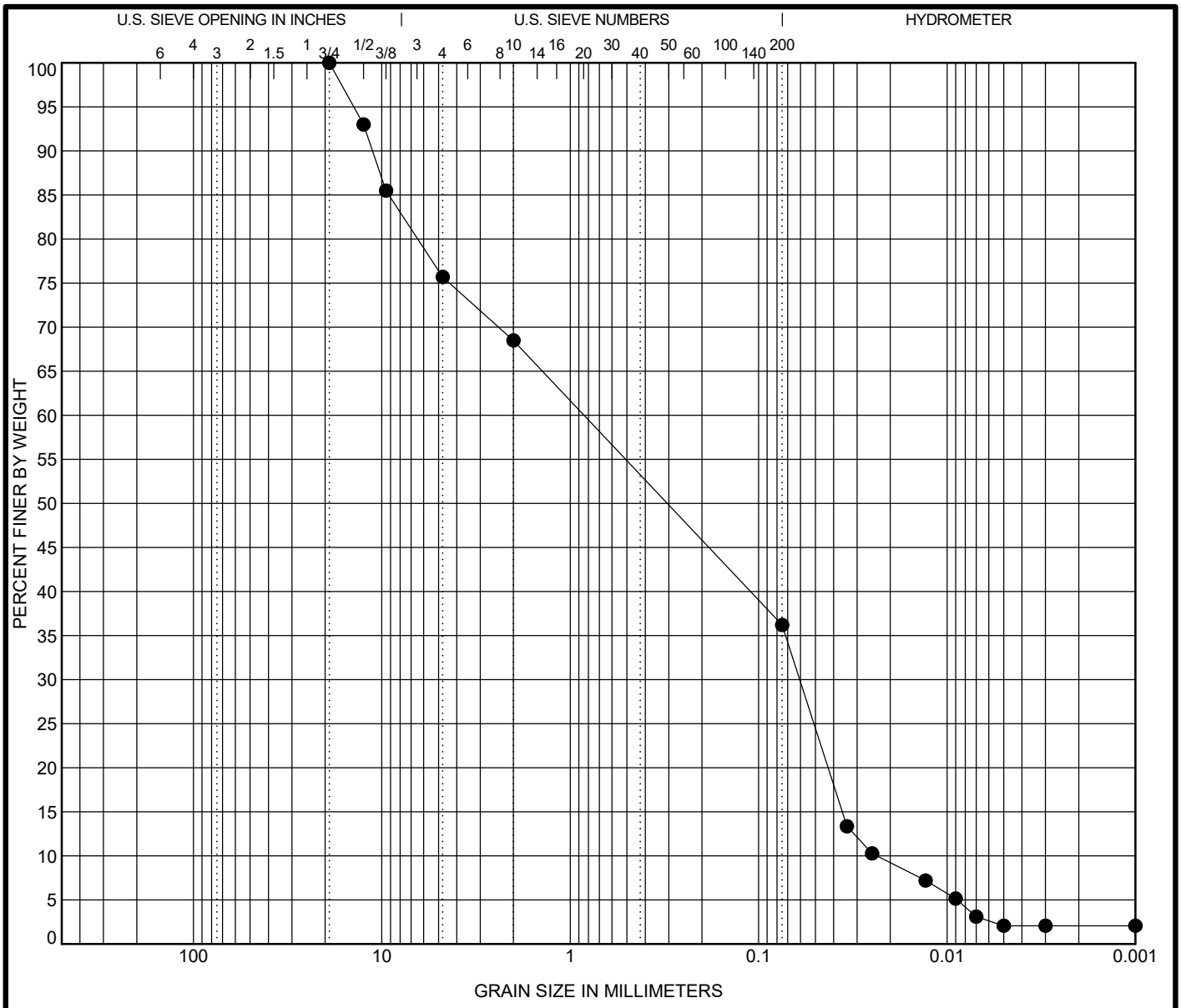
Lot No. WJ04017 (1 sample)

Please advise if you have any questions.

SIGNED: 

Stephen Hahn

SENT VIA: ☐ First Class Mail ☐ Overnight Service ☒ Email ☐ Other



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Specimen	Sample Description	LL	PL	PI	Test Method
● 385-4-UT 1.0 ft	**SILTY SAND WITH GRAVEL (SM), dark brown**	--	--	--	Atterberg ASTM D4318

Test Method	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
ASTM D7928	**19**	**0.843**	**0.061**	**0.024**	**24.3**	**39.5**	**34.1**	**2.1**

Percent Finer

Sieve Size	200	10	4	3/8"	1/2"	3/4"
% Finer	36.2	68.5	75.7	85.5	93.0	100.0

Tested By	Tested Date	Reviewed by	Calc by
EC	10/12/21	SRH	MDE

Schnabel ENGINEERING

GRADATION CURVE

Project: Pace Analytical-Federal
WJ04017
Eielson, AK

Contract: 08190058.01.553

SIEVE 1/SHEET HYDROMETERS-FEDERAL 2021.GPJ TEST TEMPLATE.GDT 10/15/21

EDD - Grain Size Analysis

Pace Lot Number: WJ04017

Sampling Location: Eielson, AK 553

Sample ID	385-4-UT
Depth (ft)	1.0
	2.0
Sample Date	9/16/2021
Analysis Date	10/12/2021
ASTM Method	D7928
Classification	SILTY SAND WITH GRAVEL (SM), dark brown
Percent Retained No. 4 Sieve (%)	24.3
Percent Passing No. 200 Sieve (%)	36.2
Percent Gravel (%)	24.3
Percent Sand (%)	39.5
Percent Silt (%)	34.1
Percent Clay (%)	2.1

Schnabel ENGINEERING

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West Columbia, SC 29169
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F/ 803-796-6250

TRANSMITTAL

TO:	Kathy Smith	**DATE:**	10/15/21
COMPANY:	Pace Analytical	**SUBJECT:**	Lab Results
ADDRESS:	106 Vantage Point Drive West Columbia, South Carolina 29169	**PROJECT NAME/NO.:**	Pace Analytical–Federal Lab Testing Schnabel Reference Number: 08190058.01 Task no. 554 (WJ04018)
FROM:	Stephen Hahn	**CC:**	

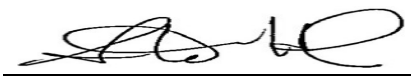
COPIES	DATE	NO.	DESCRIPTION
1	--	1	Gradation(s) and EDD for Eielson AFB

☒ AS REQUESTED ☐ FOR APPROVAL ☐ PLEASE REPLY ☐ FOR YOUR USE

Attached, please find our lab result(s) for sample(s):

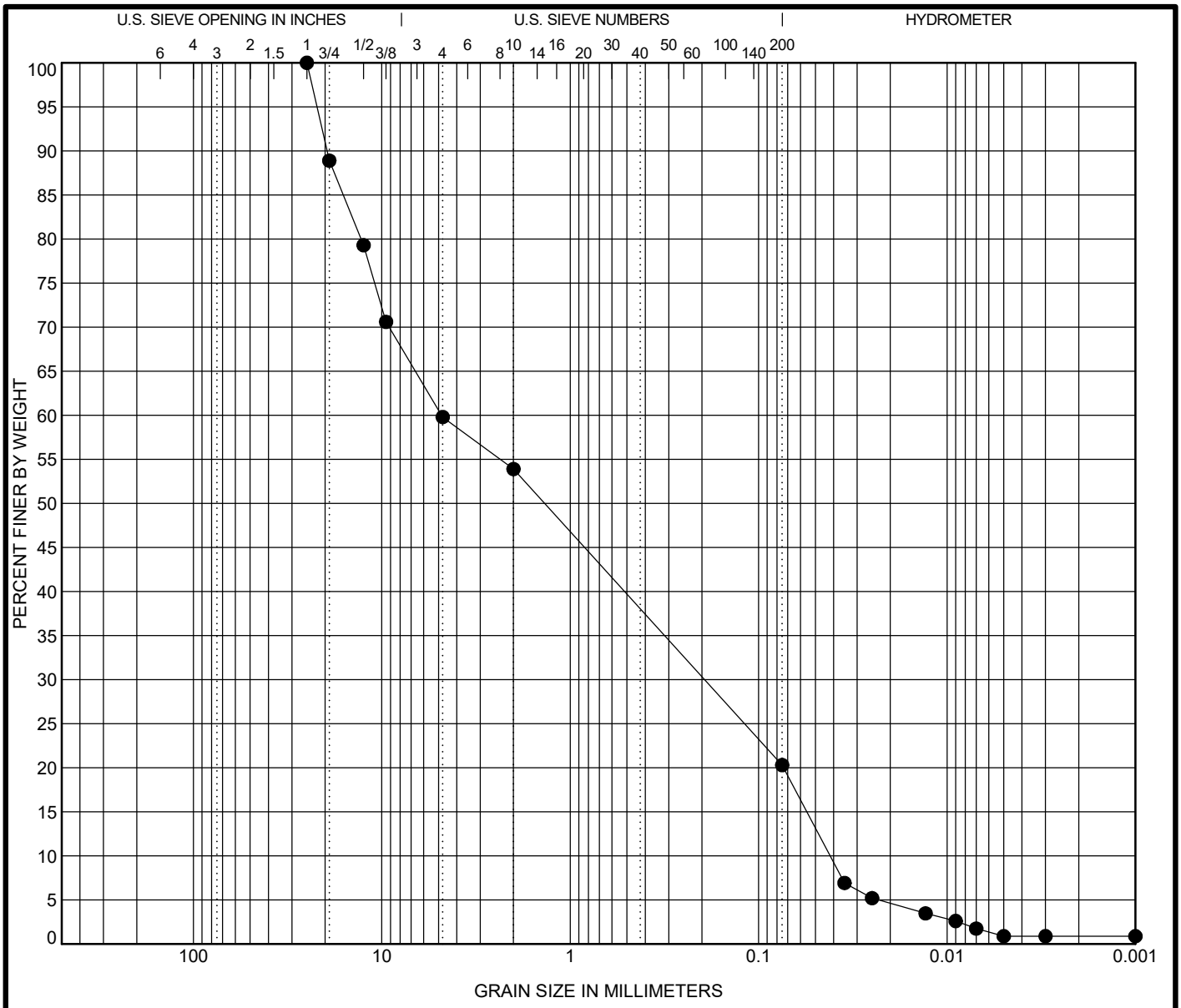
Lot No. WJ04018 (1 sample)

Please advise if you have any questions.

SIGNED: 

Stephen Hahn

SENT VIA: ☐ First Class Mail ☐ Overnight Service ☒ Email ☐ Other



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Specimen	Sample Description	LL	PL	PI	Test Method
● 382-5-UT 1.0 ft	**SILTY GRAVEL WITH SAND (GM), dark brown**	--	--	--	Atterberg ASTM D4318

Test Method	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
ASTM D7928	**25**	**4.811**	**0.194**	**0.042**	**40.2**	**39.5**	**19.4**	**0.9**

Percent Finer

Sieve Size	200	10	4	3/8"	1/2"	3/4"	1.0"
% Finer	20.3	53.9	59.8	70.6	79.3	88.9	100.0

Tested By	Tested Date	Reviewed by	Calc by
EC	10/12/21	SRH	MDE

Schnabel ENGINEERING

GRADATION CURVE

Project: Pace Analytical-Federal
WJ04018
Eielson, AK

Contract: 08190058.01.554

SIEVE 1/SHEET HYDROMETERS-FEDERAL 2021.GPJ TEST TEMPLATE.GDT 10/15/21

EDD - Grain Size Analysis

Pace Lot Number: WJ04018

Sampling Location: Eielson, AK 554

Sample ID	382-5-UT
Depth (ft)	1.0
	2.0
Sample Date	9/16/2021
Analysis Date	10/12/2021
ASTM Method	D7928
Classification	SILTY GRAVEL WITH SAND (GM), dark brown
Percent Retained No. 4 Sieve (%)	40.2
Percent Passing No. 200 Sieve (%)	20.3
Percent Gravel (%)	40.2
Percent Sand (%)	39.5
Percent Silt (%)	19.4
Percent Clay (%)	0.9

Schnabel ENGINEERING

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West Columbia, SC 29169
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F/ 803-796-6250

TRANSMITTAL

TO:	Kathy Smith	**DATE:**	10/15/21
COMPANY:	Pace Analytical	**SUBJECT:**	Lab Results
ADDRESS:	106 Vantage Point Drive West Columbia, South Carolina 29169	**PROJECT NAME/NO.:**	Pace Analytical–Federal Lab Testing Schnabel Reference Number: 08190058.01 Task no. 555 (WJ04019)
FROM:	Stephen Hahn	**CC:**	

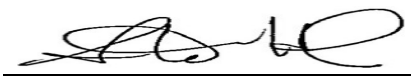
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☒ AS REQUESTED ☐ FOR APPROVAL ☐ PLEASE REPLY ☐ FOR YOUR USE

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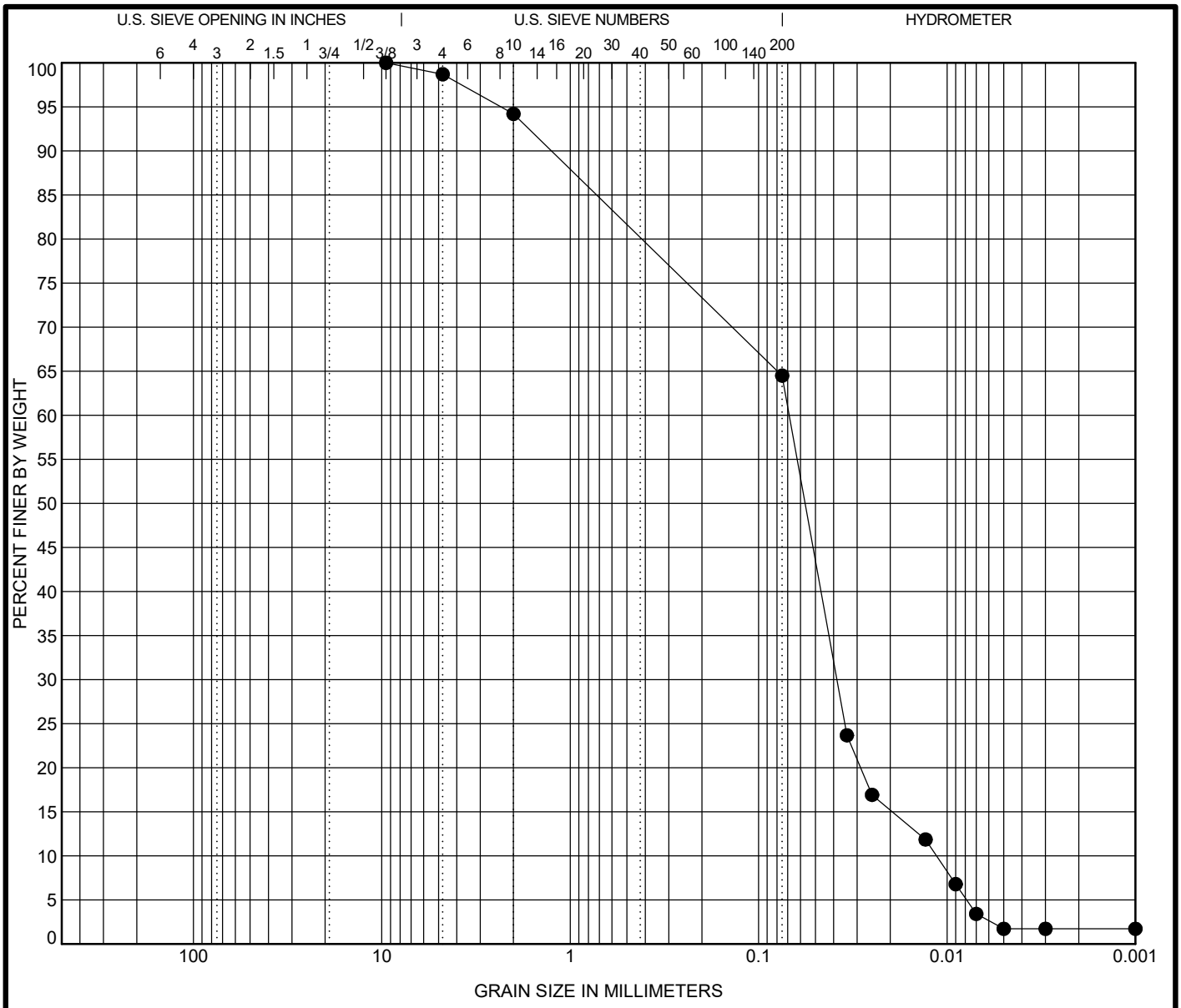
Lot No. WJ04019 (1 sample)

Please advise if you have any questions.

SIGNED: 

Stephen Hahn

SENT VIA: ☐ First Class Mail ☐ Overnight Service ☒ Email ☐ Other



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Specimen	Sample Description	LL	PL	PI	Test Method
● 393-1-UT 1.0 ft	**SANDY SILT (ML), brown**	--	--	--	Atterberg ASTM D4318

Test Method	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
ASTM D7928	**9.5**	**0.069**	**0.038**	**0.011**	**1.3**	**34.2**	**62.8**	**1.7**

Percent Finer

Sieve Size	200	10	4	3/8"
% Finer	64.5	94.2	98.7	100.0

Tested By	Tested Date	Reviewed by	Calc by
EC	10/12/21	SRH	MDE

Schnabel ENGINEERING

GRADATION CURVE

Project: Pace Analytical-Federal
WJ04019
Eielson, AK

Contract: 08190058.01.555

SIEVE 1/SHEET HYDROMETERS-FEDERAL 2021.GPJ TEST TEMPLATE.GDT 10/15/21

EDD - Grain Size Analysis

Pace Lot Number: WJ04019

Sampling Location: Eielson, AK 555

Sample ID	393-1-UT
Depth (ft)	1.0
	2.0
Sample Date	9/29/2021
Analysis Date	10/12/2021
ASTM Method	D7928
Classification	SANDY SILT (ML), brown
Percent Retained No. 4 Sieve (%)	1.3
Percent Passing No. 200 Sieve (%)	64.5
Percent Gravel (%)	1.3
Percent Sand (%)	34.2
Percent Silt (%)	62.8
Percent Clay (%)	1.7

ARCADIS – EOF VERSUS TARGET ANALYSIS

1 INTRODUCTION

For a specific DoD project in Alaska SGS Belgium has executed analysis for EOF (Extractable Organic Fluoride).

Based on the initial report there seems to be a discrepancy between the target PFAS analysis and the reported EOF analysis

During our technical discussion end of January 2022 it was agreed that SGS would do additional tests in order to evaluate the performed tests on the specific matrix.

2 PLAN OF ACTION

Following tests where proposed by SGS

- EOF analysis on a selection of samples
  - On material as such
  - On grinded material
- Fluoride (aqueous extractable) fraction
  - On material as such
  - On grinded material
- Fluoride has been measured on the methanol extracts
- TOP assay

3 OUTCOME / RESULTS

The above mentioned analysis have been done on following samples

Our reference	Description
IAC21-09930.001	Pile 393 Untreated
IAC21-09930.003	Pile 393 Untreated
IAC21-09930.004	Pile 393 Gravel
IAC21-09930.005	Pile 393 Gravel
IAC21-09930.007	Pile 393 Sand
IAC21-09930.009	Pile 393 Sand
IAC21-09722.001	Pile 393 Fine
IAC21-09722.002	Pile 393 Fine

Selection of the samples have been done as a significant concentration of PFAS was needed (from the SGS point of view)

Following results were obtained

- Leaching test and EOF analysis

Sample as such	M 1				M 2				Avg			
	EOF	dry weight	F - water	F - MeOH	EOF	dry weight	F - water	F - MeOH	EOF	dry weight	F - water	F - MeOH
	mg/kg ds	%	mg/kg ds	mg/kg ds	mg/kg ds	%	mg/kg ds	mg/kg ds	mg/kg ds	%	mg/kg ds	mg/kg ds
IAC21-09930.001	1,9	89,5	1	0,11	1,8	89,5	0,89	0,13	1,85	89,5	0,945	0,12
IAC21-09930.003	4,9	85	0,94	< 0.1	4,4	85	0,85	0,13	4,65	85	0,895	!
IAC21-09930.004	< 0.2	99,2	< 0.1	< 0.1	< 0.2	99,2	< 0.10	< 0.1	< 0.2	99,2	< 0.1	< 0.1
IAC21-09930.005	< 0.2	98,9	< 0.1	< 0.1	< 0.2	98,9	< 0.10	< 0.1	< 0.2	98,9	< 0.1	< 0.1
IAC21-09930.007	0,26	86,5	0,46	0,17	0,38	86,5	0,34	0,15	0,32	86,5	0,4	0,16
IAC21-09930.009	0,21	91	0,32	0,11	0,37	91	0,22	0,1	0,29	91	0,27	0,105
IAC21-09722.001	2,8	66,4	1,7	< 0.1	2,9	66,4	1,7	0,13	2,85	66,4	1,7	!
IAC21-09722.002	3,6	65,5	1,8	0,11	3,1	65,5	1,7	0,13	3,35	65,5	1,75	0,12

Sample grinded (< 250 µm)	M 1				M 2				Avg			
	EOF	dry weight	F - water	F - MeOH	EOF	dry weight	F - water	F - MeOH	EOF	dry weight	F - water	F - MeOH
	mg/kg ds	%	mg/kg ds	mg/kg ds	mg/kg ds	%	mg/kg ds	mg/kg ds	mg/kg ds	%	mg/kg ds	mg/kg ds
IAC21-09930.001	0,59	89,5	3,3	< 0.1	0,82	89,5	3,4	< 0.1	0,705	89,5	3,35	< 0.1
IAC21-09930.003	1,9	85	9,3	< 0.1	1,8	85	8,6	< 0.1	1,85	85	8,95	< 0.1
IAC21-09930.004	< 0.2	99,2	1,8	< 0.1	< 0.2	99,2	1,9	< 0.1	< 0.2	99,2	1,85	< 0.1
IAC21-09930.005	< 0.2	98,9	5,3	< 0.1	< 0.2	98,9	5,7	< 0.1	< 0.2	98,9	5,5	< 0.1
IAC21-09930.007	< 0.2	86,5	2	0,17	< 0.2	86,5	2,1	< 0.1	< 0.2	86,5	2,05	!
IAC21-09930.009	< 0.2	91	1,6	< 0.1	< 0.2	91	1,5	< 0.1	< 0.2	91	1,55	< 0.1
IAC21-09722.001	1,4	66,4	4,8	< 0.1	1,6	66,4	5,2	< 0.1	1,5	66,4	5	< 0.1
IAC21-09722.002	1,6	65,5	5,7	< 0.1	1,4	65,5	5,2	< 0.1	1,5	65,5	5,45	< 0.1

- TOP Assay analysis

Sample ID	IAC21-09930.007 (grind)		IAC21-09930.007 (grind)	
Analytename	Result PFAS - target	Result TOP	Result PFAS - target	Result TOP
	µg/kg dm	µg/kg dm	µg/kg dm	µg/kg dm
PFBA	0,34	12,40	0,37	14,32
PFPeA	1,20	21,90	1,02	30,10
PFHxA	4,57	33,48	4,60	43,68
PFHpA	1,20	6,24	0,38	6,30
PFOA	5,96	6,44	1,14	4,82
PFNA	2,22	2,48	< 0.2	3,04
PFDA	3,09	2,04	< 0.2	2,42
PFUnDA	1,05	1,19	< 0.2	1,68
PFDoDA	0,26	<1	< 0.2	1,47
PFTrDA	< 0.2		< 0.2	
PFTeDA	< 0.2		< 0.2	
PFHxDA	< 0.2		< 0.2	
PFBS	0,78	<1	0,42	<1
PFPeS	3,92	15,92	0,50	19,56
PFHxS	52,58	2,74	6,51	3,43
PFHpS	3,40	5,20	< 0.2	6,10
PFOS	671,84	33,25	46,48	24,64
PFNS	11,02		0,38	
PFDS	2,01		0,37	
PFOSA	3,92	<1	2,38	<1
4:2 FTS	< 0.2		< 0.2	
6:2 FTS	5,12		4,61	
8:2 FTS	17,99		3,23	
10:2 FTS	1,33		1,19	
8:2 diPAP	< 0.2		< 0.2	
HPFO-DA	< 0.2		0,21	
ADONA	< 0.2		< 0.2	
PFECHS	< 0.2		< 0.2	
PFOcDA	< 0.2		< 0.2	
PFDoDS	< 0.2		< 0.2	
N-MeFOSA	< 0.2		< 0.2	
N-EtFOSA	< 0.2		< 0.2	
N-MeFOSAA	1,05		0,23	
N-EtFOSAA	0,66		< 0.2	

6:2 diPAP	< 0.2		< 0.2	
6:2/8:2 diPAP	< 0.2		< 0.2	
PFBSA	1,04		1,57	
PFHxSA	13,45		17,71	
MePFBSA	< 0.2		< 0.2	
MePFBSAA	< 0.2		< 0.2	
PFUnDS	< 0.2		< 0.2	
PFTrDS	< 0.2		< 0.2	
Sum PFAS (lowerbound)	**809,99**	**143,28**	**93,32**	**161,56**

Sample ID	IAC21-09722.001 (grind)		IAC21-09722.002 (grind)	
Analytename	Result PFAS - target	Result TOP	Result PFAS - target	Result TOP
	µg/kg dm	µg/kg dm	µg/kg dm	µg/kg dm
PFBA	0,93	62,90	0,91	64,54
PFPeA	2,86	90,20	3,19	104,00
PFHxA	17,59	172,87	17,79	185,76
PFHpA	1,32	104,80	1,36	113,90
PFOA	5,61	63,98	5,40	72,69
PFNA	0,82	51,79	0,81	67,40
PFDA	2,06	30,74	2,04	32,90
PFUnDA	3,01	17,61	3,00	22,39
PFDoDA	2,58	9,72	2,59	9,86
PFTrDA	0,37		0,68	
PFTeDA	0,59		0,64	
PFHxDA	< 0.2		< 0.2	
PFBS	1,42	<1	1,47	<1
PFPeS	1,92	58,26	2,04	76,91
PFHxS	29,50	14,10	32,65	19,46
PFHpS	1,08	27,60	1,00	37,07
PFOS	509,47	248,88	487,85	273,32
PFNS	25,52		25,22	
PFDS	23,20		25,69	
PFOSA	19,08	<1	18,78	<1
4:2 FTS	< 0.2		< 0.2	
6:2 FTS	28,60		34,36	
8:2 FTS	40,66		40,23	
10:2 FTS	59,76		59,25	
8:2 diPAP	< 0.2		< 0.2	
HPFO-DA	1,67		0,78	

ADONA	< 0.2			< 0.2	
PFECHS	< 0.2			< 0.2	
PFOcDA	< 0.2			< 0.2	
PFDoDS	0,64			1,63	
N-MeFOSA	< 0.2			< 0.2	
N-EtFOSA	< 0.2			< 0.2	
N-MeFOSAA	0,51			0,43	
N-EtFOSAA	0,61			0,53	
6:2 diPAP	< 0.2			< 0.2	
6:2_8:2 diPAP	< 0.2			< 0.2	
PFBSA	3,37			3,56	
PFHxSA	37,20			77,55	
MePFBSA	< 0.2			< 0.2	
MePFBSAA	< 0.2			< 0.2	
PFUnDS	< 0.2			< 0.2	
PFTrDS	< 0.2			< 0.2	
Sum PFAS (lowerbound)	**821,95**	**953,45**		**851,42**	**1080,20**

- Comparison of initial versus new results and techniques

	Sample as such			Sample grinded (<250 µm)			Initial result
	EOF	F - water	F - MeOH	EOF	F - water	F - MeOH	EOF
	mg/kg ds	mg/kg ds	mg/kg ds	mg/kg ds	mg/kg ds	mg/kg ds	mg/kg
IAC21-09930.001	1,85	0,945	0,12	0,705	3,35	< 0.1	0,56
IAC21-09930.003	4,65	0,895	!	1,85	8,95	< 0.1	2
IAC21-09930.004	< 0.2	< 0.1	< 0.1	< 0.2	1,85	< 0.1	0,047
IAC21-09930.005	< 0.2	< 0.1	< 0.1	< 0.2	5,5	< 0.1	0,048
IAC21-09930.007	0,32	0,4	0,16	< 0.2	2,05	!	0,14
IAC21-09930.009	0,29	0,27	0,105	< 0.2	1,55	< 0.1	0,23
IAC21-09722.001	2,85	1,7	!	1,5	5	< 0.1	1
IAC21-09722.002	3,35	1,75	0,12	1,5	5,45	< 0.1	1,5

! = a duplo measurement for which one result was < RL

4 CONCLUSIONS

Based on the above results we concluded (intermediate as this needs to be discussed with Arcadis)

4.1 Impact of grinding/milling

We saw that after grinding of the material

4.1.1 Fluoride

- The leachable fraction of inorganic fluoride increased for the analyzed material by a factor +/- 5 – 10
- Despite the fact that there was a significant increase of the inorganic fraction the Fluoride did not lead to an increase of Fluoride in the methanol extract

This is an important conclusion because we know that the presence of inorganic fluoride leads to erroneous EOF values (false positive results).

So in this case there is no impact on the EOF analysis

As in certain regions the leachable PFAS fractions are used in order to obtain lower LOQ for the EOF analysis, in this case grinding of the material would have lead to a possible interference if this was not taken in consideration

4.1.2 Impact of grinding on EOF analysis

We have seen in a systematic way that grinding of the material has lead to decimation of the results (half of the concentrations compared to a non-grinded sample).

Grinding of coarse material leads to a more homogenized material (if subsampling is needed). The downside of grinding (especially for coarse material) is that the inner core material which is most cases non contaminated leads to a kind of “dilution” of the contaminant of interest in this case PFAS.
In general this is an item we often discuss with customers for whom analysis need to be done on bricks/stone/coarse material.

The test have shown this systematic “dilution” which had an impact on the final EOF results

4.2 EOF analysis

- During our previous EOF validation on soil samples (homogenized) we came up to a reporting level (RL) of 20 µg/kg. During this exercise it needs to be taken in account that the goal of EOF analysis on more or less or effective coarse materials need to be done in a prudent way as the stated RL. In other words using EOF as a guide parameter on low levels seems only valid for well-defined matrices.

- It has been shown (as in our previous validation tests) that the reproducibility for EOF analysis is very good
    - The initial EOF analysis compared to these for this re-test program are completely in line with initial report EOF analysis (as a remark results done a sample with a significant concentration)

4.3 TOP assay

On two samples a TOP assay and post PFAS analysis was done in duplo, for which one sample one of the analysis needs to be re-analyzed as the results are completely out of line.

We can say on average that there was a +/- 10% increase of Post PFAS analysis which is for this type of analysis well within the measurement uncertainty.

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ANALYTICAL REPORT : IAC21-08494

Your reference: PO30030317 LDR/2021-07100007
Number of samples: 4
Date of receipt: 13/09/2021
Identification of the samples:

IAC21-08494.001 - 382-5-UT-2
IAC21-08494.002 - 382-5-Sand
IAC21-08494.003 - 382-5-UT-1
IAC21-08494.004 - 382-5-G-1

Analytical results:

Determination of Extractable Organic Fluorine
(CIC, after solvent extraction)

I.A.C., a division of SGS Belgium NV ANTWERP, 07/12/2021

Sven Herremans
Lab Operations Manager

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ANALYTICAL REPORT : IAC21-08494

Analytical results - elemental analysis		
Your reference: 382-5-UT-2		Date of analysis: 02-12-2021
Determination of Extractable Organic Fluorine		
Component	Concentration (mg/kg)	Reporting limit (mg/kg)
Extractable organofluorine	0.019	0.01

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ANALYTICAL REPORT : IAC21-08494

Analytical results - elemental analysis		
Your reference: 382-5-Sand Date of analysis: 02-12-2021		
Determination of Extractable Organic Fluorine		
Component	Concentration (mg/kg)	Reporting limit (mg/kg)
Extractable organofluorine	<0.010	0.01

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ANALYTICAL REPORT : IAC21-08494

Analytical results - elemental analysis		
Your reference: 382-5-UT-1		Date of analysis: 02-12-2021
Determination of Extractable Organic Fluorine		
Component	Concentration (mg/kg)	Reporting limit (mg/kg)
Extractable organofluorine	0.020	0.01

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ANALYTICAL REPORT : IAC21-08494

Analytical results - elemental analysis		
Your reference: 382-5-G-1		Date of analysis: 02-12-2021
Determination of Extractable Organic Fluorine		
Component	Concentration (mg/kg)	Reporting limit (mg/kg)
Extractable organofluorine	0.047	0.01

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ANALYTICAL REPORT : IAC21-08867

Your reference:	PO30030317 LDR/2021-07100007
Number of samples:	12
Date of receipt:	21/09/2021
Identification of the samples:	
See next page(s)	

Analytical results:

Determination of Extractable Organic Fluorine
(CIC, after solvent extraction)

Determination of AOF
(Combustion Ion Chromatography, after SPE)

I.A.C., a division of SGS Belgium NV ANTWERP, 07/12/2021

Sven Herremans
Lab Operations Manager

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ANALYTICAL REPORT : IAC21-08867

Identification of the samples:

Client Sample Identification

IAC21-08867.001 - 382-5-S-1
IAC21-08867.002 - 382-5-S-2
IAC21-08867.003 - 382-5-S-3
IAC21-08867.004 - 382-5-G-2
IAC21-08867.005 - 382-5-G-3
IAC21-08867.006 - 382-5-F-1
IAC21-08867.007 - 382-5-F-2
IAC21-08867.008 - 382-5-F-3
IAC21-08867.009 - 382-5-UT-3
IAC21-08867.010 - DUP-01
IAC21-08867.011 - 382-5-W-UT-1
IAC21-08867.012 - 382-5-W-T-1

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ANALYTICAL REPORT : IAC21-08867

Analytical results - elemental analysis		
Your reference: 382-5-S-1		Date of analysis: 02-12-2021
Determination of Extractable Organic Fluorine		
Component	Concentration (mg/kg)	Reporting limit (mg/kg)
Extractable organofluorine	0.039	0.01

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ANALYTICAL REPORT : IAC21-08867

Analytical results - elemental analysis		
Your reference: 382-5-S-2		Date of analysis: 02-12-2021
Determination of Extractable Organic Fluorine		
Component	Concentration (mg/kg)	Reporting limit (mg/kg)
Extractable organofluorine	0.058	0.01

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ANALYTICAL REPORT : IAC21-08867

Analytical results - elemental analysis		
Your reference: 382-5-S-3		Date of analysis: 02-12-2021
Determination of Extractable Organic Fluorine		
Component	Concentration (mg/kg)	Reporting limit (mg/kg)
Extractable organofluorine	0.036	0.01

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ANALYTICAL REPORT : IAC21-08867

Analytical results - elemental analysis		
Your reference: 382-5-G-2		Date of analysis: 02-12-2021
Determination of Extractable Organic Fluorine		
Component	Concentration (mg/kg)	Reporting limit (mg/kg)
Extractable organofluorine	0.053	0.01

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ANALYTICAL REPORT : IAC21-08867

Analytical results - elemental analysis		
Your reference: 382-5-G-3		Date of analysis: 02-12-2021
Determination of Extractable Organic Fluorine		
Component	Concentration (mg/kg)	Reporting limit (mg/kg)
Extractable organofluorine	0.10	0.01

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ANALYTICAL REPORT : IAC21-08867

Analytical results - elemental analysis		
Your reference: 382-5-F-1		Date of analysis: 02-12-2021
Determination of Extractable Organic Fluorine		
Component	Concentration (mg/kg)	Reporting limit (mg/kg)
Extractable organofluorine	0.025	0.01

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ANALYTICAL REPORT : IAC21-08867

Analytical results - elemental analysis		
Your reference: 382-5-F-2		Date of analysis: 02-12-2021
Determination of Extractable Organic Fluorine		
Component	Concentration (mg/kg)	Reporting limit (mg/kg)
Extractable organofluorine	0.063	0.01

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ANALYTICAL REPORT : IAC21-08867

Analytical results - elemental analysis		
Your reference: 382-5-F-3		Date of analysis: 02-12-2021
Determination of Extractable Organic Fluorine		
Component	Concentration (mg/kg)	Reporting limit (mg/kg)
Extractable organofluorine	0.019	0.01

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ANALYTICAL REPORT : IAC21-08867

Analytical results - elemental analysis		
Your reference: 382-5-UT-3		Date of analysis: 02-12-2021
Determination of Extractable Organic Fluorine		
Component	Concentration (mg/kg)	Reporting limit (mg/kg)
Extractable organofluorine	0.053	0.01

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ANALYTICAL REPORT : IAC21-08867

Analytical results - elemental analysis		
Your reference: DUP-01		Date of analysis: 02-12-2021
Determination of Extractable Organic Fluorine		
Component	Concentration (mg/kg)	Reporting limit (mg/kg)
Extractable organofluorine	0.022	0.01

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ANALYTICAL REPORT : IAC21-08867

Analytical results - elemental analysis		
Your reference: 382-5-W-UT-1		Date of analysis: 02-12-2021
Determination of AOF		
Component	Concentration (µg/l)	Reporting limit (µg/l)
Adsorbable Organically Fluorine	<1.0	1

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ANALYTICAL REPORT : IAC21-08867

Analytical results - elemental analysis		
Your reference: 382-5-W-T-1		Date of analysis: 02-12-2021
Determination of AOF		
Component	Concentration (µg/l)	Reporting limit (µg/l)
Adsorbable Organically Fluorine	<1.0	1

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ANALYTICAL REPORT : IAC21-09126

Your reference:	PO30030317 LDR/2021-07100007
Number of samples:	15
Date of receipt:	24/09/2021
Identification of the samples:	
See next page(s)	

Analytical results:

Determination of Extractable Organic Fluorine
(CIC, after solvent extraction)

Determination of AOF
(Combustion Ion Chromatography, after SPE)

I.A.C., a division of SGS Belgium NV ANTWERP, 07/12/2021

Sven Herremans
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ANALYTICAL REPORT : IAC21-09126

Identification of the samples:

Client Sample Identification

IAC21-09126.001 - 385-4-S-2
IAC21-09126.002 - 385-4-S-3
IAC21-09126.003 - 385-4-G-2
IAC21-09126.004 - 385-4-G-3
IAC21-09126.005 - 385-4-UT-2
IAC21-09126.006 - 385-4-UT-3
IAC21-09126.007 - 385-4-UT-4
IAC21-09126.008 - 385-4-UT-5
IAC21-09126.009 - 385-4-UT-1
IAC21-09126.010 - 385-4-S-1
IAC21-09126.011 - 385-4-G-1
IAC21-09126.012 - 385-4-W-UT-1
IAC21-09126.013 - 385-4-W-T-1
IAC21-09126.014 - DUP-02
IAC21-09126.015 - DUP-03

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ANALYTICAL REPORT : IAC21-09126

Analytical results - elemental analysis		
Your reference: 385-4-S-2		Date of analysis: 02-12-2021
Determination of Extractable Organic Fluorine		
Component	Concentration (mg/kg)	Reporting limit (mg/kg)
Extractable organofluorine	0.031	0.01

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ANALYTICAL REPORT : IAC21-09126

Analytical results - elemental analysis		
Your reference: 385-4-S-3		Date of analysis: 02-12-2021
Determination of Extractable Organic Fluorine		
Component	Concentration (mg/kg)	Reporting limit (mg/kg)
Extractable organofluorine	0.021	0.01

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ANALYTICAL REPORT : IAC21-09126

Analytical results - elemental analysis		
Your reference: 385-4-G-2		Date of analysis: 02-12-2021
Determination of Extractable Organic Fluorine		
Component	Concentration (mg/kg)	Reporting limit (mg/kg)
Extractable organofluorine	0.066	0.01

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ANALYTICAL REPORT : IAC21-09126

Analytical results - elemental analysis		
Your reference: 385-4-G-3		Date of analysis: 02-12-2021
Determination of Extractable Organic Fluorine		
Component	Concentration (mg/kg)	Reporting limit (mg/kg)
Extractable organofluorine	0.023	0.01

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ANALYTICAL REPORT : IAC21-09126

Analytical results - elemental analysis		
Your reference: 385-4-UT-2		Date of analysis: 02-12-2021
Determination of Extractable Organic Fluorine		
Component	Concentration (mg/kg)	Reporting limit (mg/kg)
Extractable organofluorine	0.023	0.01

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ANALYTICAL REPORT : IAC21-09126

Analytical results - elemental analysis		
Your reference: 385-4-UT-3 Date of analysis: 02-12-2021		
Determination of Extractable Organic Fluorine		
Component	Concentration (mg/kg)	Reporting limit (mg/kg)
Extractable organofluorine	0.010	0.01

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ANALYTICAL REPORT : IAC21-09126

Analytical results - elemental analysis		
Your reference: 385-4-UT-4		Date of analysis: 02-12-2021
Determination of Extractable Organic Fluorine		
Component	Concentration (mg/kg)	Reporting limit (mg/kg)
Extractable organofluorine	0.014	0.01

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ANALYTICAL REPORT : IAC21-09126

Analytical results - elemental analysis		
Your reference: 385-4-UT-5		Date of analysis: 02-12-2021
Determination of Extractable Organic Fluorine		
Component	Concentration (mg/kg)	Reporting limit (mg/kg)
Extractable organofluorine	0.019	0.01

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ANALYTICAL REPORT : IAC21-09126

Analytical results - elemental analysis		
Your reference: 385-4-UT-1		Date of analysis: 02-12-2021
Determination of Extractable Organic Fluorine		
Component	Concentration (mg/kg)	Reporting limit (mg/kg)
Extractable organofluorine	0.024	0.01

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ANALYTICAL REPORT : IAC21-09126

Analytical results - elemental analysis		
Your reference: 385-4-S-1		Date of analysis: 02-12-2021
Determination of Extractable Organic Fluorine		
Component	Concentration (mg/kg)	Reporting limit (mg/kg)
Extractable organofluorine	0.017	0.01

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ANALYTICAL REPORT : IAC21-09126

Analytical results - elemental analysis		
Your reference: 385-4-G-1		Date of analysis: 02-12-2021
Determination of Extractable Organic Fluorine		
Component	Concentration (mg/kg)	Reporting limit (mg/kg)
Extractable organofluorine	0.023	0.01

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ANALYTICAL REPORT : IAC21-09126

Analytical results - elemental analysis		
Your reference: 385-4-W-UT-1		Date of analysis: 02-12-2021
Determination of AOF		
Component	Concentration (µg/l)	Reporting limit (µg/l)
Adsorbable Organically Fluorine	1.1	1

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ANALYTICAL REPORT : IAC21-09126

Analytical results - elemental analysis		
Your reference: 385-4-W-T-1		Date of analysis: 02-12-2021
Determination of AOF		
Component	Concentration (µg/l)	Reporting limit (µg/l)
Adsorbable Organically Fluorine	<1.0	1

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ANALYTICAL REPORT : IAC21-09126

Analytical results - elemental analysis		
Your reference: DUP-02		Date of analysis: 02-12-2021
Determination of Extractable Organic Fluorine		
Component	Concentration (mg/kg)	Reporting limit (mg/kg)
Extractable organofluorine	0.028	0.01

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ANALYTICAL REPORT : IAC21-09126

Analytical results - elemental analysis		
Your reference: DUP-03		Date of analysis: 02-12-2021
Determination of AOF		
Component	Concentration (µg/l)	Reporting limit (µg/l)
Adsorbable Organically Fluorine	<1.0	1

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ARCADIS U.S., Inc.
Attn: Nathan Nagle
10 Friends Lane
Suite 100
18940
UNITED STATES

ANALYTICAL REPORT : IAC21-09722

Your reference: PO 30030317 LDR/2021-07100007
Number of samples: 3
Date of receipt: 12/10/2021
Identification of the samples:

IAC21-09722.001 - 393-1-F-1

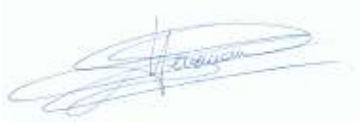
IAC21-09722.002 - 393-1-F-2

IAC21-09722.003 - 393-1-F-3

Analytical results:

Determination of Extractable Organic Fluorine
(CIC, after solvent extraction)

I.A.C., a division of SGS Belgium NV ANTWERP, 18/01/2022



Sven Herremans
Lab Operations Manager

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ANALYTICAL REPORT : IAC21-09722

Analytical results - elemental analysis		
Your reference: 393-1-F-1		Date of analysis: 18-01-2022
Determination of Extractable Organic Fluorine		
Component	Concentration (mg/kg)	Reporting limit (mg/kg)
Extractable organofluorine	1.0	0.01

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ANALYTICAL REPORT : IAC21-09722

Analytical results - elemental analysis		
Your reference: 393-1-F-2		Date of analysis: 18-01-2022
Determination of Extractable Organic Fluorine		
Component	Concentration (mg/kg)	Reporting limit (mg/kg)
Extractable organofluorine	1.5	0.01

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ANALYTICAL REPORT : IAC21-09722

Analytical results - elemental analysis		
Your reference: 393-1-F-3		Date of analysis: 18-01-2022
Determination of Extractable Organic Fluorine		
Component	Concentration (mg/kg)	Reporting limit (mg/kg)
Extractable organofluorine	1.2	0.01

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The present document voids and replaces the previously issued report(s) with same reference(s).

ANALYTICAL REPORT : IAC21-09930_R1

Your reference:	PO 30030317 LDR/2021-07100007
Number of samples:	16
Date of receipt:	15/10/2021
Identification of the samples:	
See next page(s)	

Analytical results:

Determination of Extractable Organic Fluorine
(CIC, after solvent extraction)

Determination of AOF
(Combustion Ion Chromatography, after SPE)

Remarks:

Revision: Results for samples 011 (393-1-W-UT-1) and 012 (393-W-T-1) were switched due to human error.

I.A.C., a division of SGS Belgium NV ANTWERP, 21/01/2022

Sven Herremans
Lab Operations Manager

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ANALYTICAL REPORT : IAC21-09930_R1

Identification of the samples:

Client Sample Identification

IAC21-09930.001 - 393-1-UT-1
IAC21-09930.002 - 393-1-UT-2
IAC21-09930.003 - 393-1-UT-3
IAC21-09930.004 - 393-1-G-1
IAC21-09930.005 - 393-1-G-2
IAC21-09930.006 - 393-1-G-3
IAC21-09930.007 - 393-1-S-1
IAC21-09930.008 - 393-1-S-2
IAC21-09930.009 - 393-1-S-3
IAC21-09930.010 - DUP-05
IAC21-09930.011 - 393-1-W-UT-1
IAC21-09930.012 - 393-1-W-T-1
IAC21-09930.013 - DUP-04
IAC21-09930.014 - 385-4-F-1
IAC21-09930.015 - 385-4-F-2
IAC21-09930.016 - 385-4-F-3

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ANALYTICAL REPORT : IAC21-09930_R1

Analytical results - elemental analysis		
Your reference: 393-1-UT-1		Date of analysis: 02-12-2021
Determination of Extractable Organic Fluorine		
Component	Concentration (mg/kg)	Reporting limit (mg/kg)
Extractable organofluorine	0.56	0.01

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ANALYTICAL REPORT : IAC21-09930_R1

Analytical results - elemental analysis		
Your reference: 393-1-UT-2		Date of analysis: 02-12-2021
Determination of Extractable Organic Fluorine		
Component	Concentration (mg/kg)	Reporting limit (mg/kg)
Extractable organofluorine	0.56	0.01

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ANALYTICAL REPORT : IAC21-09930_R1

Analytical results - elemental analysis		
Your reference: 393-1-UT-3		Date of analysis: 02-12-2021
Determination of Extractable Organic Fluorine		
Component	Concentration (mg/kg)	Reporting limit (mg/kg)
Extractable organofluorine	2.0	0.01

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ANALYTICAL REPORT : IAC21-09930_R1

Analytical results - elemental analysis		
Your reference: 393-1-G-1		Date of analysis: 02-12-2021
Determination of Extractable Organic Fluorine		
Component	Concentration (mg/kg)	Reporting limit (mg/kg)
Extractable organofluorine	0.047	0.01

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ANALYTICAL REPORT : IAC21-09930_R1

Analytical results - elemental analysis		
Your reference: 393-1-G-2		Date of analysis: 02-12-2021
Determination of Extractable Organic Fluorine		
Component	Concentration (mg/kg)	Reporting limit (mg/kg)
Extractable organofluorine	0.048	0.01

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Analytical results - elemental analysis		
Your reference: 393-1-G-3		Date of analysis: 02-12-2021
Determination of Extractable Organic Fluorine		
Component	Concentration (mg/kg)	Reporting limit (mg/kg)
Extractable organofluorine	0.053	0.01

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ANALYTICAL REPORT : IAC21-09930_R1

Analytical results - elemental analysis		
Your reference: 393-1-S-1		Date of analysis: 02-12-2021
Determination of Extractable Organic Fluorine		
Component	Concentration (mg/kg)	Reporting limit (mg/kg)
Extractable organofluorine	0.14	0.01

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ANALYTICAL REPORT : IAC21-09930_R1

Analytical results - elemental analysis		
Your reference: 393-1-S-2		Date of analysis: 02-12-2021
Determination of Extractable Organic Fluorine		
Component	Concentration (mg/kg)	Reporting limit (mg/kg)
Extractable organofluorine	0.095	0.01

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ANALYTICAL REPORT : IAC21-09930_R1

Analytical results - elemental analysis		
Your reference: 393-1-S-3		Date of analysis: 02-12-2021
Determination of Extractable Organic Fluorine		
Component	Concentration (mg/kg)	Reporting limit (mg/kg)
Extractable organofluorine	0.23	0.01

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ANALYTICAL REPORT : IAC21-09930_R1

Analytical results - elemental analysis		
Your reference: DUP-05		Date of analysis: 02-12-2021
Determination of AOF		
Component	Concentration (µg/l)	Reporting limit (µg/l)
Adsorbable Organically Fluorine	1.8	1

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ANALYTICAL REPORT : IAC21-09930_R1

Analytical results - elemental analysis		
Your reference: 393-1-W-UT-1		Date of analysis: 02-12-2021
Determination of AOF		
Component	Concentration (µg/l)	Reporting limit (µg/l)
Adsorbable Organically Fluorine	36	1

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ANALYTICAL REPORT : IAC21-09930_R1

Analytical results - elemental analysis		
Your reference: 393-1-W-T-1 Date of analysis: 02-12-2021		
Determination of AOF		
Component	Concentration (µg/l)	Reporting limit (µg/l)
Adsorbable Organically Fluorine	2.9	1

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ANALYTICAL REPORT : IAC21-09930_R1

Analytical results - elemental analysis		
Your reference: DUP-04		Date of analysis: 02-12-2021
Determination of Extractable Organic Fluorine		
Component	Concentration (mg/kg)	Reporting limit (mg/kg)
Extractable organofluorine	0.16	0.01

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ANALYTICAL REPORT : IAC21-09930_R1

Analytical results - elemental analysis		
Your reference: 385-4-F-1		Date of analysis: 02-12-2021
Determination of Extractable Organic Fluorine		
Component	Concentration (mg/kg)	Reporting limit (mg/kg)
Extractable organofluorine	0.025	0.01

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ANALYTICAL REPORT : IAC21-09930_R1

Analytical results - elemental analysis		
Your reference: 385-4-F-2 Date of analysis: 02-12-2021		
Determination of Extractable Organic Fluorine		
Component	Concentration (mg/kg)	Reporting limit (mg/kg)
Extractable organofluorine	0.025	0.01

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ANALYTICAL REPORT : IAC21-09930_R1

Analytical results - elemental analysis		
Your reference: 385-4-F-3		Date of analysis: 02-12-2021
Determination of Extractable Organic Fluorine		
Component	Concentration (mg/kg)	Reporting limit (mg/kg)
Extractable organofluorine	0.023	0.01

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APPENDIX D USEPA SOIL WASHING GUIDANCE DOCUMENT

Appendix D

United States
Environmental Protection
Agency

Great Lakes National Program Office
77 West Jackson Boulevard
Chicago, Illinois 60604

EPA-905-R-99-006
September 1999

EPA

Physical Separation (Soil Washing) for Volume

Reduction of Contaminated Soils and Sediments Processes and Equipment



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2. TITLE Physical Separation Equipment for Volume Reduction (Soil Washing) of Contaminated Soils & Sediments: Equipment Types, Selection & Operating Factors, Vendors & Operators, Case Studies & Treatment Trains

3. AUTHOR(S) Trudy J. Olin, Susan E. Bailey, Mike Mann, Chris Lutes, Carl Seward, Carl Singer

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4. TITLE AND SUBTITLE
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5. FUNDING NUMBERS

6. AUTHOR(S)
Olin, Trudy J.; Bailey, Susan E. of USAE WES and Mann, Michael A.; Lutes, Christopher C.; Seward, Carl A.; Singer, Carl F. of ARCADIS Geraghty-Miller

7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)
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3909 Halls Ferry Road, Vicksburg, MS 39180-6199

8. PERFORMING ORGANIZATION REPORT NUMBER

9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)
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Physical separation processes have long been used in the mining industry for selective separation of minerals from gangue. In recent years, these technologies have been adapted for volume reduction of contaminated soils and sediments. Physical separation processes are generally technically simple techniques by which the most contaminated fraction of a soil and sediment can be separated from the uncontaminated volume. Volume reduction is a viable consideration where a portion of the contaminated material is not readily treatable, where significant savings could be realized in reducing the volume requiring treatment or disposal, or where some benefit can be obtained by recovering reusable material. This document is intended as a consolidated reference for planning-level process feasibility evaluations. An overview of the standard unit processes, general equipment selection and operating considerations, and equipment and technology sources are provided. Summaries from the literature and field experiences and sample treatment trains are also included.

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Abstract

Physical separation processes have long been used in the mining industry for selective separation of minerals from gangue. In recent years, these technologies have been adapted for volume reduction of contaminated soils and sediments. Physical separation processes are generally technically simple techniques by which the most contaminated fraction of a soil and sediment can be separated from the uncontaminated volume. Volume reduction is a viable consideration where a portion of the contaminated material is not readily treatable, where significant savings could be realized in reducing the volume requiring treatment or disposal, or where some benefit can be obtained by recovering reusable material. This document is intended as a consolidated reference for planning-level process feasibility evaluations. An overview of the standard unit processes, general equipment selection and operating considerations, and equipment and technology sources are provided. Summaries from the literature and field experiences and sample treatment trains are also included.

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Contents

Page

Acknowledgments . . . iii
Abstract . . . iv
List of Figures . . . viii
List of Tables . . . x

1 Overview of Unit Processes . . . 1

Introduction . . . 1
Overview of Soil Washing Processes . . . 2
Definition of Terms . . . 2
Field Oversize . . . 2
Process Oversize . . . 2
Coarse Products . . . 3
Fine Products . . . 3
Contaminated Residuals . . . 3
Introduction to Unit Processes . . . 3
Pre-screening . . . 4
Primary Physical Size Separation . . . 4
Density Separation . . . 5
Solid/Liquid Separation . . . 5
Solids Dewatering . . . 5
Treatment Trains . . . 6
Planning for Field Operations: Material Handling and Processing Interfaces . . . 6
Interface between Excavation/Dredging, Staging, Blending and Processing . . . 6
Containment of Feed, Products, and Residuals . . . 10
Residuals . . . 10
Bench-Scale Process Validation . . . 10
Field Analytical Support . . . 10
Overview of Feasibility Evaluation Process for Physical Separation . . . 11
Step 1 Gathering Preliminary Information . . . 11
Step 2 Preliminary Materials Characterization . . . 13
Step 3 Preliminary Technical and Budgetary Feasibility Evaluation . . . 15
Step 4 Evaluation of Level of Certainty . . . 15
Step 5 Gathering Additional Data . . . 15
Step 6 Detailed Feasibility Evaluation . . . 16

2 Equipment Selection and Operating Factors 17

General Selection Criteria 17
Pre-Processing 18
Feed Hoppers 18
Grizzlies (Fixed-Bar Screens) 19
Trommels 20
Comminution 22
Particle-Size Separators/Classifiers 23
Screens 23
Hydrocyclones 26
Hydraulic Classifiers 31
Sieve Bends 32
Density Separation 33
Spiral Concentrators 33
Jigs 35
Shaking Tables 36
Multi-Gravity Separators 41
Dense Media Separation 41
Pinched Sluice 41
Liquid/Solid Separations 42
Settling Basins/Clarifiers/Lamella Separators 42
Flotation 44
Solids Dewatering 47
Centrifuges 47
Rotary Vacuum Filters 49
Filter Presses 51
Screens 53
Hydroseparators 54
Screw Classifiers 54
Auxiliary Equipment 54
Conveyors 55
Process Tanks 55
Sumps and Pumps 55
Controls 55
Weighing Devices 56

3 Treatment Trains and Cost Estimation 57

Factors Affecting Soil Washing Effectiveness 57
Type and Mechanism of Contamination 57
Volume of Material to be Processed 57
Clay Content 57
Organic Content 58
Preliminary Cost Analysis 58
Degree of Heterogeneity of Soil/Sediment Deposit 58
Treatment Trains 58
Treatment Train 1, Simple Physical Separation 58
Treatment Train 2, Physical Separation 60

Treatment Train 3, Treatment with Fines Extraction 60
Case Studies 60
Cost Estimating 60
Case Studies as a Cost Estimating Tool 63
Equipment Cost Multipliers for Total Project Cost Estimation 63
Extensive, Design Level Estimation 64
A&E Proposals 64

4 Case Studies 66

US Army Corps of Engineers 66
Twin Cities Army Ammunition Plant, Minneapolis, MN 66
USAE District, Jacksonville, Canaveral Harbor, FL 67
USAE District, Jacksonville, Miami River, FL 68
USAE District, Jacksonville, Fort Myers, FL 69
USAE District, Detroit, Erie Pier Demonstration, MN 70
USAE District, Detroit , Saginaw River Pilot Scale Demonstration, MI 72
ARCADIS Geraghty & Miller 75
The Hanford Site, Richland, WA 75
King of Prussia Technical Corporation, Winslow Township, NJ 78
FUSRAP, Maywood, NJ 81
The Monsanto Company, Everett, MA 83
The RMI Titanium Company Extrusion Plant, Ashtabula, OH 85
Lordship Point, Stratford, CT 88
Literature 91
Escambia Treating Company Superfund Site, Pensacola, FL 91
Bench-Scale Study at New York University at Buffalo, Buffalo, NY 92
Feather River Site, Oroville, CA 93

5 Summary 94

References 95

Appendix A: Detailed Cost Estimates A1

Appendix B: Equipment & Technology Sources B1

List of Figures

Page

Figure 1-1. General aspects of a physical separation treatment train 7

Figure 1-2. Treatment Train 1, simple physical separation 9

Figure 1-3. Feasibility evaluation process 12

Figure 2-1. Grizzly in series with a screen 19

Figure 2-2. Trommel 21

Figure 2-3. Vibrating screen with wash water 24

Figure 2-4. Section view of a hydrocyclone 27

Figure 2-5. Bank of four fines separation hydrocyclones in the foreground with bank of two sand dewatering hydrocyclones in background 30

Figure 2-6. Two monosizer hydraulic classifiers fed by hydrocyclones 31

Figure 2-7. Bank of spiral concentrators 33

Figure 2-8. Typical final tabling in a gold application 37

Figure 2-9. Distribution of table products by particle size and density 37

Figure 2-10. Two lamella clarifiers operating in parallel 43

Figure 2-11. Froth flotation (mechanical) cells 45

Figure 2-12. Four decanter centrifuges 47

Figure 2-13. Rotary disc filter 50

Figure 3-1. Treatment Train 1, simple physical separation 59

Figure 3-2. Treatment Train 2, physical separation 61

Figure 3-3. Treatment Train 3, treatment with fines extraction 62

Figure 4-1. General process flow diagram for the Bergmann USA System used at Saginaw Bay, MI 73

Figure 4-2. View of soil washing pilot plant at the Hanford site 75

Figure 4-3. The soil washing plant in operation at the King of Prussia site 78

Figure 4-4. Pilot plant at the Envirocare of Utah site, Clive, Utah 81

Figure 4-5. View of the soil washing plant at the Everett site 83

Figure 4-6. Pilot plant-ion exchange tanks and precipitation tank 85

Figure 4-7. View of land and marine areas to be remediated at Lordship Point 88

List of Tables

Page

Table 2-1. Cost Ranges of Several Jig Types 36

Table 2-2. Table Operating Parameters Suggested by Manufacturers 39

Table 2-3. Wilfley Concentrating Table Operating Parameters 40

Table 2-4. Concentrating Table Cost Ranges 40

Table 3-1. Itemized Cost Estimates of Three Treatment Train Scenarios 65

1 Overview of Unit Processes

Introduction

Physical separation processes have long been used in the mining industry for selective separation of minerals from gangue. In recent years, these technologies have been adapted for volume reduction of contaminated soils and sediments, and collectively referred to as soil washing. (This is distinct from soil flushing, an in-situ process.) Physical separation processes are generally technically simple techniques by which the most contaminated fraction of a soil and sediment can be separated from the uncontaminated volume. Depending on its characteristics, the "clean" fraction may require less rigorous treatment or disposal measures or may be suitable for commercial uses without treatment. The most contaminated fraction typically requires further treatment or restricted disposal.

Volume reduction is a viable consideration where a portion of the contaminated material is not readily treatable, where significant savings could be realized in reducing the volume requiring treatment or disposal, or where some benefit can be obtained by recovering reusable material. The relative volumes of "clean" to "contaminated" fractions, the waste streams produced in separation, and the subsequent treatment or disposal requirements of the respective fractions are all critical considerations in determining the viability of physical separation as a management alternative. In cases where a commercially viable product results, potential revenue production or cost avoidance should also be factored into the economic evaluation.

This document is not a comprehensive design guide but, rather, a consolidated reference for planning-level process feasibility evaluations. It is intended for both technical and nontechnical staff responsible for decision making in the management or treatment of contaminated soils and sediments. Feasibility evaluations and development of an effective physical separation treatment train require consideration of many site-specific conditions including, but not necessarily limited to, the following:

- project budget and objectives,
- applicable state and Federal regulations,
- soil and sediment types and volumes,
- contaminant type and distribution,
- potential end use or disposal options, and associated criteria, of process streams,
- equipment cost, availability and operating limitations, and
- location and climatic considerations.

Comprehensive treatment of these design considerations is beyond the scope of this document. An overview of the standard unit processes, information requirements, general equipment selection and operating considerations, and equipment and technology sources is provided. Summaries from the literature and field experiences and sample treatment trains are

also included. An extensive search was conducted to identify vendors and locate case histories. Sources within the consulting industry contributed from their expertise and field experiences. Equipment cost ranges, where available, were compiled from the literature, vendor information and a commercial estimating guide (Western Mine Engineering 1996). Unit costs and cost breakdowns were estimated for three treatment scenarios by ARCADIS Geraghty & Miller Inc., of Tampa, FL.

Chapter 1 provides an overview of physical separation, the basic unit processes utilized in typical physical separation treatment trains, and a systematic methodology for conducting feasibility evaluations. Chapter 2 contains a more detailed discussion of the unit processes, and selection and operating factors of individual pieces of equipment within these categories. Chapter 3 contains sample treatment trains and cost estimation advice. Chapter 4 contains case studies from the literature, US Army Corps of Engineers project records, and the consulting industry. From these case studies, the reader should be able to develop a technical and economic sense of scale, and where potential problems may be encountered in the field when applying physical separation processes to contaminated soils and sediments. Appendix A contains examples of detailed cost estimates. Appendix B is an equipment and technology source listing. While every effort was made to ensure that this would be a comprehensive listing, all potential sources could not be identified within the constraints of the project.

Overview of Soil Washing Processes

Definition of Terms

Some working terminology is needed to describe the range of materials that will be encountered in a soil or sediment remediation project. The following are working definitions that can be modified locally as necessary.

Field Oversize

Field oversize refers to material generally larger than 50 mm effective diameter. This material can include, but is not limited to, boulders, concrete rubble, tree cuttings, debris, scrap metal, reinforcing bar, structural steel scrap, appliances and parts, automotive debris, and industrial scrap. Every site will be different in terms of the characteristics of this fraction. The field oversize can be difficult to handle because of irregular shapes and comingling with soils; it can block feed hoppers and process equipment. Oversize must be removed from the feed stream before the soil is introduced into the process plant. Field oversize is staged and segregated. In most cases, unless this fraction is highly organic, it will test as uncontaminated and can be disposed locally.

Process Oversize

The process oversize is the fraction < 50 mm and generally larger than 2 mm. This fraction generally consists of gravel and broken or downsized debris, including plastic, metal chips, and so on. This component of the feed is also found to meet site treatment standards in most cases. As such, it can be used as backfill when mixed with other clean products, or it can be disposed locally.

Coarse Products

The coarse products are that portion of the feed stream < 2 mm and greater than the "cut-point" between sands and silts. By definition, the cut point between sand and silt is approximately 75 µm (U.S.C.S.). Clays are approximately 3 µm and smaller. For practical purposes, the cut-point ranges from 38 to 75 µm (0.038 to 0.075 mm). The coarse product is a sandy material often comingled with particles lighter and/or heavier than sand. These non-sand materials can consist of shredded natural organics like grass, leaves, and roots (a light fraction) or particulate materials such as lead, comprising a heavier component. The coarse fraction may be either clean or contaminated. If clean, no further treatment is required, of course, but if contaminated, further treatment may be required, and that will be discussed later in this chapter.

Fine Products

Fine products are those materials less than the selected cut-point and consist of clays and silts. In many cases contaminants exhibit a propensity to be concentrated in the fines (clays and silts), primarily because of the very large surface area presented by this fraction. The fines are also difficult to handle, treat and dewater. The dewatered fines are normally contaminated and, due to the concentrating effect of separating them from the bulk matrix, may be reclassified as hazardous waste, requiring disposal at a Resource, Conservation, and Recovery Act (RCRA) facility.

Contaminated Residuals

Any fraction that does not meet the site-specific treatment standard is referred to as a contaminated residual. This may include liquid process streams as well as contaminated soil or sediment fractions.

Introduction to Unit Processes

The purpose of this section is to provide the reader with an understanding of some of the tools available to achieve the desired volume reduction. Much of the philosophy of volume reduction comes from hundreds of years of mining experience worldwide. Miners are faced with problems similar to those encountered in remediation. Miners must handle a very diverse range of feed materials to recover small amounts of valuable minerals. The remediation engineer has the same challenge; to remove small amounts of contaminants from complicated and diverse feeds. Central to all mining operations is sizing. Sizing is central to processing since oversize interferences must be removed prior to further treatment. The development of a process flowsheet for the miner or remediator progresses first from simple operations to more complicated. The most complicated (and costly) steps are reserved for the smallest (and most prepared) fraction. Volume reduction uses a fundamental understanding of the physical and chemical characteristics of the feed soil or sediment and a simple, inexpensive treatment train to remove clean material. This results in a smaller mass of contaminated material to be either further treated or disposed. When properly employed, this process results in significant cost savings. The major flowsheet divisions can be referred to as physical separation, physical and chemical separation, and chemical extraction. These major divisions represent increasing complexity and cost. The focus for this document is on physical separation, but physical/chemical and extraction processes may be referred to peripherally.

Physical separation in the strictest sense is separation on the basis of differences in physical characteristics of materials, particularly size, density and magnetic properties. Inherent surface chemistry differences are also sometimes utilized, as in froth flotation. Flotation and chemical extraction processes may be used in conjunction with physical separation. Particle-size and density separations are overwhelmingly the most useful types of separations. This document will concentrate predominantly on equipment supporting these two types of separation. Soil washing treatment trains are generally composed of sequential treatment processes as dictated by the nature of material being handled, the type and distribution of contamination, the end objectives of the treatment process (regulatory requirements and material specifications), and the ultimate disposition of processed material and residuals. There are five principal components: pre-screening, size separation, density separation, solid/liquid separation and solids dewatering. Additional components, such as chemical extraction, may be required in some cases. The five components are introduced here, and further discussed, along with candidate equipment and equipment selection criteria, in Chapter 2.

Pre-Screening

Pre-screening refers to the removal, or reduction in size, of oversize materials from the bulk soil or sediment that would interfere with downstream processing operations. Oversize materials are roughly 50 mm in size or larger and require separate handling or disposal. Depending upon the history of the site, oversize materials may consist chiefly of stones, tree limbs and large clumps of soil, but may also include rubbish such as tires, concrete, plastics and even refrigerators. Dredged material and landfill soils are typically replete with a variety of non-natural objects. Firing ranges may harbor large unexploded ordnance.

The pre-screening stage of the treatment train may involve one or more of the following elements: feed hoppers, fixed bar screens (grizzlies), rotating trommel screens, comminutors, attritioners, log washers and hand picking. Fixed bar screens, trommels and hand picking are processes for achieving gross size separation. Comminutors and log rollers are size reduction processors. Attritioners are somewhat analogous to grinding mills, but their function is to free the particles from within agglomerated materials rather than reduce the size of the mineral particles. Handpicking is the utilization of manual labor to visually observe incoming materials and to remove, by hand, designated components. Handpicking of field oversize is the most unsophisticated, yet often the most efficient, method of removing troublesome debris. The laborers may be assigned to work at the point of excavation or along a particular run of conveyor belt. Handpicking should be considered when equipment design is very difficult, unavailable, or costly.

Primary Physical Size Separation

Size separation is the core of the soil washing process. Because many contaminants associate chiefly with the finer soil fractions, separation of sand size particles (> 75 μm) from silts and clays (75 μm and smaller) is typically the foundation on which the remainder of the soil washing treatment train is established and refined. (Pre-screening is, in part, a preliminary size separation step.) Sands, silts and clays also differ mineralogically, and therefore chemically. Separation of these soil fractions permits tailoring of subsequent treatment processes to the fraction being treated. In some cases, a portion of the soil will be relatively uncontaminated. Size separation then reduces the volume which must undergo further treatment or controlled disposal, resulting in significant cost savings. In other cases, size separation might be utilized

to remove a contaminated fraction which cannot be successfully treated from uncontaminated fractions, or fractions which are amenable to treatment.

Size separation equipment may include one or more of the following processes: screens (fixed or vibrating, wet or dry), hydrocyclones and sieve bends. Screens separate particles predominantly on the basis of size and shape, as distinct from classifiers, which separate on the basis of size, shape and density. Certain screen configurations may be influenced by material density as well, however.

Density Separation

Density separations are useful in cases where there are significant density differences between contaminated and uncontaminated soil or sediment fractions, or between the soil/sediment matrix and the contaminants (as with fractions contaminated with heavy metals, or containing residual munitions fragments). Minimum specific gravity differences between the materials to be separated are required for density separation to be effective. This minimum value is a function of the equipment utilized to effect the separation. A density separation circuit might include: spiral concentrators, mineral jigs, multi-gravity separators, dense media, shaking tables, or a pinched sluice. Spiral concentrators and jigs are the most commonly utilized in soil/sediment remediation processes. Shaking tables are useful for diagnostic work, but would typically not be included in a full scale treatment train. Dense media is used at full scale in mining processes, but media is expensive and the residuals likely to be problematic in most soil/sediment processing operations.

Solid/Liquid Separation

Soil washing, as the name suggests, requires processing the soil or sediment in an aqueous slurry. The volumes of water introduced to the process to achieve effective separations can be considerable. Gross separation of the solids and liquids is necessary to prepare solid residuals for more extensive dewatering treatments and to permit treatment or recycle of the process water. The distinction between solid/liquid separation and solids dewatering is not entirely clear cut, but is largely a function of the efficiency of the process. Processes resulting in a thickened sludge (perhaps 25% to 35% solids) are classified here as solid/liquid separation processes. More efficient processes, resulting in dryer product, are treated under dewatering. A solid/liquid separation stage might include one or more of the following: clarifiers, sedimentation basins, lamella clarifiers and flotation cells.

Solids Dewatering

Dewatering of solid residuals is necessary to produce a final product with good handling characteristics. Solids concentrations of 45% to 80% are possible, depending upon the size of the material and the dewatering processes used. Fine materials are most difficult to dewater and typically represent a significant portion of overall processing costs. A dewatering circuit might utilize one or more of the following: screens, belt filter presses, plate and frame filter presses, centrifuges, screw classifiers and rotary vacuum filters.

Treatment Trains

The principal soil washing processes would be assembled in a treatment train according the decision process outlined in Figure 1-1. A schematic representation of a typical treatment train is illustrated in Figure 1-2. A more complete discussion of treatment trains and the factors influencing the addition of various unit processes is contained in Chapter 3 Treatment Trains and Cost Estimation.

Planning for Field Operations: Material Handling and Processing Interfaces

In addition to selecting suitable unit processes for the material to be treated, consideration must be given to field operations. Materials management for a soil washing plant is particularly important if field operations are to progress smoothly and treatment is to be effective. Operational interfaces, containment, residuals management and process validation are all important elements of the planning/feasibility evaluation process.

Interface between Excavation/Dredging, Staging, Blending and Processing

Recognizing that material handling activities are directly related to processing is important. Excavation should not proceed independently of planning for effective pre-treatment, staging, plant feeding and treatment. If the interdependence of excavation and treatment is not considered and anticipated, soils could become piled in a huge staging area, where potential "hot-spots" (highly contaminated areas) are lost, problem soils are masked, and the pre-treatment/treatment manager has lost flexibility to control plant feeds.

The excavation plan will define locations for the placement of soils awaiting treatment. Staging areas for the feed material should be identified and should be located near the plant to optimize loading/hauling/feeding. Several staging areas may be required depending upon the source material, distances to the treatment facility, and the amount of pre-treatment required prior to introduction of the soils into the plant. Any treatment plant, irrespective of the unit operations used, will be designed for a certain range of feed characteristics. For soil treatment plants described herein, the most important feed control parameters are soil type and contaminant concentration. Thus, the remediator should do everything practical to arrange the feed piles to match the design feed characteristics of the treatment plant. This is done by managing the feed pile in discrete volumes, using field analytical tools to measure important parameters, and blending discrete piles to match, as well as possible, the design feed requirements. This blending should not be confused with dilution. Feed soils are blended to balance the contaminant load to the plant and optimize performance.

A common scenario is as follows: soils are excavated and placed on a raw soil pad; raw soils are prescreened to remove gross oversize material; the oversize is moved to a designated staging area; the undersize is moved to a feed soil staging pad to await introduction into the plant. On upland sites, soils may have already been excavated and staged, while others may be in urban industrial areas with large amounts of backfilled debris. Also, hydraulically and mechanically dredged feeds will differ substantially. Knowledge of the excavation/dredging plan can suggest methods and requirements of material handling and transfer that will simplify the pre-treatment and make the processing interfaces more efficient.

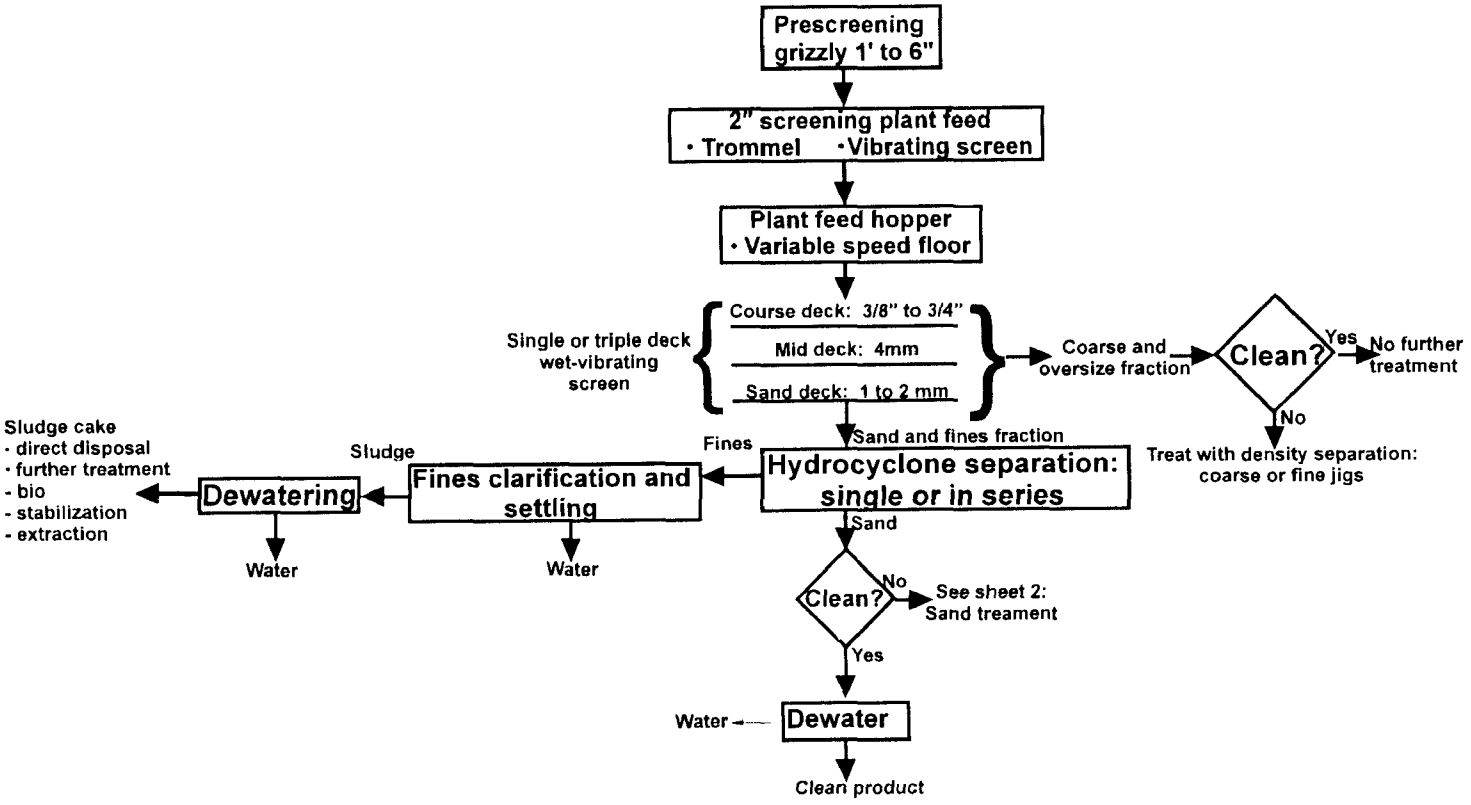


Figure 1-1a. General aspects of a physical separation treatment train (continued on the following page).

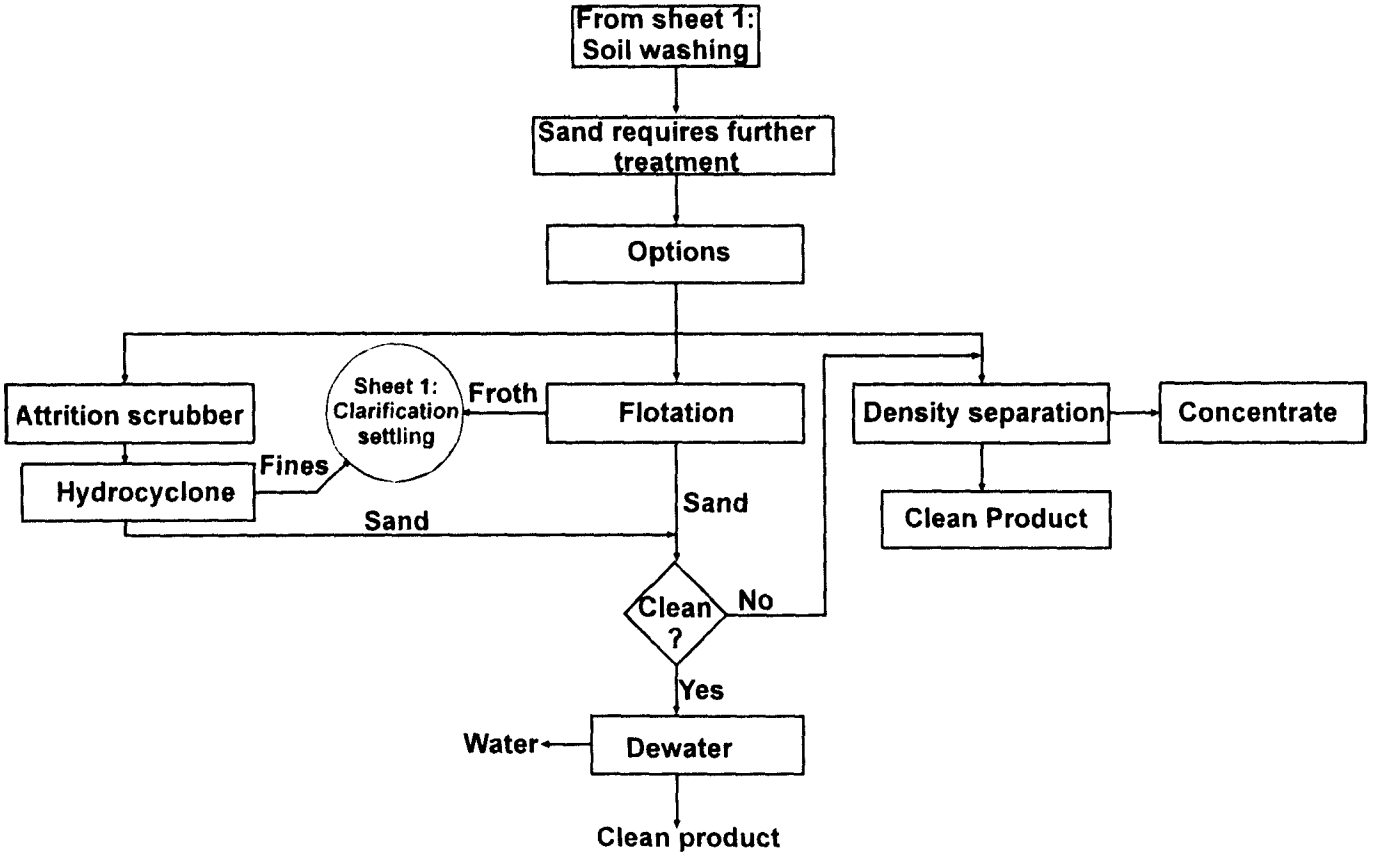


Figure 1-1b. General aspects of a physical separation treatment train (continued from previous page).

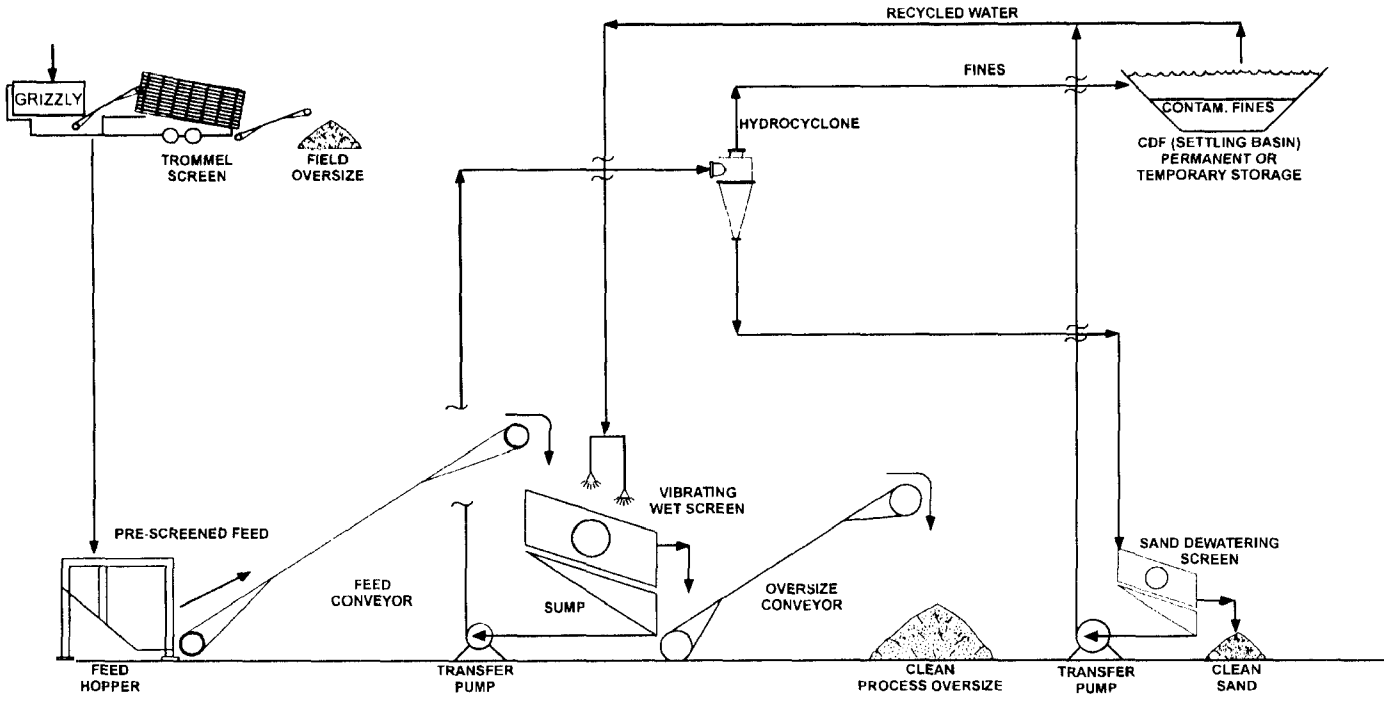


Figure 1-2. Treatment Train 1, simple physical separation.

Containment of Feed, Products, and Residuals

Staging areas may require a liner/concrete pad arrangement to protect groundwaters or surface waters from run-off or infiltration. In cases where the contaminants can be demonstrated as immobile, the pad/liner arrangement may be avoided. Consideration must also be given to weather conditions and periods of operation to protect feeds from heavy rains or freezing conditions. Feed piles are usually managed with front-end loaders; consideration must be given to bucket scraping on the underlayment such that liners or subbase are not damaged in the process. Staging areas can be easily segregated by the use of precast concrete dividers to maintain the integrity of the produced volumes.

Residuals

Both solid and liquid residuals produced by soil washing processes should be given serious consideration prior to implementation of soil washing as a remediation process. Considerable volumes of water are introduced during the soil washing process. While process water is frequently recycled through the treatment train to minimize water usage, treatment to remove solubilized and particulate contaminants is typically required both prior to recycle and prior to ultimate release. Processing costs associated with this treatment can be significant. Further separation of the most contaminated soil or sediment fraction results in a concentration effect. Contaminant concentrations per unit mass will be higher in the contaminated fraction after separation than they were in the bulk soil or sediment matrix. As a result, the regulatory classification of the material may be affected, requiring additional treatment or controlled disposal. Again, significant costs can be incurred as a result.

Bench-Scale Process Validation

All soil remediation projects require bench-scale validation work before implementation. It is essential to work with the soil matrix, to perform particle-size distribution tests, to analyze the chemical constituents, to determine the form of the contamination, and to run each unit operation in the proposed flowsheet. It is important that each contractor bidding on a project be allowed to perform individual testing. If one set of data is to be used, common agreement on such data is essential. More information on process validation is found under the headings "Step 2" and "Step 5" in the feasibility evaluation process section of this chapter.

Field Analytical Support

While a voluminous amount of analytical data has been generated on most sites, the characterization data often does not fully represent soils delivered to a treatment plant. Thus, simple, quick-turnaround analytical capability must be provided to the plant to quantify actual key contaminant feed concentrations. The principal analytical tools available include x-ray fluorescence (XRF) for metals, field gas chromatography (GC) for organics, soil gas detectors, portable radiological survey meters, colorimetric devices, and immunoassay for organics. All of these tools can be correlated with full laboratory protocol methods to provide a reasonable level of confidence in the results. These tools are not intended to replace standard analytical protocols for regulatory compliance. They are used to control and manage the feed in a balanced manner.

Overview of Feasibility Evaluation Process for Physical Separation

A systematic conceptual procedure for evaluating the suitability of physical separation for a given soil or sediment is requisite to successful implementation. Figure 1-3 provides a conceptual overview of this procedure, which begins with preliminary information gathering and materials characterization followed by preliminary evaluation of the feasibility of physical separation. If this evaluation is favorable, then more in depth information is gathered to support a more detailed feasibility evaluation whose results can be assigned a greater degree of confidence.

Step 1

Preliminary information needs, including the problem for which physical separation is being considered, the volume of material and its sources, and the anticipated time line for handling the material, must be clearly defined. The budgetary constraints, typically expressed either in cost per unit volume, costs for the entire project, or as a cost/benefit analysis, must also be assessed.

A review of existing site documents and discussions with personnel experienced in working on the site should be used to define the contaminants or other undesirable characteristics of the material that motivate the use of physical separation. The primary contaminants and pathways for any ecological or human health risks that are important with regard to the material must be kept in mind during the feasibility evaluation process. The site's history (as well as published information about similar sites) should be reviewed for clues to the distribution and disposition of contaminants. All available information on how evenly the contaminants are likely to be distributed should be gathered. For example, with regard to metals contamination, the determination made must include if they were introduced to the environment in dissolved or particulate form, what compounds/valence state they were in at that time and how long the material has had to transform or "weather" in the environment. Data on the characteristics of the bulk matrix, such as solids/moisture content, particle-size distribution (sand, silt, clay), redox potential, concentrations of total organic carbon, acid volatile sulfide, and dissolved oxygen should be collected. Even qualitative observations of the nature of the bulk matrix (e.g., "tarry"), if available, are better than a total absence of information.

The nature of the bulk matrix is important in drawing preliminary conclusions about the forms in which the contaminants exist in the environment, how they may contribute to any observed toxicity, and thus how they can best be separated or immobilized. Also, as part of the first preliminary information gathering step, the potential beneficial-use applications for clean/treated material should be assessed. Potential applications including shoreline stabilization, fill for infrastructure projects (e.g., roads), wetlands creation, landfill cover and soil improvement for agriculture should be considered in the context of the local/regional economy, geography (Landin 1997) and regulatory climate. The requirements in terms of volume, scheduling, cost, physical materials characteristics, toxicity, and contaminant concentration/mobility for each application that appears feasible should be assessed. Similar information should be gathered about non-beneficial disposal options that can serve as a basis for comparison of the beneficial-use options or could be used for disposal of the contaminated fraction of the material following a physical separation process. Disposal options may include open water disposal (EPA/USACE 1991 and 1998), confined disposal facilities either upland, near-shore or in-water,

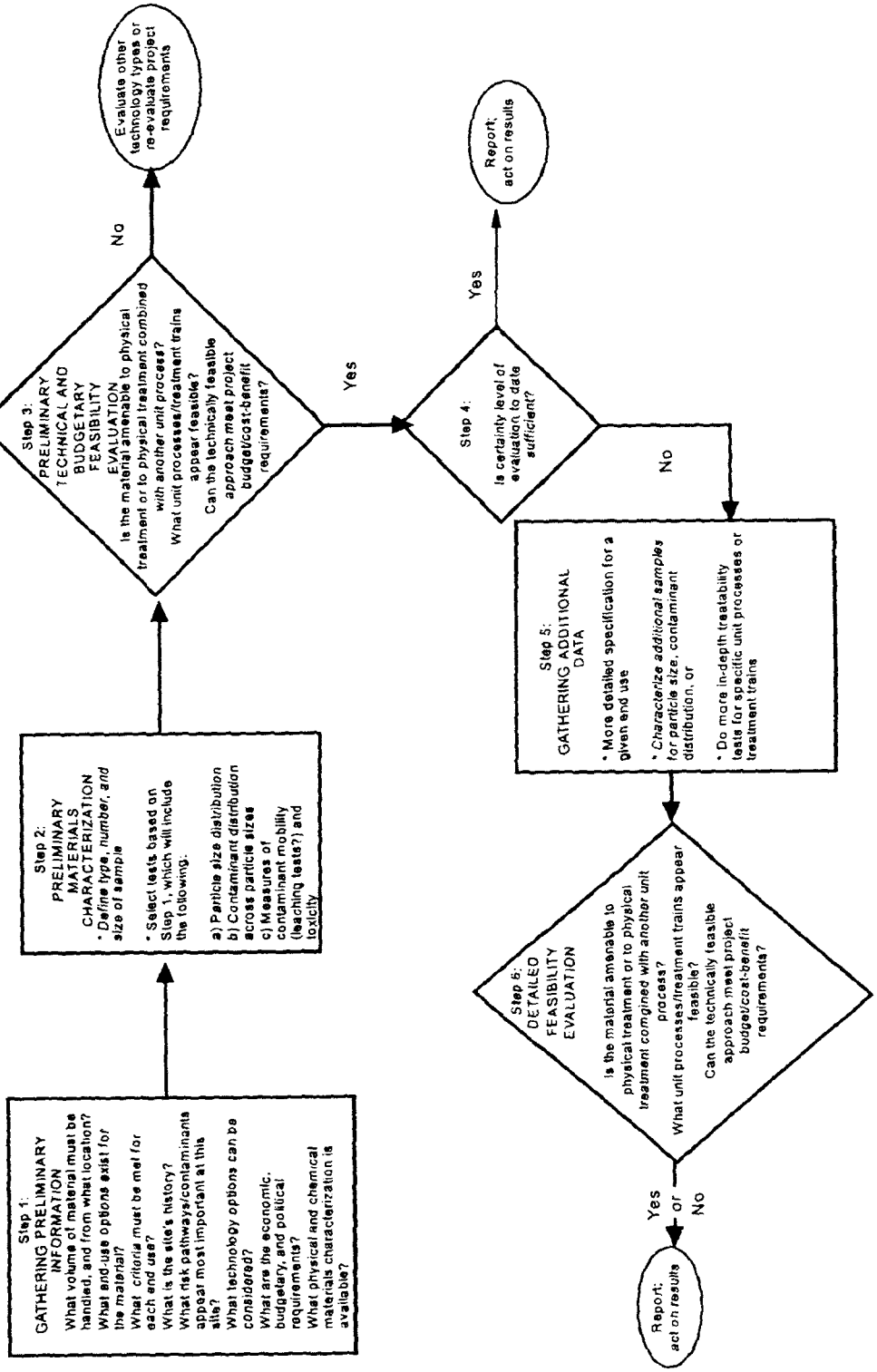


Figure 1-3. Feasibility evaluation process.

and upland disposal in municipal or hazardous waste landfills. As a rule of thumb, upland disposal and beneficial reuse options have traditionally been regulated based on a comparison between measured concentrations of contaminants of concern in the bulk material (or eluted concentrations) and "look-up" tables of values developed based on risk considerations. On the other hand, aqueous disposal options for sediments are generally regulated based on the toxicity of the whole material (EPA/USACE 1991 and 1998). In either case, determination of available disposal alternatives is a regulatory issue which may significantly impact process economics.

In addition, the range of technologies available to address the handling of the material in question needs to be defined. While this document will provide a good overview of the available physical technologies and their stage of development, chemical, biological and thermal processes should also be considered both as alternatives to and complements to the physical technologies.

Step 2

The second step as shown on Figure 1-3 is a preliminary materials characterization. This step is analogous to the "Physical Prescreening" described in EPA's "Guide for Conducting Treatability Studies Under CERCLA: Soil Washing, Interim Guidance" (USEPA 1991b). The data needs that this step will address will be defined in large part by the information gathered in Step 1. In most cases, the volume of the material requiring treatment and the level of contamination it contains will have been defined well enough to support a preliminary feasibility evaluation. However, in many cases vital information for the evaluation of physical separation processes such as particle-size distribution and the distribution of contaminants among particle-size classes is not available from site documents. At this stage, characterizing the mobility (leaching) of the contaminants of interest or their toxicity (depending on applicable regulatory scheme) for each particle-size class may be beneficial. An evaluation of the handling characteristics of the bulk material may also be desirable, either based on the qualitative observations of laboratory personnel or on geotechnical testing. Other parameters such as clay content, liquid limit (LL) and plastic limit (PL) may be of qualitative interest but may not be of practical use if they cannot be directly correlated to equipment selection.

Soils will always be characterized by type (gravels, sands, clays, silts, and so on) and quantified by the soil particle-size distribution (ASTM 422D). The particle-size distribution curve will typically be generated by sieving the material through each of ten successively smaller sieves. The material retained on each sieve is dried and weighed. The masses are then plotted on semilog paper, and the particle-size curve results. A particle-size curve always reports masses with 0% moisture or 100% dry matter. When mass balances are created, moisture must be factored back in. Contaminant distribution with respect to particle size and/or density will be a determining factor in the feasibility of achieving product specifications using only physical separation. Soils and sediments with contamination distributed over all particle sizes may require additional treatment to produce a clean product. Materials with contamination chiefly confined to a limited size fraction can typically be treated with physical separation alone. The relative volume of contaminated to clean material, however, is a key determinant to the economic viability of the process. Disposal costs of contaminated materials and process streams must be factored into the economic analysis.

Characterizing the material to be processed is also a critical intermediate step between determining product specifications and developing a treatment train. Guidance has been

developed and is being further refined for addressing this step but at a minimum will require particle-size distribution and contaminant distribution analysis. Demonstrated approaches to this intermediate step were developed in the Netherlands (where some of the earliest application of soil washing to soils and sediments took place). Two such procedures are the Fingerprint Method (developed by Heidemij Realisatie, now ARCADIS Realisatie) and the TDG test (developed by ARCADIS Realisatie and TNO Institute of Environmental and Energy Technology). The Fingerprint Method is a pilot-scale method that uses sequential hydrocyclone separations to fractionate a sample into various (typically six) particle-size classes. These classes may then be further subdivided according to density by gravity separation. The distribution of contaminants across all the various size and density fractions (11 in one case) is then determined. The results of this procedure are then used to design a full-scale treatment system that is optimized to isolate the most contaminated material from the bulk of the material, which can often be beneficially reused. This procedure has been applied more than twenty times by ARCADIS in the Netherlands (Bovendeur et al. 1991, Bovendeur and Mozley 1993, Bovendeur and Visser 1993).

The TDG test is a more simplified, small-scale procedure in which a wet screening step is used to produce three size fractions. The intermediate fraction (63 to 500 microns) is then gravity separated into three subfractions. The contaminant distribution over the resulting five fractions is then determined, and the results are used similarly to determine the optimum remedial approach (Feenstra et al. 1995).

The Waterways Experiment Station (WES) is working to develop a method to streamline the analysis and reduce costs. The method involves limiting the size and density of the cuts to only the critical fractions (i.e., cuts that separate the mineralogically different size and density fractions). For example the transition from silt to sand occurs at 63 or 75 microns, depending upon the standard used, and from clay to silt at roughly 2 to 3 microns. These fractions behave differently in their ability to hold contaminants. Significant density separations would be made to separate organic material (SG < 1.8) and metal particulates (SG > 3.0) from the mineral fraction.

No list of tests applicable to every site can be formulated. Rather, the list of required tests should be formulated using the professional judgment of persons familiar with physical separation technologies and the background of the sites. Once a set of tests to be performed is selected, the right number, volume, and type of soil or sediment samples should be collected to be tested so that they will be representative. In this sampling stage the most major problems with physical separation projects occur. The sampling and compositing must be guided by a well-thought-out plan prepared by an engineer with experience in full-scale physical separation and by an environmental chemist or geologist. The sampling plan must be executed by well-trained, motivated personnel who understand the objectives of the project. In formulating a sampling plan, careful consideration should be given to representing the type and range of material that a hypothetical full-scale physical separation plant would receive as an input. Serious errors can be made either by compositing portions of the site that would not be composited during the excavation or dredging process, and thus potentially underestimating the peak concentrations of contaminants, or by failing to composite areas of the site that would be composited during the excavation or dredging process and thus potentially overestimating the peak concentrations of contaminants that the plant would be required to treat. Sample quantities, holding times, preservation methods, etc., must be coordinated with the analytical and treatability laboratories involved during the writing of a sampling plan. Historic practices at the site and its geographic and geologic nature are important considerations in formulating

a sampling plan that will adequately represent the diversity of materials found at the site. Statistical and practical considerations involved in representative sampling are beyond the scope of this document. However, guidance can be found for sediments in the work of Mudroch and Azcue (1995) and for surface soil in manuals prepared by USEPA (1996), USEPA (1986), ASTM (1995), and the Soil Science Society of America (Petersen and Calvin 1996).

Step 3

Step 3 as shown in Figure 1-3 is the preliminary technical and budgetary feasibility evaluation. Most of the material in this document is designed to help answer the questions that must be posed in this step: "Is the soil or sediment amenable to physical treatment or to physical treatment combined with another unit process? If so, which processes or treatment trains appear feasible? Can any of the technically feasible processes which have been identified meet budgetary or cost/benefit requirements?" Further guidance in addressing these questions can be found in USEPA (1991a) and Anderson and Mann (1993).

If the answers to the questions posed in Step 3 indicate that no feasible physical process exists, then other types of technologies (e.g., biological, chemical or thermal) must be considered or the budgetary and technical goals for the project must be reexamined in light of practicality. If the answers to the questions posed in Step 3 suggest that physical separation is a feasible alternative for the site, then the certainty of that determination should be assessed.

Step 4

In this step, the confidence or certainty surrounding the preliminary positive feasibility evaluation made in Step 3 should be assessed. Both the personnel involved in the work of Steps 1 through 3 and independent technical reviewers should attempt to address the question, "Is the basis for the positive evaluation sufficiently certain, given the stage of the project/purpose of the evaluation?" If the answer to this question is positive, then the feasibility evaluation has been successfully completed. If the confidence in the evaluation is not high, most likely due to gaps in the information available on which to base the evaluation, the process should continue to the next step.

Step 5

In Step 5 additional data is gathered to support a more detailed feasibility evaluation. Again no "one size fits all" set of data gathering activities can be described. However, the preliminary feasibility analysis by this point has probably narrowed the range of beneficial reuse and disposal options, allowing a more detailed study to be made of the specifications and requirements for a treated product to be put to a given end use, and the amount of material that a given end use can handle at a given time.

Cost considerations may have forced compromises in the number of samples or types of tests performed in Step 2. After a preliminary positive feasibility determination has been made, the costs for a thorough program of sampling and analysis may be more easily justified.

The most important information gathering activity in Step 5, however, is likely to be more extensive treatability testing in which the capabilities of individual unit processes and entire treatment trains to handle the material of interest is assessed either at the lab pilot or field pilot

scales. For example, where in Step 2 a bench-scale sieve and hydrometer based particle-size separation was used, here in Step 5 a pilot scale separation involving sieves, hydrocyclones, and spiral density separators may be carried out. Further information on this process can be found in later sections of this document as well as in USEPA (1991b), Feenstra et al. (1995), and Bovendeur et al. (1991). This step can be considered to roughly parallel the remedy selection treatability studies described by USEPA.

Step 6

Based on the further information obtained in Step 5, the technical and budgetary feasibility evaluation would be revised. The questions addressed here are the same as in Step 3: "Is the soil or sediment amenable to physical treatment or to physical treatment combined with another unit process? If so, which processes or treatment trains appear feasible? And can any of the technically feasible processes which have been identified meet budgetary or cost and benefit requirements?" Step 6 will result in a more detailed determination of the feasibility of the process which, after an evaluation of the confidence level of that determination, can lead to appropriate action (i.e., proceed to engineering design of a treatment system).

2 Equipment Selection and Operating Factors

General Selection Criteria

Equipment selection for physical separation of contaminated soils and sediments requires that a number of interdependent parameters be reconciled. As discussed in chapter 1, selection should begin with the desired product specifications (e.g., percent fines, maximum acceptable contaminant levels for a given beneficial use) and maximum allowable capital and operating costs. Then work backwards to identify equipment options suitable to the characteristics of the material being processed, capable of providing the necessary capacity and efficiencies, and with capital and operating costs falling within the proposed project budget.

None of the unit processes available is capable of producing a perfect "cut." All are subject to varying levels of efficiency which are a function of the type of equipment, material characteristics, and the loading. Series installations may be necessary to refine the separation to satisfactory levels, or parallel installations may be required for sufficient capacity. These determinations are best made by testing the material to be treated in equipment of the same size selected for the treatment train and optimizing the operating parameters. Since these determinations are not always possible without first purchasing equipment, the planner must rely heavily on the expertise of the equipment and technology vendors in making reasonable initial equipment choices and the results of bench or pilot scale testing. The system so assembled will probably require some additional modifications once set up and running in the field.

The purpose of this chapter is to provide more detailed information about key unit processes in a standardized format. This information was mostly derived from vendor literature and handbooks. Each unit process for which there is adequate information is treated in a common format that provides information such as:

1) a brief restatement of the nature of the unit process,
2) a photo (if available),
3) feed material specifications,
4) capacity,
5) description of the various types of equipment available for each unit process,
6) waste/product streams produced,
7) operating variables,
8) physical size of the equipment,
9) cost (if available),
10) general comments,

11) position in flow sheet, and
12) vendor names. (Address and phone information are given in Appendix B, Equipment and Technology Sources.)

Costs were converted to January 1998 US dollars, using Chemical Engineering Plant Cost Index (CE Index). In many cases, vendors are reluctant to provide generalized cost estimates. Therefore, cost estimates are based on best available information and must be confirmed and refined for specific applications. One limitation of the Western Mine Engineering (1996) cost reference is that some of the equipment is of a type and scale relevant chiefly to large mining operations. This limitation does not present a problem for much of the milling equipment such as screens, screw classifiers and filters, but conveyor size and costs contained in this reference are clearly beyond the scale required for most soil or sediment treatment plants. In addition, there are a wide variety of pumps, hydrocyclones, and other pieces of equipment available in the marketplace, all of which could not be represented in a consolidated reference such as this. Ultimately, the only way to assess the breadth of equipment available is to contact vendors individually about equipment tailored to specific project needs. Generic cost references, however, do a reasonable job of defining the broad ranges of capacities available and associated cost as a function of capacity.

The reader should be aware that while physical separation is applicable to sediments as well as soils, much of the information discussed here is taken from mineral processing technology, which is more closely related to soils than to sediments. Sediments tend to present additional handling concerns and possible increased expense. For example, sediments often have a "sticky" nature that could be problematic in equipment such as a grizzly or trommel where the material is not yet in slurry form. Clay balls are commonly encountered in hydraulically dredged sediments and could pose processing problems. Transport and storage of wet sediment may also require different handling and containment procedures. As would also be true for some uncompacted soils, confined disposal facilities (CDFs) may not provide a stable staging area, and off site operations may be necessary.

Pre-Processing

Feed Hoppers

Feed hoppers are the logical starting point of moving raw, "as-excavated" soils into the treatment train. Feed hoppers are one of the most overlooked aspects of most plants because they are believed to be simple boxes that start soils to the more complicated downstream steps. Nothing could be further from the truth. More projects have failed because of poorly designed feed hoppers than any other aspect of the process. Feed hoppers must be selected with an awareness of the type of soil to be introduced.

The predominant feed hopper design for soil washing is the walking floor or conveyor. A sloped bottom hopper is mounted above a variable speed chevron conveyor belt. The hopper should have an adjustable feed discharge door. This adjustable door and the variable speed belt allow control of the feed rate by controlling the cross-sectional area of the feed on the belt as well as the belt speed. Feed characteristics will determine the preferred control method.

Grizzlies (Fixed-Bar Screens)

One of the first unit operations in the typical pre-screening treatment train is the fixed-bar screen or grizzly. Grizzlies are large screens (grates) consisting of fixed parallel bars, usually 100 to 200 mm apart (Osborne 1990). In mineral processing operations, grizzlies appear before the primary crushing operations to minimize the material passing through the crusher by removing the oversize material. In soil/sediment treatment operations, grizzlies primarily serve to screen out large cobbles and debris often present in feed materials. A grizzly may be incorporated as part of the first feed hopper or may be a stand alone piece of equipment, fed by front end loader and evacuated by loader or conveyor as shown in Figure 2-1.

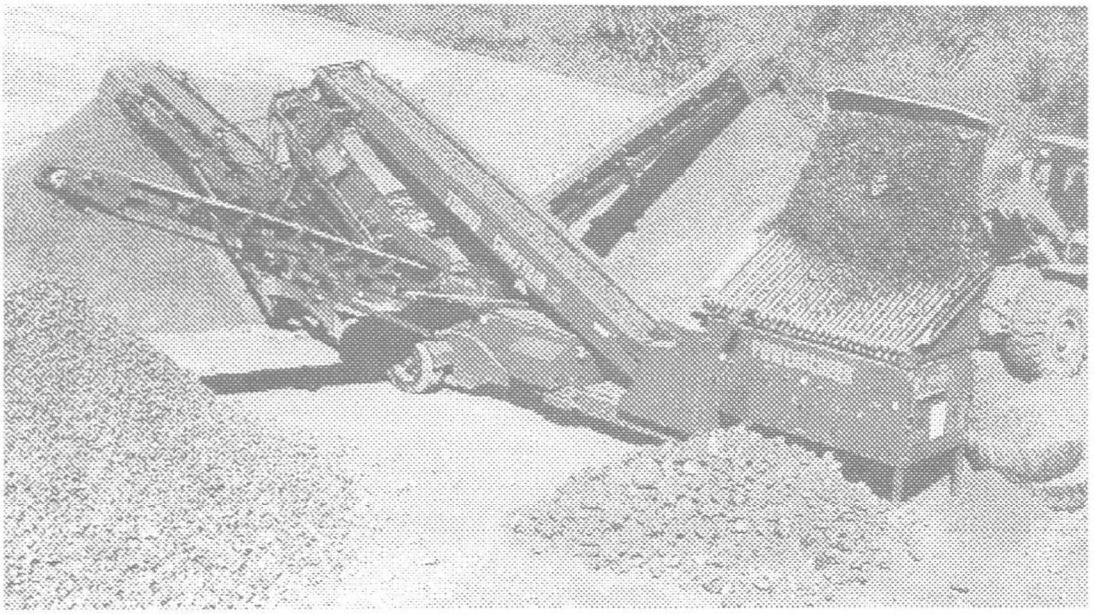


Figure 2-1. Grizzly in series with a screen (provided courtesy of Powerscreen of Florida, Inc.).

Feed material specifications -

Specific gravity - n/a

Solids content - Usually fed dry or at prevalent site water content.

Washwater - Not typically applied to grizzlies.

Particle-size ranges - Grizzly bars are usually spaced 1" to 2" (2.54 to 5.08 cm) apart.

Capacity - Limited primarily by loading equipment.

Type - Site built grizzlies are usually stationary bars. Vibrating grizzly bars promote product and oversize movement.

Waste/product streams - Oversize material is either retained on the grizzly for hand picking or slides from the inclined face of the grizzly bars.

Operating variables/parameters - Parameters for vibrating grizzlies include amplitude and frequency of vibration. The dimensions of oversize material will be determined by the spacing of the bars.

Size - Not limited with respect to size but may typically be approximately 12' x 12' (3.66 m by 3.66 m).

Cost, capital and operating - Western Mine Engineering (1996) gives capital costs for vibrating grizzlies with deck sizes ranging from 3' x 5' to 6' x 20' (1 m x 1.5 m to 1.8 m by 6 m) as $19,230 to $86,920 with operating and maintenance costs ranging from $1.38 to $6.25/hr.

General comments - Grizzly bars may be installed on vibrating assemblies; undersize product flowing between the bars. Minimum spacing nominally 1.5" (3.81 cm). Stationary bars are often installed over bins and hoppers. They are typically fed with a front end loader.

Flowsheets - Grizzlies are normally the first stage in the treatment train as shown in the generalized process flow diagram, Figure 1-1.

Vendors - Triple/S Dynamics Inc.

Trommels

Trommels (Figure 2-2) are rotating screens consisting of cylindrical, slotted drums. Oversize material passes through the central axis of the drum, while undersize material passes through the slots of the drum. Trommel screens can be removed and modified to provide a removal range of 25 to 75 mm. Trommels can be arranged in series to achieve successively larger or smaller separations by feeding either the oversize or the undersize to the next trommel. The angle of the drum and the rotating speed can be adjusted to improve performance. Moderately sized trommels have a throughput rate of approximately 100 tons per hour. While trommels are relatively inefficient, they are ideal for preparing feed soils for further treatment. Clay can be problematic, and attention must be given to application of enough energy to force feeds to their natural particle size to overcome agglomeration.

Feed material specifications -

Specific gravity - Not limited.

Solids content - Feed to trommel is normally dry or at prevailing site conditions.

Washwater - Not typically used in soil/sediment separations.

Particle-size ranges - EPA's ARCS guidance document (1994b) indicates a maximum feed size of 4 cm and a target separation range of 0.006 to 0.055 cm.

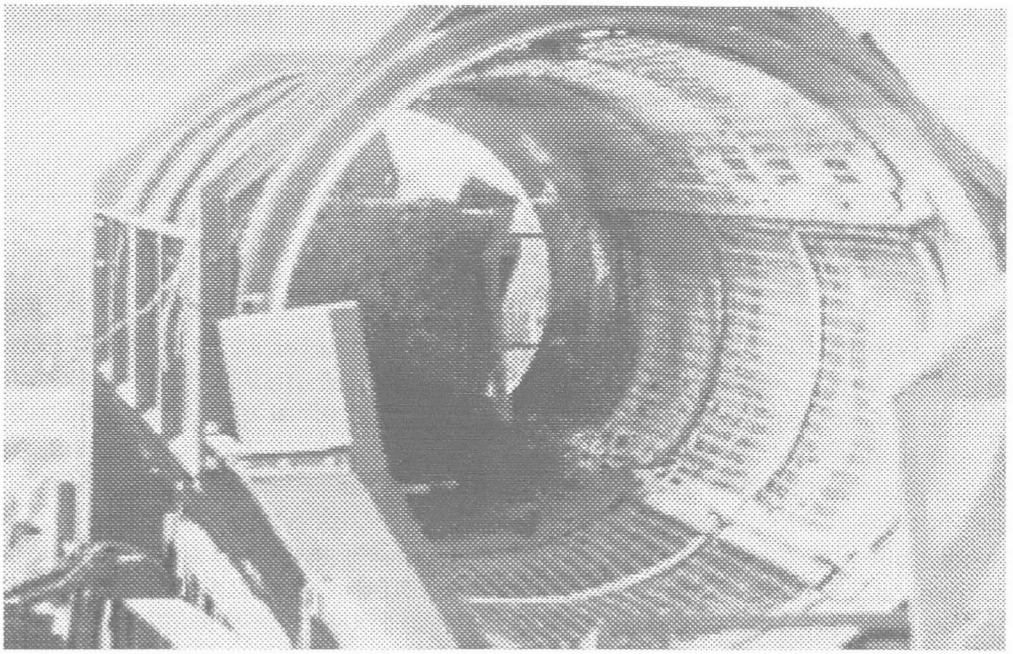


Figure 2-2. Trommel (provided by ARCADIS Geraghty-Miller).

Capacity - Western Mine Engineering (1996) gives capacities for fixed trommels at 40 to 720 cy/hr and for mobile trommels at 25 to 500 cy/hr.

Type - Trommels may be equipped with spikes or knives to aid in de-agglomeration or size reduction.

Waste/product streams - Oversize material travels down the inside of the rotating trommel and is discharged through a hopper at the end of the drum. Large agglomerates will discharge with the oversize if they have not been reduced. Undersize material passes through the grate of the trommel and is discharged through a separate hopper.

Size - Fixed trommels described range in size from 36-inch (91.44-cm) diameter and 12 feet (3.66 m) in length to 96-inch (243.84-cm) diameter and 44 feet (13.41 m) in length. (Western Mine Engineering 1996)

Cost - capital and operating - Cost information is provided for both fixed and mobile trommels (Western Mine Engineering 1996). Capital costs for fixed trommels range from $20,330 to $203,300 and operating costs from about $1.00 to almost $13.20/hr. Unit capacity costs range from approximately $300 to $500/cy/hr, with unit cost decreasing with increasing capacity. Motors are additional.

Capital costs for mobile trommels range from approximately $81,000 to $1,321,000, and operating costs from approximately $4.00 to $63.00/hr. Unit capacity costs range from approximately $2,540 to $3,250/cy/hr. Additional capital cost is attributed to skid mounting and auxiliary equipment included for the trommel operation. The reason for the higher operating costs is not given. Other assumptions on which these cost ranges were based are contained in Western Mine Engineering (1996).

Flowsheets - Trommels are typically used following a grizzly and, in soil and sediment separations, in front of a screen.

Vendors - Triple/S Dynamics Inc.
Powerscreen of Florida, Inc.

Comminution

Comminution is a general term for size reduction that may be applied without defining the actual mechanisms involved. The equipment that could be used in this area includes a wide array of crushers, grinders, and mills. Even explosive shattering is, in fact, a comminution technique. In soil treatment, these methods are rather infrequently employed. In remedial applications, the field or process oversize may be contaminated, requiring crushing or grinding to process for the removal of target contaminants.

A reasonable rule of thumb for the lower size limit resulting from various size reduction techniques is as follows: 1 m for explosives, 100 mm for primary crushing, 10 mm for secondary crushing, 1 mm for coarse grinding, and 100 µm for fine grinding. Fine grinding will create a small enough particle size such that treatment can be affected in most soil treatment facilities. These processes are used on large volumes and are expensive on both capital and operating cost levels. Power consumption is high. Common machines in this category include jaw crushers, gyratory crushers, cone crushers, hammer mills, ball mills, rod mills, and autogenous mills.

Autogenous grinding is the grinding of feeds by natural contact, rather than by using special metallic or non-metallic grinding bodies distinct from the feed. Tumbling mills are autogenous mills used where the ore (in remediation, feed soils) is used as the grinding media to produce a feed of the desired size range. The mining industry learned that when autogenous grinding was not effective, performance could be improved by adding a quantity of steel balls to the mill in an amount of 2% to 10% of the mill volume. The use of the steel balls reduced the retention time and energy requirement in the mill while producing an improved discharge.

Dispersion of agglomerates can often be performed effectively in comminution equipment. For soil remediation applications, clay soils and agglomerated soils may require additional input energy to produce acceptable treatment plant feed. Hard rock oversize can work nicely instead of steel balls. Trommel screens, modified to increase retention time, with the addition of field oversize rock, are referred to in this document as SAG (semi-autogenous grinder) mills.

A log washer is another device used to break up clumps of agglomerated soil. It consists of two rotating parallel logs with steel projections (spikes). This action results in coarse attritioning of the material.

Attritioners or attrition mills are machines that are used in remediation applications to grind materials in the coarse fraction to insure that agglomerated materials are driven to their natural particle size. Often, clays and silts can be bound together from waste formation pressures or in-place stress making the agglomerated mass appear to a screen or hydrocyclone as sand particles. Through the use of the attritioner, grinding forces are placed upon the input soils, reducing the materials to inherent particle sizes. Attritioning is synonymous with abrading, that

is using the soils as the media affecting the grinding. Attritioners can be classified as rotating-disk, fluid, and abrading sand machines. The most commonly used in remediation applications are of the rotating-disk type.

Particle-Size Separators/Classifiers

Screens

In a volume reduction operation, screens will be used for grading (sizing) material, though they may also have dewatering applications. When slurry is fed onto a screen, particles larger than the screen apertures (oversize material) pass across the screen. Particles smaller than the aperture (undersize) pass through. Because contaminants very often (but not always) associate predominantly with fine materials, which have high surface area and activity, coarse/fine separations are typical of the majority of volume reduction operations. Desirable "cuts" will be determined by the contaminant distribution with respect to particle-size and the required fines content in the finished material.

Screens will usually appear at more than one point in the treatment train, beginning with very large screens to remove field oversize materials, followed by finer screens to make the desired coarse and fine cut(s). The smallest practical size for screening is approximately 1 mm (1000 µm). While vibrating screens are available down to 500 µm, they are very large and difficult to operate. It is not feasible to use mechanical screens for separations smaller than 500 microns.

Screens may be stationary, reciprocating, or vibrating, and either wet or dry operation. High pressure spray bars on the screens are advantageous to break up agglomerated materials. (See Figure 2-3.) Deck material and configuration vary. Primary selection factors are required aperture and percentage of open area, which varies in practice from 30 to 80% of the total screen area (Osborne 1990). However, aperture shape, weave and hole pattern must also be considered. Screen manufacturers are the best resource for these determinations. Ultimately, a pilot test of the material to be processed is advisable if performance is to be adequately evaluated prior to selection.

The most widely applicable deck is the wedge wire cross-flow deck (Osborne 1990). Other mediums are rubber, polyurethane, woven wire (square or slotted holes), and perforated plates (round, square or slotted holes). While demonstrating good wear characteristics, the non-metallic surfaces all share the disadvantage of reduced open area with decreasing aperture. Screens are very durable, with long useful lives, and are generally designed so that the perforated decks can be replaced for process changes or when worn.

Feed rate and separation efficiency are the two primary design criteria for screens (Osborne 1990). There are a number of empirical relations for sizing screens. Because screen capacity is somewhat affected by the characteristics of the feed, however, capacity calculations should be based on a pilot run of representative feed materials (Osborne 1990). In general, capacity is a function of the open area. Open area is, in turn, related to wire bar profile, in the case of wire screens, and inclination. For feasibility level evaluations, only familiarity with the aperture ranges of the different types of screens, typical separation and operational efficiencies, and

relative advantages and disadvantages of each type is necessary. Manufacturers are typically in the best position to size equipment for final selection.

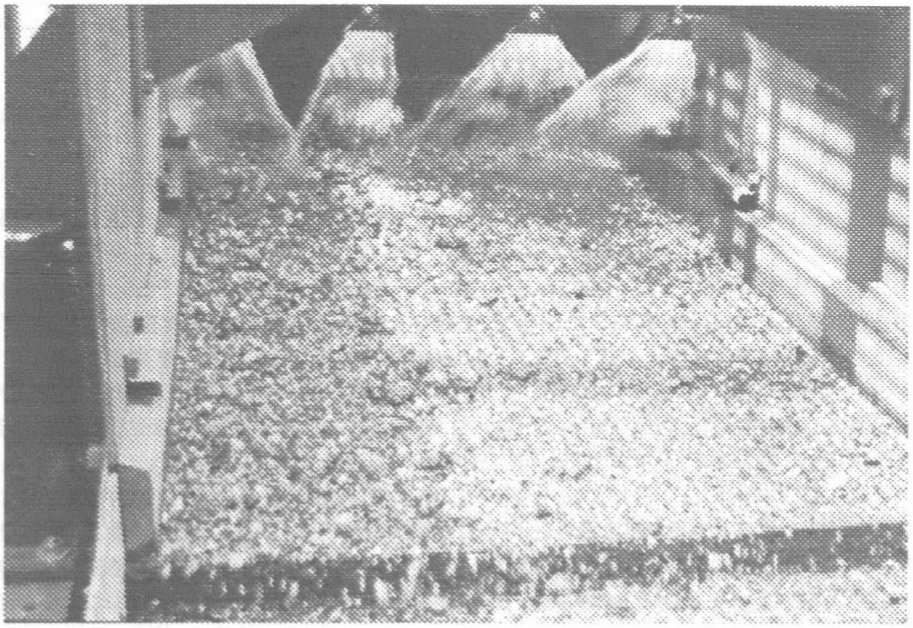


Figure 2-3. Vibrating screen with wash water (provided courtesy of ARCADIS Geraghty-Miller).

Feed material specifications -

Specific gravity - No restrictions were found in the vendor literature.

Solids content - Virtually any solids content may be fed to a screen. Moist solids tend to cause blinding on the screen restricting throughput. Accessories such as heaters or ball decks are often available to reduce blinding.

Washwater - A well-designed water spray system can increase screening capacity. Water spray systems can generally be installed on any deck.

Particle-size ranges - Particle-size separation will be dependent on the cloth chosen for the screen. Feed material should be free of particles greater than about 300 mm, or smaller depending on screen size, to avoid damaging the screen. Screens may be considered when the desired cut size is greater than about 25 µm.

Characteristics - Though not discussed extensively in vendor information, screens generally remove top sizes from fines. Some nearsize fines entrainment can generally be expected with the oversize because nearsize particulate will rarely strike the cloth at the center of an opening. Physical damage to the screens may allow oversize particles to discharge on lower screens or with the undersize product. Agglomerates will tend to behave as a large particle unless broken up by washwater or other mechanical action.

Capacity - Screen capacity is a function of the feed particle-size distribution, density, moisture, end product specifications, and other factors. Operational factors affecting capacity may include screen selection, vibration frequency and amplitude, wash water distribution, and flowrate. Pilot tests are often necessary to properly size equipment. Capacity may be up to approximately 4.5 short tons per hour per sq. ft. for metallic ores and will vary for different materials (Deurbrouck and Agey 1985).

Type -

Fixed Mechanical Screens - Fixed screens are mounted directly to the supporting structure and rely on the input energy to the loading process to stratify the bed and to perform the separation. Fixed screens are generally used for field screening to remove field oversize. The screens in this category are relatively inefficient, but the low capital and operating costs support their use.

Vibrating Screens - Vibrating screens, both inclined and horizontal, produce motion perpendicular to the plane of the screen surface. Vibrating screens are shaken by low-frequency motors mounted to the supporting frame. As the screening surface is vibrated, the bed of the material tends to develop fluid-like characteristics. Smaller particles sift through the void spaces and find their way to the bottom of the bed while larger particles remain on the screen. This effect, called stratification, improves screening efficiency and reduces on-deck retention time. Vibrating screens are enhanced by high pressure spray bars that add an additional dimension to the stratification while also forming a slurry in the bottom tank or "trough" of the screen. The wet, vibrating screen is particularly useful in diverse soils with reasonable mass fractions of process oversize and coarse grained materials.

Multiple-Decked Screens - Screening systems can be combined with multiple decks with different slot sizes. Double-decked and triple-decked screens are commercially available. These multiple-decked screens are particularly useful when a range of process oversize products is desired.

Waste/product streams - Undersize material passes through the screens and discharges from a chute or hopper with the bulk of slurry or washwater. Oversize material travels over the screen discharging from the end of the screen which is usually fitted with a chute. Oversize material is substantially dewatered when discharged from the screen.

Operating variables/parameters - The amount of water spray can be adjusted to affect the screening capacity. The amplitude of vibration may generally be adjusted with weights designed by the vendor. Some models are available with frequency adjustment as well. On vibrating gyratory screens, the flow pattern may be adjusted with eccentric weights.

Size - Width 20" to 8' (50.8 cm to 2.44 m). Length 4' to 25' (1.22 to 7.62 m). Inclined and horizontal vibratory screens are available in discrete elements by vendor. Larger sizes can be provided by some vendors when necessary. Vibrating gyratory screens are available from 24" to 72" diameter (60.96 to 182.88 cm).

Cost - capital and operating - Cost information is available for horizontal and inclined screens and polyurethane and woven wire decks (Western Mine Engineering 1996). Capacity is given in tons/hr sq.ft for screen openings ranging from 0.838 mm to approximately 100 mm, different screen levels, and both wet and dry feed. Wet screening is typically necessary in soil/sediment processing because of the need to break up agglomerated materials, and those costs are referenced here. Horizontal screens with single or multiple decks ranging in size from 4 ft by 12 ft to 6 ft by 20 ft (1.22 m by 3.66 m to 1.83 m by 6.10 m) have capital costs ranging from approximately $20,330 to $60,990 and operating costs of $1.52 to $4.57/hr. Inclined screens with polyurethane decks ranging in size from 4 ft by 8 ft to 8 ft by 20 ft (1.22 m by 2.44 m to 2.44 m by 6.10 m) have capital costs ranging from approximately $17,300 to $97,600 and operating costs ranging from approximately $1.00 to $6.60/hr. Capital costs for inclined deck with woven wire screens range from approximately $14,700 to $81,300; operating costs range from approximately $1.00 to $6.10/hr. Motors are included in these costs.

Unit capacity costs are difficult to estimate because capacity is a function of deck material as well as operating conditions, and given capacities are not referenced to a specific deck. However, if a double deck is assumed with a screen opening of 0.838 mm and a capacity of 0.21 tons/hr sq.ft. average, 1) cost for a horizontal screen will range from approximately $1,010 to $1,220/ton/hr capacity, 2) cost for an inclined screen, polyurethane deck, will range from approximately $1,220 to $1,420/ton/hr capacity, and 3) cost for an inclined screen, woven wire deck, will range from approximately $690 to $710/ton/hr capacity. Generally, the larger screens have slightly lower unit capacity costs, but this is not true in every case. Unit capacity cost spread is relatively small, however, when compared to other equipment. Other assumptions on which these cost ranges were based are contained in Western Mine Engineering (1996).

General comments - Accessories to effect feed distribution such as chutes or spreaders are generally available. Additional accessories include ball trays to reduce blinding with damp and nearsize material, screen heaters to prevent blinding with damp material, and dust enclosures. Units may generally be suspended or platform mounted. Models are available with one to five decks.

Flowsheets - Vibrating screens are typically placed after a grizzly and before processes which classify contaminated sands and fines.

Vendors - Triple/S Dynamics Inc.
Midwestern Industries, Inc.
Dorr-Oliver Inc.
W. S. Tyler, Inc.
SWECO Products
Macon Wire/DEWCO

Hydrocyclones

A hydrocyclone is a simple cone shaped device with no internal moving parts used primarily to classify but also to clarify or dewater solids from a slurry feedstream. Slurry is fed into the cone of the hydrocyclone (Figure 2-4), entering tangentially at the side. The heavy material is forced to the interior wall of the cone and moves downward in a spiral path, exiting at the bottom through the apex or spigot (underflow). As a result of the strong centrifugal forces, a central

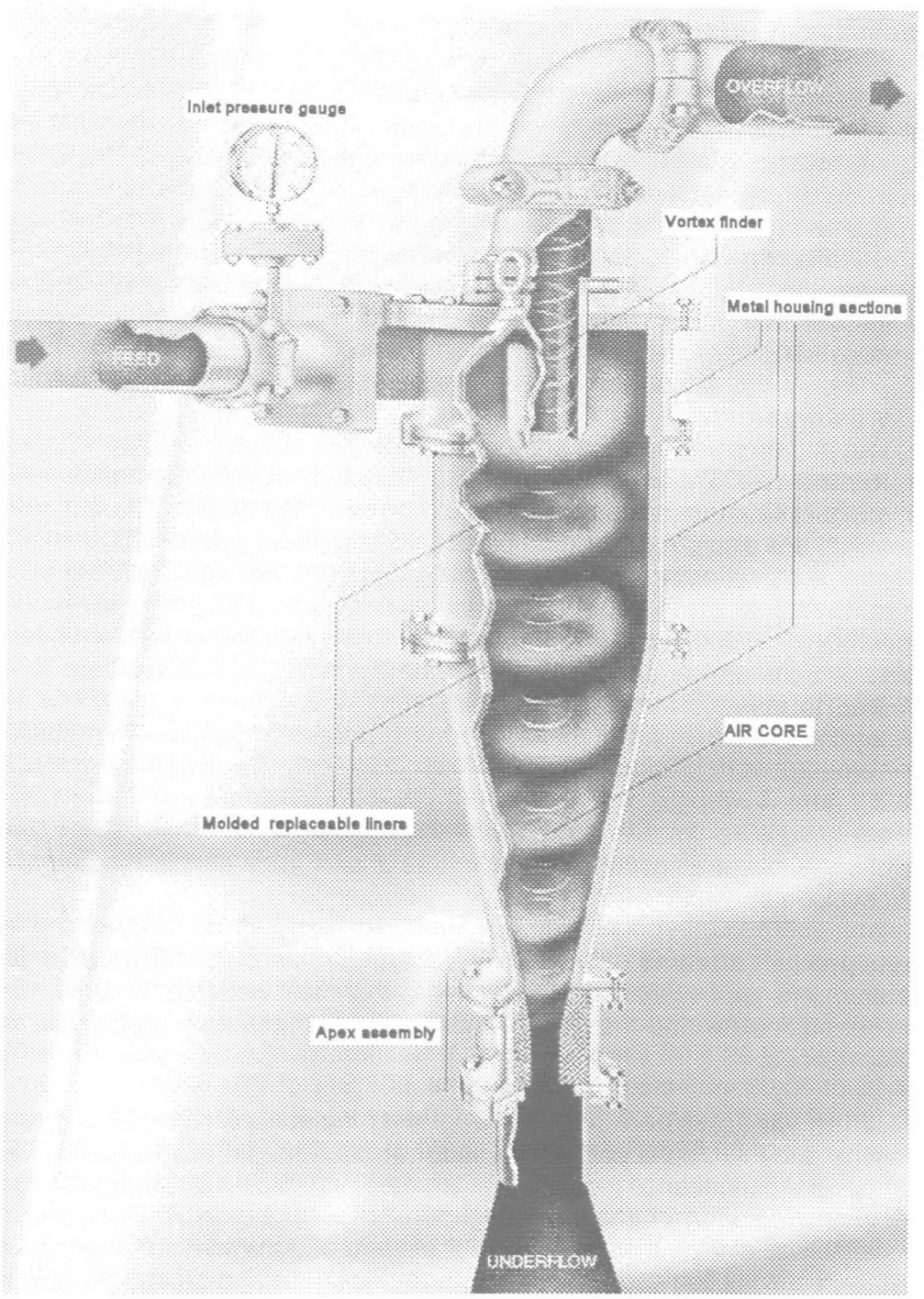


Figure 2-4. Section view of a hydrocyclone (provided courtesy of Krebs Engineers).

vortex is formed into which smaller materials are carried by the fluid out the top of the cone through the vortex finder (overflow).

Feed material specifications -

Specific gravity - Separation requires a difference in specific gravity of the fluid and the particulate. All else being equal, greater differences in specific gravity result in easier separations. Most nomographs are generated assuming a specific gravity of 2.7 for solids in water.

Solids content - Hydrocyclone feed slurry solids content typically ranges from approximately 15 to 30% solids by weight. Operation is most efficient with a dilute, low-viscosity feed which results in a finer particle size cut. General recommendations are to maintain slurry below 35% solids by volume.

Washwater - n/a

Particle-size ranges - Approximately 2 - 250 µm cut. No information was identified in the product literature regarding top size; however, the diameter of the apex, where coarse solids are discharged, should be considered when evaluating feed suitability. Largest particles entering hydrocyclone should generally be no more than half the size of the apex.

Capacity - 0.2 - 2500 m^3/hr (0.9 - 1100 gpm). Throughput is roughly correlated to size; smaller diameter units are required to achieve fine cut sizes. Pressure drop (head) can also be adjusted to manage throughput but this alters the cut size. Capacities for Mozley brand hydrocyclones are 0.1 - 1.2 m^3/hr for C155-one inch (2.54 cm), 8 - 28 m^3/hr for C516-five inch (12.7 cm), 20 - 110 m^3/hr for C630-ten inch (25.4 cm) (Carpco, Inc.).

Type - Available in poly and metal bodies, lined or unlined. Some models have interchangeable or adjustable vortex finders and/or apex orifices and other interchangeable hydrocyclone body parts.

Waste/product streams - Underflow discharge contains the "oversize" fraction. Underflow concentrations are usually limited to not more than 60% solids by volume. Overflow contains the fine particulate and the bulk of the water. Nomographs give liquid and solid split for hydrocyclones.

Operating variables/parameters - Operating variables include feed slurry solids content, pressure, and inlet, apex and vortex finder areas. The primary operating variables affecting hydrocyclone performance include pressure drop and viscosity. Changes in pressure drop are generally affected by changing throughput. Pressure increase will increase throughput and reduce the size of the cut point. Efficiency of separation is also increased, but at the expense of energy consumption and component wear. Flow rate and pressure are also related to inlet area. It is also important to maintain a constant feed rate. Constant volume pumps are recommended for this application.

Viscosity is affected by the solids content of the slurry. Temperature can also have a large impact on viscosity. In addition, some models have an adjustable apex which helps control the solids content of the underflow.

Size - Hydrocyclones are typically sized using the D_{50} cut point. At this particle size, 50% of the material will report to the underflow and 50% to the overflow. The result is a distribution, rather than an absolute cut point. A smaller size cut can also be achieved by reducing the vortex finder size. However, the cut is less sharp (a wider distribution) and the underflow density also decreases because more water is then diverted to the apex. Underflow density is also an important parameter. For a dilute underflow, the discharge from the spigot will form a spray pattern. Higher underflow density will result in a "ropey" discharge, which has the effect of minimizing the fines entrained in the underflow, but will force coarser material into the overflow (lower efficiency of separation). It can be seen that these variations are opposite sides of the same coin. The operating conditions will therefore be determined by whether the characteristics of the overflow or the underflow are most important.

The nominal size (as listed by the manufacturer) of the cyclone selected is a function of the particle-size cut desired. Within limits, the operating variables can be adjusted to achieve different cut sizes and efficiencies. As a rule, the larger the diameter the coarser the cut: roughly, 500 mm for 150 μm cut, 250 mm for 75 μm, 100 mm for 40 μm, and 25 mm for down to 5μm (Elliot 1991). This will vary, however, depending upon the arrangement of the interdependent operating variables. Efficiency curves (percentage of a given particle size reporting to underflow), capacity curves (throughput as a function of pressure and vortex finder diameter) and volume split curves (volume of feed liquid to underflow at a given pressure, as a function of vortex finder and spigot diameter) are performance indicators. These should be used, at least initially, in hydrocyclone selection followed by pilot testing with a volume of material large enough to be representative. (Selection is largely a judgement call, but will be based on documented heterogeneity of the materials to be separated, total volume to be treated, and budget). System verification is required because efficiency curves are established for a given set of conditions. Actual performance may vary significantly.

Cost – capital and operating - Cost information is given for hydrocyclones ranging in size from 4 to 28 inches (10.2 to 71.1 cm) in diameter. A 12-inch (30.5-cm) diameter is probably the maximum encountered in soil/sediment processing) (Western Mine Engineering 1996). Costs differ depending on housing construction, including rubber lined cast iron/steel and fiberglass/polyester, and unlined polyurethane. Capacity ranges from 20 to 2200 gpm, capital costs from approximately $4,070 to $12,200, and operating costs from $0.05 to $0.15/hr. As for centrifuges, unit capacity cost decreases with increasing size. For 10-inch (25.4 cm) diameter and smaller hydrocyclones, costs range from roughly $23.40 to $230.00/gpm. For 12 inch (30.48 cm) and larger hydrocyclones, costs range from roughly $5.00 to $66.00/gpm. The overlap in unit cost ranges is a reflection of the effect of capacity ranges for individual hydrocyclones, which may vary from 40 to over 1500 gpm from low to high end per unit, depending upon operating conditions. Other assumptions on which these cost ranges were based are contained in Western Mine Engineering (1996). Typical costs for hydrocyclones for soil and sediment remediation are estimated by EPA in 1998 dollars to be between $4,050 and $8,100 for a throughput of 18 to 55 dry tonnes per hour. Operating costs are estimated at $0.13 to $0.38 per dry tonne.

General comments - Cut size and sharpness of the cut in hydrocyclones are related to feed composition and hydrocyclone geometry and size. Hydrocyclones with small-cut sizes are generally smaller and have lower throughput than units for large cut sizes. Manufacturers often have interchangeable components that affect throughput, cut size, and the sharpness of the cut. Hydrocyclones are typically manifolded in parallel to obtain the desired throughput, as in Figure 2-5. Hydrocyclones made with special materials or with liners are available to resist wear from abrasion.

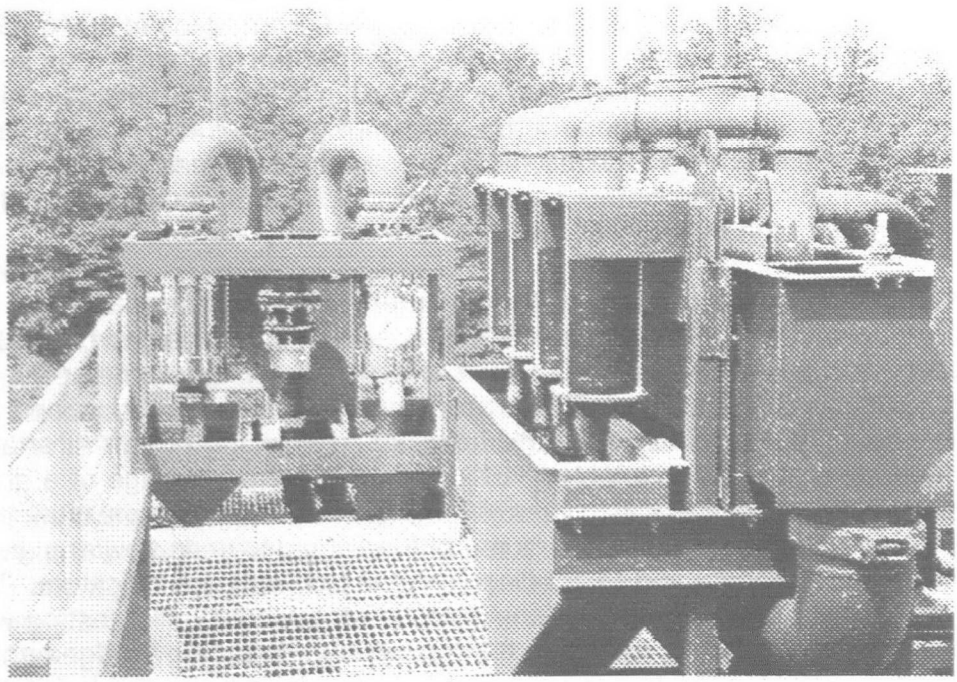


Figure 2-5. Bank of four fines separation hydrocyclones in foreground with bank of two sand dewatering hydrocyclones in background (provided courtesy of ARCADIS Geraghty-Miller).

Flowsheets - Hydrocyclones are used to separate the contaminated sand or fines size fraction. They are typically located after an oversize removal on a screen but before other classification equipment. They are also used after attrition scrubbing to separate fine contaminated material from the clean sand.

Vendors -
Bailey-Parks Urethane
Encyclon Inc.
Dorr-Oliver Inc.
Krebs Engineers
Technequip Limited
Richard Mozley Limited (distributor: CARPCO, INC.)
METPRO Supply, Inc.
Yardney Water Management Systems, Inc.

Hydraulic Classifiers

Hydraulic classifiers (Figure 2-6) are countercurrent settling chambers, which may be used to classify solids based on settling velocity. Typically, slurry is fed in from the top, and a column of water rises from the bottom. Solids with a settling velocity less than the velocity of the rising water are carried out in the overflow. Solids with a greater settling velocity are carried out in the underflow.

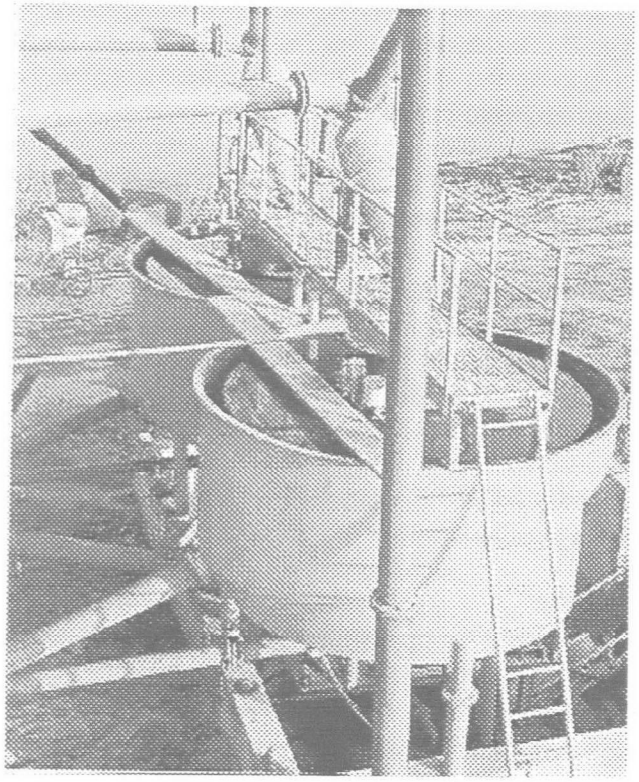


Figure 2-6. Two monosizer hydraulic classifiers fed by hydrocyclones (provided courtesy of Dorr-Oliver).

Feed material specifications -

Specific gravity - Separation requires there be a difference in specific gravity of the fluid and the particulate. All else being equal, greater differences in specific gravity result in easier separations.

Solids content - 800 to 1000 g/l

Washwater - Clean or clarified water must be provided to entrain underflow product at a minimum, or fines will contaminate the underflow.

Particle-size ranges - Nominal top size should not exceed 4 mm. Cut sizes down to 75 µm are achievable.

Characteristics - In hydraulic separators, particles with a lower settling velocity than the fluid flow will report to the overflow while particles with higher settling velocity will report to underflow. Settling velocity is determined by particle size, shape and density and by fluid density and viscosity.

Capacity - Units are available with nominal capacities up to 50 tons/hr. Capacity will vary with feed concentration and the desired cut size.

Type - Single-cell and multiple-cell units are available.

Waste/product streams - Fine particulate reports to the overflow while oversize or fast settling particulate reports to the underflow. Both streams are generally discharged as slurry.

Operating variables/parameters - Upflow velocity can be adjusted to vary cut size, within limits.

Size - Single-cell vertical flow settling basins are available from 0.2 to 24 m^2 cross sectional area.

General comments - Hydraulic classifiers are available as a single cell or "pocket" or in an eight pocket in series classifier unit.

Flowsheets - Hydraulic classifiers may be considered in a flowsheet after oversize removal and before other classification processes in the same locations considered for hydrocyclones.

Vendors - Dorr-Oliver Inc.
Floatex Separations Ltd.

Sieve Bends

Sieve bends are types of screens in which separation is affected not only by size and shape but also by density. A sieve bend is typically composed of a curved wedge wire deck. Feed is directed against the upper portion of the screen, which passes particles of a diameter approximately one half the distance between the wires. This separation is achieved in part by centrifugal effects, hence the dependence upon density. As the screen becomes worn, the edges of the wires become rounded, with an attendant decrease in the size of material passing through the screen. Regular turning of the screen can usually address this problem. The included angle of the bend varies. For mineral separations, the included angle is typically 45 to 60 degrees, with a capacity of 5 to 100 l/hr per meter of screen width for particle size separations in the range of 200 to 2000 μm. Variables in the use of sieve bends include opening size, slurry density, inclination and open area (Osborne 1990). The sieve bend is frequently useful in soil remediation work for the removal of natural organic materials (grasses and roots) from the sand fraction of the feed.

Density Separation

Spiral Concentrators

A spiral concentrator is a multi-turn helical trough. Spiral concentrators are flowing film-concentrating devices. Figure 2-7 is an example from coal processing but is applicable to soil washing. Slurry is fed into the top of the spiral. Depending upon the channel configuration of the spiral, separation of dense from light material occurs across the channel as slurry flows down the spiral. The spiral itself has no moving parts except for the flow splitters inside the channel. Test rigs are usually equipped with a hopper and centrifugal pump. Spirals incorporated as part of a larger treatment train will typically be fed by the previous unit operation and discharge to holding or settling basins for dewatering or subsequent processing. Because of their low capacity, spirals are often operated in parallel. Their use in processing of soil for remediation purposes is well established.

Efficiency may be improved by restricting the feed to a narrow size range and may be preceded in the treatment train by a hydrocyclone for that purpose. Spirals require a consistent feed rate at roughly 30% solids by weight. Spirals are adjusted with a knife-point separation tool that directs the separated fraction at the discharge end of the spiral. Spirals are equipped with two such devices that, when considering the inside and outside walls, can create three products: a heavy, a middling, and a light product. As the slurry comes down the spiral, particles heavier than sand tend to come to the inside of the spiral, while light material tends to move to the outside of the spiral. The knife-blade cutter devices can be adjusted visually to make the heavy, middling, and light separations. These three products can be directed to three segregate sumps for disposal, recycling, or further treatment. Spirals have two configurations intended for the primary removal of light or heavy materials optimized to emphasize heavy or light removals. Spirals are particularly effective for the removal of lead particles from sand, for example, or the removal of light, small-particle organic debris from the sand fraction.



Figure 2-7. Bank of spiral concentrators (provided courtesy of ARCADIS Geraghty-Miller).

Feed material specifications -

Specific gravity - 1.0 to 1.5 differential sp. gr.

Solids content - Carpco, Inc. (1993) indicates that their spiral operates with the greatest efficiency when the slurry density is between 15 and 45% solids.

Washwater - Not required for all models.
< 0.1 m^3/hr (0.5 gpm) Humphreys Mini-Spiral

Particle-size ranges - 0.075 to 3.0 mm (for coal) (Mishra and Klimpel 1987)
20 X 200 mesh (Humphreys Mini-Spiral)
Approximately 50 to 1000 µm (Carpco, Inc. 1992)

Capacity - Spirals are available in laboratory and full size. The Humphreys mini-spiral operates with as little as 20 lbs of sample for execution of feasibility studies. Spirals require a consistent feed rate and, like concentrating tables, may be more efficient for a limited size range feed. Spirals are sometimes preceded by a hydrocyclone for this reason. Capacity is increased with additional spirals (starts) operating in parallel.

1 to 1.5 tph/start (Mishra and Klimpel 1987)
2.3 m^3/hr (10 gpm) (Humphreys Mini Spiral)
(Not given for Humphreys full size spiral)

Type - Spiral concentrators vary in pitch depending on the density of the desired product. Steeper spirals are typically used for dense material, such as particulate lead, while less steep spirals are used for separation of less dense materials such as organics. Spirals are also available with multiple starts, usually two helical troughs around the same axis.

Waste/product streams - Like the concentrating tables, material coming off the spiral is generally separated into three product streams. The division of the material occurs as the material leaves the spiral through a flow splitter. Any of the process streams can be reprocessed through spirals in series for cleaner separation. Each stream must ultimately undergo dewatering. Coarser materials can be separated by simple primary settling or filtration. Fine material may require coagulation followed by lamellar settlers and filtration.

Operating variables/parameters – Flow splitters are manually adjusted.

Size - Full scale spirals typically have a footprint of nominally 3' x 3' (1 m x 1 m). They are typically purchased with multiple spirals to achieve desired capacity.

Cost - capital and operating - USEPA (1994b) estimates a typical 91 tonne/day circuit employing spirals for density separation to have a capital cost of $292,000. Operating costs are estimated at $6.54 per tonne.

Capital cost for a 5 ft to 8 ft (1.52 m to 2.44 m) single helix unit, with distributor, framing, etc. is approximately $3,050. (Western Mine Engineering 1996). Operating costs (other than labor)

are limited to parts replacement, and range from $0.01 to $0.05/hour. Other assumptions on which these cost ranges were based are contained in Western Mine Engineering (1996).

Flowsheets - As spirals are generally most effective for dense particulate of the sand fraction, they are typically used after removal of fines and clean sand fractions. Therefore, they are generally considered for use after hydrocyclones.

Vendors - Carpco, Inc.

Jigs

Jigs provide density-based separation of particulate larger than 1 mm. Essentially, a jig is an open tank filled with water with a horizontal jig screen at the top and with a spigot in the bottom for concentrate removal. The jig bed consists of a layer of coarse, heavy particles, or ragging placed on the jig screen onto which the slurry is fed. The feed flows across the ragging, and the separation takes place in the jig bed so that grains with a high specific gravity penetrate through the ragging and screen to be drawn off as a concentrate, while the light grains are carried away by the cross-flow. Separation is accomplished in the bed which is rendered fluid by a pulsating current of water so as to produce stratification. The motion can be obtained either by using a fixed sieve jig and pulsating the water or employing a moving sieve.

Feed material specifications -

> **Specific gravity** - Jigs classify largely on the basis of density. Separations are more effective when there is a large difference in density between contaminants and clean material (i.e. gravel).
>
> **Solids content** - Solids in the jig are generally quite high, 30 to 50%.
>
> **Particle-size ranges** - Generally applied to particulate larger than 1 mm but can provide concentration down to about 200 mesh for some dense materials such as gold.
>
> **Characteristics** - Pulses of water expand a solid bed. Classification is a function of differences in settling rates.

Capacity - Capacity is dependent upon the degree of separation required. For high concentrations, rates are between 0.5 to 1 cubic yards per square foot of jig area per hour.

Waste/product streams - The waste will be a slurry concentrated with the dense contaminant. The product stream will be cleaned gravel or sand slurry. Classification will not be 100 percent efficient, and some gravel/sand should be expected with the waste stream and some dense material in the product stream.

Operating variables/parameters - Classification is dependent upon the feed rate and upon the intensity and frequency of the water pulsation. Higher pressures to the jig result in greater concentration (grade) of the waste stream. Lower pressures result in lower grade.

Size - Circular jigs are available with 3 to 9 square feet (0.279 to 0.836 sq m) of bed area.

Cost - capital and operating - Western Mine Engineering (1996) gives the following costs.

Table 2-1. Cost Ranges of Several Jig Types.

Type	Size Range	Capital Cost (1998 dollars)	Hourly O&M Cost (1998 dollars)
Baum	72 - 220 sq.ft.	$337,100 -$674,100	$14.23 - $29.74
Bendelari*	6"x8" (1 cell) - 42"x42" (3 cell)	$3,810 - $28,500	$0.14 - $1.35
Circular	1.4 sq.ft. (1 cell) - 448 sq.ft. (12 cells)	$1,875 - $296,800	$0.07 - $10.27
Duplex	12" cell - 42" cell	$3,314 - $13,300	$0.11 - $0.56
Fine Coal	178 - 267 sq.ft.	$832,100 - $990,200	$32.54 - $41.92
Shot Separator		$4,190	$0.13

*Price does not include mounting platforms. Add 30% to 50% for mounting platform, maintenance catwalk and discharge launders.

General comments - There appear to be several types and manufacturers of jigs not found in the vendor literature reviewed for this document.

Flowsheets - Jigs perform density separations on oversize material. They should be considered for location after removal of sands and fines, which is generally after a screen.

Vendors - RMS-Ross Corporation

Shaking Tables

Shaking tables, like the one in Figure 2-8, also known as wet concentrating tables, consist of rectangular or semi-rectangular grooved decks which may be mounted either horizontally or on a slight incline and which operate with a reciprocating motion. Slurry is fed onto the table where it separates according to size and specific gravity of the particles. The operative mechanisms of separation are fluid flow and asymmetrical acceleration. The idealized distribution of the particles across the table is as pictured in Figure 2-9. This distribution can be affected by the height and placement of the riffles (grooves) and any irregularities of operation. The coarse low-density particles are entrained in the upper flowing fluid film where velocities are highest. The fine high-density particles report to the bottom of the fluid layer where velocities are lowest. Coarse, high-density and fine, low-density particles move through the middle fluid layer at an intermediate velocity (Deurbrouck and Agey 1985).

Tables are available in laboratory and full size. Based on the lack of references in the literature, concentrator tables are not considered to be field proven in applications involving soils or sediments. Some work has been done at lab scale with firing range soils at WES indicating potential for treatment of heavy metals contaminated soils. However, based on the literature and lab experience, it appears that concentrator tables may require more monitoring and adjustment during processing than other classifiers and may be more sensitive to changes in feed. However, if a pretest indicates suitability to a specific material, tables could provide a cost effective component of the treatment train.

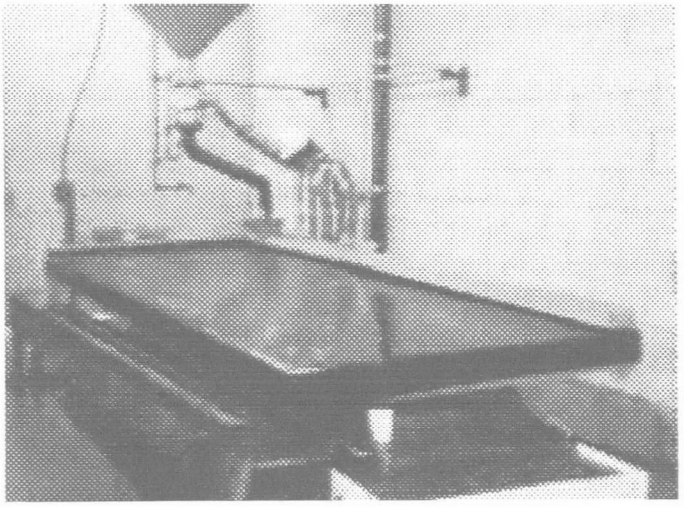


Figure 2-8. Typical final tabling in a gold application (provided courtesy of Humphreys Division of Carpco Inc.).

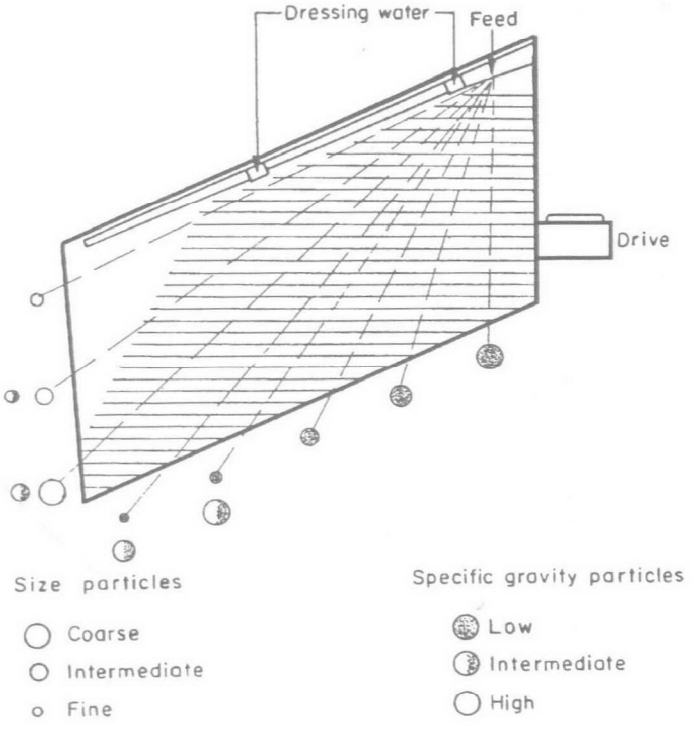


Figure 2-9. Distribution of table products by particle size and density (provided courtesy of Society for Mining, Metallurgy, and Exploration).

Feed material specifications -

Specific gravity - Specific gravity differences of at least 1.0 are typically required for efficient separation, if size and shape differences are not so significant as to govern. For soils, specific gravity differences are typically less than 1.0 (2.65 for sand, 2.65 to 2.80 for clay and silt), unless heavy metals (sp. gr. > 3.0±) or organic materials (sp. gr. 1.8) are associated with the particles. This specific gravity difference of less than 1.0 may account for the lack of references in the literature to the use of tabling in soil separation, as well as the monitoring required to maintain the desired cut. Tables may be more useful for treatability evaluation than in a continuous flow treatment train.

Solids content - Required feed solids content varies; however, the range given for slime ore is 800 to 1000 gal per ton (Deurbrouck and Agey 1985). For materials with a specific gravity of 2.65, this corresponds roughly to 25 to 30% solids by weight (W_{solids}/W_{water}). Soil processing would be expected to require this much, and possibly more, given the cohesiveness of clay materials, but this parameter does not appear to have been established for soils. Carpo, Inc. (Humphreys) recommends a 20% solids mixture for their 13A sand deck. Large top sizes (19 mm or ¾ inch) or a high proportion of fines in the feed typically impose the higher water requirements.

Particle-size ranges - Feeding a limited particle size range will improve tabling efficiency. For a given feed, the finest material is least efficiently washed (Deurbrouck and Agey 1985). Maximum top size for coal is approximately 19 mm (¾ inch) down to 10 mesh (2 mm, 0.08 inch) for heavier minerals . For materials with the density of coal (1.15 to 1.5 g/cc), ⅜ inch (0.9525 cm) to 100 mesh, or in some cases 200 mesh, is acceptable. For higher density materials, the range may be larger, ⅜ inch (0.9525 cm) to finer than 325 mesh, for example (Deurbrouck and Agey 1985). The presence of fine materials (slimes) increases the viscosity of the bed on the table and slows the stratification. Most soil components will probably fall between these two ranges. Optimum feed particle-size range must be determined on a case by case basis. Carpco, Inc. (1992) suggests a range of approximately 40 to 1000 µm. Jigs or heavy separators are more efficient for coarser materials.

Characteristics - Tabling was originally developed for mineral processing, where fine materials (referred to as slimes) are normally removed prior to tabling to improve efficiencies. For remediation processing of soils and sediments, however, removal of the fine fraction on the table may be one of the objectives and the feed will therefore be non-ideal from a mineral processing perspective. Operating parameters may need to be adjusted to compensate for this.

Capacity - Capacity is a function of table size, slurry solids concentration, and material particle size and characteristics. Capacities are highest for low density materials such as coal and larger particle sizes. Capacity of mineral processing tables for soils has not been established, but will probably be similar to that for minerals, which ranges from as little as 0.1 tons per hour to 1.2 tons per hour for a 6.5 by 14 foot deck (1.98 by 4.27 m). Capacity for a given efficiency level must be determined by pilot testing. Tables 2-2 and 2-3 give some examples for mineral processing, which range from less than 1 ton per hr per deck to over 15 ton/hr/deck. Capacities are also given by individual manufacturers/distributors.

Waste/product streams - In mineral processing applications, material coming off the table is typically separated into three product streams: cons, mids and tails. Cons are the highest density materials; mids are the mid range; and tails are the lightest particles (see Figure 2-9 for distribution of product on the table). To increase efficiency, any of these process streams may be reprocessed on tables in series. Ultimately, these streams must undergo dewatering. Coarser materials can be separated by simple primary settling or filtration. Fine material may require coagulation followed by lamella settlers and filtration.

Operating variables/parameters - Operating parameters for concentrating tables include riffle design, capacity, speed and stroke, tilt, and feed solids content. Sand tables are characterized by deep and extensive riffles, and slime tables by shallow riffles. Slime tables would most likely be suitable to soil separation, but the selection will be dictated by the desired material cut and the expected particle-size range of the feed.

Table type - Sand table, deep riffles: coarse material
Slime table, shallow riffles: fine material

Speed and Stroke - Variable. Length and frequency of stroke are interdependent variables (Deurbrouk and Agey 1985).
230 to 285 rpm and 1-¼ to ¾ inch (3.175 to 1.905 cm) stroke for coarse sands
285 to 325 rpm and ¾ to ⅜ inch (1.905 to 0.9525 cm) stroke for fine material

Table tilt - Set at the minimum inclination necessary to achieve good distribution of material across the table.

Table 2-2. Table Operating Parameters Suggested by Manufacturers (Deurbrouck and Agey 1985).

Table Model	Type	Feed: Fine size Top size	Feed: Fine size Capacity, ton per hr per deck	Feed: Coarse size Top size	Feed: Coarse size Capacity, ton per hr per deck	Speed, rpm	Stroke, in.	Deck size	Horsepower: Installed	Horsepower: Operating
Super duty and Concenco Tables, Deister Concentrator Co.										
No. 6	Ore	100 mesh	0.25	6 mesh	2.0	285-300	½-¾	6 ft 5 in. X 14 ft 1 in.	2	½
No. 666 (3 decks)	Ore	100 mesh	0.25	6 mesh	2.0	285-295	½-¾	6 ft 5 in. X 14 ft 1 in.	3	3
No. 7	Coal	28 mesh	5.0	3/4 in.	15.0	280-290	½-1½	8 ft ¼ in. X 16 ft 9¼ in.	3	1
No. 77 (2 decks)	Coal	28 mesh	5.0	3/4 in.	15.0	280-290	¾	8 ft ¼ in. X 16 ft 9¼ in.	3	3
Wilfley and Holman Tables, Wilfley Mining Machinery Co., Ltd.										
Wilfley No. 20	Ore	100 mesh	0.25	6 mesh	2.0	300-325	⅜-⅞	6 ft 0 in. X 15 ft 6 in.	3	1
Wilfley No. 21	Ore	100 mesh	0.125	6 mesh	1.0	300-325	⅜-⅞	4 ft 0 in. X 0 ft 0 in.	2	1
Holman	Ore	100 mesh	0.25	6 mesh	2.0	270-280	⅜-⅞	5 ft 6 in. X 18 ft 0 in.	2	¾-1
Wilfley No. 20C (3 decks)	Coal	28 mesh	5.0	3/4 in.	13.0	230-270	1-1¼	7 ft 0 in. X 15 ft 6 in.	3*	1
Wilfley Tables (MSI Industries, Inc.)										
No. 6A and 11D (standard)	Ore	(†)	0.5	(†)	6.25	240-300	¾-1¼	6 ft 0 in. X 15 ft 0 in.	1½	½-¾
(oversize)	Ore	(†)	0.75	(†)	7.25	240-300	¾-1¼	7 ft 0 in. X 15 ft 0 in.	2	¾-1
No. 12	Ore	(†)	0.25	(†)	0.75	260-300	¾-1¼	3 ft 6 in. X 7 ft 0 in.	1	¼-½

* Per deck
† Not available

Table 2-3. Wilfley Concentrating Table Operating Parameters (Carpco, Inc. 1992).

Model	Particle Size Range	Water Requirements L/min (gpm)	Deck Size mm (in)	Coarse Feed Stroke mm (in)	Coarse Feed Freq RPM	Coarse Feed Max Capacity kg/hr (lbs/hr)	Fine Feed Stroke mm (in)	Fine Feed Freq RPM	Fine Feed Max Capacity kg/hr (lbs/hr)
6A Standard		19-76 (5-20)	1829 X 4496 (72 X 177)	19-25 (3/4-1)	260-280	1800 (4000)	13-19 (1/2-3/4)	300	750 (1600)
6A Oversize		19-76 (5-20)	2134 X 4496 (84 X 177)	19-25 (3/4-1)	260-280	1900 (4200)	13-19 (1/2-3/4)	300	800 (1800)
12		11-57 (3-15)	1168 X 2337 (46 X 92)	10-16 (3/8-5/8)	260-300	450 (1000)	10-16 (3/8-5/8)	260-300	180 (400)
13A Sand Deck	-20+200 Mesh	4-15	457 X 1016	6-13 (1/4-1/2)	250-350	70 (150)	-	-	-
13A Slimes Deck	-200+235 Mesh	(1-4)	(18 X 40)	-	-	-	6-13	250-350	45 (100)
13B Sand Deck	-20+200 Mesh	4-23	610 X 1270 (24 X 50) Sand Deck	6-13 (1/4-1/2)	250-350	115 (250)	-	-	-
13B Slimes Deck	-200+325 Mesh	(1-6)		-	-	-	6-13 (1/4-1/2)	250-350	90 (200)

Size - Sizes range from 5 to 90 sq.ft./deck (0.465 sq.m to 8.36 sq.m/deck) with single, double, and triple deck units available (Western Mine Engineering 1996).

Cost - capital and operating - Operating costs for concentrating tables are low relative to other methods of concentration and include supervision, utilities and maintenance. Supervision costs will be a function of uniformity of feed. Significant changes in table feed require changes in table settings. Single-deck tables typically use 1- to 3-hp motors. Double- and triple-deck tables typically use 3-hp motors. Actual power consumption is somewhat less than installed horsepower (Deurbrouck and Agey 1985). Maintenance costs are reasonably low.

Complete, single deck concentrating tables range in capacity from 0.4 to 1.0 tons per hour for fine sand and 0.6 to 3.0 tons per hour for coarse sand for a table area of 32 sq ft (2.97 sq. m) and 0.8 to 2.1 and 1.25 to 6.25 tons per hour respectively for fine and coarse sand for an 80 sq ft table (Western Mine Engineering 1996). Capital cost for the 32 sq ft (2.97 sq. m) unit is given as $11,000, and $14,400 for the 80 sq ft (7.43 sq. m) unit. Unit capacity costs range from $3700 to $27,400/ton/hr for the smaller unit, and from approximately $2300 to $18,300/ton/hr for the larger unit. Operating costs range from approximately $0.85 to $1.13/hour. Other assumptions on which these cost ranges were based are contained in Western Mine Engineering (1996).

Table 2-4. Concentrating Table Cost Ranges (Western Mine Engineering 1996).

Concentrating Tables	Area (ft^2)	1998 Capital Costs	1998 Operating Costs (hourly)
Single Deck	5-90	$4570-17,100	$0.35-1.46[2]
Triple Deck	240 (80/deck)	$34,500[1]	$2.69

1) Including deck, base, frame, launders (some sizes), drive mechanism and motor.
2) Including parts, labor for maintenance, power (electric), lubrication. Operator costs are not included and will vary with the type and amount of material being processed and the number of units on-line.

General comments - Primarily useful as a diagnostic tool.

Flowsheets - Shaking tables may be considered for density separation after removal of fines (de-sliming). This typically would place shaking tables immediately after hydrocyclones in a generalized flowsheet.

Vendors - Carpco, Inc.

Multi-Gravity Separators

The Mozley Multi-Gravity separator is an enhanced gravity device for the separation of fine (dense) particles down to one micron in size. The principle of the Multi-Gravity Separator may be explained by considering the shaking action of a shaking-table in cylindrical form. The rotating action of the drum provides a high "g" force which pins the heavy particles to the drum surface to be removed by the drum scrapers. The basic variables in operation of Multi-G Separator are stroke frequency, rotational speed, surface profile on the inside of the drum and addition of wash water. The Multi-Gravity Separator may be used for removal of fine dense contaminated particles from the silt or fines fraction (< 75 microns) where other more common gravity separation techniques are ineffective.

Dense Media Separation

The most common means of making a dense media separation is to use a suspension of fine, heavy particles in water or dense salt solution as a pseudo fluid. The use of this heavy medium at a selected density (specific gravity up to 3.0) will allow the separation of different density materials. Typically, a heavy medium suspension is prepared using very fine ferrous media (< 65 mesh) suspended in water. The fine magnetic media can be recycled from the heavy media suspension by magnetic separators. The basic features of this technology are (1) ability to make sharp separations in the specific gravity range 1.25 to 3.8, (2) ability to make rapid changes in the suspension specific gravity to meet changing feed characteristics, (3) ability to remove the sink product continuously, (4) ability to treat a wide range of sizes, (5) ability to start-up and shutdown the operation quickly with minimum loss of separation efficiency, (6) ease of recovery of medium from the separated products with relatively low media losses, (7) modest medium cost, (8) low operating and maintenance cost, and (9) large capacity units occupying relatively small floor space. Dense media separation may be used for separation of contaminant material from coarse soil fraction (> 2 mm). The contaminant material must have a higher density as compared to native gravel. Significant quantities (in excess of a couple thousand tons) of coarse soil material to be separated are required in order for this technique to be considered for implementation on a project.

Pinched Sluice

The pinched sluice, or sluice box, is essentially an inclined trough through which feed is washed after large stones have been removed by means of a grizzly or trommel. Riffles are placed in the bottom to create bed turbulence, establish a hindered settling zone, and retain heavy minerals and particulate metals (e.g. lead shot, metallurgical slag) or metals associated with heavy minerals. Variables in the use of sluice boxes are width, length, and slope, selected principally by the character of the material to be concentrated. Coarse and very high specific density particles (e.g., lead) settle quickly and require a short length. Slope must be adequate to transport the pebbles and also prevent sand packing within the riffles. Common slope is

about ½ inch per ft (1.27 cm per 0.3048 m) of length. The total width may be 4 to 6 feet (1.22 to 1.83 m) and total length up to 120 feet (36.58 m). Removal of dense material (concentrate) takes place every 7 to 10 days. The sluice box may be used to remove metals occurring in particulate form or metals associated with heavy minerals. The sluice box may be considered for remedial projects with a large volume of materials to be processed in which coarse predominates (70% of the particles to be removed are coarser than 30 mesh).

Liquid/Solid Separations

Settling Basins/Clarifiers/Lamella Separators

Solids clarification is a process that separates fine solids from a slurry stream producing a thickened sludge and a clarified liquid. There are many types of process equipment to accomplish the separation including circular tank clarifiers, rectangular tank clarifiers and lamella clarifiers. Some system variables that are related to solids clarification are solids concentration and particle size, liquid specific gravity and viscosity, density of the solids, flow rates and the desired clarity of the liquid. Solids clarification is used in soil remediation to separate fine solids, typically from a sand screw or hydrocyclone overflow. The solids from clarification can be dewatered as a sludge product or further processed by bioremediation or other techniques to remove a contaminant.

Sedimentation basins, a type of clarifier, are tanks installed either in or above ground for the purpose of making separations of solids and liquids. Sedimentation basins are commonly used in wastewater treatment applications for municipal and commercial customers. Sedimentation basins must be designed to introduce feed slurries in a uniform manner, achieving a quiescent period for durations adequate to allow solids to settle and thicken while removing the relatively solids-free water as an overflow. In remediation applications, sedimentation basins can be constructed from construction materials (concrete and steel) or from excavating and lining designated areas. Field expedient "swimming pool" tankage has been constructed for use in the sedimentation step for relatively low flows. For higher flows, such as those that might be encountered in a dredging operation, sedimentation basins have been contoured or excavated into existing site profiles to provide this solids-liquid separation facility.

The lamella clarifier (Figure 2-10) is a tilted stacked plate clarifier used primarily to remove solids from a clay slurry. The tilted plate design provides a large effective settling area with a small footprint. A lamella with a 20 ft by 12 ft (6.10 m by 3.66 m) footprint can have an equivalent effective settling area of a 35-ft (10.67 m) diameter circular clarifier. Typically, a flocculator and flash mixer are provided with the lamella clarifier. The design parameters include input flowrate and solids content, settling rate of the solids, and desired clarity of the overflow. The lamella clarifier is used to concentrate the fine solids slurry from less than 5% solids to a thickened sludge of 25% solids. The sludge is then further dewatered.



Figure 2-10. Two lamella clarifiers operating in parallel (provided courtesy of ARCADIS Geraghty-Miller).

Feed material specifications -

Specific gravity - Generally applicable.

Particle-size ranges - Particles reporting to the clarifier must be large enough to settle. For fine particulate this may require a flocculation step before the clarifier. Some clarifiers incorporate flocculation equipment prior to the settling chamber.

Capacity - Prefabricated lamella clarifier units are available with between 5 and 1500 gpm nominal capacity. Larger units and conventional clarifiers are site built.

Type - Conventional clarifiers are essentially large circular or rectangular settling basins with mechanical rakes to move sludge to a central discharge point. Lamella clarifiers collect sludge on vertically angled plates, resulting in dramatically reduced footprints.

Waste/product streams - Clarified liquid exits the top of the clarifier through an overflow launder. Sludge is discharged from the bottom of the clarifier. A sludge pump or an auger are sometimes used to transport the sludge. Sludge concentration is a function of the sludge properties and clarifier features, such as sludge residence time, geometry, and mechanical action.

Operating variables/parameters - Performance of the clarifier is generally dependent upon the flow rate and the settling velocity of the particulate. The settling velocity is greatly influenced by flocculation, by the amount and type of flocculant, and by the hydraulic forces during flocculation. In lamella clarifiers, the plates can often be removed to increase spacing

between remaining plates to control re-entrainment, though this results in decreased collection area. Increased sludge residence times generally result in denser sludges. Sludge level may be controlled with a level controller to maintain appropriate residence times.

Size - Size is a function of expected flowrate and the settling velocity of the smallest particles. Sedimentation tank sizes for wastewater treatment typically range from 3- to 5-m (10- to 16-ft) depths with 3- to 60-m (10- to 200- ft) diameters for circular tanks and 15- to 90-m (50- to 300-ft) lengths by 3- to 24-m (10- to 80-ft) widths for rectangular tanks (Metcalf and Eddy 1979). Prefabricated lamella clarifiers are available as small as 7' high, 7' long and 3' wide (2 m x 2 m x 1 m) .

General comments - Performance of a clarifier is dependent on both the settling characteristics of the solids and on the flow patterns within the clarifier. Settling characteristics of the slurry must generally be evaluated by lab tests to establish settling time and sludge consolidation. In lamella clarifiers, the settled solids must be able to flow down the incline of the plates. Bypassing and re-entrainment must generally be minimized in clarifier design. In addition, clarifiers are generally designed to minimize floc dispersion. It is important to consider that flocculation may cause bulking in which the volume of the solids is increased.

Flowsheets - Clarifiers produce a clarified liquid and a thickened sludge, typically from a fine feed slurry. Clarifiers would generally be encountered after hydrocyclones and immediately prior to final dewatering.

Vendors - Filtration/Treatment Systems, LTD
Carpco, Inc.
Graver Water Systems, Inc.
Westech Engineering, Inc.

Flotation

Soil remediation flotation is a process that separates a contaminated residual from the sand-sized soil fraction. Flotation may be used to classify solids having similar settling and density characteristics based on differing surface properties. The floated material can be contaminated organic mass or an undesired mineral. A froth flotation tank (Figure 2-11) is equipped with air diffusers and mixers. The sand is chemically and/or mechanically treated to cause the contaminant to become hydrophobic. The diffused air bubble can then "attach" itself to the particle and allow it to float. The soil feed rate, contamination concentration/particle size, chemical selection/dosing, air flow rate, and retention time are design and process variables that can affect flotation.

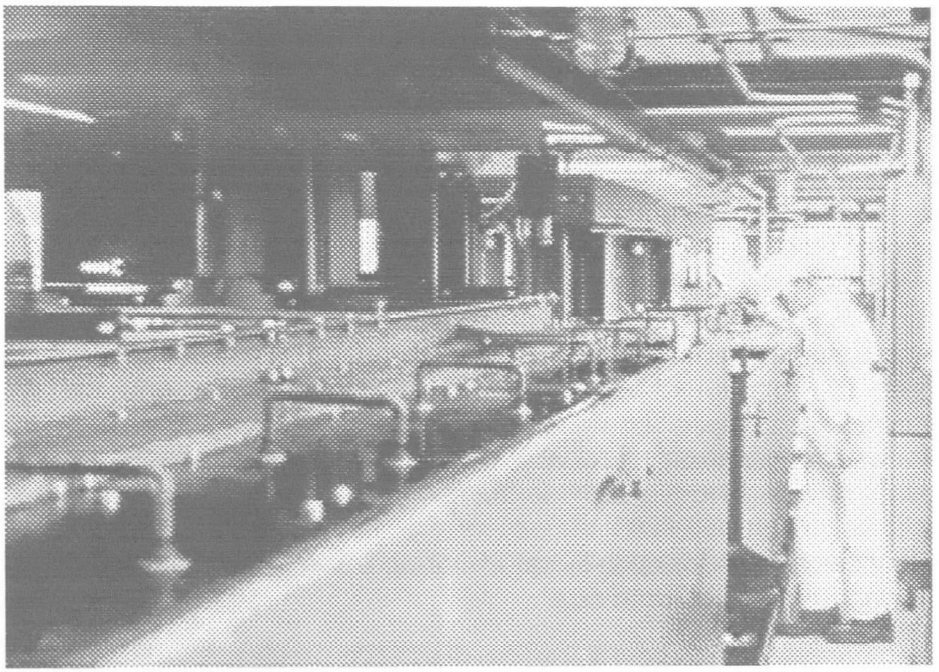


Figure 2-11. Froth flotation (mechanical) cells (provided courtesy of ARCADIS Geraghty-Miller).

Feed material specifications -

Specific gravity - Specific gravity of flotation is related to particle size of flotable fraction. Increasing specific gravity decreases the particle size that can be floated.

Solids content - Variable, typically dilute slurries about 20% solids.

Washwater - Flotation equipment may be equipped with washwater which generally sprays over the foam enhancing the separation.

Particle-size ranges - Flotation is not generally effective on fines (slimes) as fine particulate will tend to concentrate at the air water interface irrespective of the composition. Ores are often deslimed before beneficiation by flotation. Averett et al., as cited in Olin and Preston (1995), indicate maximum size separated is roughly 50 to 65 mesh.

Characteristics - Flotation equipment exploits differences in wetting properties of different solids. These differences are usually enhanced with chemicals. When a hydrophobic particle encounters a rising air bubble, it is caught on the surface of the bubble and entrained to the top of the tank. The rising bubbles form a froth above the water surface which contains the hydrophobic material. Since not every contaminated particle will be impacted and entrained by air, the cleaned product will typically have some residual contamination. In addition, the air will entrain to the froth some particles which would not be considered contaminants.

Type - There are two general types of froth flotation machines: mechanical cells and columns. Froth is swept off the mechanical cells with sweeping arms. Columns produce a variable depth froth that is allowed to overflow the vessel.

Waste/product streams - Hydrophobic particles tend to concentrate at the air water interface of rising bubbles and discharge in a froth. Hydrophilic particles tend to remain in the slurry and are discharged as the cleaned product. Reagent residuals may be found in both fractions, and toxicity of reagents is a consideration in selection.

Operating variables/parameters - Primary operating variables include selection and dose of chemicals, the amount of air introduced, mixing intensity, and the throughput. Slurry concentration and composition will also affect flotation effectiveness. In addition, some units allow for varying degrees of washwater for additional concentration of the hydrophobic particles. Columns generally provide more washing capability than mechanical cells.

Size - Mechanical cells found in literature range between 1 and 5300 ft^3 (0.28 and 1501 m^3). No data was found on column size.

Cost - capital and operating - As described in Western Mine Engineering (1996), individual self aerating flotation cell volumes range from 11 to 3000 cubic feet (0.31 to 85 m^3), requiring a corresponding floor space of 9 to 185 sq ft. (1 to 17 m^2). Flotation cells utilized in mineral circuits are normally installed in multiple banks, and this is assumed in the cost information given. Capital costs range from approximately $7,100 to $165,000 per cell, and operating costs from $0.30 to $13.20/hr. Motor and launders are additional. Unit costs range from approximately $50 to $660/cu ft, with unit cost decreasing with increasing size. Capital costs of standard flotation cells are marginally less than for self aerating, but require blowers in addition to motors and launders for operation. Operating costs are comparable. Other assumptions on which these cost ranges were based are contained in Western Mine Engineering (1996).

EPA estimates capital cost in 1998 dollars of a 91-tonnes/day froth flotation plant at $810,100 based on mineral industry experience. Operating costs are estimated at about $13/tonne.

General comments - Flotation is a complex process and should be considered in consultation with a vendor. It will only be applicable when the contaminant is not distributed over all particle-size ranges but rather, a discreet fraction of particles. In addition, the contaminant must be rendered more hydrophobic than the rest of the matrix, usually through the use of chemical additives since the contaminant is to be removed with the froth. Design and operation of the flotation cycle must proceed with due consideration to the acceptable amount of contaminant in the clean product. Pilot tests are required to evaluate the feasibility of flotation and for process design.

Flowsheets - Flotation is typically considered for use after the removal of fines in hydrocyclones for removal of organics from sand. The contaminated fraction would then typically be sent to clarification or dewatering.

Vendors - Dorr-Oliver Inc.
Osna Equipment
MIM Technologies GPO
EIMCO Process Equipment
Cominco Engineering Services Ltd
JETFLOTE Pty Limited

Solids Dewatering

Centrifuges

Centrifuges (Figure 2-12) are used to dewater or clarify slurries by enhancing sedimentation in rapidly rotating equipment. Operation of a centrifuge is not labor intensive; however, it does require a consistent feed source. Centrifuges are used for fines dewatering in soil remediation. They may be used to classify solids, analogous to hydroseparators, by adjusting operating parameters.

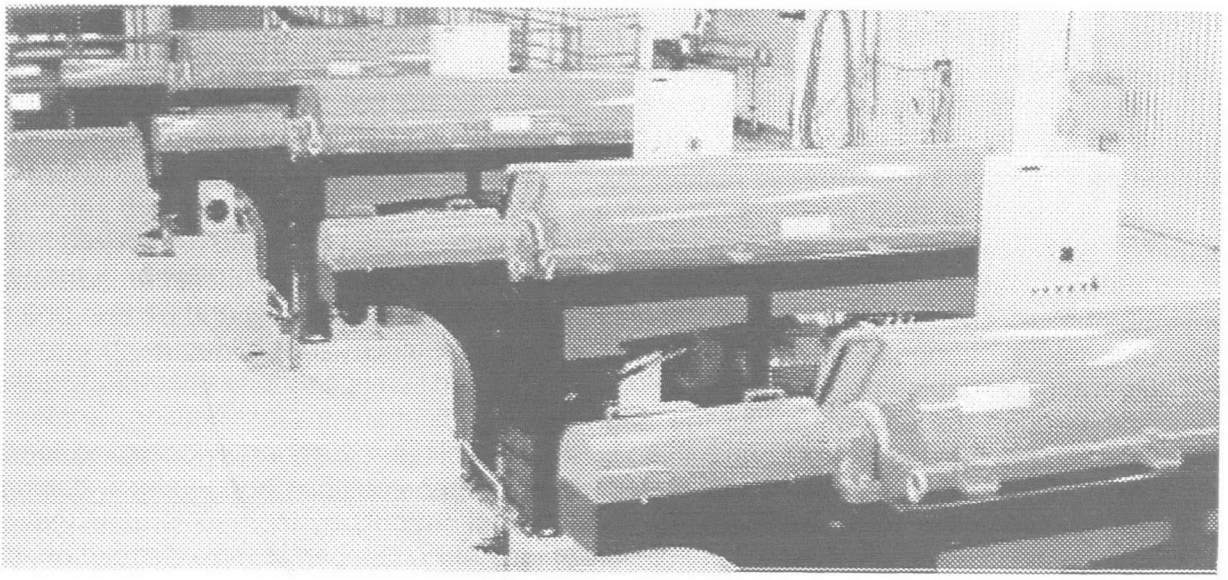


Figure 2-12. Four decanter centrifuges (provided courtesy of NOXON).

Feed material specifications -

Specific gravity - Specific gravity of particulate should be more dense than fluid in order to discharge in the underflow.

Solids content - No feed limitations were found in vendor literature. Svarovsky (1990) indicates decanter (scroll type) centrifuges are limited to 2 to 50 percent solids by volume, disk centrifuges are limited to 2 to 6 percent solids by volume, and tubular bowl centrifuges are limited to less than 1 % solids. The feed slurry can range from 1 to 70% solids, but must be uniform both in solids content and input rate for optimum performance.

Washwater - May generally be employed if required. Typical application of washwater in soil washing would occur when using centrifuge as a classifier.

Particle-size ranges - Centrifuges can clarify down into the sub-micron range. Maximum size should be discussed with the vendor.

Characteristics - Centrifuges have small footprints compared to settling basins or lamella clarifiers.

Capacity - Decanter centrifuges: 1 to 200 m^3 slurry/hr. Disk centrifuges: 2 to 225 m^3 slurry/hr. Drum centrifuges: 9 to 15 m^3 slurry/hr.

Type - There are two main types of centrifuges: sedimentation centrifuges and centrifugal filters. The vendor literature reviewed included three types of sedimentation centrifuges: decanter, disk, and tubular bowl centrifuges; no information was found on centrifugal filters in the collected literature. Decanter centrifuges have a horizontal drum with an independently rotating auger to move settled sludge to discharge. Decanter and disk centrifuges are primarily continuous devices while tubular bowl centrifuges are continuous, semi-continuous, or batch, depending on equipment design. A centrifugal filter is a solids/liquid separator that uses a bowl rotating at high speeds. The slurry is discharged into the bowl; the solids form a bed against the screen on the inner wall of the bowl; and the liquid passes through the solids and out the system. The solids either collect and are removed as a batch or are continuously removed while the drum is rotating.

Waste/product streams - Centrifuges produce an underflow in the form of a sludge or slurry containing the particulate clarified or classified from the feed. The overflow or centrate is the clean liquid that does not contain the most settleable particles.

Operating variables/parameters - In all continuous and semi-continuous centrifuges, the flow rate through the unit will affect the degree of clarification or classification, analogous to reducing the residence time in a settling basin. Machines are generally designed to operate at one drum or disk rotational frequency which may sometimes be changed by switching belts or gears. Settling velocity of particles is influenced not only by the acceleration induced by rotation, but also by size, shape, and density of the particulate, particle-size distribution, density and viscosity of the fluid, and solids content. Some units are available allowing flocculant addition; shear forces will generally disperse flocculated material entering the centrifuge, but flocculation may be performed within the acceleration field. Other important parameters for design and operation are desired cake dryness and filtrate clarity.

In continuous units, the rate of centrate (clarified liquid) discharge relative to feed may be adjusted to alter sludge concentration. In decanter centrifuges, the sludge concentration is affected by the speed of the rotating auger relative to the drum and the height of the dam controlling settling distance.

Size - Units in reviewed literature were within the following size ranges including drives and supports:

1300 to 6260 mm length x 620 to 1635 mm width x 800 to 3370 mm height (decanter)
1525 to 3200 mm length x 915 to 1855 mm width x 1675 to 2870 mm height (disk)
660 to 1270 mm length x 406 to 1270 mm width x 2032 to 2921 mm height (drum)

Cost – capital and operating - The centrifuges described in Western Mine Engineering (1996) appear to be primarily designed for coarse material dewatering. The typical feed size range referenced for the centrifuges given is 150 μm (100 mesh) to approximately 76 mm, at 30 to 40% moisture or less. Capacities range from 25 to 325 tons solids/hour, with capital costs ranging from approximately 76 to 142 thousand dollars and operating costs from approximately 4 to 7 dollars per hour. Cost per ton solids capacity per hour decreases with increasing capacity, ranging from a low of approximately $400 to a high of $3050. Other assumptions on which these cost ranges were based are contained in Western Mine Engineering (1996). Installed capital costs for solid bowl centrifuges for wastewater applications using 8 pounds of polymer per ton are estimated by EPA in 1998 dollars:

20 gpm	$253,000
100 gpm	$470,000
500 gpm	$1,019,000

O&M costs in 1998 dollars for two municipal wastewater treatment plants using solid bowl centrifuges were $31.97 and $95.12 per ton of dry solids.

General comments - Centrifuges enhance sedimentation by increasing the force acting on the particles through centrifugal acceleration; the magnitude of this force is often expressed in multiples of the acceleration of gravity or "g"s. The decanter centrifuges reviewed produce between nominally 1,900 and 5,600 g, and the disk centrifuges produce between nominally 3,900 and 10,000 g. Insufficient data were available to estimate the force produced by the tubular drum centrifuges. Centrifuges must be supplied stable support in accordance with vendor recommendations.

Flowsheets - Centrifuges may be considered for dewatering applications, typically applied to the fines fraction. Centrifuges would typically be placed after hydrocyclones in a soil treatment train.

Vendors - SANBORN Technologies
Noxon
Dorr-Oliver Inc.
Veronesi Separatori s.p.a.
Separators, Inc. (used/reconditioned)

Rotary Vacuum Filters

Two common types of rotary vacuum filters are disc and drum filters. Vacuum drum filtration is a continuous process in which a drum covered with filter media is partially submerged in a slurry, and a vacuum is applied to the inside of the drum, causing flow through the drum. Solids cake forms on the outside of the filter and is scraped off. The continuous filters can be divided into two basic categories: those forming their cake against gravity, normally called bottom feed,

and those forming their cake with gravity, sometimes called top feeding or top loading. Rotary disc filters, as in Figure 2-13, consist of filter elements (discs) mounted vertically on a central shaft and connected to a vacuum filter valve. As the panels rotate, they go through similar pick-up and dewatering operations as on drum filters. At the discharge point, the cake removal is assisted by means of blades or knives. The cake is discharged by a scraper blade mounted parallel to the drum surface. Cake discharge is assisted by a blow back of compressed air through the geotextile. A rotary vacuum filter may be considered in soil remediation projects for dewatering of the sand and/or clay fraction. The use of a rotary drum filter for dewatering of the clay fraction will require the use of filtering aids, and its performance will be less efficient as compared to a belt filter press, plate and frame filter press or centrifuge.

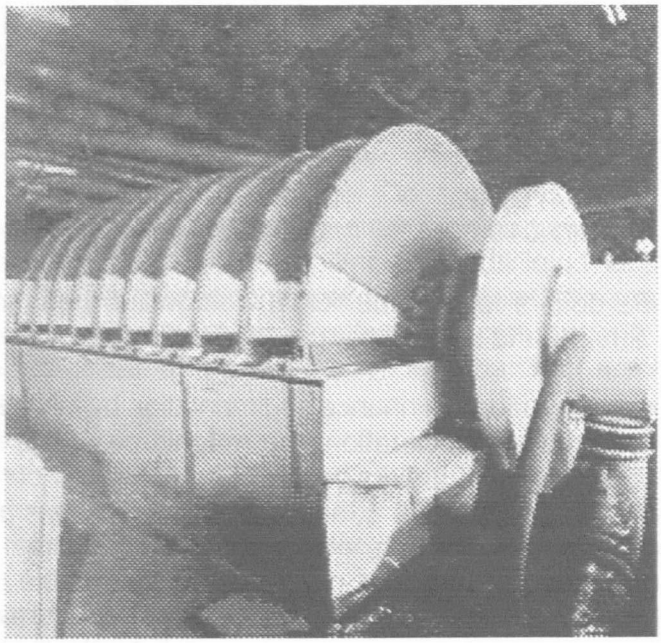


Figure 2-13. Rotary disc filter (Minerals Processing Technologies Inc.).

Feed material specifications -

Specific gravity - None specified.

Solids content - Any density that is pumpable and that can maintain particle suspension, economically the highest density practical. Filters almost always follow a thickener.

Washwater - None specified.

Particle-size ranges - Range zero to 20 mesh (Petersen Filters Corp.).

Capacity - Rotary vacuum filters are sized on filtration rates determined by laboratory and or pilot work and are reported in units of lbs/hr/ft^2. Horsepower ranges from 30 to 610 HP (Petersen Filters Corp.).

Waste/product streams - Cake, 15 to 30 percent moisture. Aqueous filtrate may contain fine suspended solids and dissolved contaminants.

Operating variables/parameters - Operating parameters are the use of filtering aids, percent vacuum, the geotextile, rotational speed, and thickness of filter cake.

Size - Drum filters 2 ft dia x 9 inches length (0.6096 m by 22.86 cm) (pilot) to 14 ft dia x 18 ft length (6 ft^2 to 792 ft^2 or 4.27 m to 5.49 m). Disc filters 4 ft (1.22 m) dia x 1 disc (pilot) to 12.5 ft (3.81 m) dia x 14 discs (25 ft^2 to 3080 ft^2) (Petersen Filters Corp.).

Cost - capital and operating - Maintenance costs vary widely with abrasiveness and corrosiveness of slurry. Primary operating cost is power. Capital cost ranges from approximately $25,085 to $501,709 US 1998 (including accessories, excluding installation) (Petersen Filters Corp.).

General comments - One technician can monitor several filters at once. Rotary vacuum filters have limited application in soil and sediment treatment despite their widespread use in industrial applications. It is generally not possible to justify the higher capital and operating costs for the improvement in cake properties for a low value product or waste stream.

Flowsheets - Rotary vacuum filters would typically be considered for final dewatering of fines after a thickener such as a lamella clarifier.

Vendors - Petersen Filters Corporation

Filter Presses

Filter presses express liquid by compressing filter cake against geotextile. The resulting cake acts like a filter media resulting in much finer retention than that resulting from the pore size of the filter. Two common types are belt filter presses and plate and frame presses.

The belt filter press is a continuous device that separates solids from liquids using three sequential processes: solids conditioning, gravity dewatering and pressure filtration. In solids conditioning, a polymer is mixed with the slurry to neutralize the electrical charges between the solids, thus allowing the solid particles to form small lumps called flocs. In gravity dewatering, the flocculated slurry is discharged onto a moving belt, and the free liquid is allowed to drain through the belt by gravity. In pressure filtration, the gravity dewatered sludge is pressed between two belts and is passed through a series of rollers with decreasing diameters. The decreasing diameters gradually increase the pressure exerted on the sludge, causing additional solids/liquid separation. The process variables affecting belt filter press design and performance are sludge characteristics, feed solids concentration, sludge age, sludge feed rate, and polymer dosing. The sludge characteristics determine the roller pressure required to obtain a dry filter cake. The feed solids concentration and feed rate determine the size of the belt press and will cause poor performance if the parameters are out of the design range.

The age of the sludge can cause poor filtration as flocs tend to break down with time. The belt filter press can be used in applications that require water removal from a fine soil fraction (< 200 microns).

A plate and frame filter press is a batch solids/liquid separator that uses a series of plates covered with a filter media. Plate and frame type filters use the pressure of the incoming slurry as the driving force for filtration. A slurry is pumped under pressure between the plates with the liquid passing through the filter media to the drain zone. When the filter pressure (typically 100 psig) is reached, the slurry pump is stopped; air is blown through the filter cake for drying; and the cake is dropped to a conveyor for removal. A cake of up to 8 inches (20.32 cm) thick can be produced, but for soil remediation applications a 1- to 3-inch (2.54 to 7.62 cm) thickness is usually desired. In most applications, the cake dryness can range between 40 to 65% solids. Parameters that affect the design and operation of a plate and frame filter are solids feed consistency, throughput rates, filterability of the solids and desired filter cake dryness. The plate and frame press is more labor intensive than other filter systems but can handle large fluctuations in feed slurry. The plate and frame filter can be used in most soil remediation applications for solids/liquid separation.

Feed material specifications -

Specific gravity - Not limited.

Solids content - Belt filter presses are applicable from 1 to 40% solids in the slurry feed (Olin and Preston 1995).

Washwater - Presses are generally equipped for washwater. However, washing will have limited application in soil/sediment remediation since the principal application is dewatering.

Particle-size ranges - WASTE-TECH indicates a maximum feed size of 100 microns for their Python Press.

Characteristics - The finer the material, the more quickly the filter will blind. Thus, clays are more problematic than coarse soils.

Capacity - The maximum hydraulic loading rate for belt filter presses tends to be around 50 gpm/m (11.4 m^3/hr/m), with belt widths ranging form 0.5 to 3 m (Viessman and Hammer 1993).

Type - Literature reviewed included belt filter presses and a Python Pinch Press. The mechanisms for compression vary from vendor to vendor as well as the maximum pressure exerted on the cake. The belt filter presses are continuous with moving cloth. The Python Pinch Press is semi-continuous with a stationary geotextile.

Waste/product streams - Filter presses produce a dry cake of soil/sediment solids. Expressed water and washwater must be disposed of or recycled and may contain fine solids and dissolved contaminants.

Operating variables/parameters - Operation of presses is quite dependent on the feed material. Material properties can often be amended by additives to affect porosity of the cake. The concentration and feedrate of the sludge are important input variables which affect the speed or cycle of the press and the pressure applied.

Size - The belt filter presses found in the vendor literature require a floor area of 151" x 126" to 259" x 165" (384 cm x 320 cm to 658 cm x 419 cm).

Cost - capital and operating - EPA estimates cost of a 40 to 50 gpm filter press at $343,500 and a 80 to 100 gpm filter press at $470,000 in 1998 dollars representing 1 and 2 meter widths, respectively. EPA's limited survey also indicated that contracted costs for filtering are typically in the range of $3 to $11 per hundred gallons of feed.

Cost information for belt filter presses in Western Mine Engineering (1996) are provided for units with belt widths ranging from 3.0 to 12.0 feet (0.914 to 3.658 m). Capital costs range from approximately $88,000 to $173,000, and operating costs from $3.05 to $6.10/hr. Estimated capacities given are for various coal circuits. Capacity ranges from 11 to 33 tons/hr for a circuit with feed material composed of 90% ash and over 80% less than 325 mesh. Unit capacity costs were roughly estimated from this information to range from $4570 to $9150/ton/hr. Other assumptions on which these cost ranges were based are contained in Western Mine Engineering (1996).

Plate and frame filter presses are described in terms of nominal size and corresponding filtration area and volume. The pressure filters described in Western Mine Engineering (1996) range from 30 sq ft to 798 sq ft (3 sq m to 74 sq m), and 1 to 30 cu ft filtration volume (0.028 to 0.850 cu m). Capital costs range from approximately $13,200 to $122,000, and operating costs from approximately $0.50 to $6.60/hr. Corresponding unit costs are then approximately $150 to $460/sq ft filtration area, with unit cost decreasing with increasing size. Other assumptions on which these cost ranges were based are contained in Western Mine Engineering (1996).

General comments - EPA (1994b) indicates that belt filter presses are generally the best suited devices for mobile treatment systems. Furthermore, contract filter services are generally available. Characterization tests are generally required to size the unit.

Flowsheets - Filter presses are generally the final stage of sludge dewatering.

Vendors - Waste-Tech Inc.
LAROX
Bethlehem Corporation

Screens

A solid/liquid separation differs from grading screening (solid/solid separation). Screens are used for dewatering for materials ranging from coarse down to about 0.1 mm but are most commonly applied to material below 1 mm (Osborne 1990). For material greater than 0.5 mm in diameter, effective drainage with no material losses through the screen can be achieved with screen apertures smaller than the smallest particle size. For finer materials, a range of particle

sizes in the feed is necessary to facilitate formation of a filter bed. The coarser particles bridge the screen apertures, creating a cake, which retains fine particles while passing the water through the cake. In general, this requires an aperture size 40% larger than the mean particle size (Osborne 1990).

In cases where the specific gravity of the solid and liquid are similar, a fixed screen with low flow rate will perform better than a moving screen. This will not typically be the case in soil/sediment remediation operations. Efficiency of this operation will vary with screen type, material characteristics, and solid to liquid ratio. A typical dewatering configuration is a classifying cyclone followed by a sieve bend and a flat or inclined deck type screen. The function of the cyclone is to present a feed low enough in fluid volume to permit drainage by capillary action (Osborne 1990). In the case of less than 0.5 mm material, this translates to 30 to 40% fines.

Hydroseparators

Hydroseparators are devices that serve two purposes: clarification and separation. A simple hydroseparator is a vertical tank with a tapered bottom for solids removal and an overflow collector to collect the clarified liquid or the finer fraction from separation. To act as a clarifier the upward liquid velocity must be such that the smallest particle can settle against the current. A polymer can be used to increase the settling velocity and the thickening of the clarified solids. The use of hydroseparators for separation was previously discussed under hydraulic classifiers.

Screw Classifiers

A screw classifier is a separation device that consists of a sloped bottom tank with parallel sides equipped with one or two spirals mounted parallel to the tank bottom. The rotating spiral provides agitation for the pool and a conveyance mechanism to the sand discharge for the settled sand. Sands drain as they are conveyed. A separation of fine particulate is made by a constant agitation of the solids in the pool and the upflow of water to the overflow weirs. The oversize fraction (sand) with 80% solids can be obtained. Factors that affect the design and operation of the screw classifier are liquid viscosity, specific gravity, and flow rate of the liquid phase. Soil parameters that affect the design and operation of the unit are chemical and physical composition, density, feed rate, particle-size distribution, and desired separation size. In soil remediation applications the screw classifier can be used to remove up to a 100-mesh particle from the soil or dewater for further processing or as a plant discharge.

Auxiliary Equipment

This section will address types of auxiliary equipment that are required in virtually all fully functional soil washing plants. Other auxiliary elements of an operating soil washing facility such as pads, electrical service, security, road access and decontamination facilities are adequately covered in other facilities and environmental engineering references and thus will not be addressed in detail in this document. However, most of these elements will be necessary for the successful completion of the project and should be considered in any cost estimation or planning exercise.

Conveyors

A belt conveyor is a transport device consisting of a continuous rubber or fabric belt supported by pulley assemblies at each end and idlers and troughing rollers along the profile. The rollers, idlers, and pulleys are mounted in a support frame structure suitable to maintain belt alignment. Belt conveyors are used as an economic transport for soil through the plant. Belt conveyors in a soil washing plant can range from a short horizontal stationary conveyor used to move soil internally, to a radial stacker to pile and stage processed soils. Design criteria should include environment, belt type, slope, belt trough and width, belt speed and material transported. Weighing belts are also available.

Process Tanks

Soil washing plants require tanks for process storage of slurries, sludges and process water. These can be a simple horizontal or vertical cylindrical tank for process water or a sophisticated sludge consolidation/holding tank. Process tanks in a soil washing plant are used to isolate equipment and allow various unit operations to operate independently. An example can be the sludge press. In some operations, the sludge production is greater than the sludge dewatering system can process. Scheduling the dewatering operation to more operating hours than the main processing plant can accommodate the production rate differences. Buffering of process flows can also prevent upsets and pulsating discharge streams that affect downline equipment feed streams. Design parameters for process should include material stored, flow rates in and out, and desired holding volume and time.

Sumps and Pumps

Liquid sumps and pumps are needed in a soil washing process to transfer slurries in the plant. Sumps are usually open vessels used to collect flows from one or more sources and provide a flooded suction to pumps for proper operation. The sumps are typically slanted bottom tanks and are designed to channel any solids in the process stream to the inlet of the pump. Most pumps used in a soil washing plant are either centrifugal or positive displacement type. Centrifugal pumps are used to transfer slurries with low viscosities. Consolidated or thickened sludges require a positive displacement pump. Typical subtypes of this pump type are diaphram and screw pumps. The design criteria for pumps for soil washing include slurry characteristics, system piping requirements and required pressure or flow of the receiving equipment.

Controls

Process controls for a soil washing plant can be as sophisticated as a Programmable Logic Controller (PLC) monitoring and controlling all phases of the process to a simple manual valve control adjusting and maintaining tank levels. PLC systems can monitor and maintain tank levels, process flows, pressures, temperatures and make decisions based on input parameters. The drawback to this system is the cost, additional effort for process changes and maintenance of the sensors, controllers and hardware. Manual control plants are usually less complicated to operate, and the equipment can be easily modified, replaced or removed without any control changes. The manual control system is less costly than a PLC system but may cost more in the manpower needed to monitor and control the process. A plant design that relies on both

manual and automatic controls along with sensors and alarms to aid in manual control is a compromise that usually is the best design for soil washing plants.

Weighing Devices

Weighing of the soil in a soil washing plant can easily be done by either of two methods. Hauling soil in trucks and weighing of each truck prior to placing soil in a feed staging area is used in some operations. This method can quantify the soil treated but cannot indicate plant feed rates for plant control. The preferred method for weighing material processed is using a conveyor belt weigh scale. This device mounts on a belt conveyor and measures the weight of load on a moving belt. The weight scale has the capability to display the feed rate in real time but also can integrate the feed rates for a total feed processed. These scales can be adjusted to deliver an accuracy of within 0.5%.

3 Treatment Trains and Cost Estimation

This chapter discusses how the unit processes discussed earlier can be combined to form an overall physical separation process. Factors that may affect performance, typical treatment trains (soil washing plants), and estimation of costs are addressed.

Factors Affecting Soil Washing Cost Effectiveness

The technical and economic viability of soil washing is quite varied depending on site-specific factors. There is no single "recipe" for application of soil washing, and effectiveness may depend on one or more factors. Some of the most significant are discussed below.

Type and Mechanism of Contamination

Contaminants distribute differently, depending upon the manner in which they are introduced to the soil or sediment. A firing range soil, for example, may have particulate lead throughout, as well as lead deposited by smearing and chemically sorbed metals solubilized by leaching. Although fines are typically considered to have the highest associated contaminant concentrations, sands may not be entirely clean in grossly contaminated environments or where the contaminants, such as oil and grease, are sticky or viscous. A review of site history is, therefore, essential before beginning any lab or field work with the site materials.

Volume of Material to be Processed

Because site preparation and mobilization/demobilization costs are relatively insensitive to the volume to be processed, low volume projects will reflect much higher unit costs than high volume projects.

Clay Content

Soil washing is generally only economical when clay and organic content is low. A significant portion of the cost attributable to clays is a result of increased dewatering costs. For sediment reclamation projects, where dewatering may be accomplished in lagoons rather than settlers or filter presses, this cost factor may be significantly reduced provided adequate storage area is available to meet the requirements of extended settling times. Clay content may result in diminished processing rates, however, with respect to separation and extraction processes.

Organic Content

Natural organic materials act as sinks for contamination. Organic materials are not confined to a single size range and may result in high contaminant concentrations in mineralogical fractions that would otherwise be relatively uncontaminated.

Preliminary Cost Analysis

The importance of conducting the preliminary feasibility evaluation in a manner that is representative of field operations cannot be overstressed. For example, wet sieving is commonly used for preliminary contaminant distribution studies. While the information obtained in this manner is useful for preliminary evaluation of process feasibility, the separation is not representative of what can be achieved in the field using, for example, hydrocyclones. A stepwise approach to feasibility evaluations, beginning with bench scale testing and progressing to pilot scale, is therefore advisable. Evaluating the material to be processed in a manner representative of what the process will "see" in the field is important. If materials are to be blended, they should be composited for feasibility evaluations as well. However, this requires advance planning of excavation operations; sufficient staging area, and blending equipment. Compositing must be approached very carefully. If no blending is planned, then each matrix must be separately evaluated.

Degree of Heterogeneity of Soil/Sediment Deposit

Small scale testing, such as bench and pilot scale feasibility tests, may not fully address the effects of heterogeneity within the soil/sediment deposit to be processed. In some cases, additional pilot testing may be required, even after operations have progressed to full scale, to assess different matrices encountered during excavation. Blending operations may be required, as previously mentioned.

Treatment Trains

Due to the complexity of soil contamination, physical separation treatment trains may be equally complex. In Chapter 1, Figure 1-1 gives an overview of how physical separation equipment can be put together to create a physical separation treatment train. Three examples of realistic configurations of increasing complexity are discussed below.

Treatment Train 1, Simple Physical Separation

One of the simplest treatment train configurations is shown in Figure 3-1. This treatment train is designed to make a simple physical separation of the field oversize, the process oversize, and the sand and fines. The configuration is appropriate for situations where there is a desire to minimize the volume of material stored in a confined disposal facility (CDF) and where there may be an opportunity to recycle oversize materials and sand. This configuration assumes that the oversize and sand products meet the specified treatment standards without treatment. The quality of the products must be confirmed in treatability studies performed on actual feed materials.

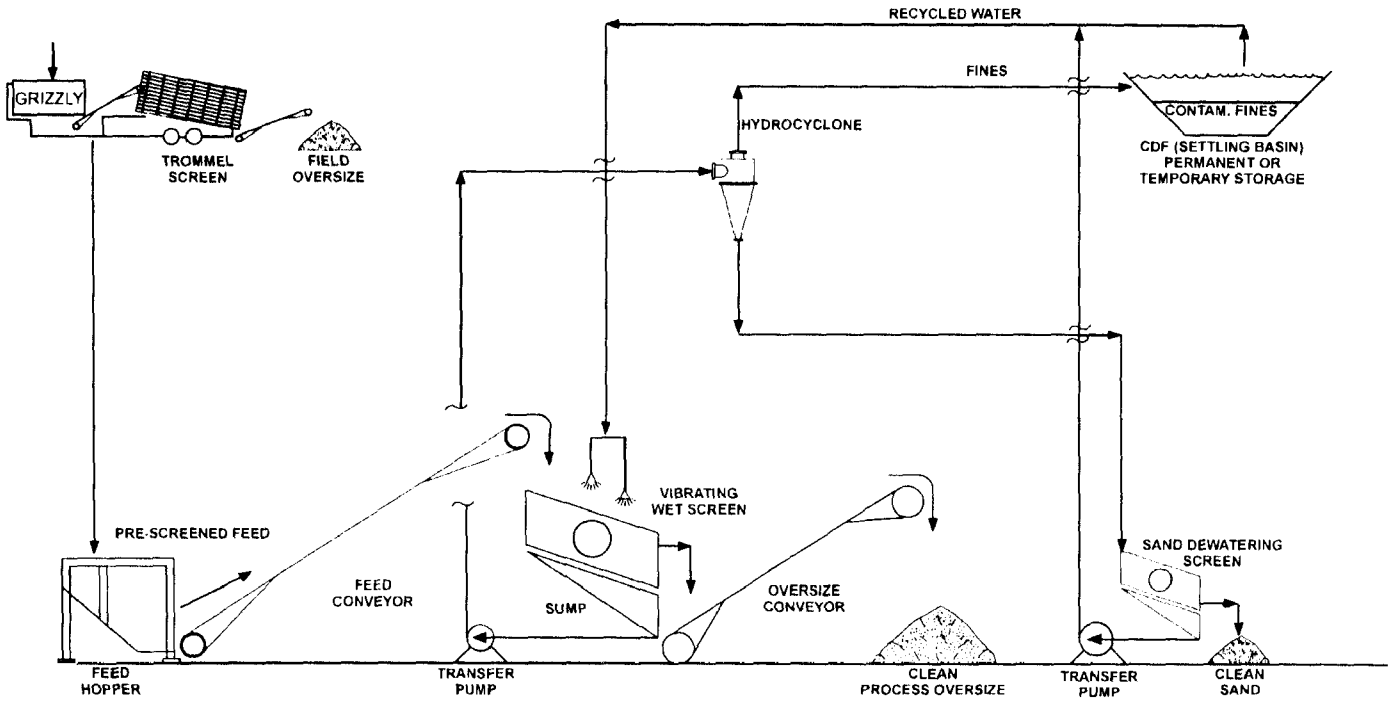


Figure 3-1. Treatment Train 1, simple physical separation. (same as figure 1-3)

Treatment Train 2, Physical Separation

Treatment Train 2 (Figure 3-2) is similar to Treatment Train 1 with the exception that a density separation step has been added on the sand stream after hydrocyclone separation. In this case, the feed material has a contaminant in the sand stream that exhibits physical density differences from the sand and can be removed by the use of a spiral concentrator or mineral jig. This contaminant may be either more or less dense than the sand and is often represented by lead (as a heavy) or naturally occurring organic matter (as a light). Oversize products are similarly removed, and it is the intention of this flowsheet to reuse or recycle the recovered products meeting the treatment standards. Contaminated fines are returned for storage to the CDF.

Treatment Train 3, Treatment with Fines Extraction

In Figure 3-3, all of the features of Treatment Train 2 are included. Oversize products are removed; separations of the sand and fines are performed with the hydrocyclone; and the sand is density separated. In this case, a decision has been made to avoid the use of the CDF and further treat the sand and fines. Also, the sand usually needs additional treatment to achieve the required standards. Froth flotation has been added to function in conjunction with surfactants to remove residual contaminants from the sand. The froth concentrate is recombined with the fines. The fines are thickened in a lamella clarifier and are further treated with wet oxidation to destroy remaining organic contaminants. A final wet oxidation step is included as an example of the way nonphysical technologies can be integrated into soil washing plants.

Case Studies

Some actual treatment trains with varying levels of complexity can be found in the case studies presented in Chapter 4.

Cost Estimating

Estimating treatment costs is perhaps the most difficult task facing the planner and design engineer. Because physical separation is still a young technology as a soil or sediment remediation technique and because costs are always highly site specific, dependable cost numbers are the most difficult information to obtain. Equipment vendors are often reluctant to provide generic equipment cost ranges, and few are published. Planning-level cost estimates can be approached, however, in a number of different ways so that the economics of separation technologies can be compared to other treatment or management alternatives. A tiered approach is recommended, beginning with the least labor intensive estimating method and progressing to the most detailed and certain methods, if it appears to be justified. Four approaches in increasing order of effort and expected reliability follow:

- Extrapolating unit costs ($/unit volume soil/sediment) from case studies of other projects.

- Application of various multipliers to equipment cost estimates to obtain rough total project costs.

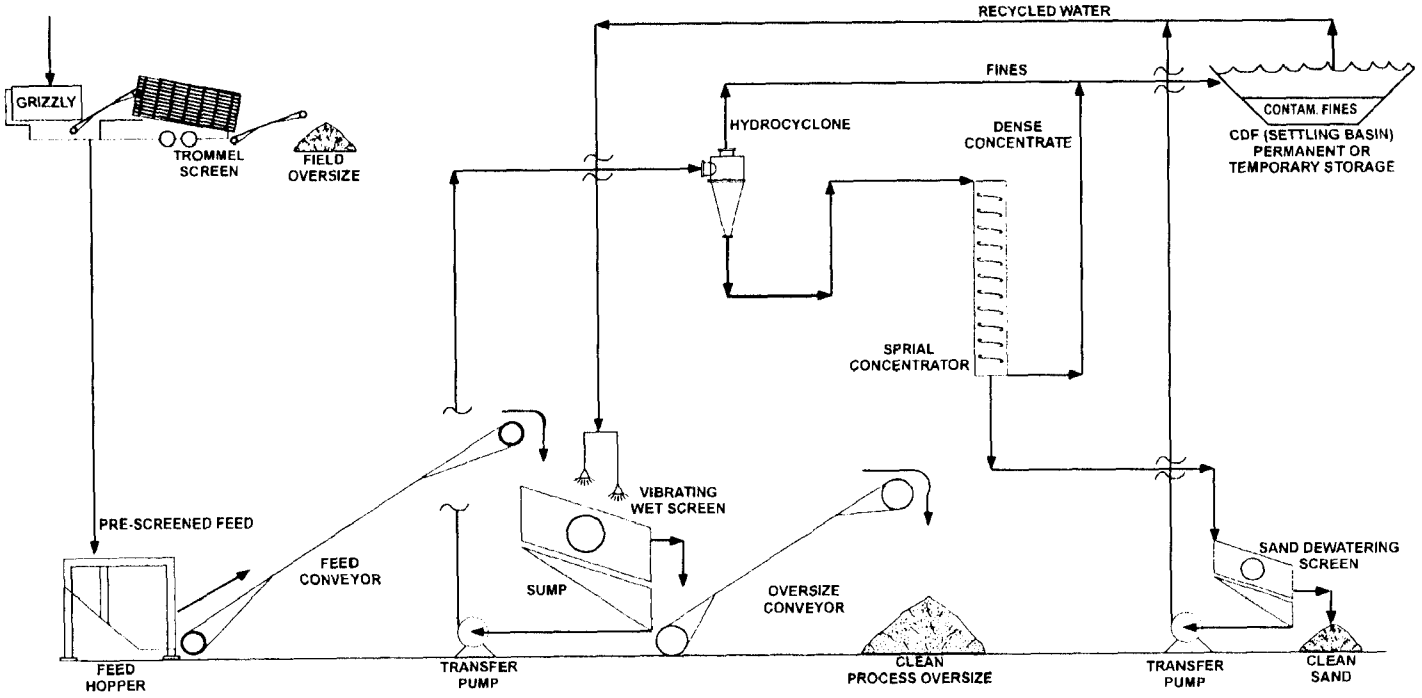


Figure 3-2. Treatment Train 2, physical separation.

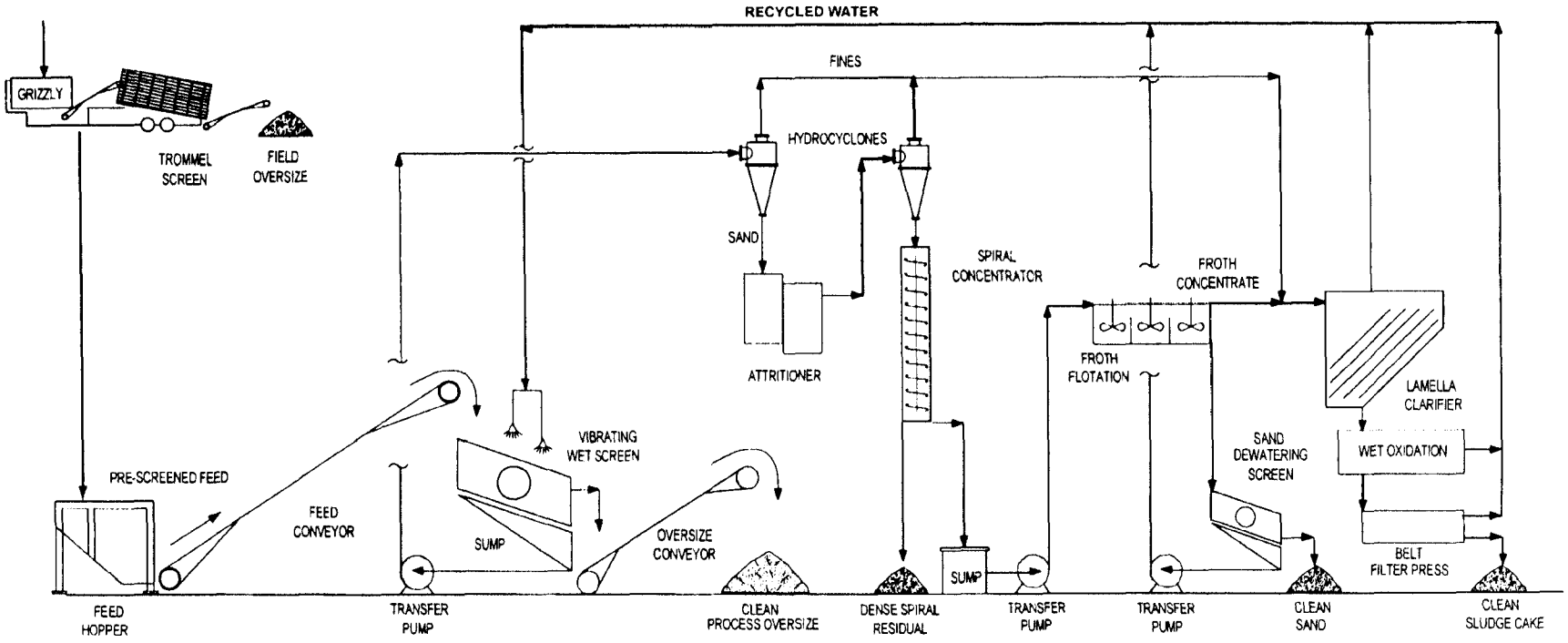


Figure 3-3. Treatment Train 3, treatment with fines extraction.

- Extensive, design level, estimation of project requirements.
- A&E proposals.

Case Studies as a Cost Estimating Tool

A range of unit costs for physical separation can be obtained from a review of case studies. Care must be exercised to determine what is included in reported costs (site preparation, mobilization-demobilization, equipment purchase and operation versus fully contracted operations, processing volume, and site specific conditions that may have influenced costs) to arrive at meaningful unit costs that can be applied to other sites. The value of this as a first step in developing cost estimates is obtaining an indication for the sensitivity of physical separation costs to processing volume, technical complexity, and site considerations. Because of the extreme variability that is normally encountered in reported unit treatment costs, this is typically not a definitive cost estimating tool, however.

Equipment Cost Multipliers for Total Project Cost Estimation

Equipment capital and operating costs can be developed from cost estimating guides (e.g., Western Mine Engineering 1996) or from vendor specifications and quotes. In both cases, at least a preliminary treatment train must be developed identifying major pieces of equipment. Developing this treatment train, in turn, requires at least preliminary site and material data acquisition efforts. Costs developed based on equipment recommendations and estimates obtained from vendors for site specific requirements will undoubtedly have a higher level of certainty than costs developed from generic data. Vendors may require more extensive site data; however, the information gathering effort is offset by shifting the burden of specifying and costing the equipment to the vendor.

Once costs for all the major equipment have been estimated, estimating the total capital cost of the project (including design, engineering, installation, and ancillary equipment of the entire facility) by multiplying this base cost by a factor typical for the industry is often helpful. Cost of installation is often proportional to the cost of the major equipment. The factor estimates costs such as piping, foundations, painting, etc. typical to all installations. Factor estimates are available for the source of expense (Perry 1984) from which components could be increased or eliminated depending on site complexity or accounting (e.g., not including corps labor in costs). Care should be taken that the equipment costs are all estimated on the same basis so inflation and delivery are taken into account. Without a typical factor for remediation or mining plants, a factor of 4.1 (Perry 1984) may be a reasonable approximation for physical separation.

By applying this methodology, the remediation engineer can quickly evaluate the tradeoffs in capital expenditure and O&M costs with plant throughput. In addition, a reasonable equipment recovery value for short-term projects could be incorporated in economic evaluation. This may be useful to evaluate equipment which may be used on subsequent projects or to approximate an anticipated use fee if a vendor is to perform the project.

Extensive, Design Level Estimation

Extensive, design-level estimation of site preparation requirements, mobilization-demobilization and operating schedules, manpower, supplies and materials requirements, and capital and operating cost estimates for individual pieces of equipment is likely to give more precise results than the previous two estimating methods and is ultimately necessary. However, itemized estimation may require a time and manpower investment that may not be justifiable in early planning-level cost estimating efforts. The treatment train and material take-offs must be more fully developed. Even then, there is an inherent level of uncertainty in all cost estimates, no matter how rigorously prepared because site conditions may necessitate process or schedule changes and impact costs. The technical and field expertise of the estimator will also be a factor. The level of effort justified for initial planning-level comparisons then must be measured against the additional accuracy that can be expected in light of these unknowns. Itemized cost estimating also parallels the effort that A&E firms preparing project proposals will invest and may be duplicative and premature for planning-level comparison of alternatives.

Itemized cost estimates for the three treatment train scenarios (Figures 3-1 through 3-3) are presented in Table 3-1. The details of these cost calculations are shown in Appendix A.

A&E Proposals

Requests for proposals (RFPs) from reputable A&E firms with experience in physical separation will likely provide the closest estimate of actual project costs. However, because of the influence of site-specific conditions on treatment costs, contractors may not be willing to provide a fixed fee bid. The planners should develop some preliminary cost estimates as a reference so that bids which clearly underestimate the complexity and difficulty of the proposed project can be identified, and excessive change orders and cost overruns can be avoided. While RFPs will ultimately provide the most precise estimate of project costs, they represent a significant time investment on the part of the preparer, require completion of treatability studies for determination of design requirements, and are typically not obtained until there is relative certainty that the project will proceed to bid.

Table 3-1. Itemized Cost Estimates of Three Treatment Train Scenarios.

Cost Component	Scenario 1	Scenario 2	Scenario 3
Mobilization, Site Preparation, Demobilization	140,000	140,000	315,000
Plant Depreciation	120,000	240,000	510,000
Plant Labor	292,775	425,010	623,364
Travel and Per Diem	108,714	108,714	217,429
Utilities	90,000	90,000	180,000
Plant Consumables	114,092	174,092	474,092
Maintenance	120,000	120,000	240,000
Process Sampling	30,000	30,000	50,000
Project Administration	50,000	50,000	50,000
Contractor Overhead and Profit	284,419	362,184	700,115
Total	1,350,000	1,740,000	3,360,000
1998 Unit Price, $/ton	22.50	29.00	56.00

Assumptions:

Processing rate is 25 tons per hour
Feed soils or sediments are delivered to the processing plant by others.
No residual disposal is provided.
Processing plant is owned by the contractor and depreciated.
A 50,000 cubic yard project is the baseline.

4 Case Studies

This chapter presents summaries of several case studies where soil separation has been used for treatment of a variety of contaminated soils and sediments. Case studies are briefly summarized to facilitate identification of important correlations, such as volume, treatment objectives, complexity of treatment trains and cost. The objective is to provide a general background in common practice, representative treatment trains, potential limitations and problems with the technology, as well as documented successes. The following case studies are taken from US Army Corps of Engineers sites, ARCADIS Geraghty & Miller experience, and literature.

US Army Corps of Engineers

Twin Cities Army Ammunition Plant, Minneapolis, MN

Site History: World War II - present: Munitions production facility (no longer active)
Site F: former open burning area
Unspecified date: Classified as Minnesota's #1 Superfund Site

Contaminants and Treatment Objectives:

Analyte	Contaminant Levels	Treatment Objectives
Lead	1600 ppm avg 86,000 ppm max	40 ppm initially 175 ppm negotiated 300 ppm enforceable standard
Antimony	Not given	4 ppm
Cadmium	Not given	4 ppm
Chromium	Not given	100 ppm
Copper	Not given	80 ppm
Mercury	Not given	0.3 ppm
Nickel	Not given	45 ppm
Silver	Not given	5 ppm

Project Volume: Not given
6-15 ton per hour processing rate

Site Ownership: Department of Defense - Army
Federal Cartridge Co. - Operating Contractor

Consultants/Contractors: Bescorp
COGNIS
Wenck Associates, Keith W. Benker, P.E., project manager

Project Status & Outcome: Completed.

Most soil returned to site following treatment. One year before closure, contractors were estimating that 95% of the soil would pass the enforceable lead standard of 300 ppm. Remaining soil was to be landfilled. The treatment was less successful for the other metals and could not achieve the stringent background-based cleanup goals. Cleanup levels based on health risk, roughly 10 to 100 times higher than objectives, are potentially achievable.

Design processing rate was 20 tons per hour. Higher contaminant concentrations and clay content were encountered at the site. At the time of publication (Benker 1994), soil was being processed at 6 to 15 tons per hour.

Treatment Train: Bulk material entered a hopper and then a trommel. The oversize material was then handpicked for munitions or cartridges. The undersize went through sand-fines separation. The fines were then extracted (Terramet, a proprietary soil leaching process developed by COGNIS). The sand went through a spiral classifier and jig for metal fragment removal before counter current extraction. The cleaned material was then dewatered and re-blended. Spent leachate from the counter current extraction went through an electrochemical reduction system where the metals were precipitated into a cake, and the cleaned leachate was recycled.

Costs: None given

Information Source(s): Benker 1994.

USAE District, Jacksonville, Canaveral Harbor, FL

Site History: Not given.

Contaminants and Treatment Objectives: The US Army Corps of Engineers, Jacksonville District, was requested by the Canaveral Port Authority (CPA) to assess hydrocyclone technology for possible use in the maintenance dredging/disposal operation at Canaveral Harbor. According to the State of Florida beach quality sand was defined as containing less than 10 percent fine-grained materials. (Fine-grained materials are typically considered to be less than 63 to 75 microns, depending upon the classification system, although the Florida definition of fines was not cited.) The project proposed to integrate dredging with processing.

Analyte	Contaminant Levels	Treatment Objectives
Uncontaminated materials	N/A	< 10% fines

Project Volume: Not given.

Site Ownership: Not given.

Consultants/Contractors: Not given.

Project Status: January 1994 - Workshop involving Port Dredging industry, hydrocyclone industry, State and US Army Corps of Engineers representatives. Concern over interdependence of processing rates between the dredging operation and the processing operation and the present availability of lower cost disposal options prevented progression beyond feasibility planning for a pilot study.

Treatment Train: Proposed maximum density separators (MDS) - hydrocyclone with vacuum applied to overflow.

Costs: Not given.

Comments: Not given.

Information Source(s): Heibel et al. 1994

USAE District, Jacksonville, Miami River, FL

Site History: Not given.

Contaminants and Treatment Objectives: This was a small pilot run to determine the feasibility of partitioning sand and silt and to determine the characteristics of the sand. Samples were prescreened through a 3/8-inch screen and then fractionated using #100, 200, and 325 mesh screens. Grain size analysis indicated 19 to 52% sand and highest contaminant levels in the less than 200 mesh (75 micron) fraction.

Analyte	Contaminant Levels	Treatment Objectives
Heavy metals	Not given	Not given

Project Volume: Five - 30 gallon samples were tested.

Site Ownership: Not given.

Consultants/Contractors: METRPO, Inc., Bartow, FL - MDS separation testing.

Project Status: March 1997 - Bottom samples collected from various locations in the project area.

April 1997 - Samples were processed through a 6-inch (15-cm) MDS test stand, for a 200 mesh split (75 microns). Two to three 5-gallon drums of sample were mixed with approximately 100 gallons of untreated groundwater (11 to 15% solids). Underflow percent solids were generally 70 to 75%. Visually, the sands appeared clean. Both underflow (sand) and overflow (fines) samples underwent chemical and bioassay sampling. The overflow demonstrated two distinct phases: a high organic settlable material and non-settlable colloidal phase.

Sediment bioassays indicated that the sand was non-toxic, suitable for commercial grade sand. Use as beach material seems unlikely because of negative public perception. Supernatant was also non-toxic. The settled organic rich overflow was thought to be suitable for use as a sealing cap between layers at an upland confined landfill. Flocculation studies of the colloidal suspension indicated that rapid settling can be achieved and a clear, non-toxic supernatant produced, with the use of cationic polymers.

Pilot project - Planned.

Treatment Train: Proposed Pilot: Water jet and eductor pump with a grizzly screen to slurry and remove clamshell dredged sediments from a scow into a feed weir. Slurry would be processed through a 12-inch (30-cm) MDS stand with 550 gpm capacity at 20 percent solids. Predicted feed split at 50 gpm underflow, 70% solids and 500 gpm overflow at 11.5 % solids. Storage capacity requirements: 150 cy/hr or 2500 cy/16 hr day. A 0.25-acre disposal area six feet in depth, or 3000 cy scow, was proposed. Assumptions: 1 to 2 days settling time for organic solids, one day drainage and excavation time, one day processing through hydrocyclone, and a four bin disposal site, or four scows to permit continuous operation.

Costs: Not given.

Comments: The proposed Miami River pilot demonstration project has not been implemented because of the stringent sediment disposal constraints imposed by Dade County, Department of Environmental Resources Management (DERM). DERM's criteria are sometimes greater than two orders of magnitude more stringent than the standard EPA TCLP criteria. Although well below national TCLP criteria, the MDS-produced underflow sand did not meet the stringent DERM criteria for clean fill, and the overflow material did not meet DERM's landfill disposal criteria.

Information Source(s): Personal Communication: Mr. Mitch A. Granat, USAE District, Jacksonville, telephone conversation, August 1997 and e-mail communication, October 1998.

USAE District, Jacksonville, Fort Myers, FL

Site History: Not given.

Contaminants and Treatment Objectives: Clean, non-toxic sediments were used in a demonstration on 21-23 September 1998.

Analyte	Contaminant Levels	Treatment Objectives
Heavy metals	Clean	Not given

Project Volume: Not given.

Site Ownership: Not given.

Consultants/Contractors: Not given.

Project Status: Grain size and TCLP results are awaited. Pending procurement of a Water Quality Certificate from the State, production application using a 14-inch (36-cm) pipeline dredge and several 24-inch (61-cm) MDSs to dredge and process Ft. Myers maintenance dredged material is planned for spring of 1999.

Treatment Train: A six-inch (15-cm) slurry pump was used to pump in-situ slurry from adjacent to the Ft. Myers Beach Navigation Channel through a ½-inch (1.27-cm) grizzly into a 30 second tank feeding a 12-inch (30-cm) maximum density hydrocyclone.

Costs: Not given.

Comments: Total processing time was about 4 hours, some of which was pumping straight water. A pile of beach sand was produced and an almost filled retention site of about 30 by 70 ft (9 by 21 m).

Information Source(s): Personal Communication: Mr. Mitch A. Granat, USAE District, Jacksonville, October 1998.

USAE District, Detroit, Erie Pier Demonstration, MN

Site History:

- Duluth-Superior Harbor designated by the International Joint Commission as one of 43 Areas of Concern in the Great Lakes Basin due partially to contaminated sediments.
- Erie Pier handles > 76,000 m^3 of dredged material annually from Duluth-Superior Harbor.
- 1988 - dredged material washing procedure implemented.

Contaminants and Treatment Objectives: Soil washing was implemented on a trial basis to evaluate the feasibility of recovering sand for use as construction fill, thus reducing the volume of dredged material to be stored in the CDF.

Analyte	Dredged Material (avg.)	Washed Material (avg.)
Total solids, %	55.0	86.0
Silts/clays (passing No. 200 sieve), %	69.0	14.0
Total volatile solids, %	2.81	0.58
PCBs, mg/kg	0.10	< 0.02
Oil & grease, mg/kg	762	263
Total organic carbon, mg/kg	19,300	2,206
Arsenic, mg/kg	1.64	0.866
Cadmium, mg/kg	2.98	1.10
Chromium, mg/kg	31.7	10.3
Copper, mg/kg	32.6	22.0
Iron, mg/kg	22,200	7,220
Lead, mg/kg	65.2	17.4
Mercury, mg/kg	0.108	0.0136
Nickel, mg/kg	20.4	7.62
Zinc, mg/kg	84.8	20.8
Cyanide, mg/kg	0.098	0.06
Ammonia nitrogen, mg/kg	278	164

Project Volume: Not given.

Site Ownership: US Army Engineer District, Detroit.

Consultants/Contractors: Not given.

Project Status: Testing demonstrated the washed sand to be suitable for use as construction fill. As a result, the washed material is no longer required to undergo extensive testing before removal from the CDF. It must only meet the criterion for use as fill (< 15% fines). Soil washing is now incorporated as a contractual requirement and is performed annually. An average of 20 to 25% of the Erie Pier dredged material is removed each year and used as construction fill in projects near Duluth-Superior Harbor.

Treatment Train: Dredged material was off-loaded in a catchment area. Water from the CDF pond was pumped over the dredged material to create a slurry that was allowed to flow down a sluiceway constructed from previously dredged material. Heavy particles settled out in the sluiceway, and the fines were carried to the ponded area. The washed sand was recovered from the sluiceway with a front-end loader.

Costs: Not given.

Comments: Not given.

Information Source(s): Olin and Bowman 1996.

USAE District, Detroit, Saginaw River Pilot Scale Demonstration, MI

Site History:

- Navigational reach of Saginaw River, and Saginaw Bay. Sediments were freshly dredged for the pilot and stockpiled in the Saginaw Bay confined disposal facility.
- 1988 Michigan Department of Natural Resources (MDNR) Remedial Action Plan
- Designated as one of 43 Great Lakes Areas of Concern (AOC) (1987 amendments to the Clean Water Act, Section 118(c)(3) & Great Lakes Water Quality Board of the International Joint Commission).

Contaminants and Treatment Objectives: According to EPA (USEPA 1994a), most contamination is a result of agricultural run-off and municipal and industrial discharges in Flint, Saginaw, Bay City and Midland, Michigan. Sediments are considered contaminated but not toxic or hazardous as defined by regulatory definitions of the Toxic Substance Control Act (TSCA) or the Resource Conservation and Recovery Act (RCRA). A wide variety of contaminants are found in these sediments, including polynuclear aromatic hydrocarbons (PAHs), polychlorinated biphenyls (PCBs), dichloro-diphenyl-trichloro-ethane (DDT), polybrominated biphenyls (PBB), poly-chloro dioxins, and a variety of metals. PCBs in the navigation channel are typically in the < 0.1 to 5 mg/kg range. Some "hot spots" have PCBs exceeding 500 mg/kg (MDNR 1988). Chemical analysis of material used as feed material for the pilot is given in the following table (USEPA 1994a).

Analyte	Contaminant Levels (mean)	Separated Sand (mean)	Separated Fines (mean)	Separated Organics (mean)
PCB	1182 ng/g	214 ng/g	2156 ng/g	3860 ng/g
Cd	0.50 mg/g	0.06 mg/g	1.64 mg/g	1.16 mg/g
Cr	23.9 mg/g	10.8 mg/g	88 1 mg/g	33.6 mg/g
Cu	17.9 mg/g	6.3 mg/g	63.6 mg/g	40.8 mg/g
Hg	0.061 mg/g	0.008 mg/g	0.199 mg/g	0.210 mg/g
Ni	11.5 mg/g	3.3 mg/g	43.2 mg/g	36.4 mg/g
Pb	20.4 mg/g	7.42 mg/g	70.8 mg/g	41.4 mg/g
Zn	96.1 mg/g	17.7 mg/g	431 mg/g	191.4 mg/g

Project Volume: Approximately 800 cubic yards dredged.

Site Ownership: Not given.

Consultants/Contractors: Bergmann USA
Thermo Analytical Inc./Environmental Research Group

Project Status:

Sep 16 - Oct 1, 1991: Site Preparation
Oct 3-9, 1991, May 2-8, 1992: Dredging and Transport of Feed Material
Oct 15-28, 1991: Erection of Pilot Plant
Oct 31 - Nov 1, 1991, May 17 - Jun 1, 1992: ARCS Treatment and Sampling
May 30 - Jun 3, 1992: SITE Treatment and Sampling
Jun 4-5, 1992: Site Closure
Sep 9-15, 1992: Disassembly of Pilot Plant

Treatment Train:

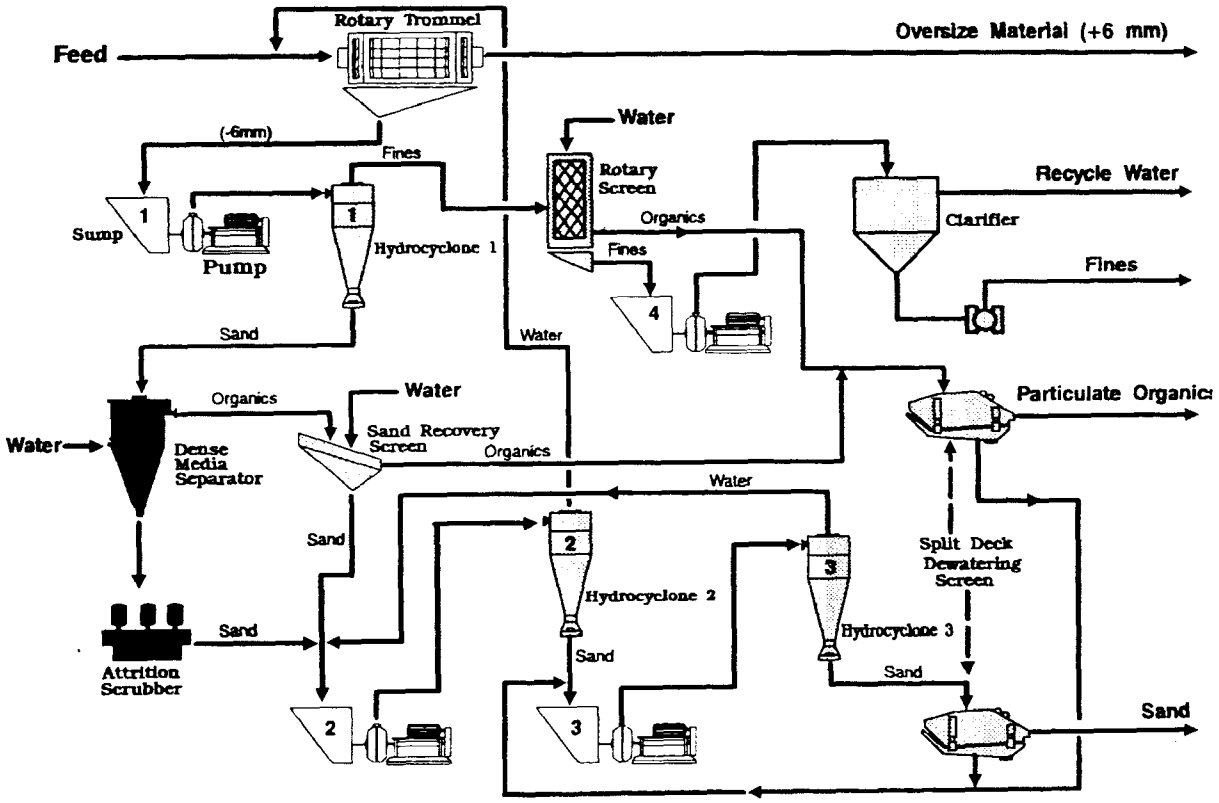


Figure 4-1. General process flow diagram for the Bergmann USA System used at Saginaw Bay, MI (USEPA 1994a).

Costs:

Activity	Approximate Cost
Project Management	$ 75,000
Health and Safety Plan	5,000
Sampling and Analysis Plan	10,000
Site Preparation	51,000
Sediment Excavation Including Tug, Barge, and Sediment Sampling to Locate Site	40,000
Grain-size Demonstration Including Vendor, Shipping, Equipment Rental (Barge, Tug, Crane, Loader), COE Field Support and Site Preparation	148,000
Sample Collection During Demonstration	32,000
Sample Analysis	146,000
Data Analysis and Report Preparation	40,000
Total	547,000

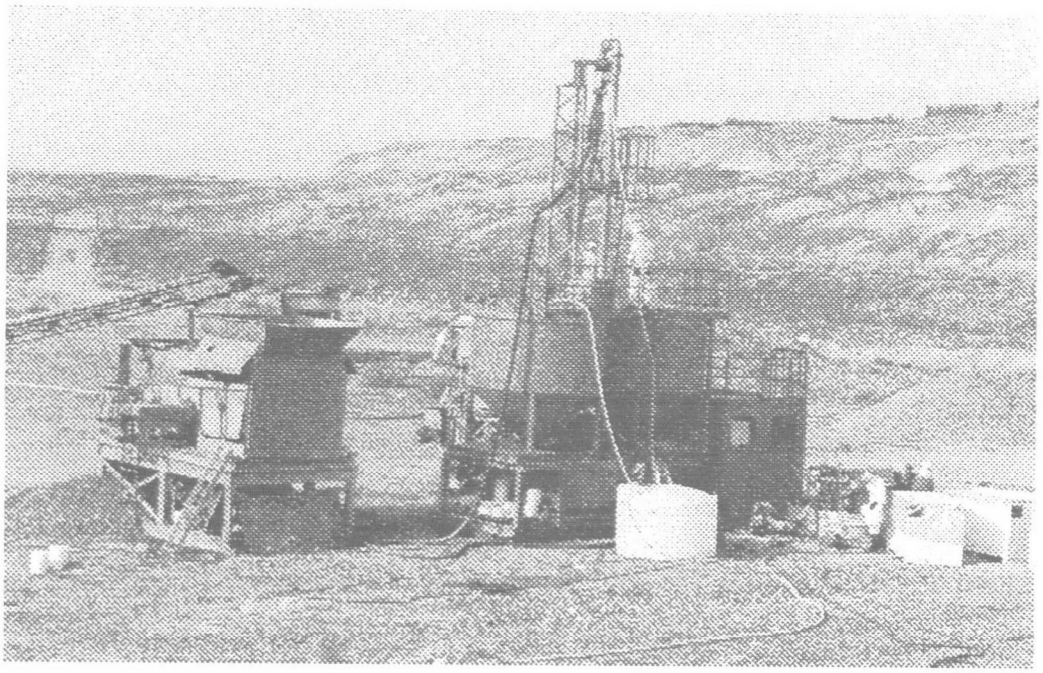
Note that in this demonstration, site preparation costs are greatly elevated by the location of the demonstration on an island.

Comments: One lesson learned from the pilot scale demonstration is that when clay is present, preprocessing should be done to eliminate formation of "clay balls" during removal of oversized materials using a log washer, high pressure sprayer, or similar device.

Information Source(s): USEPA 1994a, MDNR 1988

ARCADIS Geraghty & Miller

The Hanford Site, Richland, WA



Client
Westinghouse-Hanford Company

Project Services
Soil Washing

Contact
Ronald D. Belden
Senior Engineer
(509) 373-1982

Figure 4-2. View of soil washing pilot plant at the Hanford site.

Contaminants:
- Uranium, Metals, Organics

Quantity of Soil:
- 380 tons

Operations Period:
- March 1994 - July 1994

This was the first soil washing pilot study performed at the United States Department of Energy Hanford, Washington, site. The ART Division was responsible for all phases of the pilot study including:

- Mobilization and setup of the pilot plant
- Plant shakedown
- Preparation of site manuals including: Site Operations Manual, Quality Assurance Project Plan, and Test Procedures
- Performance of the three phases of the soil washing pilot test
- Plant decommissioning and decontamination
- Project Technical Report

The objective of this pilot study was to evaluate the capability and effectiveness of soil washing on soils at the 300-FF-1 Operable Unit (OU). Specifically, the pilot test was designed to

determine the capability of soil washing to reduce the volume of contaminated material to < 90% by weight and to meet the specified treatment standards. The results of the soil washing operation were incorporated into the Phase III Feasibility Study in the context of evaluating soil washing for full-scale remediation at specified areas of the site.

The test was conducted on soils contaminated with low-level uranium, metals and organics. Contamination originated from nuclear weapons production operations at the site from World War II until 1975. Soils from two areas within the OU were processed:

1) 300 tons of soil containing metals, organic materials and low-level uranium and,
2) 80 tons of soil containing elevated concentrations of copper and uranium.

The tests for the 300 tons of soil were conducted in three segments: 1) the pre-test run, 2) the verification run, and 3) the replication run, as follows:

1) The pre-test run provided for startup of the equipment and initial processing of soil. Adjustments and fine-tuning to the plant were made, based on the results of the pre-test run. During this run, 50 tons of soil were processed.

2) The goal of the verification run was to demonstrate that the equipment and process could achieve the specified 90% reduction by weight of contaminated material and to meet the treatment standards. During this run 125 tons of soil were processed.

3) The goal of the replication run was to confirm that the results achieved in the verification run could be replicated. During this run, an additional 125 tons of soil were processed.

A test on 80 tons of soil containing significantly higher levels of uranium due to the presence of a uranium-copper carbonate precipitate was also performed. Attrition scrubbing was tested on these soils to achieve improved treatment performance.

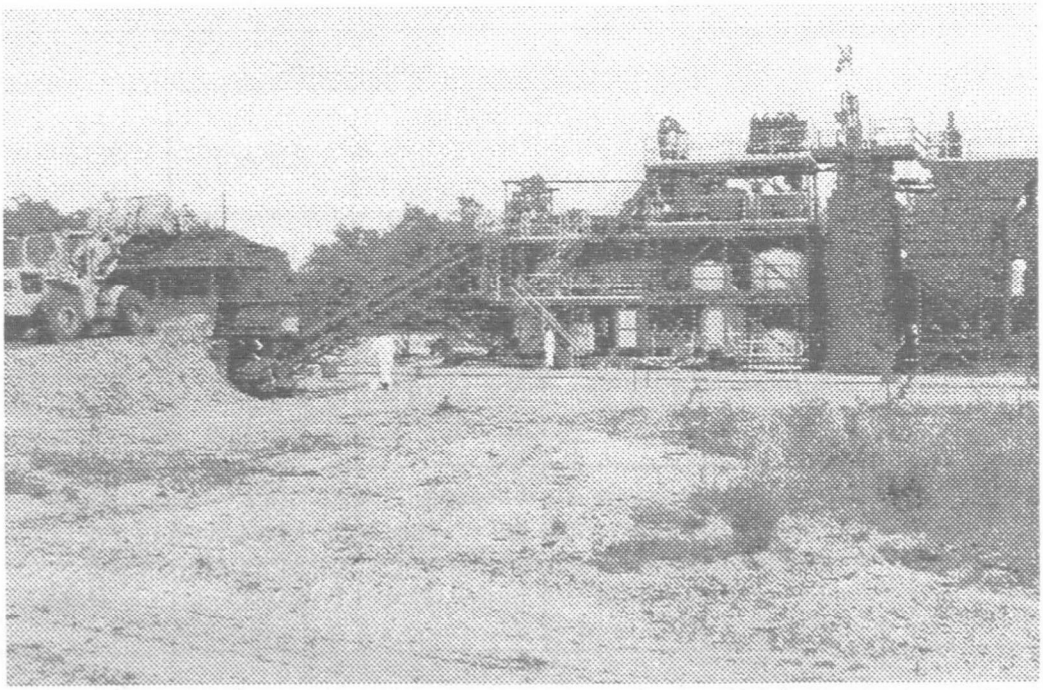
The pilot plant utilized at this site had a throughput capacity of 10 to 15 tons per hour in a mobile, easily erectable configuration. The plant consisted of a feed hopper, a double-decked wet screen, hydrocyclones, attrition scrubber, sand dewatering screen, sludge thickening and dewatering units, and the required supporting peripheral equipment. The pilot study was successful in meeting the goal of > 90% reduction by weight and was also successful in achieving the specified test performance standards.

Upon completion of the tests, ART submitted a written report to Westinghouse-Hanford Company for incorporation into the Feasibility Study.

The following test results were attained.

		Concentration			
Contaminant	Test Performance Standard	Feed	Process Oversize (Clean)	Sand (Clean)	Fines (Residual)
Cu (ppm)	11,840	2,800	199	1,180	22,000
U-238 (pCi/g)	50	132	5.5	28.5	1,660
U-235 (pCi/g)	15	4.5	0.3	1.4	58
Cs-137 (pCi/g)	3.0	0.13	0.05	0.3	0.68
Co-60 (pCi/g)	1.0	0.08	< 0.04	< 0.06	0.93

King of Prussia Technical Corporation Site, Winslow Township, NJ



Client
The King of Prussia Technical Corporation Cooperating Group

Scope of Services
Soil Washing

Contact
Frank J. Opet
Chairman, King of Prussia Technical Corporation Cooperating Group
(609) 384-7222

Figure 4-3. The soil washing plant in operation at the King of Prussia site.

Contaminants:
- Heavy Metals - Chromium, Copper and Nickel

Quantity of Soil:
- 19,200 tons

Operations Period
- June - October 1993

Background

The King of Prussia (KOP) Technical Corporation Site is located in Winslow Township, New Jersey, about 30 miles southeast of Philadelphia. The site is situated on approximately ten acres within the Pinelands National Reserve and adjacent to the State of New Jersey's Winslow Wildlife Refuge. The KOP Technical Corporation purchased the site in 1970 to operate an industrial waste recycling center. The operation was not successful, and in 1985, the site was placed on the National Priorities List. In 1990, a Record of Decision (ROD) was issued for the site, and soil washing was specified as the cleanup technology to be used for remediating the soils. A group of Potentially Responsible Parties was issued a unilateral Administrative Order to implement the requirements of the ROD.

Preliminary Activities

Two major preparatory steps were taken prior to beginning full-scale soil washing activities:

1) a treatability study to determine the applicability of soil washing to the site, and
2) a "demonstration run" of actual site soils prior to final design of the soil washing plant.

During the Treatability Study, site soils were separated into particle-size fractions, and particle-size distribution curves were constructed. Each resulting fraction was analyzed for the target contaminants, and bench-scale studies were conducted to determine the treatment unit operations to be implemented in the full-scale operation.

Demonstration Run

Because this was a new technology to the United States Environmental Protection Agency (USEPA), some questions were left from the treatability and bench-scale studies. Therefore, to fully confirm the effectiveness of the technology on KOP soils, a "demonstration run" was planned and implemented for actual KOP site materials at the ARCADIS Heidemij Realisatie full-scale fixed facility in Moerdijk, The Netherlands. With EPA and VROM (the equivalent Dutch agency) approval, 165 tons of KOP site soils were shipped to Moerdijk. A one-day treatment operation was performed with the equipment configured as recommended in the preliminary design for the KOP soil washing plant. The operation was successful in demonstrating the effectiveness of soil washing in treating the KOP soils. Soils were remediated to levels well below the ROD-specified standards.

Preparation for Full-Scale Operations

Following the demonstration run, the firm of SALA International was contracted by ART to manufacture a 25-tons-per-hour soil washing plant, and the plant was delivered to the site in May 1993. After erection of the plant on-site, a pilot run was conducted on 1,000 tons of contaminated soils excavated from the site. The pilot run was successful, again with cleanup levels well below the ROD-specified standards. As a result, USEPA granted prompt approval to proceed with full-scale remediation.

Full-scale operations at the KOP site began on June 28, 1993. The project was performed with full EPA oversight and in accordance with the approved Site Operations Plan. The process and products were controlled by on-site X-ray fluorescence using previously prepared site matrix-matched standards and confirmed by off-site CLP analysis. Correlation between the approaches was excellent. The soil washing operation was completed on October 10, 1993, and the facility was disassembled and removed from the site. The project treated 19,200 tons of soil with a volume reduction of greater than 90% on a dry solids basis. The overall analytical results were as follows.

		Avg. Conc. (mg/kg)		
Contaminant	Feed Range (mg/kg)	ROD Standard	Clean Product	Residual Product
Nickel	300-3,500	1,935	25	2,300
Chromium	500-5,500	483	73	4,700
Cooper	800-8,500	3,571	110	5,900

Awards Received for Work at the King of Prussia Site

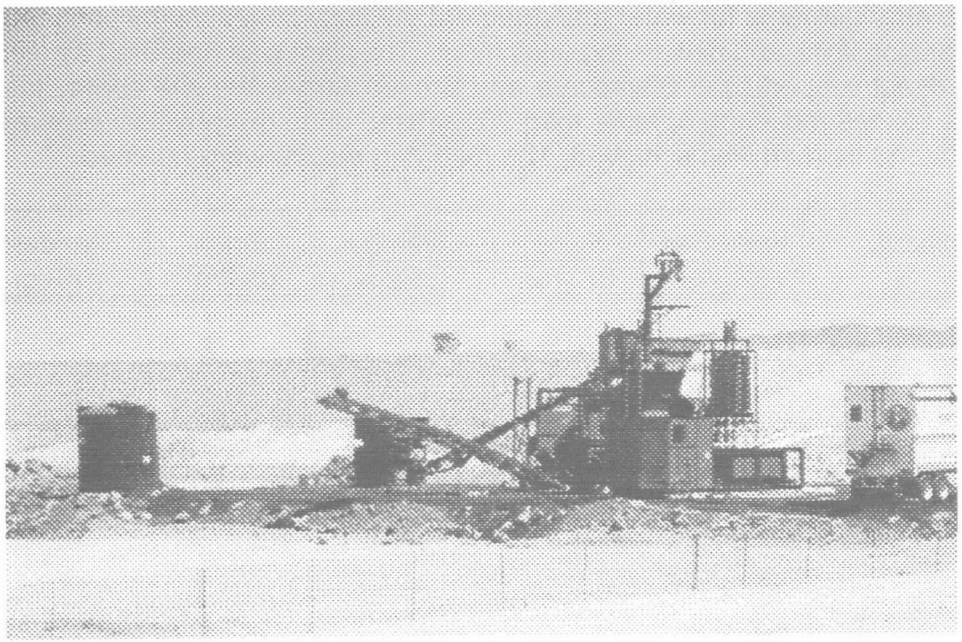
The soil washing capabilities have been recognized with three major environmental engineering awards for the soil washing operation at the King of Prussia Superfund site, Winslow Township, New Jersey.

- American Academy of Environmental Engineers "Excellence in Environmental Engineering" Honor Award for Operations/Management.

- Hazmacon Award "Best Site Remediation Nationwide."

- *Engineering News-Record* "Those Who Made Marks."

FUSRAP, Maywood, NJ



Client
Environcare of Utah, Inc.

Project Services
Soil Washing

Contact
Al Rafati
Vice President
(801) 532-1330

Figure 4-4. Pilot plant at the Envirocare of Utah site, Clive, Utah.

Contaminants:
- Radium, Thorium

Quantity of Soil:
- 1,000 tons

Operations Period:
- August 1997 - November 1997

A pilot-scale demonstration of soil washing was performed on soils from the U.S. Department of Energy's FUSRAP site in Maywood, NJ. Appropriate soils were identified at the Maywood site and shipped to the Envirocare low-level radioactive waste disposal site at Clive, Utah, for processing. Separations were made on the basis of radioactivity levels; materials higher than the treatment target were staged for the additional testing and served as the feed soil for the demonstration.

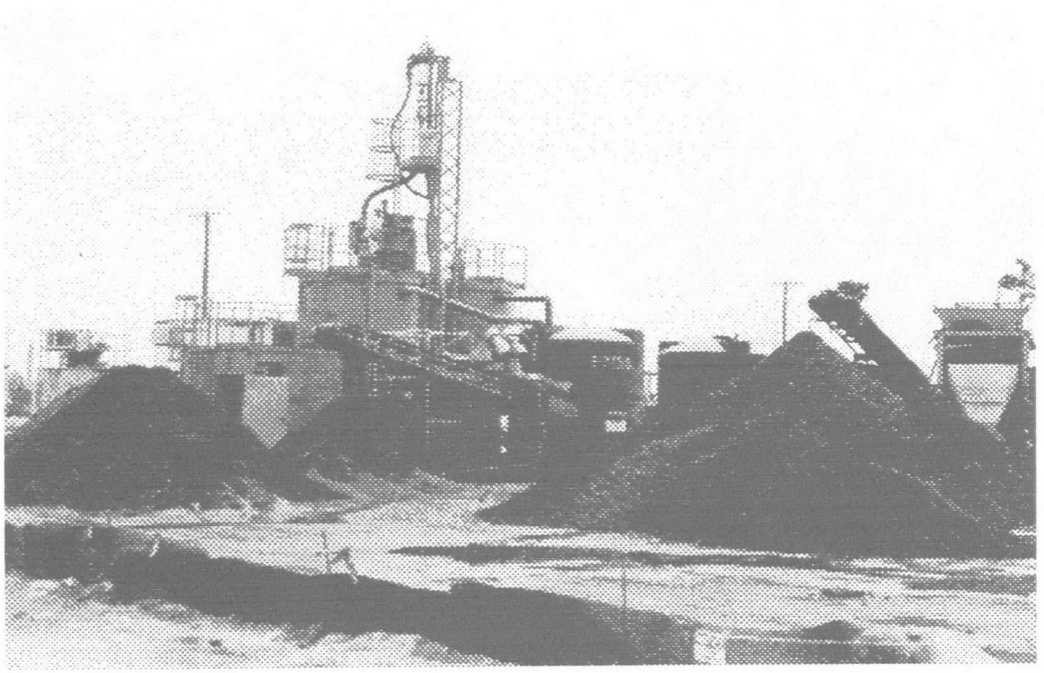
The pilot plant was mobilized to the Envirocare site from Ashtabula, Ohio. While the plant was in transit, the site was prepared and a holding pad was constructed by the Envirocare site contractor, Broken Arrow, Inc. The plant components were prepared outside the radiologically controlled area and moved into the work area. The plant was then erected on the pad; utility connections were made; and testing was completed. Operating plans, health and safety plans, and a sampling and analysis plan were prepared to support the work.

Soil exceeding the treatment standards was pre-screened at 2" (5.08 cm) using a Reed Screen-All. Material > 2" was staged for analysis as clean material, and material < 2" was staged for introduction into the treatment plant.

The treatment plant for this project consisted of a feed hopper, a double-decked wet screen, sump and pump arrangements for water management, hydrocyclones, spiral concentrators, liquid/solids separation units, and dewatering equipment. The plant was operated by company personnel with direct support from Envirocare and Broken Arrow, the site contractor. The project goal of a volume reduction of more than 80% based upon the physical separation of uranium, radium, and thorium was achieved. The following results were attained.

Contaminant	Feed Soil (pCi/g)	Sand (pCi/g)	Oversize (pCi/g)	Fines (pCi/g)	Standard (pCi/g)
Ra-226	1.5	90.6	0.5	4.7	-
Th-232	15.1	4.1	3.6	49.1	-
Total Activity	16.7	4.7	4.1	53.8	5.0

The Monsanto Company, Everett, MA



Client
The Monasanto Company

Project Services
Soil Washing

Contact
Bruce Yare
Manager, Remedial Technology
(314) 694-6370

Figure 4-5. View of the soil washing plant at the Everett site.

Contaminants:
- Bis (2-ethylhexyl) phthalate (BEHP)
- Phthalic anhydride process residues (PAPR) containing Naphthalene

Quantity of Soil:
- 9,600 tons

Operations Period:
- May 1996 - November 1996

The Monsanto Company operated a chemical plant at this 84-acre brownfield site from the mid-1800s to 1992. Manufacturing activities resulted in soil impacted with Naphthalene, BEHP, arsenic, lead and zinc. Since operations ceased, the plant facilities have been dismantled or demolished, and the site was remediated for construction of a 650,000 square foot shopping mall. Monsanto performed the cleanup at this site under the Massachusetts Contingency Plan.

Preparations for soil treatment operations began in May 1996 with a treatability study to provide data for design of the plant. The study showed that the fines fraction (< 2 mm) contained BEHP, and the oversize fraction (> 2 mm) contained PAPR. The process flow diagram design included a trommel, feed hopper, double-decked wet screen, hydrocyclones, attritioning, secondary hydrocycloning, sand dewatering, fines thickening and consolidation, sludge dewatering, and jig. The fines stream was further treated in bioslurry reactors.

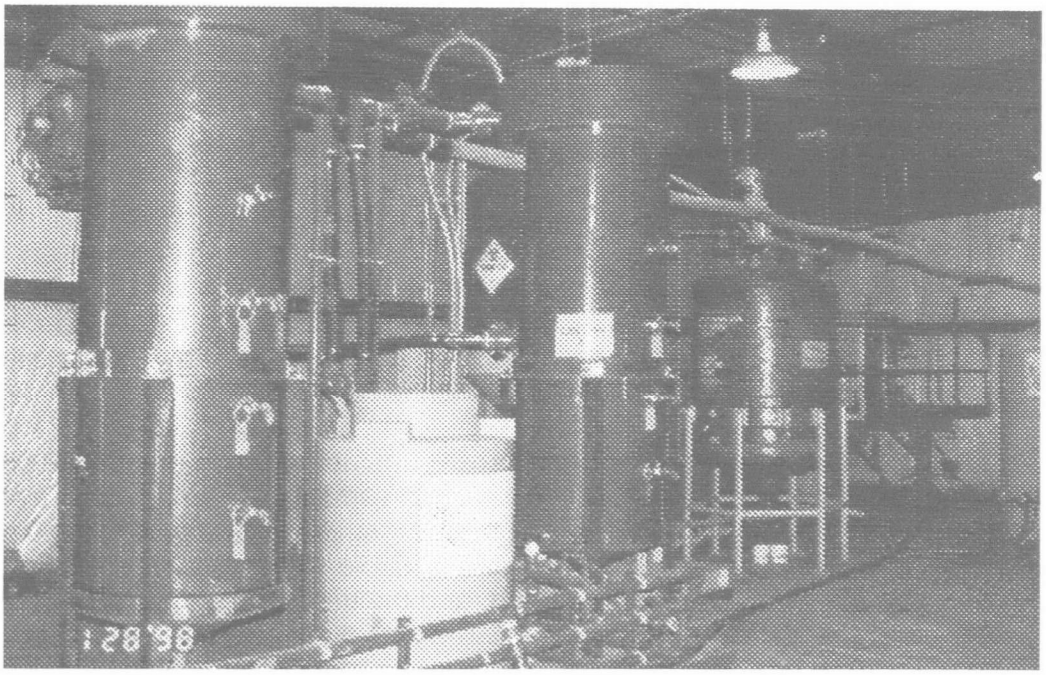
The 15 tons-per-hour soil washing plant was mobilized to the site and configured in accordance with the optimized process flow diagram. Soils consisting primarily of oversize and coarse material with less than 20% silt and clay, including construction debris, demolition rubble and other fill, were excavated from several areas around the site and delivered to the plant for processing. The soil was field-screened to remove gross oversize material, producing a plant feed < 2". This material was fed into the plant and through the wet screening unit, producing a process oversize > 2 mm, and a wet slurry < 2 mm. The process oversize, containing PAPR, was staged outside the plant for further treatment. The wet slurry was fed to the hydrocyclone separation unit, producing a coarse sand fraction and a fines fraction. The coarse sand fraction was directed to a dewatering screen and, after testing, was returned to the site as clean backfill. The fines fraction was degraded in a bioslurry system operated by another contractor. The oversize material > 2" contaminated with naphthalene concentrations higher than treatment targets was further treated by attritioning. The following results were attained.

PAPR SOILS	Feed Range (mg/kg)	Treated Soil (mg/kg)			Treatment Goal (mg/kg)
		Oversize	Sand	Fines*	
Naphthalene	5,000-40,000	22,000	520	2,900	3,000
BEHP	-	-	-	-	-

BEHP SOILS	Feed Soil (mg/kg)	Treatment Soil (mg/kg)			Treatment Goal (mg/kg)
		Oversize	Sand	Fines*	
Naphthalene	< 3,000	160	39	3,300	3,000
BEHP	5,000	2,700	390	10,000	3,000

* Fines treated in bioslurry reactors

The RMI Titanium Company Extrusion Plant, Ashtabula, OH



Client
RMI Environmental Services

Project Services
Soil Washing and Extraction

Contact
James W. Henderson
Division Manager
(440) 993-1973

Figure 4-6. Pilot plant-ion exchange tanks and precipitation tank.

Contaminants:
- Uranium

Quantity of Soil:
- 20,000 tons

Operations Period:
- August 1995 - Ongoing

Background

The RMI Titanium Company (RMI) Extrusion Plant is located in Ashtabula Township, approximately one mile south of Lake Erie, in the northeast corner of the State of Ohio. The 28.5-acre property is privately owned by the RMI Titanium Company. RMI held contracts with the U.S. Department of Energy (DOE) and its predecessor agencies to process uranium metal into forms for use in nuclear and non-nuclear weapons production at the Ashtabula site. A decontamination and decommissioning (D&D) plan for the site has been approved by the U.S. Nuclear Regulatory Commission.

During uranium extrusion operations from 1962 to 1988, particulate uranium was discharged from roof vents and stacks to the surrounding soil. The DOE owns half the buildings on the site and is responsible for funding the cleanup of all contamination associated with work performed under its contracts with RMI Titanium Company.

The cleanup of the site is being conducted under the RMI Decommission Project (RMIDP) sponsored by the DOE Office of Environmental Restoration (EM-40). EM-40 established the Innovative Treatment Remediation Demonstration (ITRD) Program to help accelerate the adoption and implementation of new and innovative soil and groundwater remediation technologies.

Technical Summary

The RMI site generally consists of high clay-content soils, which added to the complexity of the project. Because the contaminants tend to bind to the fine soil fractions and because these fractions make up a high percentage of the Ashtabula soils, typical soil treatment technologies, such as physical separation, are not effective at this site because they do not result in significant volume reduction of the contaminated soils.

In 1996, the ITRD Program sponsored a bench-scale treatability study on RMIDP soils to explore alternatives to a baseline remediation approach of excavation, transport, and off-site disposal. After extensive experimentation, the processing approach narrowed on a carbonate-bicarbonate process which demonstrated a viable technical and cost-beneficial alternative. Efficiencies of up to 90% were attained, and the treatment standard of 30 pCi/g, as established in the D&D plan for the site, was met. The potential benefit of the process is its ability to treat the fine fractions of the soil matrix and separate the uranium contamination from the soil matrix, thereby significantly reducing the volume of contaminated soil requiring off-site disposal.

To validate the results of the treatability study, the DOE Ashtabula Environmental Management Project (AEMP) office and the ITRD program co-sponsored a pilot project in January and February 1997. The primary objectives of the pilot project were to prove that chemical extraction could be successful on a large scale and to obtain operational data to support full-scale soil remediation.

The equipment was erected and operated in a portion of an existing on-site building. The design consisted of an innovative mix of existing processes. During the project, 38 batches (approximately 64 tons) of soil were processed. The soil was loaded into a rotary batch reactor with a heated carbonate-bicarbonate solution to form a 30% solids slurry. The leaching solution was allowed to contact the soils for 1 to 2 hours. A wet screening process separated oversize material (> 1 mm), and the remaining slurry was transferred into sequential thickeners to separate soils from the uranium-bearing liquids. The soil fraction was dewatered by filter press and underwent no further treatment. The radiological activity of these treated soils was measured by x-ray fluorescence (XRF) and verified by alpha spectroscopy to determine the effectiveness of the chemical extraction process. An ion-exchange system was used to remove the uranium from the liquid. The uranium eluted from the ion exchange resin, and a "yellowcake" product was recovered by chemical precipitation. Key parameters that were varied included feed-soil type and activity, reaction temperature, and leaching time. Important information that was studied for full-scale operations included leaching performance, ion exchange performance, resin loading, resin regeneration, and uranium precipitation. The system is close looped, and no adverse air or water problems were created as a result of the process.

Results

- Ashtabula soils can be effectively treated for uranium by using a sodium carbonate extraction process.

- Removal efficiencies of up to 94% were achieved, with a volume reduction of up to 95%.

- All soils selected for treatment met the free release standard of 30 pCi/g.

- Full-scale implementation of the process would result in significant schedule reduction and cost savings for the DOE over the baseline approach.

- As a result of the pilot project, planning and design to initially process 20,000 tons is underway.

- This was the first time that this process had been successfully implemented on a DOE site with uranium contamination.

Benefits

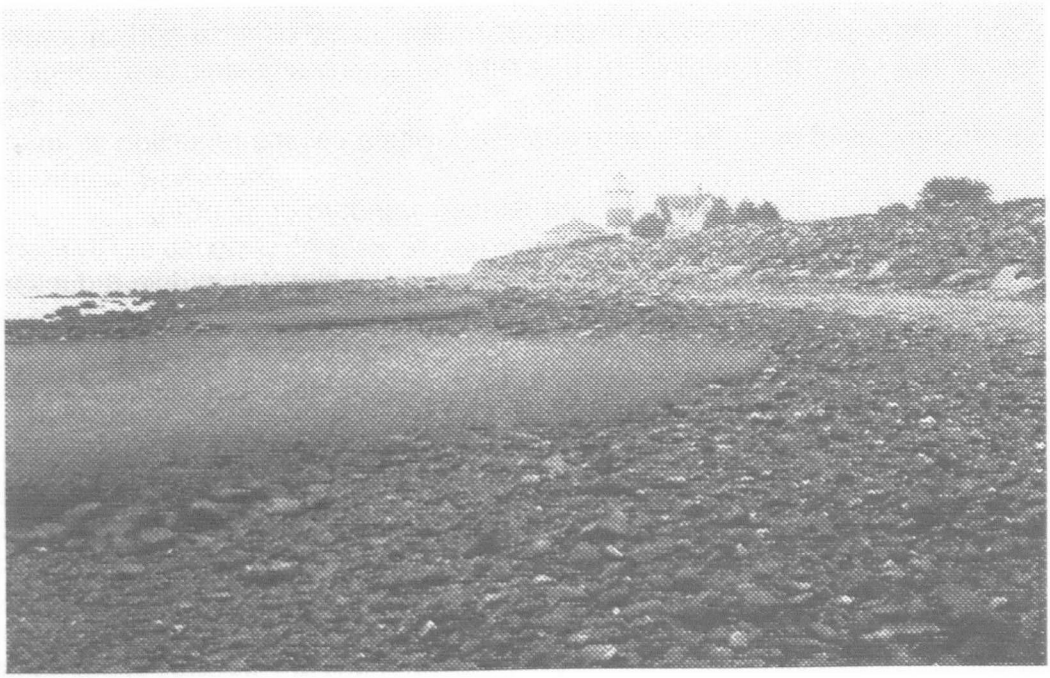
Cleanup of RMIDP soils is a component of the D&D plan for the site. Full-scale implementation of the chemical extraction process will result in significant cost savings and acceleration of schedule over the planned remedy of excavation and off-site disposal of the soil. Soil meeting the 30 pCi/g cleanup level for total uranium, expected to equal 90+% of the processed soil, will be released as clean material for backfill on the site, thus minimizing the volume of soil requiring off-site disposal, and avoiding purchase of backfill material.

Because of a unique combination of facility resources, operating experience of the participants, and deployment strategies, the site is positioned to be an excellent candidate for success in a new mission built around providing processing services for contaminated media for DOE and other sites in the future.

Results are tabulated below.

				Treated Soil		Removal Efficiency	
Pile	Area	Uranium Activity of Feed by Alpha Spec (pCi/g)	Leaching Time (hours)	XRF (pCi/g)	Alpha Spec (pCi/g)	XRF (%)	Alpha Spec (%)
2	Run 1 Area D	129	1	8	12	94	91
3	Run 2 Area D	90	2	11	12	88	87
4	Run 1 Area C	133	1	10	13	92	90
5	Run 2	145	1	17	4	88	90
					Average	90	89

Lordship Point, Stratford, CT



Client
American Marine Constructors, Inc.

Project Services
Soil Washing - Marine and Land Based

Contact
Jack Parmater
(616) 926-1717

Figure 4-7. View of land and marine areas to be remediated at Lordship Point.

Contaminants:
- Lead shot and target fragments

Quantity of Soil:
- 300,000 cubic yards soil and sediment

Operations Period:
- October 1996 - Ongoing

In late 1996, the ART Division of ARCADIS Geraghty & Miller was subcontracted by American Marine Constructors, Inc., a comprehensive marine construction, dredging, and specialty heavy construction services company, to provide marine-based and land-based treatment equipment for the removal of lead shot and trap/skeet target fragments from over 300,000 cubic yards of sediment and soil at the former Remington Arms Gun Club located at Lordship Point in Stratford, Connecticut. American Marine is prime contractor to DuPont Environmental Remediation Services (DERS). The site borders Long Island Sound and was formerly a trap and skeet shooting range where lead shot was directed over the Sound. As a result of those activities, the lead shot and target fragments have been deposited in the sediment and intertidal zone surrounding the property.

Remediation of the property and adjacent Sound areas will be conducted using standard dredging and excavation procedures, with the dredged and excavated sediment being processed through a plant to separate the lead shot and target fragments from the sediments.

The project consists of the following major activities.

- Process Design and Project Work Plans
- Application for Permits
- Process Plant Fabrication
- Mobilization of Process Plant
- Process Plant Validation Test
- Mobilization of Excavation and Dredging Equipment
- Excavation/Dredging Operation
- Process the materials to extract the lead shot and target fragments
- Return of remediated sediment to their approximate original location
- Transport of the lead shot to an approved off-site recycler
- Transport of the target fragments and organic material to the designated solid waste landfill
- Demobilization
- Site restoration

ART/American Marine prepared and submitted the process design and project work plans to DERS for approval. The process plant design has been approved by DERS and is now at the permitting phase. The design shows in detail the location of the plant, the process flow diagram and mass balances for the land-based and marine-based operations. The plant comprises the following major units.

- Triple deck vibrating wet screen for size separation
- Fine and coarse mineral jigs for density separation
- Underflow scavenger columns

ART's responsibilities also include process plant fabrication, mobilization of the process plant to the site, plant validation test, operation of the plant and dismantling and removal from the site. American Marine will mobilize the excavation and dredging equipment to the site and perform the dredging and excavation and preliminary screening of plant feed.

Permitting activities by DERS are underway and are continuing at this time. On-site remediation is expected to begin in 1998. All project activities are scheduled for completion in 1999.

Remediation will begin with excavation of material from the intertidal zone and will be accomplished using conventional land-based equipment. After these sediments have been excavated, they will be transported to the land-based process plant for removal of the lead shot, target fragments, organic material, and man-made debris. The remediated soil will be replaced in its approximate original location. Unremediated material containing dense plant growth or other living and non-living organic materials will be processed to separate the non-organic material from the organic and will be cleaned of lead shot, target fragments. Large rocks with adhered unremediated sediment will be washed and the sediment processed through the plant. The cleaned rocks will be returned to their original location with the remediated soil. Residual products will be containerized for recycling and disposal.

Following completion of the land-based remediation, the process plant will be mounted on a barge for the marine-based remediation phase of the project. Dredging will be accomplished from the low tide mark to a distance of approximately 600 feet (183 m) from shore to a maximum sediment depth of approximately 10 feet (3 m). Dredged sediment will be processed through the plant for removal of the lead shot, target fragments and debris, and the remediated sediments will be replaced at approximately the original location by discharge from the barge. Rocks segregated during the dredging operation will be placed back in their approximate original location. Large rocks will be left in place and sediments dredged from around the rock. Again, residual products will be containerized for recycling and disposal.

Recovered lead shot will be containerized and transported to an approved off-site facility for recycling. Target fragments will be disposed at a solid waste landfill. Upon completion of remediation activities, the process plant will be demobilized and removed from the site. All land-based disturbed areas will be restored to original conditions according to the Site Restoration Plan. Wetland areas will be replanted with native species and native grass, and cover will be re-established.

Literature

Escambia Treating Company Superfund Site, Pensacola, FL

Site History:

1943-1982: Treated wood products using pentachlorophenol (PCP) and creosote
Nov. 1992: Demonstration of mobile Volume Reduction Unit (VRU)
Present: Undergoing a Superfund cleanup being managed by EPA Region IV

Contaminants and Treatment Objectives: The mobile VRU was developed to demonstrate the capabilities of soil washing and to provide data that facilitate scale-up to commercial-size equipment.

Analyte	Contaminant Levels	Treatment Objectives	Results (Average % Reductions)		
			Condition 1	Condition 2	Condition 3
PCP	140 ppm	> 90 % removal	76	92	97
Creosote - fraction PAH	550-1,700 ppm	> 90 % removal	70	83	90

Project Volume: 3600 lbs.

Site Ownership: Not given.

Consultants/Contractors: US EPA Risk Reduction Engineering Laboratory (RREL).

Project Status: Not given.

Treatment Train: After excavation, soil was processed through a ¼" screen before fed to the VRU. The < ¼" soil was transferred to a feed surge bin and then conveyed through a screw conveyor to a trommel screen miniwasher at 100 lbs/hr with filtered wash water being sprayed onto the screen (2-mm slot opening). Flow was adjusted up to an approximately 13 to 1 overall water-to-soil ratio. Two vibrating screens (set at 2 mm and 0.150 mm for the demonstration) were used to segregate the soil into various size fractions. Overflow from the miniwasher (containing the courser solids) falls onto the 2-mm vibrascreen. The underflow is pumped to the second (0.150 mm) vibratory screen.

The overflow from the 2-mm vibratory screen flowed by gravity to a recovery drum. The overflow from the second vibratory screen (0.150 mm to 2 mm) was gravity fed to the recovery drum. The underflow from the second vibrascreen (< 0.150 mm) drained into a mixing tank and was pumped to a CPI (Corrugated Plate Interceptor). Materials lighter than water flow over a weir in the CPI and drain into a drum for disposal. CPI-settled solids are discharged to a recovery drum. A slurry containing fines < 38 mm overflows the CPI and gravity feeds into a mixing tank and is further pumped to a static mixer where flocculating chemicals are added. The slurry is then discharged to the floc chamber and then overflows into the clarifier where the bottom solids are augured to a drum for disposal. Clarified water is polished using cartridge-type polishing filters and activated carbon so that it can be recycled.

Costs: No cost information was given for the demonstration. However, from the demonstration, it was estimated that cost for a 10-tph VRU that was on-line 90% of the time would be $171/ton to process 10,000 tons, or $137/ton to process 20,000 tons, or $106/ton to process 200,000 tons.

Comments: Water and energy usage for the demonstration at 100 lb/hr feed rate were 66 kWh/ton and 71 gph of water (with no recycling).

Information Source(s): USEPA 1993.

Bench-Scale Study at New York University at Buffalo, Buffalo, NY

Site History: Seven soils from industrial sites were tested. The locations of the soils were not given.

Contaminants and Treatment Objectives: All seven soils were contaminated with Pb.

Soil	Contaminant Levels, mg Pb/kg	Treatment Objectives, mg Pb/kg	Unwashed Jig/Table Tailings, mg Pb/kg	Washed Jig/Table Tailings, mg Pb/kg
1	11,933	250	2,185 +1,477	203 + 16
2	2,307	1000	1,401 + 196	611 ± 67
3	5,913	1000	1,535 + 210	200 ± 12
4	3,199	250	2,195 ± 477	1218 ± 82
5	4,808	1000	1,369 ± 166	98 ± 8
6	1,394	1000	500 ± 73	391 ± 38
7	4,249	1000	2,755 ± 214	1,033 ± 55

Project Volume: Not given.

Site Ownership: Not given.

Consultants/Contractors: Not given.

Project Status: Not given.

Treatment Train: The soils were wet-sieved to produce coarse (4 to 20 mesh) and fine (20 to 200 mesh) soils. Fine sand was processed by tabling and coarse sand by jigging. The tailings were combined for analysis. Soil washing tests were also conducted in which the jigged or tabled soils were mixed with hydrochloric acid at pH = 1, 25°C, and liquid to solid ratio of 20 for a duration of 24 hours, and then filtered for analysis.

Costs: Not given.

Comments: Soils consisted mostly of coarse and fine sands.

Information Source(s): Van Benschoten et al. 1997.

Feather River Site, Oroville, CA

Site History: 1948-Present: Chemical preserving of railroad ties and telephone poles
1984: Listed, Superfund National Priorities List

Contaminants and Treatment Objectives:

Analyte	Contaminant Levels	Treatment Objectives[1]
Pentachlorophenol (PCP)	Not given	17 ppm
Polynuclear Aromatic Hydrocarbons (PAHs)	Not given	0.19 ppm (carcinogenic PAHs)
Dioxins	Not given	30 ppt
Heavy metals - arsenic, chromium, copper	Not given	Not given

[1] 1992 federal cleanup agreement

Project Volume: Approximately 250,000 cubic yards.

Site Ownership: Beazer East, Inc., Michael Tischuk Project Manager.

Consultants/Contractors: Dames & Moore, Jeff Bensch Project Manager
Westinghouse Remediation Service Inc.

Project Status: Bench scale testing and a 400-ton pilot were completed by Westinghouse Remediation Service. Current project status is unknown.

Treatment Train: Unknown.

Costs: Bench-scale treatability studies, Pilot studies, Full scale treatment
Total cost (1994): $78 million (Daniels 1994).

Comments: Treatment levels were established based on a 1987 risk based assessment using the assumption of possible future residential use of the site. Beazer asserts that this assumption resulted in extremely conservative values for the site. Beazer cited two other superfund sites with less stringent treatment requirements: 1) Beazer-owned, Houston wood treating plant, PAHs target level 700 ppm, and 2) American Creosote Works Superfund Site, Pensacola, FL, groundwater PAHs level 1100 ppb vs 0.007 ppb PAHs and 0.53 ppq dioxins at Oroville, CA.

Information Source(s): Daniels 1994.

References

Anderson, W., Ed. 1993. "Innovative Site Remediation Technology: Soil Washing/Soil Flushing (Volume 3)," WASTECH/ American Academy of Environmental Engineers.

ASTM. 1995. "Standard Guide for Soil Sampling from the Vadose Zone," Standards for Environmental Sampling, ASTM D4700-91, Philadelphia, PA.

Benker, K. W. 1994. "Treating Metals in Soil," *The Military Engineer*, Vol. 86, No. 562.

Bovendeur, J., B. J. Visser, and G. Childs. 1991. "The Fingerprint Method- A Practical Tool in Linking Characterization and Treatment of Polluted Dredged Material," CATS Conference (Characterization and Treatment of Contaminated Dredged Material), Ghent, Belgium.

Bovendeur, J. and R. Mozley. 1993. "Characterization and Treatment of Polluted Material by Environmental Application of Mineral Processing Technology," XVIII International Mineral Processing Congress, Sydney, Australia.

Bovendeur, J. and B. J. Visser. 1993. U.S. Patent #5,203,212, "Method for Determining the Composition of a Sample," United States Patent and Trademark Office, Washington, DC.

Carpco, Inc. 1992. "Which Process Fits Your Need," Bulletin No. 9210, Carpco, Inc., Jacksonville, FL.

Carpco, Inc. 1993. *Operating Instructions for the Humphrey Spiral Concentrator.* Carpco, Inc., Jacksonville FL.

Daniels, S. H. 1994. "Tough Recipe at Toxic Cleanup Site," *Engineering News-Record*, Volume 232, No. 2.

Deurbrouck, A.W. and W.W Agey. 1985. "Wet Concentrating Tables," *SME Mineral Processing Handbook, Volume I*, N.L. Weiss, Ed., Society of Mining Engineers, pp 4-32 to 4-39.

Elliot, A.J. 1991. *Slurry Handling.* Nigl P. Brown and Nigel I. Heywood, eds., Elsevier Applied Science, New York.

EPA/USACE. 1991. "Evaluation of Dredged Material Proposed For Ocean Disposal," EPA-503/8-91/001, Washington, DC.

EPA/USACE. 1998. "Evaluation of Dredged Material Proposed for Discharge in Waters of the U.S. - Testing Manual," EPA 823-B-98-004, Washington, DC.

Feenstra, L., J. Joziasse and M. Pruijn. 1995. "A Standard Method for Characterizing Contaminated Soil and Sediment for Processing by Particle Separation Techniques," TNO Institute of Environmental Sciences, Energy Research and Process Innovation Publication Reference Number P95-001.

Heibel, D.R., M. A. Granat and M. Wolff. 1994. "Coordinating the Feasibility of a Dredged Material Separation System Using Hydrocyclones for the Maintenance Dredging Operation at Canaveral Harbor," Dredging '94, Volume 1, American Society of Civil Engineers, New York, NY.

Landin, M. C., Ed. 1997. "Proceedings: International Workshop on Dredged Material Beneficial Uses," Baltimore, Maryland.

Metcalf and Eddy, Inc. 1979. *Wastewater Engineering Treatment/Disposal/Reuse*, 2nd Edition, McGraw-Hill Publishing Company, NY.

Michigan Department of Natural Resources. 1988. "Remedial Action Plan for Saginaw River and Saginaw Bay Area of Concern," MDNR Surface Water Quality Division, Lansing, MI.

Mishra, S. K. and R. R. Klimpel. 1987. *Fine Coal Processing*, Noyes Publications, Park Ridge, NJ.

Mudroch, A. and J. M. Azcue. 1995. *Manual of Aquatic Sediment Sampling*, Lewis Publishers, Boca Raton, FL.

Olin, T. J. and D. W. Bowman. 1996. "Soil Washing Potential at Confined Disposal Facilities," *Environmental Effects of Dredging*, Vol D-96-3, U.S. Army Engineer Waterways Experiment Station, Vicksburg, MS.

Olin, T. J. and K. T. Preston. 1995. "Solid Residuals Management at Centralized Vehicle Wash Facilities (CVWF)," Miscellaneous Paper EL-95-4, U.S. Army Engineer Waterways Experiment Station, Vicksburg, MS.

Osborne, D.G. 1990. *Solid-Liquid Separation*, Ladislav Svarovsky, Ed., Butterworths, Boston, MA, pp 279-310.

Perry and Green, eds. 1984. *Perry's Chemical Engineers' Handbook*, Sixth Edition, McGraw-Hill, St. Louis, MO.

Petersen, R.G. and L.D. Calvin. 1996. "Sampling," *Methods of Soil Analysis, Part 3, Chemical Methods*, Soil Science Society of America, Madison, WI.

Svarovsky, L., ed. 1990. "Separation by Centrifugal Sedimentation," *Solid-Liquid Separation*, Butterworths, London, England, pp. 251-278.

U.S. Environmental Protection Agency (USEPA). 1986. "Test Methods for Evaluating Solid Waste - Physical/Chemical Methods," Third Edition, SW-846, U.S. Environmental Protection Agency, Washington, DC.

USEPA. 1991a. "Handbook: Remediation of Contaminated Sediments," EPA/625/6-91/028, Center for Environmental Research Information, Office of Research and Development, U.S. Environmental Protection Agency, Washington, DC.

USEPA. 1991b. "Guide for Conducting Treatability Studies Under CERCLA: Soil Washing, Interim Guidance," EPA/540/2-91/020A, Office of Emergency and Remedial Response, Hazardous Site Control Division, Cincinnati, OH.

USEPA. 1993. "EPA RREL's Mobile Volume Reduction Unit Applications Analysis Report," EPA/540/AR-93/508, Risk Reduction Engineering Laboratory, Office of Research and Development, U.S. Environmental Protection Agency, Cincinnati, OH.

USEPA. 1994a. "Pilot-Scale Demonstration of Sediment Washing for the Treatment of Saginaw River Sediments," EPA 905-R94-019, Great Lakes National Program Office, Chicago, IL.

USEPA. 1994b. "Assessment and Remediation of Contaminated Sediments (ARCS) Program Remediation Guidance Document," EPA 905-R94-003, Great Lakes National Program Office, Chicago, IL.

USEPA, Region 4, Science and Ecosystem Support Division, Environmental Investigations Standard Operating Procedures and Quality Assurance Manual, May 1996.

Van Benschoten, J. E., M. R. Matsumoto and W. H. Young. 1997. "Evaluation and Analysis of Soil Washing for Seven Lead-Contaminated Soils," *Journal of Environmental Engineering.* Vol. 123, No. 3, pp. 217-224.

Viessman, W. F. and M. J. Hammer. 1993. *Water Supply and Pollution Control*, 5th edition, Harper Collins College Publishers, New York, NY.

Western Mine Engineering. 1996. *Mine and Mill Equipment Costs – An Estimators Guide*, Western Mine Engineering, Spokane, WA.

Appendix A: Detailed Cost Estimates

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Soil Washing Cost Estimate

WES Scenario 1

KEY ASSUMPTIONS	
Soil Mass (cy)	50,000
Density (tons/cy)	1.2
Soil Processed (tons)	60,000
Plant Size (tons/hour)	25
Shift Schedule (days/week-hours/day)	5-10
Plant Availibility (%)	80%
Treatment Duration (weeks)	60
Mobilization/Site Preparation/Demobilization (weeks)	9
Total Project Duration (weeks)	69
Feed - Dry Solids Concentration (%)	87%
Sludge - Dry Solids Concentration (%)	50%
ESTIMATED TREATMENT PRICES	
Mobilization (Plant)	99,000
Site Preparation	61,000
Plant Depreciation	198,000
Plant Labor	661,000
Utilities	148,000
Chemicals / HAS	99,000
Maintenance	198,000
Office Expense	89,000
Process Analytical (Plant)	37,000
Demobilization (Plant)	71,000
Insurance	0
Contingency	50,000
Total Estimated Treatment Price	**$1,711,000**
Estimated Treatment Price, $ / Ton	**85 - 100**
TOTAL ESTIMATED PROJECT COSTS	**$1,723,000**
Estimated Project Cost, $ / Ton	**85 - 100**

OPERATING ASSUMPTIONS

this estimate focuses on treatment only:

- Excavation and Prescreening to -2" not included
- Process Analytical not included
- Sludge (residual) disposal/treatment not included

Proforma
PROJECT: **WES Scenario 1**

Key Assumptions:

Volume (Cubic Yards)	50,000					
Density	1.2					
Mass (Tons)	**60,000**					
Production (Tons/Hour)	25	Pilot Plant				
Shift Schedule - # of Shifts	1	(Days/Wk):	7	(Hrs/Day):	10	
Plant Availibility	80.0%					
Treatment Duration (Weeks)	42.9	(Months):	9.9	(Years):	0.8	
Mobilization (Weeks)	5.0					
Demobilization (Weeks)	4.0					
Total Project Duration (Wks)	51.9	(Months):	12.0	(Years):	1.0	
Feed - Dry Solids Conc (%)	87.0%					
Sludge - Dry Solids Conc (%	50.0%					

*****REVENUE*****	Total
Soil Volume (tons)	60,000
Processing Fee Per Ton	22.50
Total Site Revenue	1,350,000

*****COST OF OPERATIONS*****	
Project Labor	292,775
Travel / Per Diem	108,714
Plant Depreciation	120,000
MOB, Site Prep, Demob	140,000
Excavation, Prescreening	0
Transportation	0
Plant Consumables	114,092
Equipment Rental	0
Maintenance	120,000
Utilities	90,000
Process Sampling	30,000
Sludge Disposal	0
Sludge Transportation	0
Security	0
Insurance	0
Contingency	50,000
Total Cost of Operations	1,065,581
Cost / ton	17.76
*****GROSS PROFIT*****	**284,419**
*****GROSS PROFIT %*****	**21.1%**

OPERATING COSTS

Direct Plant Labor

Title	Name	Number	35.0% Sal+Fringes
Plant Manager	Carl Seward	1	
Plant Engineer	Randall Lipham	1	
Asst Plant Eng	Local Hire	0	
Shift Supervisor	Local Hire	0	
Plant Operator	Local Hire	1	
Plant Operator	Local Hire	0	
Trommel Operator	Local Hire	0	
Heavy Equip Operator	Local Hire	0	
Laborer	Local Hire	1	
Secretary	Local Hire	0	
Subtotal		4	292,775

Schedule In Weeks:

Pre-Mob	Mob	Run Time	De-Mob	Report Writing	# Adj.	Total Time	Sal. /wk
1.0	5.0	42.9	0.0	0.0	0.0	48.9	
0.0	5.0	42.9	4.0	0.0	0.0	51.9	
0.0	0.0	0.0	0.0	0.0	0.0	0.0	
0.0	0.0	0.0	0.0	0.0	0.0	0.0	
0.0	5.0	42.9	4.0	0.0	0.0	51.9	1275
0.0	0.0	0.0	0.0	0.0	0.0	0.0	1275
0.0	0.0	0.0	0.0	0.0	0.0	0.0	1275
0.0	0.0	0.0	0.0	0.0	0.0	0.0	1275
0.0	5.0	42.9	4.0	0.0	0.0	51.9	1275
0.0	0.0	0.0	0.0	0.0	0.0	0.0	600
1.0	20.0	171.4	12.0	0.0	0.0	204.4	

Total Out-of-Town Labor Time: 151.6 Weeks

Project Management Labor

Title	Name	Number	Sal+Fringes
Plant Engineer	ART Employee	0	
Process Eng	Eric G	0	
Process Eng Back-up	Marc Pruijn	0	
Chemist	Frank Corden	0	
Subtotal		0	0

Pre-Mob	Mob	Run Time	De-Mob	Report Writing	% Adj.	Total Time	
0.0	0.0	0.0	0.0	0.0	0%	0.0	
1.0	5.0	2.0	0.0	0.0	100%	8.0	
0.0	0.0	0.0	0.0	0.0	0%	0.0	
0.0	0.0	0.0	0.0	0.0	0%	0.0	
1.0	5.0	2.0	0.0	0.0		8.0	Wks

*****TOTAL PROJECT LABOR***** **292,775**

Salaries per Phase:

Phase	Direct	Indirect	Total
Pre-Mob	2,129	1,623	3,752
Mob	28,845	8,116	36,961
Run Time	247,240	3,246	250,487
De-Mob	14,561	0	14,561
Report Writing	0	0	0
Total	292,775	12,986	305,761

*****Travel / Per Diem***** $1,000 /wk **108,714**

Travel Weeks For:

	Weeks	
Plant Labor	100.7	(Includes Pre-Mob)
Mgmt Labor	8.0	
Total	108.7	

*****Plant Depreciation***** S/ton 2.00 **120,000**

*****MOB/DEMOB and Site Prep*****

Mobilization/Erection	60,000
Site Prep (Building,Pads,Asphalt, Liner, Bins)	37,000
Revegetation	0
Demob	43,000
TOTAL	**140,000**

Site Prep Details

Site Grading	5,000
Liner	0
Asphalt/Stone	0
Building	0
Building & Sludge Pad	20,000
Power Extension	5,000
Water Extension	2,000
Office Prep	0
Miscellaneous	5,000
Installation of Well	0
TOTAL	37,000

Mob	Details	Demob	
30,000	Trucking	30,000	per Vineland Pro Forma
0		0	
25,000	Assembly/Disassembly		
0	Dieren	0	per A.E. Steel Erectors
0	Edmonton	0	
0	Wastewater Disposal	8,000	
0		0	
5,000	Misc	5,000	
60,000	TOTAL	43,000	

***Excavation/Stage/Prescre	0.00	S/ton	0	Labor 0 / Equip 0 / Misc 0
Transportation	0.00	S/ton	0	
Plant Consumables			–	
Field Office Expense			54,092	
Chemicals	0.00	S/ton	0	
Health and Safety	1.00	S/ton	60,000	
			114,092	
			–	
Equipment Rental			0	
			–	
***Equipment Maintenance**	2.00	S/ton	120,000	
			–	
Utilities				
Electrical(2000KVA)	1.00	S/ton	60,000	
Water (35gpm)	0.50	S/ton	30,000	
Septic Service	0.00	S/mo	0	
Diesel	0.000	S/gallon	0	for 1 loader and 1 trommel
TOTAL UTILITIES			90,000	
			–	
IN PROCESS SAMPLING				
Process and Residuals Analytical			30,000	
Treatability Studies			0	
TOTAL			30,000	
			–	

Field Office Detail: Supplies 3,500 /Mo.; Furniture 3,500; Office Rent 728 /Mo. per WHC GE Capital

Generator:	0 /mo.
Baker Tank:	0 /mo.
Compressor:	0 /mo.
Boiler:	0 /mo.
Steam Cleaner:	0 /day
Mobs:	0 each
Loader:	0 /wk.
Filter Press:	0 /day
	0 mob
Transformer:	0 /?

RESIDUAL MANAGEMENT

Sludge Disposal: # of tons	Disp S/ton (Incl. Tax)		
0	150	Hazardous	0
0	90	Non - Haz	0
			0

Sludge Transportation: # of tons	S/Load		
0	400	Hazardous	0
0	150	Non - Haz	0
			0

Project Data Sheet

Project Name:	WES Scenario 1	**Project Bid Price:**	
Project Number:		***Type:***	Soil Washing
			Time & Materials plus Fee
Project Address:		**Subcontractors:**	
Site Phone Number:	403-450-1478	**Plant Used:**	Pilot Plant
Site FAX Number:	403-450-0909	***Tonnage:***	60,000
Time Frame:		**Additional Equipment:**	
Start		Trommel	Own
End		Mob	$0
		Gravity Jig	$0
		Mob	$0

Other Contacts:

Name	**Position**	**Phone**	**FAX**
Conference Room	n/a		
	Site Construction Manager		
	Project Manager		
	Technical Manager		

Apartment Address:	
Apartment Phone:	
Apartment FAX:	

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Soil Washing Cost Estimate
WES Scenario 2

KEY ASSUMPTIONS	
Soil Mass (cy)	50,000
Density (tons/cy)	1.2
Soil Processed (tons)	60,000
Plant Size (tons/hour)	25
Shift Schedule (days/week-hours/day)	5-10
Plant Availibility (%)	80%
Treatment Duration (weeks)	60
Mobilization/Site Preparation/Demobilization (weeks)	9
Total Project Duration (weeks)	69
Feed - Dry Solids Concentration (%)	87%
Sludge - Dry Solids Concentration (%)	50%
ESTIMATED TREATMENT PRICES	
Mobilization (Plant)	99,000
Site Preparation	61,000
Plant Depreciation	395,000
Plant Labor	879,000
Utilities	148,000
Chemicals / HAS	198,000
Maintenance	198,000
Office Expense	89,000
Process Analytical (Plant)	37,000
Demobilization (Plant)	71,000
Insurance	0
Contingency	50,000
Total Estimated Treatment Price	**$2,225,000**
Estimated Treatment Price, $ / Ton	**85 - 100**
TOTAL ESTIMATED PROJECT COSTS	**$2,237,000**
Estimated Project Cost, $ / Ton	**85 - 100**

OPERATING ASSUMPTIONS

this estimate focuses on treatment only:

- Excavation and Prescreening to -2" not included
- Process Analytical not included
- Sludge (residual) disposal/treatment not included

Proforma
PROJECT: **WES Scenario 2**

Key Assumptions:

Volume (Cubic Yards)	50,000				
Density	1.2				
Mass (Tons)	**60,000**				
Production (Tons/Hour)	25	Pilot Plant			
Shift Schedule - # of Shifts	1	(Days/Wk):	7	(Hrs/Day):	10
Plant Availibility	80.0%				
Treatment Duration (Weeks)	42.9	(Months):	9.9	(Years):	0.8
Mobilization (Weeks)	5.0				
Demobilization (Weeks)	4.0				
Total Project Duration (Wks)	51.9	(Months):	12.0	(Years):	1.0
Feed - Dry Solids Conc (%)	87.0%				
Sludge - Dry Solids Conc (%)	50.0%				

REVENUE	Total
Soil Volume (tons)	60,000
Processing Fee Per Ton	29.00
Total Site Revenue	1,740,000

COST OF OPERATIONS	
Project Labor	425,010
Travel / Per Diem	108,714
Plant Depreciation	240,000
MOB, Site Prep, Demob	140,000
Excavation, Prescreening	0
Transportation	0
Plant Consumables	174,092
Equipment Rental	0
Maintenance	120,000
Utilities	90,000
Process Sampling	30,000
Sludge Disposal	0
Sludge Transportation	0
Security	0
Insurance	0
Contingency	50,000
Total Cost of Operations	1,377,817
Cost / ton	22.96
*****GROSS PROFIT*****	**362,183**
*****GROSS PROFIT %*****	**20.8%**

OPERATING COSTS

Direct Plant Labor

Title	Name	Number	35.0% Sal+Fringes
Plant Manager	Carl Seward	1	
Plant Engineer	Randall Lipham	1	
Asst Plant Eng	Local Hire	0	
Shift Supervisor	Local Hire	0	
Plant Operator	Local Hire	1	
Plant Operator	Local Hire	1	
Trommel Operator	Local Hire	0	
Heavy Equip Operator	Local Hire	0	
Laborer	Local Hire	2	
Secretary	Local Hire	0	
Subtotal		6	425,010

Schedule In Weeks:

Pre-Mob	Mob	Run Time	De-Mob	Report Writing	# Adj.	Total Time	Sal. /wk
1.0	5.0	42.9	0.0	0.0	0.0	48.9	
0.0	5.0	42.9	4.0	0.0	0.0	51.9	
0.0	0.0	0.0	0.0	0.0	0.0	0.0	
0.0	0.0	0.0	0.0	0.0	0.0	0.0	
0.0	5.0	42.9	4.0	0.0	0.0	51.9	1275
0.0	5.0	42.9	4.0	0.0	0.0	51.9	1275
0.0	0.0	0.0	0.0	0.0	0.0	0.0	1275
0.0	0.0	0.0	0.0	0.0	0.0	0.0	1275
0.0	5.0	42.9	4.0	0.0	0.0	51.9	1275
0.0	0.0	0.0	0.0	0.0	0.0	0.0	600
1.0	25.0	214.3	16.0	0.0	0.0	256.3	

Total Out-of-Town Labor Time: 151.6 Weeks

Project Management Labor

Title	Name	Number	Sal+Fringes
Plant Engineer	ART Employee	0	
Process Eng	Eric G	0	
Process Eng Back-up	Marc Pruijn	0	
Chemist	Frank Corden	0	
Subtotal		0	0

Pre-Mob	Mob	Run Time	De-Mob	Report Writing	% Adj.	Total Time
0.0	0.0	0.0	0.0	0.0	0%	0.0
1.0	5.0	2.0	0.0	0.0	100%	8.0
0.0	0.0	0.0	0.0	0.0	0%	0.0
0.0	0.0	0.0	0.0	0.0	0%	0.0
1.0	5.0	2.0	0.0	0.0		8.0 Wks

TOTAL PROJECT LABOR 425,010

Salaries per Phase:

Phase	Direct	Indirect	Total
Pre-Mob	2,129	1,623	3,752
Mob	41,595	8,116	49,711
Run Time	356,526	3,246	359,772
De-Mob	24,761	0	24,761
Report Writing	0	0	0
Total	425,010	12,986	437,996

Travel / Per Diem $1,000 /wk 108,714

Travel Weeks For:

	Weeks	
Plant Labor	100.7	(Includes Pre-Mob)
Mgmt Labor	8.0	
Total	108.7	

Plant Depreciation $/ton 4.00 240,000

MOB/DEMOB and Site Prep

Mobilization/Erection	60,000
Site Prep (Building,Pads,Asphalt, Liner, Bins)	37,000
Revegetation	0
Demob	43,000
TOTAL	140,000

Site Prep Details

Site Grading	5,000
Liner	0
Asphalt/Stone	0
Building	0
Building & Sludge Pad	20,000
Power Extension	5,000
Water Extension	2,000
Office Prep	0
Miscellaneous	5,000
Installation of Well	0
TOTAL	37,000

Mob	Details	Demob	
30,000	Trucking	30,000	per Vineland Pro Forma
0		0	
25,000	Assembly/Disassembly		
0	Dieren	0	per A.E. Steel Erectors
0	Edmonton	0	
0	Wastewater Disposal	8,000	
0		0	
5,000	Misc	5,000	
60,000	TOTAL	43,000	

2.2 Treatment Train 2, Detailed Cost Estimate

***Excavation/Stage/Prescre	0.00	S/ton	0	Labor 0 / Equip 0 / Misc 0
Transportation	0.00	S/ton	0	
Plant Consumables			–	
Field Office Expense			54,092	
Chemicals	1.00	S/ton	60,000	
Health and Safety	1.00	S/ton	60,000	
			174,092	
			–	
Equipment Rental			0	
			–	
***Equipment Maintenance**	2.00	S/ton	120,000	
			–	
Utilities				
Electrical(2000KVA)	1.00	S/ton	60,000	
Water (35gpm)	0.50	S/ton	30,000	
Septic Service	0.00	S/mo	0	
Diesel	0.000	S/gallon	0	
TOTAL UTILITIES			90,000	
			–	
IN PROCESS SAMPLING				
Process and Residuals Analytical			30,000	
Treatability Studies			0	
TOTAL			30,000	
			–	

Field Office Detail: Supplies 3,500 /Mo.; Furniture 3,500; Office Rent 728 /Mo. per WHC GE Capital

Generator:	0 /mo.
Baker Tank:	0 /mo.
Compressor:	0 /mo.
Boiler:	0 /mo.
Steam Cleaner:	0 /day
Mobs:	0 each
Loader:	0 /wk.
Filter Press:	0 /day
	0 mob
Transformer:	0 /?

for 1 loader and 1 trommel

RESIDUAL MANAGEMENT

Sludge Disposal: # of tons	Disp S/ton (Incl. Tax)		
0	150	Hazardous	0
0	90	Non - Haz	0
			0

Sludge Transportation: # of tons	S/Load		
0	400	Hazardous	0
0	150	Non - Haz	0
			0

Project Data Sheet

Project Name:	WES Scenario 2	**Project Bid Price:**		
Project Number:		***Type:***	Soil Washing	
			Time & Materials plus Fee	
Project Address:		**Subcontractors:**		
Site Phone Number:	403-450-1478	**Plant Used:**	Pilot Plant	
Site FAX Number:	403-450-0909	***Tonnage:***	60,000	
Time Frame:		**Additional Equipment:**		
Start			Trommel	Own
End			Mob	$0
			Gravity Jig	$0
			Mob	$0
Other Contacts:				
Name	**Position**	**Phone**	**FAX**	
Conference Room	n/a			
	Site Construction Manager			
	Project Manager			
	Technical Manager			
Apartment Address:				
Apartment Phone:				
Apartment FAX:				

ART *A Division of Geraghty & Miller, Inc.*

Soil Washing Cost Estimate

WES Scenario 3

KEY ASSUMPTIONS	
Soil Mass (cy)	50,000
Density (tons/cy)	1.2
Soil Processed (tons)	60,000
Plant Size (tons/hour)	25
Shift Schedule (days/week-hours/day)	5-10
Plant Availibility (%)	80%
Treatment Duration (weeks)	60
Mobilization/Site Preparation/Demobilization (weeks)	9
Total Project Duration (weeks)	69
Feed - Dry Solids Concentration (%)	87%
Sludge - Dry Solids Concentration (%)	50%
ESTIMATED TREATMENT PRICES	
Mobilization (Plant)	140,000
Site Preparation	226,000
Plant Depreciation	840,000
Plant Labor	1,385,000
Utilities	296,000
Chemicals / HAS	692,000
Maintenance	395,000
Office Expense	89,000
Process Analytical (Plant)	62,000
Demobilization (Plant)	153,000
Insurance	0
Contingency	50,000
Total Estimated Treatment Price	**$4,328,000**
Estimated Treatment Price, $ / Ton	**85 - 100**
TOTAL ESTIMATED PROJECT COSTS	**$4,349,000**
Estimated Project Cost, $ / Ton	**85 - 100**

OPERATING ASSUMPTIONS

this estimate focuses on treatment only:

- Excavation and Prescreening to -2" not included
- Process Analytical not included
- Sludge (residual) disposal/treatment not included

Proforma
PROJECT: **WES Scenario 3**

Key Assumptions:

Volume (Cubic Yards)	50,000					
Density	1.2					
Mass (Tons)	**60,000**					
Production (Tons/Hour)	25	Pilot Plant				
Shift Schedule - # of Shifts	1	(Days/Wk):	7	(Hrs/Day):	10	
Plant Availibility	80.0%					
Treatment Duration (Weeks)	42.9	(Months):	9.9	(Years):	0.8	
Mobilization (Weeks)	5.0					
Demobilization (Weeks)	4.0					
Total Project Duration (Wks)	51.9	(Months):	12.0	(Years):	1.0	
Feed - Dry Solids Conc (%)	87.0%					
Sludge - Dry Solids Conc (%)	50.0%					

REVENUE	Total
Soil Volume (tons)	60,000
Processing Fee Per Ton	56.00
Total Site Revenue	3,360,000

COST OF OPERATIONS	
Project Labor	623,364
Travel / Per Diem	217,429
Plant Depreciation	510,000
MOB, Site Prep, Demob	315,000
Excavation, Prescreening	0
Transportation	0
Plant Consumables	474,092
Equipment Rental	0
Maintenance	240,000
Utilities	180,000
Process Sampling	50,000
Sludge Disposal	0
Sludge Transportation	0
Security	0
Insurance	0
Contingency	50,000
Total Cost of Operations	2,659,885
Cost / ton	44.33
*****GROSS PROFIT*****	**700,115**
*****GROSS PROFIT %*****	**20.8%**

OPERATING COSTS

Direct Plant Labor

Title	Name	Number	35.0% Sal+Fringes
Plant Manager	Carl Seward	1	
Plant Engineer	Randall Lipham	1	
Asst Plant Eng	Local Hire	0	
Shift Supervisor	Local Hire	0	
Plant Operator	Local Hire	2	
Plant Operator	Local Hire	2	
Trommel Operator	Local Hire	0	
Heavy Equip Operator	Local Hire	0	
Laborer	Local Hire	3	
Secretary	Local Hire	0	
Subtotal		9	623,364

Schedule In Weeks:

Pre-Mob	Mob	Run Time	De-Mob	Report Writing	# Adj.	Total Time	Sal. /wk
1.0	5.0	42.9	0.0	0.0	0.0	48.9	
0.0	5.0	42.9	4.0	0.0	0.0	51.9	
0.0	0.0	0.0	0.0	0.0	0.0	0.0	
0.0	0.0	0.0	0.0	0.0	0.0	0.0	
0.0	5.0	42.9	4.0	0.0	0.0	51.9	1275
0.0	5.0	42.9	4.0	0.0	0.0	51.9	1275
0.0	0.0	0.0	0.0	0.0	0.0	0.0	1275
0.0	0.0	0.0	0.0	0.0	0.0	0.0	1275
0.0	5.0	42.9	4.0	0.0	0.0	51.9	1275
0.0	0.0	0.0	0.0	0.0	0.0	0.0	600
1.0	25.0	214.3	16.0	0.0	0.0	256.3	

Total Out-of-Town Labor Time: 151.6 Weeks

Project Management Labor

Title	Name	Number	Sal+Fringes
Plant Engineer	ART Employee	0	
Process Eng	Eric G	0	
Process Eng Back-up	Marc Pruijn	0	
Chemist	Frank Corden	0	
Subtotal		0	0

Pre-Mob	Mob	Run Time	De-Mob	Report Writing	% Adj.	Total Time	
0.0	0.0	0.0	0.0	0.0	0%	0.0	
1.0	5.0	2.0	0.0	0.0	100%	8.0	
0.0	0.0	0.0	0.0	0.0	0%	0.0	
0.0	0.0	0.0	0.0	0.0	0%	0.0	
1.0	5.0	2.0	0.0	0.0		8.0	Wks

*****TOTAL PROJECT LABOR***** **623,364**

Salaries per Phase:

Phase	Direct	Indirect	Total
Pre-Mob	2,129	1,623	3,752
Mob	60,720	8,116	68,836
Run Time	520,455	3,246	523,701
De-Mob	40,061	0	40,061
Report Writing	0	0	0
Total	623,364	12,986	636,350

*****Travel / Per Diem***** $2,000 /wk **217,429**

Travel Weeks For:		Weeks	
	Plant Labor	100.7	(Includes Pre-Mob)
	Mgmt Labor	8.0	
	Total	108.7	

*****Plant Depreciation***** $/ton 8.50 **510,000**

*****MOB/DEMOB and Site Prep*****

Mobilization/Erection	85,000
Site Prep (Building,Pads,Asphalt, Liner, Bins)	137,000
Revegetation	0
Demob	93,000
TOTAL	**315,000**

Site Prep Details	
Site Grading	5,000
Liner	0
Asphalt/Stone	0
Building	80,000
Building & Sludge Pad	40,000
Power Extension	5,000
Water Extension	2,000
Office Prep	0
Miscellaneous	5,000
Installation of Well	0
TOTAL	137,000

Mob	Details	Demob	
30,000	Trucking	30,000	per Vineland Pro Forma
0		0	
50,000	Assembly/Disassembly	50,000	
0	Dieren	0	per A.E. Steel Erectors
0	Edmonton	0	
0	Wastewater Disposal	8,000	
0		0	
5,000	Misc	5,000	
85,000	TOTAL	93,000	

***Excavation/Stage/Prescre	0.00	S/ton	0	Labor 0 / Equip 0 / Misc 0
Transportation	0.00	S/ton	0	
Plant Consumables			–	
Field Office Expense			54,092	
Chemicals	5.00	S/ton	300,000	
Health and Safety	2.00	S/ton	120,000	
			474,092	
			–	
Equipment Rental			0	
			–	
***Equipment Maintenance**	4.00	S/ton	240,000	
			–	
Utilities				
Electrical(2000KVA)	2.00	S/ton	120,000	
Water (35gpm)	1.00	S/ton	60,000	
Septic Service	0.00	S/mo	0	
Diesel	0.000	S/gallon	0	
TOTAL UTILITIES			180,000	
			–	
IN PROCESS SAMPLING				
Process and Residuals Analytical			50,000	
Treatability Studies			0	
TOTAL			50,000	
			–	

Field Office Detail: Supplies 3,500 /Mo.; Furniture 3,500; Office Rent 728 /Mo. per WHC GE Capital

Generator:	0 /mo.
Baker Tank:	0 /mo.
Compressor:	0 /mo.
Boiler:	0 /mo.
Steam Cleaner:	0 /day
Mobs:	0 each
Loader:	0 /wk.
Filter Press:	0 /day
	0 mob
Transformer:	0 /?

for 1 loader and 1 trommel

RESIDUAL MANAGEMENT

Sludge Disposal:

# of tons	Disp $/ton (Incl. Tax)		
0	150	Hazardous	0
0	90	Non - Haz	0
			0

Sludge Transportation:

# of tons	$/Load		
0	400	Hazardous	0
0	150	Non - Haz	0
			0

Project Data Sheet

Project Name:	WES Scenario 3	**Project Bid Price:**		
Project Number:		***Type:***	Soil Washing	
			Time & Materials plus Fee	
Project Address:		**Subcontractors:**		
Site Phone Number:	403-450-1478	**Plant Used:**	Pilot Plant	
Site FAX Number:	403-450-0909	***Tonnage:***	60,000	
Time Frame:		**Additional Equipment:**		
Start			Trommel	Own
End			Mob	$0
			Gravity Jig	$0
			Mob	$0

Other Contacts:			
Name	**Position**	**Phone**	**FAX**
Conference Room	n/a		
	Site Construction Manager		
	Project Manager		
	Technical Manager		

Apartment Address:	
Apartment Phone:	
Apartment FAX:	

Appendix B: Equipment and Technology Sources

The following is a 1998 worldwide alphabetical listing of manufacturers and distributors of physical separation equipment, consulting/contracting firms having expertise or capability in physical separation equipment selection and operation, and other information sources. Every effort was made to ensure that this was a comprehensive listing. However, due to project constraints or lack of response from some entities, some firms have undoubtedly been omitted. Product lines of any of the companies listed may be broader than indicated. Only those products and services considered relative to physical separation and for which information was provided are listed here. Given the dynamic nature of business and consulting, any business listing is bound to be obsolete within a short period unless continuously updated. The following listing will serve as a starting point; however, the user is encouraged to pursue all information sources available to identify other equipment and technology sources. See for example the other information sources at the end of this appendix. In addition to the consulting firms listed here, many of the equipment manufacturers and distributors are also equipped to assist with pilot testing and design recommendations. The user is strongly encouraged to ascertain the performance record of both companies and equipment. Inclusion here is not an endorsement.

Aaron Equipment Company
735 E. Green Street
Bensenville, IL 60106
(630) 350-2200
(630) 350-9047 (fax)

Products: Centrifuges

Alfa Laval Separations, Inc.
North American Headquarters
955 Mearns Road
Warminster, PA 18974-0556
(800) 862-0508
(215) 443-4112 (fax)

Products: Centrifuges

Allied Colloids Inc. (Allied Colloids Americas)
P.O. Box 820
2301 Wilroy Road
Suffolk, VA 23439
(757) 538-3700
(757) 538-3989 (fax)

Products: Chemical reagents (flocculants/coagulants, filtration aids, dust control, flotation reagents, and others)

Bailey-Parks Urethane
184 Gilbert Avenue
Memphis, TN 38106
(901) 774-7930
(901) 774-8444 (fax)

Product Line: Hydrocyclones

Baker Tanks
(800) BAKER 12

Product Line: Containment rental nationwide, mobile and stationary

Barrett Centrifugals Inc.
Box 15059
Worcester, MA 01615-0059
(508) 755-4306 or (800) 228-6442
(508) 753-4805 fax

Products: Centrifuge technology for recovery of industrial fluids, solid/liquid separation

Bateman Equipment Limited (BEQ)
see OSNA Equipment Inc.

Belleville Wire Cloth Co., Inc.
18 Rutgers Ave.
Cedar Grove, NJ 07009
(201) 239-0074
(201) 239-3985 (fax)

Product Line: Wire cloth

Benemax Mining Chemicals
Glenn Corporation
325 Cedar Street
St. Paul, MN 55101-1013
(612) 292-1234 or (800) 453-6267
(612) 221-1926 (fax)

Product Line: Chemical reagents (flotation, dispersants, wetting agents, flocculants, solvents, and others)

Bergmann, A Division of Linatex, Inc.
1550 Airport Road
Gallatin, TN 37066-3739
(615) 230-2217
(615) 452-5525 (fax)

Products: Commercial soil and sediment washing systems

Bethlehem Corporation
25th and Lennox Streets
Easton, PA 18045
(610) 258-7111
(610) 258-8154
bethcorp@bethcorp.com

Product line: Tower filter press

Bird Machine Company, Inc.
100 Neponset Street
South Walpole, MA 02071-9103
(508) 668-0400
(508) 668-6855 (fax)

Products: Centrifuge and filtration equipment

Brandt/EPI
P.O. Box 2327 77305-2327
2800 N. Frazier 77303
Conroe, TX
(409) 756-4800
(409) 756-8102 (fax)

Product Line: Linear motion screen separators, decanting centrifuges, hydrocyclones, dewatering systems

Carpco, Inc.
4120 Haines Street
Jacksonville, FL 32206
(904) 353-3681
(904) 353-8705 (fax)

Product/Service Line: Testing/equipment for: Spirals, concentrating tables, Mozley multi-gravity separator, Floatex classifier, Mozley hydrocyclones. Equipment only: Jigs and centrifugal jigs.

CESL
Cominco Engineering Services Ltd
1636 West 75th Avenue
Vancouver, B.C.
Canada V6P 6G2
(604) 264-5610/264-5500
(604) 264-5555 (fax)

Expertise/Services: Operating internationally in the mining, pulp, paper and petrochemical industries. Process equipment supply, metallurgical and environmental testing and

engineering, including: column flotation, oil/water separation, organic recovery, waste/water treatment (acid rock drainage and metals contaminated industrial effluents)

Compass Wire Cloth
629 Ryan Avenue
P.O. Box 305
Westville, NJ 08093
(609) 853-7616, or (609) 583-1387 ,or (800) 257-5241

Product Line: Wire cloth

Continental Conveyor & Equipment Company
P.O. Box 400
Winfield, AL 35594
(205) 487-6492
(205) 487-4233
Telex 59769

Product Line: Conveyors, conveyor idlers, dynamic modeling of conveyor systems

Dorr-Oliver Inc.
612 Wheeler's Farm Rd
P.O. Box 3819
Milford, CT 06460-8719
(203) 876-5400
(203) 876-5412

Product Line: Hydrocyclones, flotation equipment, belt filters, sand horizontal pan filter, stationary inclined screens, Hydrosizer multi-pocket classifier, Monosizer single-pocket classifier, decanter centrifuges, MERCO Disc-nozzle centrifuges

EIMCO Process Equipment
1951 Creelman Avenue
Vancouver, B.C., Canada V6J 1B8
(604) 731-7030
(604) 738-8818

Product Line: WEMCO flotation cells

Encyclon Inc.
6705 14th Avenue
Kenosha, WI 53143
(414) 654-0032
(414) 657-7435

Product Line: Cyclonic filtration systems (Hydrocylones), Oil skimmers

Ferguson Perforating and Wire Company
130 Earnest Street
Providence, RI 02905
(401) 941-8876
(401) 941-2950 (fax)
1-800-341-9800
TELEX: 92-7539

Product Line: Perforated metal/screening materials

Filtration /Treatment Systems, LTD.
204 First Avenue South
Third Floor
Seattle, Washington 98104
(206) 652-2424
(206) 652-9333 (fax)

Products: Lamella and reactor clarifiers, rotary vacuum filter, filter press, basket centrifuges, etc.

Floatex Separations Ltd.
Buswell's House
Crick, Northampton
NN6 7TT UK
0788 822387/823754
0788 823753 (fax)

Product Line: Floatex density separator (hydroseparator)

Flottweg GmbH
P.O. Box 1160
D-84131 Vilsbiburg
Germany
+49 -8741/301-0
+49 -8741/301-3 00 (fax)

Products: Decanter centrifuges, belt presses

Fluid Systems Inc.
2808 Engineers Road
Belle Chasse, LA 70037
(504) 393-1804
(504) 393-7080 (fax)
1-800-232-1804 (USA only)
fsinola@aol.com

Products: Shaking screens

Franklin Miller
60 Okner Parkway
Livingston, NJ 07039
(201) 535-9200
(201) 535-6269 (fax)

Products: Size reduction equipment (crushers, shredders, delumpers)

Gilson Company, Inc.
P.O. Box 677
Worthington, Ohio 43085-0677
(614) 548-7298 or (800) 444-1508
(614) 548-5314 (fax) or (800) 255-5314 (fax)

Product Line: Laboratory scale testing screens, rifflers, etc.

Graver Water Systems Inc.
750 Walnut Avenue
Cranford, NJ 07016
(908) 653-4200
(908) 653-4300 (fax)

Product Line: Lamella clarifier

Hendrick Screen
3074 Medley Rd
P.O. Box 22075
Owensboro, KY 42304-2075
(502) 685-5138
(502) 685-1729 (fax)

Product Line: Sludge thickeners, screen components

Humphreys (A division of Carpco, Inc.)
4120 Haines Street
Jacksonville, FL 32206
(904) 353-3681
Telex. 5-6367

Product Line: Wilfley concentrating tables, spirals

IHC Holland
PO Box 204-3360
AE Sliedrecht
The Netherlands
TEL.+31(184)411555 - TELEX 26734
TELEFAX +31(184)411884

Products: Washing, classification and separation plants for the sand and gravel industry

Infilco Degremont Inc. (IDI)
P.O. Box 71390
Richmond, VA 23255-1390
(804) 756-7600
(804) 756-7643 (fax)
1-800-446-1150

Products/Services: Full service equipment and system design and supply, pilot testing, treatability studies for wastewater. Clarifiers, filters, thickeners.

Innovat Limited
P.O. Box 61018
Oakville, ON L6J 7P5 Canada
(905) 469-1062 (fax)
innovat.limited@sympatico.ca

Product Line: Leaching vats

JETFLOTE Pty Limited
Engineering Building EB
University Drive
Callaghan, NSW 2308 Australia

Product Line: Wastewater engineering and design featuring Jameson cell floatation

Johnson Screens
(a U.S. Filter Company)
P.O. Box 64118
St. Paul, MN 55164
1-800-VEE-WIRE
(612) 638-3184
johnsonscreens.com/

Product Line: Vibrator screens

Knelson Gold Concentrators, Inc.
20321-86 Avenue
Langley, B.C.
Canada V3A 6Y3
(604) 888-4000
(604) 888-4001 (fax)

Products: Knelson concentrators

Krebs Engineers
5505 West Gillette Road
Tucson, AZ 85743
(520) 744-8200
(520) 744-8300 (fax)

Product Line: Hydrocylones, Krebs VariSieve (variable sieve bend), Liquid/Liquid Separators

Lakefield Research
185 Concession St.
Postal Bag 4300
Lakefield, ON, Canada K0L 2H0
(705) 652-2000
(705) 652-6365

Services: Pilot plant testing: flotation, spirals, tables, centrifugal separators. Water and solids characterization.

Larox
8655 East Via de Ventura Rd
Suite G227
Scottsdale, AZ 85258
(602) 922-2444
(602) 922-8470 (fax)

Product Line: Belt pressure filters

Macon Wire/DEWCO
2913 Joycliff Road
Macon, GA 31211-2805
(912) 745-5419
(912) 741-1394 (fax)
1-800-768-9155

Product Line: Vibro-separators (circular shaking screens)

McNichols Co.
2161 Kingston Court
Marietta, GA 30067-8901
(770) 952-0800
(770) 952-0858 (fax)
1-800-237-3820

Product Line: Wire cloth, perforated metal, expanded metal

Merrick Industries, Inc.
10 Arthur Drive
Lynn Haven, FL 32444
(904) 265-3611
(904) 265-9768 (fax)

Products/Services: Gravimetric heavy duty weigh feeder, other material feeders and controllers, belt conveyor scales, water treatment systems, material testing

METPRO Supply Inc.
1550 Centennial Blvd.
Bartow, FL 33830
(813) 533-7155
(813) 533-7401 (fax)

Product Line: Hydrocyclones, static screens, vibrating screens, pumps, tanks, stackers, crushers

Midwestern Industries, Inc.
P.O. Box 810
Massillon, OH 44648-0810
(330) 837-4203
(330) 837-4210 (fax)

Product Line: Vibrating screens, porta-sifters, gyra-vibratory separators, scalpers (grizzlies), wire cloth

MIM Technologies GPO
Box 1433
Brisbane Qld 4001 Australia
+617 3833 8394
+617 3833 8311 (fax)

Product Line: Jameson flotation cell

Minerals Processing Techniques, Inc. (MPTI)
P.O. Box 545
Auburn, NH 03032
(603) 483-5686
(603) 483-0315 (fax)

Product Line: Disk filters

Mozley (Richard Mozley Limited)
Cardrew, Redruth
Cornwall, TR15 ISS, UK
+44 (0)1209 211081
+44 (0)1209 211068 (fax)

Products/Services: Multi-gravity separators, hydrocyclones

Newark Wire Cloth Company
351 Verona Avenue
Newark, New Jersey 07104-1798
(201) 483-7700
(201) 483-6315 (fax)
1-800-221-0392

Product Line: Wire cloth, sieves, strainers

Noxon
Box 100 24
S-434 21 Kungsbacka, Sweden
+46 300-710 65 (telephone)
+46 300-196 04 (fax)

Products: Decanter centrifuges

Osna Equipment
7550 West Yale, #B-100
Denver, CO 80227
(303) 985-0238
(303) 985-0624 (fax)

Product Line: Flotation machines, linear screens/vibrating screens, belt filters, grizzlies, feeders, auxiliary equipment (agitators, mixers), magnetic separators

Outokumpu Mintec OY Automation
P.O. Box 84
SF-02201 Espoo, Finland
+358 0 4211 (telephone)
Telex 123677 omin sf
Telefax 358 0 421 2614

Product Line: Automatic elemental analysis (XRF real time analysis of product streams), particle-size analysis of continuous processes

Peterson Filters Corporation
1949 South 3rd West
P.O. Box 606
Salt Lake City, Utah 94110
(801) 407-7761

Product Line: Rotary vacuum filters (disc and drum type), flocculators, attritioning equipment

Phillips Chemical Company
309 Short Street
Bartlesville, OK 74004
(918) 661-0323
(918) 661-5174 (fax)
TELEX: 49-2455

Product Line: Flotation chemicals

Pleiger Plastics Company
P.O. Box 1271 - Crile Road
Washington, PA 15301-1271
(412) 228-2244
(800) PLEIGER
(412) 228-2253 (fax)

Product Line: Impact beds, polyurethane parts, including transport rollers, liners, hydrocyclone internals, valve balls

Powerscreen of Florida, Inc.
P.O. Box 5802
Lakeland, FL 33807-5802
(941) 687-7153
(941) 680-1289

Product Line: Portable screening and washing equipment, trommels

RAHCO International
N. 8700 Crestline
P.O. Box 7400
Spokane, WA 99207-0400
(509) 467-0770
(509) 466-0212 (fax)

Products/Services: System design and equipment manufacture for environmental remediation and bulk material handling

Richard Mozley Limited
Cardrew, Redruth, Cornwall TR 15 1SS
United Kingdom
(01209) 211081
(01209) 211068 (fax)

Product Line: Manufacturer, Mozley Hydrocyclones

RMS-Ross Corporation
44325 Yale Road West
Chilliwack, BC V2R 4H2
(604) 792-5911
(604) 792-7148 (fax)

Product line: Jigs

SANBORN Technologies
9 Industrial Drive
Medway, MA 02053-1796
(508) 533-8800
(508) 533-1440 (fax)

Products: Turbo separators (high-efficiency industrial centrifuges)
Soli Pac Separators (solids removing centrifuges)

Separators, Inc.
747 E. Sumner Ave.
Indianapolis, IN 46227
(317) 786-7832
(317) 782-3384 (fax)
(800) 233-9022

Products/Services: Centrifuges (sales/service of reconditioned units), test centrifuges, process test engineers, consultation

SWECO Products, Division of Emerson Electric Company
7120 New Buffington Road
Florence, KY 41022
800-849-3259
(606) 727-5122 (fax)

Product Line: Vibrating screens, sieve bends

T-Systems International, Inc.
7545 Carroll Road
San Diego, CA 92121-2401
(619) 578-1860
(619) 578-2344 (fax)

Products: T-Tape (perforated tape for heap leaching)

Technequip Limited (Subsidiary of Fuller-Traylor Inc.)
297 Garyray Drive
Toronto, Ontario, Canada M9L 1P2
(416) 749-3991
(416) 749-9767 (fax)

Product Line: Hydrocylones, Tech-Taylor valves

Techpro Mining Products Limited
2125 Wyecroft Rd.
Oakville, Ontario, Canada, L6L 5L7
(905) 847-6620
(905) 847-9052 (fax)

Products/Services: Laboratory/pilot plant/process equipment: Attrition equipment, conveyors, filters, flotation cells, jigs, spirals, thickeners, heavy media separation systems, hydrocyclones, hydraulic classifiers. Pilot plant/process design. Equipment refurbishing and rebuilding, removal or relocation, supervision, installation supervision, plant liquidation and appraisals.

Tessenderlo Kerley, Inc.
(Headquarters)
2801 W. Osborn Road
Pheonix, AZ 85017
(800) 669-0559
(602) 528-0683 (fax)

Products: Sulfur chemicals for the mining industry including xanthates, filter aids, depressants, cyanide destruction chemicals

Technical and Laboratory Services
2840 W. Twin Buttes Rd
Sahuarita, AZ 85629
(520) 791-2940
(520) 625-8091 (fax)

Products: Chemical reagents (Flotation, filter aids, water treatment)

TOYO Pumps
3807 Howland Ave.
Schofield, WI 54476
(715) 359-3428
(715) 359-9828 (fax)

Product Line: Slurry pumps

Triple/S Dynamics Inc.
P.O. Box 151027 75315-1027
1031 S. Haskell Ave. 75223
Dallas, Texas
(214) 828-8600
(214) 828-8688 (fax)
1-800-527-2116

Product Line: Trommels, vibrating screens, conveyors, fluidized-bed dry separator

Veronesi
Via Don Minzoni, 1
40050 Villanova di Castenaso
Bologna, Italy
(051) 6054511 (telephone)
Telex 511029 VERSEP I
(051) 6053183 (fax)

Products: Self-cleaning centrifuges (food and beverage applications)

Warman International, Inc.
2701 South Stoughton Rd.
Madison, WI 53716
(608) 221-2261
(608) 221-5810 (fax)

Product Line: Slurry pumps, slurry valves, hydrocyclones, agitators

Waste-Tech Inc.
1931 Industrial Drive
Libertyville, IL 60048
(708) 367-5150
(708) 367-1787 (fax)

Product Line: High pressure dewatering equipment (Python pinch press)

Wedge Wire
P.O. Box 157
22069 Fairgrounds Rd
Wellington, OH 44090
(216) 647-3341
(216) 647-5887 (fax)
1-800-344-9473

Product Line: Screening material

WesTech
P.O. Box 65068
Salt Lake City, Utah 84165-0068
(801) 265-1000
(801) 265-1080 (fax)

Product Line: Clarifiers, thickeners, belt, disc and pressure filters, screw type and reciprocating rake classifiers

Western Mine Engineering Inc.
222 West Mission Ave., Suite 218
Spokane, WA 99201
(509) 328-8023
(509) 328-2028 (fax)
1-800-400-MINE

Services: Mine and mill equipment cost estimating guide, software.

The Western States Machine Co.
1798 Fairgrove Ave.
Hamilton, OH 45011
(513) 863-4758
(513) 863-3846 (fax)

Products: Centrifuges

Westfalia Separator, Inc.
100 Fairway Ct.
Northvale, NJ 07647
(201) 767-3900
(201) 784-4399 (fax)

Products: Centrifuges

Westpro Sales Inc.
1760 Bonhill Road
Mississauga, Ontario, Canada L5T IC8
(905) 795-9606
(905) 795-9608 (fax)
1-800-667-1111
sales@westproequip.com

Product line: Remanufactured equipment: crushers, flotation cells, vibrating screens, filters, hydrocyclones

Witco Corporation
One American Lane
Greenwich, CT 06831-2559
(800) 948-2695
(203) 552-2893 (fax)

Products: Chemical reagents (Flotation, surfactants, dust suppression, and others)

W.S. Tyler Inc.
3200 Bessemer City Rd
P.O. Box 8900
Gastonia, NC 28053-9065
(704) 629-2214
(704) 865-6533 (fax)
1-800-238-9537

Product Line: Vibrating screens, high-speed, high-capacity screens, rock screens, circle throw vibrating machine, solution (dewatering) screen.

Yardney Water Management Systems, Inc.
6666 Box Springs Blvd.
Riverside, CA 92507-0736
(909) 656-6716
(800) 854-4788
(909) 656-3867 (fax)
Product Line: Sand media filters, Multi-media filters, Centrifugal separators

Other Information Sources

"Innovative Site Remediation Technology: Soil Washing/Soil Flushing"
Edited by William C. Anderson, Monograph Task Group Chair: Michael J. Mann, American Academy of Environmental Engineers,1993.

Information: Appendix A, List of vendors and contacts

SEDTEC (Sediment Technology Directory)
c/o Ian Orchard
Environment Canada
4905 Dufferin St, 2nd Floor
Downsview, Ontario M3H 5T4
(416) 739-5879
(416) 739-4342 (fax)
csrp@aestor.am.doe.ca

Information: Directory of contaminated sediment removal and treatment technologies

Vendor Information System for Innovative Treatment Technologies (VISITT)
US EPA Office of Solid Waste and Emergency Response, Technology Innovation Office
http://clu-in.com/visitt.htm

Information: A database of innovative treatment technologies compiled by USEPA, Version 6.0 December 1997