ESTCP

FINAL REPORT

Deployable Waste to Energy Convertor for Expeditionary Contingency Bases (DWECX) with Thermal Energy to Electrical Power System (TEEPS)

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14. ABSTRACT
The Department of Defense (DOD) overseas contingency operations (OCO) generate significant amounts of solid waste that must be treated and disposed properly to avoid exposure of personnel to inherent hazards, and to mitigate operational and security challenges associated with waste stream logistics. Current and expedient methods such as burn pits, impose significant space and security issues; pollute the air, water, and land; and can adversely affect the health of both troops and the local populace. Incinerators are the only proven technology that reliably addresses these problems. However, available packages do not meet operational requirements for mobility, simplicity, and energy efficiency. The overarching objective for this project was to design, build, and demonstrate an innovative, state-of-the-art prototype incinerator (DWECX-TEEPS) with objectives in 3 areas: 1) Logistics - Maintain an expeditionary logistical footprint of One 20' ISO Container, Package and containerize DWECX-TEEPS into three TRICON modules to be compatible with military airlift, sealift, and ground transportation modes, Capability to operate in worldwide climatic conditions 2) Waste Processing - Easy-to-use system to process 1000 lbs. (1/2 ton) of waste in a 24-hour day, Reduce waste by over 90% to a benign residue safe for disposal 3) Energy Production - Reduce use of fossil fuel required for waste disposal, Capture the waste heat generated from garbage disposal, Produce electrical power

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ACRONYMS AND ABBREVIATIONS

AFB	Air Force Base
APG	Aberdeen Proving Ground
ARL	Army Research Lab
APC	Air Pollution Control
ARL	U.S. Army Research Laboratory
ATEC	Army Test and Evaluation Command (ATEC)
CHP	Combined Heat and Power
DOD	Department of Defense
DWECX	Deployable Waste-to-Energy Convertor for Expeditionary Bases
EPA	Environmental Protection Agency
ESTCP	Environmental Security Technology Certification Program
ESWDS	Expeditionary Solid Waste Disposal System
EWS	Eco Waste Solutions
FEA	Finite Element Analysis
FOB	Forward Operating Base
GAL	Gallon
HX	Heat Exchanger
HERS	Heat Energy Recovery System
IRR	Internal Rate of Return
ISO	International Organization for Standardization
KW	Kilowatts
KWH	Kilowatt Hour
LBS	Pounds
L	Liter
MSW	Municipal Solid Waste
NPV	Net Present Value
OCONUS	Outside the Continental U.S.
PLC	Programmable Logic Controller
ROI	Rate of Return

TEEPS	Thermal Energy to Electrical Power System
TRL	Technology Readiness Level
USACE	United States Army Corps of Engineers
VFD	Variable Frequency Drive
WTE	Waste-to-Energy

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ABSTRACT

INTRODUCTION AND OBJECTIVES

The Department of Defense's overseas contingency operations generate significant amounts of solid waste that requires proper treatment and disposal. Poor waste management practices (burn pits and taking waste off base) can create health & safety hazards, security vulnerability, logistical challenges, and the long-term legacy of pollution. Deployable incinerators can address these issues, but do not produce energy. Recovering thermal and electrical energy from on-site produced solid waste, can provide an important component in the overall camp energy system to reduce reliance on off-base energy resources.

The objectives of our project were to design, build, and demonstrate an innovative, state-of-the-art prototype incinerator package that will 1) be contained in one 20' ISO container with the 3 TRICONs to not exceed 10,000 lbs each (2) reduce waste volume by >95 % (3) require 25 gallons of diesel fuel per burn cycle 4) produce 10kW per burn 5) produce 13 GPM of hot water 6) analyze air emissions to understand impact of energy recovery on quality of air emissions.

TECHNOLOGY DESCRIPTION

The Deployable Waste to Energy Convertor (DWECX) is a variant on the design of the EWSDS (Expeditionary Solid Waste Disposal System), a system developed by Eco Waste Solutions for the US Army. The DWECX design expands on the proven waste disposal capability of the ESWDS by adding an integrated energy recovery feature. Like the ESWDS, the DWECX waste conversion process is one of starved-air gasification of waste, followed by excess-air oxidation of the gaseous byproducts generated in the conversion process. The Thermal Energy to Electrical Power System (TEEPS) was designed to capture waste heat from the DWECX exhaust using a heat-pipe type of Heat Exchanger and then circulate the thermal oil to the ORC engine to produce electricity. A second heat exchanger condenses the working fluid using cooling water which can be used for hot water.

PERFORMANCE AND COST ASSESSMENT

Performance results 1) the final logistical footprint produced was two 20' ISO containers with the individual 6 TRICONs not exceeding 10,000 lbs. (2) Waste disposal efficiency was estimated at >95% (3) Fuel efficiency was not addressed in order to optimize Air Emissions quality 4) 3.8 kW of net electrical power was generated. Future system optimizations are expected meet the 10kW per target. 5) 13 GPM of hot water was generated 6) The analysis of air emissions yielded a good understanding of the impact of energy recovery on the quality of air emissions and an understanding of where improvements could be made. The analysis of Capital and Operating Costs provided an estimate of ROI of 5 months for capital cost investment return and a NPV of $8 M, assuming 20-year life expectancy of the incinerator package. In addition, there are a number of indirect benefits related to environmental, social, safety and health when compared to burn pits or taking waste off-site.

IMPLEMENTATION ISSUES

The ESTCP project will provide camp planners with data and reports that detail system performance, connections and integration with camp infrastructure required to take advantage of the energy produced.

Subsequent research and development will be required to adapt the concept further to make it operationally viable. In particular the ORC engine technology requires an off the shelf equipment vendor to assist in ORC integration into the DWECX-TEEPS system. Operational testing of the equipment, by soldiers, will be required to refine the package for eventual deployment. As development work matures project performance will be monitored against the Technology Transition Plan which will encompass operational, logistic, environmental, energy and financial performance data.

EXECUTIVE SUMMARY

INTRODUCTION

The Department of Defense's overseas contingency operations generate significant amounts of solid waste that requires proper treatment and disposal. Poor waste management practices can create health & safety hazards, security vulnerability, logistical challenges, and the long-term legacy of pollution. In past overseas deployments burn pits were considered an expedient method of waste disposal. However, they created many other problems by using large areas of land, consuming large amounts of fuel, creating security vulnerabilities, and polluting the ground, air, and water. Burn pits have been linked to severe health impacts on troops and host-nation populace. Deployable incinerators address most waste-related security concerns, use less fuel, require less space, and have very good emissions, but they are not producing energy. The reason that disposal is favored over waste-to-energy is that the addition of energy recovery dramatically changes the technical and operational complexity of the thermal treatment system which is problematic in deployed settings. Successful transition to the expeditionary base camp would require an effective waste disposal system that is easy to operate with a low-cost, simple, yet robust design. The biggest challenge is the small amount of waste which limits the positive energy output that the can be achieved.

This program has demonstrated and evaluated a prototype incinerator package with energy recovery. The Deployable Waste to Energy Convertor (DWECX) with Thermal Energy to Electrical Power System (TEEPS) "DWECX-TEEPS", addresses the challenges of current technologies in providing waste-to-energy for an expeditionary sized base camp.

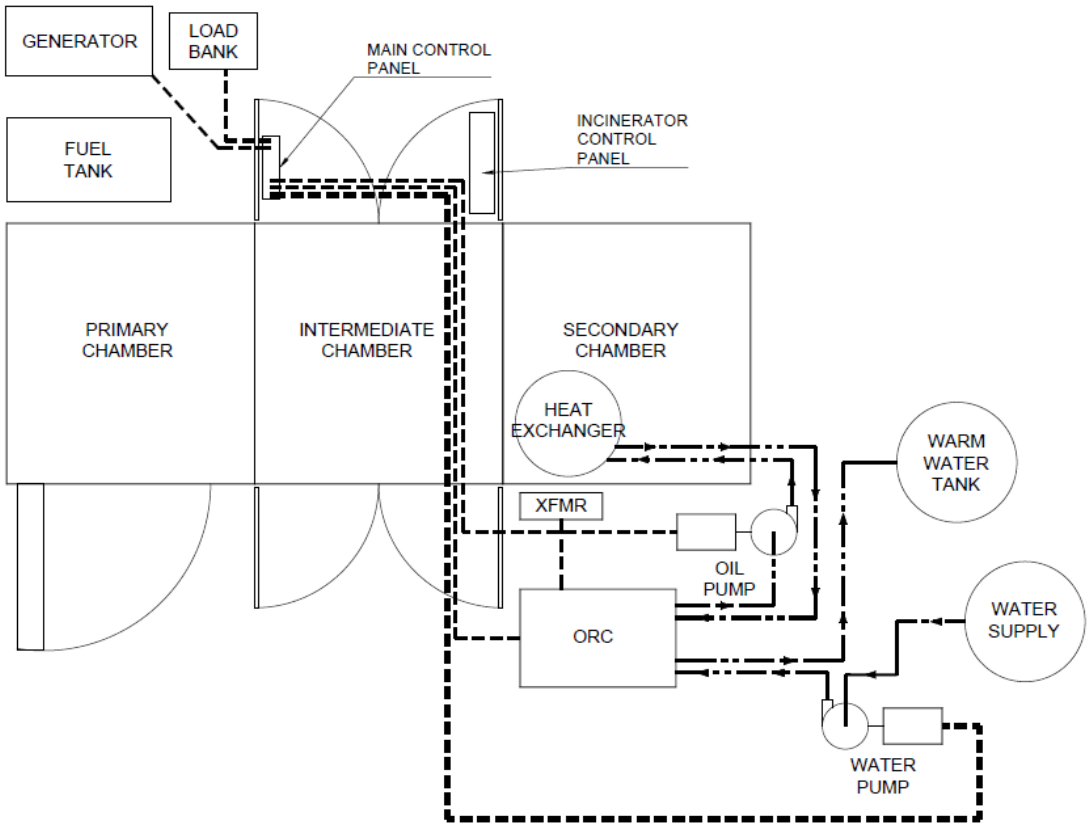
OBJECTIVES

Performance Metric	Data Requirement/ Measurement	Success Criteria
Logistical footprint	Physical Dimensions	Complete package including all required gear to not exceed more than 20' ISO container, individual containers not to exceed 10,000 lbs.
Disposal Efficiency	Volume before and after	Waste material volume reduced by 95% or more
Fuel Efficiency	Fuel Consumption	Requires less than 25 gallons of diesel fuel per cycle
Electrical Power	Power Production	>= 10kW for 5 hours of operation (per burn)
Hot Water	Water Production	>= 13GPM with an ~ΔT of 70ºF (86 to 158ºF)
Air Emissions EPA regulations 40 CFR 60, Subparts AAAA and BBBB	Dioxins/Furans Metal Emissions including Cadmium, Lead and Mercury Total PM SO2, NOx, CO, HCl Fugitive Ash Opacity	Accredited laboratory to sample emissions generated by waste conversion, with and without energy Analyze the data to understand the impact of the energy recovery on the quality of emissions

TECHNOLOGY DESCRIPTION

The DWECX is a variant on the design of EWSDS (Expeditionary Solid Waste Disposal System), a system developed by Eco Waste Solutions for the US Army. The DWECX design expands on the proven waste disposal capability of the ESWDS by adding an integrated energy recovery feature. Like the ESWDS, the DWECX waste conversion process is one of starved-air gasification of waste, followed by excess-air oxidation of the gaseous byproducts generated in the conversion process. This process is automated by a unique proprietary control system that regulates key process parameters within an ideal range. This tight control, within optimal ranges, produces significantly lower air emissions compared to typical thermal treatment technologies. Like the ESWDS, the DWECX can dispose of up to 1000 lbs. (0.5 tons) per day of typical solid non-hazardous military base waste, reducing the volume by over 95%. The TEEPS component was provided by EthosGen with support from their partner Rockwell Collins. EthosGen and Rockwell have previous experience with recovery of waste heat and production of electrical power using an Organic Rankine Cycle (ORC) engine. The TEEPS was designed to capture waste heat from the DWECX exhaust using a heat-pipe type of Heat Exchanger (HX) and then circulate it to the engine/generator to produce electricity. A second heat exchanger condenses the working fluid using cooling water which can be used for hot water or space heating.

The major components were packaged/containerized into three TRICON modules to be compatible with military airlift, sealift, and ground transportation. Each TRICON weighs less than 10,000 lbs. and can be lifted using only a forklift. This design will enable our system to be deployed to small base camps without the need for large material handling equipment.



The DWECX-TEEPS technology package as illustrated above includes the following key components;

1) Primary Chamber – a large chamber constructed of a heavy-duty steel shell with an insulating refractory liner where solid waste is loaded and undergoes the starved-air gasification process in a controlled temperature range of 760-815°C (1400-1499°F) during a burn cycle period, typically 4-6 hours. Following the burn cycle, the system goes into cooldown mode where the ash is cooled. Ash residual is manually removed to complete the ~12-hour waste process cycle.
2) Secondary Chamber – a large chamber constructed of a heavy-duty steel shell with an insulating refractory liner where the gaseous products from the Primary Chamber are fed to be fully oxidized in a controlled temperature range of 850-1000°C (1562-1832°F).
3) Heat Exchanger/Stack – hot gases exiting the Secondary Chamber pass through the Heat Exchanger where the waste heat is captured, and the cooled gases are vented to the atmosphere.
4) Organic Rankine Cycle (ORC) Engine – waste heat is used to heat thermal oil and the oil pump transfers the energy to the ORC Engine where the energy is converted to electrical power. In the demonstration the generated electricity is absorbed by the load bank.
5) Heat Exchanger/ORC - The second heat exchanger in the system condenses and cools the thermal oil using water. The heated water is transferred to the warm water storage tank
6) Oil Pump – transfers thermal oil between the Stack Heat Exchanger and the ORC Engine in a closed loop heat transfer cycle.
7) Water Pump – transfers fresh cool supply water through the ORC heat exchanger where the water recovers waste heat from the thermal oil before then being transferred to the warm water storage tank
8) Intermediate Chamber – contains control panel and the operator interface for the DWECX and the TEEPS.
9) Generator –a diesel generator is used to supply electrical power required for start-up, ignition and system monitoring.
10) Fuel Tank – diesel fuel storage to supply the primary and secondary burners.

PERFORMANCE ASSESSMENT

Logistical Footprint

The original objective was to develop a complete DWECX-TEEPS system package including the ORC engine and HX contained within 3 TRICONs, which would provide a 20’ x 8’ x 8’ shipping footprint with individual containers not to exceed 10,000 lbs. The individual TRICON container weights were maintained at <10,000 lbs. However, incorporating all equipment into 3 TRICONs did not prove to be practical. The ORC engine and Heat Exchanger, water tanks and pumps, and support equipment and spare parts each required their own individual TRICONs.

The final logistical/shipping footprint is planned to be 40’ x 8’ x 8 (that is 2 x 20’ containers made up of 3 TRICONs secured together), and is expected to be made up of the following elements;

20’ Container #1	20’ Container #2
• Primary Chamber TRICON • Intermediate Chamber TRICON • Secondary Chamber TRICON	• ORC & Heat Exchanger TRICON • Water tanks & pumps TRICON • Support equipment and parts TRICON

Disposal Efficiency

The waste reduction goal was to reduce waste on a mass and volume basis by greater than 95%.

Ash weights and volumes were not measured during the October tests and so waste efficiency results have been taken from similar tests (using the Standard Waste Mixture) using a similar EWS combustion system conducted at Tyndall in 2017 with the DWEC-HERS system.

The Tyndall tests yielded excellent disposal efficiency with an average mass waste reduction of 97.8% and with an average volume reduction of 97.8%.

Fuel Efficiency

The project objective was to reduce fuel requirements to less than 25 gallons of diesel fuel per burn cycle. Fuel consumption reductions were not addressed during the project in order to focus on optimizing flue gas temperatures for the minimizing of stack air emissions. Going forward areas where fuel efficiency can be addressed are:

- Insulating the secondary chamber. A temperature drop of ~100 C was measured across the length of the secondary chamber during the demonstrations, illustrating significant potential for fuel savings by reducing secondary chamber radiant temperature losses.
- Optimizing the locations and accuracy of secondary chamber temperature measurements will also provide opportunities to reduce fuel consumed by the secondary chamber fuel burner, while maintaining flue gas temperatures to control emissions.

Electrical Power Generation

The project objective for electrical power production was to generate >= 10kW for 5 hours of operation (per burn). Since the ORC engine was not operational, we have estimated the Gross ORC Electrical Power output based on the available thermal energy. Internal Peak Power demand was also estimated based on the estimated demands of the TEEP system and the DWECX system.

The estimated gross ORC Electrical Power Output averaged 12.74 kW and estimated net system Electrical Power Output averaged 3.79 kW during 3 test burns. We expect with system and operational optimizations that the DWECX-TEEPS system will be able to meet the 5kW objective. Optimizations could include adding insulation to the secondary chamber to reduce thermal losses.

Hot Water Generation

The project objective was to generate at least 13GPM of hot water with a ~ΔT of 72ºF (86 to 158ºF). The 3 test burns produced on average a flow rate of 36 GPM with an increase in water temperature from ORC Inlet of 92 °F to ORC Outlet of 118 °F.

As illustrated below the hot water ΔTs and the hot water flow rates during the demonstration generated an equivalent Thermal Energy Flow with respect to the units in the project objective.

	Inlet Temperature	**Outlet Temperature**	**Temperature Difference**	**Volume Flow Rate**	**Thermal Energy Flow**	
	(°F)	**(°F)**	**ΔT (°F)**	**GPM**	**MMBtu/hour**	**kw**
Project Objective	86	158	72	13	0.465	136
Three Tests Average	92	118	26	36	0.466	137

Air Emissions

The Air Emission objective was to evaluate Air Emissions against the Other Solid Waste Incinerators (OSWIs) of US EPA Standards of Performance for New Stationary Sources and Emission Guidelines for New Municipal Waste Combustion Units. The evaluation was to include air emissions with and without energy recovery to determine the impact of energy recovery on the quality of emissions.

In general, there were no adverse effects on the quality of air emissions for the compounds measured that were required as part of the OSWIs limits, in comparing emissions with the energy recovery device installed versus baseline emissions without the energy recovery device installed. The exception were the emissions of Dioxins and Furans which were higher with energy equipment installed, as was expected.

1) In comparing individual air emission compounds to the OSWIs limits we can conclude;
   a. Particulate Matter – all measurements were well below the standard
   b. Carbon Monoxide – all measurements were well below the standard
   c. Dioxins and Furans –
      i. The DF test value without heat recovery (21.4 ng/dscm) was well below the limit value (33 ng/dscm), illustrating well controlled stack temperatures during those tests.
      ii. The DF test value with heat recovery (37.3 ng/dscm) is marginally above the limit value (33 ng/dscm), illustrating the additional challenges with heat recovery equipment and the associated lower flue gas temperatures.
   d. Hydrogen Chloride – all measurements were well above the standard. The emission of HCL is directly related to the chlorine content in the waste. Food waste and chlorine-containing plastics (such as PVC) typically make the chlorine content in the waste reach 1%, which determines the higher HCL emission value, and so proper waste sorting is the key to lowering HCL emissions.

e. Sulfur Dioxide - The SO2 emissions were well above the standard. The emission of SO2 is determined by the sulfur content in the waste and also the sulfur content of the diesel fuel suppling the burners. The sulfur content in wastes is generally lower than 0.5%. It is important to minimize waste sulfur content and to use Low-sulfur fuels for waste incineration to minimizing SO2 emissions. In general, it would be necessary to add an Air Pollution Control system to meet the very low OSWIS SO2 limit.

f. Nitrogen Dioxides - The October demonstration exhibited lower NOx emissions than the OSWIS limit (84 ppm versus 103 ppm). However, the March demonstration emissions were well above the OSWIS limit (180 ppm versus 103 ppm).
   - It appears that the temperatures and oxygen contents of the primary chamber were well controlled during the final October tests, but were much higher in the preliminary March tests as the processes were being optimized, which could have resulted in the high NOx emissions.

g. Cadmium, Lead and Mercury - all measurements were well below the standard Metal emissions. Metal emissions are directly related to the corresponding metal content in the waste. The EWS gasification technologies such as controlled air technology and lower waste bed temperatures prevent or reduce metal melting and/or vaporization, and contribute to very low particulate matter emission. Heavy metals in incineration are converted mainly into non-volatile oxides and deposited with fly ash, and so are not emitted. The exception is Mercury which is highly volatile and therefore almost exclusively passes into the flue-gas stream.

h. Opacity - all measurements were well below the standard

COST ASSESSMENT

The demonstration was performed at Aberdeen Proving Grounds (APG) Army Test and Evaluation Command (ATEC) instead of at a Forward Operating Base (FOB). Therefore, actual cost tracking information from a FOB was not available. Demonstration costs are consistent with costs in a CONUS (continental USA) military technology test facility.

The electrical power of the DWECX-TEEPS could not be measured due to operational issues with the ORC engine. However, the electrical power production potential can be accurately estimated using the measured stack gas temperatures and flows that indicate how much energy is available as waste heat.

A FOB typically generates all its hot water needs using diesel fuel fired hot water heaters that run 24 hours per day. This cost could be avoided if all of the energy to heat the water comes from the waste heat produced from burning garbage.

Cost of Hot Water for Showers

The cost of generating hot water was based on the publicly available operational cost data for the WH-400 hot water heaters, specifically electrical power, and fuel consumption.

There is a significant quantity of waste heat available for recovery from the waste conversion process. In fact, there is five times more hot water available from waste conversion than can be used for showers at a 150-person base camp (based on a 10-minute shower).

Current Costs for Waste Disposal

At the time of this study, solid waste at FOBs was primarily transported off-site and/or burned in burn pits. The cost of waste disposal at FOB was referenced from the Fully Burdened Cost of Waste as estimated by AEPI (Army Environmental Policy Institute) in the 2010 Fully Burdened Cost of Waste Study.

Operating cost calculations, operational cost savings and Capital Costs are summarized below.

Capital and Operating Costs of the DWECX-TEEPS

Capital Cost of DWECX-TEEPS	**$700,000.00**	Production Price of Package
Operating Time (days/yr)	329	days
% Downtime Per Year (Maintenance)	10%	estimated based on experience
Waste processed by DWECX (lbs/batch)	6975	design criteria to meet Contigency Basing requirements
Batches per day	2.0	batches of waste processed in 24 hours
Waste processed by DWECX (tons/day)	7.0	tons
JP8 used (Gallons) per burn cycle	20	per batch cycle
JP8 used by DWECX (Gallons/day)	40	gallons per day
Cost of fuel for DWECX ($/day)	$573.20	$ per day
Annual Fuel Costs for DWEC	**$188,296.20**	
Gross Electrical Power Produced by TEEPS (ORC) System	13	kw hourly (average of the 3 cycles measured)
Gross Electrical Power Produced during Waste Processing	64	kWh/batch
Gross Electrical Power Produced by TEEPS (ORC) System	127.4666667	kWh/batch
Electrical Power used by DWECX per batch (kwh)	6.0	kWh/batch
Electrical Power used by TEEPS per batch (kwh)	12.0	kWh/batch
Electrical Power used by DWECX per day (kwh/day)	36.0	kWh per batch x batches per day
Net Electrical Power Produced	91.5	
Electricity Cost Avoided ($/day)	$1,310.72	
Annual Electrical Cost Savings	**$430,570.64**	
Operator hours required daily	0.50	15 minutes of operator time per batch to unload and load system
Hourly Cost of Operator	$25.00	$ per hour
Annual Labor Costs for DWECX	$4,106.25	not included in OPEX - assumed to be equivalent or less than current waste disposal
Percent residual of waste after DWECX processing	10%	residual includes ash, cans, glass - some could be recycled, but assumed worst case
Annual DWEC residual waste	229.1	tons per year
Annual Cost to Dispose of Ash	**$100,129.26**	residual disposal cost per year
Monthly Cost to Dispose of Residual	$8,344.11	cost per month
Maintenance as % of Capital Cost	2%	estimated Based on EWS experience
Annual Maintenance Cost	**$14,000.00**	

The required labor to operate the waste conversion equipment is also presented in the table above, but it is assumed that this labor is the same or less then that required to operate a burn pit and/or prepare waste for shipping off-site.

The ROI was calculated by taking the estimated capital cost for the DWECX-TEEPS equipment package (at a production level of 80 units) then subtracting the monthly operational cost savings. Using this calculation, the DWECX-TEEPS capital cost investment would be returned within 5 months of operation.

For another perspective we have calculated the Net Present Values (NPV) for the project. The capital equipment has a life expectancy of 20 years so we have calculated NPV over twenty years, which determines a NPV of $8,080,000. These potential substantial cost savings over the 20 years of the Waste to Energy project provides excellent financial support for the investment of $700,000 for this project. The cost savings could be used to finance additional Waste to Energy projects.

For the NPV calculation we have assumed 90% up time for the equipment and a 4% interest rate.

Indirect Cost Benefits

Not captured in the return-on-investment calculation are other indirect cost savings and other benefits that using the DWECX-TEEPS could bring. The practice of using open-air burn pits can create many more associated costs related to the environmental, social, and safety and health impacts that they cause.

The following significant indirect costs have NOT been factored into the cost/benefit analysis:

a) Medical and death benefits for personnel living and working at a FOB who may be affected by toxic exposure from burn pits
b) Long-term support of veteran(s) and their families, who may be affected by toxic exposure from burn pits
c) Toxic exposure is also indicated in some rare genetic defects in children of servicemen and women therefore, this could be a multi-generational cost burden.
d) Cost of health impacts on local population – host nations may expect reparations for health damage from burn pits
e) Environmental liability – future costs to remediate areas where burn-pits were operated or where contractors dumped waste
f) Security costs – intelligence information in the wrong hands. Waste containing classified information which may include small scraps of paper with names, coordinates and other information could be damaging to base security or mission.
g) Reputational costs – unquantifiable harm to reputation due to the practice of burn pits may continue for many decades. One impact of this may be that new potential military recruits could be discouraged from enlisting due to concerns over health dangers of toxic exposure.
h) Poor environmental performance may limit the willingness of other nations worldwide to host US base camps due to concerns over unsustainable waste practices and the potential for local environmental degradation.
i) Cost of waste transportation and disposal – transportation costs are subject to escalation, and the fully burdened cost of waste transport including logistics and administrative effort is not fully incorporated into the cost of the waste transport option.

IMPLEMENTATION ISSUES

Transitioning and Transfer of Technology

- This ESTCP project yielded a proof of concept for micro-scale waste-to-energy using a conventional waste converter system that is based on an existing program platform.
- The US Army (PM-FSS) has an IDIQ contract open to procure the ESWDS (the platform on which the DWECX waste converter is based).
- The priority is to provide a fit-for-purpose system that meets the Army requirement for waste disposal at expeditionary bases. However, DOD is focused on reducing reliance on fossil fuels, therefore a concept to adapt the ESWDS to include expeditionary energy recovery would be of great interest.

- In addition to the Army, any DOD expeditionary forces could benefit from this technology for OCONUS use.
- Agencies carrying out disaster relief or humanitarian missions could also benefit from this technology.
- The ESWDS program has produced a production-ready design, detailed technical data packages, testing program outputs and training tools which will benefit the future transition of the waste convertor.
- The ESTCP project will provide expeditionary base camp planners with data and reports that detail system performance, including volume/weight of ash residual requiring disposal, and connections and integration with base camp infrastructure required to take advantage of the energy produced.
- Subsequent research and development will be required to adapt the concept further to make it operationally viable.
  - In particular the ORC engine technology requires an off the shelf equipment vendor to assist in ORC integration into the DWECX-TEEPS system
- Operational testing of the equipment, by soldiers, will be required to refine the package for eventual deployment.
- As development work matures project performance will be monitored against the Technology Transition Plan which will encompass operational, logistic, environmental, energy and financial performance data.

PROCUREMENT ISSUES

The DWECX-TEEPS is a custom-built prototype that brings together a combination of commercial off-the-shelf components, custom-fabricated items and subassemblies, and custom PLC Programming (ladder logic), as well as integrated custom-fabricated heat recovery system, and ORC for energy conversion.

Normally these bought-out items and fabrication can be easily procured, often from many different vendors (the ORC being one exception). However, currently there are global supply chain issues resulting in shortages and delays that are affecting almost every kind of manufactured product.

Production of this kind of specialized and highly integrated equipment requires particular experience, and know-how. Under normal circumstances, with a solid quality management plan, well-thought-out production plans, and a realistic schedule, an experienced team can reliably manufacture a system like this. At the moment, although some challenges have eased, production is likely to be slower than normal.

Similarly, scaling up production is also likely to be challenging with some components, unless alternatives are sought. However, in general higher rate production numbers lend themselves to smoother production as larger orders can be placed which are often prioritized by vendors and parts can be purchased in advance of need when production numbers are certain.

The prototype was designed using knowledge and know-how gained over many years of doing this kind of work and from previous research and development efforts that have been privately funded. Construction configuration, materials and components selected build upon this experience. PLC program ladder logic is based on previously developed proprietary systems. However, new technologies developed as a result of this work would likely be covered under government purpose rights.

ENVIRONMENT, HEALTH AND SAFETY

Environment

Meeting US EPA air emission limits requires the use of air pollution control technology, but with careful management of the input waste, and utilizing a well-controlled combustion process the ESWDS is proven to meet most of the applicable limits and is safe to operate near inhabited areas. However, when energy recovery is introduced, this is not expected to be the case. Waste heat recovery is proven to have a negative impact on air emissions and Air Pollution Control equipment adds considerable cost, and logistical burden. This study helps to further the understand the impacts of energy recovery on air emissions.

Health and Safety Considerations

The equipment meets current safety regulations. It is expected that any future changes in the safety regulations could be met with some design changes that would not significantly impact implementation of the technology. The following are the key safety areas addressed by the equipment that could have increased regulations in the future.

- If the solid waste is not properly segregated to eliminate hazardous materials, some changes in in the waste process may be necessary
- The system operates at elevated temperatures (up to 850°C or 1562°F). All areas that may pose high temperature hazards are clearly identified and automated programing in place to prevent the door from being opened until ash has cooled. If required physical guards around hot surfaces these can be added with relatively minor design changes.
- Contact with hot water is not expected during heat recovery, however, if required personnel shall wear proper personal protection equipment for handling hot liquids (e.g., safety glasses, insulated gloves).
- Operators that remove the ash from the unit will be required to wear dust masks, safety glasses, and gloves. Subsequent examination and sampling of ash will require dust masks, safety glasses, and gloves.

1.0 INTRODUCTION

1.1 BACKGROUND

1.1.1 The Environmental Problem Addressed

The Department of Defense (DOD) overseas contingency operations (OCO) generate significant amounts of solid waste that requires proper treatment and disposal. Poor waste management practices create many hazards, security vulnerability, logistical challenges, and the long-term legacies of pollution. In past overseas deployments burn pits were considered an expedient method of waste disposal. However, they created many other problems by using large areas of land, consuming large amounts of fuel, creating security vulnerabilities, and polluting the ground, air, and water. Burn pits have been linked to severe health impacts on troops and host-nation populace.

Deployable incinerators address most waste-related security concerns, use less fuel, require less space, and have very good emissions, but they are not producing energy. The reason that disposal is favored over waste-to-energy is that the addition of energy recovery dramatically changes the technical and operational complexity of the thermal treatment system which is problematic in deployed settings. Energy recovery is also more practical and feasible when systems are supplied feedstock constantly on a 24-hour per day basis, but this level of attention can take away from the mission, particularly for an expeditionary sized base camp. Successful transition to the expeditionary base camp would require an effective waste disposal system that is easy to operate with a low-cost, simple, yet robust design. The biggest challenge the small amount of waste as it limits the positive energy output that the can be achieved.

1.1.2 The Technology Demonstrated

The DWECX is a variant on the design of EWSDS (Expeditionary Solid Waste Disposal System), a system developed by Eco Waste Solutions for the US Army. The DWECX design expands on the proven waste disposal capability of the ESWDS by adding an integrated energy recovery feature. Like the ESWDS, the DWECX waste conversion process is one of starved-air gasification of waste, followed by excess-air oxidation of the gaseous byproducts generated in the conversion process. This process is automated by a unique proprietary control system that regulates key process parameters within an ideal range. This tight control, within optimal ranges, produces significantly lower air emissions compared to typical thermal treatment technologies. Like the ESWDS, the DWECX can dispose of up to 1000 lbs. (0.5 tons) per day of typical solid non-hazardous military base waste, reducing the volume up to 95%.

The TEEPS component was provided by EthosGen with support from their partner Rockwell Collins. EthosGen and Rockwell have previous experience with recovery of waste heat and production of electrical power using an Organic Rankine Cycle (ORC) engine. The TEEPS was designed to capture waste heat from the DWECX exhaust using a heat-pipe type of Heat Exchanger (HX) to then circulate it to the engine/generator to produce electricity. A second heat exchanger condenses the working fluid using cooling water which can be used for hot water or space heating.

As the hot gases leave the incinerator exhaust stack it passes through a through flow heat pipe heat exchanger. The heat exchanger contains thermal oil which in turn transports the heat to the ORC.

The EthosGen ORC is known as the CraftEngine, with its unique piston expander, instead of more commonly used turbine, screw, or scroll expanders, provides substantial advantages including ease of manufacturing, low cost, and high mechanical and thermodynamic efficiency. The small physical size and simplicity of the integrated system are major advantages over other methods.

The major components were packaged/containerized into three TRICON modules to be compatible with military airlift, sealift, and ground transportation. Each TRICON weighs less than 10,000 lbs. and can be lifted using only a forklift. This design will enable our system to be deployed to small base camps without the need for large material handling equipment.

1.1.3 Expected DOD Benefit

While technically simple, the current practice of burning solid waste in open pits has proven to be unsatisfactory in meeting security, safety, and resource requirements of contingency bases. The proposed fit-for-purpose thermal conversion system would eliminate common chemical and biological hazards and significantly reduce the volume of the waste, therefore reducing logistic and administrative effort required. By its compact footprint and clean effluent, the system would have reduced signature and could be located near compatible base functions such as generators, simplifying installation, operation, and security requirements. Ideally, waste is converted to energy as received, with no preprocessing or separation of materials required as it is important to minimize the labor required for waste management activities in a contingency base. Opportunities exist to re-use the ash residual from waste processing for localized site improvements, such as inert fill for construction loading, or for or roadbed/hard-stand material. The addition of heat harvesting equipment enables the capture and conversion of waste heat into electrical power and/or thermal energy in the form of hot water for showers, dining halls and other purposes, thus reducing the amount of logistic fuel required for base operations. The entire system, inclusive of the bolt-on heat recovery device, is containerized for transportability. The goal is to have a pre-configured, pre-wired and pre-tested system that can arrive on site in a virtually "plug and play" state. The technology must operate efficiently under various environmental and operating conditions. Any temporary site requiring waste disposal, such as forward combat operations, humanitarian, or disaster relief operations, will benefit from having this capability available. If the added energy capabilities are not desired or feasible in the given the location the system must still process base camp waste efficiently and effectively. The data collected and analyzed from the demonstration could be used to develop and produce systems of different sizes and capacities, based upon need. Life cycle cost savings include reduced logistical burden of waste and fossil fuel requirements, but also enhanced operational security, force availability, and agility. Moreover, improved environmental performance may not only improve goodwill and sustainability, but also increase flexibility in siting of contingency bases worldwide. ROI is 5 months and cost savings are estimated at $142,000/month. Cost saving are based on the cost of fuel and electricity at FOB according to IECU, and comparison to the Fully Burdened Cost of Waste, and other publicly available sources.

1.2 OBJECTIVE OF THE DEMONSTRATION

The overarching objective for this project is to design and build a prototype of the "DWECX-TEEPS", demonstrate its operation and evaluate performance in the following areas: 1) Logistics, 2) Waste Processing, 3) Energy Production, 4) Environmental.

1) Logistical Objectives:

- Maintain an expeditionary logistical footprint – One 20' ISO Container
- Package and containerize DWECX-TEEPS into three TRICON modules to be compatible with military airlift, sealift, and ground transportation modes
- Capability to operate in worldwide climatic conditions

2) Waste Processing Objectives:

- Easy-to-use system to process 1000 lbs. (1/2 ton) of waste in a 24-hour day
- Reduce waste by over 95% to a benign residue safe for disposal

3) Energy Objectives:

- Reduce use of fossil fuel required for waste disposal
- Capture the waste heat generated from garbage disposal
- Produce electrical power and hot water

4) Environmental Objectives:

- Obtain air emission data with and without energy recovery
- Analyze emission data

Table 1 lists the performance objectives and a potential criterion for evaluation to determine if the overarching objectives for this demonstration have been successful.

Table 1. Performance Objectives and Evaluation Criteria

Performance Metric	Data Requirement/ Measurement	Success Criteria
Logistical footprint	Physical Dimensions	Complete package including all required gear to not exceed more than 20' ISO container, individual containers not to exceed 10,000 lbs.
Disposal Efficiency	Volume before and after	Waste material volume reduced by 95% or more
Fuel Efficiency	Fuel Consumption	Requires less than 25 gallons of diesel fuel per cycle
Electrical Power	Power Production	>= 10kW for 5 hours of operation (per burn)
Hot Water	Water Production	>= 13GPM with an ~ΔT of 70ºF (86 to 158ºF)
Air Emissions EPA regulations 40 CFR 60, Subparts AAAA and BBBB	Dioxins/Furans Metal Emissions including Cadmium, Lead and Mercury Total PM SO2, NOx, CO, HCl Fugitive Ash Opacity	Accredited laboratory to sample emissions generated by waste conversion, with and without energy Analyze the data to understand the impact of the energy recovery on the quality of emissions

1.3 REGULATORY DRIVERS

The installation energy priority of the Department of Defense is to ensure mission readiness through energy resilience. Energy resilience enables the Department's weapons platforms, facilities, equipment, and personnel to perform critical missions when the commercial grid and other off-base energy resources are unavailable. Finding technologies and approaches that lower these costs and provide highly reliable and securely available energy for locations where off-base energy resources are not available or for long duration grid outages remains a priority. The National Defense Authorization Act for Fiscal Year 2021 highlighted the importance of on-base energy resources and reducing the DoD's dependence on off-base resources. [1]

Recovering thermal and electrical energy from on-site produced solid waste, can provide an important component in the overall camp energy system to reduce reliance on off-base energy resources.

2.0 DEMONSTRATION TECHNOLOGY OVERVIEW

2.1 TECHNOLOGY DESCRIPTION - OVERVIEW

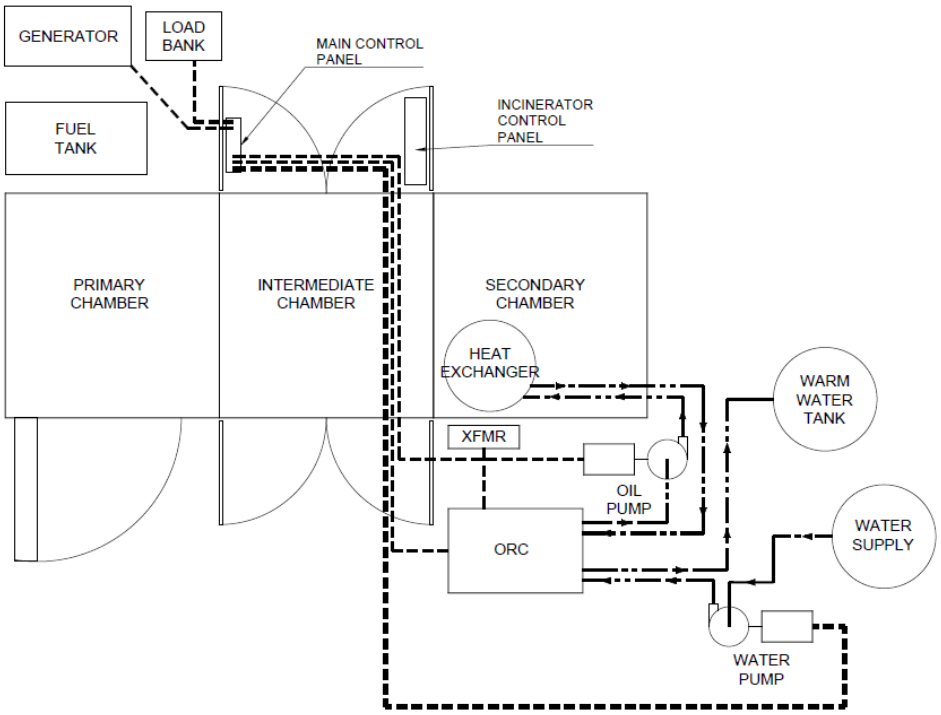


Figure 1. DWECX-TEEPS Technology Components Overview

The DWECX-TEEPS technology package as illustrated above includes the following key components;

1) Primary Chamber – a large chamber constructed of a heavy-duty steel shell with an insulating refractory liner where solid waste is loaded and undergoes the starved-air gasification process in a controlled temperature range of 760-815°C (1400-1499°F) during a burn cycle period, typically 4-6 hours. Following the burn cycle, the system goes into cooldown mode where the ash cooled. Ash residual is manually removed to complete the ~12-hour waste process cycle.
2) Secondary Chamber – a large chamber constructed of a heavy-duty steel shell with an insulating refractory liner where the gaseous products from the Primary Chamber are fed to be fully oxidized in a controlled temperature range of 850-1000°C (1562-1832°F).
3) Heat Exchanger/ Exhaust Stack – hot gases exiting the Secondary Chamber pass through the Heat Exchanger where the waste heat is captured, and the cooled gases are vented to the atmosphere.
4) Organic Rankine Cycle (ORC) Engine – waste heat is used to heat thermal oil and the oil pump transfers the energy to the ORC Engine where the energy is converted to electrical power. In the demonstration the generated electricity is absorbed by the load bank.
5) Heat Exchanger/ORC - The second heat exchanger in the system condenses and cools the thermal oil using water. The heated water is transferred to the warm water storage tank
6) Oil Pump – transfers thermal oil between the Stack Heat Exchanger and the ORC Engine in a closed loop heat transfer cycle.

7) Water Pump – transfers fresh cool supply water through the ORC heat exchanger where the water recovers waste heat from the thermal oil before then being transferred to the warm water tank
8) Intermediate Chamber – contains control panel, burners, blowers and the operator interface for the DWECX and the TEEPS.
9) Generator –a diesel generator is used to supply electrical power used required for start-up, ignition and system monitoring.
10) Fuel Tank – diesel fuel storage to supply the primary and secondary burners.

Note that a more detailed description of the DWECX-TEEPS technology package and components is provided in section 3.

2.2 TECHNOLOGY DEVELOPMENT PRIOR TO AND DURING THE ESTCP PROJECT

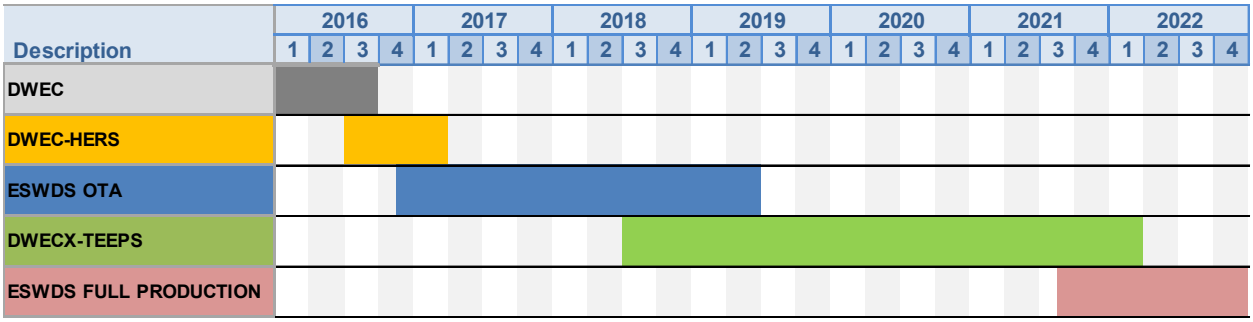


Figure 2. Technology Development History

2.2.1 Deployable Waste to Energy Convertor (DWEC) - Heat Energy Recovery System (HERS)

The DWEC and DWEC-HERS were developed and demonstrated by Eco Waste Solutions in 2016 and 2017 and provided a basis for subsequent containerized system development, as illustrated in Figure 2 above. The DWEC-HERS prototype was based on commercially available Eco Waste Solutions batch-operated, two stage waste conversion systems but with unique design features to meet the requirements of expeditionary deployments. It has a rated capacity of approximately 1000 lbs./day (over two 12-hour cycles per day), the estimated capacity required for a contingency basecamp with up to 250 people. The main differences from the existing commercial design are:

- The DWEC is configured as 3 interconnecting TRICON containers (8.0 ft. long by 6.5 ft. wide by 8.0 ft. high) with each module weighing less than 10,000lbs. This has significant logistical flexibility and advantages compared to the typical 20 ft. ISO Containers (8.0 ft. long by 20 ft. wide by 8.0 ft. high) used for mobile incinerators.
- The HERS is a micro-scale waste to energy feature that is optionally deployable. This feature located in its own TRICON container adds an induced draft duct and fan that pulls gases into a gas to hot water heat exchanger for the recovery of waste process heat in the form of hot water.

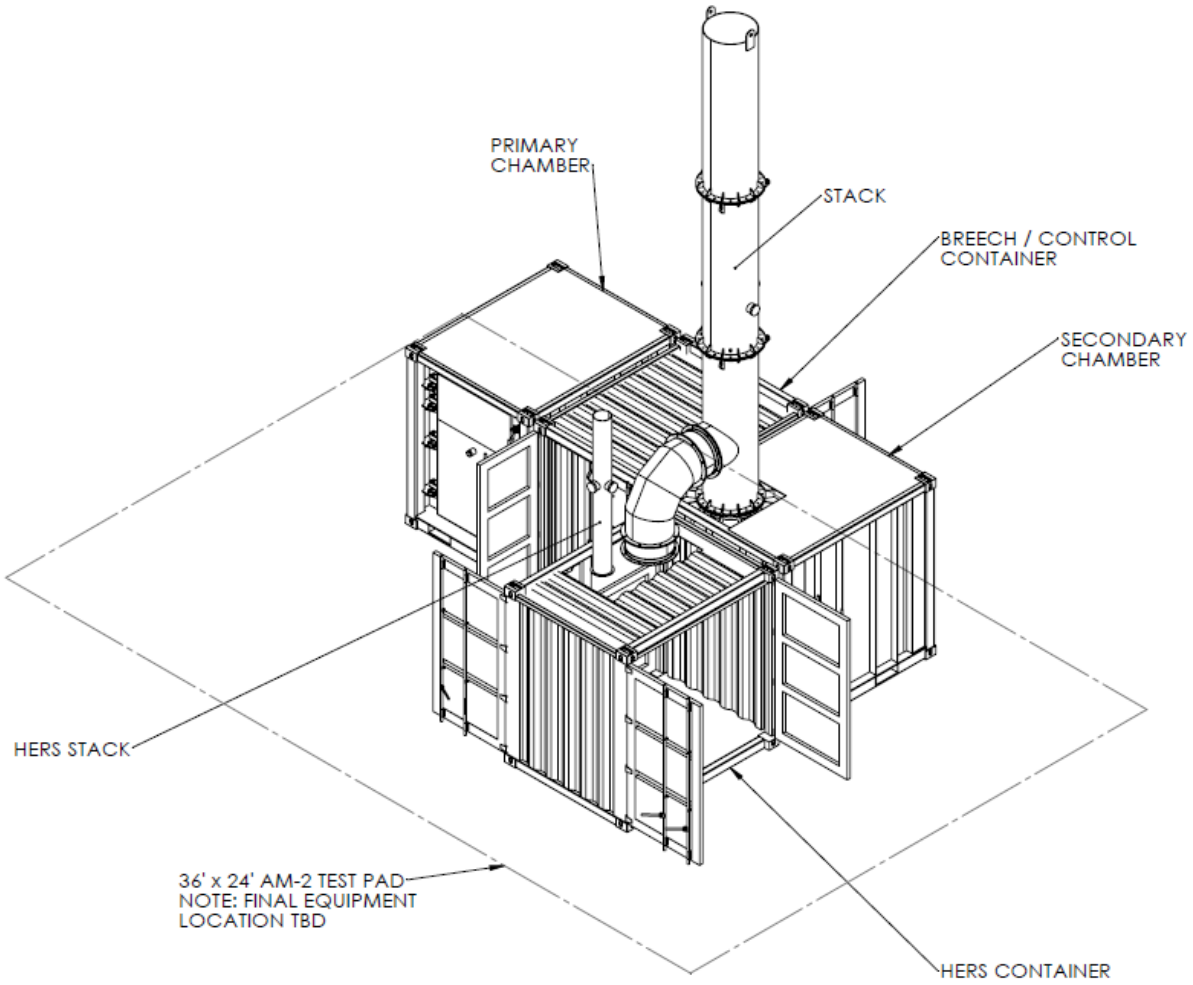


Figure 3. EWS DWEC-HERS System in Operational Configuration

The DWEC module can operate without the HERS attached. The HERS module can be attached/ operated in conjunction with the DWEC module when heat recovery is desired. The DWEC-HERS system is shipped and enclosed within four equal-sized TRICON containers that include the:

1. Primary Chamber
2. Secondary Chamber
3. Breech/Control Container
4. HERS Container

The Primary Chamber TRICON is a purpose-built large chamber constructed of a heavy-duty steel shell with an insulating refractory liner that has a large door at one end through which waste is loaded and ash/residues are removed. The unique design does not use a modified shipping container but instead the waste conversion chamber is fully integrated with the required stiffening, ISO corner blocks and fork pockets that allow for the same ease of transportability as a standard TRICON container. The Primary Chamber receives solid waste and thermally converts the waste to ash using a fully automated diesel burner for heating the waste to the point of self-combustion. It also has an air distribution manifold and blower for cooling the interior between burns.

The Secondary Chamber is connected to the Primary Chamber by a large interconnecting duct (breech) that passes through the Breech/Control Chamber. On the way to the Secondary Chamber the gases are mixed with fresh air via the combustion/mixing blower and heat supplied by a modulating diesel burner. This chamber is also refractory lined and has an internal rectangular shape (to maximize the volume available in the rectangular shaped TRICON shell). Like the Primary, the Secondary Chamber was developed as a purpose-built TRICON module that allows for ready transportation and deployment.

The DWEC module includes an exhaust stack that attaches to the Secondary Chamber for the processed gases to exit the system when not operated in heat recovery mode. When the HERS is attached, a t-duct is connected in place of one of the sections of exhaust stack. The t-duct is connected to draft inducing blower that draws most of the gaseous effluent into the HERS heat exchanger when in heat recovery mode. A pump circulates water that passes through a stainless-steel coil pack mounted inside the heat exchanger unit. The heated water is then sent to a 500-gallon temporary storage tank included with the system. The Breech/Control Container located between the Primary and Secondary Chamber containers houses the control panel and operator interface.

Key Technology Advancements

- The DWEC was Eco Waste's first-generation prototype of the future expeditionary solid waste disposal system that is uniquely configured as interconnecting TRICON containers that can be assembled using a forklift.
- The HERS demonstrated that 36 gallons/minute GPM of hot water (inlet water 92°F, Outlet water 118 °F) which is equivalent to 13 GPM of hot water (inlet water 86 °F, outlet water 158 °F) could be produced while processing a half ton of solid waste. This amount of hot water is ~500% above what the typical expeditionary camp consumes.
- The HERS highlighted the challenges of capturing waste heat from thermal waste treatment systems. The HERS Heat Exchanger (HX) was constructed of 304SS. Stainless steel is only marginally superior to mild steel when it comes to hot acidic conditions, molten salt corrosion, thermal cycling. After the two demonstration events the HX suffered catastrophic failure from acidic corrosion.
- Lessons Learned: High temperatures (1600-1800F) in combination with highly acidic gases lead to rapid corrosion of heat exchanger metal.
- Impact on future:
  - Mature design basis for the future ESWDS program.
  - DWECX-TEEPS utilizes a better heat exchanger design combined with ceramic coating – DWECX-TEEPS completed the testing and evaluation with minimal corrosion after longer operating periods compared to the DWEC-HERS
- Testing and evaluation of the DWEC-HERS focused on energy recovery and environmental outcomes. Data from this program has provided important baselines for future programs.

2.2.2 Expeditionary Solid Waste Disposal System (ESWDS)

In 2017 the Consortium for Energy, Environment and Demilitarization (CEED) facilitated a technology selection process and administered an Other Transaction Authority (OTA) development program for Product Manager Force Sustainment Systems (PMFSS). The objective of the program was to demonstrate a solid waste disposal system for use in expeditionary military environments, and assess its ability to meet a comprehensive list of requirements such as:

- capable of thermally destroying 1,000lbs. of mixed, unsorted, non-hazardous solid waste daily, reducing the volume of waste by at least 80%
- capable of air, sea, rail, and ground transport
- integrated with International Standardization for Organization (ISO) containers that meet all U.S. Coast Guard requirements, no container weighing more than 10,000 pounds.
- transport cube no more than 20-feet long, 8-feet wide, and 8-feet high
- unloaded from transport vehicle, set-up and ready for disposal within 8 hours, by no more than 4 Non-MOS (Military Occupational Specialties) soldiers, using a forklift with a lifting capacity of 10,000lbs.
- struck, ready and loaded on transport with same limitations as above
- operational configuration area no more than 20' x 40'
- easy loading and operation by no more than two soldiers
- control system that minimizes operator inputs and oversight to dispose waste.
- use camp electrical supply of 120/208V, 3-phase and be capable of operating using primarily JP8 fuel
- demonstrate a probability of at least 97 percent that it can complete a 10-hour operating shift without an essential function failure in all ambient conditions of both hot and basic climatic categories as defined in AR 70-38 (Research, Development, Test and Evaluation of Materiel for Extreme Climatic Conditions); and after transportation-induced shock, vibration and drop test.
- Other validations to include ground mobility and transport drop
- comply to the greatest extent feasible with the emission limits of Title 40 CFR 60, Subpart EEEE, Other Solid Waste Incinerator Units, assure resulting chemical concentrations at ground level remain at or below long term (1-year) "negligible severity" for air exposure as defined by U.S. Army Public Health Command Technical Guide 230 (USAPHC TG 230).
- maintain quality control and configuration control to assure the prototypes meet the design.
- deliver quality operation and maintenance manuals and training to support Government test and evaluation events.

Eco Waste Solutions had been developing and deploying mobile/containerized waste disposal systems for military applications for almost 2 decades and had designed the DWEC to meet the emerging requirements of the Army and other commercial customers looking for similar capabilities.

The DWEC waste processing unit provided a mature design that had already been demonstrated and tested processing the Army's Waste Mix (see section 4.2 Simulated Waste Feed Materials for details) representative of the typical solid waste found in an expeditionary base camp. The ESWDS eliminates the need to burn trash in open pits or alternatively backhauling the waste outside the secured area. The ESWDS utilized the DWEC's 3 TRICON design including the Primary Container, Middle Container, and Secondary Container. The containers are connected using eight horizontal connectors to form a 20-ft shipping container. Two sets of forklift pockets are provided in the base of each TRICON to allow pick-up and movement from any direction. The ESWDS can be ground transported as a complete system with any platform capable of handling 30,000 pounds, or can be transported as individual TRICONs, with any platform capable of handling 10,000 pounds. The ESWDS can be transported by C-130 and larger aircraft, CH-47D and larger rotary winged aircraft, sealift support watercraft, rail, and ship.

When the ESWDS is set up for operation, the Primary Container is connected to the Middle Container, and the Middle Container is connected to the Secondary Container using eight horizontal connectors. Four support legs with adjustable feet (stored inside the Middle Container) are attached to the Primary and Secondary Container end walls to allow the ESWDS to be leveled for operation. A four-section exhaust stack, stored inside the Middle Container, is assembled and connected to the Secondary Container. The ESWDS is designed to process 1,000 pounds of waste per day, in two 500-pound batches. The ESWDS utilizes JP-8, DF-1, or DF-2 fuel in the disposal process. The ESWDS requires external 208 VAC, 3-phase, 40-amp, 50/60-Hz electrical power, which can be supplied from field generators or fixed power sources as available.

Key Technology Advancements:

- Refinement of the DWEC interconnecting TRICON design to incorporate a lighter easier to deploy exhaust stack
- Rigorous testing regime validated the ESWDS ability to meet requirements and its feasibility for production
- Development of a complete set of technical documents including manuals, training materials and a provisioning system

2.2.3 Deployable Waste to Energy Convertor (DWECX) and Thermal Energy to Electrical Power System (TEEPS)

The DWECX-TEEPS was developed and demonstrated from 2018 through 2021 and influenced by the designs and experience of the DWEC-HERS and ESWDS programs. The DWECX-TEEPS is an energy focused design that includes increased fuel-efficiency and includes a novel energy recovery system.

The DWECX will dispose of up to 1000 lbs. (0.5 tons) per day of typical solid non-hazardous military base waste, reducing the volume by over 95%, and producing benign residues and emissions. The TEEPS component significantly expands the scope of the HERS module by not only producing hot water but by generating much needed electricity.

The TEEPS energy generation process developed by EthosGen and their partner Rockwell Collins, will convert the combustion heat produced by the DWECX to electrical power using the Organic Rankine Cycle (ORC) based engine. The TEEPS system will capture waste heat from the waste convertor exhaust through a heat exchanger and circulate it to the engine/generator. A second heat exchanger will condense the working fluid using cooling water which can be used for hot water or space heating or rejected through an air cooler. The CraftEngine, with its unique piston expander, instead of more commonly used turbine, screw, or scroll expanders, provides substantial advantages including ease of manufacturing, low cost, and high mechanical and thermodynamic efficiency. The small physical size and simplicity of the integrated system are major advantages over other methods.

The system will be packaged/containerized into three TRICON modules to be compatible with military airlift, sealift, and ground transportation. Each TRICON weighs less than 10,000 lbs. and can be lifted using only a forklift. This design will enable our system to be deployed to small base camps without the need for large material handling equipment.

Key Technology Advancements during the ESTCP project;

- Heat Exchanger (HX)
  - Optimal Heat Capture Device Location – Simulations were conducted to evaluate HX positioning in three locations, 1) inside the Secondary Chamber, 2) on top of the secondary chamber (i.e., Stack gas exit) and 3) installed in the breech (i.e., Inlet to the Secondary Chamber). The positioning of the HX at the Stack gas exit exhibited the most effective solution.
  - Working Fluid – Simulations were conducted to evaluate varying parameters for using several working fluids, material types, gas flow exit temperatures, number of heat tubes. A final selection of a high temperature thermal oil was utilized for the initial heat transfer between the heat tubes and ORC.
  - Material coating – A layer of Inconel 625 was applied through spray coating and showed promise for improving longevity of the heat exchanger heat pipes.
  - Outgoing stack temperature –The HX outlet temperature optimized to limit acidic gases, and dioxin and furan formation.

- DWECX
  - Middle Container Configuration – Modifications to the middle container weldment & configuration of hardware (blowers, burners, control panel, etc.) were made to optimize space to allow for storage and shipment of the additional waste to energy components.
  - Operator Interface – Allowed additional real time data and graphing to be observable throughout testing event.
  - Exhaust Stacks Configuration – Modified base design to allow for integration of through-flow heat exchanger in place of an exhaust stack.

- ORC
  - Commercial OTS – Identified integration issues of a commercial fixed-site ORC Engine package for application in a mobile containerized waste treatment package.

– Minimize footprint – The internal components and exterior shell were modified to allow for shipping inside of the middle container.

2.3 ADVANTAGES AND LIMITATIONS OF THE TECHNOLOGY

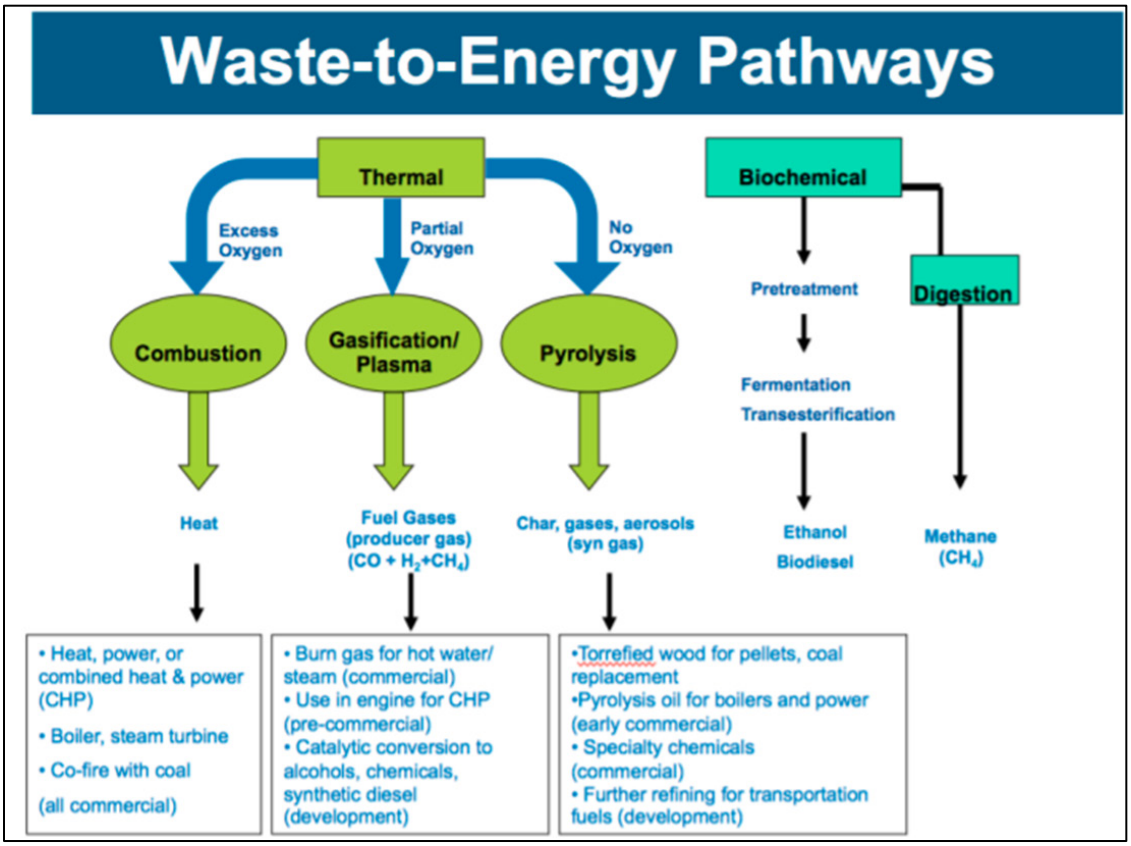


Figure 4. Waste to Energy Technologies

(source: https://www.nrel.gov/docs/fy13osti/52829.pdf)

Figure 4 above summarizes the types of Waste to Energy Technologies. Thermal WTE technologies are grouped by the chemical conditions, particularly the oxygen levels during waste conversion and output products.

Combustion involves the combustion of organic materials in the presence of excess oxygen to generate bottom ash, flue gases, particulates, and heat.

- Combustion technologies are the oldest, most bankable and proven technologies of the three methods of thermal waste to energy technology.
- Provides the most flexibility in waste feed processing and the highest simplicity of all three technology.
- However, on a large scale requires air pollution control emissions facilities to meet emissions standards.

Gasification/Plasma involves the conversion of solid material or biomass into a form of producer gas (syngas) which usually contains carbon monoxide, carbon dioxide, and hydrogen.

- Gasification doesn't generate energy through direct combustion. Therefore, gasification can be precisely controlled and produce extremely efficient methods of generating energy.
- However, the technology is new when utilized with energy generation, still growing and has limited plants in operation across the globe.
- Additionally, gasification/plasma technology requires an extremely skilled workforce, is inflexible when dealing with diverse or variable waste feedstock and has a lower volumetric/waste reduction than combustion.

Pyrolysis is the thermal decomposition of any material in which the material converts to the form of gas (biogas), liquid (tar), and solid (char) in the absence of air.

- Similar to gasification, the pyrolysis process boasts very high efficiency rates when generating energy with little to no air emissions quality concerns.
- However, the technology is similarly complex and even less mature than gasification with fewer instances of plant operation across the globe.
- Additionally, pyrolysis has the same issues when dealing with diverse or variable waste feedstock and volumetric/volume reduction.

As summarized above different technologies are more conducive to producing specific forms of energy.

2.3.1 Advantages and Limitations of DWECX-TEEPS Technology Versus Current and Alternative Technology

Advantages of DWECX-TEEPS Technology

- Packaged in TRICONs to provide a logistical footprint (~ 1 20-foot ISO container) and ease of handling (less than 10,000 lbs. per TRICON) as required for Forward Operating Bases (FOB). FOB require the processing of less than 10 tons per day of waste. Conventional WTE plants are permanent facilities (not transportable) sized to 100s-1000s tons per day of waste, as required for economies of scale.
- Conventional camp sized systems do not provide energy recovery. DWECX-TEEPS provides Electrical energy and Thermal energy recovery.
- FOB can be located anywhere in the world and so can experience extremes of temperatures and weather. The DWECX-TEEPS is designed to meet the challenges of austere weather conditions, based on EWS's years of experience in remote camp operations.
- The Containerized Design meets the priority of the FOB mission, which requires rapid mobility and ease of setup and takedown of all system.
- Meets the demands of FOBs for minimal soldier time and labor to prepare waste, and minimal skills required to operate and maintain the equipment, through the use of superior automated waste processing controls compared to conventional camp systems.

- Maintains quality of local air quality/personnel health which is often not the case for conventional camp waste systems. No visible emission can be observed from the DWECX-TEEPS. Stack emissions are effectively controlled in comparison to the Other Solid Waste Incinerators (OSWIs) of US EPA Standards of Performance for New Stationary Sources and Emission Guidelines for New Municipal Waste Combustion Units.
- The DWECX-TEEPS technology is designed to maintain a temperature of 850°C (1562°F) in the Secondary Chamber. This temperature limits the formation of Dioxins and Furans, and uses less fuel than systems with a higher temperature set-point. This technology eliminates the need for an Air Pollution Control System and its related costs, complexity, and larger footprint.

Limitations of DWECX-TEEPS Technology

- Currently small sized ORC Engine systems are a maturing technology that requires further development and testing in the field. The ORC technology used in this program will require additional diagnostics, repairs and/or development, or a new technology supplier will need to be sourced.
- A number of energy recovery systems are still in the process of being automated for the DWECX-TEEPs technology, and so a second phase of the program is required to complete the system automation.
- The energy recovery components are not fully containerized, and so a second phase of the program is required to complete the system containerization process.

2.3.2 Advantages and Limitations of DWECX-TEEPS Technology Noted During the Demonstration

Advantages

- Waste volume and weight reduction by over 95%.
- No visible emission observed. Effective control of stack emissions in comparison to the Other Solid Waste Incinerators (OSWIs) of US EPA Standards of Performance for New Stationary Sources and Emission Guidelines for New Municipal Waste Combustion Units.
- Automated waste processing controls and minimal operator input required, e.g., waste loading, ash cleanout, start system.
- Heat Exchanger design proved to be resistant to the corrosive stack gases and was effective at recovering significant thermal energy from the stack gases.

Limitations

- ORC Engine system had continued operational issues in the field demonstration, that could not be resolved. The ORC technology will require additional diagnostics and repairs and/or the use of a new technology supplier.
- Heat exchanger cooling loop VFDs were manually configured, additional process controls required to become fully automated.

3.0 EQUIPMENT AND TEST SITE DESCRIPTION

3.1 SYSTEM DESCRIPTION

The DWECX-TEEPS system (Figure 5) is based on the design of the ESWDS (Expeditionary Solid Waste Disposal System), in development by Enercon Systems Inc, in cooperation with the US Army. In comparison to the ESWDS, the DWECX is an energy focused design that includes energy recovery devices. The system is a batch-operated, two stage gasification/combustion mobile unit designed with a rated capacity of approximately 1000 lbs./day (assuming two 12-hour cycles per day).

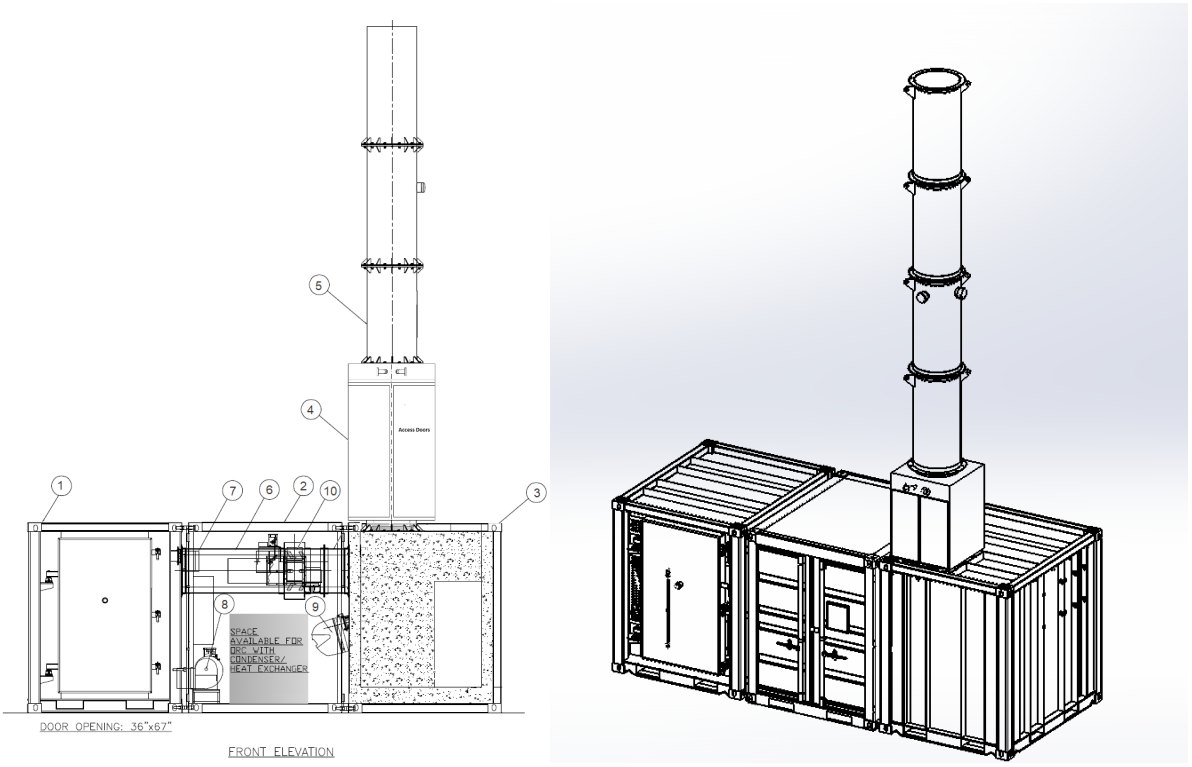


Figure 5. DWECX-TEEPS

1 – Primary Container, 2 – Middle Container, 3 – Secondary Container, 4 – Heat Pipes, 5 – Stacks, 6 – Breech, 7 – Primary Burner, 8 – Primary Blower, 9 – Secondary Burner, 10 – Secondary Blower

The DWECX-TEEPS system consists of two modules: the DWECX and TEEPS units. The DWECX module, which can be run stand alone, is similar to the standard two stage systems that EWS has manufactured for many years. The TEEPS module is manufactured by the project co-performers EthosGen in conjunction with Rockwell Collins.

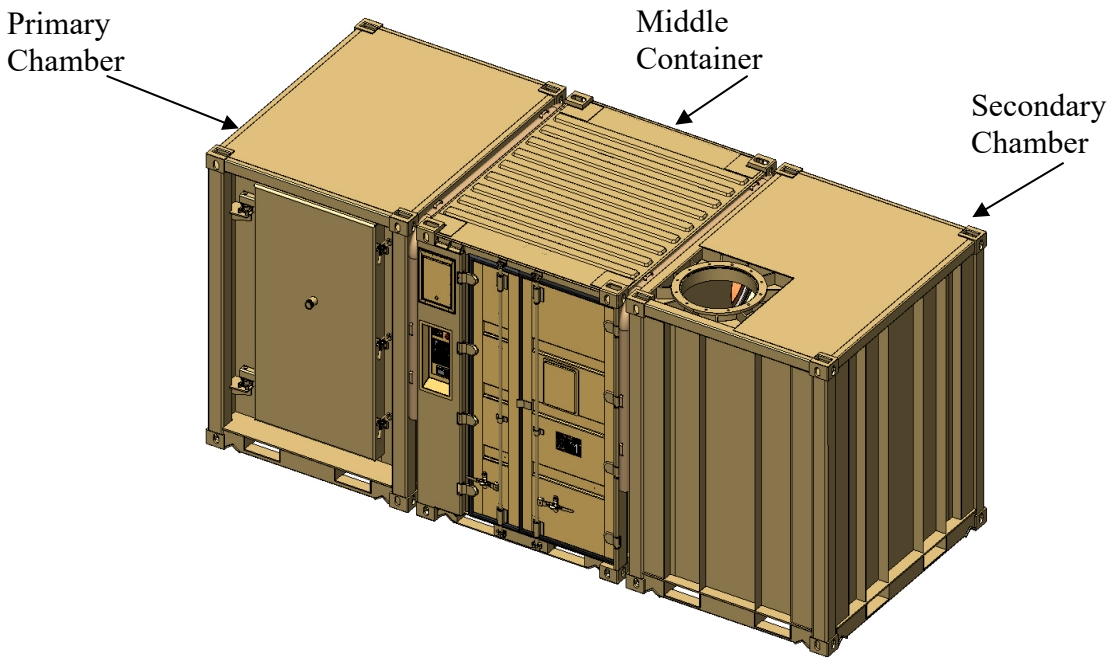


Figure 6. EWS ESWDS (DWECX basis)

The Primary Chamber is refractory lined and has a large door at one end through which waste is loaded and ash/residues are removed. It occupies one TRICON container. The Primary Chamber is equipped with a primary burner for heat up and a primary blower for cooldown. Air flow is controlled in the Primary Chamber through a damper. The Primary Chamber is connected to the Secondary Chamber by a large duct (breech) that passes through the Middle Container.

The Secondary Chamber (where the gaseous products from the primary chamber are fully oxidized) is also refractory lined and has an internal rectangular shaped volume. The Secondary Chamber occupies one TRICON container. The Secondary Chamber has a door for maintenance access and is equipped with a secondary burner (to maintain the setpoint temperature). The secondary blower is an induced blower located on the breech to control the flow from the Primary to Secondary chamber, air mixture and turbulence.

The system has one gas effluent stack, the gas exits from the top of the Secondary Chamber and passes through the Heat Exchanger before subsequentially exiting the stack assembly. The DWECX-TEEPS stack assembly will have a combined height of 13’ 6” (21’ 5” from grade). As gasses pass through the Heat Exchanger it captures waste heat and circulates it to the Organic Rankine Cycle (ORC) engine/generator. The combustion heat produced by the DWECX will be converted to electrical power using the ORC. A second heat exchanger will condense the working fluid using cooling water which can be used for hot water or space heating.

The Middle Container located between the Primary and Secondary Chamber TRICONs contains the control panel and operator interface for both the DWECX & TEEPS.

3.2 SYSTEM OPERATION

During normal operation, waste is first loaded into the Primary Chamber through the large main door. Once loaded, the door is closed, and the process automated cycle is started by the operator. Both the Primary and Secondary Chambers are first purged via the primary and secondary blowers for approximately two minutes to exhaust any potentially explosive gases that may be in the system. The ORC will be powered on and cooling fluid circulation established before the combustion cycles begin. Circulation pumps are manually regulated using motor speed controllers; the ORC uses an automated electronic control system to regulate engine startup and operation. The secondary burner is then started to heat the Secondary Chamber up to its setpoint temperature of 850°C (1562°F), with the ability to operate the Secondary Chamber at or up to 1000°C (1832°F) if desired. Once the Secondary Chamber reaches the setpoint, the primary burner is started, which begins the Burn Cycle. The primary burner remains on until the temperature in the Primary Chamber reaches 815°C (1499°F), at which point the gasification reaction should be self-sustaining. Once the reaction in the Primary Chamber begins to subside and is no longer generating sufficient heat, the temperature in the Primary Chamber will begin to drop. Once this temperature reaches 760°C (1400°F), the primary burner turns on again. The primary burner will cycle on and off as necessary to keep the Primary Chamber between 760-815°C (1400-1499°F) until the end of the Burn Cycle (as set by the control system timer) to ensure complete gasification of all organic material in the solid waste. The Burn Cycle can be determined during testing by the operator, but typically lasts 4-6 hours.

The Primary Chamber is where gasification of the waste takes place, as it is operated under sub-stoichiometric, or starved air, conditions. There is no forced air flow into the Primary Chamber, though sufficient air is present. Full combustion of the gaseous products generated in the Primary Chamber occurs in the Secondary Chamber. Unlike the Primary Chamber, the Secondary Chamber has excess air and turbulent conditions to enable complete combustion. The secondary burner and secondary blower continue to modulate as necessary throughout the Burn Cycle to maintain the Secondary Chamber at 850°C (1562°F). The modulating burner, and variable frequency drive (VFD) controlled blower work together to maintain the set point.

The TEEPS system is running as long as there is power to the system. The heat exchanger has been designed to operate at max efficiency once the Secondary Chamber temperature reaches its setpoint. While the TEEPS system is running there are two pumps that are used to transfer heat media throughout the system. An oil pump is used to transfer heat captured by the heat exchanger to the ORC engine. A water pump is used to capture / dispose of excess heat generated by the ORC engine. Based on temperature data being captured within the heat exchanger and ORC engine the system will modify the pumps operation as required. The generated electricity from the ORC engine is back fed up stream where it will be measured by a load bank to determine the amount generated.

The hot water (~ 66°C, or 151°F) generated by the ORC will be sent for storage or harmlessly released. At a target water flow rate of thirteen gallons per minute (13 GPM), it is expected that a burn cycle duration of approximately 4 hours should results in 3,120 gal of hot water.

When the Burn Cycle is completed, the cool-down cycle begins. At this point, the primary and secondary burners turn off and the primary blower turns on to send air through the system to slowly drop the temperature. The cool-down cycle will typically last for 5 hours, as set by the control system temperature sensor. At the end of the cool-down cycle, the system shuts down. Once the temperature in the Primary Chamber drops, the door can be opened to begin cleanout of ash and residues. During the majority of this test program, it is expected that ash cleanout will not take place until the following morning after the test.

The sequence of operation as planned for this test program is provided in Table 2 with estimated durations for each activity.

Table 2. Test Run Sequence of Operations and Estimate Duration

Activity	Duration (Hr:Min)	Description of Activity
Ash/Residue Collection	00:15	Each morning the ash/residues from the previous days' run will be removed from the Primary Chamber and collected in containers for later measurement, sampling, and analysis.
Waste Loading/ System Purge	00:15	Prepared simulated waste feed bags will be prepared each morning by adding the required quantity of food materials. Each bag will be weighed and loaded into the Primary Chamber. The door will be closed and the operator will initiate a 2-minute air purge to remove any potentially combustible gases from the system. Organic Rankine Cycle (ORC) power unit will be powered on and control system checked for normal indication. Cooling water will be run briefly to ensure proper flow; water temperatures recorded. Thermal oil pump will be started to establish flow through the heat exchanger and ORC system; starting temperatures recorded.
Secondary Chamber Heat-Up	00:30	Upon completion of the purge, the system will automatically commence heat-up of the Secondary Chamber to 850°C (1562°F). The ORC system will automatically regulate engine starting and throttle based upon heat available. For the duration of the cycle, thermal oil pump will be regulated to maintain input temperature to the heat exchanger unit at or below 130°C (266°F) (approximately twenty gallons per minute at full power). Water cooling pump will be regulated to maintain hot water temperature at or below 70°C (158°F).
Burn Cycle	04:00 – 06:00*	Upon reaching the secondary chamber temperature of 850°C (1562°F), the Burn Cycle will automatically commence. The primary burner will turn on to bring the primary chamber to 815°C (1499°F) and then maintain the temperature between 760 and 814°C (1400 and 1499°F) for a set amount of time determined by the EWS operator. During the burn cycle, the primary blower will not be used. Air input will be controlled by the system dampers.
Cool-down	05:00	All burners turn off and the Primary blower is used to cool the system.
Non-Powered Cooldown	Overnight	All blowers turn off.
TOTAL	**10:00 – 12:00 + Overnight**	

Note*: It may be necessary to increase burn cycle length during emissions sampling to allow for sufficient sampling duration.

3.3 TEST SITE SELECTION, LAYOUT AND RESPONSIBILITIES

In the initial proposal for ESTCP EWS suggested Tyndall AFB to be the demonstration site due to lower cost and proximity. As Tyndall AFB was no longer available to support the DWECX-TEEPS demonstration additional alternative sites were evaluated. Please refer to the report "WP18-5149 ESTCP – DWECX-TEEPS White Paper – Demonstration Site Selection, May 8, 2020 Revision A" [2] for details of the evaluation of eight potential demonstration sites.

The key selection criteria used in the evaluation were Environmental Permitting, Estimated Total Cost and Availability of site.

The final selected test site was at the Army Test and Evaluation Command (ATEC), Aberdeen Proving Ground (APG), Generator Test Bed.

Electric power, fuel and water was be provided by APG. Fuel was fed to the EWS system from a double wall fuel tank. The system fuel tank has a capacity of 581 gal (2220 l) and was placed adjacent to system. The connection point for electric power was located adjacent to the system. The system requirements (208 V, 3 phase) were supplied by a generator and connected to the EWS system through a pig-tail electrical cable. EWS provided two 2500gal water tanks to circulate hot/cold water and estimates that it will utilize 2500 gallons of water for each test (assuming re-use of water).

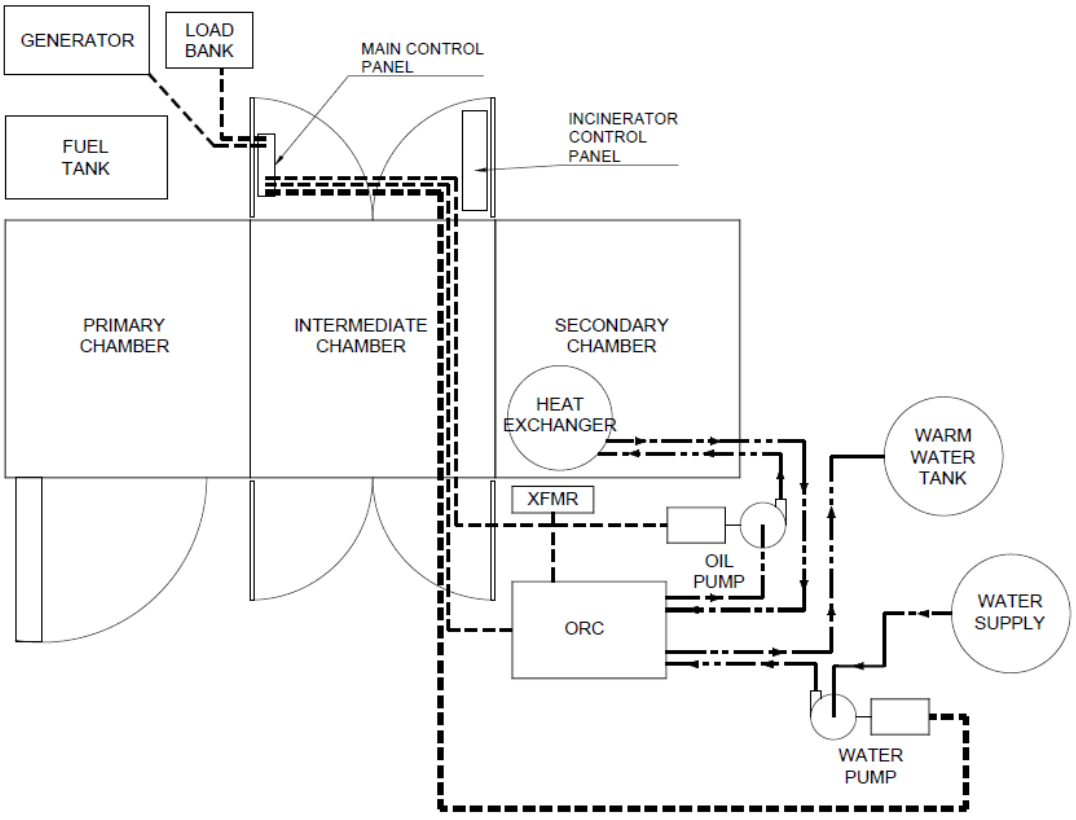


Figure 7. Test Site Layout

Table 3 summarizes the major equipment and materials that was needed for performance of these tests and the organization responsible for providing each one.

Table 3. Equipment Material and Responsibility

Eco Waste Solutions	EthosGen/ Rockwell Collins	Aberdeen, ATEC (Demonstration Site)	Alliance Source Testing/RWDI (Emissions Company)
DWECX system and associated equipment	TEEPS and associated equipment	Necessary space to setup & perform demonstration plan	Necessary equipment to setup & perform air emissions testing (section 6.0)
Spare parts and/or maintenance items as needed	All necessary consumables or heat media required for operation (thermal oil, etc.)	Connection & supply of electricity (generator), water (tanker trunk) & diesel (diesel truck)	
Feed materials (section 5.1)	On-site support during installation, operation and troubleshooting	On-site manpower support throughout duration of testing	
Rental equipment for Emissions Company (boom lift)	Spare parts and/or maintenance items as needed	Necessary permit to setup & perform demonstration plan	
		Installation equipment (crane & forklift) to support installation and decommissioning/ shipping off site	
		Pop-up tent / shelter from inclement weather	
		Disposal of ash remains	

4.0 TEST DESIGN

4.1 OVERVIEW

Table 4. Demonstration Testing Plan

Date	Configuration	Tests to be Conducted
Week 1	System assembly and checkouts	
Week 2	Base DWECX with Heat Exchanger and TEEPS	Four simulated waste burns over 4 days - Electrical Power Recovery - Hot water recovery
Week 3	Base DWECX with Heat Exchanger and TEEPS + Air Test scaffolding and equipment	Three simulated waste burns over 3 days - Air emission tests - Electrical Power Recovery - Hot water recovery
Week 4	Base DWECX + Air Test scaffolding and equipment without Heat Exchanger and TEEPS	Three simulated waste burns over 3 days - Air emission tests

4.2 SIMULATED WASTE FEED MATERIALS

All feed materials were prepared by EWS according to the Test Standards developed by U.S. Army Research Laboratory "Test Standards for Contingency Base Waste-to-Energy Technologies", [3]. The "Standard Waste Mixture" defined in the standard was used for the March demonstration. However, the waste was burning too hot during this demonstration due to the feed materials drying overnight making it difficult to control the primary chamber temperatures to the required range. Therefore, the Standard Mixture was used for the October 26th test but a Modified Standard Waste Mixture was used during the October 27th and October 28th tests to evaluate the control strategies for the Primary Chamber temperatures. In the modified mixture the Food Waste category only was modified by removing the 2% Canola Oil and increasing water content from 23.35% to 38.48%. The modification of the waste mixture reduced the Higher Heat Value from 5,314 BTU/lb. to 4,165 BTU/lb.

The simulated waste feed materials were prepared onsite in trash can liners (bags) for the standard test recipes using the approximate component weights as shown in Tables 5 and Table 6. The detailed waste mixture characterization and materials that were procured (waste recipe) and used for each waste component category are provided in Appendix B1.

Table 5. Standard Recipe by Weight Percent

Waste Category	Standard Recipe	Modified Standard Recipe
Cardboard	15%	12%
Mixed paper	10%	8%
Food waste	32%	44%
Plastic (total)	15%	12%
Wood	14%	12%
Metals	6%	5%
Glass	1%	1%
Rubber and neoprene	1%	1%
Textile	3%	2%
Miscellaneous waste/Other	3%	2%
Total	100%	100%

Note: All values shown are weight percentages. Values were adjusted for round-off errors and percentages are provided as whole numbers. Further breakdown of plastic types is provided in Table 6.

Table 6. Breakout of Plastic Recipes by Weight Percent

Plastic Type	Standard Recipe	Modified Standard Recipe
Plastic (total)	15%	12.4%
#1 PET	6.0%	4.9%
#2 HDPE	2.7%	2.2%
#3 PVC	0.9%	0.7%
#4 LDPE	2.7%	2.2%
#5 PP	0.3%	0.2%
#6 PS	1.8%	1.5%
#7 Other	0.6%	0.5%

Note: All values shown are weight percentages. Values were adjusted for round-off errors and percentages are provided as whole numbers.
PET polyethylene terephthalate
HDPE high density polyethylene
PVC polyvinyl chloride
LDPE low density polyethylene
PP polypropylene
PS polystyrene
Other plastics that may include polycarbonate, acrylic, nylon, bioplastics, composites, etc.

Table 7 contains the approximate specifications for each feed recipe bag to include the bag capacity, estimated bag content volume, bag weight, bag density, estimated energy content per pound, and estimated moisture content.

Table 7. Approximate Feed Recipe Bag Specifications

Anticipated Bag Specification	Standard Recipe
Bag capacity (gallon)	60
Bag content vol. (cu. ft.)	4
Bag weight (lbs.)	30
Bag density (lbs./cu. ft.)	7.5
Bags per batch	16
Weight per batch (lbs.)	480
Energy Content (BTU/lb.)	4,165
Moisture (wt. %)	38.5

4.3 PROCESS DATA COLLECTION

Process data was collected both manually and automatically with the equipment data logging capability. All electronic data logs were backed up daily. Table 8 provides the process monitoring data that was collected manually, method of collection, and frequency. Table 9 provides the process monitoring data that was captured by the system automatically.

Table 8. Manual Process Monitoring Data Collection

Process Data Item	Collection Method	Collection Frequency
Bag weights & quantity	Total weight & quantity used was determined by the number of pre-prepared simulated waste mixes used.	Prior to each test run.
Ash volume	Volume of ash was estimated based on volume of metal trash can used for collection.	Once per test run.
ORC hot fluid inlet / outlet temp	Via thermocouple mounted on piping	Every 5 min
ORC coolant inlet/outlet temp	Via thermocouple mounted on piping	Every 5 min
ORC pump VFD setting	Manually via display on VFD	Every 5 min

Table 9. Process Data Captured by Data Logger

Process Data Item	Units	EWS / EthosGen	Frequency
VFD	%	EWS	1 min
Primary Chamber Damper Position	% Open	EWS	1 min
Primary Chamber Temperature	°C	EWS	1 min
Secondary Chamber Temperature	°C	EWS	1 min
Stack Inlet Temperature	°C	EWS	1 min
Middle Container Temperature	°C	EWS	1 min
Stack section Temperature	°C	EWS	1 min
Primary Burner	On/Off	EWS	1 min
Secondary Burner	On/Off	EWS	1 min
Primary Blower	On/Off	EWS	1 min
Secondary Blower	On/Off	EWS	1 min
Control Power	On/Off	EWS	1min
Primary Air Proving Switch	Open/ Closed	EWS	1 min
Primary Chamber Door	Open/Closed	EWS	1 min
Primary Chamber Draft	Pa	EWS	1 min
Primary Burner Fault	Yes/No	EWS	1 min
Secondary Burner Fault	Yes/No	EWS	1 min
Fuel Fault	Yes/No	EWS	1 min
VFD Fault	Yes/No	EWS	1 min
Cycle in Progress	Yes/No	EWS	1 min
Cycle Stage	PURGE/HEAT-UP/ BURN/ COOLDOWN	EWS	1 min
ORC Fault	Yes/No	EWS	1 min
High Temperature Limit	Yes/No	EWS	1 min

4.4 STACK EMISSIONS SAMPLING AND ANALYSIS

Alliance Source Testing (AST) was contracted to perform air emissions testing during the March 2021 demonstration and Valley Environmental with RWDI USA, Consulting Engineers were contracted to perform air emissions testing during the October 2021 demonstration.

Testing and analysis procedures used for this project are presented in the Environmental Protection Agency (EPA) document Title 40, on the EPA Technology Transfer Network Emission Measurement Center (EPA-TTN- EMC) website, Test Methods Section [4]. All emissions testing will be performed by the above contracted vendors and/or their contracted laboratories in accordance with the test standards. Any deviations from the test standards shall be provided.

Testing will include determining the emission rates of particulate matter (PM), PM less than 2.5 and 10 microns (PM2.5 & PM10), sulfur dioxide (SO2), nitrogen oxides (NOx), carbon monoxide (CO), hydrogen chloride (HCl), hydrogen fluoride (HF), hydrogen bromide (HBr), bromine (Br2), chlorine (Cl2), methane (CH4), non-methane volatile organic compounds (NMVOCs), speciated volatile organic compounds (VOCs), polychlorinated dibenzodioxins and dibenzofurans (PCDD/PCDF), semi-volatile organic compounds (SVOCs; including polycyclic aromatic hydrocarbons (PAHs)), and multiple metals at the exhaust of an incinerator unit. Visible emissions evaluations (VEE) for fugitive emissions and opacity determinations will also be performed.

Table 10. AST Emission Test Parameters and Method Standards

Location	Parameter	Reference Test Method	No. Of Test Runs Planned
Incinerator Main Stack (Sample Ports)	Volumetric Flow Rate	EPA 1-2	1 Test ~5-6 hr. / Burn Cycle 3 Burn Cycles (DWECX) 3 Burn Cycles (DWECX-TEEPS)
	Oxygen / Carbon Dioxide	EPA 3A	
	Moisture	EPA 4[1,2,7,8]	
	Particulate Matter	EPA 5	
	Sulfur Dioxide	EPA 6C	
	Nitrogen Oxides	EPA 7E	
	Carbon Monoxide	EPA 10	
	PCDD, PCDF & PAHs	EPA 23 / 0010 [3,4,8]	
	Non-Methane Volatile Organic Compounds & Methane	EPA 25A	
	Halogens & Halides	EPA 26A[3,7,8]	
	Multiple Metals	EPA 29 [3,8]	
	Semi-Volatile Organic Compounds	EPA TO-15 [3]	
	Opacity	EPA 9	1 – Visual check during burn cycle

1 AST will conduct the sample analyses at the Decatur, AL laboratory.

2 Particulate sizing will be performed utilizing Computer Controlled Scanning Electron Microscopy (CCSEM) for PM2.5 & PM10. The post gravimetric filterable particulate samples will be sent to a subcontract lab for additional analysis. The analysis will be subcontracted to MVA Scientific Consultants located in Duluth, GA

3 AST will subcontract the sample analyses to Eurofins Test America located in Knoxville, TN.

4 All the sample fractions will be combined into a single fraction by the analytical laboratory before analysis and an individual catch for each of the PCDD/PCDF & PAH congeners will be reported. If separate fraction FH/BH analysis is required, additional costs will be applicable.

5 Compounds include hydrogen chloride (HCl), hydrogen fluoride (HF), hydrogen bromide (HBr), bromine (Br2) and chlorine (Cl2).

6 Metals include antimony (Sb), arsenic (As), barium (Ba), beryllium (Be), cadmium (Cd), chromium (Cr), cobalt (Co), copper (Cu), lead (Pb), manganese (Mn), mercury (Hg), nickel (Ni), phosphorous (P), selenium (Se), silver (Ag), thallium (Tl), and zinc (Zn). Separate front half and back half fractional analysis will be performed.

7 The particulate matter Method 5 sampling will be combined with Method 26A sampling train.

8 Due to expected low stack velocity, each train (Methods 5/26A, 0023A/0010, & 29) will be sampled from a single point. The average stack gas velocity will be verified before and after the completion of each test run.

Table 11. RWDI Additional Air Emission Sample Methodology

Parameter	U.S. EPA Reference Test Methods	Notes/Remarks
Volumetric Flow Rate	1-2	Full Velocity Traverses
Oxygen / Carbon Dioxide	3A	Instrumental Analysis
Moisture	4	Gravimetric Analysis
Particulate Matter & Halogens & Halides	5 & 26A*	Isokinetic Sampling
Sulfur Dioxide	6C	Instrumental Analysis
Nitrogen Oxides	7E	Instrumental Analysis
Opacity	9	Certified Observer
Carbon Monoxide	10	Instrumental Analysis
PCDD, PCDF & PAHs	23 / 0010*	Isokinetic Sampling
Volatile Organic Compounds	25A	Instrumental Analysis
Multiple Metals	29*	Isokinetic Sampling
Semi-Volatile Organic Compounds	TO-15	Constant Rate Sampling
Gas Dilution System Certification	205	---

* Due to expected low stack velocity, each train (Methods 5/26A, 0023A/0010, & 29) was sampled from a single point. The average stack gas velocity was verified before and after the completion of each test run.

Final sampling methodologies and quality assurance/control activities are detailed in Appendix B3: Stack Emission Results "2021 Source Testing Program (Incinerator Main Stack) Eco Waste Solutions Aberdeen proving Grounds".

Note that this final report from RWDI, pulls together activities and results from the AST March 2021 emission test program and the RWDI October 2021 emission test program [5].

5.0 PERFORMANCE ASSESSMENT

5.1 OVERVIEW

Table 12. Performance Objectives and Evaluation Criteria

Performance Metric	Data Requirement/ Measurement	Success Criteria
Logistical footprint	Physical Dimensions	Complete package including all required gear to not exceed more than 20' ISO container, individual containers not to exceed 10,000 lbs.
Disposal Efficiency	Volume before and after	Waste material volume reduced by 95% or more
Fuel Efficiency	Fuel Consumption	Requires less than 25 gallons of diesel fuel per cycle
Electrical Power	Power Production	>= 10kW for 5 hours of operation (per burn)
Hot Water	Water Production	>= 13GPM with a ~ΔT of 70ºF (86 to 158ºF)
Air Emissions EPA regulations 40 CFR 60, Subparts AAAA and BBBB	Dioxins/Furans Metal Emissions including Cadmium, Lead and Mercury Total PM SO2, NOx, CO, HCl Fugitive Ash Opacity	Accredited laboratory to sample emissions generated by waste conversion, with and without energy Analyze the data to understand the impact of the energy recovery on the quality of emissions

Figure 8. DWECX-TEEPS Demonstration Equipment Setup at APG

Figure 9. Demonstration Equipment Setup at APG

Figure 10. Demonstration Equipment Setup at APG Continued

Figure 11. Emission Stack Sampling Equipment

Figure 12. Emission Stack Sampling Equipment Continued

5.1.1 Overview of ORC Issues and Status

The ORC engine package as supplied in June 2020 underwent a power up check, in-house at the EthosGen work shop as shown below.

Figure 13. Organic Rankin Cycle Engine Package

In preparation for a low temperature test in the fall of 2020 the generator size was selected as 60A 3ph, 208V, 60Hz. Integration between the ORC power generation and generator output was planned such that at start-up the generator is used but eventually the ORC becomes a generator and can feed power back into the breaker box and into the load bank. Excess power that is being produced by the ORC is taken by the load bank so the generator can still run properly. The Load bank is sized the same as the ORC. Different load cells on the load bank are available such that setting the load bank high allows the ORC and generator to run at max efficiency.

In October 2020 the DWECX-TEEPS equipment packages were assembled at the EWS US outdoor test site in Dublin Ohio for dry test runs (running of fuel burners without waste) at low temperature to check out overall equipment operation.

During trouble shooting of the TEEPS package, interrelated issues were experienced with;

- 435 VAC transformer
- ORC motor issues and safety shutdowns
- Software issues
- Error codes related to grid and line voltage
- Potential inverter issues

A meeting was held with an original manufacturer engineer in Germany to review the issues encountered. Following this meeting further diagnosis suggested that the inverter or commands to the inverter may be the problem.

In early November a spare ORC unit was shipped to the test site to enable troubleshooting with spare parts or to use as a replacement unit. Once Unit 2 arrived this unit was set up adjacent to the existing unit to allow for quick transfer of power & installation of parts.

Troubleshooting continued with software engineers in Germany connecting remotely while using spare parts to evaluate potential issues with software, equipment control settings and hardware.

Replacement of Unit 1 ORC motor with unit 2 parts led to some success. The ORC motor began to turn and generate intermittent power while performing low temperature testing. The original, modified ORC had started up and ran with some continuity (~20 minutes) by working through symptoms – fixing loose wires and eventually swapping out the inverter. However, the system continued experiencing intermittent issues.

A new ground rod was installed, to enable adjustment for more operational stability. Procedures were put into place to adjust the top speed of the engine, which will make it easier to run steadily, and modifications of the valving at the oil cooler to allow modulation of water and oil flows going to the ORC and to the cooler (at the same time).

The ORC was tested with the original inverter, with the newer cable and enhanced grounding, however still appeared to suffer from communication issues.

By mid-December winter weather was causing trouble shooting to become increasingly difficult, so the DWECX system was left assembled at the test site, but the ORC was shipped in January 2021 back to Binghamton to allow for further troubleshooting in a more controlled setting indoors in the EthosGen work shop.

Trouble shooting continued throughout 2021 but the issues could not be resolved and so the demonstrations in February/March 2021 and October 2021 had to be conducted without the ORC engine.

5.1.2 Overview of Heat Exchanger Issues and Resolution

Demonstration #1 started in February, 2021 at the Aberdeen Proving Ground (APG) demonstration site. The system had been assembled and running for two weeks. As the system was entering into its' first week of air emissions testing on February 22, 2021 an observation was made while setting up air emissions testing equipment that the exhaust stack was flexing due to the wind and appeared tilted at a larger than normal degree from straight. Upon inspection damage was observed at the base of the heat exchanger which caused concerns for the structural stability of the system. The system was promptly disassembled for safety and further investigation. Air emissions testing for the week of February 22, 2021 was cancelled although the system was prepared for testing for the following week in accordance with the schedule as intended without the heat exchanger installed.

As depicted in Figure 14, the HX inlet assembly (2) which is bolted between the incinerator secondary roof (1) and the body (4) of the Heat Exchanger had begun to warp at the connection plate (3). It was also between this interface point that damage was observed at the internal welds of the inlet assembly (2) and separation had begun between welded components. No damage was present on the heat exchanger tube assembly (4) other than some minor leaking which does not cause concern.

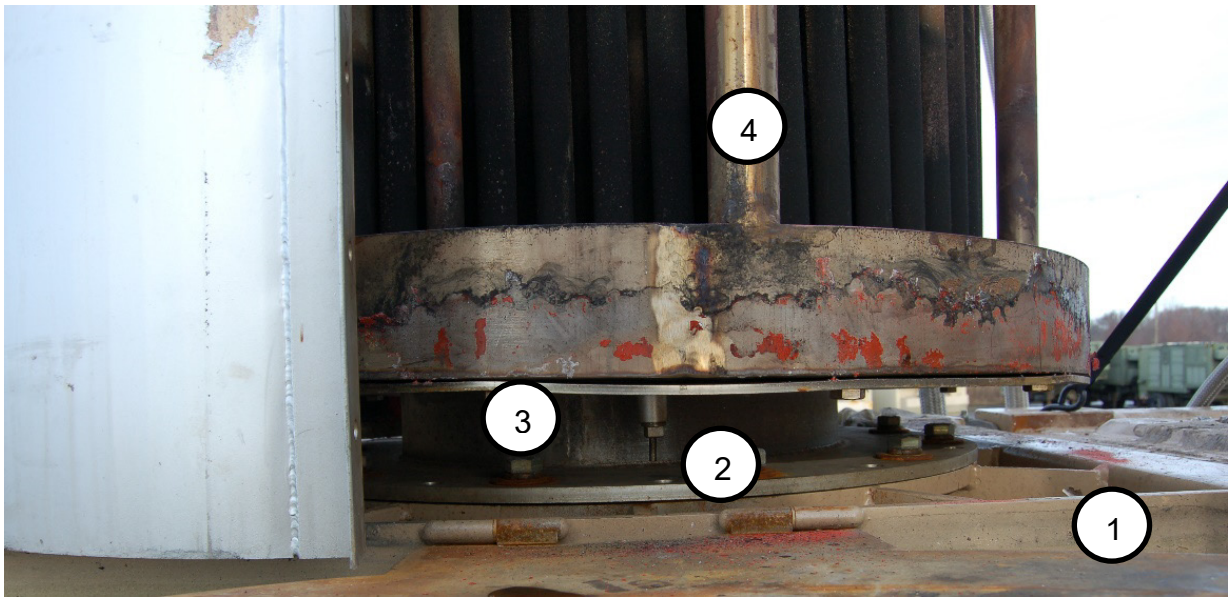


Figure 14. Heat Exchanger Damage

Please refer to report "WP18-5149 ESTCP – DWECX-TEEPS White Paper – Heat Exchanger Repair, April 1, 2021 Revision C [6] for additional details.

Results from a Finite Element Analysis (FEA), presented in Figure 15 below, confirmed insufficient structural strength and high likelihood of deflection under the proposed wind / moment loads. With the inlet section replaced by a larger diameter tube with external stiffeners, structural performance will be significantly improved; at intermediate operating temperatures stresses and deflections were found acceptable. For the situation of wind exposure at ambient temperatures (i.e., equipment not operating), we can extrapolate a conclusion that, after stiffening the inlet section, lateral deflection at top of HX would have been acceptable.

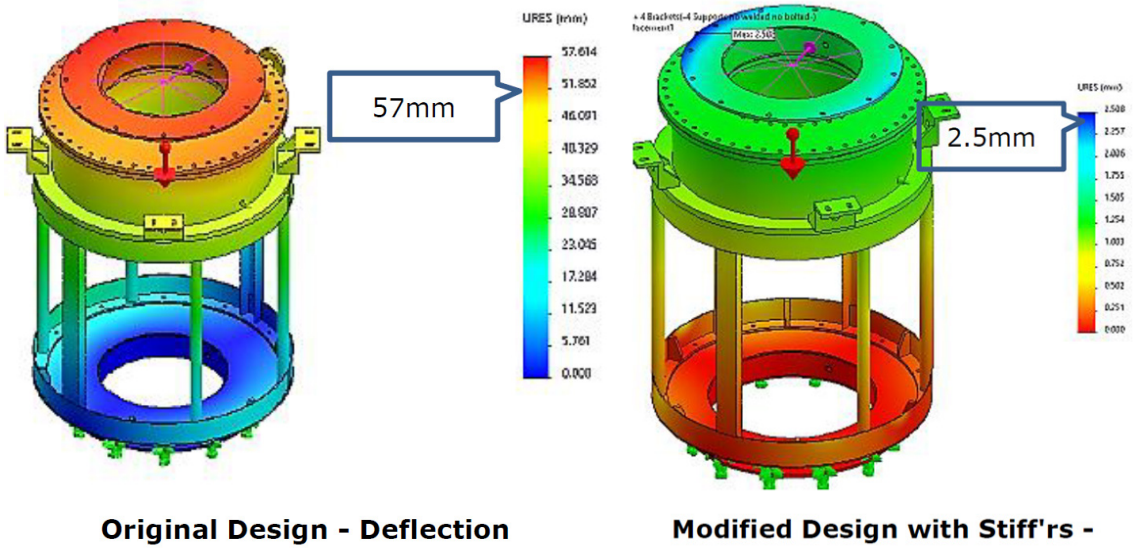


Figure 15. HX Repair Engineering and Design

Several vendors were evaluated as potential suppliers for the repair effort. Local vendors that would be a short shipping distance away, mobile vendors of trusted experts that could deploy to site and long-distance vendors who would receive the shipment of the HX. However, after discussing the solution further with APG it became apparent that the base had a resource of experienced fitters and welders who were capable of the repair. Fabrication drawings were revised by EWS and supplied to APG.

HX repairs and upgrades were completed at APG during August and September 2021 in preparation for Demonstration #2 in October and November, 2021.

5.1.3 Demonstration Waste Burns

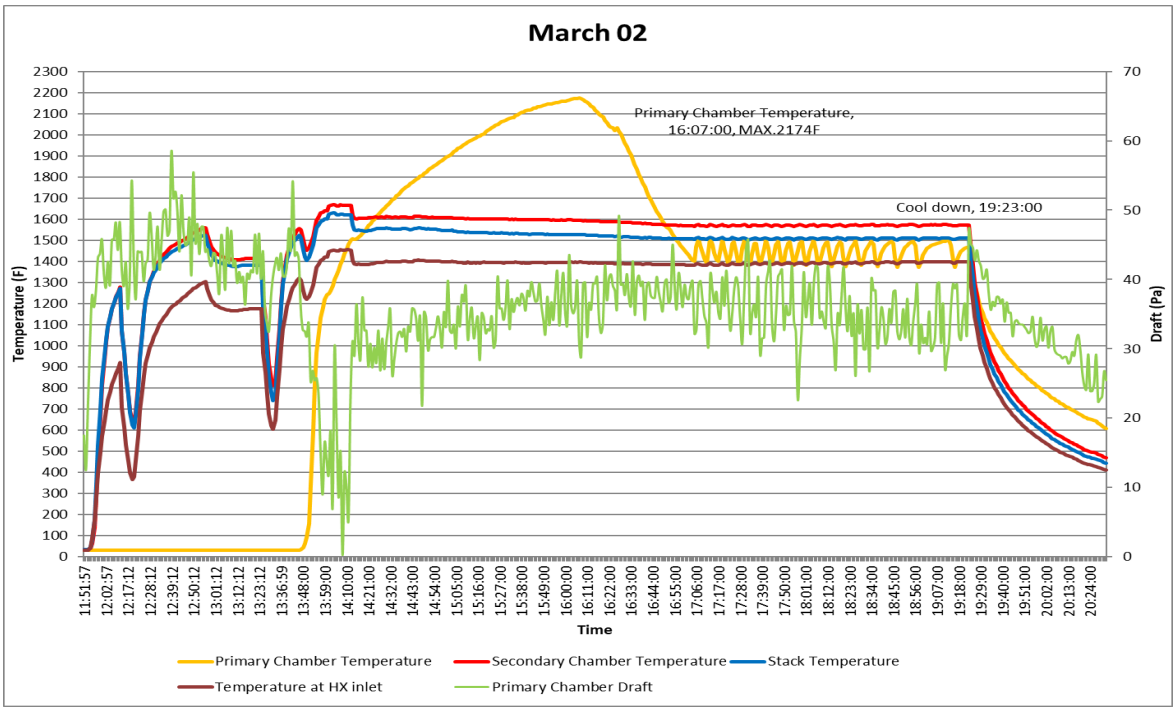


Figure 16. Waste Burn - Without HX/TEEPS With Air Emissions – March 2, 2021

Figure 16 represents "Burn 1" of the AST air emissions testing performed at APG in the configuration without the HX/TEEPS module installed. As depicted by the temperature lines dipping at the start of the burn there were intermittent fuel priming issues that needed to be resolved before air emissions testing could begin. After tightening fuel fittings and priming of the fuel lines a successful burn was restarted at approximately 13:30* that continued onwards with no faults present. An average draft of ~35pa was seen, primary chamber temperatures are slightly above expected values with a peak of 2174F and the secondary chamber controlled consistently between 1550 to 1600F.

As all monitored temperature and draft profiles were within acceptable ranges the system was deemed to be operated as designed and air emissions test was deemed VALID.

*There is a 3hr time difference between the clock settings within the EWS data logging software and the data collected by the air emission data logging software. Emissions collecting began after all issues were resolved.

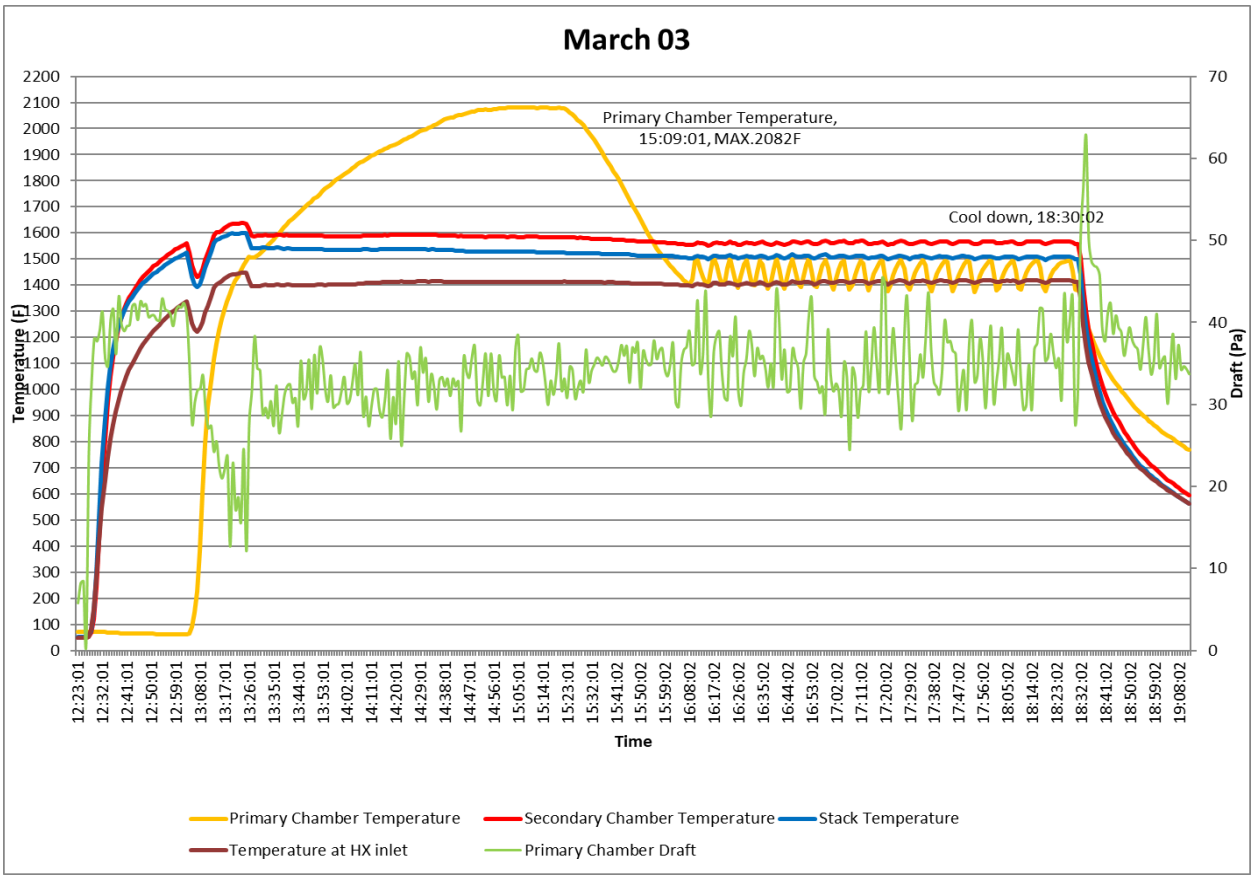


Figure 17. Waste Burn - Without HX/TEEPS – With Air Emissions - March 3, 2021

Figure 17 represents "Burn 2" of the AST air emissions testing performed at APG in the configuration without the HX/TEEPS module installed. No further faults or issues occurred prior to the collection of data for Day 2. An average draft of ~35pa was seen, primary chamber temperatures continued to trend above expected values with a peak of 2082F and the secondary chamber continued to hold consistently between 1550 to 1600F.

As all monitored temperature and draft profiles were within acceptable ranges the system was deemed to be operated as designed and air emissions test was deemed VALID.

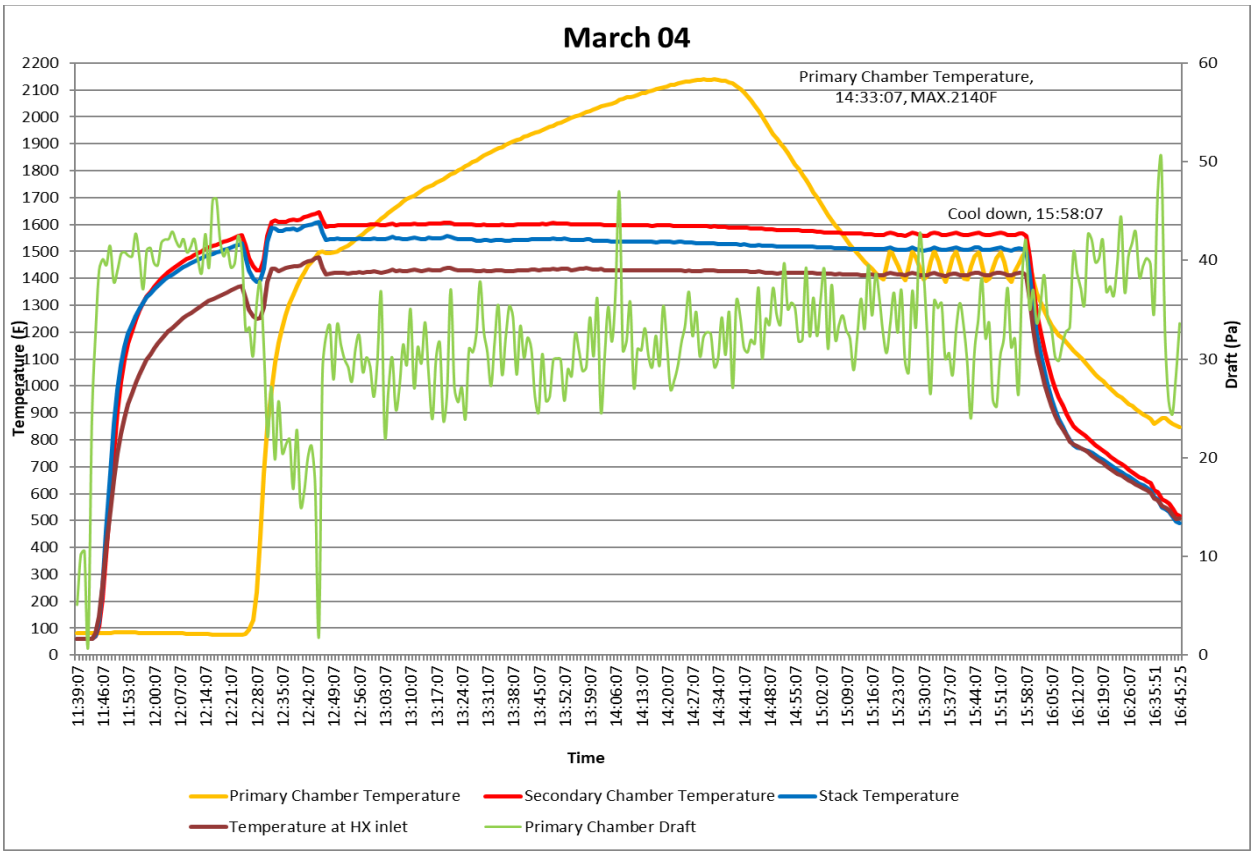


Figure 18. Waste Burn - Without HX/TEEPS – With Air Emissions - March 4, 2021

Figure 18 represents "Burn 3" and final day of the AST air emissions testing performed at APG in the configuration without the HX/TEEPS module installed. No further faults or issues occurred prior to the collection of data. An average draft of ~33pa was seen, primary chamber temperatures continued to trend above expected values with a peak of 2140F and the secondary chamber continued to hold consistently between 1550 to 1600F. Subsequent analysis determined the higher primary chamber temperatures during the March tests can be attributed to the thermal characteristics of the standard waste mixture. Section 4.1.3 under Project Design explains in detail the changes from the Standard Waste Mixture to the Modified Waste Mixture for the October tests.

As all monitored temperature and draft profiles were within acceptable ranges the system was deemed to be operated as designed and air emissions test was deemed VALID.

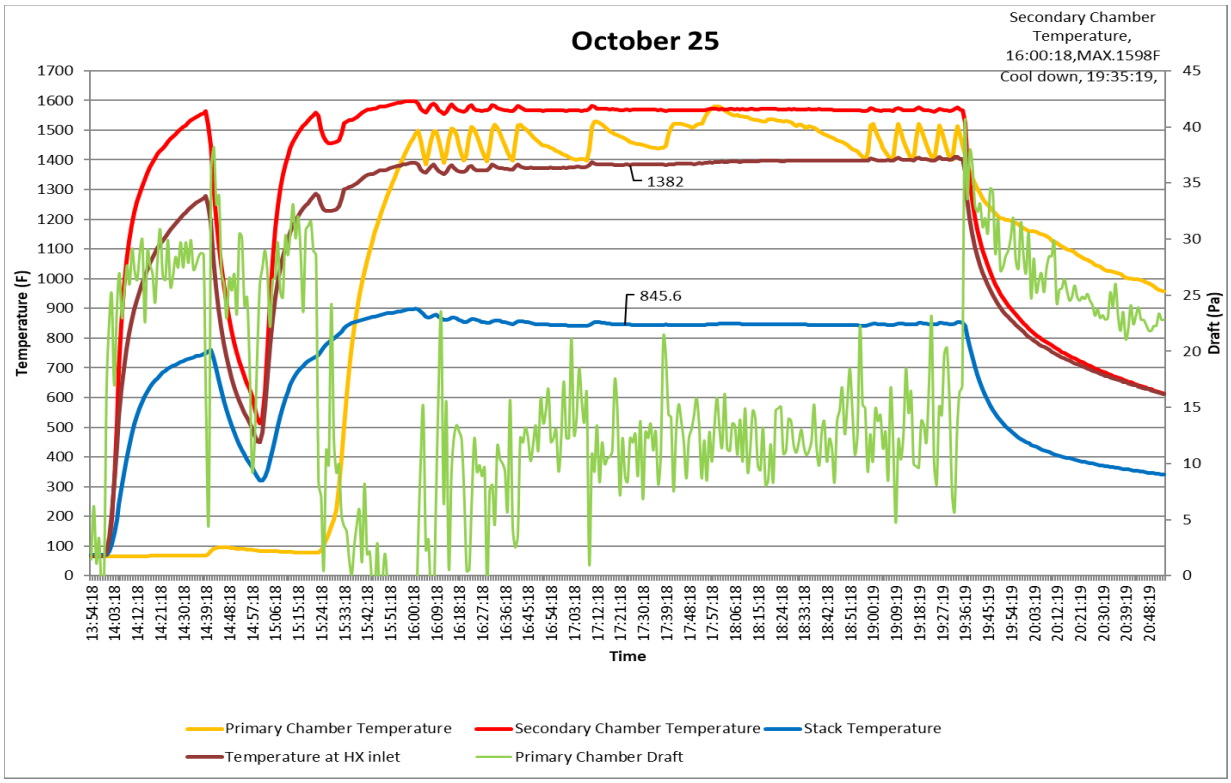


Figure 19. Waste Burn with HX/TEEPS – Without Air Emissions – October 25, 2021

Figure 19 represents a setup/configuration day as the unit had been on standby at APG due to fixes required to the HX. During the setup/configuration day in addition to confirming the proper function of all DWEC components the TEEPS components (pumps, VFDS, etc.) were configured throughout the burn to reach the required equilibrium such that it would run without any manual interaction throughout a burn cycle.

As depicted by the temperature lines dipping at the start of the burn there was a burner fault which eventually was determined to be a similar fuel priming issue that occurred back in March due to a faulty valve that needs to be replaced.

An average draft of ~13pa was seen with a lower-than-expected dip occurring at the start of the primary combustion. A drop in pressure is expected as the through-flow heat exchanger forces the path of the gas to follow a nonlinear path as it travels. Additionally, by removing heat from the stack, a loss of draft due to a smaller temperature differential is also present. Due to changes made for the modified waste mixture the primary chamber temperatures were no longer above expected values with a peak of 1571F. As the secondary chamber dropped below 1562F during the prior testing, small adjustments were made to the secondary burner to ensure the temperature remained stable for the majority of the burn. An approximate delta of 535F was seen between the HX inlet and stack temperature (HX outlet) which is an indication of thermal energy recovery. An unexpected temperature drop is occurring between the HX inlet and secondary chamber of ~200F for all tests. We expected these temperatures would be very close. Radiant heat loss from the surface of the secondary chamber is the expected cause. Subsequent design and testing focused on insulating the secondary chamber will reduce radiant heat loss.

By the end of testing all monitored incinerator temperatures, draft profiles, oil temperature & flowrate, water temperature and flowrate and VFD settings were set and within acceptable ranges such that the system was deemed to be operated as designed.

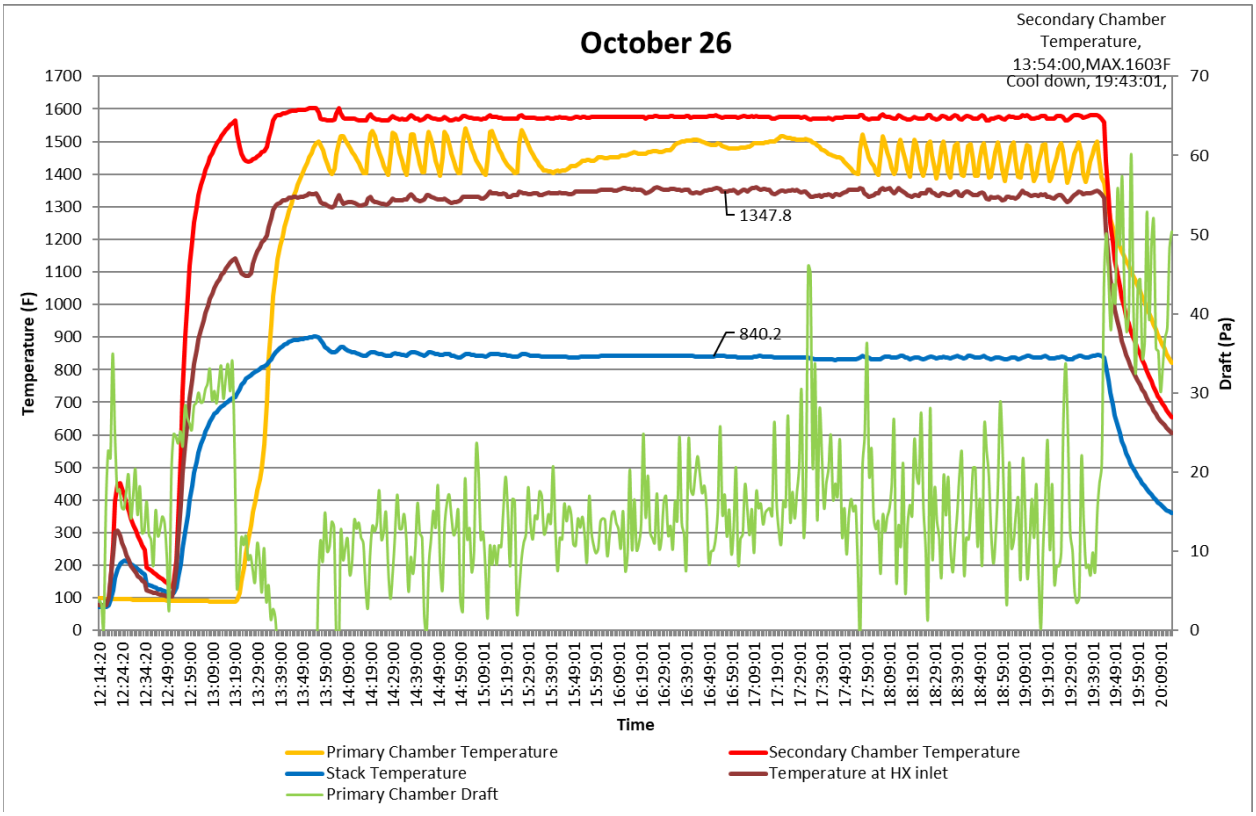


Figure 20. Waste Burn with HX - With Emissions - October 26, 2021

Figure 20 represents "Burn 1" of the RWDI air emissions testing performed at APG in the configuration with the HX/TEEPS module installed.

As depicted by the temperature lines dipping at the start of the burn there was a fuel priming issue that needed to be resolved before air emissions testing could begin. After tightening and repriming of the fuel lines a successful burn was restarted at approximately 12:50 that continued onwards with no faults present.

An average draft of ~15pa was seen with a similar dip occurring at the start of the primary combustion. The primary and secondary temperatures continue to operate at the expected temperature range with no issues occurring. A similar temperature drop of 508F was measured across the HX.

As all monitored temperature and draft profiles were within acceptable ranges the system was deemed to be operated as designed and air emissions test was deemed VALID.

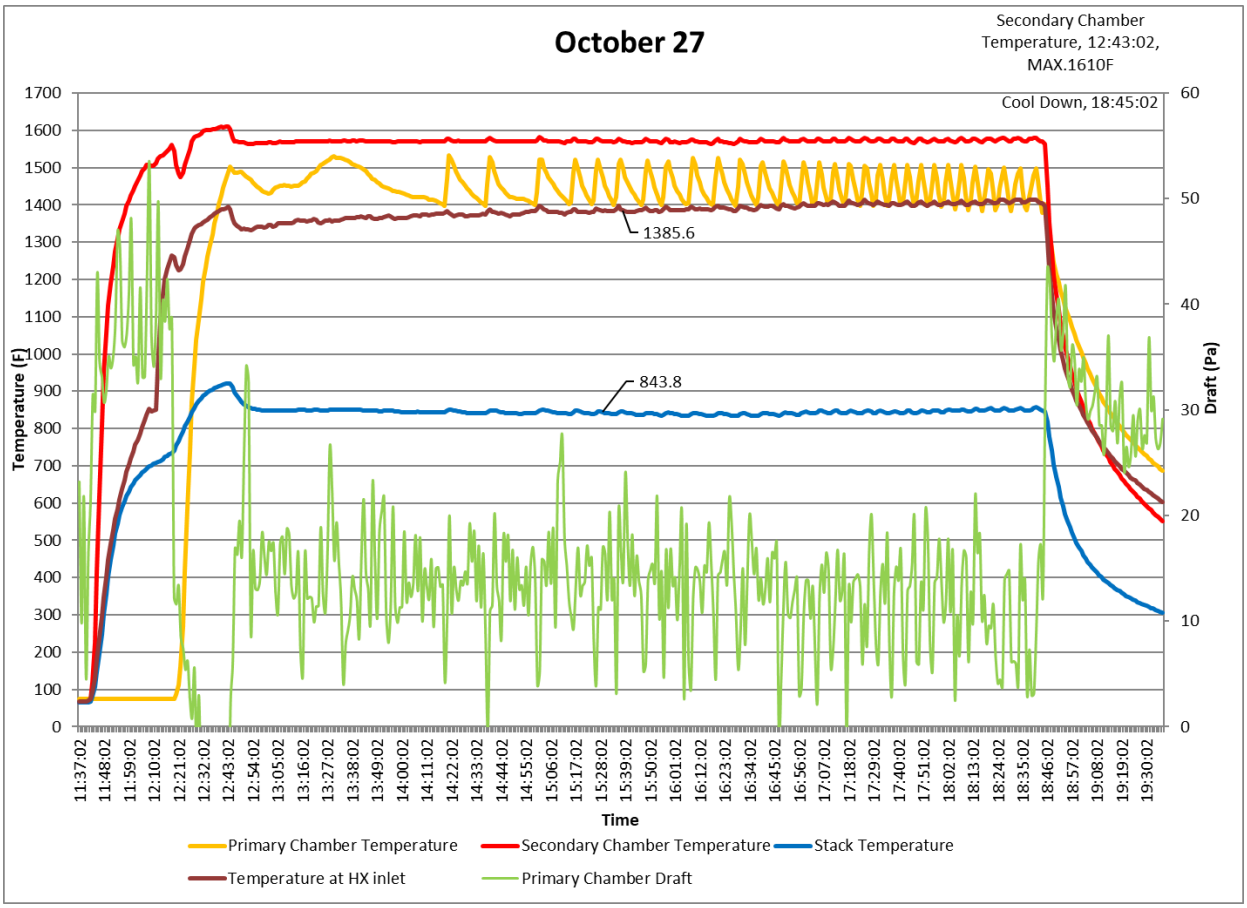


Figure 21. Waste Burn with HX – With Air Emissions – October 27, 2021

Figure 21 represents "Burn 2" of the RWDI air emissions testing performed at APG in the configuration with the HX/TEEPS module installed.

An average draft of ~15pa was seen with a similar dip occurring at the start of the primary combustion. The primary and secondary temperatures continue to operate at the expected temperature range with no issues occurring. A similar temperature drop of 542F was measured across the HX.

As all monitored temperature and draft profiles were within acceptable ranges the system was deemed to be operated as designed and air emissions test was deemed VALID.

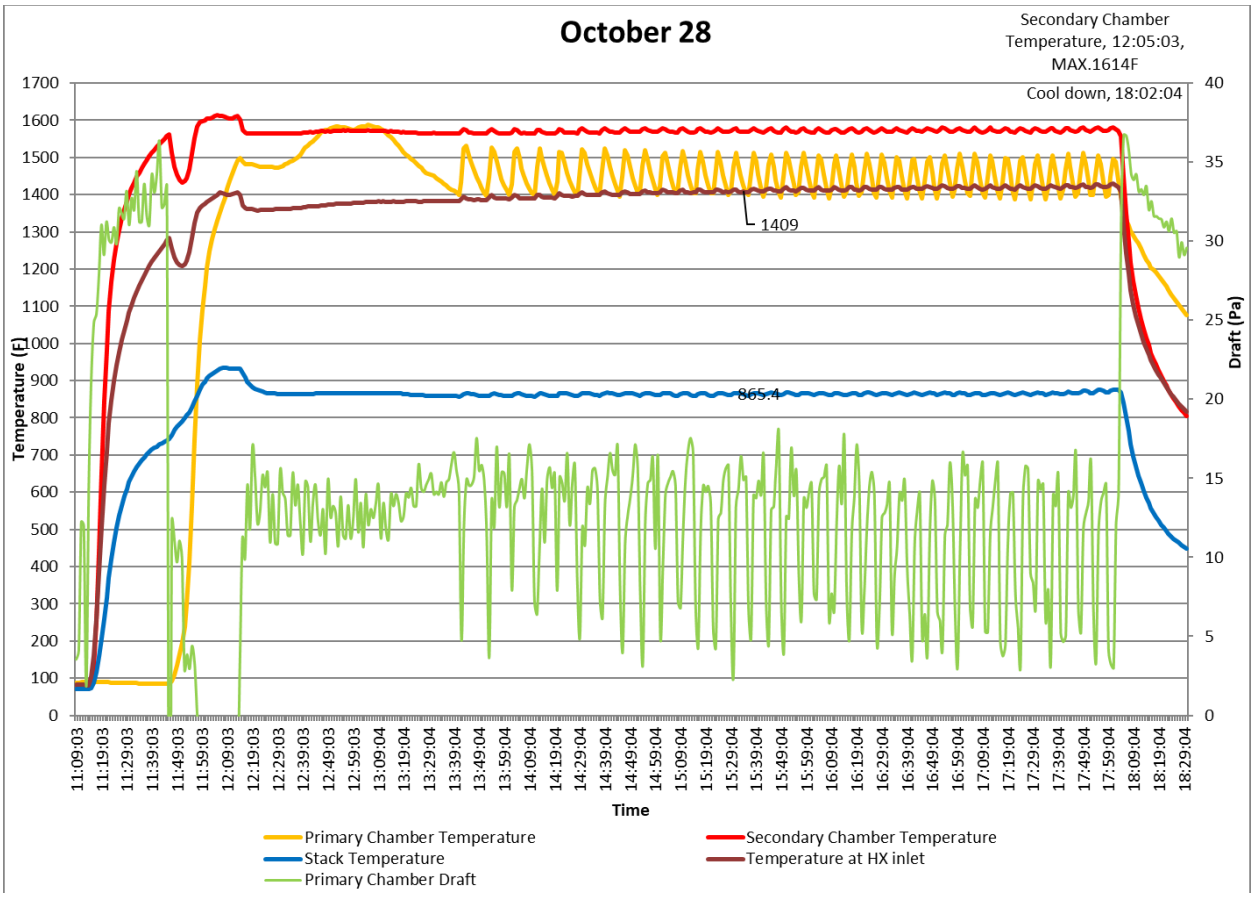


Figure 22. Waste Burn with HX - With Air Emissions - October 28, 2021

Figure 22 represents "Burn 3" and final day of the RWDI air emissions testing performed at APG in the configuration with the HX/TEEPS module installed.

An average draft of ~10pa was seen with a similar dip occurring at the start of the primary combustion. The primary and secondary temperatures continue to operate at the expected temperature range with no issues occurring. A similar temperature drop of 544F was measured across the HX.

As all monitored temperature and draft profiles were within acceptable ranges the system was deemed to be operated as designed and air emissions test was deemed VALID.

5.2 LOGISTICAL FOOTPRINT

The original objective was to develop a complete DWECX-TEEPS system package including the ORC engine and HX contained within 3 TRICONs, which would provide a 20' x 8' x 8' shipping footprint with individual TRICON containers not to exceed 10,000 lbs. The individual TRICON container weights were maintained at <10,000 lbs. This configuration did not prove to be practical. The ORC engine and Heat Exchanger, water tanks and pumps, and support equipment and spare parts each required their own individual TRICONs.

The final logistical/shipping footprint is planned to be 40' x 8' x 8' (that is 2 x 20' containers made up of 3 TRICONs secured together), and is expected to be made up of the following elements;

20’ Container #1

- Primary Chamber TRICON
- Intermediate Chamber TRICON
- Secondary Chamber TRICON

20’ Container #2

- ORC & Heat Exchanger TRICON
- Water tanks & pumps TRICON
- Support equipment and parts TRICON

5.3 FUEL EFFICIENCY

The project objective was to reduce fuel consumption to less than 25 gallons of diesel fuel per burn cycle. Fuel consumption reductions were not addressed during the project in order to focus on optimizing flue gas temperatures for the minimizing of stack air emissions. Areas where fuel efficiency can be addressed are:

- Insulating the secondary chamber. A temperature drop of ~200F was measured across the length of the secondary chamber during the demonstrations, illustrating significant potential for fuel savings by reducing secondary chamber radiant temperature losses.
- Insulating the breech section to ensure products of combustion maintain temperature as it passes from the Primary chamber to the secondary chamber.
- Preheating the Secondary blower air into the system, to reduce the temperature drop during mixing.
- Decreasing the negative draft in the system, to lower the overall pull of the gases out of the system.
- Optimizing the locations and accuracy of secondary chamber temperature measurements will also provide opportunities to reduce fuel consumed by the secondary chamber fuel burner, while maintaining flue gas temperatures to control emissions.

5.4 WASTE DISPOSAL EFFICIENCY

Figure 23. Waste Batch Before and After a Burn

Ash weights and volumes were not recorded for every day but were confirmed to be similar during the October tests and so waste efficiency results have been taken from similar tests (using the Standard Waste Mixture) using a similar EWS combustion system conducted at Tyndall in 2017 with the DWEC-HERS system as detailed in section 2.2.1 above.

The waste reduction objective was to reduce waste on a mass and volume basis by greater than 95%. Figure 23 above provides a view of waste before the burn and as remaining after the burn. As presented below the average mass waste reduction was 97.8% and the average volume reduction was 97.8%.

Table 13. Average Waste Mass and Volume Reduction

Total Mass Processed	Lbs.	480
Total Volume Processed [2]	cu.ft.	64
Mass Percent Non-Combustibles[1]	%	7.5
Ash/ Residue Mass	Lbs.	45.9
Ash/ Residue Volume	Non-compacted, cu.ft.	1.4
	Compacted [3], cu.ft.	0.75
Mass Reduction [4]	Combustible Mass Reduction, %	97.8
	Total Mass Reduction, %	90.4
Volume Reduction [4]	Non-Compacted Ash, %	97.8
	Compacted Ash, %	98.8

1. Percent non-combustibles estimated based on the total mass of metals and glass in simulated waste processed.
2. Batch volume estimate based on 16 bags at approximately 4 cubic feet each.
3. Ash residue was compacted by crushing metal and glass residues manually inside the collection drum.
4. Mass and volume reduction data are the average of three standard waste tests done at Tyndall.

5.5 ENERGY RECOVERY

The heat recovery system or TEEPS has a total of five material (gas and liquid) transfers, which are illustrated in the process flow diagram below and include: 1. Flue gas from the secondary combustion chamber, 2. Distilled water in the heat pipe heat exchanger, 3. Thermal Oil heat transfer media which transfers thermal energy between heat pipe HX and the ORC, 4. Organic working media in the ORC system, which is an organic, high molecular mass fluid to convert thermal energy to mechanical work through the Rankine cycle (vaporizing, superheating and expanding) 5. Heat transfer media (hot water) for system thermal output. These five media operate and circulate independently of each other, transferring and converting the waste heat in the flue gas into usable electrical and thermal energy (hot water).

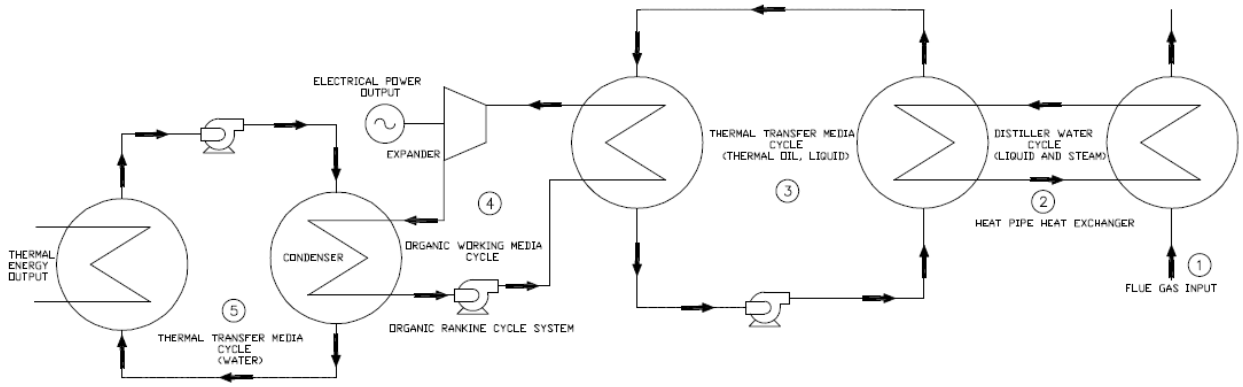


Figure 24. TEEPS Energy Recovery Cycles Flow Diagram

The performance objective was to generate >= 10 kW for 5 hours of operation (per burn cycle and to generate 13GPM with an ~ΔT of 70ºF (86 to 158ºF).

Sections 5.5.1 through Section 5.5.5 describe energy generation results in detail.

5.5.1 Total System Thermal Input (Solid Waste plus Auxiliary Fuel)

The energy production of the entire system includes the gasification and combustion of solid waste and the auxiliary fuel (diesel), which provides the heat to be recovered through the heat pipe heat exchanger.

Table 14. Total System Thermal Input (Solid Waste plus Auxiliary Fuel)

	10/26/2021		10/27/2021		10/28/2021	
Solid Waste Weight	480	lb.	480	lb.	480	lb.
Solid Waste Higher Heat Value (HHV)	5314	Btu/lb.	4165	Btu/lb.	4165	Btu/lb.
Auxiliary Fuel Flow Rate	30	gal	30	gal	30	Gal
Auxiliary Fuel Higher Heat Value	140000	Btu/gal	140000	Btu/gal	140000	Btu/gal
Total System Thermal Input	1.055	MMBtu/hr	0.966	MMBtu/hr	0.987	MMBtu/hr
	309	kw	283	kw	289	kw

The Higher Heat Value of wastes were determined from the Standard Waste Mixture used for the October 26th test and the Modified Standard Waste Mixture used during the October 27th and October 28th tests, as detailed in section 4.2 Simulated Waste Feed Materials above. Auxiliary fuel consumptions were not measured during the October tests and so fuel consumptions were taken from similar tests (using the Standard Waste Mixture) using a similar combustion system performed at Tyndall in 2017 with the DWEC-HERS system as detailed in section 2.2.1 above.

5.5.2 Flue Gas Energy Recovery

The energy contained in the flue gas is recovered via the heat pipe heat exchanger through the phase change (from liquid to steam) of distilled water.

Table 14. Flue Gas Thermal Input (From Flue Gas to HX)

	10/26/2021		10/27/2021		10/28/2021	
Avg Flue Gas Temp (Inlet of Heat Pipe Exchanger)	1330	°F	1380	°F	1396	°F
Avg Flue Gas Temp (Outlet of Heat Pipe Exchanger	842	°F	846	°F	865	°F
Average Flue Gas Mass Flow Rate	5649	lb./hour	5614	lb./hour	6187	lb./hour
Overall Flue Gas Thermal Power Input	0.787	MMBtu/hour	0.849	MMBtu/hour	0.944	MMBtu/hour
	231	kw	248	kw	276	kw

The flue gas outlet temperature was controlled to approximately 842F (450C) to attempt to avoid the temperature window of Dioxins/Furans reformation (480-842F, 250-450C). The approach to heat recovery in the demonstration was to maximize the heat extraction while minimizing the formation or reformation of Dioxins/Furans emissions, and as such the potential energy recovery from the utilization rate of the waste heat was reduced.

5.5.3 Hot Water Energy Recovery

Table 15. Thermal Output (Hot Water)

	10/26/21		10/27/21		10/28/21	
Avg Water Temperature (Inlet ORC)	89	°F	95	°F	91	°F
Avg Water Temperature (Outlet ORC)	112	°F	116	°F	124	°F
Avg Water Volume Flow Rate	36	GPM	36	GPM	36	GPM
Water Thermal Energy Output	0.427	MMBtu/hr	0.371	MMBtu/hr	0.588	MMBtu/hour
	125	kw, thermal	109	kw, thermal	172	kw, thermal

ORC water inlet and outlet temperatures and flow rates were obtained from field test data while the ORC was in place during the March demonstration. From above table, the ORC system can generate 36GPM with a ~ΔT of 70ºF (86 to 158ºF) or 109-173 kw of heat energy, for external use while generating electricity.

The project objective was to generate at least 13GPM of hot water with a ~ΔT of 72ºF (86 to 158ºF). The 3 test burns produced on average a flow rate of 36 GPM with an increase in water temperature from ORC Inlet of 92 °F to ORC Outlet of 118 °F.

As illustrated below the hot water ΔTs and the hot water flow rates during the demonstration generated an equivalent Thermal Energy Flow with respect to the project objective.

Table 16. Hot Water Generation Comparison

	Inlet Temperature	Outlet Temperature	Temperature Difference	Volume Flow Rate	Thermal Energy Flow	
	(°F)	(°F)	ΔT (°F)	GPM	MMBtu/hour	kw
Project Objective	86	158	72	13	0.465	136
Three Tests Average	92	118	26	36	0.466	137

5.5.4 Electrical Power Recovery

Table 17. Estimated Electrical Power

	10/26/21		10/27/21		10/28/21	
Gross ORC Electrical Power output	14.08	kw	13.71	kw	10.45	kw
Estimated Internal Peak power demand	9.16	kw	9.16	kw	9.16	kw
Net Electrical Power output	4.92	kw	4.55	kw	1.29	kw
Total Electrical Energy Production	84.47	kwh/Batch	82.23	kwh/Batch	62.68	kwh/Batch
Total Internal Electrical Consumption	23.92	kwh/Batch	23.97	kwh/Batch	23.53	kwh/Batch
Net Electrical Power Output	60.56	kwh/Batch	58.26	kwh/Batch	39.15	kwh/Batch

The Oct 28th test had a significantly lower Electrical Power Output, due a higher thermal output recovery (more hot water was produced) for that test as shown in Table 15 – Thermal Output (Hot Water), which resulted in less energy available for electrical generation.

The project objective for electrical power production was to generate >= 10kW for 5 hours of operation (per burn). Since the ORC engine was not operational, we have estimated the Gross ORC Electrical Power output based on the available thermal energy. Internal Peak Power demand was also estimated based on the estimated demands of the TEEP system and the DWECX system.

The estimated gross ORC Electrical Power Output averaged 12.74 kW and estimated net system Electrical Power Output averaged 3.79 kW during 3 test burns. We expect with system and operational optimizations that the DWECX-TEEPS system will be able to meet the 10 kW objective. Optimizations could include:

- Added insulation to the secondary chamber to reduce thermal losses
- Better optimization and control of the thermal & cooling fluids

5.5.5 Total System Energy Recovery Performances Summary

Table 18. System Performance Analysis

Test Date	10/26/21		10/27/21		10/28/21	
Gross Thermal Energy (Hot Water) output	125	kw	109	kw	172	kw
Estimated Gross Electrical Power output	14	kw	14	kw	10	kw
CHP (Combined Heat and Power)	139	kw	122	kw	183	kw
CHP Efficiency of Heat Exchanger and ORC	60	%	49	%	66	%
Average Thermal Energy Input Rate (Waste and Diesel)	309	kw	283	kw	289	kw
Estimated Gross Electrical Efficiency of ORC	10	%	11	%	6	%
Total System CHP Efficiency (Higher Heat Value)	45	%	43	%	63	%
Total System Gross Electrical Power Efficiency (Higher Heat Value)	5	%	5	%	4	%

We have estimated 6-10% gross electrical efficiency of the ORC which is typical of small ORC systems. Small ORC systems can be expected to have a gross electrical efficiency range from 5% -12% depending on operating conditions, so 6-10% of gross electrical efficiency is relatively conservative and reasonable.

The total system gross electrical efficiency and CHP efficiency of the small ESTCP-TEEPS system are estimated at 4-5% and 44-63 % respectively. Medium to large energy recovery systems gross electrical efficiency can be higher than 20%.

The ESTCP-TEEPS as a small waste treatment and energy recovery system without an air pollution control system was designed to balance optimum air emissions while maximizing electrical energy recovery and thermal energy recovery. The key balancing strategy was to set HX gas discharge temperatures above the Dioxin/Furan reformation temperature (842F, 450C). While balancing air emissions and energy efficiency, simultaneous outputs of electrical energy and thermal energy have been achieved.

For detailed performance data summary, please to see the Appendix B2

5.6 AIR EMISSIONS

EWS conducted two stack emission test sequences, one in March 2021 and one in October 2021. The emission test in March 2021 did not include a heat recovery system (heat exchanger), while the emission test in October 2021 did include an operating heat exchanger.

The testing included the collection of the following parameters:

Table 19. Summary of Air Sampling Parameters

Particulate Matter (Total particulate (PM) including PM10 and PM2.5)	Volatile Organic Compounds (VOCs) Total Hydrocarbon (THC) and Speciated VOCs
• Metals	• Hydrogen Fluoride (HF)
• Sulfur Dioxide (SO2)	• Hydrogen Chloride (HCl)
• Oxides of Nitrogen (NOx)	• Hydrogen Bromide (HBr)
• Carbon Monoxide (CO)	• Methane (CH4)
• Oxygen (O2)	• Dioxins & Furans (D&F)
• Carbon Dioxide (CO2)	• Polychlorinated Aromatic Hydrocarbons (PAHs)

For detailed emission parameters and data, please refer to the report of "2021 Source Testing Program (Incinerator Main Stack) Eco Waste Solutions Aberdeen proving Grounds" [5] provided in Appendix B3.

The Air Emission objective was to evaluate Air Emissions against EPA Regulations. The specific regulation was the Other Solid Waste Incinerators (OSWIs) of US EPA Standards of Performance for New Stationary Sources and Emission Guidelines for New Municipal Waste Combustion Units. The evaluation was to include air emissions with and without energy recovery to determine the impact off energy recovery on the quality of emissions. The following Table 20 – Comparison of Air Emission Tests, presents a summary of the stack testing results

In general, there were no adverse effects on the quality of air emissions for the compounds measured that were required as part of the OSWIs limits, in comparing emissions with the energy recovery device installed versus baseline emissions without the energy recovery device installed. The exception were the emissions of Dioxins and Furans which were higher with energy equipment installed, as was expected.

Table 20. Comparison of Air Emission Tests

Compound	Units	Other Solid Waste Incinerators (OSWIs) (Limits)	March 2021 Average Results (without Heat Exchanger)	October 2021 Average Results (with Heat Exchanger)
Particulate Matter (PM)	gr/dscf	0.013	0.0055	0.0061
Carbon Monoxide	ppmvd	40	10.4	15.1
Dioxins & Furans (total mass basis)	ng/dscm	33	21.4	37.3
Hydrogen Chloride	ppmvd	18	111.6	59.3
Sulfur Dioxide	ppmvd	3.1	22.7	4.29
Nitrogen Oxides	ppmvd	103	180.3	84
Cadmium	µg/dscm	18	1.6	0.9
Lead	µg/dscm	226	77.6	27.2
Mercury	µg/dscm	74	0.28	0.22
Opacity	Percent	10%	0%	0%

Note: All Numbers are adjusted to and reported at 7% oxygen, on a dry basis, and at standard conditions

5.6.1 Particulate Matter (PM)

Particulate Matter emission values are well below the OSWI limit, benefiting from batch-style gasification (starved-air) technology. Batch feeding means that waste is loaded to a cold/inactive primary chamber then slowly brought up to temperature. By contrast, continuous feeding systems, where waste and air are continually added to the waste bed, large quantities of dust become entrained in the flue gas and pulled to the exhaust. Batch feeding allows for a slower more controlled burn. complete combustion and less disturbance to the ash bed reducing entrainment of particulates in the flue gas. The starved-air process only requires for enough oxygen to maintain the burn and eliminates the need to force air into the primary chamber also reducing entrained dust.

5.6.2 Carbon Monoxide

Carbon Monoxide (CO) emissions are an important indicator for combustion efficiency. High levels of CO result when carbon in the waste is not fully oxidized to carbon dioxide (CO2). This lack of efficiency is normally due to one or more of combustion gases not being held for long enough at sufficiently high temperature in the presence of oxygen (O2). The very low CO values measured indicate that hydrocarbons are effectively combusted, and waste is more completely oxidized.

5.6.3 Dioxins & Furans

In thermal treatment of waste, that is presumed to be free of Dioxins & Furans (DF) to begin with, DF is created by one of two of potential reactions in thermal processes. One of the major contributors to DF emissions is incomplete combustion. Another important mechanism for the production of DF is the de novo synthesis. This process occurs when flue gas temperatures not hot enough or are not rapidly cooled. The temperature zone that is occurs in is in the 250°C to 400°C range. Heat recovery lowers the gas temperatures in the system and is well known to lead to de novo synthesis formation of PCDD/Fs.

The DWECX operates at much higher temperatures and the DF test values without heat recovery (21.4 ng/dscm) were well below the limit value (33 ng/dscm), illustrating well controlled stack temperatures during those tests.

By contrast, the DF test values in tests with heat recovery (37.3 ng/dscm) were marginally above the limit value (33 ng/dscm). This was not unexpected even though the heat recovery waste not very aggressive. However, gases resident at lower temperatures for longer time, as is the case in a heat exchanger, are more likely to form DF.

Air pollution control systems can mitigate this issue using cooling, activated carbon and fabric filtration before gases are exhausted to the atmosphere.

5.6.4 Hydrogen Chloride

Predictably, the Hydrogen Chloride (HCl) emissions significantly exceeded the limit in both demonstrations. The emission of HCl is directly related to the chlorine content in the waste. Chlorine-containing plastics (such as PVC) can dramatically increase levels of HCl. However, more benign wastes such as food waste still contribute to HCl through contained chlorides found in sodium chloride or potassium chloride from foods such as vegetables, grains and table salt.

Therefore, complete removal of chloride containing compounds is not feasible. Again, air pollution control systems can mitigate this issue. Most often after a cooling stage, alkaline reagents such as sodium hydroxide or calcium bicarbonate are used to neutralize acids and remove them as dissolved salts in water or via a dry reaction process.

5.6.5 Sulfur Dioxide

The SO2 emissions were well above the standard. The emission of SO2 is determined by the sulfur content in the waste and also the sulfur content of the diesel fuel suppling the burners. The sulfur content in wastes is generally lower than 0.5%. It is important to minimize waste sulfur content and to use Low-sulfur fuels for waste incineration to minimizing SO2 emissions.

If we dig deeper into the SO2 test data in March 2021 and October 2022, there is a clear trend that SO2 emission values always decrease gradually over time. In the first one to two hours SO2 emissions are very high and then rapidly falling to very low values. This trend is true for all tests. In the initial stage of waste combustion, in order to raise the temperature of the combustion chamber, the auxiliary burners especially the primary burners work at the maximum output. Due to the sulfur content of diesel fuel the burners contribute significantly to SO2 emissions. In the middle and later stages of waste combustion the very low SO2 value indicates that the combustion of the waste itself has a small proportion of the SO2 emission.

The difference between the two SO2 test values in March 2021 and October 2022 was more than four times, mainly in the one to two hours from the start of waste burning. The modified waste characteristics in October 2022 effect of SO2 is very small and can be ignored. Therefore, the different SO2 values of the two tests can likely be explained from the following reasons:

1. Different fuels are used for the two tests.
2. The test in March 2021 started too early and the burning of the waste was extremely unstable, meanwhile the burner was working at maximum output.
3. The burners sat idle for periods of time without maintenance or adjustment and may not be optimally operating.

Natural gas or propane fuels tend to produce lower SO2 emissions but are not always readily available or practical. Once again air pollution control for acid gases similar to HCl control can be applied posing similar issues in terms of increased footprint, complexity, and logistical burden.

5.6.6 Nitrogen Oxides

Nitrogen oxides occur in all combustion processes where combustibles are burned, partly through oxidation of the nitrogen content of the air, as well as the organic nitrogen content of the fuel and waste. The formation process of NOx needs high temperatures, and the presence of nitrogen, and nitrogen is present in most waste including food waste. Therefore, one possibility to reduce NOx content is to try to keep gas temperature low, while decreasing/controlling the air flow in the primary chamber as the EWS gasification technology does. The October demonstration exhibited lower NOx emissions than the OSWIS limit (84 ppm versus 103 ppm). However, the March demonstration emissions were well above the OSWIS limit (180 ppm versus 103 ppm).

Higher gas/flame temperature always cause higher thermal NOx formation when Nitrogen and Oxygen are present. During combustion nitrogen is oxidized to nitrogen oxides. This reaction only takes place significantly when temperature is very high. The reaction rate depends exponentially on the temperature and is directly proportional to the oxygen content. It appears that the temperatures and oxygen content of the primary chamber were well controlled during October tests but were much higher in the preliminary March tests during the time the process was being optimized, which could have resulted in the higher NOx emissions. Therefore, lower NOx is achievable and can be accomplished routinely with higher levels of process control but can only be guaranteed by the use of air pollution control that specifically targets NOx, - Selective Catalytic Reduction (SCR) or Selective Non-Catalytic Reduction (SNCR).

5.6.7 Metals (Cd, Pb, Hg)

Metal emissions are directly related to the corresponding metal content in the waste. Heavy metals typically remain in the waste bed or as non-volatile oxides deposited with fly ash. One exception being Mercury which is highly volatile and becomes a flue gas vapour. Heavy metal emissions measured were well below the standard. This positive result is presumed to be due the EWS gasification process which has lower waste bed temperatures that are below the melting point of most metals as well, as the process' very low particulate matter emissions. Lower PM reduces he opportunity for metals to enter the exhaust emissions.

5.6.8 Opacity

Opacity of zero is a sign of complete combustion. Complete combustion generates low CO, TOC, VOC emissions, and particulate matter emissions.

6.0 COST ASSESSMENT

The demonstration was performed at Aberdeen Proving Grounds (APG) Army Test and Evaluation Command (ATEC) instead of at a Forward Operating Base (FOB). Therefore, actual cost tracking information from a FOB was not available. Demonstration costs are consistent with costs in a CONUS (continental USA) military technology test facility.

Data gathered in this demonstration and testing program provides an excellent basis to understand some of the potential costs for operating this type of expeditionary waste to energy system over its expected life.

Understanding the economics of energy recovery involves calculating the net energy production or net energy cost savings achievable with the waste-to-energy system, combined with overall operating and capital costs.

Economic data related to fuel costs [7]and the cost of electrical power at Forward Operating Bases (FOBs) were used as inputs to the cost model that allows one to estimate the cost of processing of waste and recovering energy using the DWECX-TEEPS.

The electrical power of the DWECX-TEEPS could not be measured due to operational issues with the ORC engine. However, the electrical power production potential can be accurately estimated using the measured stack gas temperatures and flows that indicate how much energy is available as waste heat.

We were not able to estimate all of the hot water needs of an expeditionary base camp. Therefore, we focused on the cost of producing hot water for showers only, for a camp with a population of 150 people.

A FOB typically generates all its hot water needs using diesel fuel fired hot water heaters that run 24 hours per day. This cost could be avoided if all of the energy to heat the water comes from the waste heat produced from burning garbage.

The cost model was used to calculate and analyze the following:

1. The cost of producing hot water using current methods – the cost of fuel, energy and maintenance involved in hot water heating

2. The cost of processing waste, generating hot water, and energy recovery from waste heat using the DWECX-TEEPS

3. The avoided cost of hot water generation and waste disposal is compared to operating the DWECX-TEEPS and recovering energy

4. The Return on Investment (ROI) - payback in months for investment in the capital cost of the DWECX-TEEPS based on the cost savings in 3.

Cost of Hot Water for Showers

The cost of generating hot water was based on the publicly available operational cost data for the WH-400, particularly electrical power, and fuel consumption. Maintenance costs were not available for WH-400, so they were estimated based on similar diesel fired hot water heaters. Labor costs related to refilling fuel, connecting to showers etc. was not examined as it is assumed that with the DWECX-TEEPS hot water recovery would involve a similar amount of operator input

Table 21. Annual Cost of Generating Hot Water at FOB

Cost JP8 at FOB ($/Gallon)	**$14.33**	**Army FBCF IECU**
Cost of Electrical Power at FOB ($/kWh)	**$0.69**	**Average Cost to generate power at FOBs**
Hot Water for Showers		
WH-400 Fuel Consumption (Gallons/hour)	3.5	Standard Deployable Hot Water Heater
WH-400 Power Consumption (kwh)	5	
WH-400 Hours of Operation	24	
WH-400 Fuel Consumption (Gallons/day)	84	
WH-400 Power Consumption (kwh/day)	120	
Population of FOB	150	Expeditionary Base Camp Population
Hot Water used for showers (Gallons)	10	Per person
Total Water Usage (Gallons)	1,500	
% Hot Water Required for Shower	65%	Shower Hot Water Blend Rate
Total hot water usage at FOB (Gallons/day)	1,500	
days Per year	365	
Total Cost of JP8 used for Showers Annually	$439,357.80	
Total Cost of Electrical Power for Showers Annually	$30,222.00	
Cost of Maintenance ($/yr)	$5,000.00	Assumed maintenance cost
Annual Cost Hot Water for Showers	**$474,579.80**	**Assumes that the hot water system is already there (no capex expenditure)**

There is a significant quantity of waste heat available for recovery from the waste conversion process. In fact, there is five times more hot water available from waste conversion than can be used for showers at a 150-person base camp (based on a 10-minute shower).

Table 22. Available Recovered Hot Water from the DWCEX-TEEPS

Gallons of Hot Water per Batch	3,900	gallons per batch (raising temperature from 86 F to 158 F)
Hot water generated for use (Gallons/day)	7,800	gallons per batch x batches per day
Percentage of hot water requirement provided by Package	520%	

Current Costs for Waste Disposal

At the time of this study, solid waste at FOBs was primarily transported off-site and/or burned in burn pits. The cost of waste disposal at FOB was referenced from the Fully Burdened Cost of Waste as estimated by AEPI (Army Environmental Policy Institute) in the 2010 Fully Burdened Cost of Waste Study [8].

Table 23. Cost of Solid Waste Disposal for 150-person Basecamp

Waste Disposal		
Cost of waste disposal at FOB ($/ton)	**$437.00**	**AEPI (Army Environmental Policy Institute) 2010 Fully Burdened Cost of Waste Study**
Waste generated at FOB (tons/day)	0.5	Total waste from 150 persons per day
Annual Cost of Waste Disposal	**$79,752.50**	Does not include captial expenditures
Total Annual Cost for Hot Water and Waste	**$554,332.30**	Does not include capital expenditures

Table 24 presents the operational costs for the DWECX-TEEPS based on measured diesel fuel and electrical consumption, as well as the cost to dispose of the ash residual and maintain the equipment.

Table 24. Capital and Operating Costs of DWECX-TEEPS

Capital Cost of DWECX-TEEPS	**$700,000.00**	Production Price of Package
Operating Time (days/yr)	329	days
% Downtime Per Year (Maintenance)	10%	estimated based on experience
Waste processed by DWECX (lbs/batch)	6975	design criteria to meet Contigency Basing requirements
Batches per day	2.0	batches of waste processed in 24 hours
Waste processed by DWECX (tons/day)	7.0	tons
JP8 used (Gallons) per burn cycle	20	per batch cycle
JP8 used by DWECX (Gallons/day)	40	gallons per day
Cost of fuel for DWECX ($/day)	$573.20	$ per day
Annual Fuel Costs for DWEC	**$188,296.20**	
Gross Electrical Power Produced by TEEPS (ORC) System	13	kw hourly (average of the 3 cycles measured)
Gross Electrical Power Produced during Waste Processing	64	kWh/batch
Gross Electrical Power Produced by TEEPS (ORC) System	127.4666667	kWh/batch
Electrical Power used by DWECX per batch (kwh)	6.0	kWh/batch
Electrical Power used by TEEPS per batch (kwh)	12.0	kWh/batch
Electrical Power used by DWECX per day (kwh/day)	36.0	kWh per batch x batches per day
Net Electrical Power Produced	91.5	
Electricity Cost Avoided ($/day)	$1,310.72	
Annual Electrical Cost Savings	**$430,570.64**	
Operator hours required daily	0.50	15 minutes of operator time per batch to unload and load system
Hourly Cost of Operator	$25.00	$ per hour
Annual Labor Costs for DWECX	$4,106.25	not included in OPEX - assumed to be equivalent or less than current waste disposal
Percent residual of waste after DWECX processing	10%	residual includes ash, cans, glass - some could be recycled, but assumed worst case
Annual DWEC residual waste	229.1	tons per year
Annual Cost to Dispose of Ash	**$100,129.26**	residual disposal cost per year
Monthly Cost to Dispose of Residual	$8,344.11	cost per month
Maintenance as % of Capital Cost	2%	estimated Based on EWS experience
Annual Maintenance Cost	**$14,000.00**	

The required labor to operate the waste conversion equipment is also presented in the table above, but it is assumed that this labor is the same or more likely less labor that required to operate a burn pit and/or prepare waste for shipping off-site and therefore was excluded from the operational costs used in the return on investment (ROI) calculation.

The ROI was calculated in Table 25 by taking the estimated capital cost for the DWECX-TEEPS equipment package (at a production level of 80 units) then subtracting the monthly operational cost savings. Using this calculation, the DWECX-TEEPS capital cost investment would be returned within 5 months of operation.

Table 25. Potential Return on Investment from DWECX-TEEPS vs the Current Practice

Annual Savings potential from replacing the current practice with DWECX-TEEPS	**$1,715,272.36**	$/year vs traditional hot water production and waste disposal
Monthly Cost Savings	**$142,939.36**	current cost for waste disposal and hot water cost minus monthly operating cost of DWECX-TEEPS
ROI (Months)	**5**	**Capital cost / monthly savings of DWECX-TEEPS**

For another perspective we have calculated the Net Present Values (NPV) for the project. The capital equipment has a life expectancy of 20 years so we have calculated NPV over twenty years, which determines a NPV of $8,080,000. These potential substantial cost savings over the 20 years of the Waste to Energy project provides excellent financial support for the investment of $700,000 for this project. The cost savings could be used to finance additional Waste to Energy projects.

For the NPV calculation we have assumed 90% up time for the equipment and a 4% interest rate.

Indirect Cost Benefits

Not captured in the return-on-investment calculation are other indirect cost savings and other benefits that using the DWECX-TEEPS could bring. The practice of using open-air burn pits can create many more associated costs related to the environmental, social, and safety and health impacts that they cause. The air pollution associated with burn pits can impact local air quality at a basecamp and affect the health of personnel living and working there. As of Aug 31, 2022, there were more than 325,000 veterans registered on the Airborne Hazards and Open Burn Pit Registry, though Veteran's Affairs (VA) estimates that as many as 3.5 million veterans have been exposed to burn pits. [9] Based on recent reforms including the passing of the PACT Act will ensure that veterans will have compensation for screening, health care and the VA will do more research and focus on prevention. In total, the Congressional Budget Office (CBO) estimates, these measures "would increase direct spending by $225 billion and increase spending subject to appropriation by $188 billion over the 2022-2031 period. [10]

The local air quality impacts are also not welcome by communities of the host country that are located downwind of the open burning as local people including elderly and children can be more severely impacted. After the burn pit has operated the ground is contaminated and difficult to remediate and during rainy seasons the burn pit can create run-off that can migrate and contaminate larger areas including surface or ground water in some cases. The diplomatic and strategic impact of these burn pits on host communities is difficult to quantify. However, overall, the cost-benefit of eliminating burn pits with a cleaner, safer alternative is very clear.

Similarly, there are other indirect costs with utilizing outside contractors to remove waste and dispose of it. This practice opens the base camp to security risks and unplanned potential liability from improper waste disposal. Often host countries do not have adequate waste management infrastructure. Waste will most likely end up in uncontrolled dumps that produce leachate and run-off that can contaminate land and water and often are subject to accidental or deliberate open burning causing air quality issues. Also, there are security risks associated with the dependance upon local contractors from contractor vehicles entering the base or working near the base to pick up the waste. The waste also may contain confidential information or military sensitive materials such as uniforms or other damaged items that could pose a problem if they get into the wrong hands.

The following significant indirect costs have NOT been factored into the cost/benefit analysis:

- Cost of the health impacts on the warfighter due to burn pit exposure:
  - medical and death benefits, long-term support of veteran and family
- Toxic exposure indicated in some rare genetic defects in children of servicemen and women therefore, this could be a multi-generational cost burden.
- Cost of health impacts on local population – host nations may expect reparations for health damage from burn pits
- Environmental liability – future costs to remediate areas where burn-pits were operated or where contractors dumped waste

- Security costs – intelligence information in the wrong hands. Waste containing classified information which may include small scraps of paper with names, coordinates and other information could be damaging to base security or mission.
- Reputational costs – unquantifiable harm to reputation due to the practice of burn pits may continue for many decades. One impact of this may be that new potential military recruits could be discouraged from enlisting due to concerns over health dangers of toxic exposure.
- Poor environmental performance may limit the willingness of other nations worldwide to host US base camps due to concerns over unsustainable waste practices and the potential for local environmental degradation.
- Cost of waste transportation and disposal – transportation costs are subject to escalation, and the fully burdened cost of waste transport including logistics and administrative effort is not fully incorporated into the cost of the waste transport option.

The following study did analyze the benefits of indirect costs and concludes WTE a viable technology for FOB.

"A Life Cycle Analysis of DOD Expeditionary Waste Management Practices Using Simapro" concluded "When consideration is given to all potential costs and benefits of a waste management strategy, WTE technology's mitigated human and environmental health impacts and cost effectiveness make them a viable expeditionary waste management strategy for DoD contingency bases. The DoD should continue investment and research into their utilization"[11].

7.0 IMPLEMENTATION ISSUES

7.1 TRANSITIONING AND TRANSFER OF TECHNOLOGY

- This ESTCP project yielded a proof of concept for micro-scale waste-to-energy using a conventional waste converter system that is based on an existing program platform.
- The US Army (PM-FSS) has an IDIQ contract open to procure the ESWDS (the platform on which the DWECX waste converter is based).
- The priority is to provide a fit-for-purpose system that meets the Army requirement for waste disposal at expeditionary bases. However, DOD is focused on reducing reliance on fossil fuels, therefore a concept to adapt the ESWDS to include expeditionary energy recovery would be of great interest.
- In addition to the Army, any DOD expeditionary forces could benefit from this technology for OCONUS use.
- Agencies carrying out disaster relief or humanitarian missions could also benefit from this technology.
- The ESWDS program has produced a production-ready design, detailed technical data packages, testing program outputs and training tools which will benefit the future transition of the waste convertor.
- The ESTCP project will provide expeditionary base camp planners with data and reports that detail system performance, including volume/weight of ash residual requiring disposal, and connections and integration with base camp infrastructure required to take advantage of the energy produced.
- Subsequent research and development will be required to adapt the concept further to make it operationally viable.
  - In particular the ORC engine technology requires an off the shelf equipment vendor to assist in ORC integration into the DWECX-TEEPS system
- Operational testing of the equipment, by soldiers, will be required to refine the package for eventual deployment.
- As development work matures project performance will be monitored against the Technology Transition Plan which will encompass operational, logistic, environmental, energy and financial performance data.

7.2 PROCUREMENT ISSUES

The DWECX-TEEPS is a custom-built prototype that brings together a combination of commercial off-the-shelf components, custom-fabricated items and subassemblies, and custom PLC Programming (ladder logic), as well as integrated custom-fabricated heat recovery system, and ORC for energy conversion.

Normally these bought-out items and fabrication can be easily procured, often from many different vendors (the ORC being one exception). However, currently there are global supply chain issues resulting in shortages and delays that are affecting almost every kind of manufactured product.

Production of this kind of specialized and highly integrated equipment requires particular experience, and know-how. Under normal circumstances, with a solid quality management plan, well-thought-out production plans, and a realistic schedule, an experienced team can reliably manufacture a system like this. At the moment, although some challenges have eased, production is likely to be slower than normal.

Similarly, scaling up production is also likely to be challenging with some components, unless alternatives are sought. However, in general higher rate production numbers lend themselves to smoother production as larger orders can be placed which are often prioritized by vendors and parts can be purchased in advance of need when production numbers are certain.

The prototype was designed using knowledge and know-how gained over many years of doing this kind of work and from previous research and development efforts that have been privately funded. Construction configuration, materials and components selected build upon this experience. PLC program ladder logic is based on previously developed proprietary systems. However, new technologies developed as a result of this work would likely be covered under government purpose rights.

7.3 ENVIRONMENT, HEALTH AND SAFETY

Environment

As discussed in detail in Section 5.6 Air Emissions, meeting EPA Air emission limits is challenging but with carefully management of the input waste and the waste burn process the EPA OSWIS regulation can be met. This is the strictest air emission standard that is expected to be applicable.

However, if in international applications for example stricter limits were applied Air Pollution Control Equipment would than need to be considered. Adding Air Pollution Control equipment would add considerable complexity and cost to the system which would challenge the practicality of the technology. Key challenges include

- Pressure drop of the additional equipment requires draft induction
  - fan requires significant HP - reduces the net potential energy
- Gases must be cooled before they can be reacted or filtered.
  - Quench cooling uses large amounts of water
  - Air cooling requires a large footprint
- Logistical burden
  - chemical reagents, filters, and fly-ash disposal
- Complexity
  - Mini-process plant
  - Sensitive instrumentation and controls

Health and Safety Considerations

All equipment operators will need to comply with on-site and safety policies as well as other site regulations and constraints. The following section outlines any additional health and safety considerations of the DWECX-TEEPS equipment operation.

Hazardous chemical usage and handling

If the solid waste is properly segregated there will be no hazardous materials used in the waste processing other than the diesel fuel & thermal oil delivered to the equipment.

Thermal protection

The system will operate at elevated temperatures (up to 850°C or 1562°F). All areas that may pose high temperature hazards shall be clearly identified to those operating the system prior to commencing a burn. The system should be inaccessible to those who are not authorized to operate the system. After performing a waste burn, the door will remain closed until the temperature has been reduced to a safe operating temperature. This is to eliminate the possibility of waste/ash re-igniting when the chamber is loaded after ash removal.

Hot water handling

Contact with hot water is not expected during heat recovery, however, if required personnel shall wear proper personal protection equipment for handling hot liquids (e.g., safety glasses, insulated gloves).

Ash handling

Operators that remove the ash from the unit will be required to wear dust masks, safety glasses, and gloves. Subsequent examination and sampling of ash will require dust masks, safety glasses, and gloves.

8.0 REFERENCES

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APPENDIX A POINTS OF CONTACT

Organization	Role(s)	Point of Contact (POC)
Eco Waste Solutions (EWS)	Technology provider. Provides the test infrastructure, test equipment, and operations and maintenance personnel to support the test. Test Lead. Responsible for the preparation and supply of simulated waste feed materials, test coordination, and data collection. Responsible for test report. Also provides scaffolding/boom lift for gas sampling equipment and personnel.	Jean Lucas jlucas@ecosolutions.com Neil Pearce npearce@ecosolutions.com
EthosGen/ Rockwell Collins	Technology provider. Provides the test infrastructure, test equipment, and operations and maintenance personnel to support the test.	Paul Roege (EthosGen) paul.roege@ethosgen.com William Abrams (Rockwell) william.abrams@collins.com
Aberdeen Proving Ground (APG), US Army Test & Evaluation Command (ATEC)	Test site location and host. Provides test site and support infrastructure, installation support, and waste disposal (ash/residues & heat exchange water)	Gene L. Fabian (Test Officer) gene.l.fabian.civ@mail.mil
Alliance Source Testing (AST)	Emissions testing company. Provided emissions sampling and analysis services for March 2021 demonstration	Dave Felt Dave.Felt@stacktest.com
RWDI USA, Consulting Engineers	Emissions testing company. Provided emissions sampling and analysis services for October 2021 demonstration	Steve Smith Steve.Smith@rwdi.com
ESTCP	Project sponsor. Provides funding & overall technical/management oversight.	Braxton Lewis sems@serdp-estcp.org

APPENDIX B SUPPORTING DATA

APPENDIX B1: SIMULATED WASTE CHARACTERISTICS AND WASTE RECIPE

Standard Waste Mixtures Characterization

Waste Category	Percentage of Total Waste	lb/batch	Condition	As-Received Heat Value,HHV	H_2O content	Ash Content	Bulk Density
				Btu/lb	% Wt	% Wt	Lb/ft³
Aluminum	2.16%	11	Solid	0	1%	99%	20
Ferrous metals	3.60%	18	Solid	0	1%	99%	50
Other Metals	0.24%	1	Solid	0	1%	99%	30
Total Metals	**6.00%**	30	Solid	0	1%	99%	32
#1 PET	6.00%	30	Solid	13000	1%	1%	2
#2 HDPE	2.70%	14	Solid	16500	1%	1%	2
# PVC	0.90%	5	Solid	9800	1%	1%	2
#4 LDPE	2.70%	14	Solid	13500	1%	1%	1
#5 PP	0.30%	2	Solid	14000	1%	1%	1
#6 PS	1.80%	9	Solid	14000	1%	1%	1
#7 Others	0.60%	3	Solid	14000	1%	1%	2
Total Plastics	**15.00%**	75	Solid	13708	1%	1%	2
Dog Food	6.65%	33	Solid	3050	10%	23%	30
Canola Oil	2.00%	10	Liquid	13000	0.5%	1%	57
Water	23.35%	117	Lliquid	0	100%	0%	62
Total Food Waste	**32.00%**	160	Solid	1446	75%	5%	50.5
Cardboard	**15.00%**	75	Solid	6500	2%	2%	10
Mixed Paper	**10.00%**	50	Solid	6000	2%	2%	5
Wood	**14.00%**	70	Solid	6500	20%	2%	30
Glass	**1.00%**	5	Solid	0	1%	99%	50
Rubber and Neoprene	**1.00%**	5	Solid	8500	1%	2%	15
Textile	**3.00%**	15	Solid	6500	1%	1%	15
Miscellanies	**3.00%**	15	Solid	1000	70%	5%	10
TOTAL	***100.0%***	***500***	***Solid***	***5314***	***29.7%***	***9.6%***	***6.5***

Waste Higher Heat Value	**5314**	**Btu/lb**	**12.4**	**mj/kg**
Waste Moisture Content	**29.7**	**%**		
Ash/Non Combustible Content	**9.6**	**%**		
Waste Bulk Density	**6.5**	**Lb/ft³**	**105**	**kg/m³**

Modified Waste Mixtures Characterization

Waste Category	Percentage of Total Waste	lb/day	Condition	As-Received Heat Value,HHV	H2O content	Ash Content	Bulk Density
				Btu/lb	% Wt	% Wt	Lb/ft3
Aluminum	1.78%	9	Solid	0	1%	99%	20
Ferrous metals	2.97%	15	Solid	0	1%	99%	50
Other Metals	0.20%	1	Solid	0	1%	99%	30
Total Metals	**4.94%**	**25**	**Solid**	**0**	**1%**	**99%**	32
#1 PET	4.94%	25	Solid	13000	1%	1%	2
#2 HDPE	2.22%	11	Solid	16500	1%	1%	2
# PVC	0.74%	4	Solid	9800	1%	1%	2
#4 LDPE	2.22%	11	Solid	13500	1%	1%	1
#5 PP	0.25%	1	Solid	14000	1%	1%	1
#6 PS	1.48%	7	Solid	14000	1%	1%	1
#7 Others	0.49%	2	Solid	14000	1%	1%	2
Total Plastics	**12.36%**	**62**	**Solid**	**13708**	**1%**	**1%**	2
Dog Food	5.48%	27	Solid	3050	10%	23%	30
Canola Oil	0.00%	0	Liquid	13000	0.5%	1%	57
Water	38.48%	192	Lliquid	0	100%	0%	62
Total Food Waste	**43.96%**	220	Solid	**380**	89%	3%	54.7
Cardboard	**12.36%**	62	Solid	6500	2%	2%	10
Mixed Paper	**8.24%**	41	Solid	6000	2%	2%	5
Wood	**11.54%**	58	Solid	6500	20%	2%	30
Glass	**0.82%**	4	Solid	0	1%	99%	50
Rubber and Neoprene	**0.82%**	4	Solid	8500	1%	2%	15
Textile	**2.47%**	12	Solid	6500	1%	1%	15
Miscellanies	**2.47%**	12	Solid	1000	70%	5%	10
TOTAL	***100.0%***	***500***	***Solid***	***4165***	***43.7%***	***7.9%***	***7.8***

Waste Higher Heat Value	**4165**	**Btu/lb**	**9.7**	**mj/kg**
Waste Moisture Content	**43.7**	**%**		
Ash/Non Combustible Content	**7.9**	**%**		
Waste Bulk Density	**7.8**	**Lb/ft3**	**124**	**kg/m3**

Standard Waste Mixture Recipe			
Waste Category	**Lbs per 1-ton batch**	**Total Required** (10,000lbs)	**Description of Example Simulated Material**
Cardboard			
Item 1	300	1500	Uline 11x17", 1/8" inch thick, corrugated pads model no. S3585 (~1900 sheets) 9500 sheets required
Mixed Paper			
Item 1	20	100	Costco Copy Paper, Letter, 20lb, 92-Bright, 5,000ct (one 20-lb box) 5 boxes required for all burns STAPLES Order
Item 2	180	900	CKF - Savaday #100 Pulp Fiber Food Tray 21562 - 9 x 111/pkg
Food Waste			
Item 1	133	665	Gravy Train® Beef Dry Dog Food (~four 35-lb bags) 20 bags required for all burns - 41lb bags available readily
Item 2	40	200	Crisco Pure Canola Oil, 128 Ounce (~5 containers) 25 containers required for all burns - 19 - 5Litre jugs from Coscto
Item 3	467	2335	Water (~56 gallons)-$
Plastic (total)			
#1 PET	120	600	CLEAR CYLINDER BOTTLES BULK PACK - 12 OZ, STANDARD (
#2HDPE	54	270	Plastic Spray Bottles - 32 oz
#3PVC	18	90	1-1/2 in. x 10 ft. PVC Sch. 40 DWV Plain End Pipe (~1.7 needed) 10 required for all burns
#4LDPE	54	270	CONTRACTOR'S BAG - 55-60 GALLON, 3 MIL, CLEAR
#5 PP	6	30	Polypropylene Lid for Deli Containers 500/carton
#6 PS			
Item 1	11	55	Translucent Cups - 16 oz 1,000/case Total Weight required = 180lbs (item 1 & item 2 of the #6 PS)
Item 2	25	125	
#7 Other	12	60	Verbatim 700 MB 52x 80 Minute Branded Recordable Disc CD-R - 100-Disc Spindle, FFP 97458 (~3 spindles) 15 spindles
Wood			
Item 1	280	1400	2x4x8ft SPF Dimensional Lumber
Metals			
Aluminum	43.2	216	Aluminum Steam Table Pans - Full Size 50/carton
Ferrous			
Item 1	54		
Item 2	18	360	Common Nails - Bright - 3" - 50lb
Non-ferrous	4.8	24	Brass Compression Union 1/4" 10/bag
Glass			
Item 1	20	100	Clear Boston Round Glass Bottles - 32 oz
Rubber & Neoprene			
Item 1	20	100	Vigoro - Black Rubber Mulch
Textile			
Item 1	60	300	Wiping Rags - Mixed Coloured materials 10lb bags
Misc. waste/other			
Item 1	42	210	Nestle Pure Life Purified Water, 16.9-ounce plastic bottles (~40 bottles)
Item 2	6	30	Kirkland batteries - 48 pack
Item 3	6	30	Yellow, High Intensity, 6" Long, 30 Min. Duration (~102 sticks) 510 for all burns -10/pkg
Item 4	6	30	Dust-Off Compressed Gas Duster (~6 canisters) pkg of 12
Total	2000		

APPENDIX B2: PROCESS DATA

ECO600 Mobile Unit Typical/Average Performances

Test Date	10/26/2021				10/27/2021				10/28/2021			
Total System Thermal Input (Waste with Auxiliary Fuel):												
Solid Waste Weight	218	kg	**480**	lb	218	kg	**480**	lb	218	kg	**480**	lb
Solid Waste Higher Heat Value (HHV)	12.36	mj/kg	**5314**	Btu/lb	9.69	mj/kg	**4165**	Btu/lb	9.69	mj/kg	**4165**	Btu/lb
Auxiliary Fuel Flow Rate	113.56	liter	**30**	Gallon	113.56	liter	**30**	Gallon	113.56	liter	**30**	Gallon
Auxiliary Fuel Higher Heat Value	39.02	mj/liter	140000	Btu/gallon	39.02	mj/liter	140000	Btu/gallon	39.02	mj/liter	140000	Btu/gallon
Burn Time	384	min	**384**	min	385	min	**385**	min	377	min	**377**	min
ORC Run Time	360	min	**360**	min	360	min	**360**	min	360	min	**360**	min
Total System Thermal Input (Waste with Auxiliary Fuel):	309	kw	1.055	MMBtu/hour	283	kw	0.966	MMBtu/hour	289	kw	0.987	MMBtu/hour
Flue Gas Thermal Input (From Incinerator to HX):												
Overall Flue Gas Thermal Power Input												
Average Secondary Chamber Temperature	855	°C	1571	°F	855	°C	1571	°F	854	°C	1569	°F
Average Flue Gas Temperature at Inlet of Heat Pipe Exchanger	721	°C	1330	°F	749	°C	1380	°F	758	°C	1396	°F
Average Flue Gas Temperature at Outlet of Heat Pipe Exchanger	450	°C	842	°F	452	°C	846	°F	463	°C	865	°F
Average Flue Gas Mass Flow Rate	2562	kg/hour	5649	lb/hour	2546	kg/hour	5614	lb/hour	2806	kg/hour	6187	lb/hour
Overall Flue Gas Thermal Power Input	231	kw	0.787	MMBtu/hour	248	kw	0.849	MMBtu/hour	276	kw	0.944	MMBtu/hour
ORC Thermal Input:												
Overall Thermal Oil Thermal Power Input (to ORC)												
Average Thermal Oil Temperature at Inlet of ORC	132	°C	269	°F	130	°C	266	°F	133	°C	271	°F
Average Thermal Oil Temperature at Outlet of ORC	36	°C	96	°F	33	°C	92	°F	40	°C	103	°F
Assumed Average Thermal Oil Volume Flow Rate	***49***	***liter/min***	***13***	***GPM***	***43***	***liter/min***	***11***	***GPM***	***66.5***	***liter/min***	***17.57***	***GPM***
Average Thermal Oil Mass Flow Rate	49	kg/min	109	lb/min	43	kg/min	96	lb/min	67	kg/min	148	lb/min
Overall Thermal Oil Thermal Power Input	139	kw	0.475	MMBtu/hour	122	kw	0.418	MMBtu/hour	183	kw	0.624	MMBtu/hour
Heat Loss	39.67	%	39.67	%	50.73	%	50.73	%	33.88	%	33.88	%
Thermal Output (Hot Water):												
Average Water Temperature at Inlet of ORC	31	°C	89	°F	35	°C	95	°F	33	°C	91	°F
Average Water Temperature at Outlet of ORC	45	°C	112	°F	46	°C	116	°F	51	°C	124	°F
Average Water Volume Flow Rate	136	liter/min	36	GPM	136	liter/min	36	GPM	136	liter/min	36	GPM
Average Water Mass Flow Rate	135	kg/min	298	lb/min	135	kg/min	298	lb/min	135	kg/min	298	lb/min
Overall Water Thermal Energy Output	125	kw	0.427	MMBtu/hour	109	kw	0.371	MMBtu/hour	172	kw	0.588	MMBtu/hour
Performances-Electrical Power Output (Estimated for Reference):												
Gross Electrical Power output	**14**	**kw**	0.048	MMBtu/hour	**14**	**kw**	0.047	MMBtu/hour	**10**	**kw**	0.036	MMBtu/hour
Gross Electrical Efficiency of ORC	10.12	%	10.12	%	11.19	%	11.19	%	5.72	%	5.72	%
System Performances (Estimated for Reference):												
Gross Thermal Energy (Hot Water) output	125	kw	0.427	MMBtu/hour	109	kw	0.371	MMBtu/hour	172	kw	0.588	MMBtu/hour
Gross Electrical Power output	14	kw	0.048	MMBtu/hour	14	kw	0.047	MMBtu/hour	10	kw	0.036	MMBtu/hour
CHP (Combined Heat and Power)	139	kw	0.475	MMBtu/hour	122	kw	0.418	MMBtu/hour	183	kw	0.624	MMBtu/hour
CHP Efficiency of Heat Exchanger and ORC	60	%	60	%	49	%	49	%	66	%	66	%
Average Thermal Energy Input Rate (Waste and Diesel)	309	kw	1.055	MMBtu/hour	283	kw	0.966	MMBtu/hour	289	kw	0.987	MMBtu/hour
Total System CHP Efficiency (Higher Heat Value)	45	%	45	%	43	%	43	%	63	%	63	%
Total System Gross Electrical Power Efficiency (Higher Heat Value)	4.6	%	4.6	%	4.8	%	4.8	%	3.6	%	3.6	%
Estimated Electrical Power Produced:												
Assumed Peak power demand	**9.16**	**kw**			**9.16**	**kw**			**9.16**	**kw**		
Total Electrical Consumption	**23.92**	**kwh/Batch**			**23.97**	**kwh/Batch**			**23.53**	**kwh/Batch**		
Total Electrical Energy Production	**84.47**	**kwh/Batch**			**82.23**	**kwh/Batch**			**62.68**	**kwh/Batch**		
Net Electrical Power Output	**60.56**	**kwh/Batch**			**58.26**	**kwh/Batch**			**39.15**	**kwh/Batch**		

APPENDIX B3: STACK EMISSION RESULTS "2021 SOURCE TESTING PROGRAM (INCINERATOR MAIN STACK) ECO WASTE SOLUTIONS ABERDEEN PROVING GROUNDS"

FINAL REPORT

ECO WASTE SOLUTIONS ABERDEEN PROVING GROUNDS

ABERDEEN, MARYLAND

2021 SOURCE TESTING PROGRAM (INCINERATOR MAIN STACK)

RWDI #2200515

February 12, 2022

SUBMITTED TO

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EXECUTIVE SUMMARY

RWDI US LLC (RWDI) was retained by Valley Environmental to conduct emission sampling on the main stack servicing the incinerator on behalf of Eco Waste Solutions for their Aberdeen Proving Grounds location. The test program was discussed with Valley Environmental and Eco Waste Solutions prior to commencing with the study and the scope of work was confirmed and completed during the week of October 24, 2021. The testing included the following parameters:

• Particulate Matter (Total particulate (PM) including PM_{10} and $PM_{2.5}$)	• Volatile Organic Compounds (VOCs) Total Hydrocarbon (THC) and Speciated VOCs
• Metals	• Hydrogen Fluoride (HF)
• Sulfur Dioxide (SO_2)	• Hydrogen Chloride (HCl)
• Oxides of Nitrogen (NO_x)	• Hydrogen Bromide (HBr)
• Carbon Monoxide (CO)	• Methane (CH_4)
• Oxygen (O_2)	• Dioxins & Furans (D&F)
• Carbon Dioxide (CO_2)	• Polychlorinated Aromatic Hydrocarbons (PAHs)

The following table represents a summary of the stack testing results and comparison to the testing completed on March 2-4, 2021 completed by Alliance Source Testing, LLC.

Parameter	Data	Stack Testing Results October 2021 (With Heat Exchanger) (RWDI)	Stack Testing Results March 2021 (Without Heat Exchanger) (Alliance Source Testing, LLC)
Particulate Matter (PM)	Concentration	0.0061 gr/dscf @7% O_2	0.0055 gr/dscf @7% O_2
	Emission Rate	0.039 lb/hr	0.033 lb/hr
Hydrogen Chloride	Concentration	59.3 ppmvd @ 7% O_2	111.7 ppmvd @ 7% O_2
	Emission Rate	0.24 lb/hr	0.47 lb/hr
Hydrogen Fluoride	Concentration	0.57 ppmvd @ 7% O_2	4.8 ppmvd @ 7% O_2
	Emission Rate	0.0012 lb/hr	0.011 lb/hr
Hydrogen Bromide	Concentration	0.77 ppmvd @ 7% O_2	0.061 ppmvd @ 7% O_2
	Emission Rate	0.0067 lb/hr	0.00057 lb/hr
Sulfur Dioxide	Concentration	4.29 ppmvd @ 7% O_2	22.7 ppmvd @ 7% O_2
	Emission Rate	0.054 lb/hr	0.17 lb/hr
Nitrogen Oxides	Concentration	84.0 ppmvd @ 7% O_2	180.3 ppmvd @ 7% O_2
	Emission Rate	0.43 lb/hr	0.94 lb/hr
Carbon Monoxide	Concentration	15.1 ppmvd @ 7% O_2	10.4 ppmvd @ 7% O_2
	Emission Rate	0.047 lb/hr	0.033 lb/hr
Volatile Organic Compounds	Concentration	4.5 ppmvd @ 7% O_2	74.3 ppmvd @ 7% O_2
	Emission Rate	0.012 lb/hr	0.37 lb/hr
Opacity	Observation	0%	0%

Parameter	Data	Stack Testing Results October 2021 (With Heat Exchanger) (RWDI)	Stack Testing Results March 2021 (Without Heat Exchanger) (Alliance Source Testing, LLC)
Dioxin/Furan (DF)	Concentration	37.3 ng/dscm (total mass basis)	21.4 ng/dscm (total mass biasis)
	TEQ Concentration	12.4 ng/dscm @7% O_2	3.0 ng/dscm @7% O_2
	TEQ Emission Rate	$3.3x10^{-08}$ lb/hr	$7.7x10^{-09}$ lb/hr
Antimony	Concentration	50.6 µg/dscm @ 7% O_2	206.4 µg/dscm @ 7% O_2
	Emission Rate	$1.41x10^{-4}$ lb/hr	$5.5x10^{-4}$ lb/hr
Arsenic	Concentration	0.46 µg/dscm @ 7% O_2	1.3 µg/dscm @ 7% O_2
	Emission Rate	$1.28x10^{-6}$ lb/hr	$3.4x10^{-6}$ lb/hr
Barium	Concentration	5.50 µg/dscm @ 7% O_2	13.4 µg/dscm @ 7% O_2
	Emission Rate	$1.52x10^{-5}$ lb/hr	$3.6x10^{-5}$ lb/hr
Beryllium	Concentration	0.09 µg/dscm @ 7% O_2	0.037 µg/dscm @ 7% O_2
	Emission Rate	$2.56x10^{-7}$ lb/hr	$9.8x10^{-8}$ lb/hr
Cadmium	Concentration	0.90 µg/dscm @ 7% O_2	1.6 µg/dscm @ 7% O_2
	Emission Rate	$2.48x10^{-6}$ lb/hr	$4.2x10^{-6}$ lb/hr
Chromium	Concentration	3.27 µg/dscm @ 7% O_2	3.5 µg/dscm @ 7% O_2
	Emission Rate	$9.06x10^{-6}$ lb/hr	$9.2x10^{-6}$ lb/hr
Cobalt	Concentration	0.24 µg/dscm @ 7% O_2	0.36 µg/dscm @ 7% O_2
	Emission Rate	$6.53x10^{-7}$ lb/hr	$9.5x10^{-7}$ lb/hr
Copper	Concentration	29.0 µg/dscm @ 7% O_2	52.8 µg/dscm @ 7% O_2
	Emission Rate	$8.04x10^{-5}$ lb/hr	$1.4x10^{-4}$ lb/hr
Lead	Concentration	27.2 µg/dscm @ 7% O_2	77.6 µg/dscm @ 7% O_2
	Emission Rate	$7.47x10^{-5}$ lb/hr	$2.1x10^{-4}$ lb/hr
Manganese	Concentration	16.1 µg/dscm @ 7% O_2	47.3 µg/dscm @ 7% O_2
	Emission Rate	$4.42x10^{-5}$ lb/hr	$1.3x10^{-4}$ lb/hr
Nickel	Concentration	2.74 µg/dscm @ 7% O_2	2.2 µg/dscm @ 7% O_2
	Emission Rate	$7.54x10^{-6}$ lb/hr	$5.6x10^{-6}$ lb/hr
Phosphorus	Concentration	48.2 µg/dscm @ 7% O_2	187.3 µg/dscm @ 7% O_2
	Emission Rate	$1.33x10^{-4}$ lb/hr	$4.9x10^{-4}$ lb/hr
Selenium	Concentration	1.13 µg/dscm @ 7% O_2	2.3 µg/dscm @ 7% O_2
	Emission Rate	$3.15x10^{-6}$ lb/hr	$6.2x10^{-6}$ lb/hr
Silver	Concentration	4.20 µg/dscm @ 7% O_2	8.4 µg/dscm @ 7% O_2
	Emission Rate	$1.16x10^{-5}$ lb/hr	$2.2x10^{-5}$ lb/hr
Thallium	Concentration	0.16 µg/dscm @ 7% O_2	0.52 µg/dscm @ 7% O_2
	Emission Rate	$4.35x10^{-7}$ lb/hr	$1.4x10^{-6}$ lb/hr
Zinc	Concentration	564.2 µg/dscm @ 7% O_2	4,200 µg/dscm @ 7% O_2
	Emission Rate	$1.56x10^{-3}$ lb/hr	$1.1x10^{-2}$ lb/hr
Mercury	Concentration	0.22 µg/dscm @ 7% O_2	0.28 µg/dscm @ 7% O_2
	Emission Rate	$6.20x10^{-7}$ lb/hr	$7.4x10^{-7}$ lb/hr

Notes:

[1] Concentration values are expressed at 101.3 kPa, 68 °F, and 7% oxygen

Comparison of Events to Applicable Limits

Compound	Units	Other Solid Waste Incinerators (OSWIs) (Limits)	March 2021 Results (without Heat Exchanger)	October 2021 Results (with Heat Exchanger)
Carbon Monoxide	ppmvd	40	10.4	15.1
Dioxin & Furan (total mass basis)	ng/dscm	33	21.4	37.3
Hydrogen Chloride	ppmvd	18	111.6	59.3
Cadmium	µg/dscm	18	1.6	0.90
Lead	µg/dscm	226	77.6	27.2
Mercury	µg/dscm	74	0.28	0.22
Opacity	Percent	10%	0%	0%

Further details on the comparison for Polychlorinated Aromatic Hydrocarbons (PAHs) and VOCs (speciated) are provided in **Appendices C and E**, respectively. Full details on the results are provided in **Appendices A to F**.

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1 INTRODUCTION

RWDI US LLC (RWDI) was retained by Valley Environmental to conduct emission sampling on the main stack servicing the incinerator on behalf of Eco Waste Solutions for their Aberdeen Proving Grounds location. The test program was discussed with Valley Environmental and Eco Waste Solutions prior to commencing with the study and the scope of work was confirmed and completed during the week of October 24, 2021. The testing included the following parameters:

Table 1.1: Summary of Sampling Parameters

• Particulate Matter (Total particulate (PM) including PM_{10} and $PM_{2.5}$)	• Volatile Organic Compounds (VOCs) Total Hydrocarbon (THC) and Speciated VOCs
• Metals	• Hydrogen Fluoride (HF)
• Sulfur Dioxide (SO_2)	• Hydrogen Chloride (HCl)
• Oxides of Nitrogen (NO_x)	• Hydrogen Bromide (HBr)
• Carbon Monoxide (CO)	• Methane (CH_4)
• Oxygen (O_2)	• Dioxins & Furans (D&F)
• Carbon Dioxide (CO_2)	• Polychlorinated Aromatic Hydrocarbons (PAHs)

2 SOURCE DESCRIPTION

2.1 Facility Description

Eco Waste Solutions operates a waste incinerator at the Aberdeen Proving Grounds in Aberdeen, Maryland. Waste material generated at the site is processed in the waste incinerator at a high temperature to ensure proper combustion. The waste incinerator is equipped with an after-burner to complete a secondary combustion process to further reduce overall emissions.

3 SAMPLING LOCATION

3.1 Source Sample Location Description

The outlet sampling location for the main stack in located directly on top of the waste incinerator. There is no access to the sampling ports and therefore, a manlift was required to reach the sampling locations and extract gases for the various testing parameters. The stack diameter is 24 inches and the sampling ports consisted of two locations, 90 degrees apart and 4 inches in diameter. The sampling ports were located >8 duct diameters downstream from the incineration unit and >2 duct diameters upstream before the stack outlet.

4 SAMPLING METHODOLOGY

The following section provides an overview of the sampling methodologies used in this program. **Table 1**, located in the **Tables** section, summarizes the testing parameters and corresponding methodologies.

4.1 Stack Velocity, Temperature, and Volumetric Flow Rate Determination

The exhaust velocities and flow rates were determined following the US EPA Method 2, "Determination of Stack Gas Velocity and Flow Rate (Type S Pitot Tube)". Velocity measurements were taken with a pre-calibrated S-Type pitot tube and incline manometer. Volumetric flow rates were determined following the equal area method as outlined in US EPA Method 2. Temperature measurements were made simultaneously with the velocity measurements and were conducted using a chromel-alumel type "k" thermocouple in conjunction with a digital temperature indicator.

The dry molecular weight of the stack gas was determined following calculations outlined in US EPA Method 3, "Determination of Molecular Weight of Dry Stack Gas". Stack moisture content was determined through direct condensation and according to US EPA Method 4, "Determination of Moisture Content of Stack Gas".

Results from flow rate determinations for each test is provide in **Appendices A to E**.

4.2 Sampling for Gases (O_2, CO_2, CO, NOx and SO_2)

Testing for O_2, CO_2, CO, NO_X, and SO_2 was accomplished using continuous emission monitors (CEM) and the FTIR. The exhaust gas sample was sampled by drawing a sample stream of flue gases through a stainless-steel probe attached to a heated filter and a heated sample line that is attached to the Automated Sampling Console (ASC-10ST). The ASC-10ST sampling console delivers a continuous sample to the MKS MultiGas 2030 FTIR for analysis. The procedure complied with U.S. EPA Method 320.

The heated line was maintained at approximately 375°F and the MKS MultiGas 2030 FTIR and MAX Analytical ASC-10ST gas components were at 375ºF. The end of the probe was connected to a heated Teflon sample line, which delivers the sample gases from the stack to the FTIR system. The heated sample line is designed to maintain the gas temperature above 250°F in order to prevent condensation of stack gas moisture within the line. The sample was then routed through a manifold system and introduced to the individual CEM's for measurement. The sample line was heated to 375ºF.

The ASC-10ST was used to deliver calibration gases (Calibration Transfer Standard (CTS), QA Spike and Nitrogen) to the FTIR in direct (to analyzer) and system (to probe) modes.

A laptop computer was utilized for operating the MKS MultiGas 2030 FTIR and MAX Analytical ASC-10ST sampling console and logging the multi-gas FTIR data. Data was logged as one minute averages for the actual test period (FTIR PRN files and Spectra). All concentration data were determined using the MKS 2030 MultiGas FTIR software. A typical MKS 2030 FTIR and ASC-10 ST configuration is depicted in **Figure 4.2.1**.

For oxygen measurement, an EPA Method 3A compliant Brand Gaus Model 4710 wet O_2 analyzer was used. Prior to testing, sample system bias checks and instrument linearity checks (calibration error) were completed in compliance with EPA Method 3A. In addition, the analysers were calibrated (zeroed and span checked) at the completion of each run. A data logger system programmed to collect and record data at 1- second intervals was used to compute and record one-minute average concentrations. The average was drift corrected using pre and post drift checks and changed from wet to dry using stack moisture content. Results are provided in **Appendix A** section.

Figure 4.2.1: Typical MKS MultiGas 2030 FTIR and ASC-10ST measurement system

4.3 Sampling for Total Hydrocarbons (as Propane)

Testing for THC (as propane) was accomplished using continuous emission monitors (CEM). The exhaust gas sample was drawn from a single point at the center of the stack using a stainless steel probe. The sample then proceeded to a heated filter, where particulate matter was removed, and then transferred via a heated Teflon line that was heated to 375°F to prevent any condensation. The stack gas was then introduced to the CEM's for measurement.

Prior to testing, sample system bias checks and instrument linearity checks (calibration error) were conducted. In addition, the analyzers were calibrated (zeroed and span checked) at the completion of each run. Data acquisition was provided using a data logger system that generates one minute average concentrations.

Results are provided in **Appendix A** section.

4.4 Gas Dilution (Method 205)

Calibration gas was mixed using an Environics 4040 Gas Dilution System. The mass flow controllers are factory calibrated using a primary flow standard traceable to the United States National Institute of Standards and Technology (NIST). Each flow controller utilizes an 11-point calibration table with linear interpolation, to increase accuracy and reduce flow controller nonlinearity. The calibration is done yearly, and the records are included in **Appendix H.** A multi-point EPA Method 205 check was executed in the field prior to testing to ensure accurate gas-mixtures. The gas dilution system consisting of calibrated orifices or mass flow controllers and dilutes a high-level calibration gas to within ±2% of predicted values. The gas divider is capable of diluting gases at set increments and was evaluated for accuracy in the field in accordance with US EPA Method 205 "*Verification of Gas Dilution Systems for Field Instrument Calibrations*". Before testing, the gas divider dilutions were measured to evaluate that the responses are within ±2% of predicted values. In addition, a certified mid-level calibration gas within ±10% of one of the tested dilution gases were introduced into an analyzer to ensure the response of the gas calibration is within ±2% of gas divider dilution concentration.

4.5 Sampling for Total Particulate Matter (TPM) and Metals

Sampling for TPM in the exhaust stacks was performed in accordance with US EPA Method 5, "Sampling of Total Particulate Matter from Stationary Sources". Sampling was conducted using an Environmental Supply C-5000 Source Sampling System. Triplicate sampling runs were conducted for each stack. Particulate matter concentrations and emission rates were determined utilizing EPA Method 5. Metal concentrations and emission rates (Antimony, Arsenic, Barium, Beryllium, Cadmium, Cobalt, Copper, Lead, Manganese, Nickel, Phosphorus, Selenium, Silver, Thallium, Zinc and Mercury (filterable and non-filterable)) were determined utilizing Method 29. Particulate and metals were sampled using combined trains as follows.

The combined sample train consisted of a glass nozzle, a heated glass probe, a heated tared quartz filter, two chilled impingers each with 100 mL of 5% HNO_3/10% H_2O_2, an empty impinger, two chilled impingers each with 100 mL of 4% $KMnO_4$/10% H_2SO_4, an impinger with 200 grams of silica gel, and a dry gas metering console. The temperature of the filter was monitored and controlled to 248 + 250F.

At the end of each test run, the nozzle, probe, and filter front half were first rinsed and brushed with acetone into a sample jar. The nozzle, probe, and filter front half were then rinsed with 100 mL of 0.1 N nitric acid into a second sample jar. The filter was then recovered into the original labeled petri dish.

The contents of the 5% HNO_3/10% H_2O_2 impinger were poured back into the original reagent jar. Any condensate in the empty impinger was poured into a sample jar. The 4% $KMnO_4$/10% H_2SO_4 impingers were then recovered into another sample jar.

The moisture catch was then determined gravimetrically. The filter back half and 5% HNO_3/10% H_2O_2 impingers were rinsed with 100 mL of 0.1 N nitric acid into a sample jar.

The empty impinger was rinsed with 100 mL of 0.1 nitric acid into a sample jar. The 4% $KMnO_4$/10% H_2SO_4 impingers were then rinsed with 100 mL 4% $KMnO_4$/10% H_2SO_4 and 100 mL of DI water into the jar containing the 4% $KMnO_4$/10% H_2SO_4 reagent. The 4% $KMnO_4$/10% H_2SO_4 impingers and connecting glassware were rinsed with 25 mL of 8 N HCl if any brown residue remained. This HCl rinse was added to a jar containing 200 mL of DI water.

Samples were then packaged for transport to ALS Global Laboratories in Burlington, Ontario for analysis. Results are provided in **Appendix B** section.

4.6 Sampling for Dioxins (PCDD) and Furans (PCDF) and Polychlorinated Aromatic Hydrocarbons

The concentrations and emission rates of polychlorinated dibenzo-p-dioxins/polychlorinated dibenzofurans (PCDD/PCDF) or dioxins/furans) and polychlorinated aromatic hydrocarbons were determined utilizing EPA Method 23. The EPA Method 23 sampling train consisted of a glass nozzle, a heated glass probe, a heated quartz filter, a condenser, and XAD resin trap, an empty impinger, two chilled impingers each with 100mL of DI water, an empty impinger, an impinger with 200 grams of silica gel, and a dry gas metering console.

At the end of each test run, the nozzle, probe and filter front half were rinsed with acetone into a sample jar. The filter was recovered dry into a glass petri dish. The filter backhalf and condenser were rinsed with acetone into a sample jar. All of the components listed above up to the XAD resin trap were then rinsed again with hexane into a sample jar. The XAD resin trap was sealed and placed into a chilled ice chest. The contents of the first three impingers were poured back into the original reagent jar. The silica gel was poured back into its original container. The moisture catch was determined gravimetrically. The samples were analyzed in accordance with EPA Method 23 for dioxins/furans and polychlorinated aromatic hydrocarbons.

Samples were then packaged for transport to ALS Global Laboratories in Burlington, Ontario for analysis. Results are provided in **Appendix C** section.

4.7 Sampling for Total Fluorides, Total Bromides and Total Chlorides

Total Fluoride as hydrogen fluoride, Total Bromide as Hydrogen Bromide and Total Chloride as hydrogen chloride concentrations and emission rates were determined utilizing EPA Method 26A modified to use large impingers. The EPA Method 26/A sampling train consisted of a heated glass probe, a heated quartz filter, and two chilled impingers each with 100mL of 0.1N H2SO4, one empty impinger, an impinger with 200 grams of silica gel, and a dry gas metering console.

At the end of each test run, the contents of the impingers were poured into a sample jar. The silica gel was returned to its original container. The moisture catch in the train components was then determined gravimetrically. The filter backhalf and H_2SO_4 impingers were rinsed with DI water into the H_2SO_4 reagent jar.

The H_2SO_4 portion of the sample was analyzed in accordance with EPA Method 26/26B.

Samples were then packaged for transport to ALS Global Laboratories in Burlington, Ontario for analysis. Results are provided in **Appendix D** section.

4.8 Sampling for Volatile Organic Compounds (VOC) Speciated

Sampling for speciated Volatile Organic Compounds (VOCs) was completed using U.S. EPA Method TO-15. Prepared stainless steel canisters by ALS Global Laboratories are cleaned and proofed prior to receiving. The gas sample is extracted from a stainless steel probe to a heated line and then through clean Teflon line, conditioning system to the summa canisters.

Samples were then packaged for transport to ALS Global Laboratories in Burlington, Ontario for analysis. Results are provided in **Appendix E** section.

4.9 Sampling for Opacity

Opacity (visible emissions) observations were completed by RWDI trained and Certified staff following the requirements under Method 9. Results are provided in **Appendix F** section.

4.10 Quality Assurance/ Quality Control Activities

Applicable quality assurance measures were implemented during the sampling program to ensure the integrity of the results. These measures included detailed documentation of field data, equipment calibrations for all measured parameters, completion of Chain of Custody forms when submitting laboratory samples, and submission of field blank samples to the laboratories. **Table 2** presents a sample log and summarizes the sampling times.

Quality control procedures specific to the CEM monitoring included linearity checks, to determine the instrument performance, and reproducibility checks prior to its use in the field. Regular performance checks on the analyzer were also carried out during the testing program by performing hourly zero checks and span calibration checks using primary gas standards. Sample system bias checks were also done. These checks were used to verify the ongoing accuracy of the monitor and sampling system over time. Pollutant-free (zero) air was introduced to perform the zero checks, followed by a known calibration (span) gas into the monitor. The response of the monitor to pollutant-free air and the corresponding sensitivity to the span gas were recorded regularly during the tests.

Leak checks were performed on the Method 5, 23 and 26 sampling train by plugging the sample inlet and pulling a representative vacuum. This check was done before and after each test. Similar leak check procedures for pitot tube and pressure lines were also conducted. Daily temperature sensor audits were completed by noting the ambient temperature, as measured by a reference thermometer, and comparing these values to those obtained from the stack sensor. Leak checks for each test were documented on the field data sheets presented in the applicable appendices for each sample parameter.

5 RESULTS

The average emission results for this study are presented in the **Tables** section of this report. **Table 2** presents a summary of test dates and times. A minimum of three (3) tests on the stack was performed for all of the parameters tested in the study. Detailed information regarding each test run can be found in the corresponding Appendix. Below is a summary of the applicable Table and Appendix ID with corresponding test parameter.

Table 5.1: References to Results Summary

Parameter	Appendix
Stack Gas Characteristics	C/D/E
Continuous Emission Monitoring (CO, SO_2, NO_x, O_2, CO_2, and THC)	A
Total Particulate Matter and Selected Metals	B
Dioxins and Furans and Polychlorinated Aromatic Hydrocarbons (PAHs)	C
Hydrogen Chloride, Hydrogen Bromide, and Hydrogen Fluoride	D
VOCs (Speciated)	E
Opacity	F

Field notes are provided in **Appendix G**. All calibration information for the equipment used for this study is included in **Appendix H**. All laboratory results are included in **Appendix I**. Sample calculations are provide in **Appendix J**.

5.1 Discussion of Results

The following table represents a summary of the stack testing results and comparison to the testing completed on March 2-4, 2021 completed by Alliance Source Testing, LLC.

Table 5.1.1: Summary of Results from October 2021 and March 2021

Parameter	Data	Stack Testing Results October 2021 (With Heat Exchanger) (RWDI)	Stack Testing Results March 2021 (Without Heat Exchanger) (Alliance Source Testing, LLC)
Particulate Matter (PM)	Concentration	0.0061 gr/dscf @7% O_2	0.0055 gr/dscf @7% O_2
	Emission Rate	0.039 lb/hr	0.033 lb/hr
Hydrogen Chloride	Concentration	59.3 ppmvd @ 7% O_2	111.7 ppmvd @ 7% O_2
	Emission Rate	0.24 lb/hr	0.47 lb/hr
Hydrogen Fluoride	Concentration	0.57 ppmvd @ 7% O_2	4.8 ppmvd @ 7% O_2
	Emission Rate	0.0012 lb/hr	0.011 lb/hr
Hydrogen Bromide	Concentration	0.77 ppmvd @ 7% O_2	0.061 ppmvd @ 7% O_2
	Emission Rate	0.0067 lb/hr	0.00057 lb/hr
Sulfur Dioxide	Concentration	4.29 ppmvd @ 7% O_2	22.7 ppmvd @ 7% O_2
	Emission Rate	0.054 lb/hr	0.17 lb/hr
Nitrogen Oxides	Concentration	84.0 ppmvd @ 7% O_2	180.3 ppmvd @ 7% O_2
	Emission Rate	0.43 lb/hr	0.94 lb/hr
Carbon Monoxide	Concentration	15.1 ppmvd @ 7% O_2	10.4 ppmvd @ 7% O_2
	Emission Rate	0.047 lb/hr	0.033 lb/hr

Parameter	Data	Stack Testing Results October 2021 (With Heat Exchanger) (RWDI)	Stack Testing Results March 2021 (Without Heat Exchanger) (Alliance Source Testing, LLC)
Volatile Organic Compounds	Concentration	4.5 ppmvd @ 7% O_2	74.3 ppmvd @ 7% O_2
	Emission Rate	0.012 lb/hr	0.37 lb/hr
Opacity	Observation	0%	0%
Dioxin/Furan (DF)	Concentration	37.3 ng/dscm (total mass basis)	21.4 ng/dscm (total mass basis)
	Concentration	12.4 ng/dscm @7% O_2	3.0 ng/dscm @7% O_2
	Emission Rate	$3.3x10^{-08}$ lb/hr	$7.7x10^{-09}$ lb/hr
Antimony	Concentration	50.6 µg/dscm @ 7% O_2	206.4 µg/dscm @ 7% O_2
	Emission Rate	$1.41x10^{-4}$ lb/hr	$5.5x10^{-4}$ lb/hr
Arsenic	Concentration	0.46 µg/dscm @ 7% O_2	1.3 µg/dscm @ 7% O_2
	Emission Rate	$1.28x10^{-6}$ lb/hr	$3.4x10^{-6}$ lb/hr
Barium	Concentration	5.50 µg/dscm @ 7% O_2	13.4 µg/dscm @ 7% O_2
	Emission Rate	$1.52x10^{-5}$ lb/hr	$3.6x10^{-5}$ lb/hr
Beryllium	Concentration	0.09 µg/dscm @ 7% O_2	0.037 µg/dscm @ 7% O_2
	Emission Rate	$2.56x10^{-7}$ lb/hr	$9.8x10^{-8}$ lb/hr
Cadmium	Concentration	0.90 µg/dscm @ 7% O_2	1.6 µg/dscm @ 7% O_2
	Emission Rate	$2.48x10^{-6}$ lb/hr	$4.2x10^{-6}$ lb/hr
Chromium	Concentration	3.27 µg/dscm @ 7% O_2	3.5 µg/dscm @ 7% O_2
	Emission Rate	$9.06x10^{-6}$ lb/hr	$9.2x10^{-6}$ lb/hr
Cobalt	Concentration	0.24 µg/dscm @ 7% O_2	0.36 µg/dscm @ 7% O_2
	Emission Rate	$6.53x10^{-7}$ lb/hr	$9.5x10^{-7}$ lb/hr
Copper	Concentration	29.0 µg/dscm @ 7% O_2	52.8 µg/dscm @ 7% O_2
	Emission Rate	$8.04x10^{-5}$ lb/hr	$1.4x10^{-4}$ lb/hr
Lead	Concentration	27.2 µg/dscm @ 7% O_2	77.6 µg/dscm @ 7% O_2
	Emission Rate	$7.47x10^{-5}$ lb/hr	$2.1x10^{-4}$ lb/hr
Manganese	Concentration	16.1 µg/dscm @ 7% O_2	47.3 µg/dscm @ 7% O_2
	Emission Rate	$4.42x10^{-5}$ lb/hr	$1.3x10^{-4}$ lb/hr
Nickel	Concentration	2.74 µg/dscm @ 7% O_2	2.2 µg/dscm @ 7% O_2
	Emission Rate	$7.54x10^{-6}$ lb/hr	$5.6x10^{-6}$ lb/hr
Phosphorus	Concentration	48.2 µg/dscm @ 7% O_2	187.3 µg/dscm @ 7% O_2
	Emission Rate	$1.33x10^{-4}$ lb/hr	$4.9x10^{-4}$ lb/hr
Selenium	Concentration	1.13 µg/dscm @ 7% O_2	2.3 µg/dscm @ 7% O_2
	Emission Rate	$3.15x10^{-6}$ lb/hr	$6.2x10^{-6}$ lb/hr
Silver	Concentration	4.20 µg/dscm @ 7% O_2	8.4 µg/dscm @ 7% O_2
	Emission Rate	$1.16x10^{-5}$ lb/hr	$2.2x10^{-5}$ lb/hr
Thallium	Concentration	0.16 µg/dscm @ 7% O_2	0.52 µg/dscm @ 7% O_2
	Emission Rate	$4.35x10^{-7}$ lb/hr	$1.4x10^{-6}$ lb/hr
Zinc	Concentration	564.2 µg/dscm @ 7% O_2	4,200 µg/dscm @ 7% O_2
	Emission Rate	$1.56x10^{-3}$ lb/hr	$1.1x10^{-2}$ lb/hr
Mercury	Concentration	0.22 µg/dscm @ 7% O_2	0.28 µg/dscm @ 7% O_2
	Emission Rate	$6.20x10^{-7}$ lb/hr	$7.4x10^{-7}$ lb/hr

Notes:
[1] Concentration values are expressed at 101.3 kPa, 68 °F, and 7% oxygen

Table 5.1.2: Summary of Test Runs – Particulate Matter and Halides

Run Number	Run 1	Run 2	Run 3	Average
Date	**October 26, 2022**	**October 27, 2022**	**October 28, 2022**	
Particulate Matter				
Concentration, grains/dscf @ 7%O_2.	0.0049	0.0066	0.0070	0.0061
Emission Rate, lb/hr	0.030	0.041	0.041	0.039
Hydrogen Chloride				
Concentration, ppmvd @ 7%O_2.	13.10	47.99	116.7	59.3
Emission Rate, lb/hr	0.049	0.18	0.495	0.241
Hydrogen Fluoride				
Concentration, ppmvd @ 7%O_2.	0.51	0.64	0.57	0.57
Emission Rate, lb/hr	0.0011	0.0013	0.0013	0.0012
Hydrogen Bromide				
Concentration, ppmvd @ 7%O_2.	0.77	0.74	0.79	0.77
Emission Rate, lb/hr	0.0064	0.0062	0.0075	0.0067

Table 5.1.3: Summary of Test Runs – SO_2, NO_x, CO, VOC, and Visible Emissions

Run Number	Run 1	Run 2	Run 3	Average
Date	**October 26, 2022**	**October 27, 2022**	**October 28, 2022**	
Sulfur Dioxide				
Concentration, ppmvd @ 7%O_2.	2.1	3.2	7.5	4.29
Emission Rate, lb/hr	0.05	0.06	0.06	0.05
Nitrogen Oxides				
Concentration, ppmvd @ 7%O_2.	80.1	82.0	89.8	84.0
Emission Rate, lb/hr	0.41	0.42	0.46	0.43
Carbon Monoxide				
Concentration, ppmvd @ 7%O_2.	15.7	12.4	17.0	15.1
Emission Rate, lb/hr	0.049	0.039	0.053	0.047
Volatile Organic				
Concentration, ppmvd @ 7%O_2.	0.0	1.8	11.6	4.5
Emission Rate, lb/hr	0.00	0.009	0.027	0.012
Visible Emission Evaluations				
6-Minute Average, Opacity, %	0%	0%	0%	0%
Limit, %	--	--	--	10%

Table 5.1.4: Summary of Test Runs – Dioxins and Furans

Run Number	Run 1	Run 2	Run 3	Average
Date	**October 26, 2022**	**October 27, 2022**	**October 28, 2022**	
D/F Concentration, ng/dscm (total mass basis)	35.1	33.0	43.5	37.3
D/F TEQ Concentration, ng/dscm (@7% O_2)[1]	11.3	11.7	14.1	12.4
D/F TEQ Emission Rate, lb/hr[1]	2.98×10^{-8}	2.95×10^{-8}	4.06×10^{-8}	3.30×10^{-8}
2,3,7,8-TCDD Concentration, ng/dscm @ 7% O_2	0.46	0.40	0.44	0.43
1,2,3,7,8-PeCDD Concentration, ng/dscm @ 7% O_2	1.47	1.50	1.60	1.53
1,2,3,4,7,8-HxCDD Concentration, ng/dscm @ 7% O_2	0.65	0.68	0.70	0.68
1,2,3,6,7,8-HxCDD Concentration, ng/dscm @ 7% O_2	1.02	1.00	1.10	1.04
1,2,3,7,8,9-HxCDD Concentration, ng/dscm @ 7% O_2	1.36	1.22	1.38	1.32
1,2,3,4,6,7,8-HpCDD Concentration, ng/dscm @ 7% O_2	2.79	3.02	3.41	3.07
OCDD Concentration, ng/dscm @ 7% O_2	1.16	1.59	1.81	1.52
2,3,7,8-TCDF Concentration, ng/dscm @ 7% O_2	5.36	5.12	5.44	5.30
1,2,3,7,8-PeCDF Concentration, ng/dscm @ 7% O_2	4.94	4.13	4.67	4.58
2,3,4,7,8-PeCDF Concentration, ng/dscm @ 7% O_2	14.7	16.0	19.4	16.7
1,2,3,4,7,8-HxCDF Concentration, ng/dscm @ 7% O_2	4.70	4.31	5.71	4.91
1,2,3,6,7,8-HxCDF Concentration, ng/dscm @ 7% O_2	4.94	4.13	5.30	4.79
2,3,4,6,7,8-HxCDF Concentration, ng/dscm @ 7% O_2	5.26	4.74	6.44	5.48
1,2,3,7,8,9-HxCDF Concentration, ng/dscm @ 7% O_2	0.88	0.84	1.05	0.92
1,2,3,4,6,7,8-HpCDF Concentration, ng/dscm @ 7% O_2	7.08	6.34	8.98	7.47
1,2,3,4,7,8,9-HpCDF Concentration, ng/dscm @ 7% O_2	0.59	0.48	0.67	0.58
OCDF Concentration, ng/dscm @ 7% O_2	0.69	0.68	0.91	0.76

Table 5.1.5: Summary of Test Runs – Metals

Run Number	Run 1	Run 2	Run 3	Average
Date	**October 26, 2022**	**October 27, 2022**	**October 28, 2022**	
Antimony				
Concentration, ug/dscm@ 7%O_2.	40.3	49.5	62.1	50.6
Emission Rate, lb/hr	$1.09x10^{-4}$	$1.32x10^{-4}$	$1.83x10^{-4}$	$1.41x10^{-4}$
Arsenic				
Concentration, ug/dscm@ 7%O_2.	0.47	0.48	0.43	0.46
Emission Rate, lb/hr	$1.27x10^{-6}$	$1.28x10^{-6}$	$1.28x10^{-6}$	$1.28x10^{-6}$
Barium				
Concentration, ug/dscm@ 7%O_2.	5.91	5.96	4.65	5.50
Emission Rate, lb/hr	$1.59x10^{-5}$	$1.59x10^{-5}$	$1.37x10^{-5}$	$1.52x10^{-5}$
Beryllium				
Concentration, ug/dscm@ 7%O_2.	0.09	0.10	0.09	0.09
Emission Rate, lb/hr	$2.55x10^{-7}$	$2.56x10^{-7}$	$2.56x10^{-7}$	$2.56x10^{-7}$
Cadmium				
Concentration, ug/dscm@ 7%O_2.	0.70	1.14	0.85	0.90
Emission Rate, lb/hr	$1.90x10^{-6}$	$3.03x10^{-6}$	$2.50x10^{-6}$	$2.48x10^{-6}$
Chromium				
Concentration, ug/dscm@ 7%O_2.	2.90	3.50	3.41	3.27
Emission Rate, lb/hr	$7.81x10^{-6}$	$9.31x10^{-6}$	$1.00x10^{-5}$	$9.06x10^{-}$
Cobalt				
Concentration, ug/dscm@ 7%O_2.	0.19	0.26	0.26	0.24
Emission Rate, lb/hr	$5.01x10^{-7}$	$6.88x10^{-7}$	$7.71x10^{-7}$	$6.53x10^{-7}$
Copper				
Concentration, ug/dscm@ 7%O_2.	23.0	34.2	30.0	29.0
Emission Rate, lb/hr	$6.19x10^{-5}$	$9.09x10^{-5}$	$8.84x10^{-5}$	$8.04x10^{-5}$
Lead				
Concentration, ug/dscm@ 7%O_2.	23.6	36.7	21.5	27.2
Emission Rate, lb/hr	$6.35x10^{-5}$	$9.73x10^{-5}$	$6.34x10^{-5}$	$7.47x10^{-5}$
Manganese				
Concentration, ug/dscm@ 7%O_2.	17.5	17.8	12.9	16.1
Emission Rate, lb/hr	$4.70x10^{-5}$	$4.73x10^{-5}$	$3.82x10^{-5}$	$4.42x10^{-5}$
Nickel				
Concentration, ug/dscm@ 7%O_2.	2.59	3.27	2.35	2.74
Emission Rate, lb/hr	$6.98x10^{-6}$	$8.70x10^{-6}$	$6.93x10^{-6}$	$7.54x10^{-6}$
Phosphorus				
Concentration, ug/dscm@ 7%O_2.	47.3	53.8	43.4	48.2
Emission Rate, lb/hr	$1.27x10^{-4}$	$1.43x10^{-4}$	$1.28x10^{-4}$	$1.33x10^{-4}$
Selenium				
Concentration, ug/dscm@ 7%O_2.	0.95	1.20	1.26	1.13
Emission Rate, lb/hr	$2.55x10^{-6}$	$3.18x10^{-6}$	$3.72x10^{-6}$	$3.15x10^{-6}$
Silver				
Concentration, ug/dscm@ 7%O_2.	3.79	5.43	3.38	4.20
Emission Rate, lb/hr	$1.02x10^{-5}$	$1.45x10^{-5}$	$9.98x10^{-6}$	$1.16x10^{-5}$
Thallium				
Concentration, ug/dscm@ 7%O_2.	0.15	0.19	0.14	0.16
Emission Rate, lb/hr	$4.09x10^{-7}$	$4.96x10^{-7}$	$3.99x10^{-7}$	$4.35x10^{-7}$

Run Number	Run 1	Run 2	Run 3	Average
Date	October 26, 2022	October 27, 2022	October 28, 2022	
Zinc				
Concentration, ug/dscm@ 7%O_2.	515.4	682.2	495.2	564.2
Emission Rate, lb/hr	$1.39x10^{-3}$	$1.82x10^{-3}$	$1.46x10^{-3}$	$1.56x10^{-3}$
Mercury				
Concentration, ug/dscm@ 7%O_2.	0.13	0.27	0.27	0.22
Emission Rate, lb/hr	$3.59x10^{-7}$	$7.10x10^{-7}$	$7.90x10^{-7}$	$6.20x10^{-7}$

Table 5.1.6: Summary of Test Runs – Polychlorinated Aromatic Hydrocarbons (PAHs)

Run Number	Run 1	Run 2	Run 3	Average
Date	October 26, 2022	October 27, 2022	October 28, 2022	
Acenaphthalene				
Concentration, ng/dscm	5.5	1.8	4.4	3.9
Concentration, ppmvd @ 7%O_2	$1.45x10^{-6}$	$4.96x10^{-7}$	$1.13x10^{-6}$	$1.02x10^{-6}$
Emission Rate, lb/hr	$2.38x10^{-8}$	$7.86x10^{-9}$	$2.06x10^{-8}$	$1.70x10^{-8}$
Acenaphthylene				
Concentration, ng/dscm	48	21	41	37
Concentration, ppmvd @ 7%O_2	$1.21x10^{-5}$	$5.29x10^{-6}$	$9.81x10^{-6}$	$9.08x10^{-6}$
Emission Rate, lb/hr	$2.06x10^{-7}$	$8.73x10^{-8}$	$1.83x10^{-7}$	$1.60x10^{-7}$
Anthracene				
Concentration, ng/dscm	27	11	6.9	15
Concentration, ppmvd @ 7%O_2	$6.21x10^{-6}$	$2.63x10^{-6}$	$1.50x10^{-6}$	$3.45x10^{-6}$
Emission Rate, lb/hr	$1.19x10^{-7}$	$4.92x10^{-8}$	$3.17x10^{-8}$	$6.60x10^{-8}$
Fluoroanthene				
Concentration, ng/dscm	52	24	28	35
Concentration, ppmvd @ 7%O_2	$1.03x10^{-5}$	$4.90x10^{-6}$	$5.39x10^{-6}$	$6.88x10^{-6}$
Emission Rate, lb/hr	$2.22x10^{-7}$	$1.03x10^{-7}$	$1.27x10^{-7}$	$1.50x10^{-7}$
Pyrene				
Concentration, ng/dscm	25	7.1	6.2	13
Concentration, ppmvd @ 7%O_2	$4.99x10^{-6}$	$1.46x10^{-6}$	$1.18x10^{-6}$	$2.54x10^{-6}$
Emission Rate, lb/hr	$1.11x10^{-7}$	$3.10x10^{-8}$	$2.86x10^{-8}$	$5.60x10^{-8}$
Benzo[a]anthracene				
Concentration, ng/dscm	1.9	1.8	1.7	1.8
Concentration, ppmvd @ 7%O_2	$3.42x10^{-7}$	$3.31x10^{-7}$	$2.91x10^{-7}$	$3.21x10^{-7}$
Emission Rate, lb/hr	$8.73x10^{-9}$	$7.86x10^{-9}$	$7.86x10^{-9}$	$8.00x10^{-9}$
Chrysene				
Concentration, ng/dscm	2500	970	2100	1857
Concentration, ppmvd @ 7%O_2	$3.71x10^{-4}$	$1.46x10^{-4}$	$2.97x10^{-4}$	$2.71x10^{-4}$
Emission Rate, lb/hr	$1.11x10^{-5}$	$4.21x10^{-6}$	$9.52x10^{-6}$	$8.20x10^{-6}$
Benzo[b]fluoranthene				
Concentration, ng/dscm	11	4.7	6.3	7.3
Concentration, ppmvd @ 7%O_2	$1.78x10^{-6}$	$7.71x10^{-7}$	$9.60x10^{-7}$	$1.17x10^{-6}$
Emission Rate, lb/hr	$4.84x10^{-8}$	$2.06x10^{-8}$	$2.86x10^{-8}$	$3.20x10^{-8}$

Run Number	Run 1	Run 2	Run 3	Average
Date	October 26, 2022	October 27, 2022	October 28, 2022	
Benzo[k]fluoroanthrene				
Concentration, ng/dscm	1.7	2.0	1.7	1.8
Concentration, ppmvd @ 7%O_2	$2.70x10^{-7}$	$3.29x10^{-7}$	$2.63x10^{-7}$	$2.88x10^{-7}$
Emission Rate, lb/hr	$7.38x10^{-9}$	$8.73x10^{-9}$	$7.86x10^{-9}$	$7.90x10^{-9}$
Benzo[e]pyrene				
Concentration, ng/dscm	13	4.0	7.7	8.2
Concentration, ppmvd @ 7%O_2	$2.14x10^{-6}$	$6.58x10^{-7}$	$1.18x10^{-6}$	$1.32x10^{-6}$
Emission Rate, lb/hr	$5.79x10^{-8}$	$1.75x10^{-8}$	$3.49x10^{-8}$	$3.70x10^{-8}$
Benzo[a]pyrene				
Concentration, ng/dscm	1.7	3.3	3.2	2.7
Concentration, ppmvd @ 7%O_2	$2.42x10^{-7}$	$4.86x10^{-7}$	$4.31x10^{-7}$	$3.86x10^{-7}$
Emission Rate, lb/hr	$7.38x10^{-9}$	$1.43x10^{-8}$	$1.43x10^{-8}$	$1.20x10^{-8}$
Perylene				
Concentration, ng/dscm	4.8	1.8	3.3	3.3
Concentration, ppmvd @ 7%O_2	$7.61x10^{-7}$	$2.99x10^{-7}$	$5.04x10^{-7}$	$5.22x10^{-7}$
Emission Rate, lb/hr	$2.06x10^{-8}$	$7.86x10^{-9}$	$1.51x10^{-8}$	$1.50x10^{-8}$
Indo[1,2,3-cd]pyrene				
Concentration, ng/dscm	2.7	1.8	1.7	2.1
Concentration, ppmvd @ 7%O_2	$3.46x10^{-7}$	$2.42x10^{-7}$	$2.12x10^{-7}$	$2.67x10^{-7}$
Emission Rate, lb/hr	$1.19x10^{-8}$	$7.86x10^{-9}$	$7.86x10^{-9}$	$9.10x10^{-9}$
Dibenz(a,h)perylene				
Concentration, ng/dscm	1.7	1.8	1.7	1.7
Concentration, ppmvd @ 7%O_2	$2.45x10^{-7}$	$2.71x10^{-7}$	$2.39x10^{-7}$	$2.52x10^{-7}$
Emission Rate, lb/hr	$7.38x10^{-9}$	$7.86x10^{-9}$	$7.86x10^{-9}$	$7.70x10^{-9}$
Benzo(ghi)perylene				
Concentration, ng/dscm	1.7	1.8	1.7	1.7
Concentration, ppmvd @ 7%O_2	$2.47x10^{-7}$	$2.73x10^{-7}$	$2.39x10^{-7}$	$2.53x10^{-7}$
Emission Rate, lb/hr	$7.38x10^{-9}$	$7.86x10^{-9}$	$2.40x10^{-7}$	$7.70x10^{-9}$
Naphthalene				
Concentration, ng/dscm	1100	630	1200	977
Concentration, ppmvd @ 7%O_2	$3.48x10^{-4}$	$2.02x10^{-4}$	$3.51x10^{-4}$	$3.00x10^{-4}$
Emission Rate, lb/hr	$4.84x10^{-6}$	$2.70x10^{-6}$	$5.32x10^{-6}$	$4.30x10^{-6}$
2-Methylnaphthalene				
Concentration, ng/dscm	22	14	20	19
Concentration, ppmvd @ 7%O_2	$5.95x10^{-6}$	$3.80x10^{-6}$	$4.96x10^{-6}$	$4.91x10^{-6}$
Emission Rate, lb/hr	$9.52x10^{-8}$	$6.03x10^{-8}$	$8.73x10^{-8}$	$8.20x10^{-8}$
Fluorene				
Concentration, ng/dscm	94	32	72	66
Concentration, ppmvd @ 7%O_2	$2.28x10^{-5}$	$7.88x10^{-6}$	$1.66x10^{-5}$	$1.58x10^{-5}$
Emission Rate, lb/hr	$4.05x10^{-7}$	$1.35x10^{-7}$	$3.25x10^{-7}$	$2.90x10^{-7}$
Phenanthrene				
Concentration, ng/dscm	1000	420	870	763
Concentration, ppmvd @ 7%O_2	$2.36x10^{-4}$	$9.75x10^{-5}$	$1.88x10^{-4}$	$1.74x10^{-4}$
Emission Rate, lb/hr	$4.52x10^{-6}$	$1.83x10^{-6}$	$3.97x10^{-6}$	$3.40x10^{-6}$

Table 5.1.7: Summary of Test Runs – Speciated VOCs

Run Number	Run 1	Run 2	Run 3	Average
Date	**October 26, 2022**	**October 27, 2022**	**October 28, 2022**	
Acetone				
Concentration, ppmvd @ 7%O_2	221.7	462.7	380.7	355.1
Emission Rate, lb/hr	$1.40x10^{-3}$	$2.89x10^{-3}$	$2.62x10^{-3}$	$2.30x10^{-3}$
Allyl Chloride				
Concentration, ppmvd @ 7%O_2	0.33	0.34	0.31	0.33
Emission Rate, lb/hr	$2.78x10^{-6}$	$2.80x10^{-6}$	$2.90x10^{-6}$	$2.83x10^{-6}$
Benzene				
Concentration, ppmvd @ 7%O_2	27.0	77.5	101.3	68.6
Emission Rate, lb/hr	$2.30x10^{-4}$	$6.49x10^{-4}$	$9.44x10^{-4}$	$6.07x10^{-4}$
Benzyl Chloride				
Concentration, ppmvd @ 7%O_2	0.33	0.34	0.31	0.33
Emission Rate, lb/hr	$4.40x10^{-6}$	$4.44x10^{-6}$	$4.60x10^{-6}$	$4.48x10^{-6}$
Bromodichloromethane				
Concentration, ppmvd @ 7%O_2	0.33	0.34	0.31	0.33
Emission Rate, lb/hr	$5.73x10^{-6}$	$5.78x10^{-6}$	$5.98x10^{-6}$	$5.83x10^{-6}$
Bromoform				
Concentration, ppmvd @ 7%O_2	0.33	0.34	0.31	0.33
Emission Rate, lb/hr	$9.25x10^{-6}$	$9.33x10^{-6}$	$9.67x10^{-6}$	$9.42x10^{-6}$
Bromomethane				
Concentration, ppmvd @ 7%O_2	0.33	4.71	0.31	1.8
Emission Rate, lb/hr	$3.44x10^{-6}$	$4.80x10^{-5}$	$3.59x10^{-6}$	$1.83x10^{-5}$
1,3-Butadiene				
Concentration, ppmvd @ 7%O_2	0.33	0.34	0.31	0.33
Emission Rate, lb/hr	$1.94x10^{-6}$	$1.96x10^{-6}$	$2.03x10^{-6}$	$1.97x10^{-6}$
Carbon Disulfide				
Concentration, ppmvd @ 7%O_2	2.04	9.83	9.95	7.3
Emission Rate, lb/hr	$1.69x10^{-5}$	$7.96x10^{-5}$	$9.07x10^{-5}$	$6.24x10^{-5}$
Carbon Tetrachloride				
Concentration, ppmvd @ 7%O_2	0.33	0.34	0.31	0.33
Emission Rate, lb/hr	$5.73x10^{-6}$	$5.78x10^{-6}$	$5.98x10^{-6}$	$5.83x10^{-6}$
Chlorobenzene				
Concentration, ppmvd @ 7%O_2	1.17	1.34	1.36	1.29
Emission Rate, lb/hr	$1.45x10^{-5}$	$1.63x10^{-5}$	$1.83x10^{-5}$	$1.63x10^{-5}$
Dibromochloromethane				
Concentration, ppmvd @ 7%O_2	0.33	0.34	0.31	0.33
Emission Rate, lb/hr	$7.49x10^{-6}$	$7.56x10^{-6}$	$7.83x10^{-6}$	$7.62x10^{-6}$
Chloroethane				
Concentration, ppmvd @ 7%O_2	0.33	0.34	0.31	0.33
Emission Rate, lb/hr	$2.33x10^{-6}$	$2.36x10^{-6}$	$3.91x10^{-6}$	$2.87x10^{-6}$
Chloroform				
Concentration, ppmvd @ 7%O_2	0.33	0.34	0.31	0.33
Emission Rate, lb/hr	$4.32x10^{-6}$	$4.36x10^{-6}$	$4.51x10^{-6}$	$4.39x10^{-6}$
Chloromethane				
Concentration, ppmvd @ 7%O_2	5.97	9.66	7.74	7.80
Emission Rate, lb/hr	$3.28x10^{-5}$	$5.24x10^{-5}$	$4.70x10^{-5}$	$4.41x10^{-5}$

Run Number	Run 1	Run 2	Run 3	Average
Date	October 26, 2022	October 27, 2022	October 28, 2022	
Cyclohexane				
Concentration, ppmvd @ 7%O_2	0.43	0.85	0.92	0.70
Emission Rate, lb/hr	$3.92x10^{-6}$	$7.60x10^{-6}$	$9.21x10^{-6}$	$6.91x10^{-6}$
1,2-Dibromoethane				
Concentration, ppmvd @ 7%O_2	0.33	0.34	0.31	0.33
Emission Rate, lb/hr	$6.61x10^{-6}$	$6.67x10^{-6}$	$6.90x10^{-6}$	$6.73x10^{-6}$
1,2-Dichlorobenzene				
Concentration, ppmvd @ 7%O_2	0.63	0.81	0.79	0.70
Emission Rate, lb/hr	$1.01x10^{-5}$	$1.29x10^{-5}$	$1.38x10^{-5}$	$1.23x10^{-5}$
1,3-Dichlorobenzene				
Concentration, ppmvd @ 7%O_2	0.56	0.61	0.57	0.60
Emission Rate, lb/hr	$8.81x10^{-6}$	$9.33x10^{-6}$	$1.01x10^{-5}$	$9.42x10^{-6}$
1,4-Dichlorobenzene				
Concentration, ppmvd @ 7%O_2	0.33	0.34	0.63	0.40
Emission Rate, lb/hr	$5.29x10^{-6}$	$5.33x10^{-6}$	$1.10x10^{-5}$	$7.22x10^{-6}$
Dichlorodifluoromethane				
Concentration, ppmvd @ 7%O_2	0.33	0.34	0.31	0.33
Emission Rate, lb/hr	$4.36x10^{-6}$	$4.40x10^{-6}$	$4.56x10^{-6}$	$4.44x10^{-6}$
1,1-Dichloroethane				
Concentration, ppmvd @ 7%O_2	0.33	1.34	0.31	0.70
Emission Rate, lb/hr	$3.57x10^{-6}$	$1.43x10^{-5}$	$3.73x10^{-6}$	$7.19x10^{-6}$
1,2-Dichloroethane				
Concentration, ppmvd @ 7%O_2	0.33	0.34	0.31	0.33
Emission Rate, lb/hr	$3.57x10^{-6}$	$3.60x10^{-5}$	$3.73x10^{-6}$	$3.63x10^{-6}$
1,1-Dichloroethene				
Concentration, ppmvd @ 7%O_2	0.33	0.34	0.31	0.33
Emission Rate, lb/hr	$3.48x10^{-6}$	$3.51x10^{-6}$	$3.64x10^{-6}$	$3.54x10^{-6}$
cis -1,2-Dichloroethene				
Concentration, ppmvd @ 7%O_2	0.33	0.34	0.31	0.33
Emission Rate, lb/hr	$3.48x10^{-6}$	$3.51x10^{-6}$	$3.64x10^{-6}$	$3.54x10^{-6}$
trans -1,2-Dichloroethene				
Concentration, ppmvd @ 7%O_2	0.33	0.34	0.31	0.33
Emission Rate, lb/hr	$3.48x10^{-6}$	$3.51x10^{-6}$	$3.64x10^{-6}$	$3.54x10^{-6}$
Methylene Chloride				
Concentration, ppmvd @ 7%O_2	2.47	2.36	2.69	2.50
Emission Rate, lb/hr	$2.28x10^{-5}$	$2.15x10^{-5}$	$2.72x10^{-5}$	$2.38x10^{-5}$
1,2-Dichloropropane				
Concentration, ppmvd @ 7%O_2	0.33	0.34	0.31	0.33
Emission Rate, lb/hr	$4.05x10^{-6}$	$4.09x10^{-6}$	$4.23x10^{-6}$	$4.13x10^{-6}$
cis-1,3-Dichloropropene				
Concentration, ppmvd @ 7%O_2	0.33	0.34	0.31	0.33
Emission Rate, lb/hr	$4.01x10^{-6}$	$4.04x10^{-6}$	$4.19x10^{-6}$	$4.08x10^{-6}$
trans-1,3-Dichloropropene				
Concentration, ppmvd @ 7%O_2	0.33	0.34	0.31	0.33
Emission Rate, lb/hr	$4.01x10^{-6}$	$4.04x10^{-6}$	$4.19x10^{-6}$	$4.08x10^{-6}$

Run Number	Run 1	Run 2	Run 3	Average
Date	October 26, 2022	October 27, 2022	October 28, 2022	
1,4-Dioxane				
Concentration, ppmvd @ 7%O_2	0.33	0.34	0.31	0.33
Emission Rate, lb/hr	$3.17x10^{-6}$	$3.20x10^{-6}$	$3.31x10^{-6}$	$3.23x10^{-6}$
Ethyl Acetate				
Concentration, ppmvd @ 7%O_2	0.33	1.27	1.14	0.90
Emission Rate, lb/hr	$3.17x10^{-6}$	$1.21x10^{-5}$	$1.20x10^{-5}$	$9.08x10^{-6}$
Ethyl Benzene				
Concentration, ppmvd @ 7%O_2	0.33	0.34	0.31	0.33
Emission Rate, lb/hr	$3.83x10^{-6}$	$3.87x10^{-6}$	$4.00x10^{-6}$	$3.90x10^{-6}$
4-Ethyl Toluene				
Concentration, ppmvd @ 7%O_2	0.43	0.34	0.31	0.40
Emission Rate, lb/hr	$5.59x10^{-6}$	$4.36x10^{-6}$	$4.51x10^{-6}$	$4.82x10^{-6}$
n-Heptane				
Concentration, ppmvd @ 7%O_2	0.98	1.34	1.74	1.40
Emission Rate, lb/hr	$1.07x10^{-5}$	$1.44x10^{-5}$	$2.08x10^{-5}$	$1.53x10^{-5}$
Hexachlorobutadiene				
Concentration, ppmvd @ 7%O_2	0.33	0.34	0.31	0.33
Emission Rate, lb/hr	$9.25x10^{-6}$	$9.33x10^{-6}$	$9.67x10^{-6}$	$9.42x10^{-6}$
n-Hexane				
Concentration, ppmvd @ 7%O_2	32.8	16.8	9.32	19.6
Emission Rate, lb/hr	$3.08x10^{-4}$	$1.55x10^{-4}$	$9.62x10^{-5}$	$1.87x10^{-4}$
2-Hexanone				
Concentration, ppmvd @ 7%O_2	1.65	1.70	1.56	1.60
Emission Rate, lb/hr	$1.81x10^{-5}$	$1.82x10^{-5}$	$1.89x10^{-5}$	$1.84x10^{-5}$
Isoctane				
Concentration, ppmvd @ 7%O_2	1.14	6.46	3.03	3.50
Emission Rate, lb/hr	$1.43x10^{-5}$	$7.91x10^{-5}$	$4.13x10^{-5}$	$4.49x10^{-5}$
Isopropylbenzene				
Concentration, ppmvd @ 7%O_2	0.33	0.34	0.31	0.33
Emission Rate, lb/hr	$4.32x10^{-6}$	$4.36x10^{-6}$	$4.51x10^{-6}$	$4.39x10^{-6}$
Methyl Ethyl Ketone				
Concentration, ppmvd @ 7%O_2	4.88	9.15	13.27	9.10
Emission Rate, lb/hr	$3.84x10^{-5}$	$7.07x10^{-5}$	$1.14x10^{-4}$	$7.42x10^{-5}$
Methyl Isobutyl Ketone				
Concentration, ppmvd @ 7%O_2	18.0	27.5	10.3	18.6
Emission Rate, lb/hr	$1.96x10^{-4}$	$2.94x10^{-4}$	$1.22x10^{-4}$	$2.04x10^{-4}$
Methyl tert-butyl Ketone				
Concentration, ppmvd @ 7%O_2	0.46	0.34	0.31	0.40
Emission Rate, lb/hr	$4.40x10^{-6}$	$3.20x10^{-6}$	$3.31x10^{-6}$	$3.64x10^{-6}$
Naphthalene				
Concentration, ppmvd @ 7%O_2	1.01	1.78	1.33	1.40
Emission Rate, lb/hr	$1.41x10^{-5}$	$2.44x10^{-5}$	$2.03x10^{-5}$	$1.96x10^{-5}$
Propylene				
Concentration, ppmvd @ 7%O_2	17.8	23.4	31.0	24.1
Emission Rate, lb/hr	$8.19x10^{-5}$	$1.05x10^{-4}$	$1.55x10^{-4}$	$1.14x10^{-4}$

Run Number	Run 1	Run 2	Run 3	Average
Date	October 26, 2022	October 27, 2022	October 28, 2022	
Styrene				
Concentration, ppmvd @ 7%O_2	0.33	0.34	0.31	0.33
Emission Rate, lb/hr	$3.74x10^{-6}$	$3.78x10^{-6}$	$3.91x10^{-6}$	$3.81x10^{-6}$
1,1,2,2-Tetrachloroethane				
Concentration, ppmvd @ 7%O_2	0.33	0.34	0.31	0.33
Emission Rate, lb/hr	$6.17x10^{-6}$	$6.22x10^{-6}$	$6.44x10^{-6}$	$6.28x10^{-6}$
Tetrachlorethylene				
Concentration, ppmvd @ 7%O_2	0.33	0.34	0.31	0.33
Emission Rate, lb/hr	$6.17x10^{-6}$	$6.22x10^{-6}$	$6.44x10^{-6}$	$6.28x10^{-6}$
Tetrahydrofuran				
Concentration, ppmvd @ 7%O_2	8.27	5.64	9.00	7.60
Emission Rate, lb/hr	$6.43x10^{-5}$	$4.37x10^{-5}$	$7.73x10^{-5}$	$6.18x10^{-5}$
Toluene				
Concentration, ppmvd @ 7%O_2	2.95	2.29	3.22	2.80
Emission Rate, lb/hr	$2.96x10^{-5}$	$2.26x10^{-5}$	$3.54x10^{-5}$	$2.92x10^{-5}$
Freon 113				
Concentration, ppmvd @ 7%O_2	0.33	0.34	0.31	0.33
Emission Rate, lb/hr	$6.61x10^{-6}$	$6.67x10^{-6}$	$6.90x10^{-6}$	$6.73x10^{-6}$
1,2,4-Trichlorobenzene				
Concentration, ppmvd @ 7%O_2	0.66	1.12	0.92	0.90
Emission Rate, lb/hr	$1.28x10^{-5}$	$2.18x10^{-5}$	$1.98x10^{-5}$	$1.81x10^{-5}$
1,1,1-Trichloroethane				
Concentration, ppmvd @ 7%O_2	0.33	0.34	0.31	0.33
Emission Rate, lb/hr	$4.85x10^{-6}$	$4.89x10^{-6}$	$5.06x10^{-6}$	$4.93x10^{-6}$
1,1,2-Trichloroethane				
Concentration, ppmvd @ 7%O_2	0.33	0.34	0.31	0.33
Emission Rate, lb/hr	$4.85x10^{-6}$	$4.89x10^{-6}$	$5.06x10^{-6}$	$4.93x10^{-6}$
Trichloroethylene				
Concentration, ppmvd @ 7%O_2	0.33	0.34	0.31	0.33
Emission Rate, lb/hr	$4.85x10^{-6}$	$4.89x10^{-6}$	$5.06x10^{-6}$	$4.93x10^{-6}$
Trichlorotrifluoromethane				
Concentration, ppmvd @ 7%O_2	0.33	0.34	0.31	0.33
Emission Rate, lb/hr	$4.85x10^{-6}$	$4.89x10^{-6}$	$5.06x10^{-6}$	$4.93x10^{-6}$
Freon 114				
Concentration, ppmvd @ 7%O_2	0.33	0.34	0.31	0.33
Emission Rate, lb/hr	$6.27x10^{-6}$	$6.22x10^{-6}$	$6.44x10^{-6}$	$6.28x10^{-6}$
1,2,4-Trimethylbenzene				
Concentration, ppmvd @ 7%O_2	2.07	0.85	0.95	1.30
Emission Rate, lb/hr	$2.70x10^{-5}$	$1.08x10^{-5}$	$1.36x10^{-5}$	$1.72x10^{-5}$
1,3,5-Trimethylbenzene				
Concentration, ppmvd @ 7%O_2	0.56	0.34	0.35	0.40
Emission Rate, lb/hr	$7.31x10^{-6}$	$4.36x10^{-6}$	$4.97x10^{-6}$	$5.55x10^{-6}$
Vinyl Acetate				
Concentration, ppmvd @ 7%O_2	2.32	2.37	2.19	2.30
Emission Rate, lb/hr	$2.16x10^{-5}$	$2.18x10^{-5}$	$2.26x10^{-5}$	$2.20x10^{-5}$

Run Number	Run 1	Run 2	Run 3	Average
Date	October 26, 2022	October 27, 2022	October 28, 2022	
Vinyl Bromide				
Concentration, ppmvd @ 7%O_2	0.33	0.34	0.31	0.33
Emission Rate, lb/hr	$3.83x10^{-6}$	$3.87x10^{-6}$	$4.00x10^{-6}$	$3.90x10^{-6}$
Vinyl Chloride				
Concentration, ppmvd @ 7%O_2	0.33	0.34	0.31	0.33
Emission Rate, lb/hr	$2.25x10^{-6}$	$2.27x10^{-6}$	$2.58x10^{-6}$	$2.36x10^{-6}$
o-Xylene				
Concentration, ppmvd @ 7%O_2	0.33	0.34	0.41	0.40
Emission Rate, lb/hr	$3.83x10^{-6}$	$3.87x10^{-6}$	$5.20x10^{-6}$	$4.30x10^{-6}$
m/p-Xylene				
Concentration, ppmvd @ 7%O_2	0.76	0.68	0.76	0.70
Emission Rate, lb/hr	$8.81x10^{-6}$	$7.56x10^{-6}$	$9.67x10^{-6}$	$8.68x10^{-6}$

Table 5.1.8: Comparison of Events to Applicable Limits

Compound	Units	Other Solid Waste Incinerators (OSWIs) (Limits)	March 2021 Results (without Heat Exchanger)	October 2021 Results (with Heat Exchanger)
Carbon Monoxide	ppmvd	40	10.4	15.1
Dioxin & Furan (total mass basis)	ng/dscm	33	21.4	37.3
Hydrogen Chloride	ppmvd	18	111.6	59.3
Cadmium	µg/dscm	18	1.6	0.90
Lead	µg/dscm	226	77.6	27.2
Mercury	µg/dscm	74	0.28	0.22
Opacity	Percent	10%	0%	0%

Further details on the comparison for Polychlorinated Aromatic Hydrocarbons (PAHs) and VOCs (speciated) are provided in **Appendices C and E**, respectively. Full details on the results are provided in **Appendices A to F**.

6 OPERATING CONDITIONS

Operating conditions during the sampling were monitored by Eco Waste personnel. All equipment was operated under normal maximum operating conditions.

7 CONCLUSIONS

Testing was successfully completed during the week of October 24th, 2021. All sources were tested in accordance the agreed scope of work for the project.

TABLES

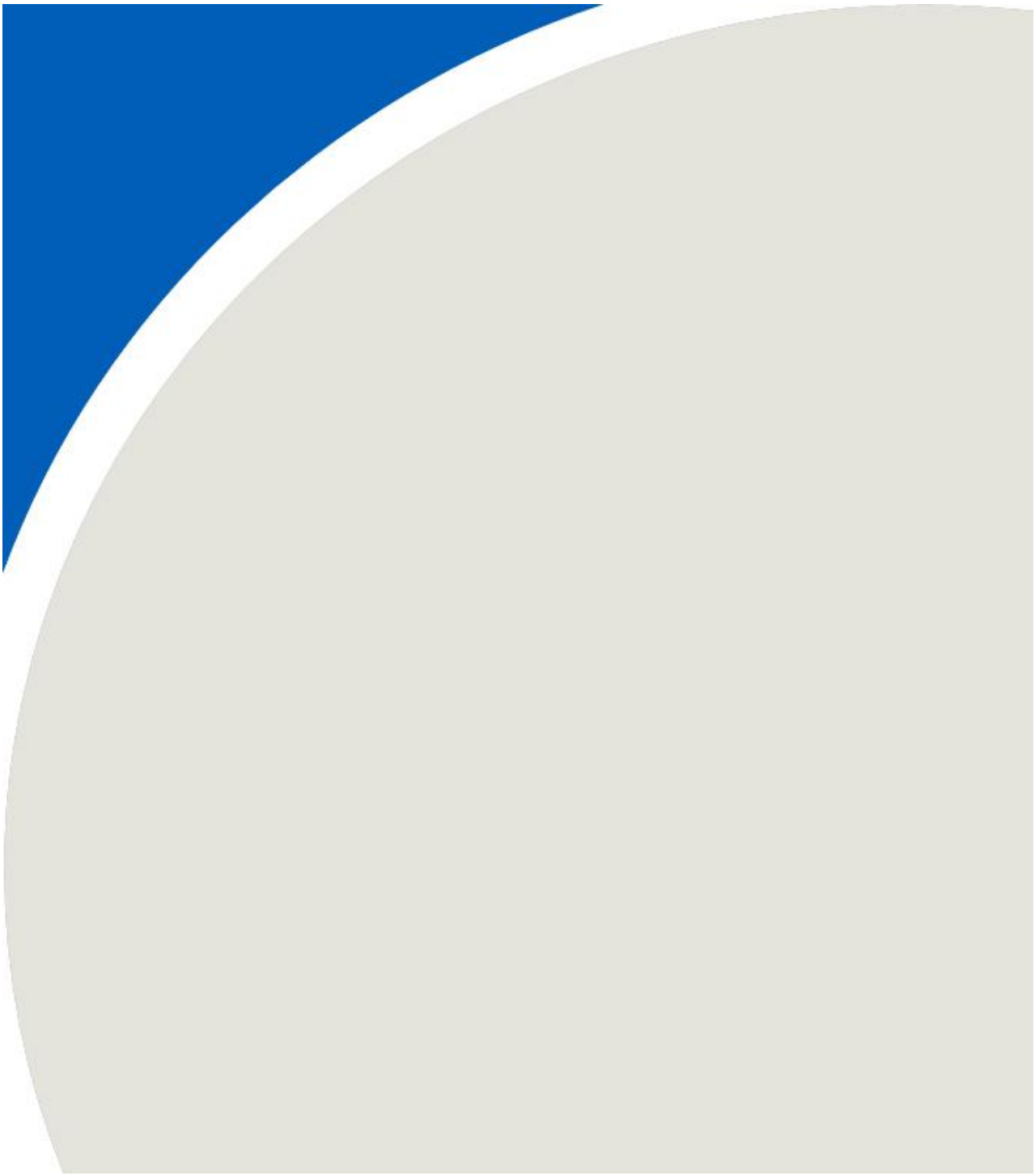


Table 1: Summary of Sampling Parameters and Methodology

Source Location	No. of Tests per Stack	Sampling Parameter	Sampling Method
Main Stack Incineration	9	Velocity, Temperature and Flow Rate	U.S. EPA [1] Methods 1-4
	3	Total Particulate Matter	U.S. EPA [1] Method 5
	3	Metals	U.S. EPA [1] Method 29
	3	4-8 PCDD/PCDF & PAHs	U.S. EPA [1] Method 23
	3	Hydrogen Chloride, Hydrogen Fluoride, and Hydrogen Bromide	U.S. EPA [1] Method 26A
	3	Sulphur Dioxide	U.S. EPA [1] Method 6C (CEM)
	3	Total Oxides of Nitrogen	U.S. EPA [1] Method 7E (CEM)
	3	Oxygen	U.S. EPA [1] Method 3A (CEM)
	3	Carbon Dioxide	U.S. EPA [1] Method 3A (CEM)
	3	Carbon Monoxide	U.S. EPA [1] Method 10 (CEM)
	3	Total Hydrocarbons (THC)	U.S. EPA [1] Method 25A (CEM)
	3	Methane	U.S. EPA [1] Method 25A (CEM)
	3	Nonmethane Organic Compounds (NMOCs)	U.S. EPA [1] Method 25A (CEM)
	3	Volatile Organic Compounds (Speciated VOCs)	U.S. EPA [1] TO-15

Notes:

[1] U.S. EPA - United States Environmental Protection Agency

Table 2: Sampling Summary and Sample Log

Source and Test #	Sampling Date	Start Time	End Time
Velocity / Total Particulate / Metals			
Blank	28-Oct-21	-	-
Test #1	26-Oct-21	11:04 AM	3:14 PM
Test #2	27-Oct-21	9:40 AM	1:58 PM
Test #3	28-Oct-21	9:26 AM	1:32 PM
Velocity / Dioxins and Furans / Polychlorinatd Aromatic Hydrocarbons (PAHs)			
Blank	28-Oct-21	-	-
Test #1	26-Oct-21	11:04 AM	3:14 PM
Test #2	27-Oct-21	9:40 AM	1:58 PM
Test #3	28-Oct-21	9:26 AM	1:32 PM
Velocity/ Volatile Organic Compounds (VOCs)			
Blank	28-Oct-21	-	-
Test #1	26-Oct-21	11:04 AM	3:14 PM
Test #2	27-Oct-21	9:40 AM	1:58 PM
Test #3	28-Oct-21	9:26 AM	1:32 PM
Hydrogen Chloride / Hydrogen Fluoride / Hydrogen Bromide			
Blank	28-Oct-21	-	-
Test #1	26-Oct-21	3:29 PM	4:31 PM
Test #2	27-Oct-21	2:17 PM	3:17 PM
Test #3	28-Oct-21	1:52 PM	2:52 PM

Table 3: Comparison of Sampling Events to Applicable Limits

Compound	Units	Other Solid Waste Incinerators (OSWIs) (Limits)	March 2021 Results (Without Heat Exchanger)	October 2021 Results (With Heat Exchanger)
Carbon Monoxide	ppmvd	40	10.4	15.1
Dioxin & Furan	ng/dscm (total mass basis)	33	21.4	37.3
Hydrogen Chloride	ppmvd	18	111.6	59.3
Cadmium	µg/dscm	18	1.6	0.9
Lead	µg/dscm	226	77.6	27.2
Mercury	µg/dscm	74	0.28	0.22
Opacity	Percent Opacity	10	0	0

APPENDIX A

Summary of CEM/FTIR Data- Incinerator

Overall Average Concentrations

O_2 (%$_w$)	O_2 (%$_d$)	CO (ppm)	NO_X (ppm)	VOC (ppm$_w$)	VOC (ppm$_d$)	SO_2 (ppm$_d$)
11.5	12.7	8.9	49.7	2.0	1.4	4.3

Test ID: Test 1 Date: 26-Oct-21

Time	O_2 (%$_w$)	O_2 (%$_d$)	CO (ppm)	NOX (ppm)	VOC (ppm$_w$)[1]	VOC (ppm$_d$)[1]	SO_2 (ppm$_d$)
11:04 to 15:14	11.3	12.5	9.5	48.4	0.0	0.0	3.8

Test ID: Test 2 Date: 27-Oct-21

Time	O_2 (%$_w$)	O_2 (%$_d$)	CO (ppm)	NOX (ppm)	VOC (ppm$_w$)	VOC (ppm$_d$)	SO_2 (ppm$_d$)
09:40 to 13:58	11.4	12.6	7.4	48.9	2.0	1.1	4.9

Test ID: Test 3 Date: 28-Oct-21

Time	O_2 (%$_w$)	O_2 (%$_d$)	CO (ppm)	NOX (ppm)	VOC (ppm$_w$)	VOC (ppm$_d$)	SO_2 (ppm$_d$)
09:26 to 13:32	11.7	12.9	9.8	51.8	4.1	3.2	4.3

[1]Test 1 VOC measured slightly negative and is being reported as 0.

Summary of CEM/FTIR Data- Incinerator

Overall Average Emissions

CO (ppm @ 7% O2)	CO (lb/hr)	NO_x (ppm @ 7% O_2)	NO_x (lb/hr)	VOC (ppm_d @ 7% O_2)	VOC (lb/hr)	VOC (lb/hr)	SO_2 (ppm @ 7% O_2)	SO_2 (lb/hr)
15.1	0.047	84.0	0.43	4.5	0.012	1.4	4.29	0.054

Test ID: 1 Date: 26-Oct-21

Time	CO (ppm @ 7% O2)	CO (lb/hr)	NO_x (ppm @ 7% O_2)	NO_x (lb/hr)	VOC (ppm_d @ 7% O_2)[1]	VOC (lb/hr)[1]	VOC (lb/hr)	SO_2 (ppm @ 7% O_2)	SO_2 (lb/hr)
11:04 to 15:14	15.7	0.049	80.1	0.41	0.0	0.000	0.0	2.1	0.05

Test ID: 2 Date: 27-Oct-21

Time	CO (ppm @ 7% O2)	CO (lb/hr)	NO_x (ppm @ 7% O_2)	NO_x (lb/hr)	VOC (ppm_d @ 7% O_2)[2]	VOC (lb/hr)	VOC (lb/hr)	SO_2 (ppm @ 7% O_2)	SO_2 (lb/hr)
09:40 to 13:58	12.4	0.039	82.0	0.42	1.8	0.009	1.1	3.2	0.06

Test ID: 3 Date: 28-Oct-21

Time	CO (ppm @ 7% O2)	CO (lb/hr)	NO_x (ppm @ 7% O_2)	NO_x (lb/hr)	VOC (ppm_d @ 7% O_2)	VOC (lb/hr)	VOC (lb/hr)	SO_2 (ppm @ 7% O_2)	SO_2 (lb/hr)
09:26 to 13:32	17.0	0.053	89.8	0.46	11.6	0.027	3.2	7.5	0.06

[1]Test 1 VOC measured slightly negative, therfore VOC corrected to 7% O_2 and lb/hr are reported as 0.

[2]Test 2 VOC corrected to 7% O_2 is slightly negative and is reported as 0.

Test 1

Incinerator

Date	26-Oct-21								
Analyte	O_2 (%)		THC (ppm wet)		CH4 (ppm wet)		CO (ppm dry)	NO_x (ppm dry)	SO_2 (ppm dry)	H_2O (%)	Spectral File
Zero											
Zero Value *(Cv)*	0.00		0.00		0.00						
Direct *(C Dir)*	0.00		-0.11		-0.24						
Calibration Error *(ACE)*	0.00%	*PASS*	-0.10%	*PASS*	-0.23%	*PASS*					
System Initial *(Csi)*	0.35		-0.11		-0.24						
System Post *(Csf)*	0.46		2.38		-0.57						
Average *(Co)*	0.41		1.14		-0.41						
System Bias Initial *(SBi)*	1.7%	*PASS*	0.0%	*PASS*	0.0%	*PASS*					
System Bias Post *(SBf)*	2.2%	*PASS*	2.4%	*PASS*	-0.3%	*PASS*					
Drift Assessment *(D)*	0.53%	*PASS*	2.35%	*PASS*	-0.31%	*PASS*					
Low											
Low Value *(Cv)*	NA		29.90		29.90						
Direct *(C Dir)*	NA		29.00		29.00						
Calibration Error *(ACE)*	NA	NA	-3.01%	*PASS*	-3.01%	*PASS*					
Mid											
Mid Value *(Cv)*	10.10		49.90		49.90						
Direct *(C Dir)*	10.15		49.03		50.08						
Calibration Error *(ACE)*	0.24%	*PASS*	-1.74%	*PASS*	0.36%	*PASS*					
System Initial *(Csi)*	10.25		49.03		50.08						
System Post *(Csf)*	10.24		51.71		50.72						
Average *(Cm)*	10.2		50.4		50.4						
System Bias Initial *(SBi)*	0.5%	*PASS*	0.0%	*PASS*	0.0%	*PASS*					
System Bias Post *(SBf)*	0.4%	*PASS*	2.5%	*PASS*	0.6%	*PASS*					
Drift Assessment *(D)*	-0.05%	*PASS*	2.53%	*PASS*	0.61%	*PASS*					
High											
High Value *(CS/Cv)*	20.93		89.90		89.80						
Direct *(C Dir)*	20.90		89.96		89.66						
Calibration Error *(ACE)*	-0.14%	*PASS*	0.07%	*PASS*	-0.16%	*PASS*					
Analyser Span (Range)	20.93		105.76		105.65						

FTIR Data

Analyte	O2 (%)		THC (ppm wet)	CH4 (ppm wet)	CO (ppm dry)	NOX (ppm dry)	SO2 (ppm dry)	H2O (%)	FTIR Spectral File
Average	11.46	11.35	-0.94	-0.49	9.50	48.44	3.77	9.22	
Time	**Recorded**	**Corrected**	**Recorded**	**Recorded**	**Recorded**	**Recorded**	**Recorded**	**Recorded**	
11:04	10.81	10.68	1.06	-0.03	15.32	44.61	5.92	11.09	T1_000009.LAB
11:06	10.78	10.65	0.96	-0.05	15.02	44.99	5.56	9.57	T1_000010.LAB
11:07	10.85	10.72	0.82	-0.07	14.88	45.20	4.87	9.73	T1_000011.LAB
11:08	10.93	10.81	0.46	-0.10	14.86	45.96	3.63	10.10	T1_000012.LAB
11:09	10.92	10.80	0.21	-0.11	14.81	45.94	4.44	10.74	T1_000013.LAB
11:10	9.27	9.09	0.20	-0.12	14.96	46.20	5.74	11.76	T1_000014.LAB
11:11	8.83	8.65	0.39	-0.13	15.20	43.73	12.42	15.66	T1_000015.LAB
11:12	10.92	10.79	0.61	-0.14	14.90	41.89	11.06	11.42	T1_000016.LAB
11:13	10.83	10.70	0.39	-0.15	14.73	40.71	7.49	9.90	T1_000017.LAB
11:14	10.68	10.54	0.22	-0.18	14.55	42.92	5.72	11.15	T1_000018.LAB
11:15	10.74	10.61	0.33	-0.19	14.19	44.84	4.12	11.10	T1_000019.LAB
11:16	10.98	10.85	0.59	-0.20	13.87	45.05	3.16	10.85	T1_000020.LAB
11:17	11.09	10.97	1.05	-0.21	13.57	45.76	3.52	10.66	T1_000021.LAB
11:18	11.05	10.92	1.33	-0.22	13.35	45.37	3.65	10.77	T1_000022.LAB
11:19	10.92	10.79	1.17	-0.21	12.93	45.77	3.73	11.00	T1_000023.LAB
11:20	9.55	9.38	0.37	-0.22	12.64	44.61	5.85	10.39	T1_000024.LAB
11:21	9.75	9.59	-0.17	-0.25	12.53	43.70	11.54	10.70	T1_000025.LAB
11:22	10.87	10.74	-0.28	-0.26	12.71	41.24	7.54	12.06	T1_000026.LAB
11:23	10.88	10.76	-0.13	-0.26	12.44	44.46	6.40	12.26	T1_000027.LAB
11:24	10.84	10.71	-0.10	-0.28	11.94	45.90	5.66	11.94	T1_000028.LAB
11:25	10.90	10.77	-0.20	-0.29	11.56	46.81	5.30	11.94	T1_000029.LAB
11:26	10.96	10.84	-0.41	-0.30	11.61	46.35	4.77	12.66	T1_000030.LAB
11:28	11.09	10.96	-0.46	-0.31	11.20	46.22	4.33	11.29	T1_000031.LAB
11:29	9.37	9.21	-0.34	-0.32	10.99	44.76	6.07	11.70	T1_000032.LAB
11:30	10.75	10.62	-0.20	-0.32	10.79	42.20	10.35	10.85	T1_000033.LAB
11:31	11.27	11.15	-0.14	-0.33	10.67	43.51	6.44	10.18	T1_000034.LAB
11:32	11.15	11.02	-0.19	-0.35	10.32	45.92	4.77	9.45	T1_000035.LAB
11:33	11.37	11.26	-0.34	-0.36	10.08	46.79	3.23	10.36	T1_000036.LAB
11:34	11.21	11.10	-0.52	-0.38	9.76	47.12	3.50	9.79	T1_000037.LAB
11:35	11.21	11.09	-0.65	-0.39	9.63	47.67	3.12	10.59	T1_000038.LAB
11:36	9.53	9.36	-0.63	-0.40	9.66	47.40	4.62	11.42	T1_000039.LAB
11:37	10.42	10.28	-0.66	-0.40	9.72	43.05	9.32	13.15	T1_000040.LAB
11:38	11.20	11.08	-0.49	-0.41	9.64	45.70	6.57	12.03	T1_000041.LAB
11:39	11.26	11.14	-0.63	-0.41	9.41	47.90	5.15	10.40	T1_000042.LAB
11:40	11.40	11.29	-0.75	-0.43	9.20	48.22	4.09	9.61	T1_000043.LAB
11:41	11.65	11.54	-0.89	-0.44	8.99	47.78	3.33	8.94	T1_000044.LAB
11:42	11.62	11.51	-0.88	-0.45	8.88	47.89	2.75	9.14	T1_000045.LAB
11:43	10.33	10.19	-0.89	-0.46	8.89	48.18	3.68	9.38	T1_000046.LAB
11:44	10.31	10.17	-0.84	-0.47	8.75	44.64	8.64	9.21	T1_000047.LAB
11:45	11.46	11.35	-0.63	-0.48	8.87	46.31	6.10	9.57	T1_000048.LAB
11:46	11.59	11.48	-0.69	-0.48	8.78	48.31	5.15	9.20	T1_000049.LAB
11:47	11.44	11.32	-0.78	-0.49	8.64	49.71	4.99	9.39	T1_000050.LAB
11:48	11.29	11.17	-0.88	-0.51	8.52	50.46	4.74	10.23	T1_000051.LAB
11:50	11.52	11.41	-0.97	-0.51	8.49	49.92	4.27	10.85	T1_000052.LAB
11:51	11.36	11.25	-1.10	-0.52	8.35	49.95	4.06	10.75	T1_000053.LAB
11:52	10.12	9.97	-1.20	-0.52	8.32	50.59	4.34	11.18	T1_000054.LAB
11:53	9.53	9.36	-1.24	-0.53	8.17	45.67	10.17	11.35	T1_000055.LAB
11:54	11.09	10.97	-1.25	-0.53	8.38	44.74	8.82	11.45	T1_000056.LAB
11:55	11.11	10.99	-1.26	-0.54	8.25	48.24	6.19	10.94	T1_000057.LAB
11:56	11.19	11.07	-1.31	-0.55	8.15	49.22	5.46	11.42	T1_000058.LAB
11:57	11.21	11.09	-1.38	-0.55	8.09	49.30	4.65	10.95	T1_000059.LAB
11:58	11.30	11.19	-1.35	-0.55	8.04	49.18	4.11	10.56	T1_000060.LAB
11:59	11.53	11.41	-1.34	-0.56	7.97	48.69	3.52	9.71	T1_000061.LAB
12:00	11.71	11.60	-1.31	-0.56	7.97	48.39	2.99	9.60	T1_000062.LAB
12:01	11.48	11.37	-1.26	-0.57	7.91	48.71	2.67	8.81	T1_000063.LAB
12:02	11.15	11.03	-1.37	-0.58	7.89	48.88	2.42	10.61	T1_000064.LAB
12:03	10.27	10.13	-1.36	-0.59	7.84	49.12	3.00	10.63	T1_000065.LAB
12:04	9.72	9.56	-1.41	-0.61	7.94	44.54	7.25	11.46	T1_000066.LAB
12:05	11.34	11.23	-1.46	-0.63	8.04	44.72	6.48	10.84	T1_000067.LAB
12:06	11.21	11.09	-1.44	-0.63	7.97	47.99	4.77	10.57	T1_000068.LAB
12:07	11.25	11.13	-1.43	-0.63	7.95	48.13	4.01	11.12	T1_000069.LAB
12:08	11.51	11.39	-1.30	-0.64	7.93	48.25	3.91	9.86	T1_000070.LAB
12:09	11.59	11.48	-1.33	-0.65	7.84	48.68	3.48	9.46	T1_000071.LAB
12:10	11.59	11.48	-1.40	-0.65	7.83	48.39	2.48	9.58	T1_000072.LAB
12:12	11.58	11.47	-1.47	-0.64	7.83	48.37	2.51	9.56	T1_000073.LAB
12:13	11.88	11.78	-1.41	-0.65	7.76	47.53	2.50	8.00	T1_000074.LAB
12:14	11.44	11.33	-1.31	-0.64	7.72	48.81	2.01	8.85	T1_000075.LAB
12:15	11.54	11.43	-1.19	-0.64	7.83	49.28	2.18	9.93	T1_000076.LAB
12:16	11.66	11.55	-1.10	-0.64	7.89	48.69	2.59	9.57	T1_000077.LAB
12:17	10.22	10.07	-1.18	-0.65	7.85	49.66	3.23	9.29	T1_000078.LAB
12:18	10.16	10.01	-1.26	-0.65	7.83	44.35	8.33	10.50	T1_000079.LAB
12:19	11.55	11.44	-1.29	-0.65	7.98	45.66	5.59	9.50	T1_000080.LAB
12:20	11.52	11.41	-1.37	-0.66	8.02	47.87	4.08	9.77	T1_000081.LAB
12:21	11.63	11.52	-1.35	-0.66	7.86	48.52	3.54	9.26	T1_000082.LAB
12:22	11.59	11.48	-1.41	-0.67	7.87	48.10	3.27	9.01	T1_000083.LAB
12:23	11.47	11.36	-1.41	-0.67	7.88	48.72	2.98	9.40	T1_000084.LAB
12:24	11.54	11.42	-1.46	-0.67	7.88	49.46	2.81	10.10	T1_000085.LAB
12:25	11.72	11.61	-1.40	-0.68	7.86	48.76	2.63	9.45	T1_000086.LAB
12:26	11.79	11.69	-1.30	-0.68	7.74	49.18	2.61	8.83	T1_000087.LAB
12:27	11.71	11.60	-1.28	-0.67	7.69	48.97	2.51	8.53	T1_000088.LAB
12:28	11.60	11.49	-1.18	-0.67	7.66	50.26	2.63	9.25	T1_000089.LAB
12:29	11.43	11.32	-1.08	-0.66	7.66	49.85	2.71	9.88	T1_000090.LAB
12:30	11.54	11.43	-1.23	-0.66	7.59	49.50	2.73	10.69	T1_000091.LAB
12:31	11.61	11.50	-1.03	-0.66	7.91	49.39	2.66	9.68	T1_000092.LAB
12:32	11.57	11.46	-1.14	-0.65	8.52	49.37	2.72	9.08	T1_000093.LAB

Test 1

Incinerator

Date	26-Oct-21								
Analyte	O_2 (%)		THC (ppm wet)		CH4 (ppm wet)		CO (ppm dry)	NO_x (ppm dry)	SO_2 (ppm dry)	H_2O (%)	Spectral File
Zero											
Zero Value *(Cv)*	0.00		0.00		0.00						
Direct *(C Dir)*	0.00		-0.11		-0.24						
Calibration Error *(ACE)*	0.00%	*PASS*	-0.10%	*PASS*	-0.23%	*PASS*					
System Initial *(Csi)*	0.35		-0.11		-0.24						
System Post *(Csf)*	0.46		2.38		-0.57						
Average *(Co)*	0.41		1.14		-0.41						
System Bias Initial *(SBi)*	1.7%	*PASS*	0.0%	*PASS*	0.0%	*PASS*					
System Bias Post *(SBf)*	2.2%	*PASS*	2.4%	*PASS*	-0.3%	*PASS*					
Drift Assessment *(D)*	0.53%	*PASS*	2.35%	*PASS*	-0.31%	*PASS*					
Low											
Low Value *(Cv)*	NA		29.90		29.90						
Direct *(C Dir)*	NA		29.00		29.00						
Calibration Error *(ACE)*	NA	NA	-3.01%	*PASS*	-3.01%	*PASS*					
Mid											
Mid Value *(Cv)*	10.10		49.90		49.90						
Direct *(C Dir)*	10.15		49.03		50.08						
Calibration Error *(ACE)*	0.24%	*PASS*	-1.74%	*PASS*	0.36%	*PASS*					
System Initial *(Csi)*	10.25		49.03		50.08						
System Post *(Csf)*	10.24		51.71		50.72						
Average *(Cm)*	10.2		50.4		50.4						
System Bias Initial *(SBi)*	0.5%	*PASS*	0.0%	*PASS*	0.0%	*PASS*					
System Bias Post *(SBf)*	0.4%	*PASS*	2.5%	*PASS*	0.6%	*PASS*					
Drift Assessment *(D)*	-0.05%	*PASS*	2.53%	*PASS*	0.61%	*PASS*					
High											
High Value *(CS/Cv)*	20.93		89.90		89.80						
Direct *(C Dir)*	20.90		89.96		89.66						
Calibration Error *(ACE)*	-0.14%	*PASS*	0.07%	*PASS*	-0.16%	*PASS*					
Analyser Span (Range)	20.93		105.76		105.65						

FTIR Data

Analyte	O2 (%)		THC (ppm wet)	CH4 (ppm wet)	CO (ppm dry)	NOX (ppm dry)	SO2 (ppm dry)	H2O (%)	FTIR Spectral File
Average	11.46	11.35	-0.94	-0.49	9.50	48.44	3.77	9.22	
Time	**Recorded**	**Corrected**	**Recorded**	**Recorded**	**Recorded**	**Recorded**	**Recorded**	**Recorded**	
12:34	11.62	11.51	-0.96	-0.64	8.52	49.16	2.60	8.63	T1_000094.LAB
12:35	11.58	11.47	-1.08	-0.63	8.58	48.69	2.57	8.87	T1_000095.LAB
12:36	11.70	11.59	-1.31	-0.63	8.60	49.33	2.60	9.19	T1_000096.LAB
12:37	11.58	11.47	-1.37	-0.65	8.56	48.89	2.62	8.73	T1_000097.LAB
12:38	11.64	11.53	-1.34	-0.65	8.48	49.37	2.57	8.98	T1_000098.LAB
12:39	11.62	11.51	-1.42	-0.66	8.49	48.54	2.57	8.39	T1_000099.LAB
12:40	11.60	11.49	-1.37	-0.66	8.52	48.79	2.64	9.07	T1_000100.LAB
12:41	11.61	11.50	-1.48	-0.67	8.44	48.91	2.66	9.09	T1_000101.LAB
12:42	11.31	11.20	-1.53	-0.67	8.49	50.58	3.08	9.62	T1_000102.LAB
12:43	11.41	11.30	-1.50	-0.68	8.50	50.09	3.16	9.80	T1_000103.LAB
12:44	11.47	11.35	-1.23	-0.68	8.16	49.97	3.33	9.26	T1_000104.LAB
12:45	11.54	11.43	-1.09	-0.65	7.22	49.90	3.41	9.33	T1_000105.LAB
12:46	11.44	11.33	-1.13	-0.63	7.10	49.65	3.34	9.11	T1_000106.LAB
12:47	11.64	11.53	-1.10	-0.63	7.20	49.28	3.01	9.55	T1_000107.LAB
12:48	11.62	11.51	-1.05	-0.63	7.27	48.97	2.96	9.13	T1_000108.LAB
12:49	11.52	11.41	-1.06	-0.62	7.82	49.43	2.74	9.04	T1_000109.LAB
12:50	11.52	11.41	-1.12	-0.62	8.37	49.96	2.74	9.38	T1_000110.LAB
12:51	11.53	11.42	-1.15	-0.62	8.37	49.84	3.14	9.88	T1_000111.LAB
12:52	11.42	11.31	-1.09	-0.62	8.40	50.05	3.28	10.03	T1_000112.LAB
12:53	11.45	11.34	-1.01	-0.60	8.40	50.78	3.24	10.01	T1_000113.LAB
12:55	11.54	11.43	-0.91	-0.60	8.43	50.83	3.16	9.76	T1_000114.LAB
12:56	11.66	11.55	-0.97	-0.61	8.28	51.42	2.89	8.85	T1_000115.LAB
12:57	11.66	11.55	-1.08	-0.62	8.35	51.05	2.72	8.99	T1_000116.LAB
12:58	11.55	11.44	-1.51	-0.63	8.38	51.23	2.69	9.67	T1_000117.LAB
12:59	11.74	11.63	-1.61	-0.65	8.34	51.65	2.61	9.35	T1_000118.LAB
13:00	11.59	11.48	-1.61	-0.65	8.20	51.45	2.55	8.98	T1_000119.LAB
13:01	11.65	11.54	-1.37	-0.65	8.24	50.76	2.17	8.72	T1_000120.LAB
13:02	11.55	11.44	-1.35	-0.64	8.20	51.37	2.24	9.22	T1_000121.LAB
13:03	11.46	11.35	-1.15	-0.64	8.37	51.32	2.36	10.30	T1_000122.LAB
13:04	11.45	11.34	-1.11	-0.62	8.22	51.83	2.59	9.56	T1_000123.LAB
13:05	11.74	11.64	-1.13	-0.61	8.26	51.52	2.54	9.19	T1_000124.LAB
13:06	11.62	11.51	-1.13	-0.60	8.19	51.34	2.75	8.45	T1_000125.LAB
13:07	11.67	11.56	-0.97	-0.60	7.85	50.78	2.41	8.64	T1_000126.LAB
13:08	11.60	11.49	-1.02	-0.61	7.53	50.81	2.25	8.59	T1_000127.LAB
13:09	11.35	11.23	-1.11	-0.62	7.35	50.94	2.17	9.42	T1_000128.LAB
13:10	11.63	11.52	-1.14	-0.63	7.19	51.23	1.99	9.48	T1_000129.LAB
13:11	11.62	11.52	-1.10	-0.63	7.27	51.20	1.95	9.27	T1_000130.LAB
13:12	11.85	11.75	-1.11	-0.63	7.37	51.13	2.36	8.80	T1_000131.LAB
13:13	12.06	11.97	-1.08	-0.63	7.87	50.06	2.30	7.15	T1_000132.LAB
13:14	11.81	11.71	-1.11	-0.63	8.01	51.34	2.41	7.81	T1_000133.LAB
13:15	11.76	11.65	-0.98	-0.63	8.04	50.79	2.47	8.31	T1_000134.LAB
13:17	11.41	11.30	-0.89	-0.62	8.19	50.97	2.54	9.79	T1_000135.LAB
13:18	11.46	11.35	-0.99	-0.62	8.30	50.64	2.56	10.97	T1_000136.LAB
13:19	11.45	11.34	-1.02	-0.61	8.30	50.79	2.88	10.61	T1_000137.LAB
13:20	11.10	10.98	-0.96	-0.61	7.59	50.40	2.28	10.04	T1_000138.LAB
13:21	11.79	11.68	-1.14	-0.62	7.07	49.90	2.48	9.34	T1_000139.LAB
13:22	11.71	11.61	-1.42	-0.63	7.33	49.79	2.47	8.53	T1_000140.LAB
13:23	11.85	11.75	-1.45	-0.64	7.89	49.15	2.28	8.05	T1_000141.LAB
13:24	11.78	11.67	-1.51	-0.64	8.16	49.77	2.06	8.60	T1_000142.LAB
13:25	11.83	11.73	-1.43	-0.64	8.12	49.66	2.09	8.42	T1_000143.LAB
13:26	11.57	11.46	-1.47	-0.63	8.16	48.25	3.60	8.86	T1_000144.LAB
13:27	11.90	11.79	-1.47	-0.62	8.30	47.59	2.97	8.57	T1_000145.LAB
13:28	11.72	11.62	-1.27	-0.61	8.19	48.76	2.83	7.71	T1_000146.LAB
13:29	11.81	11.71	-1.23	-0.60	8.20	48.72	2.64	7.85	T1_000147.LAB
13:30	11.77	11.67	-1.25	-0.62	8.13	49.14	2.66	8.11	T1_000148.LAB
13:31	11.70	11.60	-1.16	-0.63	8.21	49.05	2.51	8.02	T1_000149.LAB
13:32	11.58	11.47	-1.17	-0.63	8.17	49.24	2.50	8.57	T1_000150.LAB
13:33	12.12	12.02	-1.09	-0.64	8.30	47.85	1.99	7.89	T1_000151.LAB
14:50	17.66	17.71	-1.41	-0.64	8.39	34.44	6.27	3.57	T1-2_000152.LAB
14:51	13.07	13.00	-1.58	-0.66	30.71	37.46	6.12	3.16	T1-2_000153.LAB
14:55	12.51	12.42	-1.54	-0.67	11.06	52.80	5.08	3.27	T1-3_000154.LAB
14:56	12.71	12.63	-1.31	-0.66	11.14	52.51	4.57	3.85	T1-3_000155.LAB
14:57	11.88	11.77	-1.21	-0.65	11.11	53.13	4.53	4.19	T1-3_000156.LAB
14:58	11.15	11.03	-1.20	-0.64	10.98	54.30	6.18	5.19	T1-3_000157.LAB
14:59	12.50	12.42	-1.06	-0.63	11.16	50.10	6.28	5.61	T1-3_000158.LAB
15:00	12.45	12.37	-1.07	-0.62	11.02	51.26	4.81	6.03	T1-3_000159.LAB
15:01	12.34	12.25	-1.11	-0.61	10.85	51.73	4.16	6.44	T1-3_000160.LAB
15:02	12.17	12.07	-1.14	-0.60	11.23	51.72	1.04	3.50	T1-4_000161.LAB
15:03	13.37	13.30	-1.11	-0.60	11.26	48.80	0.78	3.74	T1-4_000162.LAB
15:04	13.18	13.12	-1.19	-0.60	11.18	50.32	0.45	4.29	T1-4_000163.LAB
15:05	12.21	12.12	-1.17	-0.60	11.29	51.91	0.40	4.93	T1-4_000164.LAB
15:06	11.87	11.77	-1.20	-0.60	11.23	52.84	0.51	5.29	T1-4_000165.LAB
15:07	11.90	11.80	-1.23	-0.60	11.35	52.47	0.79	5.77	T1-4_000166.LAB
15:08	13.05	12.98	-1.50	-1.23	11.40	51.26	0.92	6.09	T1-4_000167.LAB
15:09	13.74	13.69	-1.23	0.64	11.51	46.19	0.73	5.37	T1-4_000168.LAB
15:11	13.10	13.03	-1.09	1.26	11.03	48.66	0.45	5.79	T1-4_000169.LAB
15:12	12.02	11.92	-1.13	1.25	11.13	52.89	0.37	6.75	T1-4_000170.LAB
15:13	12.45	12.36	-1.10	1.21	11.26	49.88	0.45	6.32	T1-4_000171.LAB
15:14	12.08	11.98	-1.05	1.17	11.01	51.53	0.58	6.26	T1-4_000172.LAB

Test 2

Incinerator

Date	27-Oct-21								
Analyte	**O_2 (%)**		**THC (ppm wet)**		**CH4 (ppm wet)**	**CO (ppm dry)**	**NO_X (ppm dry)**	**SO_2 (ppm dry)**	**H_2O (%)**	**Spectral File**
Zero										
Zero Value *(Cv)*	0.00		0.00		0.00					
Direct *(C Dir)*	0.00		0.16		0.39					
Calibration Error *(ACE)*	0.00%	*PASS*	0.15%	*PASS*	0.37%	*PASS*				
System Initial *(Csi)*	0.41		0.16		0.39					
System Post *(Csf)*	0.44		0.32		0.41					
Average *(Co)*	0.43		0.24		0.40					
System Bias Initial *(SBi)*	2.0%	*PASS*	0.0%	*PASS*	0.0%	*PASS*				
System Bias Post *(SBf)*	2.1%	*PASS*	0.2%	*PASS*	0.0%	*PASS*				
Drift Assessment *(D)*	0.14%	*PASS*	0.15%	*PASS*	0.02%	*PASS*				
Mid										
Low Value *(Cv)*	NA		29.90		29.90					
Direct *(C Dir)*	NA		29.17		29.89					
Calibration Error *(ACE)*	NA	NA	-2.44%	*PASS*	-0.03%	*PASS*				
Mid										
Mid Value *(Cv)*	10.10		49.90		49.90					
Direct *(C Dir)*	10.18		49.45		49.91					
Calibration Error *(ACE)*	0.38%	*PASS*	-0.90%	*PASS*	0.02%	*PASS*				
System Initial *(Csi)*	10.33		49.45		49.91					
System Post *(Csf)*	10.21		48.77		47.43					
Average *(Cm)*	10.3		49.1		48.7					
System Bias Initial *(SBi)*	0.7%	*PASS*	0.0%	*PASS*	0.0%	*PASS*				
System Bias Post *(SBf)*	0.1%	*PASS*	-0.6%	*PASS*	-2.3%	*PASS*				
Drift Assessment *(D)*	-0.57%	*PASS*	-0.64%	*PASS*	-2.34%	*PASS*				
High										
High Value *(CS/Cv)*	20.93		89.90		89.90					
Direct *(C Dir)*	20.91		89.77		89.46					
Calibration Error *(ACE)*	-0.10%	*PASS*	-0.14%	*PASS*	-0.49%	*PASS*				
Analyser Span (Range)	20.93		105.76		105.76					

FTIR Data

Analyte	**O2 (%)**		**THC (ppm wet)**	**CH4 (ppm wet)**	**CO (ppm dry)**	**NOX (ppm dry)**	**SO2 (ppm dry)**	**H2O (%)**	**FTIR Spectral File**
Average	11.57	11.43	1.99	0.92	7.41	48.93	4.91	9.29	
Time	**Recorded**	**Corrected**	**Recorded**	**Recorded**	**Recorded**	**Recorded**	**Recorded**	**Recorded**	
9:40	10.23	10.06	2.07	0.58	6.80	42.26	16.14	12.68	T2_000005.LAB
9:41	10.26	10.09	1.99	0.56	6.67	41.97	15.89	11.38	T2_000006.LAB
9:42	10.38	10.21	2.06	0.54	6.61	42.34	15.22	12.60	T2_000007.LAB
9:43	10.29	10.12	2.13	0.52	6.73	42.05	14.91	12.05	T2_000008.LAB
9:44	10.26	10.09	2.00	0.50	7.08	42.20	14.54	11.57	T2_000009.LAB
9:45	10.76	10.60	2.03	0.49	7.09	42.03	14.02	10.96	T2_000010.LAB
9:46	10.43	10.27	1.93	0.47	6.90	42.80	13.97	11.23	T2_000011.LAB
9:48	10.42	10.25	2.02	0.47	6.77	43.18	13.12	11.89	T2_000012.LAB
9:49	10.53	10.37	1.79	0.46	7.18	43.57	12.61	12.01	T2_000013.LAB
9:50	10.56	10.40	1.67	0.46	7.19	43.78	12.57	11.32	T2_000014.LAB
9:51	10.88	10.72	1.75	0.45	7.46	43.43	12.33	10.67	T2_000015.LAB
9:52	10.48	10.31	1.89	0.44	7.08	44.34	12.05	10.30	T2_000016.LAB
9:53	10.51	10.35	1.92	0.43	6.87	43.64	11.98	11.36	T2_000017.LAB
9:54	10.69	10.53	2.06	0.43	7.62	43.58	11.85	11.50	T2_000018.LAB
9:55	11.14	10.99	2.05	0.44	9.40	43.62	11.58	10.42	T2_000019.LAB
9:56	10.69	10.53	1.85	0.43	9.60	43.42	11.65	9.22	T2_000020.LAB
9:57	10.45	10.28	1.86	0.43	7.42	43.69	11.50	10.63	T2_000021.LAB
9:58	10.50	10.33	1.92	0.43	7.25	43.23	11.39	12.15	T2_000022.LAB
9:59	10.66	10.50	1.83	0.43	8.92	42.93	10.81	10.39	T2_000023.LAB
10:00	10.67	10.51	1.67	0.43	8.09	42.94	10.58	10.06	T2_000024.LAB
10:01	10.78	10.62	1.86	0.43	7.67	42.76	10.36	11.54	T2_000025.LAB
10:02	10.84	10.69	1.66	0.43	8.12	43.64	9.73	9.62	T2_000026.LAB
10:03	10.64	10.48	1.60	0.42	7.51	43.13	9.49	10.25	T2_000027.LAB
10:04	10.78	10.62	1.76	0.42	7.24	42.91	9.29	10.78	T2_000028.LAB
10:05	10.72	10.56	1.95	0.43	7.58	43.27	8.98	11.38	T2_000029.LAB
10:06	10.68	10.52	2.18	0.43	7.95	44.05	8.59	10.69	T2_000030.LAB
10:07	10.94	10.79	2.65	0.43	7.99	43.39	8.62	10.34	T2_000031.LAB
10:09	10.89	10.74	2.20	0.43	7.83	43.24	8.67	9.28	T2_000032.LAB
10:10	11.00	10.85	1.71	0.44	7.32	42.99	8.61	9.57	T2_000033.LAB
10:11	10.81	10.65	1.82	0.44	6.96	43.17	8.70	9.07	T2_000034.LAB
10:12	10.78	10.63	2.03	0.43	6.99	42.14	8.93	10.15	T2_000035.LAB
10:13	10.62	10.45	2.35	0.43	6.97	42.31	8.75	10.66	T2_000036.LAB
10:14	10.69	10.53	2.58	0.43	7.17	42.43	8.67	11.53	T2_000037.LAB
10:15	11.03	10.88	2.26	0.44	7.30	41.54	8.76	9.08	T2_000038.LAB
10:16	10.95	10.80	1.80	0.44	7.21	41.70	8.76	8.51	T2_000039.LAB
10:17	10.66	10.50	1.79	0.45	7.15	41.16	8.46	9.93	T2_000040.LAB
10:18	10.78	10.63	2.04	0.45	7.14	41.02	8.31	10.17	T2_000041.LAB
10:19	10.64	10.48	2.35	0.45	7.21	41.39	8.62	11.38	T2_000042.LAB
10:20	10.83	10.67	2.43	0.46	7.28	41.54	8.57	9.65	T2_000043.LAB
10:21	11.36	11.22	2.36	0.46	7.38	41.27	8.16	9.74	T2_000044.LAB
10:22	10.91	10.75	2.39	0.46	7.30	42.71	8.00	9.29	T2_000045.LAB
10:23	10.81	10.66	2.05	0.47	7.27	43.03	7.60	10.69	T2_000046.LAB
10:24	11.18	11.03	1.94	0.48	7.34	43.20	7.49	9.68	T2_000047.LAB
10:25	10.90	10.75	2.31	0.48	7.36	43.40	7.56	9.76	T2_000048.LAB
10:26	10.88	10.72	1.80	0.48	7.39	43.57	7.19	10.27	T2_000049.LAB
10:27	10.99	10.84	1.68	0.47	7.45	43.88	6.89	10.01	T2_000050.LAB
10:28	11.29	11.14	1.99	0.47	7.35	44.50	6.16	10.07	T2_000051.LAB
10:29	11.03	10.88	2.20	0.47	7.32	45.40	5.64	9.74	T2_000052.LAB
10:31	11.19	11.04	2.20	0.48	7.28	45.77	6.02	9.88	T2_000053.LAB
10:32	11.11	10.97	2.04	0.49	7.33	44.77	6.25	10.11	T2_000054.LAB
10:33	11.02	10.87	2.24	0.50	7.35	45.30	6.00	10.73	T2_000055.LAB
10:34	11.24	11.10	2.69	0.51	7.47	46.49	7.31	9.10	T2_000056.LAB
10:35	11.21	11.06	3.19	0.53	7.47	45.92	7.05	10.14	T2_000057.LAB
10:36	11.36	11.22	3.60	0.57	7.35	45.72	6.40	9.30	T2_000058.LAB
10:37	11.23	11.08	3.27	0.62	7.39	45.85	5.71	9.43	T2_000059.LAB
10:38	11.16	11.01	2.10	0.65	7.35	46.82	4.62	10.81	T2_000060.LAB
10:39	11.52	11.39	2.10	0.65	7.38	46.48	5.84	8.92	T2_000061.LAB
10:40	11.78	11.65	2.28	0.65	7.26	46.52	5.43	8.15	T2_000062.LAB
10:41	11.47	11.33	2.39	0.65	7.08	47.80	3.98	8.59	T2_000063.LAB
10:42	11.34	11.20	2.31	0.66	7.11	47.00	4.84	9.82	T2_000064.LAB
10:43	11.39	11.25	1.78	0.66	7.08	47.21	5.61	10.20	T2_000065.LAB
10:44	11.20	11.06	1.92	0.65	7.08	47.22	5.82	10.37	T2_000066.LAB
10:45	11.34	11.20	2.21	0.65	7.11	47.82	5.70	10.28	T2_000067.LAB
10:46	11.24	11.10	2.69	0.67	7.24	47.29	5.51	10.01	T2_000068.LAB
10:47	11.54	11.40	2.54	0.71	7.24	46.78	5.44	10.18	T2_000069.LAB
10:48	11.72	11.59	2.16	0.75	7.20	46.69	5.40	8.31	T2_000070.LAB
10:49	11.58	11.44	1.96	0.76	7.06	47.35	5.20	7.77	T2_000071.LAB
10:50	11.53	11.39	1.75	0.74	7.01	47.95	5.12	8.88	T2_000072.LAB
10:51	11.44	11.30	1.72	0.72	6.97	47.80	4.77	9.29	T2_000073.LAB
10:53	11.48	11.34	1.83	0.72	6.97	47.02	4.26	9.37	T2_000074.LAB
10:54	11.55	11.41	1.74	0.73	7.00	47.52	3.92	9.51	T2_000075.LAB
10:55	11.51	11.37	1.72	0.74	6.96	47.57	4.42	9.42	T2_000076.LAB
10:56	11.59	11.46	1.51	0.76	7.06	47.97	4.88	10.04	T2_000077.LAB
10:57	11.52	11.38	1.38	0.78	6.98	47.82	5.05	9.08	T2_000078.LAB
10:58	11.46	11.32	1.37	0.79	6.99	48.43	4.94	9.69	T2_000079.LAB
10:59	11.51	11.38	1.33	0.80	6.96	48.00	4.88	10.10	T2_000080.LAB
11:00	11.62	11.48	1.42	0.81	6.96	47.75	4.86	9.57	T2_000081.LAB
11:01	11.47	11.33	1.41	0.82	6.84	48.16	5.12	9.10	T2_000082.LAB
11:02	11.33	11.19	1.28	0.82	6.88	48.13	4.82	10.09	T2_000083.LAB
11:03	11.60	11.47	1.43	0.82	6.87	47.70	4.71	10.34	T2_000084.LAB
11:04	11.70	11.57	1.47	0.80	6.85	47.42	4.77	8.45	T2_000085.LAB
11:05	11.38	11.24	1.47	0.77	6.82	47.84	4.76	9.73	T2_000086.LAB
11:06	11.47	11.33	1.51	0.77	6.84	48.86	4.35	8.82	T2_000087.LAB

Test 2

Incinerator

Date	27-Oct-21								
Analyte	**O_2 (%)**		**THC (ppm wet)**		**CH4 (ppm wet)**	**CO (ppm dry)**	**NO_X (ppm dry)**	**SO_2 (ppm dry)**	**H_2O (%)**	**Spectral File**
Zero										
Zero Value *(Cv)*	0.00		0.00		0.00					
Direct *(C Dir)*	0.00		0.16		0.39					
Calibration Error *(ACE)*	0.00%	*PASS*	0.15%	*PASS*	0.37%	*PASS*				
System Initial *(Csi)*	0.41		0.16		0.39					
System Post *(Csf)*	0.44		0.32		0.41					
Average *(Co)*	0.43		0.24		0.40					
System Bias Initial *(SBi)*	2.0%	*PASS*	0.0%	*PASS*	0.0%	*PASS*				
System Bias Post *(SBf)*	2.1%	*PASS*	0.2%	*PASS*	0.0%	*PASS*				
Drift Assessment *(D)*	0.14%	*PASS*	0.15%	*PASS*	0.02%	*PASS*				
Mid										
Low Value *(Cv)*	NA		29.90		29.90					
Direct *(C Dir)*	NA		29.17		29.89					
Calibration Error *(ACE)*	NA	NA	-2.44%	*PASS*	-0.03%	*PASS*				
Mid										
Mid Value *(Cv)*	10.10		49.90		49.90					
Direct *(C Dir)*	10.18		49.45		49.91					
Calibration Error *(ACE)*	0.38%	*PASS*	-0.90%	*PASS*	0.02%	*PASS*				
System Initial *(Csi)*	10.33		49.45		49.91					
System Post *(Csf)*	10.21		48.77		47.43					
Average *(Cm)*	10.3		49.1		48.7					
System Bias Initial *(SBi)*	0.7%	*PASS*	0.0%	*PASS*	0.0%	*PASS*				
System Bias Post *(SBf)*	0.1%	*PASS*	-0.6%	*PASS*	-2.3%	*PASS*				
Drift Assessment *(D)*	-0.57%	*PASS*	-0.64%	*PASS*	-2.34%	*PASS*				
High										
High Value *(CS/Cv)*	20.93		89.90		89.90					
Direct *(C Dir)*	20.91		89.77		89.46					
Calibration Error *(ACE)*	-0.10%	*PASS*	-0.14%	*PASS*	-0.49%	*PASS*				
Analyser Span (Range)	20.93		105.76		105.76					

FTIR Data

Analyte	**O2 (%)**		**THC (ppm wet)**	**CH4 (ppm wet)**	**CO (ppm dry)**	**NOX (ppm dry)**	**SO2 (ppm dry)**	**H2O (%)**	**FTIR Spectral File**
Average	11.57	11.43	1.99	0.92	7.41	48.93	4.91	9.29	
Time	**Recorded**	**Corrected**	**Recorded**	**Recorded**	**Recorded**	**Recorded**	**Recorded**	**Recorded**	
11:07	11.29	11.14	1.44	0.77	6.94	48.02	4.37	10.63	T2_000088.LAB
11:08	11.64	11.50	1.39	0.79	6.91	48.48	4.66	10.14	T2_000089.LAB
11:09	11.58	11.45	1.35	0.81	6.94	49.41	5.21	9.45	T2_000090.LAB
11:10	11.69	11.56	1.39	0.83	6.93	49.03	4.88	9.27	T2_000091.LAB
11:11	11.71	11.57	1.32	0.85	6.89	49.45	4.76	8.66	T2_000092.LAB
11:12	10.28	10.11	1.45	0.86	6.79	46.54	8.56	8.87	T2_000093.LAB
11:13	11.95	11.83	1.39	0.88	6.96	41.56	15.17	8.05	T2_000094.LAB
11:15	11.57	11.44	1.34	0.88	6.95	46.92	5.62	8.29	T2_000095.LAB
11:16	11.69	11.55	1.33	0.89	6.90	48.84	4.48	8.73	T2_000096.LAB
11:17	11.39	11.25	1.13	0.89	6.96	49.58	4.47	9.99	T2_000097.LAB
11:18	11.44	11.30	1.09	0.91	7.01	50.28	5.67	10.72	T2_000098.LAB
11:19	11.71	11.58	1.04	0.93	7.00	49.26	5.39	9.09	T2_000099.LAB
11:20	11.85	11.72	1.22	0.94	7.01	49.67	4.97	8.85	T2_000100.LAB
11:21	11.80	11.67	1.44	0.93	6.88	49.37	4.60	8.61	T2_000101.LAB
11:22	11.77	11.64	1.47	0.92	6.85	49.86	4.27	8.51	T2_000102.LAB
11:23	11.73	11.60	1.56	0.91	6.95	49.96	4.08	9.04	T2_000103.LAB
11:24	11.89	11.76	1.34	0.88	6.93	50.42	3.30	9.61	T2_000104.LAB
11:25	11.59	11.45	1.26	0.85	7.00	50.49	3.62	9.60	T2_000105.LAB
11:26	11.78	11.65	1.28	0.81	6.90	50.41	3.54	9.19	T2_000106.LAB
11:27	11.62	11.48	1.36	0.80	6.92	50.70	3.93	9.31	T2_000107.LAB
11:28	11.70	11.56	1.30	0.80	6.91	50.85	3.60	9.73	T2_000108.LAB
11:29	11.85	11.72	1.39	0.83	6.97	50.32	3.34	9.56	T2_000109.LAB
11:30	10.21	10.04	1.35	0.87	6.93	50.65	4.81	9.23	T2_000110.LAB
11:31	11.01	10.86	1.28	0.87	7.06	44.68	10.89	10.66	T2_000111.LAB
11:32	11.77	11.64	1.23	0.87	7.33	47.27	5.55	10.25	T2_000112.LAB
11:33	11.63	11.49	1.25	0.89	7.13	50.48	4.82	10.04	T2_000113.LAB
11:34	11.85	11.72	1.39	0.89	7.14	50.65	4.32	8.86	T2_000114.LAB
11:35	11.81	11.68	1.35	0.86	7.00	51.05	4.11	8.52	T2_000115.LAB
11:37	11.74	11.61	1.26	0.84	7.02	50.99	3.93	9.02	T2_000116.LAB
11:38	11.92	11.80	1.38	0.86	7.16	50.91	3.65	8.80	T2_000117.LAB
11:39	11.88	11.75	1.40	0.87	7.05	51.17	3.51	8.73	T2_000118.LAB
11:40	11.85	11.72	1.29	0.85	7.05	50.92	2.79	8.19	T2_000119.LAB
11:41	11.57	11.43	1.29	0.84	7.00	51.66	2.36	8.62	T2_000120.LAB
11:42	11.59	11.46	1.18	0.83	7.20	51.74	2.59	10.57	T2_000121.LAB
11:43	11.72	11.59	1.34	0.82	7.14	51.78	3.69	9.02	T2_000122.LAB
11:44	11.82	11.69	1.17	0.82	7.17	51.57	3.79	9.08	T2_000123.LAB
11:45	11.69	11.56	1.08	0.82	7.13	52.51	3.62	8.68	T2_000124.LAB
11:46	11.66	11.53	1.22	0.81	7.20	52.20	3.80	9.38	T2_000125.LAB
11:47	11.60	11.47	1.27	0.82	7.22	52.25	3.49	9.92	T2_000126.LAB
11:48	11.57	11.44	1.37	0.82	7.21	52.25	3.43	10.38	T2_000127.LAB
11:49	11.73	11.60	1.44	0.84	7.23	52.03	3.43	10.16	T2_000128.LAB
11:50	11.82	11.69	1.67	0.86	7.15	51.84	3.64	9.19	T2_000129.LAB
11:51	11.68	11.55	1.60	0.87	7.17	51.63	3.58	9.34	T2_000130.LAB
11:52	10.52	10.36	1.46	0.87	7.16	52.84	4.19	9.95	T2_000131.LAB
11:53	10.38	10.22	1.58	0.87	7.15	46.57	10.40	10.11	T2_000132.LAB
11:54	11.79	11.66	1.60	0.89	7.37	45.91	8.15	9.87	T2_000133.LAB
11:55	11.90	11.77	1.68	0.92	7.14	50.31	4.86	8.55	T2_000134.LAB
11:56	11.94	11.81	1.73	0.94	7.13	51.18	4.22	8.40	T2_000135.LAB
11:58	11.90	11.77	1.74	0.94	7.04	51.62	3.84	7.67	T2_000136.LAB
11:59	11.87	11.74	1.87	0.93	6.99	51.94	3.22	8.23	T2_000137.LAB
12:00	11.67	11.53	1.81	0.92	7.03	52.75	2.49	9.10	T2_000138.LAB
12:01	11.89	11.76	1.86	0.94	7.04	52.82	2.37	8.99	T2_000139.LAB
12:02	12.16	12.04	1.76	0.95	6.98	52.20	2.47	8.47	T2_000140.LAB
12:03	12.00	11.88	1.54	0.95	7.07	52.83	1.85	8.40	T2_000141.LAB
12:04	12.09	11.96	1.45	0.94	7.01	53.12	1.65	8.85	T2_000142.LAB
12:05	11.90	11.77	1.45	0.92	7.06	53.64	2.26	8.23	T2_000143.LAB
12:06	11.73	11.59	1.63	0.92	6.96	54.59	2.44	9.55	T2_000144.LAB
12:07	12.11	11.99	1.75	0.92	6.99	54.20	2.46	9.19	T2_000145.LAB
12:08	10.42	10.25	1.69	0.93	6.98	54.09	4.19	8.78	T2_000146.LAB
12:09	11.48	11.35	1.53	0.95	7.05	48.14	8.62	9.01	T2_000147.LAB
12:10	12.02	11.90	1.63	0.96	7.24	49.65	4.65	9.34	T2_000148.LAB
12:11	11.90	11.77	1.55	0.98	7.22	52.85	3.19	9.16	T2_000149.LAB
12:12	11.99	11.87	1.49	1.01	7.15	53.63	3.08	9.30	T2_000150.LAB
12:13	11.99	11.86	1.54	1.02	7.20	53.30	2.87	9.59	T2_000151.LAB
12:14	12.21	12.09	1.64	1.01	7.17	53.35	2.66	9.14	T2_000152.LAB
12:15	12.03	11.91	1.48	1.00	7.13	53.54	2.73	8.71	T2_000153.LAB
12:16	12.14	12.02	1.62	1.01	7.05	53.66	2.48	8.17	T2_000154.LAB
12:17	11.16	11.01	1.60	1.01	7.11	55.23	2.50	8.56	T2_000155.LAB
12:18	10.44	10.27	1.52	0.97	7.12	50.86	5.96	9.32	T2_000156.LAB
12:20	12.16	12.04	1.61	0.96	7.32	47.91	5.93	8.96	T2_000157.LAB
12:21	12.02	11.90	1.64	0.97	7.16	52.31	2.45	9.15	T2_000158.LAB
12:22	11.79	11.66	1.69	0.99	7.31	54.16	2.25	9.31	T2_000159.LAB
12:23	12.07	11.94	1.66	1.00	7.25	54.19	2.48	9.43	T2_000160.LAB
12:24	11.97	11.85	1.71	0.99	7.17	54.24	2.74	8.57	T2_000161.LAB
12:25	11.99	11.87	1.65	0.99	7.22	54.16	2.55	9.32	T2_000162.LAB
12:26	12.15	12.03	1.60	0.99	7.20	53.28	2.40	8.51	T2_000163.LAB
12:27	11.96	11.83	1.67	1.00	7.21	54.15	2.26	9.24	T2_000164.LAB
12:28	10.49	10.32	1.83	1.03	7.31	54.06	4.25	9.64	T2_000165.LAB
12:29	11.73	11.60	1.72	1.04	7.36	47.03	7.79	10.28	T2_000166.LAB
12:30	12.04	11.91	1.89	1.04	7.47	50.27	4.32	9.03	T2_000167.LAB
12:31	12.10	11.98	1.85	1.05	7.30	52.84	3.40	7.95	T2_000168.LAB
12:32	12.17	12.05	1.82	1.07	7.27	52.87	2.97	8.23	T2_000169.LAB
12:33	12.03	11.90	1.79	1.09	7.28	52.43	2.54	8.66	T2_000170.LAB

Test 2

Incinerator

Date	27-Oct-21								
Analyte	**O_2 (%)**		**THC (ppm wet)**		**CH4 (ppm wet)**	**CO (ppm dry)**	**NO_X (ppm dry)**	**SO_2 (ppm dry)**	**H_2O (%)**	**Spectral File**
Zero										
Zero Value *(Cv)*	0.00		0.00		0.00					
Direct *(C Dir)*	0.00		0.16		0.39					
Calibration Error *(ACE)*	0.00%	*PASS*	0.15%	*PASS*	0.37%	*PASS*				
System Initial *(Csi)*	0.41		0.16		0.39					
System Post *(Csf)*	0.44		0.32		0.41					
Average *(Co)*	0.43		0.24		0.40					
System Bias Initial *(SBi)*	2.0%	*PASS*	0.0%	*PASS*	0.0%	*PASS*				
System Bias Post *(SBf)*	2.1%	*PASS*	0.2%	*PASS*	0.0%	*PASS*				
Drift Assessment *(D)*	0.14%	*PASS*	0.15%	*PASS*	0.02%	*PASS*				
Mid										
Low Value *(Cv)*	NA		29.90		29.90					
Direct *(C Dir)*	NA		29.17		29.89					
Calibration Error *(ACE)*	NA	NA	-2.44%	*PASS*	-0.03%	*PASS*				
Mid										
Mid Value *(Cv)*	10.10		49.90		49.90					
Direct *(C Dir)*	10.18		49.45		49.91					
Calibration Error *(ACE)*	0.38%	*PASS*	-0.90%	*PASS*	0.02%	*PASS*				
System Initial *(Csi)*	10.33		49.45		49.91					
System Post *(Csf)*	10.21		48.77		47.43					
Average *(Cm)*	10.3		49.1		48.7					
System Bias Initial *(SBi)*	0.7%	*PASS*	0.0%	*PASS*	0.0%	*PASS*				
System Bias Post *(SBf)*	0.1%	*PASS*	-0.6%	*PASS*	-2.3%	*PASS*				
Drift Assessment *(D)*	-0.57%	*PASS*	-0.64%	*PASS*	-2.34%	*PASS*				
High										
High Value *(CS/Cv)*	20.93		89.90		89.90					
Direct *(C Dir)*	20.91		89.77		89.46					
Calibration Error *(ACE)*	-0.10%	*PASS*	-0.14%	*PASS*	-0.49%	*PASS*				
Analyser Span (Range)	20.93		105.76		105.76					

FTIR Data

Analyte	**O2 (%)**		**THC (ppm wet)**	**CH4 (ppm wet)**	**CO (ppm dry)**	**NOX (ppm dry)**	**SO2 (ppm dry)**	**H2O (%)**	**FTIR Spectral File**
Average	11.57	11.43	1.99	0.92	7.41	48.93	4.91	9.29	
Time	**Recorded**	**Corrected**	**Recorded**	**Recorded**	**Recorded**	**Recorded**	**Recorded**	**Recorded**	
12:34	12.23	12.11	1.99	1.11	7.35	52.51	1.93	8.75	T2_000171.LAB
12:35	12.00	11.88	2.14	1.12	7.29	53.20	1.88	8.24	T2_000172.LAB
12:36	11.93	11.80	1.99	1.10	7.29	53.42	1.81	9.63	T2_000173.LAB
12:37	11.99	11.87	2.04	1.09	7.23	53.24	1.93	8.98	T2_000174.LAB
12:38	11.90	11.77	1.85	1.09	7.35	53.17	2.27	9.61	T2_000175.LAB
12:39	10.94	10.78	1.88	1.08	7.39	54.72	2.58	9.49	T2_000176.LAB
12:40	10.81	10.66	1.91	1.09	7.30	50.83	5.47	8.71	T2_000177.LAB
12:42	12.30	12.18	1.88	1.11	7.36	47.89	6.18	7.94	T2_000178.LAB
12:43	12.17	12.05	2.09	1.13	7.49	52.16	2.81	8.59	T2_000179.LAB
12:44	12.02	11.89	1.84	1.12	7.55	52.81	2.06	9.53	T2_000180.LAB
12:45	12.10	11.98	1.98	1.10	7.42	52.97	2.29	8.87	T2_000181.LAB
12:46	12.45	12.33	2.10	1.10	7.47	52.18	2.31	8.23	T2_000182.LAB
12:47	12.19	12.07	2.13	1.10	7.39	52.62	2.09	7.90	T2_000183.LAB
12:48	12.11	11.98	2.10	1.10	7.50	52.98	1.82	8.96	T2_000184.LAB
12:49	10.58	10.42	1.94	1.11	7.54	53.79	3.64	9.51	T2_000185.LAB
12:50	11.86	11.73	1.98	1.12	7.56	49.15	6.46	9.20	T2_000186.LAB
12:51	12.20	12.08	2.15	1.14	7.68	50.27	4.05	8.70	T2_000187.LAB
12:52	12.17	12.05	2.17	1.15	7.60	52.58	2.90	8.21	T2_000188.LAB
12:53	12.02	11.90	2.00	1.17	7.56	53.13	2.39	9.03	T2_000189.LAB
12:54	12.23	12.11	2.07	1.19	7.60	52.15	2.25	8.74	T2_000190.LAB
12:55	12.24	12.12	2.05	1.19	7.56	51.78	2.16	9.08	T2_000191.LAB
12:56	12.20	12.08	2.18	1.19	7.56	52.44	2.02	8.36	T2_000192.LAB
12:57	12.14	12.02	2.19	1.21	7.53	52.62	1.96	8.44	T2_000193.LAB
12:58	12.14	12.02	2.24	1.21	7.48	52.71	1.81	8.83	T2_000194.LAB
12:59	12.24	12.12	2.15	1.22	7.55	52.50	1.70	8.70	T2_000195.LAB
13:00	10.59	10.42	2.14	1.22	7.59	52.29	3.99	8.92	T2_000196.LAB
13:01	12.15	12.03	2.30	1.22	7.76	46.66	5.57	9.58	T2_000197.LAB
13:02	12.23	12.11	2.23	1.22	7.78	50.15	2.82	8.35	T2_000198.LAB
13:04	11.99	11.86	2.34	1.24	7.70	51.59	2.13	8.91	T2_000199.LAB
13:05	12.20	12.08	2.31	1.25	7.77	51.26	1.75	9.66	T2_000200.LAB
13:06	12.27	12.15	2.17	1.25	7.65	51.66	2.11	8.49	T2_000201.LAB
13:07	12.35	12.23	2.38	1.24	7.58	51.84	2.41	7.96	T2_000202.LAB
13:08	12.33	12.21	2.50	1.22	7.63	51.08	2.28	8.15	T2_000203.LAB
13:09	12.24	12.12	2.44	1.20	7.70	51.64	2.03	8.60	T2_000204.LAB
13:10	12.17	12.05	2.36	1.18	7.65	51.60	1.82	8.40	T2_000205.LAB
13:11	11.05	10.90	2.37	1.19	7.65	53.40	2.23	8.22	T2_000206.LAB
13:12	10.59	10.43	2.60	1.23	7.71	49.91	5.01	8.97	T2_000207.LAB
13:13	12.19	12.07	2.60	1.27	7.84	46.99	3.88	9.33	T2_000208.LAB
13:14	12.12	12.00	2.58	1.30	7.85	50.23	2.22	8.83	T2_000209.LAB
13:15	12.17	12.05	2.47	1.33	7.87	50.40	2.26	9.45	T2_000210.LAB
13:16	12.44	12.33	2.55	1.35	7.74	50.52	2.28	8.11	T2_000211.LAB
13:17	12.41	12.29	2.73	1.35	7.68	50.53	2.14	7.51	T2_000212.LAB
13:18	12.31	12.19	2.56	1.34	7.64	50.65	1.99	7.55	T2_000213.LAB
13:19	12.40	12.28	2.51	1.33	7.78	50.09	1.50	7.63	T2_000214.LAB
13:20	12.37	12.26	2.52	1.31	7.65	51.27	1.06	7.97	T2_000215.LAB
13:21	10.71	10.55	2.50	1.30	7.65	52.61	2.03	7.63	T2_000216.LAB
13:22	11.10	10.95	2.63	1.31	7.85	48.96	4.15	8.86	T2_000217.LAB
13:23	12.25	12.14	2.89	1.34	8.07	47.90	2.79	9.34	T2_000218.LAB
13:25	12.15	12.03	2.90	1.36	8.06	50.27	2.11	9.07	T2_000219.LAB
13:26	12.19	12.07	2.75	1.37	7.97	50.44	2.09	8.81	T2_000220.LAB
13:27	12.45	12.34	2.64	1.40	7.99	50.58	1.87	7.76	T2_000221.LAB
13:28	12.34	12.22	2.54	1.42	7.95	51.07	1.71	7.59	T2_000222.LAB
13:29	12.32	12.21	2.71	1.45	7.93	50.82	1.56	7.85	T2_000223.LAB
13:30	12.20	12.08	2.77	1.46	8.08	50.78	1.62	8.52	T2_000224.LAB
13:31	10.96	10.81	2.56	1.44	8.06	52.18	2.36	8.87	T2_000225.LAB
13:32	11.45	11.31	2.35	1.40	8.22	48.19	3.90	9.62	T2_000226.LAB
13:33	12.35	12.23	2.41	1.38	8.32	47.74	2.63	8.62	T2_000227.LAB
13:34	12.05	11.93	2.54	1.41	8.26	49.75	1.94	9.28	T2_000228.LAB
13:35	12.08	11.96	2.90	1.42	8.26	50.82	1.98	9.35	T2_000229.LAB
13:36	12.29	12.18	2.66	1.43	8.17	51.42	1.93	8.55	T2_000230.LAB
13:37	12.45	12.34	2.62	1.44	8.25	50.36	1.74	8.21	T2_000231.LAB
13:38	12.53	12.42	2.69	1.45	8.14	50.93	1.62	7.07	T2_000232.LAB
13:39	12.67	12.56	2.61	1.46	8.10	51.01	1.45	6.47	T2_000233.LAB
13:40	10.90	10.74	3.22	1.49	8.19	53.57	1.83	7.88	T2_000234.LAB
13:41	10.92	10.77	3.07	1.49	8.36	50.62	3.23	9.59	T2_000235.LAB
13:42	12.35	12.23	2.81	1.46	8.48	47.30	2.69	8.41	T2_000236.LAB
13:43	12.31	12.20	2.71	1.44	8.56	49.86	1.79	8.49	T2_000237.LAB
13:44	12.42	12.30	2.89	1.45	8.39	50.62	1.47	8.05	T2_000238.LAB
13:45	12.46	12.35	2.99	1.49	8.37	50.48	1.36	7.68	T2_000239.LAB
13:47	12.49	12.38	2.86	1.53	8.36	50.63	1.03	7.47	T2_000240.LAB
13:48	12.14	12.01	3.10	1.56	8.57	51.02	0.80	9.08	T2_000241.LAB
13:49	12.42	12.30	2.99	1.55	8.51	51.49	0.86	9.06	T2_000242.LAB
13:50	10.99	10.84	2.57	1.48	8.44	52.08	2.05	8.15	T2_000243.LAB
13:51	12.36	12.24	2.71	1.44	8.54	48.04	2.86	8.77	T2_000244.LAB
13:52	12.60	12.49	2.90	1.44	8.62	49.16	1.72	7.95	T2_000245.LAB
13:53	12.45	12.33	3.03	1.44	8.49	50.46	1.28	7.88	T2_000246.LAB
13:54	12.41	12.29	3.18	1.48	8.44	51.06	1.09	8.63	T2_000247.LAB
13:55	12.54	12.42	3.28	1.52	8.58	51.38	1.01	8.89	T2_000248.LAB
13:56	10.96	10.81	3.27	1.58	8.47	53.12	1.54	8.41	T2_000249.LAB
13:57	11.12	10.97	3.23	1.62	8.52	50.54	2.63	8.64	T2_000250.LAB
13:58	12.33	12.21	3.34	1.65	8.67	47.22	2.36	9.17	T2_000251.LAB

Test 3

Incinerator

Date	28-Oct-21								
Analyte	**O_2 (%)**		**THC (ppm wet)**		**CH4 (ppm wet)**	**CO (ppm dry)**	**NO_X (ppm dry)**	**SO_2 (ppm dry)**	**H_2O (%)**	**Spectral File**
Low										
Zero Value *(Cv)*	0.00		0.00		0.00					
Direct *(C Dir)*	0.00		0.46		0.38					
Calibration Error *(ACE)*	0.00%	*PASS*	0.43%	*PASS*	0.36%	*PASS*				
System Initial *(Csi)*	0.41		0.46		0.38					
System Post *(Csf)*	0.37		1.57		1.50					
Average *(Co)*	0.39		1.02		0.94					
System Bias Initial *(SBi)*	2.0%	*PASS*	0.0%	*PASS*	0.0%	*PASS*				
System Bias Post *(SBf)*	1.8%	*PASS*	1.0%	*PASS*	1.1%	*PASS*				
Drift Assessment *(D)*	-0.19%	*PASS*	1.05%	*PASS*	1.06%	*PASS*				
Low										
Low Value *(Cv)*	NA		29.90		29.90					
Direct *(C Dir)*	NA		29.70		30.37					
Calibration Error *(ACE)*	NA	NA	-0.67%	*PASS*	1.57%	*PASS*				
Mid										
Mid Value *(Cv)*	10.10		49.90		49.90					
Direct *(C Dir)*	10.16		49.87		50.60					
Calibration Error *(ACE)*	0.29%	*PASS*	-0.03%	*PASS*	0.66%	*PASS*				
System Initial *(Csi)*	10.19		49.87		50.6					
System Post *(Csf)*	9.99		48.32		49.09					
Average *(Cm)*	10.1		49.1		49.8					
System Bias Initial *(SBi)*	0.1%	*PASS*	0.0%	*PASS*	0.0%	*PASS*				
System Bias Post *(SBf)*	-0.8%	*PASS*	-1.5%	*PASS*	-1.4%	*PASS*				
Drift Assessment *(D)*	-0.96%	*PASS*	-1.47%	*PASS*	-1.43%	*PASS*				
High										
High Value *(CS/Cv)*	20.93		89.90		89.90					
Direct *(C Dir)*	20.91		89.89		90.09					
Calibration Error *(ACE)*	-0.10%	*PASS*	-0.01%	*PASS*	0.18%	*PASS*				
Analyser Span (Range)	20.93		105.76		105.76					

FTIR Data

Analyte	**O2 (%)**		**THC (ppm wet)**	**CH4 (ppm wet)**	**CO (ppm dry)**	**NOX (ppm dry)**	**SO2 (ppm dry)**	**H2O (%)**	**FTIR Spectral File**
Average	11.64	11.71	4.14	1.97	9.83	51.81	4.34	9.03	
Time	**Recorded**	**Corrected**	**Recorded**	**Recorded**	**Recorded**	**Recorded**	**Recorded**	**Recorded**	
9:26	10.53	10.56	2.05	0.64	6.03	40.76	10.68	11.16	T3_000017.LAB
9:27	10.42	10.44	2.16	0.66	5.94	40.68	10.59	11.00	T3_000018.LAB
9:28	10.55	10.58	2.03	0.69	5.91	41.20	10.34	10.88	T3_000019.LAB
9:29	10.60	10.63	2.00	0.70	5.91	41.29	10.05	10.52	T3_000020.LAB
9:30	10.49	10.52	1.85	0.72	5.92	41.46	9.98	10.68	T3_000021.LAB
9:31	10.53	10.56	2.09	0.73	5.93	41.19	10.25	10.88	T3_000022.LAB
9:32	10.51	10.53	2.24	0.75	5.99	40.72	10.58	11.01	T3_000023.LAB
9:33	10.56	10.59	2.44	0.76	6.00	40.80	10.90	10.67	T3_000024.LAB
9:34	10.53	10.55	1.94	0.78	6.02	41.16	10.48	10.68	T3_000025.LAB
9:36	10.54	10.57	2.67	0.79	6.11	40.79	10.49	10.73	T3_000026.LAB
9:37	10.51	10.54	2.35	0.81	6.02	40.71	10.97	10.90	T3_000027.LAB
9:38	10.66	10.70	2.36	0.83	5.97	40.99	10.93	10.09	T3_000028.LAB
9:39	10.69	10.72	2.36	0.84	6.06	40.31	11.20	10.21	T3_000029.LAB
9:40	10.58	10.61	2.79	0.86	6.14	40.98	10.65	10.56	T3_000030.LAB
9:41	10.58	10.61	2.62	0.87	6.18	41.53	10.76	10.43	T3_000031.LAB
9:42	10.73	10.76	2.35	0.89	6.14	41.15	10.36	10.33	T3_000032.LAB
9:43	10.75	10.78	2.15	0.90	6.17	41.37	9.92	9.20	T3_000033.LAB
9:44	10.70	10.73	2.85	0.90	6.22	41.75	10.09	9.64	T3_000034.LAB
9:45	10.71	10.74	2.58	0.92	6.29	42.12	9.38	10.25	T3_000035.LAB
9:46	10.71	10.75	2.58	0.93	6.33	42.72	9.78	10.48	T3_000036.LAB
9:47	10.83	10.87	2.65	0.95	6.41	43.17	10.03	10.67	T3_000037.LAB
9:48	10.73	10.76	3.07	0.97	6.45	42.18	10.15	10.61	T3_000038.LAB
9:49	10.82	10.86	3.02	1.00	6.43	43.15	10.57	10.67	T3_000039.LAB
9:50	10.85	10.89	3.11	1.02	6.47	43.86	10.42	10.19	T3_000040.LAB
9:51	10.81	10.84	3.04	1.03	6.44	44.61	10.26	10.24	T3_000041.LAB
9:52	10.80	10.84	3.14	1.05	6.60	44.91	10.52	10.43	T3_000042.LAB
9:53	10.87	10.91	3.14	1.07	6.57	42.88	10.70	10.07	T3_000043.LAB
9:54	10.81	10.85	3.59	1.08	6.64	43.11	10.52	10.14	T3_000044.LAB
9:55	10.90	10.95	3.53	1.10	6.64	43.21	9.92	10.18	T3_000045.LAB
9:56	10.88	10.92	3.90	1.14	6.74	44.38	9.01	10.13	T3_000046.LAB
9:58	10.97	11.01	3.27	1.16	6.73	44.13	9.56	10.00	T3_000047.LAB
9:59	10.88	10.92	4.18	1.17	6.86	44.42	9.09	10.23	T3_000048.LAB
10:00	11.00	11.05	3.48	1.18	6.89	44.59	9.08	9.85	T3_000049.LAB
10:01	11.12	11.17	3.19	1.21	6.87	47.06	8.46	9.44	T3_000050.LAB
10:02	11.06	11.11	3.20	1.22	6.92	46.80	8.02	9.14	T3_000051.LAB
10:03	11.04	11.09	3.32	1.24	7.02	46.19	7.51	9.75	T3_000052.LAB
10:04	11.10	11.15	3.80	1.26	7.11	46.84	7.45	10.13	T3_000053.LAB
10:05	11.28	11.34	4.25	1.28	7.07	48.08	7.22	9.58	T3_000054.LAB
10:06	11.12	11.17	3.89	1.30	7.09	48.59	7.31	9.44	T3_000055.LAB
10:07	11.24	11.30	3.80	1.32	7.20	48.58	7.05	10.01	T3_000056.LAB
10:08	11.23	11.29	3.90	1.33	7.23	49.07	7.11	10.00	T3_000057.LAB
10:09	11.28	11.34	3.92	1.35	7.25	50.10	6.86	9.95	T3_000058.LAB
10:10	11.36	11.42	4.08	1.39	7.29	50.43	6.56	9.60	T3_000059.LAB
10:11	11.29	11.35	3.96	1.41	7.43	50.80	6.61	9.99	T3_000060.LAB
10:12	11.24	11.29	4.12	1.46	7.41	51.19	6.45	10.02	T3_000061.LAB
10:13	11.35	11.41	4.23	1.51	7.44	51.32	6.50	10.18	T3_000062.LAB
10:14	11.37	11.43	4.83	1.55	7.54	51.05	6.57	10.03	T3_000063.LAB
10:15	11.41	11.48	4.23	1.58	7.60	50.84	6.44	10.03	T3_000064.LAB
10:16	11.48	11.55	4.10	1.57	7.65	51.27	6.59	9.79	T3_000065.LAB
10:17	11.41	11.47	4.82	1.56	7.74	51.98	6.75	9.74	T3_000066.LAB
10:19	11.53	11.60	4.54	1.59	7.76	52.57	6.37	9.59	T3_000067.LAB
10:20	11.38	11.45	4.49	1.61	7.72	52.93	5.94	9.35	T3_000068.LAB
10:21	11.49	11.56	4.41	1.63	7.84	53.18	6.09	9.53	T3_000069.LAB
10:22	11.58	11.65	4.55	1.68	7.90	53.19	5.73	9.31	T3_000070.LAB
10:23	11.50	11.57	4.66	1.73	7.91	53.10	5.70	9.23	T3_000071.LAB
10:24	11.49	11.56	4.67	1.76	7.97	53.36	5.40	9.16	T3_000072.LAB
10:25	11.62	11.69	4.69	1.81	8.17	53.29	5.28	9.55	T3_000073.LAB
10:26	11.66	11.74	4.46	1.86	8.14	53.81	5.07	9.21	T3_000074.LAB
10:27	11.66	11.73	4.78	1.90	8.18	53.38	4.73	8.63	T3_000075.LAB
10:28	11.64	11.71	4.55	1.91	8.16	53.62	4.78	8.81	T3_000076.LAB
10:29	11.68	11.76	4.38	1.88	8.35	53.34	4.81	9.49	T3_000077.LAB
10:30	11.71	11.78	4.19	1.85	8.45	53.28	4.94	9.49	T3_000078.LAB
10:31	11.64	11.72	4.12	1.85	8.41	53.33	5.09	9.36	T3_000079.LAB
10:32	11.68	11.76	3.95	1.86	8.46	53.37	5.10	9.49	T3_000080.LAB
10:33	11.78	11.86	4.51	1.89	8.58	53.65	4.61	8.93	T3_000081.LAB
10:34	10.54	10.56	4.37	1.93	8.56	55.30	5.01	8.76	T3_000082.LAB
10:35	10.08	10.09	4.49	1.97	8.73	50.41	11.52	9.24	T3_000083.LAB
10:36	11.70	11.78	4.46	1.99	9.03	47.09	10.04	9.54	T3_000084.LAB
10:37	11.73	11.81	4.35	1.96	9.08	51.00	5.76	9.16	T3_000085.LAB
10:38	11.74	11.82	4.02	1.93	9.00	52.82	4.67	8.83	T3_000086.LAB
10:39	11.69	11.76	3.98	1.93	9.14	52.98	4.53	9.27	T3_000087.LAB
10:41	11.74	11.82	4.08	1.93	9.16	53.47	4.36	9.42	T3_000088.LAB
10:42	11.91	11.99	3.87	1.96	9.21	53.46	3.92	8.95	T3_000089.LAB
10:43	11.81	11.89	4.23	1.99	9.24	53.57	3.57	8.63	T3_000090.LAB
10:44	11.85	11.93	4.21	2.00	9.37	53.65	3.39	9.11	T3_000091.LAB
10:45	11.89	11.97	4.18	2.02	9.42	53.66	3.42	9.17	T3_000092.LAB
10:46	10.33	10.35	4.28	2.03	9.53	55.14	7.25	9.63	T3_000093.LAB
10:47	11.72	11.79	4.44	2.02	9.62	48.87	9.95	9.67	T3_000094.LAB
10:48	11.83	11.91	4.29	2.00	9.77	51.84	5.32	9.28	T3_000095.LAB
10:49	11.78	11.86	3.85	1.97	9.81	53.02	4.32	9.64	T3_000096.LAB
10:50	11.78	11.86	4.77	2.01	9.81	53.63	3.96	9.32	T3_000097.LAB
10:51	11.85	11.93	4.38	2.07	9.83	53.88	3.65	9.28	T3_000098.LAB
10:52	11.87	11.95	3.85	2.11	9.95	53.45	3.57	9.35	T3_000099.LAB

Test 3

Incinerator

Date	28-Oct-21								
Analyte	O_2 (%)		THC (ppm wet)		CH4 (ppm wet)		CO (ppm dry)	NO_X (ppm dry)	SO_2 (ppm dry)	H_2O (%)	Spectral File
Low											
Zero Value *(Cv)*	0.00		0.00		0.00						
Direct *(C Dir)*	0.00		0.46		0.38						
Calibration Error *(ACE)*	0.00%	*PASS*	0.43%	*PASS*	0.36%	*PASS*					
System Initial *(Csi)*	0.41		0.46		0.38						
System Post *(Csf)*	0.37		1.57		1.50						
Average *(Co)*	0.39		1.02		0.94						
System Bias Initial *(SBi)*	2.0%	*PASS*	0.0%	*PASS*	0.0%	*PASS*					
System Bias Post *(SBf)*	1.8%	*PASS*	1.0%	*PASS*	1.1%	*PASS*					
Drift Assessment *(D)*	-0.19%	*PASS*	1.05%	*PASS*	1.06%	*PASS*					
Low											
Low Value *(Cv)*	NA		29.90		29.90						
Direct *(C Dir)*	NA		29.70		30.37						
Calibration Error *(ACE)*	NA	NA	-0.67%	*PASS*	1.57%	*PASS*					
Mid											
Mid Value *(Cv)*	10.10		49.90		49.90						
Direct *(C Dir)*	10.16		49.87		50.60						
Calibration Error *(ACE)*	0.29%	*PASS*	-0.03%	*PASS*	0.66%	*PASS*					
System Initial *(Csi)*	10.19		49.87		50.6						
System Post *(Csf)*	9.99		48.32		49.09						
Average *(Cm)*	10.1		49.1		49.8						
System Bias Initial *(SBi)*	0.1%	*PASS*	0.0%	*PASS*	0.0%	*PASS*					
System Bias Post *(SBf)*	-0.8%	*PASS*	-1.5%	*PASS*	-1.4%	*PASS*					
Drift Assessment *(D)*	-0.96%	*PASS*	-1.47%	*PASS*	-1.43%	*PASS*					
High											
High Value *(CS/Cv)*	20.93		89.90		89.90						
Direct *(C Dir)*	20.91		89.89		90.09						
Calibration Error *(ACE)*	-0.10%	*PASS*	-0.01%	*PASS*	0.18%	*PASS*					
Analyser Span (Range)	20.93		105.76		105.76						

FTIR Data

Analyte	O2 (%)		THC (ppm wet)	CH4 (ppm wet)	CO (ppm dry)	NOX (ppm dry)	SO2 (ppm dry)	H2O (%)	FTIR Spectral File
Average	11.64	11.71	4.14	1.97	9.83	51.81	4.34	9.03	
Time	**Recorded**	**Corrected**	**Recorded**	**Recorded**	**Recorded**	**Recorded**	**Recorded**	**Recorded**	
10:53	11.85	11.93	4.14	2.13	9.96	53.52	3.37	9.43	T3_000100.LAB
10:54	11.05	11.10	4.04	2.13	10.07	55.05	3.53	9.34	T3_000101.LAB
10:55	10.28	10.30	4.29	2.15	10.11	52.58	8.16	9.63	T3_000102.LAB
10:56	11.83	11.91	4.28	2.15	10.30	48.12	9.19	9.54	T3_000103.LAB
10:57	11.88	11.96	4.85	2.17	10.39	51.53	4.75	9.11	T3_000104.LAB
10:58	11.95	12.03	4.62	2.16	10.37	53.42	3.61	8.42	T3_000105.LAB
10:59	11.93	12.02	4.29	2.15	10.23	54.20	3.20	8.56	T3_000106.LAB
11:00	11.93	12.02	4.08	2.12	10.28	53.30	2.87	8.72	T3_000107.LAB
11:01	11.89	11.97	3.92	2.09	10.31	54.01	2.90	8.77	T3_000108.LAB
11:03	12.04	12.13	3.99	2.09	10.26	54.21	2.69	8.43	T3_000109.LAB
11:04	11.33	11.39	3.99	2.11	10.36	55.47	2.72	8.49	T3_000110.LAB
11:05	10.49	10.52	3.71	2.15	10.31	53.31	6.39	8.86	T3_000111.LAB
11:06	11.91	12.00	3.54	2.15	10.53	50.13	7.13	8.78	T3_000112.LAB
11:07	11.93	12.02	3.63	2.14	10.59	53.33	3.79	8.79	T3_000113.LAB
11:08	11.83	11.91	3.66	2.14	10.51	54.01	3.23	8.98	T3_000114.LAB
11:09	11.95	12.03	3.63	2.12	10.47	53.69	2.92	9.04	T3_000115.LAB
11:10	11.88	11.97	3.58	2.13	10.52	53.89	2.61	9.26	T3_000116.LAB
11:11	11.86	11.94	3.55	2.13	10.58	53.95	2.44	9.44	T3_000117.LAB
11:12	11.59	11.66	3.64	2.12	10.39	54.67	2.24	8.07	T3_000118.LAB
11:13	10.58	10.61	4.34	2.11	10.61	54.88	5.08	8.65	T3_000119.LAB
11:14	12.00	12.09	3.96	2.06	10.79	50.49	6.46	9.23	T3_000120.LAB
11:15	12.14	12.23	3.26	2.00	10.86	53.22	3.03	7.84	T3_000121.LAB
11:16	11.90	11.98	3.64	1.98	10.93	53.98	2.56	8.57	T3_000122.LAB
11:17	11.86	11.94	3.69	1.99	11.06	54.15	2.43	9.21	T3_000123.LAB
11:18	11.89	11.97	3.84	2.03	11.08	54.43	2.42	9.24	T3_000124.LAB
11:19	11.89	11.98	3.64	2.09	11.03	54.53	2.41	9.35	T3_000125.LAB
11:20	12.09	12.19	4.45	2.10	11.03	53.73	2.31	9.25	T3_000126.LAB
11:21	10.54	10.57	3.81	2.09	11.02	55.49	3.15	9.00	T3_000127.LAB
11:22	10.84	10.88	4.66	2.08	11.10	52.85	6.97	9.63	T3_000128.LAB
11:23	11.93	12.02	4.20	2.07	11.22	51.66	4.88	9.70	T3_000129.LAB
11:25	12.20	12.30	4.01	2.08	11.08	53.78	2.98	8.46	T3_000130.LAB
11:26	12.18	12.27	4.96	2.10	11.03	54.73	2.56	7.88	T3_000131.LAB
11:27	12.24	12.33	4.46	2.11	11.03	54.44	2.07	7.40	T3_000132.LAB
11:28	12.27	12.37	4.33	2.17	11.17	54.21	1.89	7.17	T3_000133.LAB
11:29	12.13	12.23	3.84	2.21	11.42	53.83	1.82	8.30	T3_000134.LAB
11:30	10.68	10.72	3.97	2.21	11.64	55.75	2.11	9.00	T3_000135.LAB
11:31	10.38	10.40	3.50	2.21	11.73	55.49	4.87	11.07	T3_000136.LAB
11:32	12.08	12.17	3.80	2.21	11.92	52.00	5.91	10.53	T3_000137.LAB
11:33	12.06	12.15	3.78	2.21	11.76	54.31	2.92	8.78	T3_000138.LAB
11:34	11.99	12.08	4.00	2.20	11.80	54.32	2.73	9.56	T3_000139.LAB
11:35	12.02	12.11	4.37	2.21	11.85	54.66	2.83	9.79	T3_000140.LAB
11:36	12.04	12.13	4.26	2.19	11.69	55.12	2.33	9.37	T3_000141.LAB
11:37	12.03	12.12	4.33	2.21	11.58	54.47	2.30	9.04	T3_000142.LAB
11:38	10.74	10.78	4.06	2.23	11.58	57.29	2.82	9.42	T3_000143.LAB
11:39	10.62	10.65	4.15	2.23	11.62	55.79	5.54	9.85	T3_000144.LAB
11:40	12.07	12.16	4.03	2.24	11.77	52.18	5.24	9.83	T3_000145.LAB
11:41	12.17	12.26	4.29	2.24	11.69	53.91	3.00	9.22	T3_000146.LAB
11:42	12.18	12.28	3.98	2.21	11.44	54.72	2.30	8.43	T3_000147.LAB
11:43	12.10	12.19	4.03	2.17	11.41	53.90	2.19	8.69	T3_000148.LAB
11:44	12.12	12.21	3.97	2.15	11.43	53.71	2.09	9.00	T3_000149.LAB
11:45	11.10	11.15	4.24	2.18	11.38	56.22	1.97	8.60	T3_000150.LAB
11:47	10.80	10.84	3.94	2.20	11.37	56.30	4.08	8.97	T3_000151.LAB
11:48	12.23	12.33	3.84	2.18	11.39	52.59	5.28	8.26	T3_000152.LAB
11:49	12.15	12.25	3.97	2.17	11.47	53.92	3.09	8.47	T3_000153.LAB
11:50	12.15	12.25	3.91	2.17	11.40	54.70	2.43	9.01	T3_000154.LAB
11:51	12.15	12.24	3.99	2.16	11.41	55.01	2.06	9.02	T3_000155.LAB
11:52	12.11	12.20	4.27	2.13	11.32	55.28	1.96	8.87	T3_000156.LAB
11:53	12.30	12.40	3.81	2.11	11.31	54.93	1.69	8.66	T3_000157.LAB
11:54	10.85	10.90	3.75	2.11	11.33	58.51	2.86	8.70	T3_000158.LAB
11:55	11.83	11.91	4.07	2.11	11.43	54.22	5.73	9.18	T3_000159.LAB
11:56	12.25	12.35	4.15	2.12	11.60	52.71	3.56	8.84	T3_000160.LAB
11:57	12.10	12.19	4.12	2.16	11.45	53.62	2.23	8.85	T3_000161.LAB
11:58	12.22	12.32	4.28	2.18	11.38	54.18	1.93	9.00	T3_000162.LAB
11:59	12.31	12.41	4.38	2.18	11.33	54.09	1.70	8.74	T3_000163.LAB
12:00	12.29	12.39	4.18	2.15	11.26	53.76	1.49	8.05	T3_000164.LAB
12:01	10.88	10.92	3.94	2.13	11.24	57.61	2.59	8.35	T3_000165.LAB
12:02	11.68	11.75	4.16	2.17	11.28	55.04	4.48	8.72	T3_000166.LAB
12:03	12.25	12.35	4.06	2.20	11.50	52.30	2.93	8.88	T3_000167.LAB
12:04	12.33	12.43	4.15	2.22	11.38	53.85	1.78	8.52	T3_000168.LAB
12:05	12.39	12.50	4.39	2.24	11.18	53.65	1.54	7.51	T3_000169.LAB
12:06	12.24	12.34	4.19	2.24	11.24	53.73	1.38	8.16	T3_000170.LAB
12:08	11.17	11.23	4.21	2.23	11.20	55.52	1.75	8.62	T3_000171.LAB
12:09	10.91	10.95	4.22	2.21	11.19	57.01	2.82	8.46	T3_000172.LAB
12:10	12.16	12.26	3.97	2.23	11.40	53.37	4.22	9.20	T3_000173.LAB
12:11	12.33	12.43	3.66	2.24	11.44	53.21	2.40	8.82	T3_000174.LAB
12:12	12.30	12.40	3.41	2.24	11.28	53.79	1.70	8.47	T3_000175.LAB
12:13	12.31	12.42	3.64	2.24	11.13	53.94	1.44	8.33	T3_000176.LAB
12:14	12.24	12.34	3.97	2.23	11.20	54.18	1.33	8.66	T3_000177.LAB
12:15	11.00	11.05	3.88	2.19	11.22	56.62	1.77	8.71	T3_000178.LAB
12:16	10.98	11.03	3.55	2.16	11.20	56.00	3.39	8.59	T3_000179.LAB
12:17	12.36	12.47	3.99	2.19	11.26	52.23	3.28	8.52	T3_000180.LAB
12:18	12.38	12.49	3.80	2.21	11.30	52.82	1.78	8.63	T3_000181.LAB
12:19	12.25	12.35	4.00	2.21	11.28	53.43	1.55	8.91	T3_000182.LAB
12:20	12.33	12.43	4.00	2.21	11.24	53.46	1.55	8.88	T3_000183.LAB
12:21	12.01	12.10	4.72	2.21	11.24	54.40	1.45	8.64	T3_000184.LAB

Test 3

Incinerator

Date	28-Oct-21								
Analyte	**O_2 (%)**		**THC (ppm wet)**		**CH4 (ppm wet)**		**CO (ppm dry)**	**NO_X (ppm dry)**	**SO_2 (ppm dry)**	**H_2O (%)**	**Spectral File**
Low											
Zero Value *(Cv)*	0.00		0.00		0.00						
Direct *(C Dir)*	0.00		0.46		0.38						
Calibration Error *(ACE)*	0.00%	*PASS*	0.43%	*PASS*	0.36%	*PASS*					
System Initial *(Csi)*	0.41		0.46		0.38						
System Post *(Csf)*	0.37		1.57		1.50						
Average *(Co)*	0.39		1.02		0.94						
System Bias Initial *(SBi)*	2.0%	*PASS*	0.0%	*PASS*	0.0%	*PASS*					
System Bias Post *(SBf)*	1.8%	*PASS*	1.0%	*PASS*	1.1%	*PASS*					
Drift Assessment *(D)*	-0.19%	*PASS*	1.05%	*PASS*	1.06%	*PASS*					
Low											
Low Value *(Cv)*	NA		29.90		29.90						
Direct *(C Dir)*	NA		29.70		30.37						
Calibration Error *(ACE)*	NA	NA	-0.67%	*PASS*	1.57%	*PASS*					
Mid											
Mid Value *(Cv)*	10.10		49.90		49.90						
Direct *(C Dir)*	10.16		49.87		50.60						
Calibration Error *(ACE)*	0.29%	*PASS*	-0.03%	*PASS*	0.66%	*PASS*					
System Initial *(Csi)*	10.19		49.87		50.6						
System Post *(Csf)*	9.99		48.32		49.09						
Average *(Cm)*	10.1		49.1		49.8						
System Bias Initial *(SBi)*	0.1%	*PASS*	0.0%	*PASS*	0.0%	*PASS*					
System Bias Post *(SBf)*	-0.8%	*PASS*	-1.5%	*PASS*	-1.4%	*PASS*					
Drift Assessment *(D)*	-0.96%	*PASS*	-1.47%	*PASS*	-1.43%	*PASS*					
High											
High Value *(CS/Cv)*	20.93		89.90		89.90						
Direct *(C Dir)*	20.91		89.89		90.09						
Calibration Error *(ACE)*	-0.10%	*PASS*	-0.01%	*PASS*	0.18%	*PASS*					
Analyser Span (Range)	20.93		105.76		105.76						

FTIR Data

Analyte	**O2 (%)**		**THC (ppm wet)**	**CH4 (ppm wet)**	**CO (ppm dry)**	**NOX (ppm dry)**	**SO2 (ppm dry)**	**H2O (%)**	**FTIR Spectral File**
Average	11.64	11.71	4.14	1.97	9.83	51.81	4.34	9.03	
Time	**Recorded**	**Corrected**	**Recorded**	**Recorded**	**Recorded**	**Recorded**	**Recorded**	**Recorded**	
12:22	11.04	11.09	4.25	2.20	11.09	57.34	2.51	8.65	T3_000185.LAB
12:23	11.82	11.90	4.03	2.20	11.16	54.63	4.06	8.83	T3_000186.LAB
12:24	12.43	12.54	4.10	2.22	11.29	52.19	2.51	8.28	T3_000187.LAB
12:25	12.23	12.33	4.53	2.23	11.12	53.88	1.78	8.30	T3_000188.LAB
12:26	12.23	12.33	4.49	2.22	11.16	54.11	1.70	8.81	T3_000189.LAB
12:27	12.44	12.55	4.35	2.23	11.16	53.49	1.56	8.63	T3_000190.LAB
12:28	11.71	11.79	4.73	2.24	11.09	54.62	1.46	8.04	T3_000191.LAB
12:30	11.01	11.06	4.64	2.24	11.00	56.26	2.41	8.68	T3_000192.LAB
12:31	11.93	12.02	4.51	2.26	11.10	54.03	3.88	9.19	T3_000193.LAB
12:32	12.40	12.51	4.50	2.30	11.05	51.60	2.31	8.13	T3_000194.LAB
12:33	12.56	12.67	4.79	2.31	10.97	52.80	1.39	7.35	T3_000195.LAB
12:34	12.47	12.58	4.58	2.30	10.95	52.77	1.28	7.71	T3_000196.LAB
12:35	12.42	12.52	4.67	2.31	11.18	53.09	1.15	8.35	T3_000197.LAB
12:36	11.04	11.09	4.73	2.32	11.19	55.95	1.93	9.15	T3_000198.LAB
12:37	11.03	11.08	5.06	2.32	11.21	54.56	3.16	9.05	T3_000199.LAB
12:38	12.56	12.68	5.02	2.32	11.16	51.21	2.51	7.85	T3_000200.LAB
12:39	12.37	12.47	4.84	2.32	11.33	52.28	1.69	8.02	T3_000201.LAB
12:40	12.35	12.46	4.20	2.33	11.16	52.76	1.40	8.62	T3_000202.LAB
12:41	12.52	12.64	4.35	2.33	11.20	53.00	1.09	7.90	T3_000203.LAB
12:42	10.97	11.02	4.74	2.33	11.17	56.42	1.74	8.07	T3_000204.LAB
12:43	11.07	11.12	4.96	2.35	11.27	54.56	3.24	8.83	T3_000205.LAB
12:44	12.39	12.50	5.73	2.35	11.49	50.60	3.41	8.98	T3_000206.LAB
12:45	12.38	12.49	5.10	2.37	11.32	51.49	2.11	8.68	T3_000207.LAB
12:46	12.31	12.42	4.67	2.40	11.22	52.67	1.66	8.62	T3_000208.LAB
12:47	12.44	12.54	5.03	2.43	11.17	52.60	1.35	8.15	T3_000209.LAB
12:48	11.28	11.34	5.19	2.43	11.07	54.37	1.34	8.07	T3_000210.LAB
12:49	11.02	11.07	4.82	2.41	11.14	54.28	2.61	8.58	T3_000211.LAB
12:50	12.27	12.36	4.93	2.39	11.26	51.70	3.13	8.53	T3_000212.LAB
12:52	12.46	12.57	5.02	2.36	11.37	50.73	1.77	8.41	T3_000213.LAB
12:53	12.43	12.53	5.01	2.37	11.19	52.20	1.24	8.33	T3_000214.LAB
12:54	12.55	12.66	4.90	2.40	11.24	52.26	0.99	8.55	T3_000215.LAB
12:55	11.31	11.37	4.99	2.40	11.19	54.63	1.17	8.52	T3_000216.LAB
12:56	11.23	11.29	4.96	2.39	11.20	55.02	2.05	8.59	T3_000217.LAB
12:57	11.80	11.88	4.92	2.41	11.18	54.19	2.87	8.68	T3_000218.LAB
12:58	12.69	12.81	5.33	2.41	11.37	50.86	1.85	7.91	T3_000219.LAB
12:59	12.61	12.72	5.11	2.40	11.24	52.66	1.30	7.81	T3_000220.LAB
13:00	12.50	12.61	5.08	2.43	11.14	53.42	1.04	8.11	T3_000221.LAB
13:01	11.48	11.55	5.51	2.44	11.16	55.63	1.10	8.30	T3_000222.LAB
13:02	11.19	11.25	5.68	2.44	11.11	55.19	2.03	8.56	T3_000223.LAB
13:03	11.50	11.57	5.44	2.45	11.12	54.79	2.83	8.62	T3_000224.LAB
13:04	12.71	12.83	5.33	2.44	11.14	51.09	1.79	7.93	T3_000225.LAB
13:05	12.65	12.77	5.41	2.44	11.12	52.88	1.09	7.44	T3_000226.LAB
13:06	12.63	12.75	5.00	2.48	11.01	54.13	0.81	7.58	T3_000227.LAB
13:07	11.49	11.56	5.13	2.50	11.04	56.29	0.98	7.82	T3_000228.LAB
13:08	11.18	11.23	4.82	2.50	10.98	55.03	1.59	8.15	T3_000229.LAB
13:09	11.34	11.40	4.97	2.50	11.05	54.99	2.38	8.19	T3_000230.LAB
13:10	12.70	12.82	5.12	2.51	11.19	50.42	1.56	7.91	T3_000231.LAB
13:11	12.62	12.73	5.00	2.49	11.19	52.48	0.96	8.00	T3_000232.LAB
13:12	12.64	12.76	4.93	2.50	11.04	53.56	0.82	8.05	T3_000233.LAB
13:14	11.36	11.42	5.02	2.55	10.94	56.13	1.03	8.10	T3_000234.LAB
13:15	11.25	11.31	5.29	2.56	10.97	54.82	1.74	8.67	T3_000235.LAB
13:16	12.16	12.26	4.73	2.55	11.05	53.92	2.42	8.86	T3_000236.LAB
13:17	12.63	12.75	4.45	2.54	11.06	51.69	1.49	8.33	T3_000237.LAB
13:18	12.58	12.69	4.46	2.53	10.91	53.19	1.22	8.32	T3_000238.LAB
13:19	12.69	12.80	4.08	2.53	10.82	53.96	1.20	7.96	T3_000239.LAB
13:20	11.18	11.23	4.55	2.54	10.94	56.71	1.08	8.06	T3_000240.LAB
13:21	11.18	11.24	4.50	2.55	10.95	55.16	2.20	8.56	T3_000241.LAB
13:22	12.42	12.53	4.82	2.56	10.98	52.79	2.72	8.53	T3_000242.LAB
13:23	12.62	12.73	5.02	2.57	11.15	52.09	1.48	8.13	T3_000243.LAB
13:24	12.59	12.70	4.90	2.56	10.95	53.93	1.01	8.11	T3_000244.LAB
13:25	12.65	12.76	4.97	2.56	10.93	53.89	0.89	7.90	T3_000245.LAB
13:26	11.25	11.31	5.08	2.58	10.87	56.48	1.34	8.23	T3_000246.LAB
13:27	11.35	11.41	5.53	2.60	10.88	55.20	2.29	8.17	T3_000247.LAB
13:28	12.59	12.71	5.10	2.60	10.98	52.71	2.58	7.90	T3_000248.LAB
13:29	12.71	12.83	5.47	2.60	11.05	52.15	1.45	7.60	T3_000249.LAB
13:30	12.67	12.78	5.69	2.60	10.83	53.52	1.32	7.70	T3_000250.LAB
13:31	12.68	12.80	5.56	2.58	10.81	54.44	1.15	7.75	T3_000251.LAB
13:32	11.32	11.39	5.45	2.59	10.96	56.86	1.22	8.24	T3_000252.LAB

Calibration Transfer Standard (CTS) Data

Location	Aberdeen, MD	**Process**	Incinerator
Date	October 26, 2021	**Analyte**	Ethylene

CTS Gas	Certified Concentration	Concentration Units	Cylinder #
Ethylene	99.2	ppmvd	CC52216

Data Point	Analyte, Calibration Gas T1			
	Spectrum	Date	Time	(ppmvd)
Pre Test 1 Direct CTS				
1	DIRECT CTS_000011.LAB	10/26/2021	8:11:15 AM	97.27
2	DIRECT CTS_000012.LAB	10/26/2021	8:11:23 AM	97.07
3	DIRECT CTS_000013.LAB	10/26/2021	8:11:31 AM	96.99
4	DIRECT CTS_000014.LAB	10/26/2021	8:11:38 AM	96.81
5	DIRECT CTS_000015.LAB	10/26/2021	8:11:46 AM	97.02
6	DIRECT CTS_000016.LAB	10/26/2021	8:11:54 AM	96.79
7	DIRECT CTS_000017.LAB	10/26/2021	8:12:02 AM	96.89
8	DIRECT CTS_000018.LAB	10/26/2021	8:12:10 AM	97.29
9	DIRECT CTS_000019.LAB	10/26/2021	8:12:18 AM	97.10
10	DIRECT CTS_000020.LAB	10/26/2021	8:12:26 AM	96.98
	Pre Test 1 Direct CTS AVERAGE			**97.02**

CTS Concentration of Analyte (ppm_{vd})
97.02
Difference From Cylinder Value (%)
-2.25
Allowable Criteria +/- 5%
Result (Pass/Fail)
Pass

Data Point	Analyte,Calibration Gas			
	Spectrum	Date	Time	(ppm)
Pre Test 1 System CTS				
1	SYSTEM CTS_000017.LAB	10/26/2021	8:31:46 AM	95.62
2	SYSTEM CTS_000018.LAB	10/26/2021	8:31:53 AM	95.45
3	SYSTEM CTS_000019.LAB	10/26/2021	8:32:01 AM	95.44
4	SYSTEM CTS_000020.LAB	10/26/2021	8:32:09 AM	95.51
5	SYSTEM CTS_000021.LAB	10/26/2021	8:32:17 AM	95.52
6	SYSTEM CTS_000022.LAB	10/26/2021	8:32:25 AM	95.46
7	SYSTEM CTS_000023.LAB	10/26/2021	8:32:33 AM	95.64
8	SYSTEM CTS_000024.LAB	10/26/2021	8:32:41 AM	95.76
9	SYSTEM CTS_000025.LAB	10/26/2021	8:32:49 AM	95.48
10	SYSTEM CTS_000026.LAB	10/26/2021	8:32:56 AM	95.63
	Pre Test 1 System CTS AVERAGE			**95.55**

CTS Concentration of Analyte (ppm)
95.55
Difference From Direct CTS Value (%)
-1.54
Allowable Criteria +/- 5%
Result (Pass/Fail)
Pass

Data Point	Analyte,Calibration Gas			
	Spectrum	Date	Time	(ppm)
Post Test 1 Direct CTS				
1	POST CTS_000007.LAB	10/26/2021	5:29:26 PM	94.74
2	POST CTS_000008.LAB	10/26/2021	5:29:34 PM	94.65
3	POST CTS_000009.LAB	10/26/2021	5:29:42 PM	94.56
4	POST CTS_000010.LAB	10/26/2021	5:29:50 PM	95.09
5	POST CTS_000011.LAB	10/26/2021	5:29:58 PM	94.93
6	POST CTS_000012.LAB	10/26/2021	5:30:06 PM	94.69
7	POST CTS_000013.LAB	10/26/2021	5:30:13 PM	94.80
8	POST CTS_000014.LAB	10/26/2021	5:30:21 PM	94.76
9	POST CTS_000015.LAB	10/26/2021	5:30:29 PM	94.61
10	POST CTS_000016.LAB	10/26/2021	5:30:37 PM	94.79
	Post Test 1 Direct CTS AVERAGE			**94.76**

CTS Concentration of Analyte (ppm_{vd})
94.76
Difference From Cylinder Value (%)
-4.68
Allowable +/- 5%
Pass/Fail
Pass

Calibration Transfer Standard (CTS) Data

Location	Aberdeen, MD	**Process**	Incinerator
Date	October 27, 2021	**Analyte**	Ethylene

CTS Gas	Certified Concentration	Concentration Units	Cylinder #
Ethylene	99.2	ppmvd	CC52216

Data Point	Analyte, Calibration Gas T1			
	Spectrum	Date	Time	(ppmvd)
Pre Test 2 Direct CTS				
1	DIRECT CTS_000013.LAB	10/27/2021	7:40:12 AM	97.37
2	DIRECT CTS_000014.LAB	10/27/2021	7:40:19 AM	97.48
3	DIRECT CTS_000015.LAB	10/27/2021	7:40:28 AM	97.12
4	DIRECT CTS_000016.LAB	10/27/2021	7:40:35 AM	97.49
5	DIRECT CTS_000017.LAB	10/27/2021	7:40:43 AM	97.06
6	DIRECT CTS_000018.LAB	10/27/2021	7:40:51 AM	97.21
7	DIRECT CTS_000019.LAB	10/27/2021	7:40:59 AM	97.37
8	DIRECT CTS_000020.LAB	10/27/2021	7:41:06 AM	97.15
9	DIRECT CTS_000021.LAB	10/27/2021	7:41:14 AM	97.02
10	DIRECT CTS_000022.LAB	10/27/2021	7:41:22 AM	97.07
	Pre Test 2 Direct CTS AVERAGE			**97.23**

CTS Concentration of Analyte (ppm_{vd})
97.23
Difference From Cylinder Value (%)
-2.02
Allowable Criteria +/- 5%
Result (Pass/Fail)
Pass

Data Point	Analyte,Calibration Gas			
	Spectrum	Date	Time	(ppm)
Pre Test 2 System CTS				
1	SYSTEM CTS_000013.LAB	10/27/2021	7:59:24 AM	95.27
2	SYSTEM CTS_000014.LAB	10/27/2021	7:59:32 AM	95.39
3	SYSTEM CTS_000015.LAB	10/27/2021	7:59:40 AM	95.06
4	SYSTEM CTS_000016.LAB	10/27/2021	7:59:48 AM	95.50
5	SYSTEM CTS_000017.LAB	10/27/2021	7:59:55 AM	95.74
6	SYSTEM CTS_000018.LAB	10/27/2021	8:00:04 AM	95.53
7	SYSTEM CTS_000019.LAB	10/27/2021	8:00:11 AM	95.57
8	SYSTEM CTS_000020.LAB	10/27/2021	8:00:19 AM	95.51
9	SYSTEM CTS_000021.LAB	10/27/2021	8:00:27 AM	95.73
10	SYSTEM CTS_000022.LAB	10/27/2021	8:00:35 AM	95.37
	Pre Test 2 System CTS AVERAGE			**95.47**

CTS Concentration of Analyte (ppm)
95.47
Difference From Direct CTS Value (%)
-1.85
Allowable Criteria +/- 5%
Result (Pass/Fail)
Pass

Post Test 2 Direct CTS				
1	POST SYSTEM CTS_000007.LAB	10/27/2021	2:32:01 PM	94.64
2	POST SYSTEM CTS_000008.LAB	10/27/2021	2:32:09 PM	94.95
3	POST SYSTEM CTS_000009.LAB	10/27/2021	2:32:17 PM	95.05
4	POST SYSTEM CTS_000010.LAB	10/27/2021	2:32:25 PM	95.15
5	POST SYSTEM CTS_000011.LAB	10/27/2021	2:32:33 PM	95.13
6	POST SYSTEM CTS_000012.LAB	10/27/2021	2:32:41 PM	94.77
7	POST SYSTEM CTS_000013.LAB	10/27/2021	2:32:49 PM	95.21
8	POST SYSTEM CTS_000014.LAB	10/27/2021	2:32:56 PM	95.24
9	POST SYSTEM CTS_000015.LAB	10/27/2021	2:33:04 PM	94.87
10	POST SYSTEM CTS_000016.LAB	10/27/2021	2:33:12 PM	94.92
	Post Test 2 Direct CTS AVERAGE			**94.99**

CTS Concentration of Analyte (ppm_{vd})
94.99
Difference From Cylinder Value (%)
-4.43
Allowable +/- 5%
Pass/Fail
Pass

Calibration Transfer Standard (CTS) Data

Location	Aberdeen, MD	**Process**	Incinerator
Date	October 28, 2021	**Analyte**	Ethylene

CTS Gas	Certified Concentration	Concentration Units	Cylinder #
Ethylene	99.2	ppmvd	CC52216

Data Point	Analyte, Calibration Gas T1			
	Spectrum	Date	Time	(ppmvd)
Pre Test 3 Direct CTS				
1	28_DIRECT CTS_000008.LAB	10/28/2021	7:32:54 AM	98.08
2	28_DIRECT CTS_000009.LAB	10/28/2021	7:33:01 AM	97.97
3	28_DIRECT CTS_000010.LAB	10/28/2021	7:33:10 AM	98.03
4	28_DIRECT CTS_000011.LAB	10/28/2021	7:33:17 AM	97.96
5	28_DIRECT CTS_000012.LAB	10/28/2021	7:33:25 AM	98.05
6	28_DIRECT CTS_000013.LAB	10/28/2021	7:33:33 AM	97.96
7	28_DIRECT CTS_000014.LAB	10/28/2021	7:33:41 AM	98.06
8	28_DIRECT CTS_000015.LAB	10/28/2021	7:33:49 AM	98.02
9	28_DIRECT CTS_000016.LAB	10/28/2021	7:33:56 AM	98.12
10	28_DIRECT CTS_000017.LAB	10/28/2021	7:34:05 AM	97.99
	Pre Test 3 Direct CTS AVERAGE			**98.02**

CTS Concentration of Analyte (ppm_{vd})
98.02
Difference From Cylinder Value (%)
-1.20
Allowable Criteria +/- 5%
Result (Pass/Fail)
Pass

Data Point	Analyte,Calibration Gas			
	Spectrum	Date	Time	(ppm)
Pre Test 3 System CTS				
1	28_SYSTEM CTS_000004.LAB	10/28/2021	7:49:19 AM	96.23
2	28_SYSTEM CTS_000005.LAB	10/28/2021	7:49:27 AM	96.38
3	28_SYSTEM CTS_000006.LAB	10/28/2021	7:49:35 AM	96.28
4	28_SYSTEM CTS_000007.LAB	10/28/2021	7:49:42 AM	96.41
5	28_SYSTEM CTS_000008.LAB	10/28/2021	7:49:50 AM	96.43
6	28_SYSTEM CTS_000009.LAB	10/28/2021	7:49:58 AM	96.32
7	28_SYSTEM CTS_000010.LAB	10/28/2021	7:50:06 AM	96.30
8	28_SYSTEM CTS_000011.LAB	10/28/2021	7:50:14 AM	96.30
9	28_SYSTEM CTS_000012.LAB	10/28/2021	7:50:22 AM	96.20
10	28_SYSTEM CTS_000013.LAB	10/28/2021	7:50:29 AM	96.31
	Pre Test 3 System CTS AVERAGE			**96.32**

CTS Concentration of Analyte (ppm)
96.32
Difference From Direct CTS Value (%)
-1.77
Allowable Criteria +/- 5%
Result (Pass/Fail)
Pass

Data Point	Analyte,Calibration Gas			
	Spectrum	Date	Time	(ppm)
Post Test 3 Direct CTS				
1	28_CTS_000006.LAB	10/28/2021	3:07:37 PM	96.40
2	28_CTS_000007.LAB	10/28/2021	3:07:45 PM	96.25
3	28_CTS_000008.LAB	10/28/2021	3:07:52 PM	96.47
4	28_CTS_000009.LAB	10/28/2021	3:08:00 PM	96.61
5	28_CTS_000010.LAB	10/28/2021	3:08:08 PM	96.70
6	28_CTS_000011.LAB	10/28/2021	3:08:16 PM	96.60
7	28_CTS_000012.LAB	10/28/2021	3:08:24 PM	96.59
8	28_CTS_000013.LAB	10/28/2021	3:08:32 PM	96.51
9	28_CTS_000014.LAB	10/28/2021	3:08:40 PM	96.58
10	28_CTS_000015.LAB	10/28/2021	3:08:48 PM	96.71
	Post Test 3 Direct CTS AVERAGE			**96.54**

CTS Concentration of Analyte (ppm_{vd})
96.54
Difference From Cylinder Value (%)
-2.75
Allowable +/- 5%
Pass/Fail
Pass

FTIR, QA Spike Data

Location	Aberdeen, MD	**Process**	Incinerator
Date	October 26-28, 2021	**Analyte**	Carbon Monoxide

Calibration Gas	Certified Concentration	Cylinder #	Conc. Units	Response Time (sec)
Carbon Monoxide	1514	CC335731	ppm	27
SF_6	10.0		ppm	

Data Point	Analyte, Direct T1				
	Spectrum	**Date**	**Time**	**Carbon Monoxide (ppm)**	**SF6 (ppm)**
1	SYSTEM NOX CO_000026.LAB	10/26/2021	8:36:53	1486.42	9.46
2	SYSTEM NOX CO_000027.LAB	10/26/2021	8:37:01	1491.70	9.47
3	SYSTEM NOX CO_000028.LAB	10/26/2021	8:37:08	1489.47	9.48
4	SYSTEM NOX CO_000029.LAB	10/26/2021	8:37:16	1491.57	9.48
5	SYSTEM NOX CO_000030.LAB	10/26/2021	8:37:24	1490.80	9.47
6	SYSTEM NOX CO_000031.LAB	10/26/2021	8:37:32	1489.56	9.47
7	SYSTEM NOX CO_000032.LAB	10/26/2021	8:37:40	1493.07	9.46
8	SYSTEM NOX CO_000033.LAB	10/26/2021	8:37:48	1491.33	9.48
9	SYSTEM NOX CO_000034.LAB	10/26/2021	8:37:55	1485.94	9.49
10	SYSTEM NOX CO_000035.LAB	10/26/2021	8:38:03	1488.06	9.48
11	SYSTEM NOX CO_000036.LAB	10/26/2021	8:38:11	1492.62	9.48
12	SYSTEM NOX CO_000037.LAB	10/26/2021	8:38:19	1491.62	9.48
			AVERAGE	**1490.18**	**9.47**

Spike Replicate#1

Data Point	Analyte, Native					Analyte, Spiked				
	Spectrum	**Date**	**Time**	**Carbon Monoxide (ppm)**	**SF6 (ppm)**	**Spectrum**	**Date**	**Time**	**Carbon Monoxide (ppm)**	**SF6 (ppm)**
1	REAL NATIVE 1 NOX_000117.LAB	10/26/2021	10:34:08	24.23	0.00	REAL SPIKE 1 NOX_000012.LAB	10/26/2021	10:37:19	62.85	0.23
2	REAL NATIVE 1 NOX_000118.LAB	10/26/2021	10:34:16	24.21	0.00	REAL SPIKE 1 NOX_000013.LAB	10/26/2021	10:37:27	63.16	0.24
3	REAL NATIVE 1 NOX_000119.LAB	10/26/2021	10:34:24	23.93	0.00	REAL SPIKE 1 NOX_000014.LAB	10/26/2021	10:37:35	62.94	0.23
4	REAL NATIVE 1 NOX_000120.LAB	10/26/2021	10:34:32	23.98	0.00	REAL SPIKE 1 NOX_000015.LAB	10/26/2021	10:37:42	62.89	0.23
5	REAL NATIVE 1 NOX_000121.LAB	10/26/2021	10:34:40	23.60	0.00	REAL SPIKE 1 NOX_000016.LAB	10/26/2021	10:37:50	61.30	0.23
6	REAL NATIVE 1 NOX_000122.LAB	10/26/2021	10:34:47	23.53	0.00	REAL SPIKE 1 NOX_000017.LAB	10/26/2021	10:37:58	65.07	0.25
7	REAL NATIVE 1 NOX_000123.LAB	10/26/2021	10:34:55	23.85	0.00	REAL SPIKE 1 NOX_000018.LAB	10/26/2021	10:38:06	65.54	0.25
8	REAL NATIVE 1 NOX_000124.LAB	10/26/2021	10:35:03	23.59	0.00	REAL SPIKE 1 NOX_000019.LAB	10/26/2021	10:38:14	61.56	0.24
9	REAL NATIVE 1 NOX_000125.LAB	10/26/2021	10:35:11	23.54	0.00	REAL SPIKE 1 NOX_000020.LAB	10/26/2021	10:38:22	59.44	0.22
10	REAL NATIVE 1 NOX_000126.LAB	10/26/2021	10:35:19	23.77	0.01	REAL SPIKE 1 NOX_000021.LAB	10/26/2021	10:38:29	63.65	0.24
			AVERAGE	**23.82**	**0.00**			**AVERAGE**	**62.84**	**0.24**

Spike Replicate#1			**Criteria**	**Pass/Fail**
Direct Carbon Monoxide Standard Concentration	ppm	1490.18		
Direct SF_6 Standard Concentration	ppm	9.474		
Native Concentration of Analyte	ppm	23.82		
Concentration of SF6, Spiked	ppm	0.236		
Concentration of Analyte, Spiked	ppm	62.84		
Dilution (%)		2.49	≤ 10%	Pass
Dilution factor		0.02		
Spike Recovery (%)		106.77%	70 ≤ % ≤ 130	Pass

Data Point	Analyte, Direct T2				
	Spectrum	**Date**	**Time**	**Carbon Monoxide (ppm)**	**SF6 (ppm)**
1	DIRECT NOX CO_000011.LAB	10/27/2021	7:44:01	1505.12	9.67
2	DIRECT NOX CO_000012.LAB	10/27/2021	7:44:09	1509.22	9.66
3	DIRECT NOX CO_000013.LAB	10/27/2021	7:44:17	1508.67	9.66
4	DIRECT NOX CO_000014.LAB	10/27/2021	7:44:24	1501.84	9.66
5	DIRECT NOX CO_000015.LAB	10/27/2021	7:44:32	1505.24	9.66
6	DIRECT NOX CO_000016.LAB	10/27/2021	7:44:40	1504.08	9.65
7	DIRECT NOX CO_000017.LAB	10/27/2021	7:44:48	1503.00	9.65
8	DIRECT NOX CO_000018.LAB	10/27/2021	7:44:56	1505.28	9.64
9	DIRECT NOX CO_000019.LAB	10/27/2021	7:45:04	1504.25	9.63
10	DIRECT NOX CO_000020.LAB	10/27/2021	7:45:12	1508.68	9.64
11	DIRECT NOX CO_000021.LAB	10/27/2021	7:45:19	1505.58	9.63
12	DIRECT NOX CO_000022.LAB	10/27/2021	7:45:27	1505.97	9.64
			AVERAGE	**1505.58**	**9.65**

Spike Replicate#2

Data Point	Analyte, Native					Analyte, Spiked				
	Spectrum	**Date**	**Time**	**Carbon Monoxide (ppm)**	**SF6 (ppm)**	**Spectrum**	**Date**	**Time**	**Carbon Monoxide (ppm)**	**SF6 (ppm)**
1	NATIVE 2 NOX CO_000034.LAB	10/27/2021	8:44:17	26.70	0.00	SPIKE 2 NOX CO_000050.LAB	10/27/2021	8:52:24	56.93	0.26
2	NATIVE 2 NOX CO_000035.LAB	10/27/2021	8:44:25	26.38	0.00	SPIKE 2 NOX CO_000051.LAB	10/27/2021	8:52:32	56.78	0.26
3	NATIVE 2 NOX CO_000036.LAB	10/27/2021	8:44:33	26.86	0.00	SPIKE 2 NOX CO_000052.LAB	10/27/2021	8:52:40	56.81	0.25
4	NATIVE 2 NOX CO_000037.LAB	10/27/2021	8:44:41	26.32	0.00	SPIKE 2 NOX CO_000053.LAB	10/27/2021	8:52:48	56.99	0.26
5	NATIVE 2 NOX CO_000038.LAB	10/27/2021	8:44:49	26.75	0.00	SPIKE 2 NOX CO_000054.LAB	10/27/2021	8:52:56	56.68	0.26
6	NATIVE 2 NOX CO_000039.LAB	10/27/2021	8:44:57	25.95	0.00	SPIKE 2 NOX CO_000055.LAB	10/27/2021	8:53:03	56.79	0.26
7	NATIVE 2 NOX CO_000040.LAB	10/27/2021	8:45:04	25.59	0.00	SPIKE 2 NOX CO_000056.LAB	10/27/2021	8:53:11	56.47	0.26
8	NATIVE 2 NOX CO_000041.LAB	10/27/2021	8:45:12	24.89	-0.01	SPIKE 2 NOX CO_000057.LAB	10/27/2021	8:53:19	56.69	0.25
9	NATIVE 2 NOX CO_000042.LAB	10/27/2021	8:45:20	24.99	0.00	SPIKE 2 NOX CO_000058.LAB	10/27/2021	8:53:27	56.73	0.26
10	NATIVE 2 NOX CO_000043.LAB	10/27/2021	8:45:28	24.96	0.00	SPIKE 2 NOX CO_000059.LAB	10/27/2021	8:53:35	56.62	0.25
			AVERAGE	**25.94**	**0.00**			**AVERAGE**	**56.75**	**0.26**

Spike Replicate#2			**Criteria**	**Pass/Fail**
Direct Carbon Monoxide Standard Concentration	ppm	1505.58		
Direct SF_6 Standard Concentration	ppm	9.648		
Native Concentration of Analyte	ppm	25.94		
Concentration of SF6, Spiked	ppm	0.257		
Concentration of Analyte, Spiked	ppm	56.75		
Dilution (%)		2.67	≤ 10%	Pass
Dilution factor		0.03		
Spike Recovery (%)		78.47%	70 ≤ % ≤ 130	Pass

Data Point	Analyte, Direct T2				
	Spectrum	**Date**	**Time**	**Carbon Monoxide (ppm)**	**SF6 (ppm)**
1	28_DIRECT NOX CO_000015.LAB	10/28/2021	7:36:23	1538.90	9.72
2	28_DIRECT NOX CO_000016.LAB	10/28/2021	7:36:31	1531.58	9.72
3	28_DIRECT NOX CO_000017.LAB	10/28/2021	7:36:39	1536.08	9.71
4	28_DIRECT NOX CO_000018.LAB	10/28/2021	7:36:47	1530.51	9.71
5	28_DIRECT NOX CO_000019.LAB	10/28/2021	7:36:55	1532.14	9.70
6	28_DIRECT NOX CO_000020.LAB	10/28/2021	7:37:03	1531.18	9.69
7	28_DIRECT NOX CO_000021.LAB	10/28/2021	7:37:10	1532.57	9.70
8	28_DIRECT NOX CO_000022.LAB	10/28/2021	7:37:18	1534.44	9.71
9	28_DIRECT NOX CO_000023.LAB	10/28/2021	7:37:26	1531.85	9.69
10	28_DIRECT NOX CO_000024.LAB	10/28/2021	7:37:34	1527.89	9.70
11	28_DIRECT NOX CO_000025.LAB	10/28/2021	7:37:42	1531.03	9.71
12	28_DIRECT NOX CO_000026.LAB	10/28/2021	7:37:50	1530.92	9.67
			AVERAGE	**1532.42**	**9.70**

Spike Replicate#3

Data Point	Analyte, Native					Analyte, Spiked				
	Spectrum	**Date**	**Time**	**Carbon Monoxide (ppm)**	**SF6 (ppm)**	**Spectrum**	**Date**	**Time**	**Carbon Monoxide (ppm)**	**SF6 (ppm)**
1	28_NATIVE1_NOX CO_000011.LAB	10/28/2021	8:24:00	15.62	-0.01	28_SPIKE1_NOX CO_000031.LAB	10/28/2021	8:29:39	48.52	0.22
2	28_NATIVE1_NOX CO_000012.LAB	10/28/2021	8:24:08	15.71	0.00	28_SPIKE1_NOX CO_000032.LAB	10/28/2021	8:29:46	48.65	0.22
3	28_NATIVE1_NOX CO_000013.LAB	10/28/2021	8:24:16	15.67	-0.01	28_SPIKE1_NOX CO_000033.LAB	10/28/2021	8:29:54	48.76	0.22
4	28_NATIVE1_NOX CO_000014.LAB	10/28/2021	8:24:24	15.60	-0.01	28_SPIKE1_NOX CO_000034.LAB	10/28/2021	8:30:02	49.14	0.23
5	28_NATIVE1_NOX CO_000015.LAB	10/28/2021	8:24:31	15.39	-0.01	28_SPIKE1_NOX CO_000035.LAB	10/28/2021	8:30:10	48.89	0.22
6	28_NATIVE1_NOX CO_000016.LAB	10/28/2021	8:24:39	15.35	0.00	28_SPIKE1_NOX CO_000036.LAB	10/28/2021	8:30:18	49.08	0.22
7	28_NATIVE1_NOX CO_000017.LAB	10/28/2021	8:24:47	15.22	-0.01	28_SPIKE1_NOX CO_000037.LAB	10/28/2021	8:30:26	48.81	0.22
8	28_NATIVE1_NOX CO_000018.LAB	10/28/2021	8:24:55	15.01	-0.01	28_SPIKE1_NOX CO_000038.LAB	10/28/2021	8:30:34	48.89	0.22
9	28_NATIVE1_NOX CO_000019.LAB	10/28/2021	8:25:03	15.02	0.00	28_SPIKE1_NOX CO_000039.LAB	10/28/2021	8:30:41	49.23	0.22
10	28_NATIVE1_NOX CO_000020.LAB	10/28/2021	8:25:11	14.94	-0.01	28_SPIKE1_NOX CO_000040.LAB	10/28/2021	8:30:49	48.86	0.23
			AVERAGE	**15.35**	**-0.01**			**AVERAGE**	**48.88**	**0.22**

Spike Replicate#3			**Criteria**	**Pass/Fail**
Direct Carbon Monoxide Standard Concentration	ppm	1532.42		
Direct SF_6 Standard Concentration	ppm	9.703		
Native Concentration of Analyte	ppm	15.35		
Concentration of SF6, Spiked	ppm	0.229		
Concentration of Analyte, Spiked	ppm	48.88		
Dilution (%)		2.36	≤ 10%	Pass
Dilution factor		0.02		
Spike Recovery (%)		93.72%	70 ≤ % ≤ 130	Pass

FTIR, QA Spike Data

Location	Aberdeen, MD	**Process**	Incinerator
Date	October 26-28, 2021	**Analyte**	NOx

Calibration Gas	Certified Concentration	Cylinder #	Conc. Units	Response Time (sec)
NOx	503	CC335731	ppm	27
SF_6	10.0		ppm	

Data Point	Analyte, Direct T1				
	Spectrum	**Date**	**Time**	**NOx (ppm)**	**SF6 (ppm)**
1	DIRECT NOX CO_000010.LAB	10/26/2021	8:15:15	492.18	9.60
2	DIRECT NOX CO_000011.LAB	10/26/2021	8:15:22	492.40	9.62
3	DIRECT NOX CO_000012.LAB	10/26/2021	8:15:31	492.59	9.62
4	DIRECT NOX CO_000013.LAB	10/26/2021	8:15:38	492.59	9.61
5	DIRECT NOX CO_000014.LAB	10/26/2021	8:15:46	492.74	9.61
6	DIRECT NOX CO_000015.LAB	10/26/2021	8:15:54	492.80	9.61
7	DIRECT NOX CO_000016.LAB	10/26/2021	8:16:02	493.26	9.63
8	DIRECT NOX CO_000017.LAB	10/26/2021	8:16:10	492.75	9.62
9	DIRECT NOX CO_000018.LAB	10/26/2021	8:16:17	493.02	9.62
10	DIRECT NOX CO_000019.LAB	10/26/2021	8:16:26	492.76	9.63
11	DIRECT NOX CO_000020.LAB	10/26/2021	8:16:34	493.29	9.63
12	DIRECT NOX CO_000021.LAB	10/26/2021	8:16:41	493.27	9.63
			AVERAGE	**492.80**	**9.62**

Spike Replicate#1

Data Point	Analyte, Native					Analyte, Spiked				
	Spectrum	**Date**	**Time**	**NOx (ppm)**	**SF6 (ppm)**	**Spectrum**	**Date**	**Time**	**NOx (ppm)**	**SF6 (ppm)**
1	REAL NATIVE 1 NOX_000117.LAB	10/26/2021	10:34:08	59.99	0.00	REAL SPIKE 1 NOX_000012.LAB	10/26/2021	10:37:19	70.41	0.23
2	REAL NATIVE 1 NOX_000118.LAB	10/26/2021	10:34:16	59.48	0.00	REAL SPIKE 1 NOX_000013.LAB	10/26/2021	10:37:27	70.83	0.24
3	REAL NATIVE 1 NOX_000119.LAB	10/26/2021	10:34:24	58.68	0.00	REAL SPIKE 1 NOX_000014.LAB	10/26/2021	10:37:35	69.92	0.23
4	REAL NATIVE 1 NOX_000120.LAB	10/26/2021	10:34:32	57.86	0.00	REAL SPIKE 1 NOX_000015.LAB	10/26/2021	10:37:42	69.20	0.23
5	REAL NATIVE 1 NOX_000121.LAB	10/26/2021	10:34:40	57.56	0.00	REAL SPIKE 1 NOX_000016.LAB	10/26/2021	10:37:50	69.90	0.23
6	REAL NATIVE 1 NOX_000122.LAB	10/26/2021	10:34:47	58.77	0.00	REAL SPIKE 1 NOX_000017.LAB	10/26/2021	10:37:58	70.90	0.25
7	REAL NATIVE 1 NOX_000123.LAB	10/26/2021	10:34:55	59.34	0.00	REAL SPIKE 1 NOX_000018.LAB	10/26/2021	10:38:06	70.24	0.25
8	REAL NATIVE 1 NOX_000124.LAB	10/26/2021	10:35:03	59.54	0.00	REAL SPIKE 1 NOX_000019.LAB	10/26/2021	10:38:14	68.95	0.24
9	REAL NATIVE 1 NOX_000125.LAB	10/26/2021	10:35:11	59.05	0.00	REAL SPIKE 1 NOX_000020.LAB	10/26/2021	10:38:22	68.44	0.22
10	REAL NATIVE 1 NOX_000126.LAB	10/26/2021	10:35:19	59.94	0.01	REAL SPIKE 1 NOX_000021.LAB	10/26/2021	10:38:29	70.12	0.24
			AVERAGE	**59.02**	**0.00**			**AVERAGE**	**69.89**	**0.24**

Spike Replicate#1			**Criteria**	**Pass/Fail**
Direct NOx Standard Concentration	ppm	492.80		
Direct SF_6 Standard Concentration	ppm	9.620		
Native Concentration of Analyte	ppm	59.02		
Concentration of SF6, Spiked	ppm	0.236		
Concentration of Analyte, Spiked	ppm	69.89		
Dilution (%)		2.45	≤ 10%	Pass
Dilution factor		0.02		
Spike Recovery (%)		101.95%	70 ≤ % ≤ 130	Pass

Data Point	Analyte, Direct T2				
	Spectrum	**Date**	**Time**	**NOx (ppm)**	**SF6 (ppm)**
1	DIRECT NOX CO_000011.LAB	10/27/2021	7:44:01	494.25	9.67
2	DIRECT NOX CO_000012.LAB	10/27/2021	7:44:09	494.65	9.66
3	DIRECT NOX CO_000013.LAB	10/27/2021	7:44:17	494.36	9.66
4	DIRECT NOX CO_000014.LAB	10/27/2021	7:44:24	494.33	9.66
5	DIRECT NOX CO_000015.LAB	10/27/2021	7:44:32	494.55	9.66
6	DIRECT NOX CO_000016.LAB	10/27/2021	7:44:40	494.38	9.65
7	DIRECT NOX CO_000017.LAB	10/27/2021	7:44:48	494.45	9.65
8	DIRECT NOX CO_000018.LAB	10/27/2021	7:44:56	494.89	9.64
9	DIRECT NOX CO_000019.LAB	10/27/2021	7:45:04	494.58	9.63
10	DIRECT NOX CO_000020.LAB	10/27/2021	7:45:12	494.47	9.64
11	DIRECT NOX CO_000021.LAB	10/27/2021	7:45:19	494.11	9.63
12	DIRECT NOX CO_000022.LAB	10/27/2021	7:45:27	494.46	9.64
			AVERAGE	**494.46**	**9.65**

Spike Replicate#2

Data Point	Analyte, Native					Analyte, Spiked				
	Spectrum	**Date**	**Time**	**NOx (ppm)**	**SF6 (ppm)**	**Spectrum**	**Date**	**Time**	**NOx (ppm)**	**SF6 (ppm)**
1	NATIVE 2 NOX CO_000034.LAB	10/27/2021	8:44:17	47.02	0.00	SPIKE 2 NOX CO_000050.LAB	10/27/2021	8:52:24	60.44	0.26
2	NATIVE 2 NOX CO_000035.LAB	10/27/2021	8:44:25	47.35	0.00	SPIKE 2 NOX CO_000051.LAB	10/27/2021	8:52:32	61.11	0.26
3	NATIVE 2 NOX CO_000036.LAB	10/27/2021	8:44:33	48.55	0.00	SPIKE 2 NOX CO_000052.LAB	10/27/2021	8:52:40	61.45	0.25
4	NATIVE 2 NOX CO_000037.LAB	10/27/2021	8:44:41	47.21	0.00	SPIKE 2 NOX CO_000053.LAB	10/27/2021	8:52:48	62.39	0.26
5	NATIVE 2 NOX CO_000038.LAB	10/27/2021	8:44:49	48.14	0.00	SPIKE 2 NOX CO_000054.LAB	10/27/2021	8:52:56	60.81	0.26
6	NATIVE 2 NOX CO_000039.LAB	10/27/2021	8:44:57	46.85	0.00	SPIKE 2 NOX CO_000055.LAB	10/27/2021	8:53:03	61.74	0.26
7	NATIVE 2 NOX CO_000040.LAB	10/27/2021	8:45:04	47.01	0.00	SPIKE 2 NOX CO_000056.LAB	10/27/2021	8:53:11	61.09	0.26
8	NATIVE 2 NOX CO_000041.LAB	10/27/2021	8:45:12	46.59	-0.01	SPIKE 2 NOX CO_000057.LAB	10/27/2021	8:53:19	59.93	0.25
9	NATIVE 2 NOX CO_000042.LAB	10/27/2021	8:45:20	47.60	0.00	SPIKE 2 NOX CO_000058.LAB	10/27/2021	8:53:27	61.46	0.26
10	NATIVE 2 NOX CO_000043.LAB	10/27/2021	8:45:28	48.18	0.00	SPIKE 2 NOX CO_000059.LAB	10/27/2021	8:53:35	61.88	0.25
			AVERAGE	**47.45**	**0.00**			**AVERAGE**	**61.23**	**0.26**

Spike Replicate#2			**Criteria**	**Pass/Fail**
Direct NOx Standard Concentration	ppm	494.46		
Direct SF_6 Standard Concentration	ppm	9.648		
Native Concentration of Analyte	ppm	47.45		
Concentration of SF6, Spiked	ppm	0.257		
Concentration of Analyte, Spiked	ppm	61.23		
Dilution (%)		2.67	≤ 10%	Pass
Dilution factor		0.03		
Spike Recovery (%)		114.11%	70 ≤ % ≤ 130	Pass

Data Point	Analyte, Direct T3				
	Spectrum	**Date**	**Time**	**NOx (ppm)**	**SF6 (ppm)**
1	28_DIRECT NOX CO_000015.LAB	10/28/2021	7:36:23	499.70	9.72
2	28_DIRECT NOX CO_000016.LAB	10/28/2021	7:36:31	500.04	9.72
3	28_DIRECT NOX CO_000017.LAB	10/28/2021	7:36:39	499.70	9.71
4	28_DIRECT NOX CO_000018.LAB	10/28/2021	7:36:47	499.68	9.71
5	28_DIRECT NOX CO_000019.LAB	10/28/2021	7:36:55	499.88	9.70
6	28_DIRECT NOX CO_000020.LAB	10/28/2021	7:37:03	499.78	9.69
7	28_DIRECT NOX CO_000021.LAB	10/28/2021	7:37:10	499.63	9.70
8	28_DIRECT NOX CO_000022.LAB	10/28/2021	7:37:18	499.39	9.71
9	28_DIRECT NOX CO_000023.LAB	10/28/2021	7:37:26	500.53	9.69
10	28_DIRECT NOX CO_000024.LAB	10/28/2021	7:37:34	499.56	9.70
11	28_DIRECT NOX CO_000025.LAB	10/28/2021	7:37:42	500.40	9.71
12	28_DIRECT NOX CO_000026.LAB	10/28/2021	7:37:50	500.18	9.67
			AVERAGE	**499.87**	**9.70**

Spike Replicate#3

Data Point	Analyte, Native					Analyte, Spiked				
	Spectrum	**Date**	**Time**	**NOx (ppm)**	**SF6 (ppm)**	**Spectrum**	**Date**	**Time**	**NOx (ppm)**	**SF6 (ppm)**
1	28_NATIVE1_NOX CO_000011.LAB	10/28/2021	8:24:00	44.33	-0.01	28_SPIKE1_NOX CO_000031.LAB	10/28/2021	8:29:39	54.90	0.22
2	28_NATIVE1_NOX CO_000012.LAB	10/28/2021	8:24:08	44.74	0.00	28_SPIKE1_NOX CO_000032.LAB	10/28/2021	8:29:46	55.05	0.22
3	28_NATIVE1_NOX CO_000013.LAB	10/28/2021	8:24:16	44.67	-0.01	28_SPIKE1_NOX CO_000033.LAB	10/28/2021	8:29:54	56.11	0.22
4	28_NATIVE1_NOX CO_000014.LAB	10/28/2021	8:24:24	44.35	-0.01	28_SPIKE1_NOX CO_000034.LAB	10/28/2021	8:30:02	56.12	0.23
5	28_NATIVE1_NOX CO_000015.LAB	10/28/2021	8:24:31	44.79	-0.01	28_SPIKE1_NOX CO_000035.LAB	10/28/2021	8:30:10	56.23	0.22
6	28_NATIVE1_NOX CO_000016.LAB	10/28/2021	8:24:39	44.97	0.00	28_SPIKE1_NOX CO_000036.LAB	10/28/2021	8:30:18	56.89	0.22
7	28_NATIVE1_NOX CO_000017.LAB	10/28/2021	8:24:47	45.07	-0.01	28_SPIKE1_NOX CO_000037.LAB	10/28/2021	8:30:26	57.24	0.22
8	28_NATIVE1_NOX CO_000018.LAB	10/28/2021	8:24:55	45.03	-0.01	28_SPIKE1_NOX CO_000038.LAB	10/28/2021	8:30:34	56.85	0.22
9	28_NATIVE1_NOX CO_000019.LAB	10/28/2021	8:25:03	44.87	0.00	28_SPIKE1_NOX CO_000039.LAB	10/28/2021	8:30:41	57.56	0.22
10	28_NATIVE1_NOX CO_000020.LAB	10/28/2021	8:25:11	45.38	-0.01	28_SPIKE1_NOX CO_000040.LAB	10/28/2021	8:30:49	57.05	0.23
			AVERAGE	**44.82**	**-0.01**			**AVERAGE**	**56.40**	**0.22**

Spike Replicate#3			**Criteria**	**Pass/Fail**
Direct NOx Standard Concentration	ppm	499.87		
Direct SF_6 Standard Concentration	ppm	9.703		
Native Concentration of Analyte	ppm	44.82		
Concentration of SF6, Spiked	ppm	0.229		
Concentration of Analyte, Spiked	ppm	56.40		
Dilution (%)		2.36	≤ 10%	Pass
Dilution factor		0.02		
Spike Recovery (%)		107.11%	70 ≤ % ≤ 130	Pass

FTIR, QA Spike Data

Location	Aberdeen, MD	**Process**	Incinerator
Date	October 28, 2021	**Analyte**	SO2

Calibration Gas	Certified Concentration	Cylinder #	Conc. Units	Response Time (sec)
SO2	191.8	CC124834	ppm	30

Data Point	Analyte, Direct			
	Spectrum	Date	Time	CO2 (%)
1	PRE TEST_CAL SYSTEM_000338.LAB	7/23/2020	9:15:28	193.18
2	PRE TEST_CAL SYSTEM_000339.LAB	7/23/2020	9:15:36	192.89
3	PRE TEST_CAL SYSTEM_000340.LAB	7/23/2020	9:15:44	192.88
4	PRE TEST_CAL SYSTEM_000341.LAB	7/23/2020	9:15:51	192.92
5	PRE TEST_CAL SYSTEM_000342.LAB	7/23/2020	9:15:59	193.15
6	PRE TEST_CAL SYSTEM_000343.LAB	7/23/2020	9:16:06	192.93
7	PRE TEST_CAL SYSTEM_000344.LAB	7/23/2020	9:16:14	192.95
8	PRE TEST_CAL SYSTEM_000345.LAB	7/23/2020	9:16:21	193.25
9	PRE TEST_CAL SYSTEM_000346.LAB	7/23/2020	9:16:29	193.09
10	PRE TEST_CAL SYSTEM_000347.LAB	7/23/2020	9:16:36	192.91
11	PRE TEST_CAL SYSTEM_000348.LAB	7/23/2020	9:16:43	193.12
12	PRE TEST_CAL SYSTEM_000349.LAB	7/23/2020	9:16:51	193.48
		AVERAGE		**193.06**

Spike Replicate#1

Data Point	Analyte, Native					Analyte, Spiked				
	Spectrum	Date	Time	SO2 (ppm)	CO2 (%)	Spectrum	Date	Time	SO2 (ppm)	CO2 (%)
1	28_NATIVE1-5_SO2_000001.LAB	10/28/2021	13:57:30	1.38	6.55	28_SPIKE1-5_SO2_000001.LAB	10/28/2021	14:03:47	6.43	6.37
2	28_NATIVE1-5_SO2_000002.LAB	10/28/2021	13:58:02	1.69	6.56	28_SPIKE1-5_SO2_000002.LAB	10/28/2021	14:04:19	6.85	6.39
3	28_NATIVE1-5_SO2_000003.LAB	10/28/2021	13:58:33	2.13	6.58	28_SPIKE1-5_SO2_000003.LAB	10/28/2021	14:04:50	7.44	6.38
4	28_NATIVE1-5_SO2_000004.LAB	10/28/2021	13:59:04	2.61	6.49	28_SPIKE1-5_SO2_000004.LAB	10/28/2021	14:05:22	7.54	6.03
5	28_NATIVE1-5_SO2_000005.LAB	10/28/2021	13:59:36	1.98	5.62	28_SPIKE1-5_SO2_000005.LAB	10/28/2021	14:05:53	7.36	5.35
6	28_NATIVE1-5_SO2_000006.LAB	10/28/2021	14:00:07	2.05	5.45	28_SPIKE1-5_SO2_000006.LAB	10/28/2021	14:06:24	7.01	5.26
7	28_NATIVE1-5_SO2_000007.LAB	10/28/2021	14:00:39	1.37	5.45	28_SPIKE1-5_SO2_000007.LAB	10/28/2021	14:06:56	6.97	5.27
8	28_NATIVE1-5_SO2_000008.LAB	10/28/2021	14:01:10	1.46	5.42	28_SPIKE1-5_SO2_000008.LAB	10/28/2021	14:07:28	6.82	5.28
9	28_NATIVE1-5_SO2_000009.LAB	10/28/2021	14:01:41	1.21	5.44	28_SPIKE1-5_SO2_000009.LAB	10/28/2021	14:07:59	6.63	5.28
10	28_NATIVE1-5_SO2_000010.LAB	10/28/2021	14:02:13	1.14	5.44	28_SPIKE1-5_SO2_000010.LAB	10/28/2021	14:08:30	6.64	5.27
		AVERAGE		**1.70**	**5.90**		**AVERAGE**		**6.97**	**5.69**

Spike Replicate#1			Criteria	Pass/Fail
Direct SO2 Standard Concentration	ppm	193.06		
Native Concentration of CO2	%	5.900		
Native Concentration of Analyte	ppm	1.70		
Concentration of CO2, Spiked	%	5.687		
Concentration of Analyte, Spiked	ppm	6.97		
Dilution (%)		96.40		
Dilution factor		0.04	≤ 0.1	Pass
Spike Recovery (%)		76.78%	70 ≤ % ≤ 130	Pass

Spike Replicate#2

Data Point	Analyte, Native					Analyte, Spiked				
	Spectrum	Date	Time	SO2 (ppm)	CO2 (%)	Spectrum	Date	Time	SO2 (ppm)	CO2 (%)
1	28_NATIVE2_SO2_000001.LAB	10/28/2021	14:13:07	1.50	5.40	28_SPIKE2_SO2_000001.LAB	10/28/2021	14:20:22	6.28	5.22
2	28_NATIVE2_SO2_000002.LAB	10/28/2021	14:13:39	1.24	5.42	28_SPIKE2_SO2_000002.LAB	10/28/2021	14:20:53	6.37	5.22
3	28_NATIVE2_SO2_000003.LAB	10/28/2021	14:14:10	1.20	5.39	28_SPIKE2_SO2_000003.LAB	10/28/2021	14:21:25	6.34	5.82
4	28_NATIVE2_SO2_000004.LAB	10/28/2021	14:14:42	0.94	5.39	28_SPIKE2_SO2_000004.LAB	10/28/2021	14:21:56	6.71	6.29
5	28_NATIVE2_SO2_000005.LAB	10/28/2021	14:15:13	1.06	5.80	28_SPIKE2_SO2_000005.LAB	10/28/2021	14:22:28	7.09	6.31
6	28_NATIVE2_SO2_000006.LAB	10/28/2021	14:15:45	1.21	6.49	28_SPIKE2_SO2_000006.LAB	10/28/2021	14:22:59	7.48	6.32
7	28_NATIVE2_SO2_000007.LAB	10/28/2021	14:16:16	1.71	6.56	28_SPIKE2_SO2_000007.LAB	10/28/2021	14:23:31	7.78	6.28
8	28_NATIVE2_SO2_000008.LAB	10/28/2021	14:16:47	2.13	6.51	28_SPIKE2_SO2_000008.LAB	10/28/2021	14:24:02	7.47	5.55
9	28_NATIVE2_SO2_000009.LAB	10/28/2021	14:17:19	2.97	6.52	28_SPIKE2_SO2_000009.LAB	10/28/2021	14:24:33	7.03	5.24
10	28_NATIVE2_SO2_000010.LAB	10/28/2021	14:17:50	2.30	5.76	28_SPIKE2_SO2_000010.LAB	10/28/2021	14:25:05	6.87	5.22
		AVERAGE		**1.63**	**5.92**		**AVERAGE**		**6.94**	**5.75**

Spike Replicate#2			Criteria	Pass/Fail
Direct SO2 Standard Concentration	ppm	193.06		
Native Concentration of CO2	%	5.924		
Native Concentration of Analyte	ppm	1.63		
Concentration of CO2, Spiked	%	5.745		
Concentration of Analyte, Spiked	ppm	6.94		
Dilution (%)		96.98		
Dilution factor		0.03	≤ 0.1	Pass
Spike Recovery (%)		92.00%	70 ≤ % ≤ 130	Pass

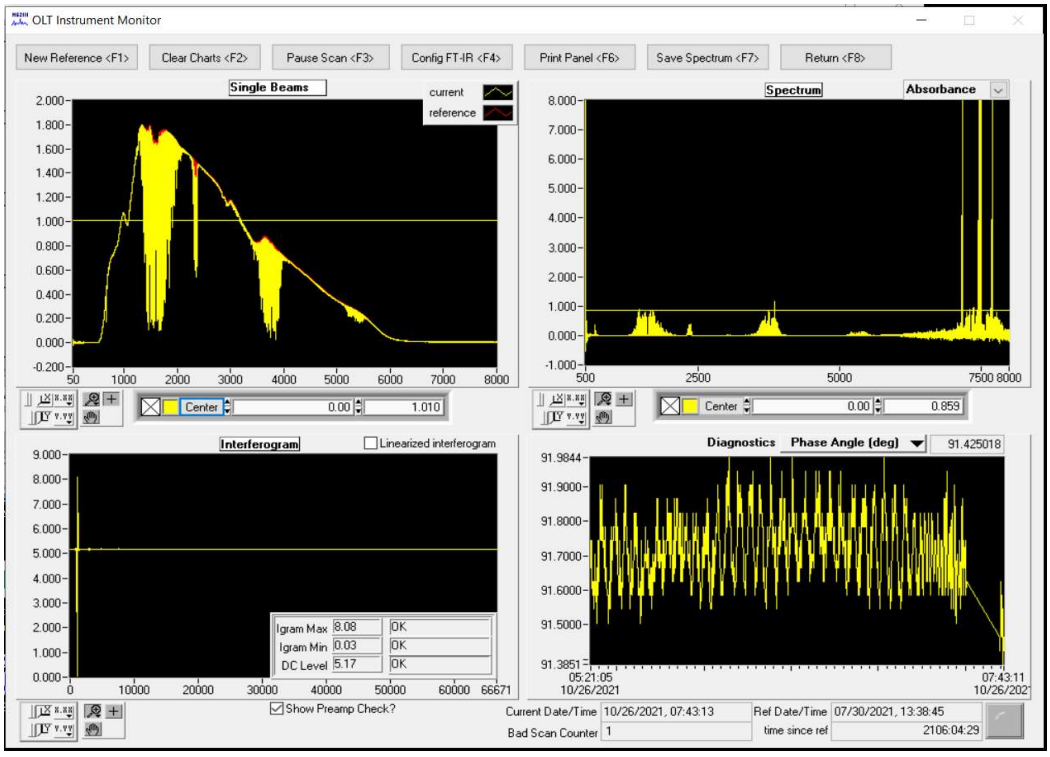
Spike Replicate#3

Data Point	Analyte, Native					Analyte, Spiked				
	Spectrum	Date	Time	SO2 (ppm)	CO2 (%)	Spectrum	Date	Time	SO2 (ppm)	CO2 (%)
1	28_NATIVE3_SO2_000011.LAB	10/28/2021	14:37:36	1.04	5.34	28_SPIKE3_SO2_000005.LAB	10/28/2021	14:45:40	6.68	5.42
2	28_NATIVE3_SO2_000012.LAB	10/28/2021	14:38:08	0.81	5.35	28_SPIKE3_SO2_000006.LAB	10/28/2021	14:46:12	6.56	6.21
3	28_NATIVE3_SO2_000013.LAB	10/28/2021	14:38:39	1.01	5.35	28_SPIKE3_SO2_000007.LAB	10/28/2021	14:46:43	6.82	6.25
4	28_NATIVE3_SO2_000014.LAB	10/28/2021	14:39:10	0.98	5.35	28_SPIKE3_SO2_000008.LAB	10/28/2021	14:47:15	6.87	6.23
5	28_NATIVE3_SO2_000015.LAB	10/28/2021	14:39:42	0.81	5.83	28_SPIKE3_SO2_000009.LAB	10/28/2021	14:47:46	7.15	6.17
6	28_NATIVE3_SO2_000016.LAB	10/28/2021	14:40:13	1.23	6.41	28_SPIKE3_SO2_000010.LAB	10/28/2021	14:48:17	7.05	5.96
7	28_NATIVE3_SO2_000017.LAB	10/28/2021	14:40:44	1.99	6.46	28_SPIKE3_SO2_000011.LAB	10/28/2021	14:48:49	7.16	5.21
8	28_NATIVE3_SO2_000018.LAB	10/28/2021	14:41:16	2.29	6.47	28_SPIKE3_SO2_000012.LAB	10/28/2021	14:49:20	6.96	5.14
9	28_NATIVE3_SO2_000019.LAB	10/28/2021	14:41:48	2.60	6.42	28_SPIKE3_SO2_000013.LAB	10/28/2021	14:49:52	7.01	5.15
	28_NATIVE3_SO2_000020.LAB	10/28/2021	14:42:19	1.99	5.74	28_SPIKE3_SO2_000014.LAB	10/28/2021	14:50:23	7.08	5.16
		AVERAGE		**1.47**	**5.87**		**AVERAGE**		**6.93**	**5.69**

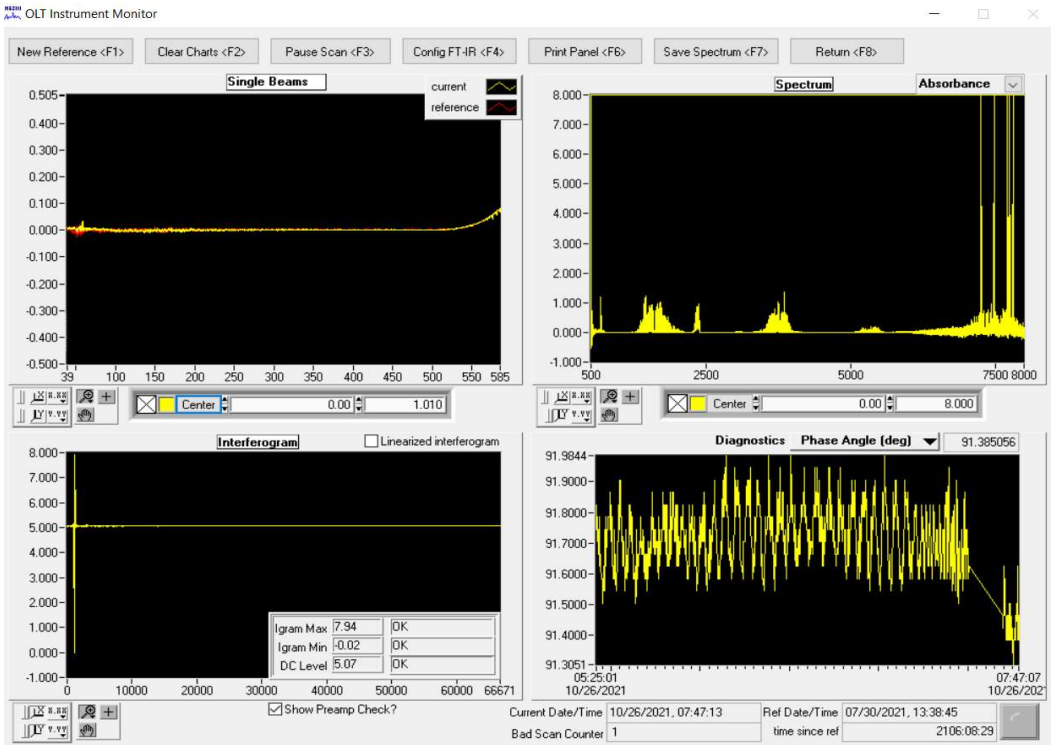
Spike Replicate#3			Criteria	Pass/Fail
Direct SO2 Standard Concentration	ppm	193.06		
Native Concentration of CO2	%	5.873		
Native Concentration of Analyte	ppm	1.47		
Concentration of CO2, Spiked	%	5.688		
Concentration of Analyte, Spiked	ppm	6.93		
Dilution (%)		96.86		
Dilution factor		0.03	≤ 0.1	Pass
Spike Recovery (%)		90.76%	70 ≤ % ≤ 130	Pass

Test 1 QA/QC Screenshots

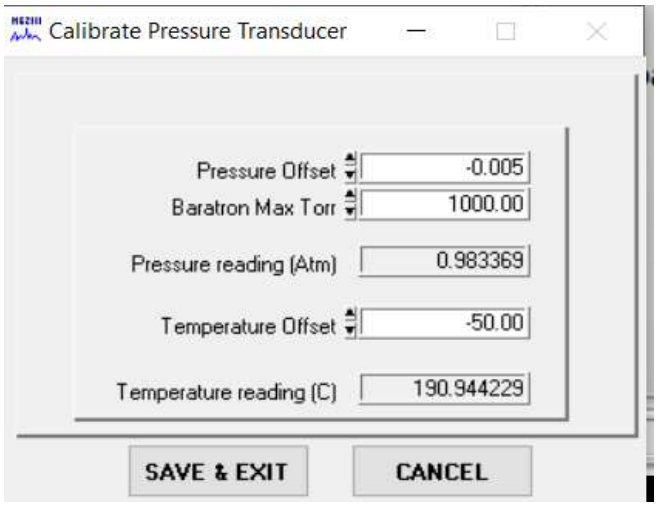
Screenshot#1- Instrument Diagnostics



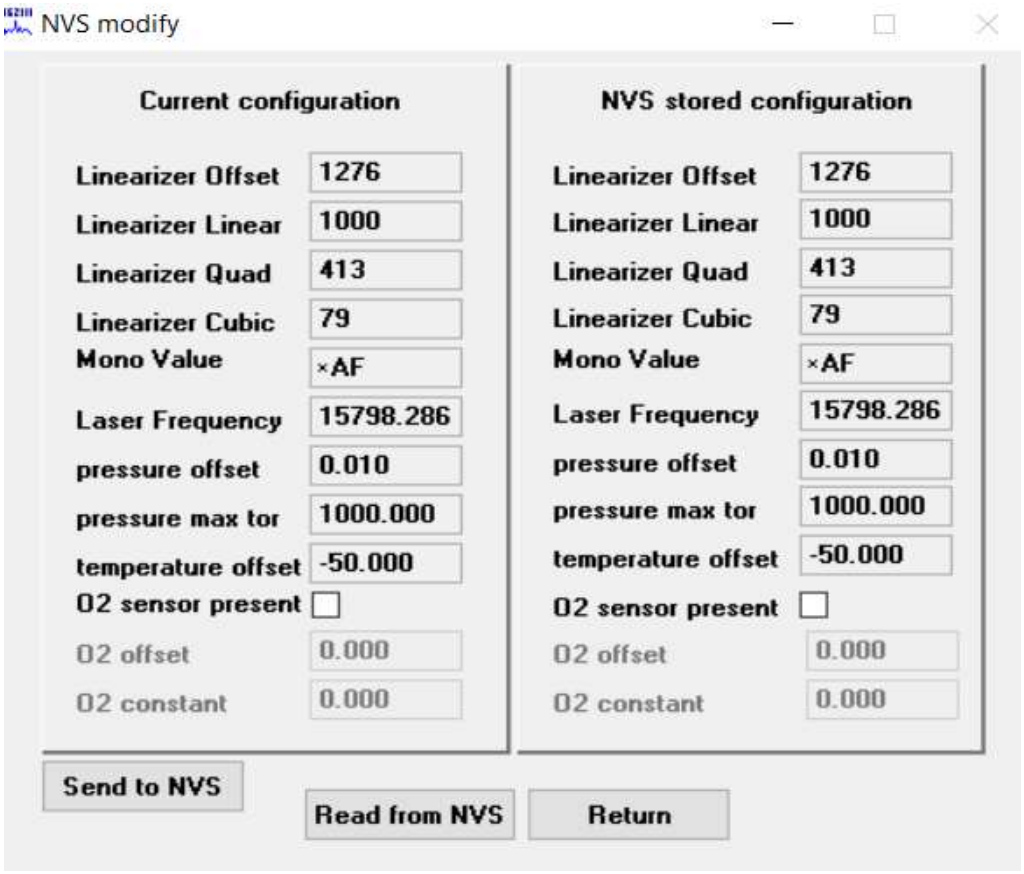
Screenshot#2- Detector Linearity



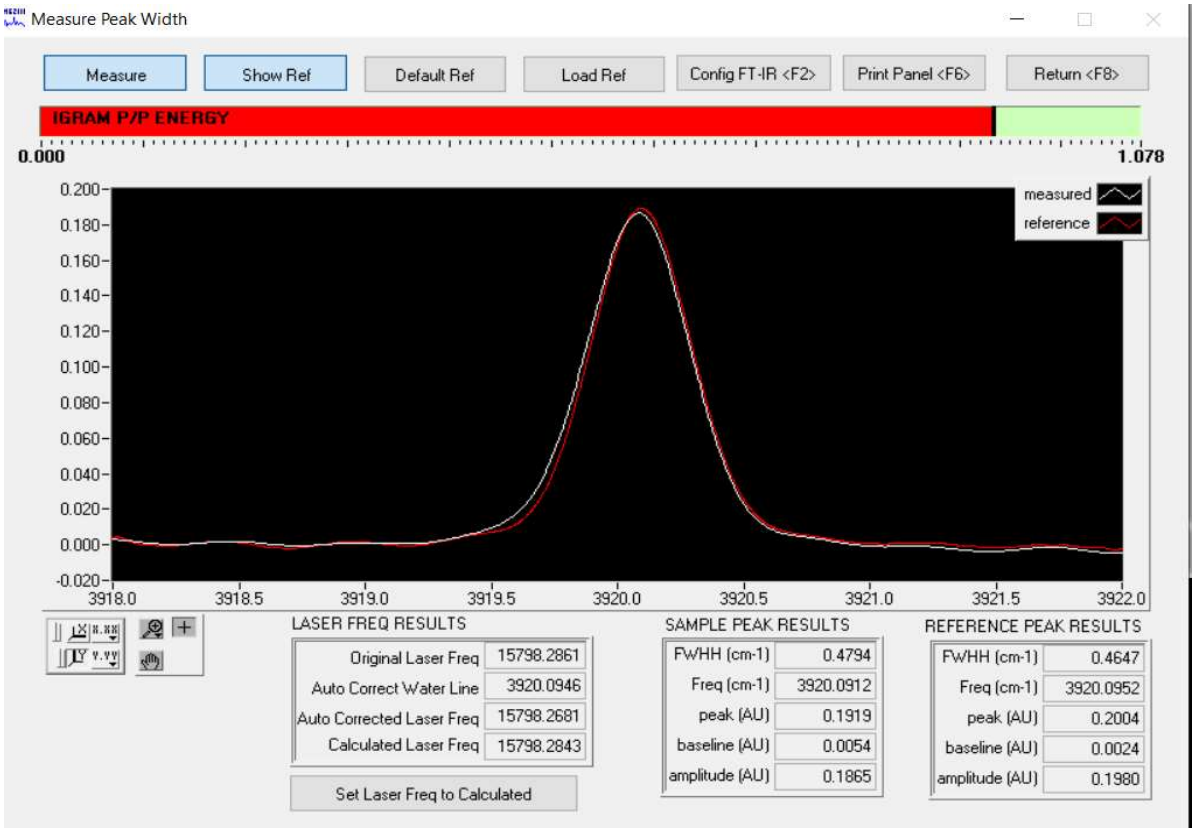
Screenshot#3- Pressure Transducer Settings



Screenshot#4- Linearizer Constants

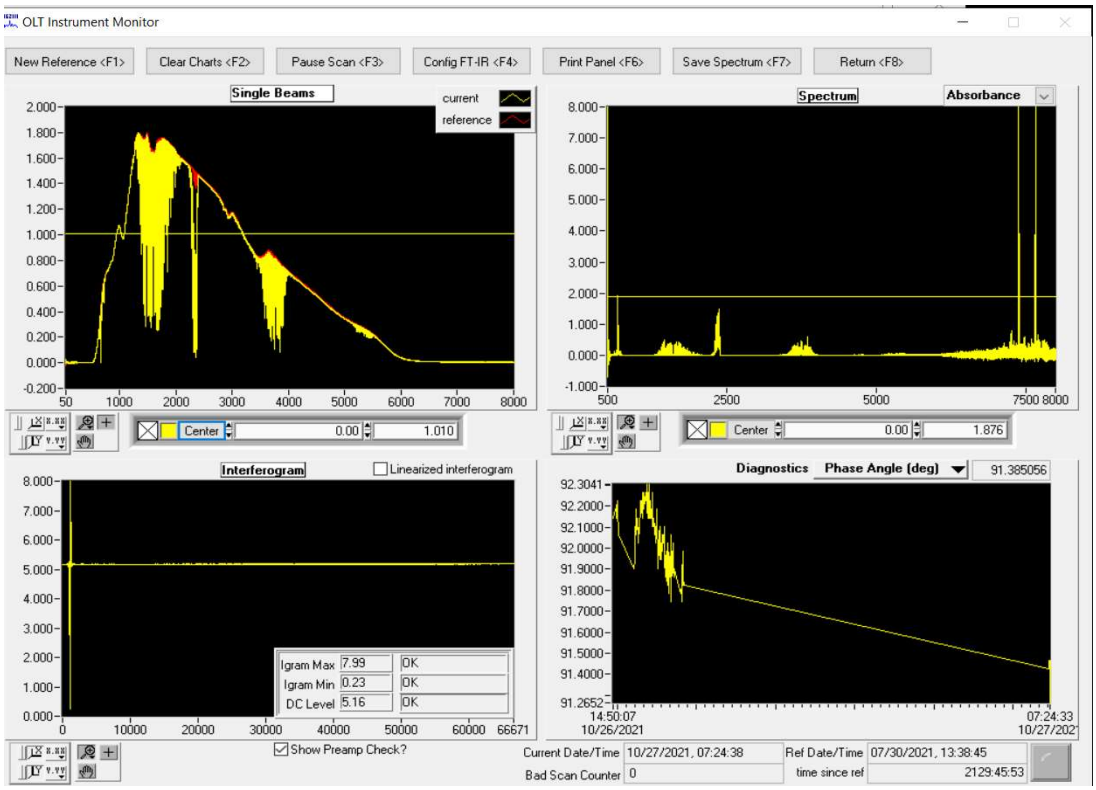


Screenshot#5- Peak Analysis

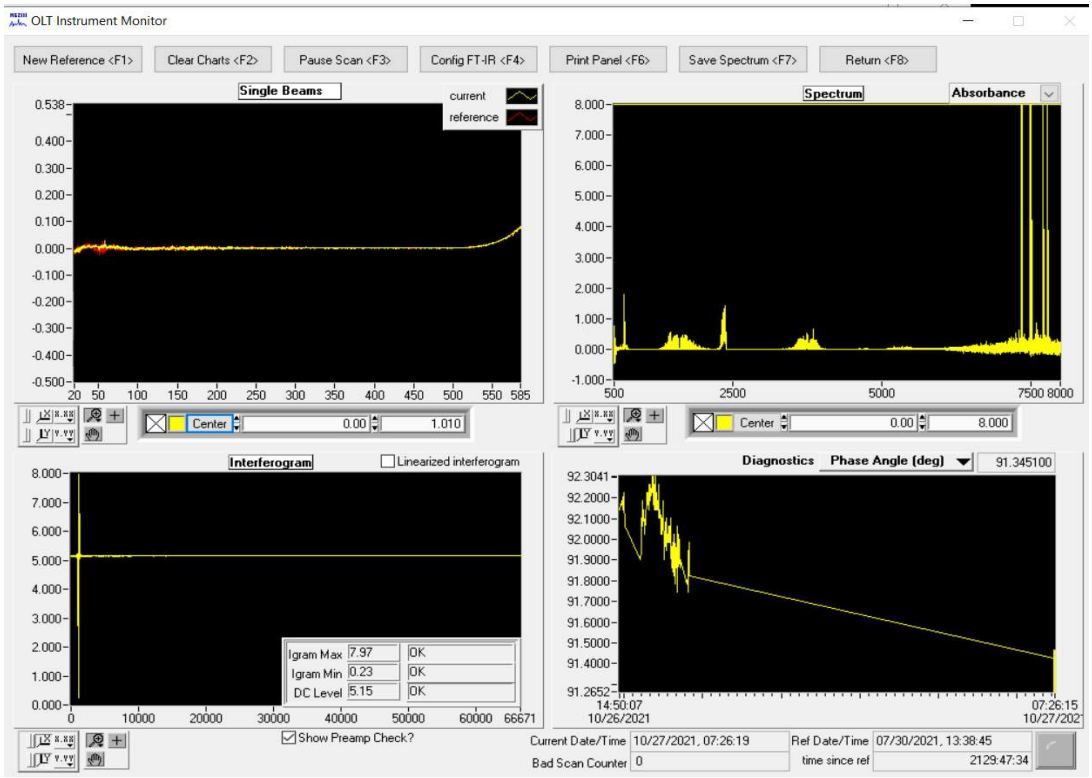


Test 2 QA/QC Screenshots

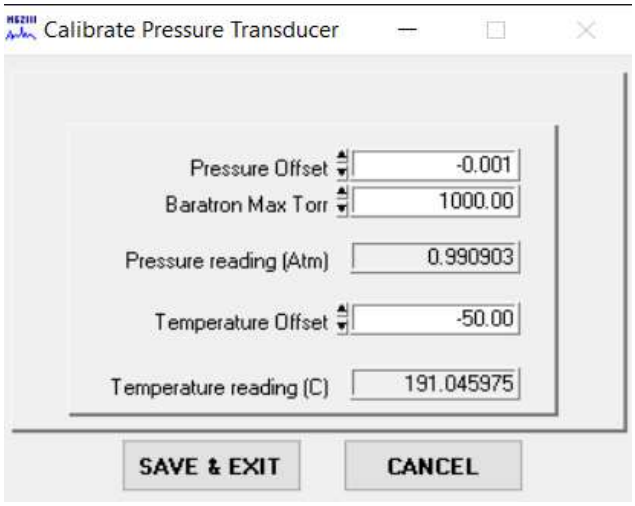
Screenshot#1- Instrument Diagnostics



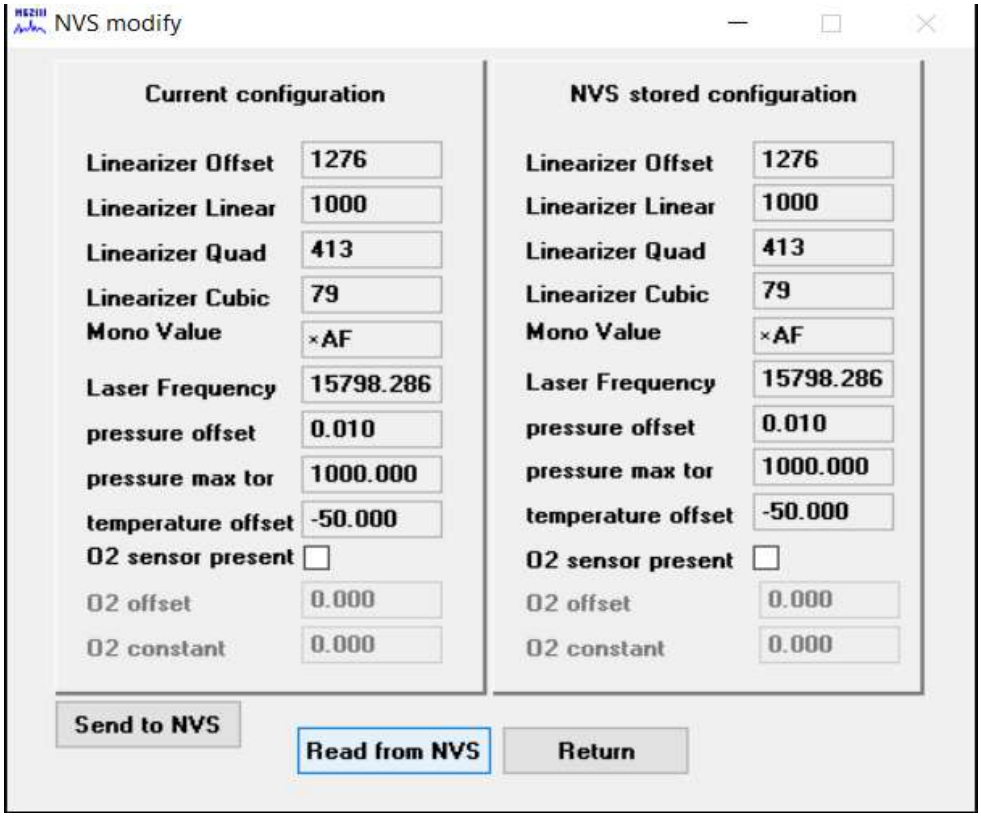
Screenshot#2- Detector Linearity



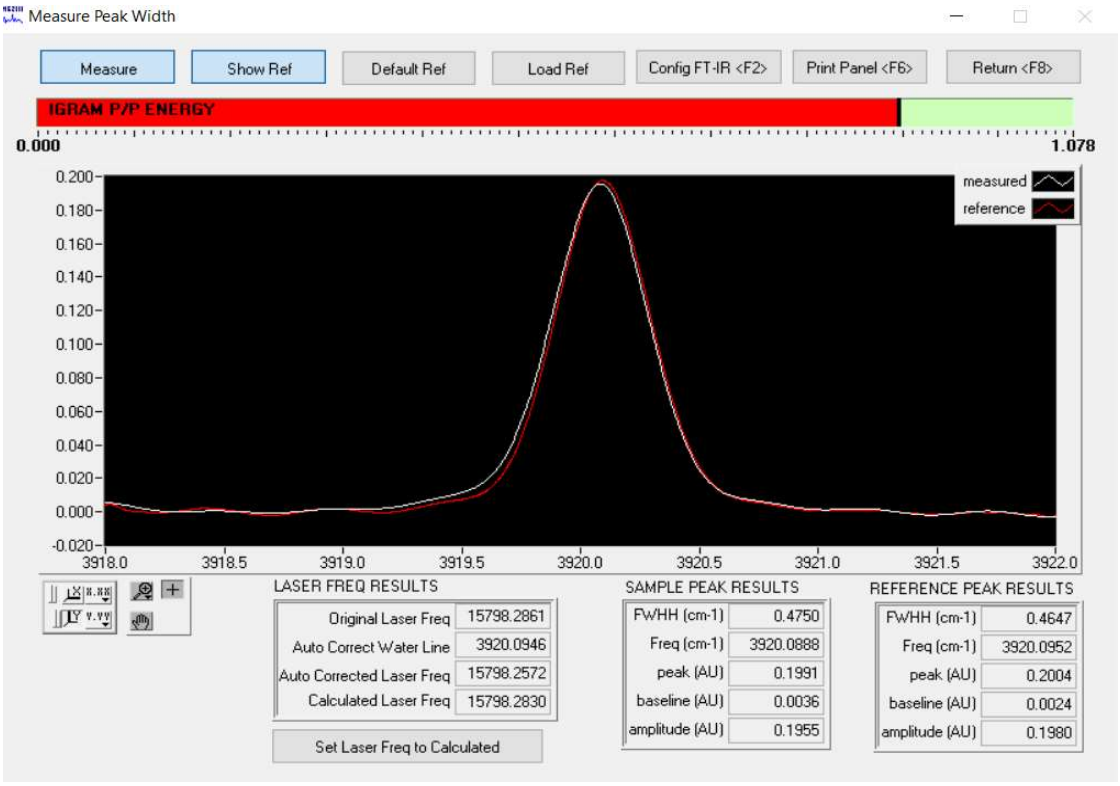
Screenshot#3- Pressure Transducer Settings



Screenshot#4- Linearizer Constants

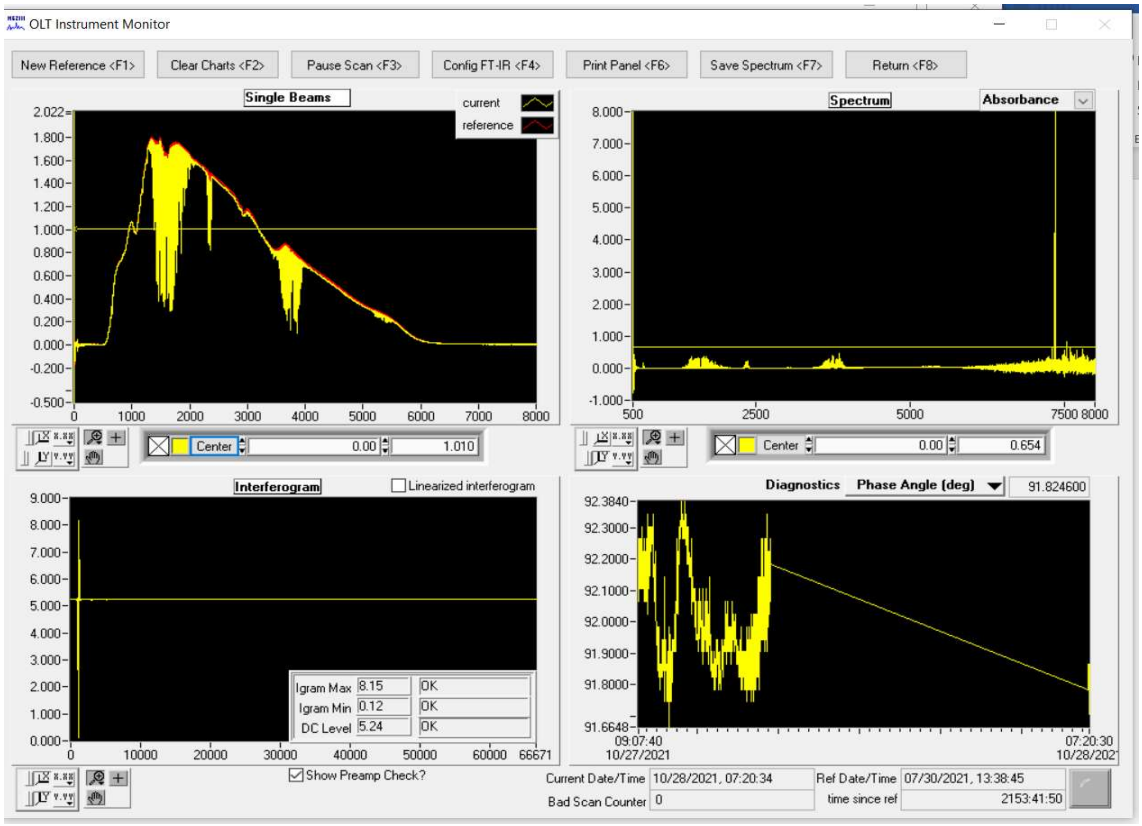


Screenshot#5- Peak Analysis

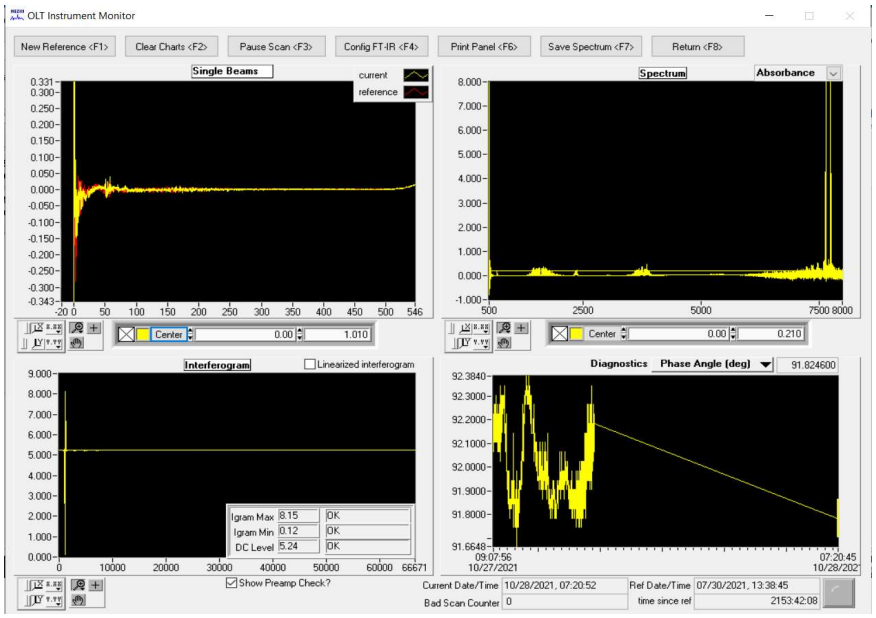


Test 3 QA/QC Screenshots

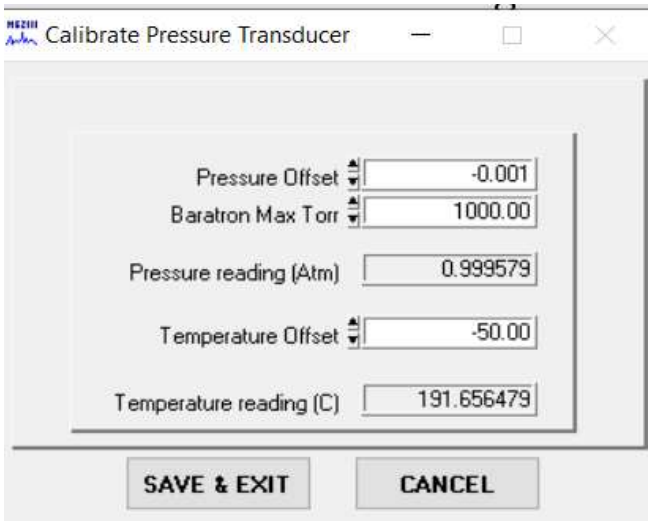
Screenshot#1- Instrument Diagnostics



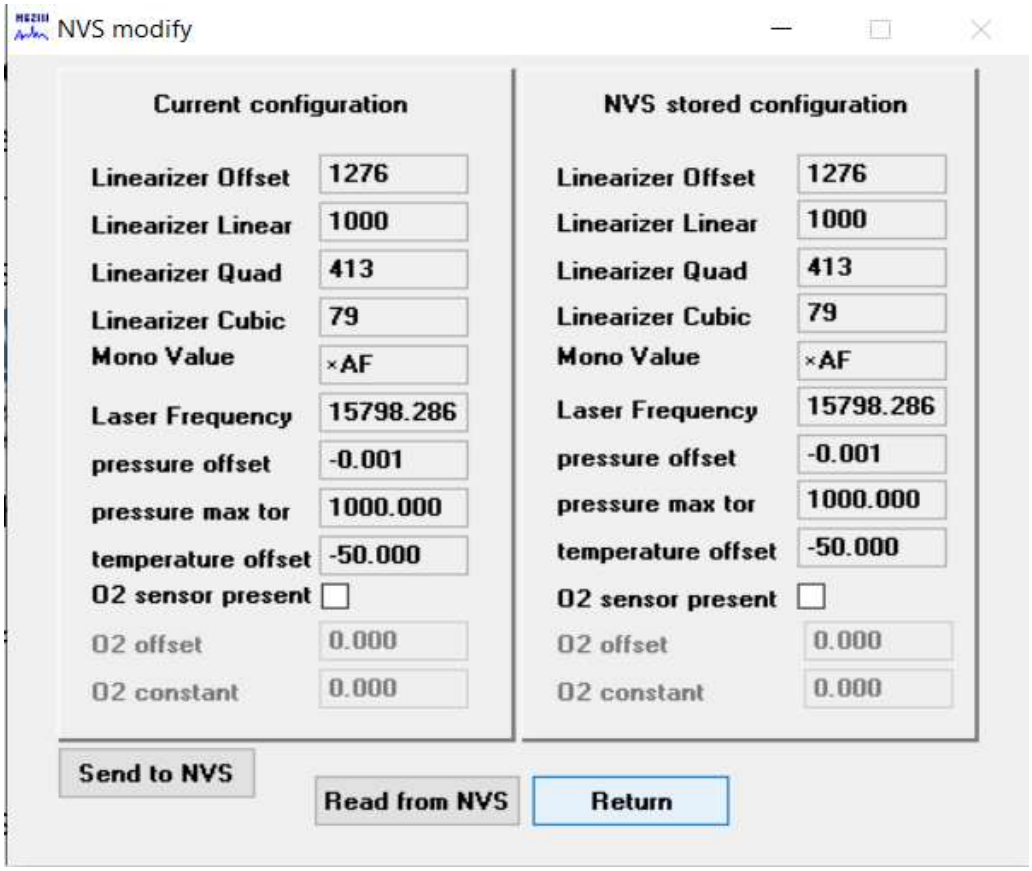
Screenshot#2- Detector Linearity



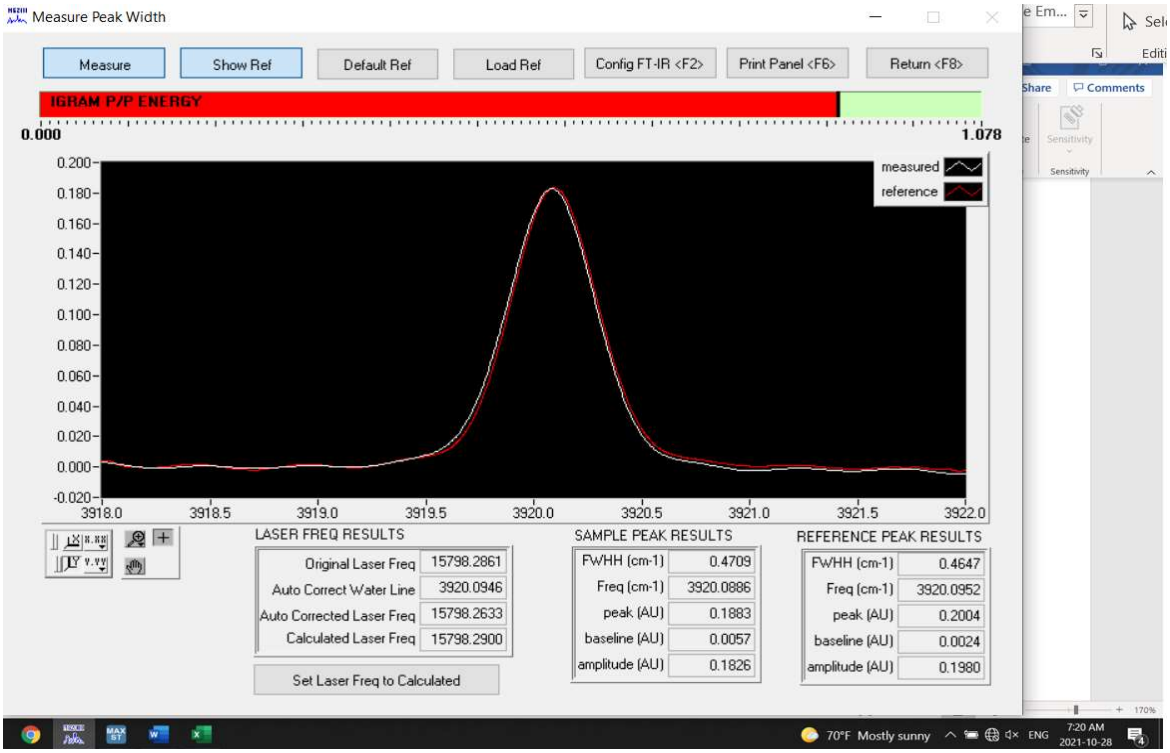
Screenshot#3- Pressure Transducer Settings



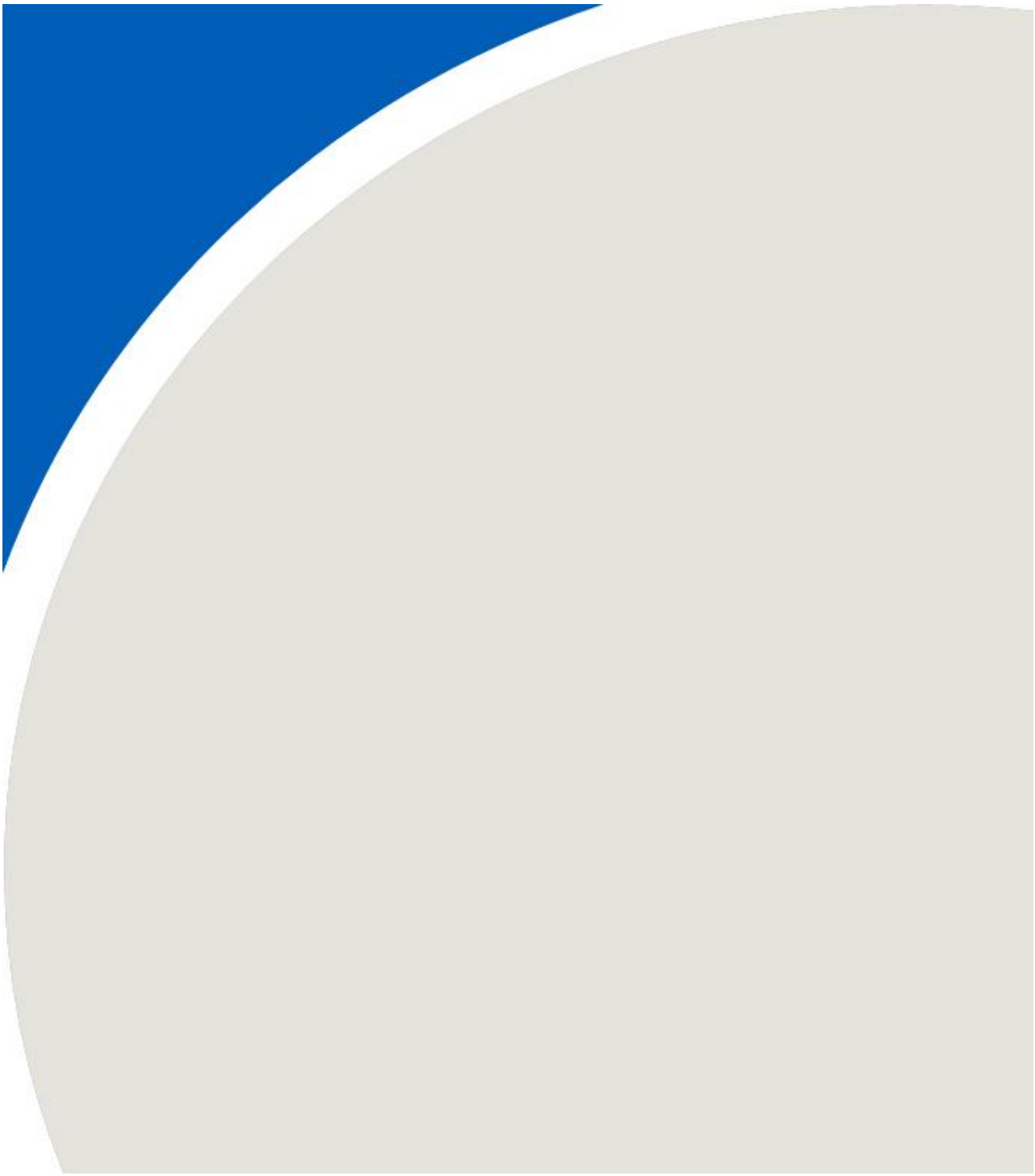
Screenshot#4- Linearizer Constants



Screenshot#5- Peak Analysis



APPENDIX B



Particulate Matter and Metals Sampling Results

Aberdeen Proving Grounds Main Incinerator Stack

Test :	Test #1			Test #2			Test #3			AVERAGE RESULTS			
Sample Volume (Rm^3) [1] :	3.50			3.53			3.64						
Stack Flow Rate (Rm^3/s) [1] :	0.56			0.57			0.59						
Parameter	**Lab Data**	**Concentration**	**Emission Rate**	**Lab Data**	**Concentration**	**Emission Rate**	**Lab Data**	**Concentration**	**Emission Rate**	**Concentration**	**Concentration @ 7% O_2**	**Emission Rate**	
Particulate	**(mg)**	**(gr/dscf)**	**(lbs/hr)**	**(mg)**	**(gr/dscf)**	**(lbs/hr)**	**(mg)**	**(gr/dscf)**	**(lbs/hr)**	**(gr/dscf)**	**(gr/dscf)**	**(lbs/hr)**	
Particulate in Acetone Rinse	2.9	-	-	6.3	-	-	5.4	-	-	-	-	-	
Particulate on Filter	20.6	-	-	25.9	-	-	29.7	-	-	-	-	-	
Total Particulate Matter	23.5	0.0029	0.030	32.2	0.0040	0.041	35.1	0.004	0.045	0.004	0.0061	0.039	
Metals	**(µg)**	**($µg/m^3$)**	**(µg/s)**	**(µg)**	**($µg/m^3$)**	**(µg/s)**	**(µg)**	**($µg/m^3$)**	**(µg/s)**	**($µg/m^3$)**	**($µg/m^3$)**	**(µg/s)**	lb/hr
Antimony	85.2	24.30	13.7	103	29.20	16.600	143	39.30	23.100	31.00	50.63	17.80	1.41E-04
Arsenic	1	0.29	0.161	1	0.28	0.161	1	0.28	0.161	0.28	0.46	0.16	1.28E-06
Barium	12.5	3.57	2.010	12.4	3.51	2.000	10.7	2.94	1.730	3.34	5.50	1.91	1.52E-05
Beryllium	0.2	0.06	0.032	0.2	0.06	0.032	0.2	0.06	0.032	0.06	0.09	0.03	2.56E-07
Cadmium	1.49	0.43	0.239	2.37	0.67	0.382	1.95	0.54	0.315	0.55	0.90	0.31	2.48E-06
Chromium	6.13	1.75	0.984	7.28	2.06	1.170	7.84	2.16	1.270	1.99	3.27	1.14	9.06E-06
Cobalt	0.393	0.11	0.063	0.538	0.15	0.087	0.602	0.17	0.097	0.14	0.24	0.08	6.53E-07
Copper	48.6	13.90	7.81	71.1	20.20	11.500	69.0	19.00	11.100	17.70	29.04	10.10	8.04E-05
Lead	49.8	14.20	8.00	76.1	21.60	12.300	49.5	13.60	7.990	16.50	27.20	9.42	7.47E-05
Manganese	36.9	10.50	5.93	37.0	10.50	5.960	29.8	8.19	4.810	9.74	16.06	5.57	4.42E-05
Nickel	5.48	1.57	0.880	6.80	1.93	1.100	5.41	1.49	0.873	1.66	2.74	0.95	7.54E-06
Phosphorus	100	28.60	16.1	112	31.70	18.000	100	27.50	16.100	29.30	48.17	16.80	1.33E-04
Selenium	2	0.57	0.321	2.49	0.71	0.401	2.90	0.80	0.468	0.69	1.13	0.40	3.15E-06
Silver	8.02	2.29	1.290	11.3	3.20	1.820	7.79	2.14	1.260	2.55	4.20	1.46	1.16E-05
Thallium	0.321	0.09	0.052	0.388	0.11	0.063	0.311	0.09	0.050	0.10	0.16	0.05	4.35E-07
Zinc	1090	311.00	175	1420	402	229	1140	313	184	342	564.24	196	1.56E-03
Mercury	**(µg)**	**($µg/m^3$)**	**(µg/s)**	**(µg)**	**($µg/m^3$)**	**(µg/s)**	**(µg)**	**($µg/m^3$)**	**(µg/s)**	**($µg/m^3$)**	**($µg/m^3$)**	**(µg/s)**	lb/hr
Filterable Hg	0.015	-	-	0.015	-	-	0.015	-	-	-		-	
Non-Filterable Hg	< 0.267	-	-	< 0.5398	-	-	< 0.6012	-	-	-		-	
Total Hg	< 0.28	< 0.081	< 0.045300	< 0.55	< 0.2	< 0.089400	< 0.62	< 0.17	< 0.10	< 0.14	< 0.22	< 0.08	6.20E-07

Notes :

[1] Sample volume and volumetric flow rate based on dry referenced conditions (101.3 kPa and 68 °F)

***'<'** indicates that laboratory results were below the Reportable Detection Limit (RDL). This detection limit was used to calculate the concentration and emission rate.*

Concentration and Emission Rate has been reported to 3 significant figures.

Average O2 12.43333

Particulate Matter and Metals Sampling

Aberdeen Proving Grounds Main Incinerator Stack

Facility:	Ecowaste	**Operator:**	MDS
City:	Aberdeen, MD	**Entered by:**	DTD
Source:	Incinerator	**Checked by:**	MDS
Reference Method:	US EPA Method 5/29		

DATA INPUTS	**Symbol**	**Units**	**Test #1** TPM/Metals	**Test #2** TPM/Metals	**Test #3** TPM/Metals
Date			26-Oct-21	27-Oct-21	28-Oct-21
Start Time			11:04 AM	9:40 AM	9:26 AM
End Time			3:14 PM	1:58 PM	1:32 PM
Round Stack, Diameter (Inside)	d_s	in	24	24	24
Standard Temperature	T_s	°F	68	68	68
Standard Pressure	P_s	in.Hg	29.92	29.92	29.92
Nozzle Diameter	D_n	in	0.5	0.5	0.500
Average Stack Temperature	T_s	°F	802	836	860
Average Meter Temperature	T_m	°F	78	77	75
Barometric Pressure	P_{bar}	" Hg	30.29	29.7	29.9
Stack Static Pressure	P_g	" H_2O	-0.09	-0.09	-0.09
Average Delta H	dH	" H_2O	0.84	0.89	0.93
Average Velocity Head (root mean square)	dP_{rms}	" H_2O	0.04	0.04	0.04
Pitot Coefficient	C_p	-	0.840	0.840	0.840
	Pitot ID :		Valley 4'		
Gas Sample Volume	V_m	ft^3	126.77	130.27	132.84
DGM Calibration Factor	Y	-	0.9790	0.9790	0.9790
	DGM ID:		Detroit A		
Total Sampling Time	min	minutes	240	240	240
Stack Gas Oxygen Concentration	O_2	%	12.5	12.7	12.1
Stack Gas Carbon Dioxide Concentration	CO_2	%	6.5	6.5	6.4
Impinger Gain	W_w	g	256.5	274.0	271.3

Particulate Matter and Metals Sampling

Facility:	Ecowaste	**Operator:**	MDS
City:	Aberdeen, MD	**Entered by:**	DTD
Source:	Incinerator	**Checked by:**	MDS
Reference Method:	US EPA Method 5/29		

Emissions Calculations	**Symbol**	**Units**	**Test #1** TPM / Metals	**Test #2** TPM / Metals	**Test #3** TPM / Metals	**AVERAGE** TPM / Metals
Nozzle Area	A_n	ft²	1.36E-03	1.36E-03	1.36E-03	
Stack Area	A_s	ft²	3.14	3.14	3.14	
Average Stack Temperature	T_s	°R	1262	1296	1320	1293
Average DGM Temperature	T_m	°R	538	537	535	537
Sample Volume at Reference Conditions	V_{mStd}	ft³	123.67	124.68	128.50	
	V_{mmstd}	**m³**	**3.50**	**3.53**	**3.64**	
Vol. of Water Vapour	V_{wStd}	ft³	12.07	12.89	12.77	12.58
Water Fraction	B_{ws}		8.9%	9.4%	9.0%	9.1%
Molecular Weight, dry	M_d	g/mole	29.66	29.66	29.62	29.65
Molecular Weight, wet	M_w	g/mole	28.62	28.56	28.57	28.59
Absolute Stack Pressure	P_s	in. Hg	30.28	29.69	29.89	29.96
Stack Gas Velocity	U_s	ft/s	16.38	17.45	18.16	17.33
	U_{sm}	**m/s**	**4.99**	**5.32**	**5.53**	5.28
Actual Gas Flow Rate	Q_{act}	acf/min	3,087	3,289	3,423	3,266
Dry Gas Flow Rate (dry, ref)	Q_{ref}	dscf/min	1,191	1,205	1,244	1,214
	Q_{mref}	**m³/min**	**34**	**34**	**35**	34
	Qmref (Actual O_2)	**m³/s**	**0.56**	**0.57**	**0.59**	0.57
Isokinetic Rate	I	%	100	100	99	100

Particulate Matter and Metals Sampling

Facility:	Aberdeen Proving	**Operator:**	MDS
City:	Aberdeen, MD	**Entered by:**	BTD
Source:	Incinerator	**Checked by:**	MDS
Reference Method:	USEPA M5/29	**Test Date:**	26-Oct-21
Run:	Test #1		

Pt.	Time (min)	Velocity Press. ("H_2O)	Orifice Press. ("H_2O)	Meter Volume (ft³)	Stack Temp (°F)	Probe Temp (°F)	Box Temp (°F)	Imp Temp (°F)	Meter Temp (°F)	Vac Pressure ("Hg)	Percentage Isokinetic (%)	Stack Velocity (ft/sec)
Traverse 1- West												
Pre-Test Leak Check =		<0.01 @ 10" Hg										
1	0	0.03	0.78	484.50	761		250	50	74	2	104	14.76
	5	0.03	0.77	487.05	764		252	48	72	2	100	14.78
2	10	0.03	0.72	489.50	767		250	49	76	2	98	14.80
	15	0.03	0.72	491.90	762		256	48	74	2	99	14.77
3	20	0.03	0.72	494.33	760		251	46	74	2	99	14.76
	25	0.04	0.96	496.76	771		250	46	75	2	99	17.12
4	30	0.04	0.93	499.55	808		253	46	76	2	100	17.37
	35	0.04	0.93	502.34	817		256	46	76	2	100	17.43
5	40	0.04	0.93	505.13	827		254	48	77	2	100	17.50
	45	0.04	0.93	507.90	821		254	50	78	2	100	17.46
6	50	0.04	0.91	510.69	837		251	52	78	2	101	17.57
	55	0.04	0.92	513.48	833		248	53	79	2	99	17.54
7	60	0.04	0.91	516.23	843		248	55	78	2	102	17.61
	65	0.03	0.71	519.04	796		252	58	78	2	103	14.97
8	70	0.03	0.71	521.56	793		253	59	79	2	101	14.95
	75	0.03	0.71	524.02	798		252	57	79	2	100	14.98
9	80	0.03	0.71	526.46	795		256	57	79	2	100	14.97
	85	0.03	0.72	528.91	777		252	52	79	2	99	14.86
10	90	0.03	0.72	531.35	770		250	52	80	2	99	14.82
	95	0.03	0.72	533.79	763		249	52	80	2	98	14.77
11	100	0.03	0.73	536.21	764		250	52	80	2	101	14.78
	105	0.03	0.74	538.71	760		251	52	80	2	98	14.76
12	110	0.03	0.74	541.13	747		253	52	80	2	101	14.68
	115	0.03	0.74	543.64	743		255	53	80	2	99	14.65
	120			546.11								
Traverse 2- North												
1	120	0.03	0.81	546.11	647		257	55	80	2	99	14.06
	125	0.03	0.87	548.70	568		251	50	79	2	101	13.55
2	130	0.03	0.92	551.43	512		259	50	79	2	101	13.17
	135	0.03	0.70	554.23	810		254	51	80	2	107	15.06
3	140	0.04	0.92	556.83	835		259	51	80	2	100	17.56
	145	0.04	0.92	559.60	838		258	50	80	2	100	17.58
4	150	0.04	0.92	562.39	840		244	51	80	2	101	17.59
	155	0.04	0.92	565.18	849		256	51	80	2	97	17.65
5	160	0.04	0.92	567.85	838		254	51	79	2	100	17.58
	165	0.04	0.91	570.61	846		246	51	79	2	100	17.63
6	170	0.04	0.91	573.37	848		257	51	78	2	100	17.64
	175	0.04	0.91	576.13	850		252	51	78	2	101	17.66
7	180	0.04	0.90	578.90	851		245	51	78	2	95	17.66
	185	0.04	0.91	581.52	850		250	51	78	2	97	17.66
8	190	0.04	0.91	584.20	840		252	51	77	2	101	17.59
	195	0.04	0.89	586.98	864		248	51	77	2	101	17.75
9	200	0.04	0.89	589.75	863		253	52	76	2	95	17.74
	205	0.04	0.89	592.33	863		260	52	76	2	105	17.74
10	210	0.04	0.89	595.20	864		255	52	76	2	97	17.75
	215	0.04	0.89	597.86	878		254	51	75	2	99	17.84
11	220	0.04	0.89	600.54	864		254	51	75	2	98	17.75
	225	0.04	0.89	603.21	868		256	51	75	2	99	17.78
12	230	0.04	0.89	605.90	871		247	52	74	2	99	17.80
	235	0.04	0.89	608.59	867		249	52	75	2	99	17.77
	240			611.27								
Post-test Leak Check =		<0.01 @ 5" Hg										
	Average	0.04	0.84	126.77	802	#DIV/0!	252	51	78	-	100	16.38

Particulate Matter and Metals Sampling

Facility: Ecowaste
City: Aberdeen, MD
Source: Incinerator
Reference Method: US EPA Method 5/29
Run: Test #2

Operator: MDS
Entered by: BTD
Checked by: MDS
Test Date: 27-Oct-21

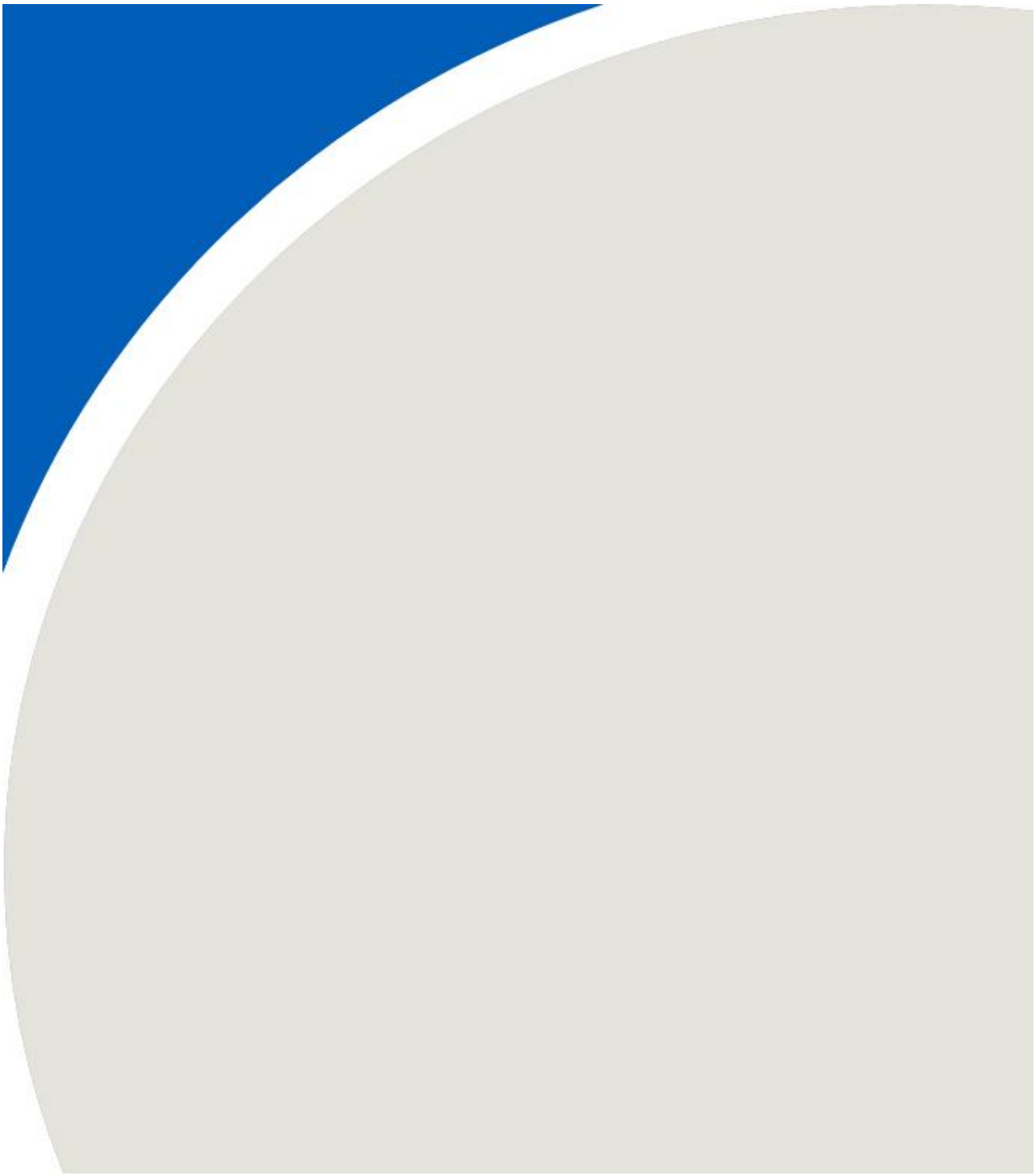
Pt.	Time (min)	Velocity Press. ("H_2O)	Orifice Press. ("H_2O)	Meter Volume (ft³)	Stack Temp (°F)	Probe Temp (°F)	Box Temp (°F)	Imp Temp (°F)	Meter Temp (°F)	Vac Pressure ("Hg)	Percentage Isokinetic (%)	Stack Velocity (ft/sec)
Traverse 1- North												
Pre-Test Leak Check =	<0.01 @ 10" Hg											
1	0	0.03	0.70	611.62	819		249	51	78	2	99	15.27
	5	0.03	0.70	614.02	801		254	49	77	2	99	15.17
2	10	0.03	0.71	616.43	790		249	49	77	2	98	15.10
	15	0.03	0.71	618.83	788		253	49	76	2	100	15.09
3	20	0.03	1.12	621.29	784		252	49	76	2	100	15.06
	25	0.05	1.10	623.73	856		246	53	75	2	102	20.00
4	30	0.05	1.10	626.86	863		253	55	76	2	101	20.05
	35	0.05	1.10	629.96	879		256	58	76	2	100	20.18
5	40	0.05	1.10	633.00	879		253	59	75	2	99	20.18
	45	0.05	1.10	636.01	879		249	57	76	2	100	20.18
6	50	0.05	1.10	639.06	881		250	59	77	2	101	20.19
	55	0.05	1.10	642.13	876		257	59	77	2	100	20.15
7	60	0.05	1.10	645.18	876		252	59	77	2	99	20.15
	65	0.03	0.70	648.22	805		249	61	77	2	101	15.19
8	70	0.03	0.69	650.69	829		252	55	77	2	97	15.33
	75	0.03	0.70	653.04	807		249	57	78	2	99	15.20
9	80	0.03	0.70	655.45	805		250	57	79	2	101	15.19
	85	0.03	0.71	657.92	806		248	57	81	2	99	15.20
10	90	0.03	0.71	660.36	807		250	57	82	2	98	15.20
	95	0.03	0.71	662.78	805		246	59	81	2	101	15.19
11	100	0.03	0.71	665.26	805		253	60	81	2	100	15.19
	105	0.03	0.70	667.71	811		248	60	81	2	100	15.23
12	110	0.03	0.71	670.17	805		251	60	81	2	102	15.19
	115	0.03	0.71	672.68	806		256	61	80	2	94	15.20
	120			674.98								
Traverse 2- West												
1	0	0.03	0.70	674.98	807		250	61	78	2	98	15.20
	5	0.03	0.70	677.37	806		252	62	78	2	98	15.20
2	10	0.03	0.69	679.77	821		251	62	77	2	100	15.29
	15	0.03	0.70	682.20	804		250	62	77	2	98	15.18
3	20	0.03	0.70	684.60	804		251	62	77	2	98	15.18
	25	0.05	1.10	686.99	846		249	63	77	2	98	19.93
4	30	0.05	1.10	690.02	884		246	63	76	2	100	20.21
	35	0.05	1.10	693.07	855		250	63	77	2	99	19.99
5	40	0.05	1.10	696.11	868		251	59	76	2	98	20.09
	45	0.05	1.10	699.12	866		250	59	76	2	100	20.08
6	50	0.05	1.10	702.19	870		245	60	76	2	99	20.11
	55	0.05	1.10	705.21	866		250	60	76	2	102	20.08
7	60	0.05	1.10	708.33	863		253	61	76	2	100	20.05
	65	0.05	1.10	711.39	867		255	61	76	2	100	20.08
8	70	0.05	1.10	714.45	854		247	61	76	2	100	19.99
	75	0.05	1.10	717.54	859		250	60	77	2	99	20.02
9	80	0.05	1.10	720.59	855		250	63	77	2	97	19.99
	85	0.05	1.10	723.57	858		253	64	77	2	100	20.02
10	90	0.05	1.10	726.66	852		253	60	77	2	97	19.97
	95	0.03	0.68	729.66	852		251	58	77	2	105	15.47
11	100	0.03	0.69	732.17	829		249	43	78	2	101	15.33
	105	0.03	0.69	734.62	832		249	43	78	2	101	15.35
12	110	0.03	0.68	737.06	839		253	43	77	2	101	15.39
	115	0.03	0.69	739.49	828		249	43	77	2	99	15.33
	120			741.89								
Post-test Leak Check =	<0.01 @ 5" Hg											
	Average	0.04	0.89	130.27	836	#DIV/0!	251	57	77	-	100	17.45

Particulate Matter and Metals Sampling

Facility:	Aberdeen Proving	**Operator:**	MDS
City:	Aberdeen, MD	**Entered by:**	BTD
Source:	Incinerator	**Checked by:**	MDS
Reference Method:	USEPA M5/29	**Test Date:**	28-Oct-21
Run:	Test #3		

Pt.	Time (min)	Velocity Press. ("H_2O)	Orifice Press. ("H_2O)	Meter Volume (ft³)	Stack Temp (°F)	Probe Temp (°F)	Box Temp (°F)	Imp Temp (°F)	Meter Temp (°F)	Vac Pressure ("Hg)	Percentage Isokinetic (%)	Stack Velocity (ft/sec)
Traverse 1- West												
Pre-Test Leak Check =	<0.01 @ 10" Hg											
1	0	0.03	0.68	742.15	828		249	52	70	2	101	15.33
	5	0.03	0.68	744.57	833		250	50	70	2	101	15.36
2	10	0.03	0.68	746.98	833		252	48	71	2	100	15.36
	15	0.03	0.68	749.37	833		250	48	70	2	99	15.36
3	20	0.05	1.10	751.74	884		249	48	71	2	99	20.21
	25	0.05	1.10	754.73	884		250	48	71	2	98	20.21
4	30	0.05	1.10	757.69	880		252	47	72	2	99	20.18
	35	0.05	1.10	760.70	886		251	50	72	2	98	20.23
5	40	0.05	1.10	763.66	883		251	48	73	2	95	20.21
	45	0.05	1.10	766.56	881		250	48	73	2	99	20.19
6	50	0.05	1.10	769.57	879		250	49	74	2	99	20.18
	55	0.05	1.10	772.58	879		250	49	74	2	100	20.18
7	60	0.05	1.10	775.62	879		249	50	74	2	100	20.18
	65	0.05	1.10	778.66	871		251	50	74	2	99	20.12
8	70	0.05	1.10	781.69	879		251	50	74	2	99	20.18
	75	0.05	1.10	784.71	870		249	51	75	2	97	20.11
9	80	0.05	1.10	787.67	849		251	51	74	2	95	19.95
	85	0.05	1.10	790.61	842		251	51	75	2	99	19.89
10	90	0.05	1.10	793.67	852		249	51	75	2	101	19.97
	95	0.05	1.10	796.78	842		251	52	75	2	101	19.89
11	100	0.03	0.68	799.90	842		249	52	75	2	105	15.41
	105	0.03	0.68	802.42	845		249	52	75	2	101	15.43
12	110	0.03	0.69	804.85	824		250	52	75	2	99	15.30
	115	0.03	0.69	807.25	830		249	52	75	2	101	15.34
	120			809.69								
Traverse 2- North												
1	120	0.03	0.69	809.69	816		250	53	75	2	100	15.26
	125	0.03	0.69	812.11	814		248	54	75	2	96	15.24
2	130	0.03	0.69	814.44	816		249	54	75	2	100	15.26
	135	0.03	0.69	816.86	827		248	54	75	2	99	15.32
3	140	0.05	1.20	819.25	813		250	54	75	2	99	19.67
	145	0.05	1.10	822.35	865		249	55	77	2	101	20.07
4	150	0.05	1.10	825.45	880		251	56	76	2	100	20.18
	155	0.05	1.10	828.52	870		251	56	77	2	99	20.11
5	160	0.05	1.10	831.57	858		250	56	77	2	100	20.02
	165	0.05	1.10	834.66	865		252	56	77	2	100	20.07
6	170	0.05	1.10	837.75	876		252	57	78	2	99	20.15
	175	0.05	1.10	840.80	858		250	57	78	2	98	20.02
7	180	0.05	1.10	843.83	863		250	58	78	2	99	20.05
	185	0.05	1.10	846.89	868		252	58	78	2	100	20.09
8	190	0.05	1.10	849.96	871		249	59	78	2	98	20.12
	195	0.05	1.10	852.99	858		249	60	78	2	99	20.02
9	200	0.03	0.68	856.05	841		250	61	79	2	101	15.40
	205	0.03	0.68	858.49	884		252	61	79	2	105	15.66
10	210	0.03	0.66	860.98	892		253	61	79	2	99	15.70
	215	0.03	0.68	863.33	889		250	62	79	2	99	15.69
11	220	0.03	0.68	865.68	883		251	62	79	2	98	15.65
	225	0.03	0.66	868.02	883		252	62	79	2	98	15.65
12	230	0.03	0.66	870.36	888		250	63	79	2	98	15.68
	235	0.03	0.66	872.68	898		249	63	79	2	97	15.74
	240			874.99								
Post-Test Leak Check =	<0.01 @ 5" Hg											
	Average	0.04	0.93	132.84	860	#DIV/0!	250	54	75	-	99	18.16

APPENDIX C



Sampling Results - Polychlorinated Aromatic Hydrocarbons

Source: Incinerator Main Stack

Test :	**Test #1**			Test 1 Concentration @68 °F and 7 % O_2	**Test #2**			Test 2 Concentration @68 °F and 7 % O_2	**Test #3**			Test 3 Concentration @68 °F and 7 % O_2	Average Concentration	Average Concentration @68 °F and 7 % O_2	Average Emission Rate
Sample Volume (m^3) [1] :	3.55				3.29				3.48						
Stack Flow Rate (m^3/s) [1] :	0.55				0.55				0.57						
	(ng)	**(ng/m^3)**	**(ng/s)**	**(ng/m^3)**	**(ng)**	**(ng/m^3)**	**(ng/s)**	**(ng/m^3)**	**(ng)**	**(ng/m^3)**	**(ng/s)**	**(ng/m^3)**	**(ng/m^3)**	**(ng/m^3)**	**(lb/hr)**
Naphthalene	3920	1100	610	1826	2060	630	340	1062	4070	1200	670	1845	966.0	1585.81	4.30E-06
2-Methylnaphthalene	79.7	22	12	37.12	46	14	7.6	23.72	68.3	20	11	30.96	18.7	30.66	8.20E-08
Acenaphthylene	171	48	26	79.64	67.4	21	11	34.75	142	41	23	64.37	36.5	59.86	1.60E-07
Acenaphthene	19.4	5.5	3	9.03	< 6.0	< 1.80	< 0.99	< 3.09	15.5	4.4	2.6	7.03	< 3.91	< 6.42	< 1.70E-08
Fluorene	333	94	51	155	104	32	17	53.63	250	72	41	113	65.7	107.86	2.90E-07
Phenanthrene	3700	1000	570	1723	1380	420	230	712	3030	870	500	1373	777.0	1275.41	3.40E-06
Anthracene	97.3	27	15	45.31	37.3	11	6.2	19.23	24.1	6.9	4	10.92	15.2	24.98	6.60E-08
Fluoranthene	184	52	28	85.69	78.8	24	13	40.63	98.6	28	16	44.69	34.7	56.94	1.50E-07
Pyrene	88.7	25	14	41.31	23.4	7.1	3.9	12.07	21.6	6.2	3.6	9.79	12.8	20.95	5.60E-08
Benzo(a)Anthracene	6.87	1.9	1.1	3.20	< 6.0	< 1.80	< 0.99	< 3.09	< 6.0	< 1.70	< 0.99	< 2.72	< 1.83	< 3.00	< 8.00E-09
Chrysene	8920	2500	1400	4154	3180	970	530	1640	7330	2100	1200	3323	1860	3054	8.20E-06
Benzo(b)Fluoranthene	39.6	11	6.1	18.44	15.5	4.7	2.6	7.99	21.9	6.3	3.6	9.93	7.4	12.12	3.20E-08
Benzo(k)Fluoranthene	< 6.0	< 1.70	< 0.93	< 2.79	6.6	2	1.1	3.40	< 6.0	< 1.70	< 0.99	< 2.72	< 1.81	< 2.96	< 7.90E-09
Benzo(e)Pyrene	47.5	13	7.3	22.12	13.2	4	2.2	6.81	26.8	7.7	4.4	12.15	8.4	13.72	3.70E-08
Benzo(a)Pyrene	< 6.0	1.7	0.93	2.79	10.9	3.3	1.8	5.62	11	3.2	1.8	4.99	2.7	4.47	1.20E-08
Perylene	16.9	4.8	2.6	7.87	< 6.0	< 1.80	< 0.99	< 3.09	11.5	3.3	1.9	5.21	< 3.29	< 5.41	< 1.50E-08
Indeno(1,2,3-cd)Pyrene	9.51	2.7	1.5	4.43	< 6.0	< 1.80	< 0.99	< 3.09	< 6.0	< 1.70	< 0.99	< 2.72	< 2.07	< 3.41	< 9.10E-09
Dibenzo(a,h)Anthracene	< 6.0	< 1.70	< 0.93	< 2.79	< 6.0	< 1.80	< 0.99	< 3.09	< 6.0	< 1.70	< 0.99	< 2.72	< 1.75	< 2.87	< 7.70E-09
Benzo(g,h,i)Perylene	< 6.0	< 1.70	< 0.93	< 2.79	< 6.0	< 1.80	< 0.99	< 3.09	< 6.0	< 1.70	< 0.99	< 2.72	< 1.75	< 2.87	< 7.70E-09

Notes :

[1] Sample volume and volumetric flow rate based on dry referenced conditions (101.3 kPa and 68 °F)

***'<'** indicates that laboratory results were below the Reportable Detection Limit (RDL) This detection limit was used to calculate the concentration and emission rate.*

Concentration and Emission Rate has been re 2 significant figures.

*CDD = chlorodibenzo-*p*-dioxin

**CDF = chlorodibenzo-*p*-furan

Sampling Results - Dioxins and Furans

Source: Incinerator Main Stack

Test :	Test #1			Test 1 Concentration @68 °F and 7 % O_2	Test #2			Test 2 Concentration @68 °F and 7 % O_2	Test #3			Test 3 Concentration @68 °F and 7 % O_2	Average Concentration	Average Concentration	1989 NATO TEF's	Average TEQ Concentration @68 °F and 7 % O_2	TEQ Emission Rate	TEQ Emission Rate
Sample Volume (m^3) [1] :	3.55				3.29				3.48									
Stack Flow Rate (m^3/s) [1] :	0.55				0.55				0.57									
	(pg)	(pg/m^3)	(pg/s)	(ng/m^3)	(pg)	(pg/m^3)	(pg/s)	(ng/m^3)	(pg)	(pg/m^3)	(pg/s)	(ng/m^3)	(pg/m^3)	(ng/m^3)		(ng/m^3)	(ng/s)	(lb/hr)
2,3,7,8-Tetra CDD *	988	280	150	0.46	772	230	130	0.40	978	280	160	0.44	265.0	0.3	1.0	0.43	0.15	1.19E-09
1,2,3,7,8-Penta CDD *	3160	890	490	1.47	2910	890	480	1.50	3540	1000	580	1.60	930.0	0.9	0.5	0.76	0.26	2.06E-09
1,2,3,4,7,8-Hexa CDD *	1390	390	210	0.65	1320	400	220	0.68	1540	440	250	0.70	412.0	0.4	0.1	0.07	0.023	1.83E-10
1,2,3,6,7,8-Hexa CDD *	2180	610	340	1.02	1940	590	320	1.00	2420	690	400	1.10	633.0	0.6	0.1	0.10	0.035	2.78E-10
1,2,3,7,8,9-Hexa CDD *	2910	820	450	1.36	2370	720	390	1.22	3050	880	500	1.38	805.0	0.8	0.1	0.13	0.045	3.57E-10
1,2,3,4,6,7,8-Hepta CDD *	5990	1700	930	2.79	5860	1800	970	3.02	7530	2200	1200	3.41	1880.0	1.9	0.01	0.03	0.01	7.94E-11
1,2,3,4,6,7,8,9-Octa CDD *	2500	700	390	1.16	3090	940	510	1.59	4000	1100	660	1.81	930.0	0.9	0.001	0.0015	0.00052	4.13E-12
2,3,7,8-Tetra CDF **	11500	3200	1800	5.36	9920	3000	1600	5.12	12000	3400	2000	5.44	3230.0	3.2	0.1	0.53	0.18	1.43E-09
1,2,3,7,8-Penta CDF **	10600	3000	1600	4.94	8010	2400	1300	4.13	10300	3000	1700	4.67	2790.0	2.8	0.05	0.23	0.078	6.19E-10
2,3,4,7,8-Penta CDF **	31500	8900	4900	14.67	31000	9400	5100	15.98	42900	12000	7100	19.45	10200.0	10.2	0.5	8.37	2.8	2.22E-08
1,2,3,4,7,8-Hexa CDF **	10100	2800	1600	4.70	8350	2500	1400	4.31	12600	3600	2100	5.71	3000.0	3.0	0.1	0.49	0.17	1.35E-09
1,2,3,6,7,8-Hexa CDF **	10600	3000	1600	4.94	8020	2400	1300	4.14	11700	3400	1900	5.30	2930.0	2.9	0.1	0.48	0.16	1.27E-09
2,3,4,6,7,8-Hexa CDF **	11300	3200	1700	5.26	9190	2800	1500	4.74	14200	4100	2300	6.44	3350.0	3.4	0.1	0.55	0.19	1.51E-09
1,2,3,7,8,9-Hexa CDF **	1880	530	290	0.88	1620	490	270	0.84	2330	670	380	1.06	564.0	0.6	0.1	0.09	0.031	2.46E-10
1,2,3,4,6,7,8-Hepta CDF **	15200	4300	2300	7.08	12300	3700	2000	6.34	19800	5700	3300	8.98	4570.0	4.6	0.01	0.07	0.025	1.98E-10
1,2,3,4,7,8,9-Hepta CDF **	1260	350	190	0.59	940	290	160	0.48	1480	420	240	0.67	355.0	0.4	0.01	0.0058	0.002	1.59E-11
1,2,3,4,6,7,8,9-Octa CDF **	1490	420	230	0.69	1320	400	220	0.68	2010	580	330	0.91	466.0	0.5	0.001	0.0008	0.00026	2.06E-12
Total TEQ D/F													37310.0	37.3	**Total TEQ D/F**	12.37	4.16	3.30E-08

Notes :

[1] Sample volume and volumetric flow rate based on dry referenced conditions (101.3 kPa and 68 °F) sum(

'<' indicates that laboratory results were below the Reportable Detection Limit (RDL) This detection limit was used to calculate the concentration and emission rate.

Concentration and Emission Rate has been re 2 significant figures.

*CDD = chlorodibenzo-*p*-dioxin

**CDF = chlorodibenzo-*p*-furan

Dioxin and Furans / Polychlorinated Aromatic Hydrocarbons Sampling

Aberdeen Proving Grounds

Facility:	Aberdeen Proving Grounds	**Operator:**	TD
City:	Aberdeen, MD	**Entered by:**	TD
Source:	Incinerator Main Stack	**Checked by:**	KNE
Reference Method:	US EPA Method 23		

DATA INPUTS	**Symbol**	**Units**	**Test #1**	**Test #2**	**Test #3**
			Dioxins /Furans	Dioxins /Furans	Dioxins /Furans
Date			26-Oct-21	27-Oct-21	28-Oct-21
Start Time			11:04 AM	9:40 AM	9:26 AM
End Time			3:14 PM	1:58 PM	1:32 PM
Round Stack, Diameter (Inside)	d_s	in	24	24	24
Standard Temperature	T_s	°F	68	68	68
Standard Pressure	P_s	" Hg	29.9	29.9	29.9
Nozzle Diameter	D_n	in	0.5	0.5	0.5
Average Stack Temperature	T_s	°F	818	836	840
Average Meter Temperature	T_m	°F	74	74	73
Barometric Pressure	P_{bar}	" Hg	29.5	29.7	29
Stack Static Pressure	P_g	" H_2O	-0.09	-0.09	-0.09
Average Delta H	dH	" H_2O	0.80	0.75	0.86
Average Velocity Head	dP_{rms}	" H_2O	0.04	0.04	0.04
Pitot Coefficient	C_p	-	0.840	0.840	0.840
		Pitot ID ->	Valley 4' 2		
Gas Sample Volume	V_m	ft³	128.89	118.36	128.37
DGM Calibration Factor	Y	-	0.997	0.997	0.997
		DGM ID ->	RWDI Console E		
Total Sampling Time	min	min	240	240	240
Stack Gas Oxygen Concentration	O_2	%	12.5	12.7	12.1
Stack Gas Carbon Dioxide Concentration	CO_2	%	6.5	8.9	8.9
Impinger Gain	W_w	g	260	245.2	258.1

Dioxin and Furans / Polychlorinated Aromatic Hydrocarbons Sampling

Facility:	Aberdeen Proving Grounds	**Operator:**	TD/ML
City:	Aberdeen, MD	**Entered by:**	TD
Source:	Incinerator Main Stack	**Checked by:**	KNE
Reference Method:	US EPA Method 23		

Emissions Calculations	**Symbol**	**Units**	**Test #1** Dioxins /Furans	**Test #2** Dioxins /Furans	**Test #3** Dioxins /Furans	**AVERAGE**
Nozzle Area	A_n	ft²	0.00136	0.00136	0.00136	
Stack Area	A_s	ft²	3.14	3.14	3.14	
Average Stack Temperature	T_s	°R	1278	1296	1300	1291
Average DGM Temperature	T_m	°R	534	534	533	
Sample Volume at Reference Conditions	V_{mStd}	ft³	125.56	116.17	123.13	
	V_{mmstd}	**m³**	**3.55**	**3.29**	**3.48**	
Vol. of Water Vapour	V_{wStd}	ft³	12.2356	11.539112	12.146186	
Water Fraction	B_{ws}		8.9%	9.0%	9.0%	9.0%
Molecular Weight, dry	M_d	g/mole	29.66	30.04	30.02	29.91
Molecular Weight, wet	M_w	g/mole	28.62	28.95	28.94	28.84
Absolute Stack Pressure	P_s	" Hg	29.49	29.69	28.99	29.39
Stack Gas Velocity	U_s	ft/s	16.63	16.66	18.02	17.10
	U_{sm}	**m/s**	**5.07**	**5.08**	**5.49**	**5.21**
Actual Gas Flow Rate	Q_{act}	acf/min	3,135	3,139	3,396	3,223
Dry Gas Flow Rate (dry, ref)	Q_{ref}	dscf/min	1,164	1,155	1,217	1,178
	Q_{Rm}	m³/min	33	33	34	33
	Qmref (Actual O_2)	**m³/s**	**0.55**	**0.55**	**0.57**	**0.6**
	Qmref (@7% O_2)	**m^3/s**	**0.9**	**0.9**	**0.9**	**0.9**
Isokinetic Rate	I	%	104	96	97	99

Dioxin and Furans / Polychlorinated Aromatic Hydrocarbons Sampling

Facility: Aberdeen Proving Grounds
City: Aberdeen, MD
Source: Incinerator
Reference Method: US EPA Method 23
Run: Test 1

Operator: NL
Entered by: BTD
Checked by: KNE
Test Date: 26-Oct-21

Point	Time (min)	Velocity Pressure (" H_2O)	Orifice Pressure (" H_2O)	Meter Volume (ft^3)	Stack Temp (^oF)	Probe Temp (^oF)	Box Temp (^oF)	Imp Temp (^oF)	Meter Temp (^oF)	XAD Trap (^oF)	Vacuum Pressure (" Hg)	Percentage Isokinetic (%)	Stack Velocity (ft/s)
Traverse 1- North													
Pre-Test Leak Check =		<0.01 @ 15" Hg											
1	0	0.05	1.15	5.62	761	250	238	66	70	55	3	104	19.31
	5	0.03	0.67	8.87	784	250	237	61	70	54	3	98	15.10
2	10	0.03	0.68	11.22	767	250	240	61	70	60	3	96	15.00
	15	0.03	0.67	13.54	778	250	243	59	71	60	4	98	15.06
3	20	0.04	0.91	15.89	762	250	247	59	71	58	5	98	17.28
	25	0.10	2.20	18.62	781	250	246	58	71	56	7	95	27.53
4	30	0.05	1.20	22.77	829	250	246	58	71	56	5	109	19.84
	35	0.03	0.66	26.09	813	250	242	58	72	54	4	101	15.27
5	40	0.03	0.66	28.50	816	250	244	58	72	52	4	101	15.29
	45	0.08	1.70	30.91	854	250	244	59	73	51	6	97	25.34
6	50	0.04	0.85	34.60	860	250	243	60	74	45	4	102	17.96
	55	0.04	0.85	37.36	855	250	240	59	74	44	4	101	17.93
7	60	0.05	1.05	40.11	861	250	244	58	74	44	5	105	20.09
	65	0.05	1.09	43.30	827	250	245	57	74	45	5	104	19.83
8	70	0.03	0.65	46.48	828	250	248	57	75	46	4	108	15.36
	75	0.03	0.65	49.05	828	250	249	56	75	47	4	103	15.36
9	80	0.03	0.66	51.50	816	250	247	56	76	46	4	104	15.29
	85	0.03	0.67	54.00	785	250	247	56	75	45	4	112	15.10
10	90	0.03	0.67	56.70	786	250	246	55	76	45	4	105	15.11
	95	0.03	0.68	59.24	785	250	242	55	76	45	4	106	15.10
11	100	0.03	0.68	61.82	787	250	246	55	77	46	4	104	15.12
	105	0.03	0.68	64.35	788	250	240	56	77	47	4	107	15.12
12	110	0.03	0.68	66.95	790	250	246	56	77	47	4	104	15.14
	115	0.03	0.68	69.47	790	250	249	56	77	48	4	104	15.14
	120			72.00									
Traverse 2- West													
1	120	0.03	0.68	72.00	790	250	249	66	77	49	4.0	102	15.14
	125	0.04	0.90	74.47	789	250	246	63	77	49	4	108	17.47
2	130	0.04	0.90	77.49	790	250	248	59	77	50	5	106	17.48
	135	0.04	0.90	80.47	791	250	248	59	77	51	5	105	17.48
3	140	0.04	0.85	83.40	853	250	240	59	76	52	5	103	17.91
	145	0.04	0.90	86.22	798	250	242	59	77	51	5	109	17.53
4	150	0.04	0.90	89.25	805	250	247	59	77	46	5	108	17.58
	155	0.03	0.67	92.25	804	250	241	60	76	46	4	107	15.22
5	160	0.03	0.67	94.83	804	250	241	62	76	45	4	104	15.22
	165	0.03	0.66	97.33	818	250	245	63	76	46	4	104	15.30
6	170	0.03	0.64	99.83	856	250	244	62	76	45	4	106	15.53
	175	0.03	0.64	102.33	858	250	249	58	76	46	4	106	15.54
7	180	0.03	0.64	104.83	856	250	251	58	75	45	4	107	15.53
	185	0.03	0.64	107.35	857	250	247	58	75	46	4	103	15.54
8	190	0.04	0.85	109.78	859	250	247	58	74	46	5	105	17.95
	195	0.03	0.65	112.63	851	250	249	58	74	45	5	110	15.50
9	200	0.03	0.64	115.22	846	250	243	58	73	46	4	104	15.47
	205	0.03	0.64	117.67	843	250	240	58	73	46	4	103	15.45
10	210	0.03	0.64	120.09	842	250	248	58	73	47	4	103	15.45
	215	0.03	0.64	122.51	839	250	246	58	72	48	4	104	15.43
11	220	0.03	0.64	124.95	852	250	247	58	72	49	4	104	15.51
	225	0.03	0.64	127.40	849	250	248	58	71	50	4	99	15.49
12	230	0.03	0.64	129.73	839	250	250	59	71	51	4	101	15.43
	235	0.03	0.64	132.10	839	250	241	59	71	52	4	102	15.43
	240			134.51									
Post-Test Leak Check =		<0.01 @ 12" Hg											
	Average	0.04	0.80	128.89	818	250	245	59	74	49	-	104	16.63

Dioxin and Furans / Polychlorinated Aromatic Hydrocarbons Sampling

Facility:	Aberdeen Proving Grounds	**Operator:**	NL
City:	Aberdeen, MD	**Entered by:**	BTD
Source:	Incinerator	**Checked by:**	KNE
Reference Method:	US EPA Method 23	**Test Date:**	27-Oct-21
Run:	Test 1		

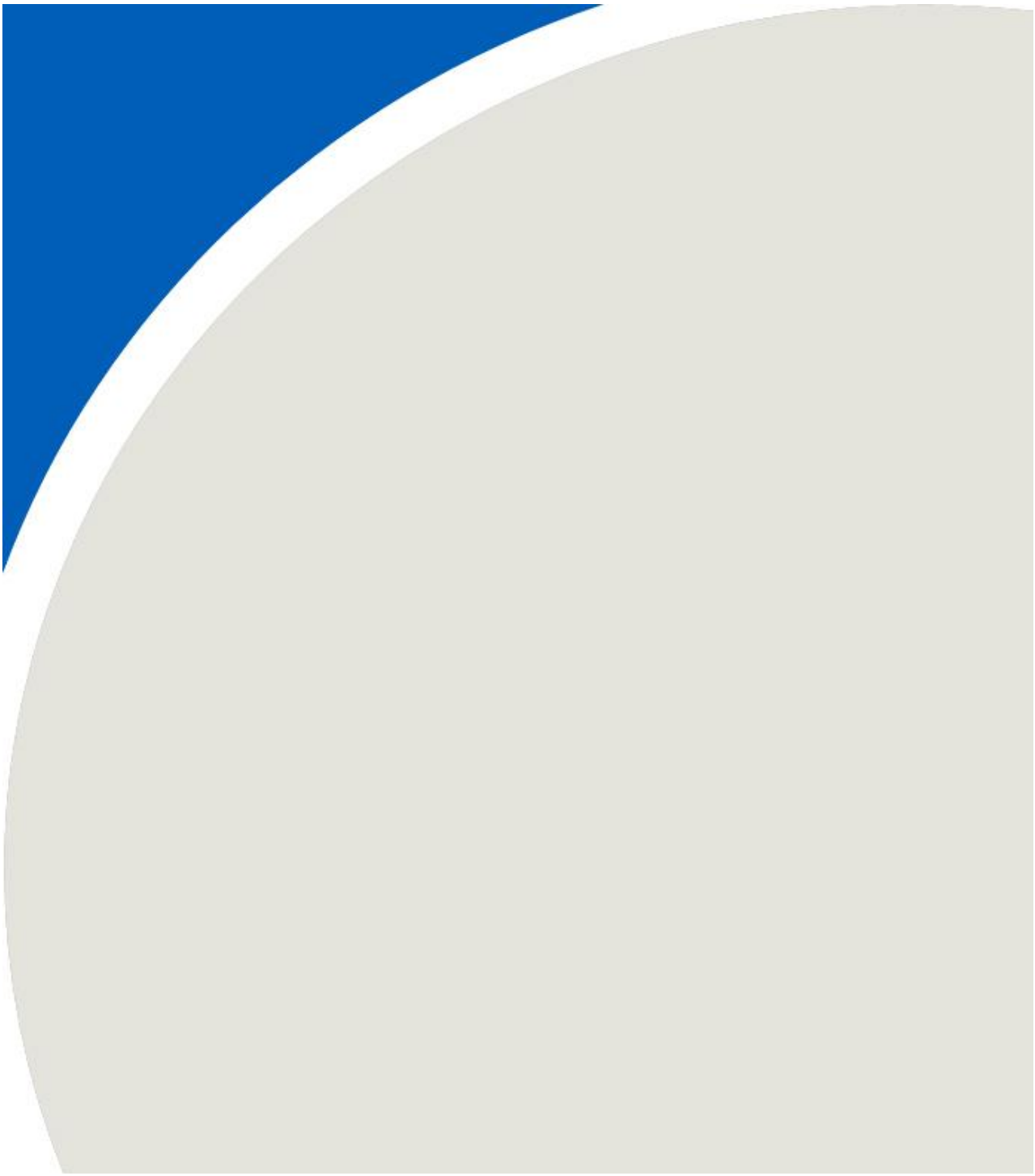
Point	Time (min)	Velocity Pressure (" H_2O)	Orifice Pressure (" H_2O)	Meter Volume (ft^3)	Stack Temp (°F)	Probe Temp (°F)	Box Temp (°F)	Imp Temp (°F)	Meter Temp (°F)	XAD Trap (°F)	Vacuum Pressure (" Hg)	Percentage Isokinetic (%)	Stack Velocity (ft/s)
Traverse 1- West													
Pre-Test Leak Check =		<0.01 @ 13" Hg											
1	0	0.03	0.65	164.69	814	250	243	66	73	42	1	99	15.28
	5	0.03	0.65	167.04	801	250	237	61	74	42	1	95	15.20
2	10	0.03	0.65	169.31	799	250	247	61	73	41	1	93	15.19
	15	0.03	0.65	171.55	800	250	252	59	73	41	1	96	15.20
3	20	0.03	0.62	173.84	856	250	242	59	73	41	1	92	15.53
	25	0.03	0.62	176.00	864	250	244	58	72	45	3	99	15.58
4	30	0.03	0.62	178.30	867	250	242	58	73	43	3	98	15.59
	35	0.03	0.61	180.58	877	250	238	58	73	43	3	102	15.65
5	40	0.03	0.61	182.96	880	250	233	58	72	45	3	93	15.67
	45	0.04	0.82	185.12	879	250	231	59	72	47	3	95	18.09
6	50	0.04	0.82	187.66	880	250	232	60	73	47	3	97	18.09
	55	0.04	0.82	190.25	875	250	237	59	73	47	3	95	18.06
7	60	0.04	0.82	192.81	878	250	234	58	73	48	3	97	18.08
	65	0.04	0.84	195.41	845	250	232	57	75	49	3	95	17.86
8	70	0.03	0.64	198.00	842	250	231	57	75	50	2	98	15.45
	75	0.03	0.63	200.33	842	250	239	56	76	51	2	98	15.45
9	80	0.03	0.64	202.65	837	250	238	56	76	44	3	98	15.42
	85	0.03	0.63	204.99	858	250	238	56	77	43	3	97	15.54
10	90	0.03	0.64	207.28	838	250	236	55	78	42	3	95	15.42
	95	0.03	0.64	209.55	841	250	237	55	78	43	3	96	15.44
11	100	0.03	0.64	211.83	827	250	237	55	78	43	3	95	15.36
	105	0.03	0.65	214.11	818	250	237	56	78	43	3	96	15.30
12	110	0.03	0.64	216.42	838	250	235	56	78	43	3	96	15.42
	115	0.03	0.64	218.70	833	250	233	56	78	44	3	98	15.39
	120			221.03									
Traverse 2- North													
													0.00
1	120	0.03	0.64	221.03	831	250	238	66	76	47	3	92	15.38
	125	0.03	0.65	223.22	805	250	237	61	75	47	3	101	15.23
2	130	0.03	0.65	225.65	805	250	240	61	75	51	4	92	15.23
	135	0.03	0.65	227.85	806	250	243	59	74	51	4	92	15.23
3	140	0.03	0.63	230.06	836	250	247	59	73	52	4	96	15.41
	145	0.05	1.10	232.33	805	250	246	58	73	53	6	98	19.66
4	150	0.05	1.05	235.35	838	250	246	58	72	46	5	95	19.91
	155	0.05	1.05	238.25	836	250	242	58	72	45	5	97	19.90
5	160	0.05	1.05	241.20	843	250	244	58	72	45	5	96	19.95
	165	0.05	1.05	244.10	841	250	244	59	72	45	5	97	19.93
6	170	0.05	1.04	247.04	851	250	243	60	71	47	5	97	20.01
	175	0.05	1.05	249.96	831	250	240	59	72	47	5	96	19.86
7	180	0.04	0.84	252.88	840	250	244	58	72	46	4	97	17.82
	185	0.04	0.84	255.51	835	250	245	57	72	47	4	95	17.79
8	190	0.04	0.85	258.11	832	250	248	57	72	49	4	95	17.77
	195	0.04	0.86	260.71	804	250	249	56	72	50	4	95	17.57
9	200	0.04	0.87	263.33	802	250	247	56	72	52	4	95	17.56
	205	0.04	0.86	265.96	806	250	247	56	72	53	4	98	17.59
10	210	0.04	0.87	268.65	801	250	246	55	72	55	4	95	17.55
	215	0.03	0.65	271.28	800	250	242	55	72	56	3	102	15.20
11	220	0.03	0.63	273.72	843	250	246	55	72	45	3	99	15.45
	225	0.03	0.63	276.05	847	250	240	56	73	44	3	100	15.48
12	230	0.03	0.63	278.40	837	250	246	56	73	45	3	100	15.42
	235	0.03	0.63	280.77	847	250	249	56	73	46	3	98	15.31
	240			283.05									
Post-Test Leak Check =		<0.01 @ 12" Hg											
	Average	0.04	0.75	118.36	836	250	241	58	74	46	-	96	16.66

Dioxin and Furans / Polychlorinated Aromatic Hydrocarbons Sampling

Facility:	Aberdeen Proving Grounds	**Operator:**	NL
City:	Aberdeen, MD	**Entered by:**	BTD
Source:	Incinerator	**Checked by:**	KNE
Reference Method:	US EPA Method 23	**Test Date:**	28-Oct-21
Run:	Test 1		

Point	Time (min)	Velocity Pressure (" H_2O)	Orifice Pressure (" H_2O)	Meter Volume (ft^3)	Stack Temp (°F)	Probe Temp (°F)	Box Temp (°F)	Imp Temp (°F)	Meter Temp (°F)	XAD Trap (°F)	Vacuum Pressure (" Hg)	Percentage Isokinetic (%)	Stack Velocity (ft/sec)
Traverse 1- North													
Pre-test Leak Check =		<0.01 @ 13" Hg											
1	0	0.03	0.68	312.46	763	250	250	66	69	40	2	95	14.97
	5	0.03	0.66	314.76	775	250	248	61	69	41	2	94	15.04
2	10	0.03	0.66	317.02	779	250	252	61	69	41	2	95	15.07
	15	0.03	0.66	319.30	780	250	250	59	69	43	3	94	15.07
3	20	0.03	0.67	321.56	752	250	253	59	69	41	3	97	14.90
	25	0.03	0.63	323.91	832	250	252	58	69	41	3	93	15.39
4	30	0.04	0.85	326.09	832	250	251	58	70	41	3	93	17.77
	35	0.04	0.84	328.61	834	250	254	58	69	41	3	97	17.78
5	40	0.05	1.05	331.23	835	250	252	58	70	42	4	98	19.89
	45	0.05	1.05	334.20	830	250	250	59	70	42	4	95	19.85
6	50	0.05	1.05	337.09	831	250	251	60	71	42	4	96	19.86
	55	0.05	1.05	340.00	829	250	250	59	71	42	4	95	19.84
7	60	0.05	1.15	342.89	723	250	247	58	72	41	4	98	19.01
	65	0.05	1.00	346.00	866	250	250	57	72	42	4	103	20.12
8	70	0.05	1.00	349.10	871	250	254	57	73	43	4	91	20.16
	75	0.04	0.82	351.83	867	250	251	56	72	43	4	98	18.01
9	80	0.04	0.83	354.46	862	250	252	56	73	43	4	97	17.97
	85	0.04	0.83	357.09	858	250	251	56	73	43	4	96	17.95
10	90	0.04	0.83	359.70	862	250	251	55	74	44	4	100	17.97
	95	0.04	0.83	362.40	854	250	251	55	73	46	4	90	17.92
11	100	0.04	0.83	364.83	861	250	249	55	74	45	4	100	17.97
	105	0.04	0.86	367.53	823	250	251	56	74	46	4	98	17.71
12	110	0.03	0.65	370.21	814	250	250	56	74	47	3	96	15.28
	115	0.03	0.64	372.50	829	250	248	56	74	49	3	100	15.37
	120			374.87									
Traverse 2- West													
													0.00
1	120	0.03	0.64	374.87	817	250	252	66	74	51	3	98	15.30
	125	0.03	0.64	377.22	825	250	251	61	74	52	3	98	15.35
2	130	0.04	0.86	379.56	814	250	248	61	74	54	4	96	17.64
	135	0.04	0.86	382.20	820	250	251	59	74	55	4	96	17.68
3	140	0.05	1.00	384.85	870	250	250	59	75	56	5	99	20.15
	145	0.05	1.05	387.84	862	250	252	58	74	51	5	103	20.09
4	150	0.05	1.00	390.95	863	250	254	58	75	42	5	96	20.10
	155	0.06	1.20	393.87	875	250	252	58	75	41	5	97	22.12
5	160	0.05	1.00	397.07	860	250	250	58	75	42	5	99	20.08
	165	0.05	1.00	400.08	862	250	248	59	75	42	5	96	20.09
6	170	0.05	1.00	403.00	861	250	248	60	75	42	5	101	20.09
	175	0.05	1.00	406.05	863	250	252	59	75	42	5	97	20.10
7	180	0.05	1.00	409.00	863	250	250	58	76	41	5	97	20.10
	185	0.05	1.00	411.95	866	250	251	57	76	42	5	96	20.12
8	190	0.05	1.00	414.86	875	250	251	57	76	42	5	97	20.19
	195	0.04	0.83	417.79	868	250	250	56	76	43	4	104	18.01
9	200	0.04	0.84	420.60	856	250	246	56	76	42	5	92	17.93
	205	0.04	0.84	423.11	860	250	250	56	76	42	5	99	17.96
10	210	0.04	0.83	425.80	866	250	250	55	77	43	5	101	18.00
	215	0.04	0.83	428.55	873	250	248	55	76	45	5	95	18.05
11	220	0.04	0.83	431.11	867	250	250	55	77	43	5	100	18.01
	225	0.03	0.63	433.83	857	250	249	56	76	44	4	100	15.54
12	230	0.03	0.63	436.19	859	250	247	56	77	43	4	98	15.55
	235	0.03	0.63	438.51	866	250	252	56	76	44	4	99	15.61
	240			440.83									
Post-test Leak Check =		<0.01 @ 12" Hg											
		0.04	0.86	128.37	840	250	250	58	73	44	-	97	18.02

APPENDIX D



Hydrogen Halide Sampling

Test :	Test No. 1							Test No. 2							Test No. 3							AVERAGE RESULTS	
Sample ID :	L2659099-5							L2659099-6							L2659099-7								
Sample Volume (Rm^3) [1] :	0.81							0.80							0.84								
Stack Flow Rate (Rm^3/s) [1] :	0.52							0.5							0.6								
O2%	12.5							12.7							12.1								
	Lab Data (ug)	Concentration (ug/m^3)	Emission Rate (mg/s)	Emission Rate (lb/hr)	Concentration (mg/m^3)	Concentration (ppmvd)	Concentration (ppmvd 7% O_2)	Lab Data (ug)	Concentration (ug/m^3)	Emission Rate (mg/s)	Emission Rate (lb/hr)	Concentration (mg/m^3)	Concentration (ppmvd)	Concentration (ppmvd 7% O_2)	Lab Data (ug)	Concentration (ug/m^3)	Emission Rate (mg/s)	Emission Rate (lb/hr)	Concentration (mg/m^3)	Concentration (ppmvd)	Concentration (ppmvd 7% O_2)	Concentration (ppmvd 7% O_2)	Emission Rate (lb/hr)
Hydrogen Flouride	210	258	0.133	1.06E-03	0.26	0.31	0.51	251	315	0.166	1.32E-03	0.32	0.38	0.64	251	298	0.166	1.32E-03	0.30	0.36	0.57	0.574	1.23E-03
Hydrogen Chloride	9740	12000	6.17	4.90E-02	12.00	7.92	13.10	34200	42900	22.6	1.79E-01	42.90	28.31	47.99	94400	112000	62.4	4.95E-01	112.00	73.91	116.74	59.3	2.41E-01
Hydrogen Bromide	< 1270	1560	0.805	6.39E-03	1.560	0.464	0.768	< 1170	1470	0.775	6.15E-03	1.470	0.437	0.741	< 1420	1680	0.939	7.45E-03	1.68	0.500	0.789	0.766	6.66E-03

Notes: *[1] Sample volume and volumetric flow rate based on dry referenced conditions (101.3kPa, and 68 ^{o} F)*

'<' indicates that laboratory results were below the detection limit. This detection limit was used to calculate the concentration and emission rate.

Hydrogen Halide Sampling

Facility:	Ecowaste	**Operator:**	NL
City:	Aberdeen, MD	**Entered by:**	BTD
Source:	Incinerator	**Checked by:**	MDS
Reference Method:	US EPA Method 26A		

DATA INPUTS	**Symbol**	**Units**	**Test #1** 26A	**Test #2** 26A	**Test #3** 26A
Date			10/26/2021	10/27/2021	10/28/2021
Start Time			3:29 PM	2:17 PM	1:52 PM
End Time			4:31 PM	3:17 PM	2:52 PM
Round Stack, Diameter (Inside)	d_s	in	24	24	24
Standard Temperature	T_s	^oF	68	68	68
Standard Pressure	P_s	in.Hg	29.92	29.92	29.92
Nozzle Diameter	D_n	in	0.500	0.500	0.500
Average Stack Temperature	T_s	^oF	809	867	851
Average Meter Temperature	T_m	^oF	71	73	75
Barometric Pressure	P_{bar}	" Hg	29.5	29.5	29.75
Stack Static Pressure	P_g	" H_2O	-0.09	-0.09	-0.09
Average Delta H	dH	" H_2O	0.66	0.73	0.78
Average Velocity Head (root mean square)	dP_{rms}	" H_2O	0.03	0.03	0.04
Pitot Coefficient	C_p	-	0.84	0.84	0.84
		Pitot ID :	VES 4H		
Gas Sample Volume	V_m	ft^3	29.40	28.95	30.43
DGM Calibration Factor	Y	-	0.9950	0.9950	0.9950
		DGM ID:	Console A		
Total Sampling Time	min	minutes	60	60	60
Stack Gas Oxygen Concentration	O_2	%	12.5	12.7	12.1
Stack Gas Carbon Dioxide Concentration	CO_2	%	6.5	6.5	6.4
Impinger Gain	W_w	g	45.6	47.6	47.3

Hydrogen Halide Sampling

Facility:	Ecowaste	**Operator:**	NL
City:	Aberdeen, MD	**Entered by:**	BTD
Source:	Incinerator	**Checked by:**	MDS
Reference Method:	US EPA Method 26A		

Emissions Calculations	**Symbol**	**Units**	**Test #1** TPM / Metals	**Test #2** TPM / Metals	**Test #3** TPM / Metals	**AVERAGE** TPM / Metals
Nozzle Area	A_n	ft^2	1.36E-03	1.36E-03	1.36E-03	
Stack Area	A_s	ft^2	3.14	3.14	3.14	
Average Stack Temperature	T_s	^oR	1269	1327	1311	1302
Average DGM Temperature	T_m	^oR	531	533	535	
Sample Volume at Reference Conditions	V_{mStd}	ft^3	28.75	28.18	29.78	
	V_{mmstd}	**m^3**	**0.81**	**0.80**	**0.84**	
Vol. of Water Vapour	V_{wStd}	ft^3	2.146	2.240	2.226	
Water Fraction	B_{ws}		0.069	0.074	0.070	7.1%
Molecular Weight, dry	M_d	g/gmole	29.66	29.66	29.62	29.65
Molecular Weight, wet	M_w	g/gmole	28.85	28.80	28.81	28.82
Absolute Stack Pressure	P_s	in. Hg	29.49	29.49	29.74	29.58
Stack Gas Velocity	U_s	ft/s	15.19	16.33	16.83	16.12
	U_{sm}	**m/s**	**4.63**	**4.98**	**5.13**	4.91
Actual Gas Flow Rate	Q_{act}	acf/min	2,863	3,079	3,172	3,038
Dry Gas Flow Rate (dry, ref)	Q_{ref}	dscf/min	1,093	1,119	1,182	1,131
	Q_{mref}	**m^3/min**	**31**	**32**	**33**	32
	Qmref	**m^3/sec**	**0.52**	**0.53**	**0.56**	0.53
Isokinetic Rate	I	%	101	97	97	98

Hydrogen Halide Sampling

Facility:	Aberdeen Proving Grounds	**Operator:**	NL
City:	Aberdeen, MD	**Entered by:**	BTD
Source:	Incinerator	**Checked by:**	MDS
Reference Method:	US EPA Method 26A	**Test Date:**	10/26/2021
Run:	T1		

Pt.	Time (min)	Velocity Press. ("H_2O)	Orifice Press. ("H_2O)	Meter Volume (ft^3)	Stack Temp (°F)	Probe Temp (°F)	Box Temp (°F)	Imp Temp (°F)	Meter Temp (°F)	Vac Pressure ("Hg)	Percentage Isokinetic (%)	Stack Velocity (ft/sec)
Traverse 1												
Pre-test Leak Check =		<0.01 at 15" Hg										
1	0	0.03	0.68	134.95	784	253	253	58	69	1.0	99	15.04
2	5	0.03	0.65	137.37	831	255	255	55	70	1.0	103	15.32
3	10	0.03	0.65	139.85	811	254	254	54	70	1.0	94	15.20
4	15	0.03	0.65	142.12	819	253	253	54	70	1.0	103	15.25
5	20	0.03	0.65	144.6	816	254	254	53	70	1.0	101	15.23
6	25	0.03	0.65	147.05	829	254	255	53	70	1.0	104	15.31
7	30	0.03	0.65	149.55	820	252	253	52	71	1.0	103	15.26
8	35	0.03	0.65	152.05	819	248	250	52	71	1.0	103	15.25
9	40	0.03	0.66	154.55	797	248	252	52	71	1.0	101	15.12
10	45	0.03	0.65	157.01	820	247	250	52	71	1.0	101	15.26
11	50	0.03	0.65	159.45	823	248	252	52	72	1.0	97	15.27
12	55	0.03	0.70	161.80	733	248	252	52	72	1.0	102	14.73
	60			164.35								
Post-test Leak Check =		<0.01 at 2" Hg										
	Average	0.03	0.66	29.40	808.50	251	253	53	71	-	101	15.19

Hydrogen Halide Sampling

Facility:	Aberdeen Proving Grounds	**Operator:**	NL
City:	Aberdeen, MD	**Entered by:**	BTD
Source:	Incinerator	**Checked by:**	MDS
Reference Method:	US EPA Method 26A	**Test Date:**	10/27/2021
Run:	T2		

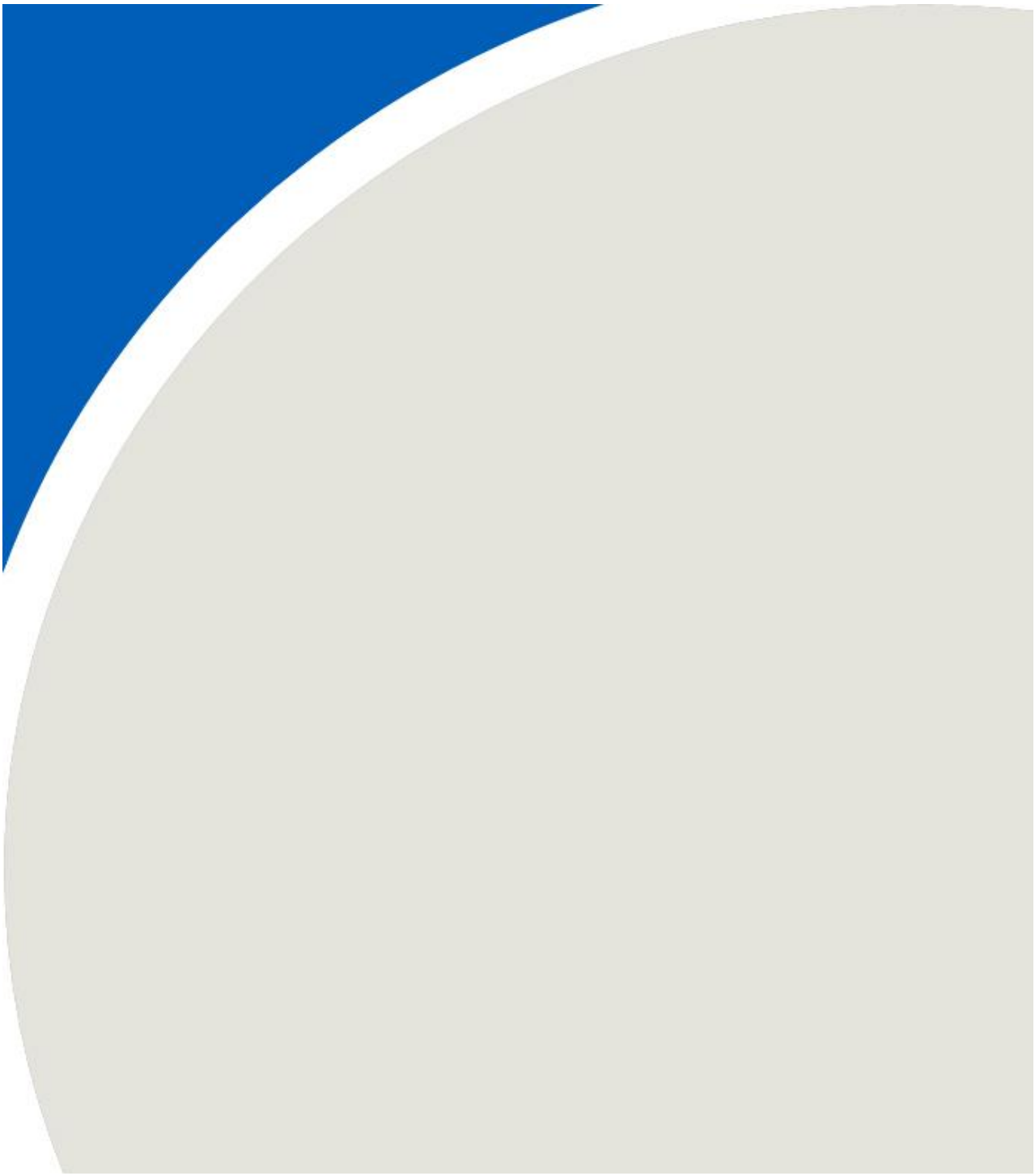
Pt.	Time (min)	Velocity Press. ("H_2O)	Orifice Press. ("H_2O)	Meter Volume (ft^3)	Stack Temp (°F)	Probe Temp (°F)	Box Temp (°F)	Imp Temp (°F)	Meter Temp (°F)	Vac Pressure ("Hg)	Percentage Isokinetic (%)	Stack Velocity (ft/sec)
Traverse 4												
Pre-Test Leak Check =		<0.01 at 15" Hg										
1	0	0.03	0.69	283.24	821	253	245	67	73	2.0	104	15.26
2	5	0.03	0.66	285.75	869	255	246	53	72	2.0	93	15.54
3	10	0.03	0.66	287.94	876	254	249	52	73	2.0	97	15.59
4	15	0.03	0.65	290.24	867	253	242	52	72	2.0	99	15.53
5	20	0.04	0.88	292.58	862	254	242	52	73	2.0	94	17.90
6	25	0.04	0.87	295.17	867	254	243	52	73	2.0	94	17.94
7	30	0.04	0.87	297.75	872	252	242	52	74	2.0	98	17.97
8	35	0.04	0.87	300.44	883	248	247	52	74	2.0	97	18.04
9	40	0.03	0.65	303.08	879	248	244	53	74	2.0	98	15.60
10	45	0.03	0.65	305.40	875	247	231	53	73	2.0	96	15.58
11	50	0.03	0.66	307.67	864	248	242	54	74	2.0	98	15.52
12	55	0.03	0.66	310.00	867	248	240	55	73	2.0	92	15.53
	60			312.19								
Post-Test Leak Check =		<0.01 at 3"Hg										
	Average	0.03	0.73	28.95	867	251	243	54	73	-	97	16.33

Hydrogen Halide Sampling

Facility:	Aberdeen Proving Grounds	**Operator:**	NL
City:	Aberdeen, MD	**Entered by:**	BTD
Source:	Incinerator	**Checked by:**	MDS
Reference Method:	US EPA Method 26A	**Test Date:**	10/28/2021
Run:	T3		

Pt.	Time (min)	Velocity Press. ("H_2O)	Orifice Press. ("H_2O)	Meter Volume (ft˘)	Stack Temp (˘F)	Probe Temp (˘F)	Box Temp (˘F)	Imp Temp (˘F)	Meter Temp (˘F)	Vac Pressure ("Hg)	Percentage Isokinetic (%)	Stack Velocity (ft/sec)
Traverse 1												
Pre-Test Leak Check =		<0.01 at 15" Hg										
1	0	0.04	0.90	441.20	855	250	250	55	76	1.0	99	17.85
2	5	0.04	0.87	443.95	859	250	244	44	75	1.0	98	17.88
3	10	0.04	0.87	446.65	853	250	247	44	75	1.0	96	17.84
4	15	0.04	0.87	449.30	845	250	248	44	74	1.0	98	17.79
5	20	0.04	0.87	452.01	842	250	252	45	75	1.0	96	17.77
6	25	0.03	0.65	454.68	846	250	251	46	74	1.0	96	15.41
7	30	0.04	0.87	457.00	853	250	249	47	75	1.0	102	17.84
8	35	0.04	0.87	459.83	858	250	253	48	74	1.0	95	17.88
9	40	0.03	0.65	462.45	853	250	251	49	75	1.0	94	15.45
10	45	0.03	0.65	464.71	845	250	250	50	75	1.0	95	15.40
11	50	0.03	0.65	467.00	848	250	250	52	75	1.0	94	15.42
12	55	0.03	0.65	469.27	857	250	252	55	75	1.0	99	15.39
	60			471.63								
Post-Test Leak Check =		<0.01 at 2"Hg										
	Average	0.04	0.78	30.43	851	250	250	48	75	-	97	16.83

APPENDIX E



Volatile Organic Compound Sampling

Incinerator

	Units	Test #1			Test #2			Test #3			Average	
Sample ID :		Pair 1 ID = 5			Pair 2 ID = 1			Pair 3 ID = 6			-	
Sampling Date :	-	Oct 26, 21			Oct 27, 21			Oct 28, 21			-	
Sampling Times :	-	12:55 - 13:55			11:16 - 12:16			11:05 - 12:05			-	
Oxygen In Stack[1] :	%	12.5			12.7			12.1			12.433	
Stack Flow Rate[1], [2]	Rm^3/s	0.56			0.56			0.58			0.6	
		Test Data	Concentration @ 7%O2	Emission Rate (lb/hr)	Test Data	Concentration @ 7%O2	Emission Rate (lb/hr)	Test Data	Concentration @ 7%O2	Emission Rate (lb/hr)	Average Concentration @ 7% O_2	Emission Rate (lb/hr)
Acetone	ppb(V)	134	221.74	-	273	462.77	-	241	380.67	-	355.1	-
Acetone	ug/m3	318	526.21	1.40E-03	650	1,101.83	2.89E-03	570	900.34	2.62E-03	842.8	2.30E-03
Allyl chloride	ppb(V)	<0.20	< 0.33	< -	<0.20	< 0.34	< -	<0.20	< 0.31	< -	0.3	-
Allyl chloride	ug/m3	<0.63	< 1.04	< 2.78E-06	<0.63	< 1.07	< 2.80E-06	<0.63	< 0.98	< 2.90E-06	1.0	2.83E-06
Benzene	ppb(V)	16.3	26.97	-	45.7	77.47	-	64.1	101.25	-	68.6	-
Benzene	ug/m3	52.2	86.38	2.30E-04	146	247.49	6.49E-04	205	323.81	9.44E-04	219.2	6.07E-04
Benzyl chloride	ppb(V)	<0.20	< 0.33	< -	<0.20	< 0.34	< -	<0.20	< 0.31	< -	0.3	-
Benzyl chloride	ug/m3	<1.0	< 1.65	< 4.40E-06	<1.0	< 1.70	< 4.44E-06	<1.0	< 1.56	< 4.60E-06	1.6	4.48E-06
Bromodichloromethane	ppb(V)	<0.20	< 0.33	< -	<0.20	< 0.34	< -	<0.20	< 0.31	< -	0.3	-
Bromodichloromethane	ug/m3	<1.3	< 2.15	< 5.73E-06	<1.3	< 2.20	< 5.78E-06	<1.3	< 2.03	< 5.98E-06	2.1	5.83E-06
Bromoform	ppb(V)	<0.20	< 0.33	< -	<0.20	< 0.34	< -	<0.20	< 0.31	< -	0.3	-
Bromoform	ug/m3	<2.1	< 3.48	< 9.25E-06	<2.1	< 3.56	< 9.33E-06	<2.1	< 3.28	< 9.67E-06	3.4	9.42E-06
Bromomethane	ppb(V)	<2.3	< 0.33	< -	2.78	4.71	-	<0.20	< 0.31	< -	1.8	-
Bromomethane	ug/m3	<9.0	< 1.29	< 3.44E-06	10.8	18.31	4.80E-05	<0.78	< 1.22	< 3.59E-06	6.9	1.83E-05
1,3-Butadiene	ppb(V)	<0.20	< 0.33	< -	<0.94	< 0.34	< -	<0.20	< 0.31	< -	0.3	-
1,3-Butadiene	ug/m3	<0.44	< 0.73	< 1.94E-06	<2.1	< 0.75	< 1.96E-06	<0.44	< 0.69	< 2.03E-06	0.7	1.97E-06
Carbon Disulfide	ppb(V)	1.23	2.04	-	5.8	9.83	-	6.3	9.95	-	7.3	-
Carbon Disulfide	ug/m3	3.83	6.34	1.69E-05	17.9	30.34	7.96E-05	19.7	31.12	9.07E-05	22.6	6.24E-05
Carbon Tetrachloride	ppb(V)	<0.20	< 0.33	< -	<0.20	< 0.34	< -	<0.20	< 0.31	< -	0.3	-
Carbon Tetrachloride	ug/m3	<1.3	< 2.15	< 5.73E-06	<1.3	< 2.20	< 5.78E-06	<1.3	< 2.03	< 5.98E-06	2.1	5.83E-06
Chlorobenzene	ppb(V)	0.71	1.17	-	0.79	1.34	-	0.86	1.36	-	1.3	-
Chlorobenzene	ug/m3	3.29	5.44	1.45E-05	3.66	6.20	1.63E-05	3.97	6.27	1.83E-05	6.0	1.63E-05
Dibromochloromethane	ppb(V)	<0.20	< 0.33	< -	<0.20	< 0.34	< -	<0.20	< 0.31	< -	0.3	-
Dibromochloromethane	ug/m3	<1.7	< 2.81	< 7.49E-06	<1.7	< 2.88	< 7.56E-06	<1.7	< 2.66	< 7.83E-06	2.8	7.62E-06
Chloroethane	ppb(V)	<0.20	< 0.33	< -	<0.20	< 0.34	< -	0.32	0.51	-	0.4	-
Chloroethane	ug/m3	<0.53	< 0.88	< 2.33E-06	<0.53	< 0.90	< 2.36E-06	0.85	1.34	3.91E-06	1.0	2.87E-06
Chloroform	ppb(V)	<0.20	< 0.33	< -	<0.20	< 0.34	< -	<0.20	< 0.31	< -	0.3	-
Chloroform	ug/m3	<0.98	< 1.62	< 4.32E-06	<0.98	< 1.66	< 4.36E-06	<0.98	< 1.53	< 4.51E-06	1.6	4.39E-06
Chloromethane	ppb(V)	3.61	5.97	-	5.7	9.66	-	4.9	7.74	-	7.8	-
Chloromethane	ug/m3	7.45	12.33	3.28E-05	11.8	20.00	5.24E-05	10.2	16.11	4.70E-05	16.1	4.41E-05
Cyclohexane	ppb(V)	0.26	0.43	-	0.5	0.85	-	0.58	0.92	-	0.7	-
Cyclohexane	ug/m3	0.89	1.47	3.92E-06	1.71	2.90	7.60E-06	2	3.16	9.21E-06	2.5	6.91E-06
1,2-Dibromoethane	ppb(V)	<0.20	< 0.33	< -	<0.20	< 0.34	< -	<0.20	< 0.31	< -	0.3	-
1,2-Dibromoethane	ug/m3	<1.5	< 2.48	< 6.61E-06	<1.5	< 2.54	< 6.67E-06	<1.5	< 2.34	< 6.90E-06	2.5	6.73E-06
1,2-Dichlorobenzene	ppb(V)	0.38	0.63	-	0.48	0.81	-	0.5	0.79	-	0.7	-
1,2-Dichlorobenzene	ug/m3	2.3	3.81	1.01E-05	2.9	4.92	1.29E-05	3	4.74	1.38E-05	4.5	1.23E-05
1,3-Dichlorobenzene	ppb(V)	0.34	0.56	-	0.36	0.61	-	0.36	0.57	-	0.6	-
1,3-Dichlorobenzene	ug/m3	2	3.31	8.81E-06	2.1	3.56	9.33E-06	2.2	3.48	1.01E-05	3.4	9.42E-06
1,4-Dichlorobenzene	ppb(V)	<0.20	< 0.33	< -	<0.20	< 0.34	< -	0.4	0.63	-	0.4	-
1,4-Dichlorobenzene	ug/m3	<1.2	< 1.99	< 5.29E-06	<1.2	< 2.03	< 5.33E-06	2.4	3.79	1.10E-05	2.6	7.22E-06
Dichlorodifluoromethane	ppb(V)	<0.20	< 0.33	< -	<0.20	< 0.34	< -	<0.20	< 0.31	< -	0.3	-
Dichlorodifluoromethane	ug/m3	<0.99	< 1.64	< 4.36E-06	<0.99	< 1.68	< 4.40E-06	<0.99	< 1.55	< 4.56E-06	1.6	4.44E-06
1,1-Dichloroethane	ppb(V)	<0.20	< 0.33	< -	0.79	1.34	-	<0.20	< 0.31	< -	0.7	-
1,1-Dichloroethane	ug/m3	<0.81	< 1.34	< 3.57E-06	3.21	5.44	1.43E-05	<0.81	< 1.27	< 3.73E-06	2.7	7.19E-06
1,2-Dichloroethane	ppb(V)	<0.20	< 0.33	< -	<0.20	< 0.34	< -	<0.20	< 0.31	< -	0.3	-
1,2-Dichloroethane	ug/m3	<0.81	< 1.34	< 3.57E-06	<0.81	< 1.37	< 3.60E-06	<0.81	< 1.27	< 3.73E-06	1.3	3.63E-06
1,1-Dichloroethene	ppb(V)	<0.20	< 0.33	< -	<0.20	< 0.34	< -	<0.20	< 0.31	< -	0.3	-
1,1-Dichloroethene	ug/m3	<0.79	< 1.31	< 3.48E-06	<0.79	< 1.34	< 3.51E-06	<0.79	< 1.23	< 3.64E-06	1.3	3.54E-06
cis-1,2-Dichloroethene	ppb(V)	<0.20	< 0.33	< -	<0.20	< 0.34	< -	<0.20	< 0.31	< -	0.3	-
cis-1,2-Dichloroethene	ug/m3	<0.79	< 1.31	< 3.48E-06	<0.79	< 1.34	< 3.51E-06	<0.79	< 1.23	< 3.64E-06	1.3	3.54E-06
trans-1,2-Dichloroethene	ppb(V)	<0.20	< 0.33	< -	<0.20	< 0.34	< -	<0.20	< 0.31	< -	0.3	-
trans-1,2-Dichloroethene	ug/m3	<0.79	< 1.31	< 3.48E-06	<0.79	< 1.34	< 3.51E-06	<0.79	< 1.23	< 3.64E-06	1.3	3.54E-06
Methylene chloride	ppb(V)	1.49	2.47	-	1.39	2.36	-	1.7	2.69	-	2.5	-
Methylene chloride	ug/m3	5.17	8.56	2.28E-05	4.83	8.19	2.15E-05	5.91	9.34	2.72E-05	8.7	2.38E-05
1,2-Dichloropropane	ppb(V)	<0.20	< 0.33	< -	<0.20	< 0.34	< -	<0.20	< 0.31	< -	0.3	-
1,2-Dichloropropane	ug/m3	<0.92	< 1.52	< 4.05E-06	<0.92	< 1.56	< 4.09E-06	<0.92	< 1.44	< 4.23E-06	1.5	4.13E-06
cis-1,3-Dichloropropene	ppb(V)	<0.20	< 0.33	< -	<0.20	< 0.34	< -	<0.20	< 0.31	< -	0.3	-
cis-1,3-Dichloropropene	ug/m3	<0.91	< 1.51	< 4.01E-06	<0.91	< 1.54	< 4.04E-06	<0.91	< 1.42	< 4.19E-06	1.5	4.08E-06
trans-1,3-Dichloropropene	ppb(V)	<0.20	< 0.33	< -	<0.20	< 0.34	< -	<0.20	< 0.31	< -	0.3	-
trans-1,3-Dichloropropene	ug/m3	<0.91	< 1.51	< 4.01E-06	<0.91	< 1.54	< 4.04E-06	<0.91	< 1.42	< 4.19E-06	1.5	4.08E-06
1,4-Dioxane	ppb(V)	<0.20	< 0.33	< -	<0.20	< 0.34	< -	<0.20	< 0.31	< -	0.3	-
1,4-Dioxane	ug/m3	<0.72	< 1.19	< 3.17E-06	<0.72	< 1.22	< 3.20E-06	<0.72	< 1.12	< 3.31E-06	1.2	3.23E-06
Ethyl acetate	ppb(V)	<0.20	< 0.33	< -	0.75	1.27	-	0.72	1.14	-	0.9	-
Ethyl acetate	ug/m3	<0.72	< 1.19	< 3.17E-06	2.72	4.61	1.21E-05	2.6	4.11	1.20E-05	3.3	9.08E-06
Ethylbenzene	ppb(V)	<0.20	< 0.33	< -	<0.20	< 0.34	< -	<0.20	< 0.31	< -	0.3	-
Ethylbenzene	ug/m3	<0.87	< 1.44	< 3.83E-06	<0.87	< 1.47	< 3.87E-06	<0.87	< 1.36	< 4.00E-06	1.4	3.90E-06
4-Ethyltoluene	ppb(V)	0.26	0.43	-	<0.20	< 0.34	< -	<0.20	< 0.31	< -	0.4	-
4-Ethyltoluene	ug/m3	1.27	2.10	5.59E-06	<0.98	< 1.66	< 4.36E-06	<0.98	< 1.53	< 4.51E-06	1.8	4.82E-06
n-Heptane	ppb(V)	0.59	0.98	-	0.79	1.34	-	1.1	1.74	-	1.4	-
n-Heptane	ug/m3	2.44	4.04	1.07E-05	3.25	5.51	1.44E-05	4.51	7.12	2.08E-05	5.6	1.53E-05
Hexachlorobutadiene	ppb(V)	<0.20	< 0.33	< -	<0.20	< 0.34	< -	<0.20	< 0.31	< -	0.3	-
Hexachlorobutadiene	ug/m3	<2.1	< 3.48	< 9.25E-06	<2.1	< 3.56	< 9.33E-06	<2.1	< 3.28	< 9.67E-06	3.4	9.42E-06
n-Hexane	ppb(V)	19.8	32.76	-	9.9	16.78	-	5.9	9.32	-	19.6	-
n-Hexane	ug/m3	70	115.83	3.08E-04	34.9	59.16	1.55E-04	20.9	33.01	9.62E-05	69.3	1.87E-04
2-Hexanone	ppb(V)	<1.0	< 1.65	< -	<1.0	< 1.70	< -	<1.0	< 1.56	< -	1.6	-
2-Hexanone	ug/m3	<4.1	< 6.78	< 1.81E-05	<4.1	< 6.95	< 1.82E-05	<4.1	< 6.40	< 1.89E-05	6.7	1.84E-05
Isooctane	ppb(V)	0.69	1.14	-	3.81	6.46	-	1.92	3.03	-	3.5	-
Isooctane	ug/m3	3.24	5.36	1.43E-05	17.8	30.17	7.91E-05	8.98	14.18	4.13E-05	16.6	4.49E-05
Isopropylbenzene	ppb(V)	<0.20	< 0.33	< -	<0.20	< 0.34	< -	<0.20	< 0.31	< -	0.3	-
Isopropylbenzene	ug/m3	<0.98	< 1.62	< 4.32E-06	<0.98	< 1.66	< 4.36E-06	<0.98	< 1.53	< 4.51E-06	1.6	4.39E-06
Methyl ethyl ketone	ppb(V)	2.95	4.88	-	5.4	9.15	-	8.4	13.27	-	9.1	-
Methyl ethyl ketone	ug/m3	8.71	14.41	3.84E-05	15.9	26.95	7.07E-05	24.7	39.01	1.14E-04	26.8	7.42E-05
Methyl isobutyl ketone	ppb(V)	10.9	18.04	-	16.2	27.46	-	6.5	10.27	-	18.6	-
Methyl isobutyl ketone	ug/m3	44.6	73.80	1.96E-04	66.2	112.22	2.94E-04	26.6	42.02	1.22E-04	76.0	2.04E-04
MTBE	ppb(V)	0.28	0.46	-	<0.20	< 0.34	< -	<0.20	< 0.31	< -	0.4	-
MTBE	ug/m3	1	1.65	4.40E-06	<0.72	< 1.22	< 3.20E-06	<0.72	< 1.12	< 3.31E-06	1.3	3.64E-06
Naphthalene	ppb(V)	0.61	1.01	-	1.05	1.78	-	0.84	1.33	-	1.4	-
Naphthalene	ug/m3	3.2	5.30	1.41E-05	5.5	9.32	2.44E-05	4.4	6.95	2.03E-05	7.2	1.96E-05
Propylene	ppb(V)	10.8	17.87	-	13.8	23.39	-	19.6	30.96	-	24.1	-
Propylene	ug/m3	18.6	30.78	8.19E-05	23.7	40.17	1.05E-04	33.7	53.23	1.55E-04	41.4	1.14E-04
Styrene	ppb(V)	<0.20	< 0.33	< -	<0.20	< 0.34	< -	<0.20	< 0.31	< -	0.3	-
Styrene	ug/m3	<0.85	< 1.41	< 3.74E-06	<0.85	< 1.44	< 3.78E-06	<0.85	< 1.33	< 3.91E-06	1.4	3.81E-06
1,1,2,2-Tetrachloroethane	ppb(V)	<0.20	< 0.33	< -	<0.20	< 0.34	< -	<0.20	< 0.31	< -	0.3	-
1,1,2,2-Tetrachloroethane	ug/m3	<1.4	< 2.32	< 6.17E-06	<1.4	< 2.37	< 6.22E-06	<1.4	< 2.19	< 6.44E-06	2.3	6.28E-06
Tetrachloroethylene	ppb(V)	<0.20	< 0.33	< -	<0.20	< 0.34	< -	<0.20	< 0.31	< -	0.3	-
Tetrachloroethylene	ug/m3	<1.4	< 2.32	< 6.17E-06	<1.4	< 2.37	< 6.22E-06	<1.4	< 2.19	< 6.44E-06	2.3	6.28E-06
Tetrahydrofuran	ppb(V)	5	8.27	-	3.33	5.64	-	5.7	9.00	-	7.6	-
Tetrahydrofuran	ug/m3	14.6	24.16	6.43E-05	9.84	16.68	4.37E-05	16.8	26.54	7.73E-05	22.5	6.18E-05
Toluene	ppb(V)	1.78	2.95	-	1.35	2.29	-	2.04	3.22	-	2.8	-
Toluene	ug/m3	6.73	11.14	2.96E-05	5.09	8.63	2.26E-05	7.7	12.16	3.54E-05	10.6	2.92E-05
Freon 113	ppb(V)	<0.20	< 0.33	< -	<0.20	< 0.34	< -	<0.20	< 0.31	< -	0.3	-
Freon 113	ug/m3	<1.5	< 2.48	< 6.61E-06	<1.5	< 2.54	< 6.67E-06	<1.5	< 2.34	< 6.90E-06	2.5	6.73E-06
1,2,4-Trichlorobenzene	ppb(V)	0.4	0.66	-	0.66	1.12	-	0.58	0.92	-	0.9	-
1,2,4-Trichlorobenzene	ug/m3	2.9	4.80	1.28E-05	4.9	8.31	2.18E-05	4.3	6.79	1.98E-05	6.6	1.81E-05
1,1,1-Trichloroethane	ppb(V)	<0.20	< 0.33	< -	<0.20	< 0.34	< -	<0.20	< 0.31	< -	0.3	-
1,1,1-Trichloroethane	ug/m3	<1.1	< 1.82	< 4.85E-06	<1.1	< 1.86	< 4.89E-06	<1.1	< 1.72	< 5.06E-06	1.8	4.93E-06
1,1,2-Trichloroethane	ppb(V)	<0.20	< 0.33	< -	<0.20	< 0.34	< -	<0.20	< 0.31	< -	0.3	-
1,1,2-Trichloroethane	ug/m3	<1.1	< 1.82	< 4.85E-06	<1.1	< 1.86	< 4.89E-06	<1.1	< 1.72	< 5.06E-06	1.8	4.93E-06
Trichloroethylene	ppb(V)	<0.20	< 0.33	< -	<0.20	< 0.34	< -	<0.20	< 0.31	< -	0.3	-
Trichloroethylene	ug/m3	<1.1	< 1.82	< 4.85E-06	<1.1	< 1.86	< 4.89E-06	<1.1	< 1.72	< 5.06E-06	1.8	4.93E-06
Trichlorofluoromethane	ppb(V)	<0.20	< 0.33	< -	<0.20	< 0.34	< -	<0.20	< 0.31	< -	0.3	-
Trichlorofluoromethane	ug/m3	<1.1	< 1.82	< 4.85E-06	<1.1	< 1.86	< 4.89E-06	<1.1	< 1.72	< 5.06E-06	1.8	4.93E-06
Freon 114	ppb(V)	<0.20	< 0.33	< -	<0.20	< 0.34	< -	<0.20	< 0.31	< -	0.3	-
Freon 114	ug/m3	<1.4	< 2.32	< 6.17E-06	<1.4	< 2.37	< 6.22E-06	<1.4	< 2.19	< 6.44E-06	2.3	6.28E-06
1,2,4-Trimethylbenzene	ppb(V)	1.25	2.07	-	0.5	0.85	-	0.6	0.95	-	1.3	-
1,2,4-Trimethylbenzene	ug/m3	6.14	10.16	2.70E-05	2.44	4.14	1.08E-05	2.95	4.66	1.36E-05	6.3	1.72E-05
1,3,5-Trimethylbenzene	ppb(V)	0.34	0.56	-	<0.20	< 0.34	< -	0.22	0.35	-	0.4	-
1,3,5-Trimethylbenzene	ug/m3	1.66	2.75	7.31E-06	<0.98	< 1.66	< 4.36E-06	1.08	1.71	4.97E-06	2.0	5.55E-06
Vinyl acetate	ppb(V)	<2.1	< 2.32	< -	<1.4	< 2.37	< -	<10	< 2.19	< -	2.3	-
Vinyl acetate	ug/m3	<7.4	< 8.11	< 2.16E-05	<4.9	< 8.31	< 2.18E-05	<35	< 7.65	< 2.26E-05	8.0	2.20E-05
Vinyl bromide	ppb(V)	<0.20	< 0.33	< -	<0.20	< 0.34	< -	<0.20	< 0.31	< -	0.3	-
Vinyl bromide	ug/m3	<0.87	< 1.44	< 3.83E-06	<0.87	< 1.47	< 3.87E-06	<0.87	< 1.36	< 4.00E-06	1.4	3.90E-06
Vinyl chloride	ppb(V)	<0.20	< 0.33	< -	<0.20	< 0.34	< -	0.22	0.35	-	0.3	-
Vinyl chloride	ug/m3	<0.51	< 0.84	< 2.25E-06	<0.51	< 0.86	< 2.27E-06	0.56	0.88	2.58E-06	0.9	2.36E-06
o-Xylene	ppb(V)	<0.20	< 0.33	< -	<0.20	< 0.34	< -	0.26	0.41	-	0.4	-
o-Xylene	ug/m3	<0.87	< 1.44	< 3.83E-06	<0.87	< 1.47	< 3.87E-06	1.13	1.78	5.20E-06	1.6	4.30E-06
m&p-Xylene	ppb(V)	0.46	0.76	-	<0.40	< 0.68	< -	0.48	0.76	-	0.7	-
m&p-Xylene	ug/m3	2	3.31	8.81E-06	<1.7	< 2.88	< 7.56E-06	2.1	3.32	9.67E-06	3.2	8.68E-06

Notes:

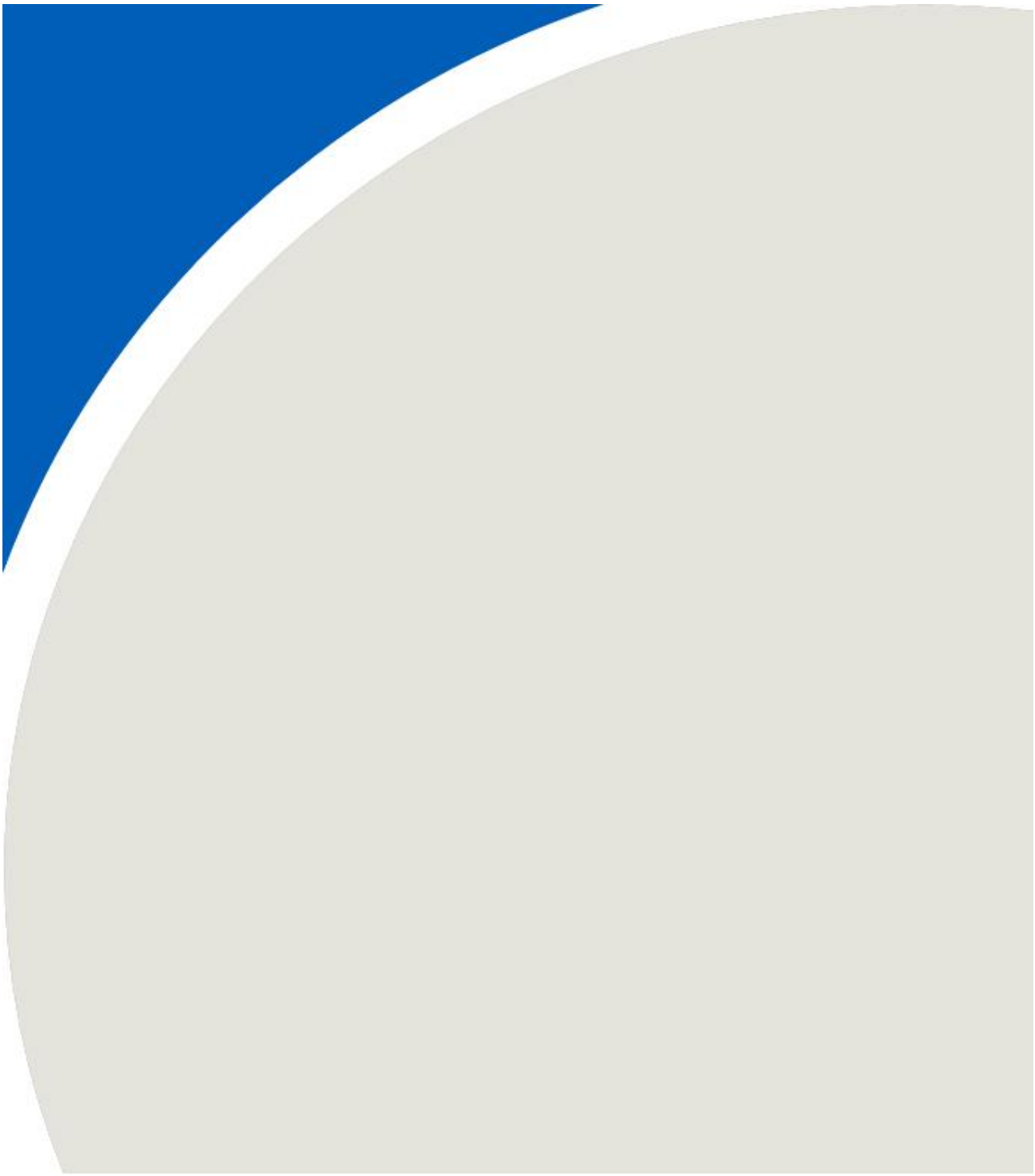
' < ' indicates that the laboratory results were less than the Reportable Detection Limit (RDL). This RDL was used to calculate the concentration and emission rate.

[1] Sample volume, volumetric flow rate, and concentration based on dry referenced conditions (101.3 kPa, 25 °C, and Actual Oxygen)

[2] Average of the measured volumetric flow rates from isokinetic testing

[3] Correct O_2 to 7% equation ***a*((21-7)/(21-b))*** *a=concentration @ original O_2 b=original O_2 %*

APPENDIX F



Aberdeen Proving Grounds

RWDI Project #2200515

Facility: Aderdeen Proving Grounds
City: Aberdeen, Maryland
Source: Main Stack Incinerations
Test ID: Test 1

Operator: BD
Entered by: BCB
Checked by: KNE

Observation Date: October 26, 2021
Start Time: 11:04 AM
Stop Time: 12:04 PM

Number of Six Minute Average Readings above **20%** were **0**
Range of Opacity Reading **0** to **0**

Observations

min \ sec	0	15	30	45
1	0	0	0	0
2	0	0	0	0
3	0	0	0	0
4	0	0	0	0
5	0	0	0	0
6	0	0	0	0
7	0	0	0	0
8	0	0	0	0
9	0	0	0	0
10	0	0	0	0
11	0	0	0	0
12	0	0	0	0
13	0	0	0	0
14	0	0	0	0
15	0	0	0	0
16	0	0	0	0
17	0	0	0	0
18	0	0	0	0
19	0	0	0	0
20	0	0	0	0
21	0	0	0	0
22	0	0	0	0
23	0	0	0	0
24	0	0	0	0
25	0	0	0	0
26	0	0	0	0
27	0	0	0	0
28	0	0	0	0
29	0	0	0	0
30	0	0	0	0
31	0	0	0	0
32	0	0	0	0
33	0	0	0	0
34	0	0	0	0
35	0	0	0	0
36	0	0	0	0
37	0	0	0	0
38	0	0	0	0
39	0	0	0	0
40	0	0	0	0
41	0	0	0	0
42	0	0	0	0
43	0	0	0	0
44	0	0	0	0
45	0	0	0	0
46	0	0	0	0
47	0	0	0	0
48	0	0	0	0
49	0	0	0	0
50	0	0	0	0
51	0	0	0	0
52	0	0	0	0
53	0	0	0	0
54	0	0	0	0
55	0	0	0	0
56	0	0	0	0
57	0	0	0	0
58	0	0	0	0
59	0	0	0	0
60	0	0	0	0

Summary of running 6 min Averages

Start #	6-min Average Opacity	Event
1	0	
2	0	
3	0	
4	0	
5	0	
6	0	
7	0	
8	0	
9	0	
10	0	
11	0	
12	0	
13	0	
14	0	
15	0	
16	0	
17	0	
18	0	
19	0	
20	0	
21	0	
22	0	
23	0	
24	0	
25	0	
26	0	
27	0	
28	0	
29	0	
30	0	
31	0	
32	0	
33	0	
34	0	
35	0	
36	0	
37	0	
38	0	
39	0	
40	0	
41	0	
42	0	
43	0	
44	0	
45	0	
46	0	
47	0	
48	0	
49	0	
50	0	
51	0	
52	0	
53	0	
54	0	
55	0	

Maximum 6 min Average = 0

Aberdeen Proving Grounds

RWDI Project #2200515

Facility: Aderdeen Proving Grounds
City: Aberdeen, Maryland
Source: Main Stack Incinerations
Test ID: Test 1

Operator: BD
Entered by: BCB
Checked by: KNE

Observation Date: October 27, 2021
Start Time: 9:40 AM
Stop Time: 10:40 AM

Number of Six Minute Average Readings above **20%** were **0**
Range of Opacity Reading **0** to **0**

Observations

min \ sec	0	15	30	45
1	0	0	0	0
2	0	0	0	0
3	0	0	0	0
4	0	0	0	0
5	0	0	0	0
6	0	0	0	0
7	0	0	0	0
8	0	0	0	0
9	0	0	0	0
10	0	0	0	0
11	0	0	0	0
12	0	0	0	0
13	0	0	0	0
14	0	0	0	0
15	0	0	0	0
16	0	0	0	0
17	0	0	0	0
18	0	0	0	0
19	0	0	0	0
20	0	0	0	0
21	0	0	0	0
22	0	0	0	0
23	0	0	0	0
24	0	0	0	0
25	0	0	0	0
26	0	0	0	0
27	0	0	0	0
28	0	0	0	0
29	0	0	0	0
30	0	0	0	0
31	0	0	0	0
32	0	0	0	0
33	0	0	0	0
34	0	0	0	0
35	0	0	0	0
36	0	0	0	0
37	0	0	0	0
38	0	0	0	0
39	0	0	0	0
40	0	0	0	0
41	0	0	0	0
42	0	0	0	0
43	0	0	0	0
44	0	0	0	0
45	0	0	0	0
46	0	0	0	0
47	0	0	0	0
48	0	0	0	0
49	0	0	0	0
50	0	0	0	0
51	0	0	0	0
52	0	0	0	0
53	0	0	0	0
54	0	0	0	0
55	0	0	0	0
56	0	0	0	0
57	0	0	0	0
58	0	0	0	0
59	0	0	0	0
60	0	0	0	0

Summary of running 6 min Averages

Start #	6-min Average Opacity	Event
1	0	
2	0	
3	0	
4	0	
5	0	
6	0	
7	0	
8	0	
9	0	
10	0	
11	0	
12	0	
13	0	
14	0	
15	0	
16	0	
17	0	
18	0	
19	0	
20	0	
21	0	
22	0	
23	0	
24	0	
25	0	
26	0	
27	0	
28	0	
29	0	
30	0	
31	0	
32	0	
33	0	
34	0	
35	0	
36	0	
37	0	
38	0	
39	0	
40	0	
41	0	
42	0	
43	0	
44	0	
45	0	
46	0	
47	0	
48	0	
49	0	
50	0	
51	0	
52	0	
53	0	
54	0	
55	0	

Maximum 6 min Average = 0

Aberdeen Proving Grounds

RWDI Project #2200515

Facility: Aderdeen Proving Grounds
City: Aberdeen, Maryland
Source: Main Stack Incinerations
Test ID: Test 1

Operator: BD
Entered by: BCB
Checked by: KNE

Observation Date: October 28, 2021
Start Time: 9:29 AM
Stop Time: 10:29 AM

Number of Six Minute Average Readings above **20%** were **0**
Range of Opacity Reading **0** to **0**

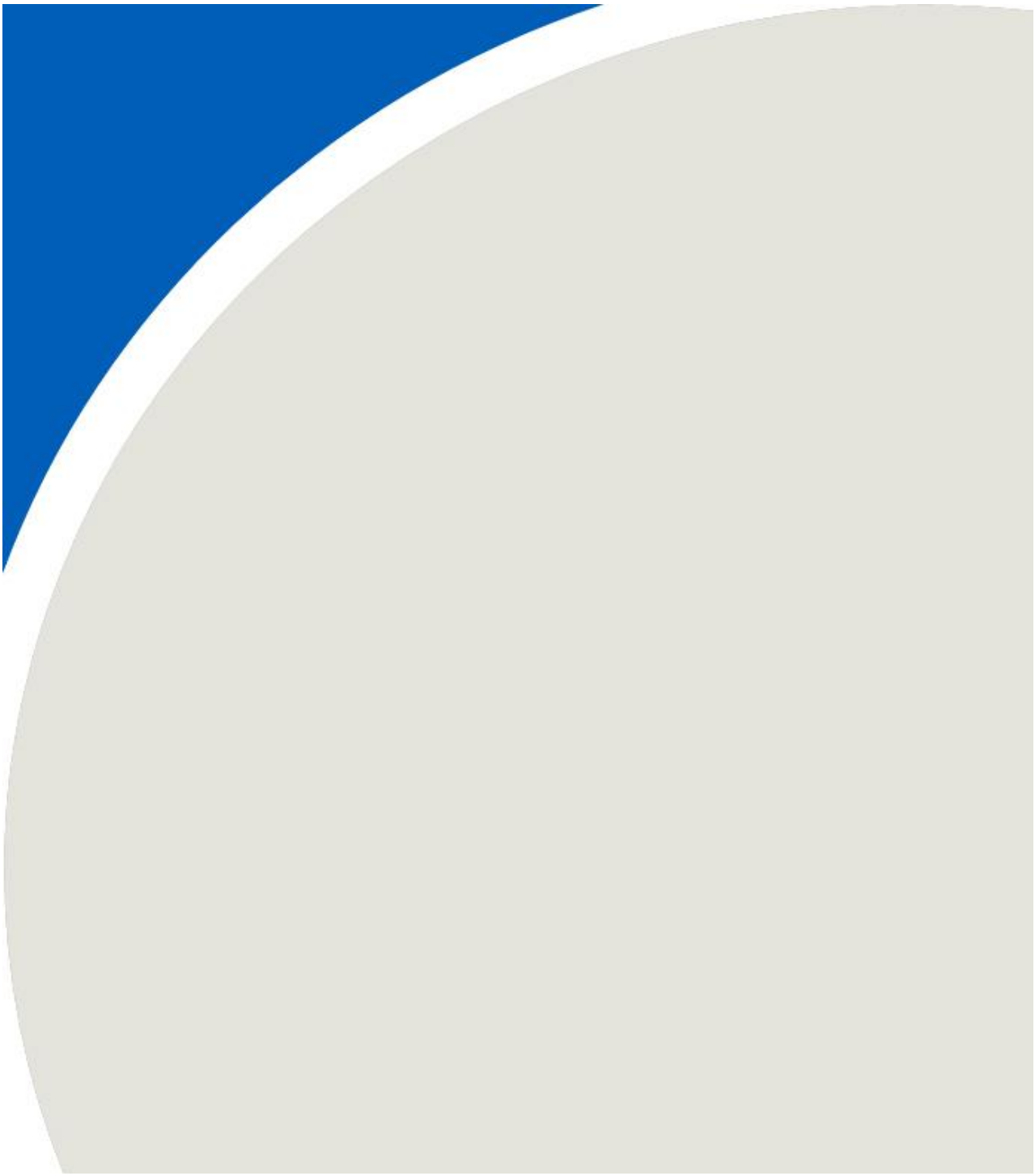
Observations

min \ sec	0	15	30	45
1	0	0	0	0
2	0	0	0	0
3	0	0	0	0
4	0	0	0	0
5	0	0	0	0
6	0	0	0	0
7	0	0	0	0
8	0	0	0	0
9	0	0	0	0
10	0	0	0	0
11	0	0	0	0
12	0	0	0	0
13	0	0	0	0
14	0	0	0	0
15	0	0	0	0
16	0	0	0	0
17	0	0	0	0
18	0	0	0	0
19	0	0	0	0
20	0	0	0	0
21	0	0	0	0
22	0	0	0	0
23	0	0	0	0
24	0	0	0	0
25	0	0	0	0
26	0	0	0	0
27	0	0	0	0
28	0	0	0	0
29	0	0	0	0
30	0	0	0	0
31	0	0	0	0
32	0	0	0	0
33	0	0	0	0
34	0	0	0	0
35	0	0	0	0
36	0	0	0	0
37	0	0	0	0
38	0	0	0	0
39	0	0	0	0
40	0	0	0	0
41	0	0	0	0
42	0	0	0	0
43	0	0	0	0
44	0	0	0	0
45	0	0	0	0
46	0	0	0	0
47	0	0	0	0
48	0	0	0	0
49	0	0	0	0
50	0	0	0	0
51	0	0	0	0
52	0	0	0	0
53	0	0	0	0
54	0	0	0	0
55	0	0	0	0
56	0	0	0	0
57	0	0	0	0
58	0	0	0	0
59	0	0	0	0
60	0	0	0	0

Summary of running 6 min Averages		
Start #	6-min Average Opacity	Event
1	0	
2	0	
3	0	
4	0	
5	0	
6	0	
7	0	
8	0	
9	0	
10	0	
11	0	
12	0	
13	0	
14	0	
15	0	
16	0	
17	0	
18	0	
19	0	
20	0	
21	0	
22	0	
23	0	
24	0	
25	0	
26	0	
27	0	
28	0	
29	0	
30	0	
31	0	
32	0	
33	0	
34	0	
35	0	
36	0	
37	0	
38	0	
39	0	
40	0	
41	0	
42	0	
43	0	
44	0	
45	0	
46	0	
47	0	
48	0	
49	0	
50	0	
51	0	
52	0	
53	0	
54	0	
55	0	

Maximum 6 min Average = 0

APPENDIX G



FTIR

CONTINUOUS EMISSION MONITORING
SYSTEM CALIBRATION AND DRIFT CALIBRATION

Client: Eco waste				Date: 10-28-21		
Project Number: 220051S				Start Time: 7:30		
Sample Location: Incinerator				Finish Time: 1600		
	NOx	CO	SO_2	CTS		
Range						
TIME						
Direct 7:30 Zero	-0.10	-0.04	-0.05			
Mid. Span						
High Span	7:35 446.84	1532.71	7:38 193.01	7:32 98.91		
TIME						
System 7:46 Zero	0.06	4.5	0.51			
7:53 Span	440.50	1507.6	7:56 188.28	7:48 96.25		
TIME						
Zero						
8.00 Native 8:22 Span	44.56	15.47				
TIME						
Zero	SFL 0.22					
Spike 8:25 Span	55.68	48.89				
TIME						
Zero	0.22					
Span	~~55.68~~	~~48.89~~				
TIME						
0.00 Native 8:31 Zero	47.31	11.47				
2.23 Spike 8:33 Span	57.64	48.30				
TIME						
0.00 Native 8:37 Zero	41.76	14.19				
0.24 Spike 8:51 Span	100.08	54.08				
TIME 7:00						
~~7.39 Native 8:54 Zero~~			~~29.03 2.26~~			
~~Spike 9:08 Span~~						
TIME						
~~5.38 5.99 Native 13:38 Zero~~			~~1.74 2.78~~			
~~Spike~~ Span						
TIME						
5.42 Native 13:57 Zero			1.69			
5.27 Spike 14:05 Span			6.95			
TIME						
5.45 Native 14:12 Zero			1.71			
5.31 Spike 14:19 Span			7.00			
TIME						
5.40 Native 1430 Zero			1.47			
5.27 Spike 1438 Span			6.87			
TIME						
1500 Zero	-0.02					
Span				96.47		
TIME						
Zero						
Span						

Leak Check ✓
Line Temp 275
Filter Temp 375
Chiller Temp NA

SF_6
9.72

9.50

Drift Criterion: <3% of Span — Bias Criterion: <5% of Span

Converter Check	NO_2 Value	NO reading	NO_2 Reading	NO_x reading	> 90%
	—	—	—	—	—

Line Temp 375
Filter Temp 375
Chiller Temp NA

Response Time (sec)	—

Notes:

CONTINUOUS EMISSION MONITORING
SYSTEM CALIBRATION AND DRIFT CALIBRATION

Client:	Eco Waste			Date:	10-26-21	
Project Number:	2200515			Start Time:	7:20	
Sample Location:	Incinerator			Finish Time:	1800	
	10.10 O_2 20.93	29.9 49.9 THC 89.9	29.9 49.9 CH_4 89.8			
Range	0-25	0-100	0-100			
TIME						
Direct Zero	0.00	-0.11	-0.24			
Mid. Span	10.15	24.00 49.03	24.00 / 50.08			
High Span	20.90	~~89.96~~	89.66			
TIME						
System Zero	0.35	-0.11	-0.24			
Span	10.25	49.03	50.08			
TIME						
Zero	0.46	2.38	-0.57			
Span	10.24	51.11	50.72			
TIME						
Zero						
Span						
TIME						
Zero						
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TIME						
Zero						
Span						
TIME						
Zero						
Span						

Leak Check ✓
Line Temp 375
Filter Temp 375
Chiller Temp 4.1

THC 9.42
CH_4 29.00

Drift Criterion: <3% of Span Bias Criterion: <5% of Span

Converter Check	NO_2 Value	NO reading	NO_2 Reading	NO_x reading	> 90%

Line Temp 375
Filter Temp 375
Chiller Temp 4.1

Response Time (sec)		Notes:

FTIR Data Sheet (Page 1 of 2)- RWDI (v1.1_12/15/20)

Project#	
Client:	~~AP~~ Eco Waste
Date:	10-26-21
Operator:	MDS
FTIR Make/Model	MKS Multigas
Stack / Source:	
Barometric Pressure (atm)	29.5 0.9859
FTIR Pressure Transducer (atm)	0.9834

Target Analytes

NOx	(YES) / NO
Carbon Monoxide	(YES) / NO
THC	YES / (NO)
Speciated Hydrocarbons (Methane/Ethane/H2O)	YES / (NO)
Formaldehyde	YES / (NO)
Other Analytes (specify)	SO_2

Measurement System Response Time (seconds)

	NOx	CO	~~THC~~ SO_2	Other Analytes (specify)
Time-	77	77	30	—

Sample Flow Rate (Test Run)

Sample flow rate (liters per minute, lpm):	Test Run 1 (lpm)	Test Run 2 (lpm)	Test Run 3 (lpm)	Criteria
	7	7	7	≤9.5LPM

Temperature Controllers

	Test Run 1	Test Run 2	Test Run 3	Criteria
Heated Sample Line (°F)	375	~~375~~		≥250°F
Heated Probe (°F)	375			≥250°F
Heated Filter Box (°F)	375			≥250°F
Gas Cell Heater (°C)	190			191°C (within ± 10°C)
Gas Inlet Heater (°C)	190			191°C (within ± 10°C)
Oven (°C)	190			191°C (within ± 10°C)
ASC-10 Oven Temp (°C)	190			191°C (within ± 10°C)
ASC-10 Pump Temp (°C)	190			191°C (within ± 10°C)

FTIR Data Sheet (Page 2 of 2)- RWDI (v1.1_12/15/20)

Pretest QA

Activity	Start Time	Spot Reading (ppm)	Criteria
Direct Zero (daily background)	8:05	-0.09 NOx	Value near zero
Direct CTS	8:10	97.0	Within 5% of cylinder
Direct Cal Gas 1 NOx	8:14	492.5 9.62	Within 5% of cylinder
Direct Cal Gas 2 (if applicable) CO	8:14	1502.70 9.62	Within 5% of cylinder
Direct Cal Gas 3 (if applicable) SO_2	8:18	190.49	0.00 CO_2 Within 5% of cylinder
Direct Cal Gas 4 (if applicable)	-	-	Within 5% of cylinder
System Zero	8:24	-0.12 NOx	Value near zero
System CTS	8:29	95.76	~~9.48~~ Within 5% of cylinder
System Cal Gas 1 NOx	8:33	486.307	9.48 Within 5% of cylinder
System Cal Gas 2 (if applicable) CO	8:33 C	1489.79	9.48 Within 5% of cylinder
SO_2	8:38	187.45	

QA Spike Check

Spike Analyte & Surrogate	NOx			
QA Spike Gas Concentration (System mode)	492.5	9.62		
Sample Flow Rate (LPM)	Replicate#1- 8	Replicate#2-	Replicate#3-	≤9.5LPM
Spike Gas Flow Rate (LPM)	Replicate#1- 0.16	Replicate#2-	Replicate#3-	≤10% of sample flow

Activity	Start/End Time	Analyte Reading (ppm)	Surrogate (ppm) or Diluent (%)	Criteria
Replicate#1-Native	~~10:28~~ 10:32	~~50.1~~ 58.7	0.00	-
Replicate#1-Spiked	~~10:33~~ 10:36	69.77	0.23	70-130% spike recovery
Replicate#2-Native				-
Replicate#2-Spiked				70-130% spike recovery
Replicate#3-Native				-
Replicate#3-Spiked				70-130% spike recovery

Post Test QA

Activity	Start Time	Analyte Reading (ppm)	Criteria
Test 1 - System Zero	5:26	-.15 NOx	Value near zero
Test 1 - System CTS	5:38	94.74	Within 5% of cylinder
Test 2 - System Zero			Value near zero
Test 2 - System CTS			Within 5% of cylinder
Test 3 - System Zero			Value near zero
Test 3 - System CTS			Within 5% of cylinder

FTIR Data Sheet (Page 2 of 2)- RWDI (v1.1_12/15/20)

Pretest QA

Activity	Start Time	Spot Reading (ppm)	Criteria
Direct Zero (daily background)			Value near zero
Direct CTS			Within 5% of cylinder
Direct Cal Gas 1			Within 5% of cylinder
Direct Cal Gas 2 (if applicable)			Within 5% of cylinder
Direct Cal Gas 3 (if applicable)			Within 5% of cylinder
Direct Cal Gas 4 (if applicable)			Within 5% of cylinder
System Zero			Value near zero
System CTS			Within 5% of cylinder
System Cal Gas 1			Within 5% of cylinder
System Cal Gas 2 (if applicable)			Within 5% of cylinder

QA Spike Check

Spike Analyte & Surrogate	CO			
QA Spike Gas Concentration (System mode)	1502.70	9.62 SF_6		
Sample Flow Rate (LPM)	Replicate#1- 8	Replicate#2-	Replicate#3-	≤9.5LPM
Spike Gas Flow Rate (LPM)	Replicate#1- 6.16	Replicate#2-	Replicate#3-	≤10% of sample flow

Activity	Start/End Time	Analyte Reading (ppm)	Surrogate (ppm) or Diluent (%)	Criteria
Replicate#1-Native	~~10:08 10:15~~	~~23.6~~ 23.9	0.00	-
Replicate#1-Spiked	10:36	63.10	0.23	70-130% spike recovery
Replicate#2-Native				-
Replicate#2-Spiked				70-130% spike recovery
Replicate#3-Native				-
Replicate#3-Spiked				70-130% spike recovery

Post Test QA

Activity	Start Time	Analyte Reading (ppm)	Criteria
Test 1 - System Zero			Value near zero
Test 1 - System CTS			Within 5% of cylinder
Test 2 - System Zero			Value near zero
Test 2 - System CTS			Within 5% of cylinder
Test 3 - System Zero			Value near zero
Test 3 - System CTS			Within 5% of cylinder

FTIR Data Sheet (Page 2 of 2)- RWDI (v1.1_12/15/20)

Pretest QA

Activity	Start Time	Spot Reading (ppm)	Criteria
Direct Zero (daily background)			Value near zero
Direct CTS			Within 5% of cylinder
Direct Cal Gas 1			Within 5% of cylinder
Direct Cal Gas 2 (if applicable)			Within 5% of cylinder
Direct Cal Gas 3 (if applicable)			Within 5% of cylinder
Direct Cal Gas 4 (if applicable)			Within 5% of cylinder
System Zero			Value near zero
System CTS			Within 5% of cylinder
System Cal Gas 1			Within 5% of cylinder
System Cal Gas 2 (if applicable)			Within 5% of cylinder

QA Spike Check

Spike Analyte & Surrogate	~~CO~~ SO_2			
QA Spike Gas Concentration (System mode)	~~150~~ 190.49			
Sample Flow Rate (LPM)	Replicate#1- 8	Replicate#2-	Replicate#3-	≤9.5LPM
Spike Gas Flow Rate (LPM)	Replicate#1-	Replicate#2-	Replicate#3-	≤10% of sample flow

Activity	Start/End Time	Analyte Reading (ppm)	Surrogate (ppm) or Diluent (%)	Criteria
Replicate#1-Native	~~10:40~~ 10:51	~~16.8~~ 5.9	~~7.7~~ 6.5	-
Replicate#1-Spiked	10:48 10:53	~~15.5~~ 14.8	~~6.78~~ 6.1	70-130% spike recovery
Replicate#2-Native				-
Replicate#2-Spiked				70-130% spike recovery
Replicate#3-Native				-
Replicate#3-Spiked				70-130% spike recovery

Post Test QA

Activity	Start Time	Analyte Reading (ppm)	Criteria
Test 1 - System Zero			Value near zero
Test 1 - System CTS			Within 5% of cylinder
Test 2 - System Zero			Value near zero
Test 2 - System CTS			Within 5% of cylinder
Test 3 - System Zero			Value near zero
Test 3 - System CTS			Within 5% of cylinder

CONTINUOUS EMISSION MONITORING
SYSTEM CALIBRATION AND DRIFT CALIBRATION

Client: Eco Waste				Date: 10.27.21		
Project Number: 2200515				Start Time: 740		
Sample Location: Incinerator				Finish Time: 1600		
	10.10 O_2 20.93	24.9 49.9 THC 89.9	24.9 49.9 CH4 89.9			
Range	0-25	0-100	0-100			
TIME						
Direct Zero	0.00	0.16	0.39			
Mid. Span	10.18	24.17/49.45	24.89 49.91			
High Span	20.91	89.77	89.46			
TIME						
System Zero	0.41	0.16	0.39			
Span	10.33	49.45	49.91			
TIME						
Zero	6.44	0.32	0.41			
Span	10.21	48.77	47.43			
TIME						
Zero						
Span						
TIME						
Zero						
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TIME						
Zero						
Span						
Drift Criterion: <3% of Span			Bias Criterion: <5% of Span			

Converter Check	NO_2 Value	NO reading	NO_2 Reading	NO_x reading	> 90%
	—	—	—	—	—

Response Time (sec)	—

Notes:

Leak Check ✓
Line Temp 375
Filter Temp 375
Chiller Temp 4.1

18.97
49.91

Line Temp 375
Filter Temp 375
Chiller Temp 4.1

FTIR Data Sheet (Page 1 of 2)- RWDI (v1.1_12/15/20)

Project#	2200515
Client:	Eco Waste
Date:	10.27.21
Operator:	MDS
FTIR Make/Model	MKS
Stack / Source:	Incinerator
Barometric Pressure (atm)	0.9926
FTIR Pressure Transducer (atm)	0.9904

Target Analytes

NOx	(YES) / NO
Carbon Monoxide	(YES) / NO
THC	YES / (NO)
Speciated Hydrocarbons (Methane/Ethane/H2O)	YES / (NO)
Formaldehyde	YES / (NO)
Other Analytes (specify)	SO2

Measurement System Response Time (seconds)

	NOx	CO	THC	Other Analytes (specify)
Time-	27	27	30	—

Sample Flow Rate (Test Run)

Sample flow rate (liters per minute, lpm):	Test Run 1 (lpm)	Test Run 2 (lpm)	Test Run 3 (lpm)	Criteria
	7	7	7	≤9.5LPM

Temperature Controllers

	Test Run 1	Test Run 2	Test Run 3	Criteria
Heated Sample Line (°F)	375	375	375	≥250°F
Heated Probe (°F)	375	375	375	≥250°F
Heated Filter Box (°F)	375	375	375	≥250°F
Gas Cell Heater (°C)	190	190	190	191°C (within ± 10°C)
Gas Inlet Heater (°C)	190	190	190	191°C (within ± 10°C)
Oven (°C)	190	190	190	191°C (within ± 10°C)
ASC-10 Oven Temp (°C)	190	190	190	191°C (within ± 10°C)
ASC-10 Pump Temp (°C)	190	190	190	191°C (within ± 10°C)

FTIR Data Sheet (Page 2 of 2)- RWDI (v1.1_12/15/20)

Pretest QA

Activity	Start Time	Spot Reading (ppm)		Criteria
Direct Zero (daily background)	7:35	0.00 NO_x		Value near zero
Direct CTS	7:38	97.37		Within 5% of cylinder
Direct Cal Gas 1 NO_x	7:42	494.44	9.65	Within 5% of cylinder
Direct Cal Gas 2 (if applicable) CO	7:42	1505.54	9.65	Within 5% of cylinder
Direct Cal Gas 3 (if applicable) SO_2	7:47	191.13		Within 5% of cylinder
Direct Cal Gas 4 (if applicable)	-	-		Within 5% of cylinder
System Zero	7:55	-0.07 NO_x		Value near zero
System CTS	7:59	95.31		Within 5% of cylinder
System Cal Gas 1 NO_x	8:03	486.18	9.46	Within 5% of cylinder
System Cal Gas 2 (if applicable) CO	8:03	1483.52	9.46	Within 5% of cylinder
SO_2	8:10	187.201		

QA Spike Check

Spike Analyte & Surrogate	NO_x			
QA Spike Gas Concentration (System mode)	494.44	9.65		
Sample Flow Rate (LPM)	Replicate#1- 8	Replicate#2- 8	Replicate#3- 8	≤9.5LPM
Spike Gas Flow Rate (LPM)	Replicate#1- .16	Replicate#2- .16	Replicate#3- .16	≤10% of sample flow

Activity	Start/End Time	Analyte Reading (ppm)	Surrogate (ppm) or Diluent (%)	Criteria
Replicate#1-Native	8:40	45.38	0.00	-
Replicate#1-Spiked	8:45	54.86	0.26	70-130% spike recovery
Replicate#2-Native	1450	51.62	0.00	-
Replicate#2-Spiked	1456	65.82	0.27	70-130% spike recovery
Replicate#3-Native	1506	48.80	0.00	-
Replicate#3-Spiked	1509	66.47	0.27	70-130% spike recovery

Post Test QA

Activity	Start Time	Analyte Reading (ppm)	Criteria
Test 1 - System Zero	1427	0.06 NO_x	Value near zero
Test 1 - System CTS	1431	95.00	Within 5% of cylinder
Test 2 - System Zero			Value near zero
Test 2 - System CTS			Within 5% of cylinder
Test 3 - System Zero			Value near zero
Test 3 - System CTS			Within 5% of cylinder

FTIR Data Sheet (Page 2 of 2)- RWDI (v1.1_12/15/20)

Pretest QA

Activity	Start Time	Spot Reading (ppm)	Criteria
Direct Zero (daily background)			Value near zero
Direct CTS			Within 5% of cylinder
Direct Cal Gas 1			Within 5% of cylinder
Direct Cal Gas 2 (if applicable)			Within 5% of cylinder
Direct Cal Gas 3 (if applicable)			Within 5% of cylinder
Direct Cal Gas 4 (if applicable)			Within 5% of cylinder
System Zero			Value near zero
System CTS			Within 5% of cylinder
System Cal Gas 1			Within 5% of cylinder
System Cal Gas 2 (if applicable)			Within 5% of cylinder

QA Spike Check

Spike Analyte & Surrogate	CO			
QA Spike Gas Concentration (System mode)	~~1504.4~~ 1505.54 9.65			
Sample Flow Rate (LPM)	Replicate#1- 8	Replicate#2-	Replicate#3-	≤9.5LPM
Spike Gas Flow Rate (LPM)	Replicate#1- .16	Replicate#2-	Replicate#3-	≤10% of sample flow
Activity	**Start/End Time**	**Analyte Reading (ppm)**	**Surrogate (ppm) or Diluent (%)**	**Criteria**
Replicate#1-Native	8:40	27.79	0.00	-
Replicate#1-Spiked	8:45	57.22	0.26	70-130% spike recovery
Replicate#2-Native	1450	8.36	0.00	-
Replicate#2-Spiked	1456	52.79	0.27	70-130% spike recovery
Replicate#3-Native	1506	8.43	0.00	-
Replicate#3-Spiked	1509	54.42	0.27	70-130% spike recovery

Post Test QA

Activity	Start Time	Analyte Reading (ppm)	Criteria
Test 1 - System Zero			Value near zero
Test 1 - System CTS			Within 5% of cylinder
Test 2 - System Zero			Value near zero
Test 2 - System CTS			Within 5% of cylinder
Test 3 - System Zero			Value near zero
Test 3 - System CTS			Within 5% of cylinder

CONTINUOUS EMISSION MONITORING
SYSTEM CALIBRATION AND DRIFT CALIBRATION

Client:	Eco Waste			Date:	10-28-21	
Project Number:	2200515			Start Time:	7:30	
Sample Location:	Incinerator			Finish Time:	16:00	
	10.10 O_2 20.93	29.9 49.9 THC 89.9	29.9 49.9 CH_4 89.9			
Range	0-25	0-100	0-100			
TIME						
Direct Zero	0.00	0.46	0.38			
Mid. Span	10.16	29.70 49.87	30.37 50.60			
High Span	20.91	89.89	90.06			
TIME						
System ~~Zero~~ Zero	0.41	0.46				
Span	10.29	49.87	50.60			
TIME						
Zero	0.37	1.57	1.50			
Span	9.99	48.32	49.09			
TIME						
Zero						
Span						
TIME						
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Span						
Drift Criterion: <3% of Span			Bias Criterion: <5% of Span			

Converter Check	NO_2 Value	NO reading	NO_2 Reading	NO_x reading	> 90%
	—	—	—	—	—

Response Time (sec)	—

Notes:

Leak Check ✓
Line Temp 375
Filter Temp 375
Chiller Temp NA

THC 49.42

CH_4 50.60

Line Temp 375
Filter Temp 375
Chiller Temp NA

FTIR Data Sheet (Page 1 of 2)- RWDI (v1.1_12/15/20)

Project#	2200515
Client:	Eco Waste
Date:	10-25-21
Operator:	MDS
FTIR Make/Model	MKS
Stack / Source:	Incinerator
Barometric Pressure (atm)	29.9 0.9993
FTIR Pressure Transducer (atm)	0 0.9996

Target Analytes

NOx	(YES) / NO
Carbon Monoxide	(YES) / NO
THC	YES / (NO)
Speciated Hydrocarbons (Methane/Ethane/H2O)	YES / (NO)
Formaldehyde	YES / (NO)
Other Analytes (specify)	SO_2

Measurement System Response Time (seconds)

	NOx	CO	~~THC~~ SO_2	Other Analytes (specify)
Time-	27	27	30	

Sample Flow Rate (Test Run)

Sample flow rate (liters per minute, lpm):	Test Run 1 (lpm)	Test Run 2 (lpm)	Test Run 3 (lpm)	Criteria
	7	7	7	≤9.5LPM

Temperature Controllers

	Test Run 1	Test Run 2	Test Run 3	Criteria
Heated Sample Line (°F)	375			≥250°F
Heated Probe (°F)	375			≥250°F
Heated Filter Box (°F)	375			≥250°F
Gas Cell Heater (°C)	190			191°C (within ± 10°C)
Gas Inlet Heater (°C)	190			191°C (within ± 10°C)
Oven (°C)	190			191°C (within ± 10°C)
ASC-10 Oven Temp (°C)	190			191°C (within ± 10°C)
ASC-10 Pump Temp (°C)	190			191°C (within ± 10°C)

RWDI AIR Inc.
Consulting Engineers

Moisture Analysis Data Sheet

Project #: 2200515 Project: ABERDEEN PROVING

Date: 10/26/21 Test: II M5/29-T1

Filter ID: QZ8828

Sample Loc. Incinerator XAD Trap ID: -

Train ID: ~~M29-T1~~ ~~M5/29-T1~~

Pre-weights By: BD Post-weights By: BD+MS

Impinger #	Impinger Contents	Final Weight (g)	Initial Weight (g)	Net Condensate (g)
1	Empty	821.2	631.6	189.6
2	5%/10%	796.2	756.8	39.4
3	5%/10%	752.6	746.1	6.5
4	Empty	644.4	643.6	0.8
5	KMnO4 H2SO4	757.2	756.6	0.6
6	"	745.5	744.7	0.8
7	Silica	944.6	925.8	18.8
8				
TOTAL				256.5

Balance QA Check:

	Actual (g)	Measured (g)	Error <+/- 0.5 g	Initials
Pre-weights	1,000	1000.1	✓	BD
Post-weights	1,000	999.9	✓	BD

Observations	Pre-test	Post-test
1st Imp colour	~~Clear~~ Clear	Clear
Silica % spent	~ 0%	~ 40%

Nozzle Measurements:

1	0.5
2	0.5
3	0.5
ΔD	0
Avg	0

ΔD must be < 0.004 "

Comments:

Beyamin Durham
Signature

10-26-21
Date

— Isokinetic Sampling Train Data Sheet —

Operator Signature:

Job Name: Aberdeen Proving | Plant: Aberdeen | Test No.: 1 | Start Time: 11:04 | Stack D: 24"
Job Number: 2200515 | Source: Incinerator | Operators: MDS | Finish Time: 15:14 | Pre -Pitot Check: ✓ (< 0.1" @ 3.0" for 15 sec)
Client: Valley Env | Traverse: 2 | Traverse Dir.: I-O | Date: 10-26-21 | Port length: | Page: 1 of 1

Dn: 0.50 Cp: 0.84 Bws: 10 dH@: 1.900 Y: 0.979 Pbar: 29.5 Pstatic: -.09 CO2: 6.3 O2: 10.2 Pitot ID: M29

Pt. (#)	Time (min)	Velocity Press. ("H20)	Orifice Press. ("H20)	Gas Meter Reading Desired (ft3)	Gas Meter Reading Actual (ft3)	Stack Temp. (oF)	Probe Temp. (oF)	Box Temp. (oF)	Imp. Temp. (oF)	Cond. Temp. (oF)	Meter Inlet (oF)	Meter Outlet (oF)	Vac. Press. ("Hg)	Comments
1	0	0.03	.78	-	484.50	761	-	250	50	-	-	74	2	
	5	0.03	.72	487.04	487.05	764	-	252	48	-	-	72	2	
2	10	0.03	.72	489.59	489.50	767	-	250	49	-	-	76	2	
	15	0.03	.72	491.96	491.90	762	-	256	48	-	-	74	2	
3	20	0.03	.72	494.36	494.33	760	-	251	46	-	-	74	2	
	25	0.04	.96	496.79	496.76	771	-	250	46	-	-	75	2	
4	30	0.04	.93	499.60	499.55	808	-	253	46	-	-	76	2	
	35	0.04	.93	502.35	502.34	817	-	256	46	-	-	76	2	
5	40	0.04	.93	505.13	505.13	827	-	254	48	-	-	77	2	
	45	0.04	.93	507.91	507.90	821	-	254	50	-	-	78	2	
6	50	0.04	.91	510.70	510.69	837	-	251	52	-	-	78	2	
	55	0.04	.92	513.47	513.48	833	-	248	53	-	-	79	2	
7	60	0.04	.91	516.27	516.23	843	-	248	55	-	-	78	2	
	65	0.03	.71	519.00	519.04	796	-	252	58	-	-	78	2	
8	70	0.03	.71	521.48	521.56	793	-	253	59	-	-	79	2	
	75	0.03	.71	524.01	524.02	798	-	252	57	-	-	79	2	
9	80	0.03	.71	526.47	526.46	795	-	256	57	-	-	79	2	
	85	0.03	.72	528.91	528.91	777	-	262	58	-	-	79	2	
10	90	0.03	.72	531.35	531.35	770	-	250	52	-	-	80	2	
	95	0.03	.72	533.83	533.79	763	-	249	52	-	-	80	2	
11	100	0.03	.73	536.28	536.21	764	-	250	52	-	-	80	2	
	105	0.03	.74	538.70	538.71	760	-	251	52	-	-	80	2	
12	110	0.03	.74	541.22	541.13	747	-	253	52	-	-	80	2	
	115	0.03	.74	543.63	543.64	743	-	255	53	-	-	80	2	
	120			546.15	546.11									P: 1304
1	120	0.03	.81		546.11	647	-	267	55	-	-	80	2	S: 1314
	125	0.03	.87	548.72	548.70	568	-	251	50	-	-	79	2	
2	130	0.03	.92	551.41	551.43	512	-	259	50	-	-	79	2	
	135	0.03	.70	554.21	554.23	810	-	254	51	-	-	80	2	
3	140	0.04	.92	556.67	556.83	835	-	259	51	-	-	80	2	
	145	0.04	.92	559.62	559.60	838	-	258	50	-	-	80	2	
4	150	0.04	.92	562.39	562.39	840	-	244	51	-	-	80	2	
	155	0.04	.92	565.18	565.18	849	-	256	51	-	-	80	2	
5	160	0.04	.92	567.96	567.85	838	-	254	51	-	-	79	2	
	165	0.04	.91	570.63	570.61	846	-	246	51	-	-	79	2	
6	170	0.04	.91	573.38	573.37	848	-	257	51	-	-	78	2	
	175	0.04	.91	576.14	576.13	850	-	252	51	-	-	78	2	
7	180	0.04	.90	578.89	578.90	851	-	245	51	-	-	78	2	
	185	0.04	.91	581.66	581.62	850	-	250	51	-	-	78	2	
8	190	0.04	.91	584.28	584.20	840	-	252	51	-	-	77	2	
	195	0.04	.89	586.97	586.98	864	-	248	51	-	-	77	2	
9	200	0.04	.89	589.72	589.75	863	-	253	52	-	-	76	2	
	205	0.04	.89	592.31	592.33	863	-	260	52	-	-	76	2	
10	210	0.04	.89	595.07	595.20	864	-	255	52	-	-	76	2	
	215	0.04	.89	597.94	597.86	878	-	254	51	-	-	75	2	
11	220	0.04	.89	600.60	600.54	864	-	254	51	-	-	75	2	
	225	0.04	.89	603.28	603.21	868	-	256	51	-	-	75	2	
12	230	0.04	.89	606.02	605.90	811	-	247	52	-	-	74	2	
	235	0.04	.89	608.62	608.59	867	-	249	52	-	-	75	2	
	240			611.32	611.27									End 1514

Pretest Leak Check Rate (cfm) 0.000 at 10" vacuum ("Hg) Leak Vol Start 484.31 Leak Vol, End 484.50 Post -Pitot Check: ✓ (< 0.1" @ 3.0" for 15 sec)
Posttest Leak Check Rate (cfm) 0.000 at 5" vacuum ("Hg) Leak Vol Start 611.27 Leak Vol. End 611.62

RWDI AIR Inc.
Consulting Engineers

Moisture Analysis Data Sheet

Project #: 2200515 Project: ABERDEEN PROVING

Date: 10/27/21 Test: T2

Filter ID: QZ8818

Sample Loc. Incinerator XAD Trap ID: —

Train ID: M5/29 T2

Pre-weights By: BD Post-weights By: _____

Impinger #	Impinger Contents	Final Weight (g)	Initial Weight (g)	Net Condensate (g)
1	Empty	828.5	636.0	192.5
2	5%/10%	812.8	761.0	51.8
3	"	752.7	746.3	6.4
4	Empty	648.5	647.4	1.1
5	$KMnO_4/H_2SO_4$	743.4	745.0	-1.6
6	"	750.4	749.7	0
7	Silica	897.1	873.3	23.8
8				
TOTAL				274

Balance QA Check:

	Actual (g)	Measured (g)	Error <+/- 0.5 g	Initials
Pre-weights	1000.0	1000.0	✓	BD
Post-weights	1000.0	1000.1	✓	BD

Observations	Pre-test	Post-test
1st Imp colour	Clear	Clear
Silica % spent	40 %	60 %

Nozzle Measurements:
1 0.5
2 0.5
3 0.5
ΔD 0
Avg 0
ΔD must be < 0.004 "

Comments: _____

Benjamin Dunham
Signature

10-27-21
Date

— Isokinetic Sampling Train Data Sheet —

Operator Signature:

Job Name: Aberdeen Proving | Plant: Aberdeen | Test No.: 29-T2 | Start Time: 9:40 | Stack D.: 24"
Job Number: 2200515 | Source: Incinerator | Operators: MDS | Finish Time: 13:58 | Pre -Pitot Check: ✓ (< 0.1" @ 3.0" for 15 sec)
Client: Valley Env | Traverse: 2 | Traverse Dir.: In-Out | Date: 10.27.21 | Port length: | Page: 1 of 1

Dn: 0.500 | Cp: 0.84 | Bws: 10 | dH@: 1.900 | Y: 0.979 | Pbar: 24.7 | Pstatic: -0.09 | CO2: 6.3 | O2: 10.2 | Pitot ID:

Pt. (#)	Time (min)	Velocity Press. ("H20)	Orifice Press. ("H20)	Gas Meter Reading Desired (ft3)	Gas Meter Reading Actual (ft3)	Stack Temp. (oF)	Probe Temp. (oF)	Box Temp. (oF)	Imp. Temp. (oF)	Cond. Temp. (oF)	Meter Inlet (oF)	Meter Outlet (oF)	Vac. Press. ("Hg)	Comments
1	0	0.03	0.70	—	611.62	819	-	249	57	-	-	78	2	
	5	.03	.70	614.03	614.02	801	-	254	49	-	-	77	2	
2	10	.03	.70	616.45	616.43	790	-	249	49	-	-	77	2	
	15	.03	.71	618.87	618.83	788	-	253	49	-	-	76	2	
3	20	.03	.71	621.27	621.29	784	-	252	49	-	-	76	2	
	25	.05	1.12	623.73	623.73	856	-	246	53	-	-	75	2	
4	30	.05	1.1	626.79	626.86	863	-	253	55	-	-	76	2	
	35	.05	1.1	629.91	629.96	879	-	256	58	-	-	76	2	P:10:15 S:10:18
5	40	.05	1.1	633.00	633.00	879	-	253	59	-	-	75	2	
	45	.05	1.1	636.03	636.01	879	-	249	57	-	-	76	2	
6	50	.05	1.1	639.05	639.06	881	-	250	59	-	-	77	2	
	55	.05	1.1	642.10	642.13	876	-	257	59	-	-	77	2	
7	60	.05	1.1	645.17	645.18	876	-	252	59	-	-	77	2	
	65	.03	.70	648.22	648.22	805	-	249	61	-	-	77	2	
8	70	.03	.69	650.64	650.69	829	-	252	55	-	-	77	2	
	75	.03	.70	653.09	653.04	807	-	249	57	-	-	78	2	
9	80	.03	.70	655.47	655.45	805	-	250	57	-	-	79	2	
	85	.03	.71	657.88	657.92	806	-	248	57	-	-	81	2	
10	90	.03	.71	660.36	660.36	807	-	250	57	-	-	82	2	
	95	.03	.71	662.80	662.78	805	-	246	59	-	-	81	2	
11	100	.03	.71	665.22	665.26	805	-	253	60	-	-	81	2	
	105	.03	.70	667.70	667.71	811	-	248	60	-	-	81	2	
12	110	.03	.71	670.15	670.17	805	-	251	60	-	-	81	2	
	115	.03	.71	672.61	672.68	806	-	256	61	-	-	80	2	
	120			675.12	674.98									
1	120	.03	.70	—	674.98	807	-	250	61	-	-	78	2	P:11:46
	125	.03	.70	677.42	677.37	806	-	252	62	-	-	78	2	S:11:58
2	130	.03	.69	679.80	679.77	821	-	251	62	-	-	77	2	
	135	.03	.70	682.18	682.20	804	-	250	62	-	-	77	2	
3	140	.03	.70	684.62	684.60	804	-	251	62	-	-	77	2	
	145	.05	1.1	687.02	686.99	846	-	249	63	-	-	77	2	
4	150	.05	1.1	690.02	690.02	684	-	246	63	-	-	76	2	
	155	.03	1.1	693.05	693.07	855	-	250	63	-	-	77	2	
5	160	.05	1.1	696.14	696.11	868	-	251	59	-	-	76	2	
	165	.05	1.1	699.16	699.12	866	-	250	59	-	-	76	2	
6	170	.05	1.1	702.17	702.19	870	-	245	60	-	-	76	2	
	175	.05	1.1	705.24	705.21	866	-	250	60	-	-	76	2	
7	180	.05	1.1	708.26	708.33	863	-	253	61	-	-	76	2	
	185	.05	1.1	711.38	711.39	867	-	255	61	-	-	76	2	
8	190	.05	1.1	714.44	714.45	854	-	247	61	-	-	76	2	
	195	.05	1.1	717.51	717.54	859	-	250	60	-	-	77	2	
9	200	.05	1.1	720.60	720.59	855	-	250	62	-	-	77	2	
	205	.05	1.1	723.65	723.57	858	-	253	64	-	-	77	2	
10	210	.05	1.1	726.63	726.66	852	-	253	60	-	-	77	2	
	215	.03	.68	729.73	729.66	852	-	251	58	-	-	77	2	
11	220	.03	.69	732.04	732.17	829	-	249	43	-	-	78	2	
	225	.03	.69	734.58	734.62	832	-	249	43	-	-	78	2	
12	230	.03	.68	737.02	737.06	839	-	253	43	-	-	77	2	
	235	.03	.69	739.45	739.49	828	-	249	43	-	-	77	2	
	240	.05		741.89	741.89									E 1358

Pretest Leak Check Rate (cfm) 0.000 at 10" vacuum ("Hg) | Leak Vol Start | Leak Vol. End | Post -Pitot Check: ✓ (< 0.1" @ 3.0" for 15 sec)
Posttest Leak Check Rate (cfm) 0.029 at 5" vacuum ("Hg) | Leak Vol Start 741.89 | Leak Vol. End 742.15

RWDI AIR Inc.
Consulting Engineers

Moisture Analysis Data Sheet

Project #: 2200515 Project: ABERDEEN PROVING

Date: 10-28-21 Test: M5/29-T3

Filter ID: QZ8817

Sample Loc. Incinerator XAD Trap ID: ———

Train ID: M5/29 T3

Pre-weights By: BD Post-weights By: BD

Impinger #	Impinger Contents	Final Weight (g)	Initial Weight (g)	Net Condensate (g)
1	Empty	824.4	635.0	189.4
2	5% 10%	810.3	763.4	46.9
3	5% 10%	759.1	751.2	7.9
4	Empty	647.5	646.6	0.9
5	$KMnO_4$ / H_2SO_4	746.7	746.1	0.6
6	"	752.3	752.3	0
7	Silica	902.3	876.7	25.6
8				
TOTAL				271.3

Balance QA Check:

	Actual (g)	Measured (g)	Error <+/- 0.5 g	Initials
Pre-weights	1000.0	999.9	✓	BD
Post-weights	1000.0	1000.1	✓	BD

Observations	Pre-test	Post-test
1st Imp colour	Clear	Clear
Silica % spent	60%	80%

Nozzle Measurements:
1 0.5
2 0.5
3 0.5
ΔD 0
Avg 0
ΔD must be < 0.004 "

Comments:

Benjamin Dunlap
Signature

10-28-21
Date

— Isokinetic Sampling Train Data Sheet —

Operator Signature:

Job Name: Aberdeen Proving | Plant: Aberdeen | Test No.: 3 - 29 | Start Time: 9:26 | Stack D.: 24"
Job Number: 2200515 | Source: Incinerator | Operators: MDS | Finish Time: 13:32 | Pre -Pitot Check: ✓ (< 0.1" @ 3.0" for 15 sec)
Client: Valley Env | Traverse: 2 | Traverse Dir.: In-Out | Date: 10-28-21 | Port length: | Page: 1 of 1

Dn: .501 Cp: 0.84 Bws: .10 dH@: 1.980 Y: 0.979 Pbar: 29.9 Pstatic: 0.09 CO2: 6.3 O2: 10.2 Pitot ID:

Pt. (#)	Time (min)	Velocity Press. ("H20)	Orifice Press. ("H20)	Gas Meter Reading Desired (ft3)	Gas Meter Reading Actual (ft3)	Stack Temp. (oF)	Probe Temp. (oF)	Box Temp. (oF)	Imp. Temp. (oF)	Cond. Temp. (oF)	Meter Inlet (oF)	Meter Outlet (oF)	Vac. Press. ("Hg)	Comments
1	0	0.03	0.68	—	742.15	828	—	249	52	—	—	70	2	S: 9:26
	5	0.03	0.68	744.51	744.57	823	—	250	50	—	—	70	2	
2	10	0.03	.68	746.93	746.98	833	—	252	48	—	—	71	2	
	15	0.03	.68	749.34	749.37	~~833~~ 833	—	250	48	—	—	70	2	
3	20	.05	1.1	751.73	751.74	884	—	249	48	—	—	71	2	
	25	.05	1.1	754.73	754.73	884	—	250	48	—	—	71	2	
4	30	.05	1.1	757.72	757.69	880	—	252	49	—	—	72	2	
	35	.05	1.1	760.68	760.70	886	—	251	50	—	—	72	2	
5	40	.05	1.1	763.69	763.66	883	—	251	48	—	—	73	2	
	45	.05	1.1	766.66	766.50	881	—	250	48	—	—	73	2	
6	50	.05	1.1	769.57	769.57	879	—	250	49	—	—	74	2	
772.58*	55	.05	1.1	772.58	~~772.58~~	879	—	250	49	—	—	74	2	
7	60	.05	1.1	775.69	775.67	874	—	249	50	—	—	74	2	
	65	.05	1.1	778.63	778.66	871	—	251	50	—	—	74	2	
8	70	.05	1.1	781.68	781.69	874	—	251	50	—	—	74	2	
	75	.05	1.1	784.70	784.71	870	—	249	51	—	—	75	2	
9	80	.05	1.1	787.74	787.67	849	—	250	51	—	—	74	2	
	85	.05	1.1	790.72	790.61	842	—	251	51	—	—	75	2	
10	90	.05	1.1	793.67	793.67	852	—	249	51	—	—	75	2	
	95	.05	1.1	796.72	796.78	842	—	251	52	—	—	75	2	
11	100	.03	0.68	799.84	799.90	842	—	249	52	—	—	75	2	
	105	.03	.68	802.27	802.42	845	—	249	52	—	—	75	2	
12	110	.03	.69	804.79	804.85	824	—	250	52	—	—	75	2	
	115	.03	.69	807.24	807.25	830	—	249	52	—	—	75	2	
	120			809.63	809.69									P: 11:26
1	120	.03	.69	-	809.69	816	—	250	53	—	—	75	2	S: 11:32
	125	.03	.69	812.09	812.11	814	—	248	54	—	—	75	2	
2	130	.03	.69	814.51	814.44	816	—	249	54	—	—	75	2	
	135	.03	.69	816.84	816.86	827	—	248	54	—	—	75	2	
3	140	.05	1.2	819.25	819.25	813	—	250	54	—	—	75	2	
	145	.05	1.1	822.35	822.35	865	—	249	55	—	—	77	2	
4	150	.05	1.1	825.40	825.45	880	—	251	56	—	—	76	2	
	155	.05	1.1	828.47	828.52	870	—	251	56	—	—	77	2	
5	160	.05	1.1	831.56	831.57	858	—	250	56	—	—	77	2	
	165	.05	1.1	834.62	834.66	865	—	252	56	—	—	77	2	
6	170	.05	1.1	837.71	837.75	876	—	252	57	—	—	78	2	
	175	.05	1.1	840.79	840.80	858	—	250	57	—	—	78	2	
7	180	.05	1.1	843.86	843.83	863	—	250	58	—	—	78	2	
	185	.05	1.1	846.88	846.89	838	—	252	58	—	—	78	2	
8	190	.05	1.1	849.94	849.96	871	—	249	59	—	—	78	2	
353.01 -	195	.05	1.1	~~849.96~~	852.99	858	—	248	60	—	—	78	2	
856.05 - 9	200	.03	.68	856.05	~~849~~	841	—	250	61	—	—	79	2	
	205	.03	.69	858.42	858.49	884	—	252	61	—	—	79	2	
10	210	.03	~~.69~~	860.84	860.98	892	—	253	61	—	—	79	2	
	215	.03	.68	863.32	863.33	884	—	250	62	—	—	79	2	
11	220	.03	.68	865.67	865.68	883	—	251	62	—	—	79	2	
	225	.03	.66	868.02	869.02	883	—	252	62	—	—	79	2	
12	230	.03	.66	870.37	870.36	888	—	250	63	—	—	79	2	
	235	.03	.66	872.71	~~872~~ 872.68	898	—	249	63	—	—	79	2	
	240			875.02	874.99									13:32

Pretest Leak Check Rate (cfm) 0.000 at 20 vacuum ("Hg) Leak Vol Start _____ Leak Vol. End _____ Post -Pitot Check: ✓ (< 0.1" @ 3.0" for 15 sec)
Posttest Leak Check Rate (cfm) .000 at 6 vacuum ("Hg) Leak Vol Start _____ Leak Vol. End _____

RWDI AIR Inc.
Consulting Engineers

Moisture Analysis Data Sheet

Project #: 2200515 Project: Aberdeen Proving Grounds

Date: 10-26-21 Test: T1

Filter ID: QZ88116

Sample Loc. Incinerator XAD Trap ID: —

Train ID: M26-T1

Pre-weights By: BD Post-weights By: BD

Impinger #	Impinger Contents	Final Weight (g)	Initial Weight (g)	Net Condensate (g)
1	0.1N H_2SO_4	763.7	731.1	32.6
2	0.1N H_2SO_4	732.8	729.4	3.4
3	Empty	656.1	655.2	0.9
4	Silica	895.5	888.8	6.7
5				
6				
7				
8				
TOTAL				43.6

Balance QA Check:

	Actual (g)	Measured (g)	Error <+/- 0.5 g	Initials
Pre-weights	1000.0	999.6	✓	BD
Post-weights	1000.0	999.9	✓	BTD

Observations	Pre-test	Post-test
1st Imp colour	Clear	Clear
Silica % spent	0%	40%

Nozzle Measurements:
1 .5
2 .5
3 .5
ΔD 0
Avg .5
ΔD must be < 0.004 "

Comments:

Benjamin Dunlap
Signature

10-26-21
Date

Location:	ECOWASTE APG	**Start Time:**	3:29 PM	**1.15 UN No.**	ECO600-HCL-R1
Date:	10/26/21 **Method:** M26A	**End Time:**	4:31 PM	**JOB No.**	VES2021533

STACK DATA			EQUIPMENT			ESTIMATES			FILTERS		
% Moisture:	6.7	% est.	METER BOX:	DA		Est. Tm:	76	°F	Filter #	Tare Weight	STP @ 25C 101.3 kPa Modified September 2006
Barometric:	29.50	in Hg	Y:	0.995		Est. Ts:	872	°F			
Static Press:	-0.09	in H_2O	Ko:	0.73		Est. dP:	0.09	in H_2O			
Stack Press:	29.49	in Hg	ΔH@:	1.721	in H_2O	Est. Dn:	0.4822	inches			
%CO2:	6.00	%	PITOT:	VES 4H		LEAK CHECKS					FINAL CATCH
%O2:	11.00	%	#REF! Cp:	0.82							Liquid Vol. (ml)
%N2/CO:	83.00	%	NOZZLE:	16							43.6
Md:	29.40	lb/lb-mole	Dn:	0.500	in						Particulate Mass (mg)
Ms:	28.64	lb/lb-mole	Stack Area:	1.97	ft^2	Leak Rate	0.001	_____	0.001	cfm	
Msa:	28.64	lb/lb-mole	Stack Diameter:	19	inches	Vacuum	15	_____	15	in. Hg	

Sample Point	Sample Time (minutes)		Dry Gas Meter Reading (ft^3)	Pitot ΔP (in. H_2O)	Gas Temperatures (°F)			Orifice Press. ΔH (in H_2O)		Pump Vac. (in Hg)	Gas Temps (°F)		K FACTOR = 22.225		
					DGM								Imp. XAD	% ISO	Vs (fps)
	Begin	End			Inlet	Outlet	Stack	Ideal	Actual		Probe	Filter			
1	0	5.0	134.950	0.030	69	69	784	0.706	0.68	1.0	253.0	253	58	101.1	14.71
2	5	10.0	137.370	0.030	70	70	831	0.673	0.65	1.0	255.0	255	55	105.3	14.99
3	10	15.0	139.850	0.030	70	70	811	0.683	0.65	1.0	254.0	254	54	95.6	14.87
4	15	20.0	142.120	0.030	70	70	819	0.679	0.65	1.0	253.0	253	54	104.8	14.92
5	20	25.0	144.600	0.030	70	70	816	0.681	0.65	1.0	254.0	254	53	103.4	14.90
6	25	30.0	147.050	0.030	70	70	829	0.674	0.65	1.0	254.0	255	53	106.1	14.98
7	30	35.0	149.550	0.030	71	71	820	0.680	0.65	1.0	252.0	253	52	105.5	14.92
8	35	40.0	152.050	0.030	71	71	819	0.680	0.65	1.0	248.0	250	52	105.4	14.92
9	40	45.0	154.550	0.030	71	71	797	0.692	0.66	1.0	248.0	252	52	102.9	14.79
10	45	50.0	157.010	0.030	71	71	820	0.680	0.65	1.0	247.0	250	52	103.0	14.92
11	50	55.0	159.450	0.030	72	72	823	0.680	0.65	1.0	248.0	252	52	99.1	14.94
97	55	60.0	161.800	0.030	72	72	733	0.731	0.70	1.0	248.0	252	52	103.7	14.41
9999	Final DGM:		164.350												

RWDI AIR Inc.
Consulting Engineers

Moisture Analysis Data Sheet

Project #: 2200515 Project: Aberdeen Proving Grounds

Date: 10-27-21 Test: M26-T2

Filter ID: QZ88116

Sample Loc. Incinerator XAD Trap ID: —

Train ID: —

Pre-weights By: BD Post-weights By: BTD

Impinger #	Impinger Contents	Final Weight (g)	Initial Weight (g)	Net Condensate (g)
1	0.1N H_2SO_4	776.0	735.2	40.8
2	0.1N H_2SO_4	740.4	734.4	6.0
3	Empty	658.0	656.8	1.2
4	Silica	901.1	895.5	5.6
5				
6				
7				
8				
TOTAL				53.6

Balance QA Check:

	Actual (g)	Measured (g)	Error <+/- 0.5 g	Initials
Pre-weights	1000	999.8	✓	BD
Post-weights	1000.0	999.9	✓	BTD

Observations	Pre-test	Post-test
1st Imp colour	Clear	Clear
Silica % spent	~5%	30%

Nozzle Measurements:
1 .5
2 .5
3 .5
ΔD 0
Avg 0
ΔD must be < 0.004 "

Comments:

Benjamin Dahlen
Signature

10-27-21
Date

Location: ECOWASTE APG | **Start Time:** 2:17 PM | **73 UN No.** ECO600-HCL-R2

Date: 10/27/21 | **Method:** M26A | **End Time:** 3:17 PM | **JOB No.** VES2021533

STACK DATA			EQUIPMENT			ESTIMATES			FILTERS		
% Moisture:	6.7	% est.	METER BOX:	DA		Est. Tm:	76	°F	Filter #	Tare Weight	STP @ 25C 101.3 kPa Modified September 2006
Barometric:	29.50	in Hg	Y:	0.995		Est. Ts:	872	°F	xad 1		
Static Press:	-0.09	in H_2O	Ko:	0.73		Est. dP:	0.09	in H_2O			
Stack Press:	29.49	in Hg	ΔH@:	1.721	in H_2O	Est. Dn:	0.4822	inches			
%CO2:	6.00	%	PITOT:	VES 4H		LEAK CHECKS					FINAL CATCH
%O2:	11.00	%	#REF! Cp:	0.82							Liquid Vol. (ml) 53.6
%N2/CO:	83.00	%	NOZZLE:	16							
Md:	29.40	lb/lb-mole	Dn:	0.500	in						Particulate Mass (mg)
Ms:	28.64	lb/lb-mole	Stack Area:	1.97	ft^2	Leak Rate	0.001	_____	0.001	cfm	
Msa:	28.47	lb/lb-mole	Stack Diameter:	19	inches	Vacuum	15	_____	15	in. Hg	

Sample Point	Sample Time (minutes)		Dry Gas Meter Reading (ft^3)	Pitot ΔP	Gas Temperatures (°F)			Orifice Press. ΔH (in H_20)		Pump Vac.	Gas Temps (°F)		K FACTOR = 22.225		
					DGM								Imp.	% ISO	Vs
	Begin	End		(in. H_2O)	Inlet	Outlet	Stack	Ideal	Actual	(in Hg)	Probe	Filter	XAD		(fps)
1	0	5.0	283.240	0.030	73	73	821	0.691	0.69	2.0	253.0	245	67	105.3	14.97
2	5	10.0	285.750	0.030	72	72	869	0.656	0.66	2.0	255.0	246	53	93.7	15.25
3	10	15.0	287.940	0.030	73	73	876	0.654	0.66	2.0	254.0	249	52	98.5	15.29
4	15	20.0	290.240	0.030	72	72	867	0.657	0.65	2.0	253.0	242	52	100.0	15.24
5	20	25.0	292.580	0.040	73	73	862	0.881	0.88	2.0	254.0	242	52	95.6	17.56
6	25	30.0	295.170	0.040	73	73	867	0.877	0.87	2.0	254.0	243	52	95.4	17.60
7	30	35.0	297.750	0.040	74	74	872	0.876	0.87	2.0	252.0	242	52	99.5	17.63
8	35	40.0	300.440	0.040	74	74	883	0.868	0.87	2.0	248.0	247	52	98.0	17.70
9	40	45.0	303.080	0.030	74	74	879	0.654	0.65	2.0	248.0	244	53	99.3	15.31
10	45	50.0	305.400	0.030	73	73	875	0.654	0.65	2.0	247.0	231	53	97.2	15.29
11	50	55.0	307.670	0.030	74	74	864	0.661	0.66	2.0	248.0	242	54	99.1	15.22
97	55	60.0	310.000	0.030	73	73	867	0.658	0.66	2.0	248.0	240	55	93.5	15.24
9999	Final DGM:		312.190												

RWDI AIR Inc.
Consulting Engineers

Moisture Analysis Data Sheet

Project #: 2200515 Project: Aberdeen Proving Grounds

Date: 10-28-21 Test: 26-T3

Filter ID: Q28816

Sample Loc. Incinerator XAD Trap ID: —

Train ID: —

Pre-weights By: BD Post-weights By: MS

Impinger #	Impinger Contents	Final Weight (g)	Initial Weight (g)	Net Condensate (g)
1	0.1N H_2SO_4	770.2	735.8	34.4
2	0.1N H_2SO_4	737.4	732.3	5.1
3	EMPTY	659.2	658.0	1.2
4	Silica	908.5	901.1	7.4
5				
6				
7				
8				
TOTAL				48.1

Balance QA Check:

	Actual (g)	Measured (g)	Error <+/- 0.5 g	Initials
Pre-weights	1000	999.9	✓	MS
Post-weights	1000.0	999.8	✓	MS

Observations	Pre-test	Post-test
1st Imp colour	Clear	Clear
Silica % spent	0%	40%

Nozzle Measurements:

1 .5
2 .5
3 .5
ΔD 0
Avg .5

ΔD must be < 0.004 "

Comments:

Signature

10-28-21
Date

Date: 10/28/2021

SAMPLING TRAINS DATA SHEET

Page 1 of 7

Client: ECOWASTE | Project: 2021533 | Sampling Location: Stack | Traverse: 1 | Run: HCl-R2

O2 N | Meter Factor 0.995 | Nozzle dia. 0.520 | Traverse Direction: DOT | Diameter 19

CO2 C | Barom. Press. 29.74 | Probe ID | Pitot Factor 41HR 0.82 | Static Press. -.08 | Start Time: 13:52 | Stop Time: 14:52

Pt.	Time (min)	O2 (%)	CO2 (%)	Meter Reading (FT³)	Velocity Press P	Meter In (deg F)	Meter Out (deg F)	Stack Temp. (deg F)	Orifice Press H	Probe Temp. (deg F)	Box Temp. (deg F)	Imp Temp. (deg F)	XAD Temp. (deg F)	Vac. (IN Hg)
1	0			441.20	.04	76	76	855	0.9	250	250	53	N/A	1.0
	5			443.95	.04	75	75	854	0.87	250	244	44		1.0
2	10			446.65	.04	75	74	853	0.87	250	247	44		1.0
	15			449.3	.04	74	74	845	.87	250	248	44		1.0
3	20			452.01	.04	75	75	847	.87	250	250	45		1.0
	25			454.68	.03	74	74	846	.65	250	250	46		1.0
4	30			457.00	.04	75	75	853	.87	250	245	47		1.0
	35			459.83	.04	74	74	858	.87	250	253	48		1.0
5	40			462.45	.03	75	74	853	.65	250	257	49		1.0
	45			464.71	.03	75	75	847	.65	250	250	50		1.0
6	50			467.0	.03	75	75	848	.65	250	250	52		1.0
	55			469.27	.03	75	75	852	.65	250	250	55		1.0
~~7~~	60			471.63										
	~~65~~													

Pre-test leak check: Rate (cfm) .001 at 15 inches Hg (Vacumn) | Leak Volume Start: — | Leak Volume End: — | Operators: DL / BD

Post-test leak check: Rate (cfm) .001 at 14 inches Hg (Vacumn) | Leak Volume Start: — | Leak Volume End: — | Signature:

RWDI AIR Inc.
Consulting Engineers

Moisture Analysis Data Sheet

Project #: 2200515 Project: Aberdeen Proving Grounds

Date: 10/26/2021 Test: M23-R1

Filter ID: N/A

Sample Loc. Incinerator XAD Trap ID: #5

Train ID: —

Pre-weights By: H.L. Post-weights By: N.L.

T2

Impinger #	Impinger Contents	Final Weight (g)	Initial Weight (g)	Net Condensate (g)
1	DLK	712.2	486.9	225.9
2	D.I	791.8	788.5	3.3
3	BLK	608.7	606.4	2.3
4	S.G.	933.4	904.9	28.5
5				
6				
7	Cond	772.3	272.3	0
8	XAD #5	323.8	323.8	0
TOTAL				260.0

488.5
791.8
608.7
933.4

Balance QA Check:

	Actual (g)	Measured (g)	Error <+/- 0.5 g	Initials
Pre-weights	1000.0	1000.1	✓	BTD
Post-weights	1000.0	999.9	✓	BTD

Observations	Pre-test	Post-test
1st Imp colour	Clear	Clear
Silica % spent	0%	~30%

Nozzle Measurements:
1 0.500
2 0.500
3 0.500
ΔD 0.000
Avg 0.500
ΔD must be < 0.004 "

Comments:

Signature

10/26/2021
Date

Location:	ECOWASTE APG			**Start Time:**	11:04 AM	**1.15 UN No.**	ECO600-SVOC-R1
Date:	10/26/21	**Method:**	1/RM/2	**End Time:**	3:12 PM	**JOB No.**	VES2021533

STACK DATA			EQUIPMENT			ESTIMATES			FILTERS		
% Moisture:	9	% est.	METER BOX:	DA		Est. Tm:	76	°F	Filter #	Tare Weight	STP @ 25C 101.3 kPa Modified September 2006
Barometric:	29.50	in Hg	Y:	0.995		Est. Ts:	872	°F	XAD 5		
Static Press:	-0.09	in H_2O	Ko:	0.73		Est. dP:	0.09	in H_2O			
Stack Press:	29.49	in Hg	ΔH@:	1.721	in H_2O	Est. Dn:	0.4872	inches			
%CO2:	6.00	%	PITOT:	VES 4H		LEAK CHECKS					FINAL CATCH
%O2:	11.00	%	#REF! Cp:	0.82							Liquid Vol. (ml)
%N2/CO:	83.00	%	NOZZLE:	16							260
Md:	29.40	lb/lb-mole	Dn:	0.500	in						Particulate Mass (mg)
Ms:	28.37	lb/lb-mole	Stack Area:	1.97	ft^2	Leak Rate	0.001	0.001	cfm		
Msa:	28.39	lb/lb-mole	Stack Diameter:	19	inches	Vacuum	15	15	in. Hg		

Sample Point	Sample Time (minutes)		Dry Gas Meter Reading (ft^3)	Pitot ΔP	Gas Temperatures (°F)			Orifice Press. ΔH (in H_2O)		Pump Vac.	Gas Temps (°F)		K FACTOR =		21.338
					DGM								Imp.	% ISO	Vs
	Begin	End		(in. H_2O)	Inlet	Outlet	Stack	Ideal	Actual	(in Hg)	Probe	Filter	XAD		(fps)
1	0	5.0	5.620	0.050	70	70	761	1.153	1.15	3.0		238	55	106.2	18.90
2	5	10.0	8.870	0.030	70	70	784	0.670	0.67	3.0		237	54	100.0	14.78
3	10	15.0	11.220	0.030	70	70	767	0.680	0.68	3.0		240	60	98.0	14.68
4	15	20.0	13.540	0.030	71	71	778	0.675	0.67	4.0		243	60	99.6	14.74
5	20	25.0	15.890	0.040	71	71	762	0.911	0.91	5.0		247	58	99.6	16.91
6	25	30.0	18.620	0.100	71	71	781	2.236	2.20	7.0		246	56	96.8	26.95
7	30	35.0	22.770	0.050	71	71	829	1.079	1.20	5.0		246	56	**111.3**	19.42
8	35	40.0	26.090	0.030	72	72	813	0.658	0.66	4.0		242	54	103.3	14.95
9	40	45.0	28.500	0.030	72	72	816	0.656	0.66	4.0		244	52	103.5	14.97
10	45	50.0	30.910	0.080	73	73	854	1.698	1.70	6.0		244	51	98.5	24.80
11	50	55.0	34.600	0.040	74	74	860	0.848	0.85	4.0		243	45	104.0	17.58
12	55	60.0	37.360	0.040	74	74	855	0.852	0.85	4.0		240	44	103.4	17.54
13	60	65.0	40.110	0.050	74	74	861	1.059	1.05	5.0		244	44	107.6	19.66
14	65	70.0	43.300	0.050	74	74	827	1.087	1.09	5.0		245	45	105.9	19.40
15	70	75.0	46.480	0.030	75	75	828	0.654	0.65	4.0		248	46	**110.2**	15.04
16	75	80.0	49.050	0.030	75	75	828	0.654	0.65	4.0		249	47	105.1	15.04
17	80	85.0	51.500	0.030	76	76	816	0.661	0.66	4.0		247	46	106.5	14.97
18	85	90.0	54.000	0.030	75	75	785	0.676	0.67	4.0		247	45	**113.8**	14.78
19	90	95.0	56.700	0.030	76	76	786	0.677	0.67	4.0		246	45	106.9	14.79
20	95	100.0	59.240	0.030	76	76	785	0.677	0.68	4.0		242	45	108.6	14.78
21	100	105.0	61.820	0.030	77	77	787	0.678	0.68	4.0		246	46	106.4	14.79
22	105	110.0	64.350	0.030	77	77	788	0.677	0.68	4.0		240	47	109.4	14.80
23	110	115.0	66.950	0.030	77	77	790	0.676	0.68	4.0		246	47	106.1	14.81
24	115	120.0	69.470	0.030	77	77	790	0.676	0.68	4.0		249	48	106.5	14.81
25	120	125.0	72.000	0.030	77	77	790	0.676	0.68	4.0		249	49	104.0	14.81
26	125	130.0	74.470	0.040	77	77	789	0.901	0.90	4.0		246	49	**110.1**	17.10
27	130	135.0	77.490	0.040	77	77	790	0.901	0.90	5.0		248	50	108.7	17.10
28	135	140.0	80.470	0.040	77	77	791	0.900	0.90	5.0		248	51	106.9	17.11
29	140	145.0	83.400	0.040	76	76	853	0.856	0.85	5.0		240	52	105.6	17.53
30	145	150.0	86.220	0.040	77	77	798	0.895	0.90	5.0		242	51	**110.9**	17.16
31	150	155.0	89.250	0.040	77	77	805	0.890	0.90	5.0		247	46	**110.1**	17.21
32	155	160.0	92.250	0.030	76	76	804	0.667	0.67	4.0		241	46	109.4	14.90
33	160	165.0	94.830	0.030	76	76	804	0.667	0.67	4.0		241	45	106.0	14.90
34	165	170.0	97.330	0.030	76	76	818	0.660	0.66	4.0		245	46	106.6	14.98
35	170	175.0	99.830	0.030	76	76	856	0.641	0.64	4.0		244	45	108.2	15.20
36	175	180.0	102.330	0.030	76	76	858	0.640	0.64	4.0		249	46	108.2	15.21
37	180	185.0	104.830	0.030	75	75	856	0.640	0.64	4.0		251	45	109.2	15.20
38	185	190.0	107.350	0.030	75	75	857	0.639	0.64	4.0		247	46	105.4	15.20
39	190	195.0	109.780	0.040	74	74	859	0.849	0.85	5.0		247	46	107.4	17.57
40	195	200.0	112.630	0.030	74	74	851	0.641	0.65	5.0		249	45	**112.3**	15.17
41	200	205.0	115.220	0.030	73	73	846	0.642	0.64	4.0		243	46	106.2	15.14
42	205	210.0	117.670	0.030	73	73	843	0.644	0.64	4.0		240	46	104.8	15.12
43	210	215.0	120.090	0.030	73	73	842	0.644	0.64	4.0		248	47	104.7	15.12
44	215	220.0	122.510	0.030	72	72	839	0.644	0.64	4.0		246	48	105.7	15.10
45	220	225.0	124.950	0.030	72	72	852	0.638	0.64	4.0		247	49	106.6	15.18
46	225	230.0	127.400	0.030	71	71	849	0.638	0.64	4.0		248	50	101.5	15.16
47	230	235.0	129.730	0.030	71	71	839	0.643	0.64	4.0		250	51	102.8	15.10
97	235	240.0	132.100	0.030	71	71	839	0.643	0.64	4.0		241	52	104.6	15.10
9999	**Final DGM:**		134.510												

RWDI AIR Inc.
Consulting Engineers

Moisture Analysis Data Sheet

Project #: 2200515 Project: Aberdeen Proving Grounds

Date: 10/27/2021 Test: IW-SVOC-122 M23

Filter ID: —

Sample Loc. Incinerator XAD Trap ID: #3

Train ID: —

Pre-weights By: N.L. Post-weights By: N.L

Impinger #	Impinger Contents	Final Weight (g)	Initial Weight (g)	Net Condensate (g)
1	Blank	685.4	488.4	~~146.6~~ 196.6
2	100 mL DI	793.8	791.8	2
3	Blank	611.7	608.7	3
4	S.G.	955.5	927.3	28.2
5				
6				
7	XAD #3	341.2	326.1	15.1
8	COND	272.3	272.3	0
TOTAL				244.9

Balance QA Check:

	Actual (g)	Measured (g)	Error <+/- 0.5 g	Initials
Pre-weights	1000.0	1000.0	✓	BTD
Post-weights	1000.0	1000.0	✓	BTD

Observations	Pre-test	Post-test
1st Imp colour	Clear	Clear
Silica % spent	0	30%

Nozzle Measurements:

1 0.500
2 0.500
3 0.500
ΔD 0.000
Avg 0.500

ΔD must be < 0.004 "

Comments:

Signature

10/27/2021

Date

Location:	ECOWASTE APG	**Start Time:**	9:40 AM	**RUN No.**	ECO600-SVOC-R2
Date:	10/27/21	**Method:**	EPA 23	**End Time:**	1:58 PM	**JOB No.**	VES2021533

STACK DATA			EQUIPMENT			ESTIMATES			FILTERS		
% Moisture:	9.1	% est.	METER BOX:	DA		Est. Tm:	70	°F	Filter #	Tare Weight	STP @ 25C 101.3 kPa Modified September 2006
Barometric:	29.70	in Hg	Y:	0.995		Est. Ts:	700	°F	XAD 3		
Static Press:	-0.07	in H_2O	Ko:	0.73		Est. dP:	0.08	in H_2O			
Stack Press:	29.69	in Hg	ΔH@:	1.721	in H_2O	Est. Dn:	0.4884	inches			
%CO2:	6.00	%	PITOT:	VES 4H		LEAK CHECKS				FINAL CATCH	
%O2:	11.00	%	#REF! Cp:	0.82						Liquid Vol. (ml)	
%N2/CO:	83.00	%	NOZZLE:	16						245.2	
Md:	29.40	lb/lb-mole	Dn:	0.500	in					Particulate Mass (mg)	
Ms:	28.36	lb/lb-mole	Stack Area:	1.97	ft^2	Leak Rate	0.001	0.001	cfm		
Msa:	28.36	lb/lb-mole	Stack Diameter:	19	inches	Vacuum	15	15	in. Hg		

Sample Point	Sample Time (minutes)		Dry Gas Meter Reading (ft^3)	Pitot ΔP	Gas Temperatures (°F) DGM			Orifice Press. ΔH (in H_2O)		Pump Vac.	Gas Temps (°F)		K FACTOR = 24.186 Imp.	% ISO	Vs
	Begin	End		(in. H_2O)	Inlet	Outlet	Stack	Ideal	Actual	(in Hg)	Probe	Filter	XAD		(fps)
1	0	5.0	164.690	0.030	73	73	814	0.666	0.65	1.0	250.0	243	42	101.0	14.91
2	5	10.0	167.040	0.030	74	74	801	0.665	0.65	1.0	250.0	237	42	96.9	14.83
3	10	15.0	169.310	0.030	73	73	799	0.665	0.65	1.0	250.0	247	41	95.7	14.82
4	15	20.0	171.550	0.030	73	73	800	0.664	0.65	1.0	250.0	252	41	97.9	14.83
5	20	25.0	173.840	0.030	73	73	856	0.636	0.62	1.0	250.0	242	41	94.4	15.15
6	25	30.0	176.000	0.030	72	72	864	0.631	0.62	3.0	250.0	244	45	101.0	15.20
7	30	35.0	178.300	0.030	73	73	867	0.631	0.62	3.0	250.0	242	43	100.0	15.22
8	35	40.0	180.580	0.030	73	73	877	0.626	0.61	3.0	250.0	238	43	104.8	15.27
9	40	45.0	182.960	0.030	72	72	880	0.624	0.61	3.0	250.0	233	45	95.4	15.29
10	45	50.0	185.120	0.040	72	72	879	0.832	0.82	3.0	250.0	231	47	97.2	17.65
11	50	55.0	187.660	0.040	73	73	880	0.833	0.82	3.0	250.0	232	47	98.9	17.66
12	55	60.0	190.250	0.040	73	73	875	0.836	0.82	3.0	250.0	237	47	97.6	17.62
13	60	65.0	192.810	0.040	73	73	878	0.834	0.82	3.0	250.0	234	48	99.2	17.64
14	65	70.0	195.410	0.040	75	75	845	0.858	0.84	3.0	250.0	232	49	97.3	17.42
15	70	75.0	198.000	0.030	75	75	842	0.645	0.64	2.0	250.0	231	50	100.9	15.07
16	75	80.0	200.330	0.030	76	76	842	0.647	0.63	2.0	250.0	239	51	100.2	15.07
17	80	85.0	202.650	0.030	76	76	837	0.649	0.64	3.0	250.0	238	44	100.9	15.04
18	85	90.0	204.990	0.030	77	77	858	0.640	0.63	3.0	250.0	238	43	99.4	15.16
19	90	95.0	207.280	0.030	78	78	838	0.651	0.64	3.0	250.0	236	42	97.6	15.05
20	95	100.0	209.550	0.030	78	78	841	0.650	0.64	3.0	250.0	237	43	98.1	15.07
21	100	105.0	211.830	0.030	78	78	827	0.657	0.64	3.0	250.0	237	43	97.6	14.98
22	105	110.0	214.110	0.030	78	78	818	0.661	0.65	3.0	250.0	237	43	98.5	14.93
23	110	115.0	216.420	0.030	78	78	838	0.651	0.64	3.0	250.0	235	43	98.0	15.05
24	115	120.0	218.700	0.030	78	78	833	0.654	0.64	3.0	250.0	233	44	100.0	15.02
25	120	125.0	221.030	0.030	76	76	831	0.652	0.64	3.0	250.0	236	47	94.2	15.01
26	125	130.0	223.220	0.030	75	75	805	0.664	0.65	3.0	250.0	237	47	103.7	14.86
27	130	135.0	225.650	0.030	75	75	805	0.664	0.65	4.0	250.0	235	51	93.9	14.86
28	135	140.0	227.850	0.030	74	74	806	0.663	0.65	4.0	250.0	242	51	94.5	14.86
29	140	145.0	230.060	0.030	73	73	836	0.646	0.63	4.0	250.0	245	52	98.4	15.04
30	145	150.0	232.330	0.050	73	73	805	1.102	1.10	6.0	250.0	236	53	100.3	19.18
31	150	155.0	235.350	0.050	72	72	838	1.072	1.05	5.0	250.0	232	46	97.7	19.43
32	155	160.0	238.250	0.050	72	72	836	1.074	1.05	5.0	250.0	242	45	99.3	19.41
33	160	165.0	241.200	0.050	72	72	843	1.068	1.05	5.0	250.0	238	45	97.9	19.47
34	165	170.0	244.100	0.050	72	72	841	1.069	1.05	5.0	250.0	235	45	99.2	19.45
35	170	175.0	247.040	0.050	71	71	851	1.059	1.04	5.0	250.0	237	47	99.1	19.52
36	175	180.0	249.960	0.050	72	72	831	1.078	1.05	5.0	250.0	240	47	98.1	19.38
37	180	185.0	252.880	0.040	72	72	840	0.857	0.84	4.0	250.0	242	46	99.1	17.39
38	185	190.0	255.510	0.040	72	72	835	0.860	0.84	4.0	250.0	238	47	97.8	17.36
39	190	195.0	258.110	0.040	72	72	832	0.862	0.85	4.0	250.0	231	49	97.7	17.34
40	195	200.0	260.710	0.040	72	72	804	0.881	0.86	4.0	250.0	235	50	97.4	17.15
41	200	205.0	263.330	0.040	72	72	802	0.882	0.87	4.0	250.0	237	52	97.7	17.13
42	205	210.0	265.960	0.040	72	72	806	0.880	0.86	4.0	250.0	239	53	100.1	17.16
43	210	215.0	268.650	0.040	72	72	801	0.883	0.87	4.0	250.0	230	55	97.6	17.13
44	215	220.0	271.280	0.030	72	72	800	0.663	0.65	3.0	250.0	237	56	104.5	14.83
45	220	225.0	273.720	0.030	72	72	843	0.641	0.63	3.0	250.0	227	45	101.5	15.08
46	225	230.0	276.050	0.030	73	73	847	0.641	0.63	3.0	250.0	230	44	102.3	15.10
47	230	235.0	278.400	0.030	73	73	837	0.646	0.63	3.0	250.0	248	45	102.8	15.04
97	235	240.0	280.770	0.030	73	73	847	0.641	0.63	3.0	250.0	250	46	99.3	15.10
9999	Final DGM:		283.050												

RWDI AIR Inc.
Consulting Engineers

Moisture Analysis Data Sheet

Project #: 2200515 Project: Aberdeen Proving Grounds

Date: 10/28/2021 Test: IH-SVOC-123

Filter ID: —

Sample Loc. Incinerator XAD Trap ID: #1

Train ID: —

Pre-weights By: N.L Post-weights By: N.L

Impinger #	Impinger Contents	Final Weight (g)	Initial Weight (g)	Net Condensate (g)
1	~~H_2O~~ Empty	719.0	488.5	230.5
2	H_2O	794.0	793.8	0.2
3	Empty	613.2	611.7	1.5
4	Silica	978.6	955.5	23.1
5				
6				
7	Cond	272.3	272.3	0
8	XAD #1	339.2	336.5	2.7
TOTAL				258.1

Balance QA Check:

	Actual (g)	Measured (g)	Error <+/- 0.5 g	Initials
Pre-weights	1000.0	999.9	✓	BTD
Post-weights	1000.0	1000.0	✓	BTD

Observations	Pre-test	Post-test
1st Imp colour	Clear	Clear
Silica % spent	30%	70%

Nozzle Measurements:
1 0.500
2 0.500
3 0.500
ΔD 0.000
Avg 0.500
ΔD must be < 0.004 "

Comments:

Signature

10/28/2021
Date

Date: 8/10/28/2021

SAMPLING TRAINS DATA SHEET

Page 1 of 2

Client: ECOWASTE Project: 2021537 Sampling Location: STK Traverse: 1 Run: SVOC-123

O2 21 Meter Factor DH 0.995 Nozzle dia. 0.500 Traverse Direction: OUT Diameter 15

CO2 0 Barom. Press. 29.75 Probe ID Pitot Factor 0.82 Static Press. ____ Start Time: ____ Stop Time: 11:27

Pt.	Time (min)	O2 (%)	CO2 (%)	Meter Reading (FT³)	Velocity Press P	Meter In (deg F)	Meter Out (deg F)	Stack Temp. (deg F)	Orifice Press H	Probe Temp. (deg F)	Box Temp. (deg F)	Imp Temp. (deg F)	XAD Temp. (deg F)	Vac. (IN Hg)
1	0	10#	6.5	312.46	.03	69	69	763	.68	250	250	40	40	2.0
	5			314.76	.03	69	69	775	0.66	250	248	41	41	2.0
	10			317.02	.03	69	69	779	0.66	250	252	41	41	2.0
	15			319.30	.03	69	69	780	0.66	250	250	43	43	3.0
2	20			321.56	.03	69	69	752	.67	250	253	43	41	3.0
	25			323.91	.03	69	69	832	.63	250	252	43	41	3.0
	30			326.09	.04	70	70	832	.85	250	257	43	41	3.0
	35			328.61	.04	69	69	834	.84	250	254	43	41	3.0
3	40			331.23	.05	70	70	835	1.05	250	252	43	42	4.0
	45			334.20	.05	70	70	830	1.04	250	250	44	42	4.0
	50			337.09	.05	71	71	831	1.05	250	257	45	42	4.0
	55			340.0	.05	71	71	829	1.04	250	250	45	42	4.0
4	60			342.84	.05	72	72	723	1.15	250	247	46	41	4.0
	65			346.0	.05	72	72	806	1.0	250	250	46	42	4.0
	70			349.1	.05	73	73	871	1.0	250	254	46	43	4.0
	75			351.87	.04	72	72	867	.82	257	257	46	43	4.0
5	80			354.41	.04	73	73	862	.83	250	252	47	43	4.0
	85			357.09	.04	73	73	858	.83	250	251	47	43	4.0
	90			359.7	.04	74	74	862	.83	250	257	49	44	4.0
	95			364.83	.04	74	74	861	.83	250	249	49	45	4.0
6	100			367.53	.03	74	74	823	.86	250	257	49	46	4.0
	105			372.52	.03	74	74	829	.64	250	250	49	46	4.0
	110			370.21	.03	74	74	824	.65	250	250	49	47	3.0
	116			372.5	.03	74	74	829	.64	250	247	49	49	3.0
	120			374.87										

Pre-test leak check: Rate (cfm) .001 at 15 inches Hg (Vacumn) Leak Volume Start: 312.23 Leak Volume End: 312.46 Operators: LL/BD

Post-test leak check: Rate (cfm) ___ at ___ inches Hg (Vacumn) Leak Volume Start: ____ Leak Volume End: ____ Signature: ____

Date: 10/28/2021

SAMPLING TRAINS DATA SHEET

Page 2 of 2

Client: ECOWASTE | Project: 2022537 | Sampling Location: Stack | Traverse: 2 | Run: SVOC-123

O2 11 | Meter Factor DH 0.995 | Nozzle dia. 0.500 | Traverse Direction: OUT | Diameter 14

CO2 0 | Barom. Press. 29.75 | Probe ID | Pitot Factor 1.46 .82 | Static Press. -.07 | Start Time: 11:31 | Stop Time: 13:31

Pt.	Time (min)	O2 (%)	CO2 (%)	Meter Reading (FT³)	Velocity Press P	Meter In (deg F)	Meter Out (deg F)	Stack Temp. (deg F)	Orifice Press H	Probe Temp. (deg F)	Box Temp. (deg F)	Imp Temp. (deg F)	XAD Temp. (deg F)	Vac. (IN Hg)
1	0			374.87	.03	74	74	817	.64	250	252	55	57	3.0
	5			377.22	.03	74	74	825	.64	250	251	55	52	3.0
	10			379.56	.04	74	74	814	.86	250	248	54	54	3.1
	15			382.2	.04	74	74	820	.86	250	251	55	55	4.0
2	20			384.85	.05	74	75	870	1.0	250	250	54	56	5.0
	25			387.14	.05	74	74	862	1.04	250	250	54	52	5.0
	30			390.95	.05	75	74	863	1.0	250	252	55	52	5.0
	35			393.87	.06	75	74	875	1.2	250	252	49	51	5.0
3	40			397.07	.05	74	75	860	1.0	250	250	49	52	5.0
	45			400.08	.05	74	75	862	1.0	250	249	44	52	5.0
	50			403.00	.05	75	75	861	1.0	250	248	49	52	5.0
	55			406.05	.05	74	74	863	1.0	250	252	49	52	5.0
4	60			409.00	.05	76	74	863	1.0	250	252	49	51	5.0
	65			411.55	.05	76	76	866	1.0	250	250	49	52	5.0
	70			414.86	.05	74	76	875	1.0	250	249	49	52	5.0
	75			417.79	.04	74	74	868	.83	250	250	49	53	4.0
5	80			420.6	.04	74	74	856	.84	250	244	48	52	5.0
	85			423.11	.04	76	74	860	.84	250	250	48	52	5.0
	90			425.8	.04	77	77	866	.83	250	250	48	53	5.0
	95			428.55	.04	74	74	873	.83	250	248	48	55	5.0
6	100			431.11	.04	77	77	867	.83	250	250	49	53	5.0
	105			433.83	.03	74	76	857	.63	250	249	49	54	4.0
	110			436.19	.03	77	77	859	.63	250	247	49	53	4.0
	115			438.57	.03	74	74	866	.63	250	252	49	54	4.0
	120			440.83										

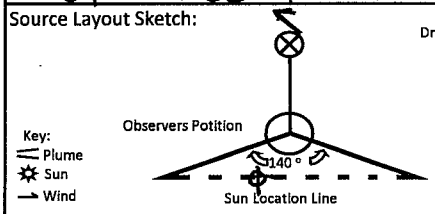
Pre-test leak check: Rate (cfm) — at — inches Hg (Vacumn) | Leak Volume Start: — | Leak Volume End: — | Operators: NL JBD

Post-test leak check: Rate (cfm) 0.005 at 15 inches Hg (Vacumn) | Leak Volume Start: 440.83 | Leak Volume End: 440.96 | Signature:

Visible Emission Observation Form:

Source Name: Incinerator			**Observation Date:** 10-26-21					**Start Time:** 11:04				**Stop Time:** 12:04			
Address: 6836 Civil Rd			Sec / Min	1	15	30	45	Sec / Min	1	15	30	45			
City Aberdeen	**Provience** MD	**Postal Code:** 21005	1	0	0	0	0	31	0	0	0	0			
			2	0	0	0	0	32	0	0	0	0			
Phone:	**Source ID:**		3	0	0	0	0	33	0	0	0	0			
			4	0	0	0	0	34	0	0	0	0			
Process Equipment:	**Operating Mode:**		5	0	0	0	0	35	0	0	0	0			
			6	0	0	0	0	36	0	0	0	0			
Control Equipment:	**Operating Mode:**		7	0	0	0	0	37	0	0	0	0			
			8	0	0	0	0	38	0	0	0	0			
Describe Emissiong Point: Mouth of stack			9	0	0	0	0	39	0	0	0	0			
			10	0	0	0	0	40	0	0	0	0			
Height above Ground Level: Start: 30' Stop: 30'	**Height Relative to Observer:** Start: 33' Stop: 33'		11	0	0	0	0	41	0	0	0	0			
			12	0	0	0	0	42	0	0	0	0			
Distance from Observer: Start: 90' Stop: 90'	**Direction from Observer:** Start: NW Stop: NW		13	0	0	0	0	43	0	0	0	0			
			14	0	0	0	0	44	0	0	0	0			
Describe Emissions: Start: Clear Stop: Clear			15	0	0	0	0	45	0	0	0	0			
			16	0	0	0	0	46	0	0	0	0			
Emission Colour: Start: Clear Stop: Clear	**Plume Type:** Continuous / Fugitive / Intermittent		17	0	0	0	0	47	0	0	0	0			
			18	0	0	0	0	48	0	0	0	0			
Water Droplets Present:	**If Present:** Continuous / Attached / Detached		19	0	0	0	0	49	0	0	0	0			
			20	0	0	0	0	50	0	0	0	0			
Point in the Plume at Which Opacity was Determined: Start: Mouth of Stack Stop: Mouth of Stack			21	0	0	0	0	51	0	0	0	0			
			22	0	0	0	0	52	0	0	0	0			
Describe Background: Start: Partly Cloudy Sky Stop: Partly Cloudy Sky			23	0	0	0	0	53	0	0	0	0			
			24	0	0	0	0	54	0	0	0	0			
Background Colour: Start: Blue/Gray Stop: Blue/Gray	**Sky Condition:** Start: P.Cloudy Stop: P.Cloudy		25	0	0	0	0	55	0	0	0	0			
			26	0	0	0	0	56	0	0	0	0			
Wind Speed: Start: 12mph Stop: 12	**Wind Direction:** Start: W Stop: W		27	0	0	0	0	57	0	0	0	0			
			28	0	0	0	0	58	0	0	0	0			
Ambient Temp: Start: 64 Stop: 66	**Relative Humidity** Start: 81% Stop: 73%		29	0	0	0	0	59	0	0	0	0			
			30	0	0	0	0	60	0	0	0	0			

Source Layout Sketch:



Average Opacity for Highest Period: 0

Number of Reading Above: 0 % were 0

Range of Opacity Readings: Minimum: 0 Maximum: 0

Observers Name (Print): Benjamin Durham

Observers Signature: Benjamin Durham **Date:** 10-26-21

Comments:

Organization: RWDI

I have received a copy of these Opacity Observations:

Certified By: AeroMet **Date:** 10-20-21

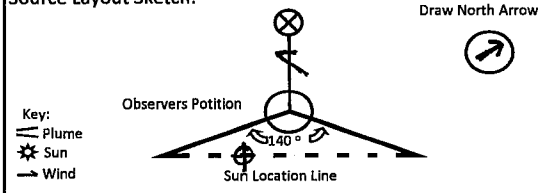
Title: **Date:**

Verified By: **Date:**

Visible Emission Observation Form:

Source Name: Incinerator			**Observation Date:** 10-27-21					**Start Time:** 9:40				**Stop Time:** 10:40		
Address: 68360 Civil Rd			Min \ Sec	1	15	30	45	Min \ Sec	1	15	30	45		
City: Aberdeen	Provience: MD	Postal Code: 21005	1	0	0	0	0	31	0	0	0	0		
			2	0	0	0	0	32	0	0	0	0		
Phone:	**Source ID:**		3	0	0	0	0	33	0	0	0	0		
			4	0	0	0	0	34	0	0	0	0		
Process Equipment:	**Operating Mode:**		5	0	0	0	0	35	0	0	0	0		
			6	0	0	0	0	36	0	0	0	0		
Control Equipment:	**Operating Mode:**		7	0	0	0	0	37	0	0	0	0		
			8	0	0	0	0	38	0	0	0	0		
Describe Emissiong Point: Mouth of Stack			9	0	0	0	0	39	0	0	0	0		
			10	0	0	0	0	40	0	0	0	0		
Height above Ground Level: Start: 30' Stop: 30'	**Height Relative to Observer:** Start: 33' Stop: 33'		11	0	0	0	0	41	0	0	0	0		
			12	0	0	0	0	42	0	0	0	0		
Distance from Observer: Start: 90' Stop: 90'	**Direction from Observer:** Start: NW Stop: NW		13	0	0	0	0	43	0	0	0	0		
			14	0	0	0	0	44	0	0	0	0		
Describe Emissions: Start: Clear Stop: Clear			15	0	0	0	0	45	0	0	0	0		
			16	0	0	0	0	46	0	0	0	0		
Emission Colour: Start: Clear Stop: Clear	**Plume Type:** Continuous / Fugitive / Intermittent		17	0	0	0	0	47	0	0	0	0		
			18	0	0	0	0	48	0	0	0	0		
Water Droplets Present:	**If Present:** Continuous / Attached / Detached		19	0	0	0	0	49	0	0	0	0		
			20	0	0	0	0	50	0	0	0	0		
Point in the Plume at Which Opacity was Determined: Start: Mouth of Stack Stop: Mouth of Stack			21	0	0	0	0	51	0	0	0	0		
			22	0	0	0	0	52	0	0	0	0		
Describe Background: Start: Cloudy Sky Stop: P. Cloudy Sky			23	0	0	0	0	53	0	0	0	0		
			24	0	0	0	0	54	0	0	0	0		
Background Colour: Start: Gray Stop: Gray	**Sky Condition:** Start: Cloudy Stop: P. Cloudy		25	0	0	0	0	55	0	0	0	0		
			26	0	0	0	0	56	0	0	0	0		
Wind Speed: Start: 14 Stop: 12	**Wind Direction:** Start: W Stop: W		27	0	0	0	0	57	0	0	0	0		
			28	0	0	0	0	58	0	0	0	0		
Ambient Temp: Start: 54 Stop: 58	**Relative Humidity** Start: 82% Stop: 74%		29	0	0	0	0	59	0	0	0	0		
			30	0	0	0	0	60	0	0	0	0		

Source Layout Sketch:



Average Opacity for Highest Period: 0

Number of Reading Above: 0 % were 0

Range of Opacity Readings: Minimum: 0 Maximum: 0

Observers Name (Print): Benjamin Durham

Observers Signature: Benjamin Durham **Date:** 10-27-21

Comments:

Organization: RWDI

I have received a copy of these Opacity Observations:

Certified By: AeroMet **Date:** 10-20-21

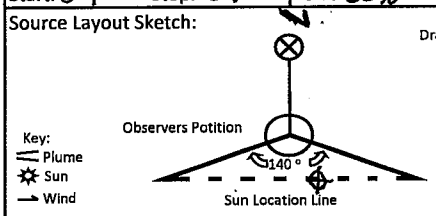
Title: **Date:**

Verified By: **Date:**

Visible Emission Observation Form:

Source Name: Incinerator			**Observation Date:** 10-28-21					**Start Time:** 9:29		**Stop Time:** 10:29		
Address: 6836 Civil Rd			Sec / Min	1	15	30	45	Sec / Min	1	15	30	45
City: Aberdeen	Provience: MI	Postal Code: 21005	1	0	0	0	0	31	0	0	0	0
			2	0	0	0	0	32	0	0	0	0
Phone:	**Source ID:**		3	0	0	0	0	33	0	0	0	0
			4	0	0	0	0	34	0	0	0	0
Process Equipment:	**Operating Mode:**		5	0	0	0	0	35	0	0	0	0
			6	0	0	0	0	36	0	0	0	0
Control Equipment:	**Operating Mode:**		7	0	0	0	0	37	0	0	0	0
			8	0	0	0	0	38	0	0	0	0
Describe Emissiong Point: Mouth of Stack			9	0	0	0	0	39	0	0	0	0
			10	0	0	0	0	40	0	0	0	0
Height above Ground Level: Start: 30' Stop: 30'	**Height Relative to Observer:** Start: 33' Stop: 33'		11	0	0	0	0	41	0	0	0	0
			12	0	0	0	0	42	0	0	0	0
Distance from Observer: Start: 90' Stop: 90'	**Direction from Observer:** Start: NW Stop: NW		13	0	0	0	0	43	0	0	0	0
			14	0	0	0	0	44	0	0	0	0
Describe Emissions: Start: Clear Stop: Clear			15	0	0	0	0	45	0	0	0	0
			16	0	0	0	0	46	0	0	0	0
Emission Colour: Start: Clear Stop: Clear	**Plume Type:** Fugitive / Continuous / Intermittent		17	0	0	0	0	47	0	0	0	0
			18	0	0	0	0	48	0	0	0	0
Water Droplets Present:	**If Present:** Attached / Continuous / Detached		19	0	0	0	0	49	0	0	0	0
			20	0	0	0	0	50	0	0	0	0
Point in the Plume at Which Opacity was Determined: Start: Mouth of Stack Stop: Mouth of Stack			21	0	0	0	0	51	0	0	0	0
			22	0	0	0	0	52	0	0	0	0
Describe Background: Start: Sky Stop: Sky			23	0	0	0	0	53	0	0	0	0
			24	0	0	0	0	54	0	0	0	0
Background Colour: Start: Blue Stop: Blue	**Sky Condition:** Start: Clear Stop: Clear		25	0	0	0	0	55	0	0	0	0
			26	0	0	0	0	56	0	0	0	0
Wind Speed: Start: 5mph Stop: 4mph	**Wind Direction:** Start: ~~ESE~~ ESE Stop: ESE		27	0	0	0	0	57	0	0	0	0
			28	0	0	0	0	58	0	0	0	0
Ambient Temp: Start: 54° Stop: 59°	**Relative Humidity** Start: 85% Stop: 71%		29	0	0	0	0	59	0	0	0	0
			30	0	0	0	0	60	0	0	0	0

Source Layout Sketch:



Average Opacity for Highest Period: 0

Number of Reading Above: 0 % were 0

Range of Opacity Readings: Minimum: 0 Maximum: 0

Observers Name (Print): Benjamin Durham

Observers Signature: Benjamin Durham **Date:** 10-28-21

Comments:

Organization: RWDI

I have received a copy of these Opacity Observations:

Certified By: AeroMet **Date:** 10-20-21

Title: **Date:**

Verified By: **Date:**

APPENDIX H

APEX SOURCE TESTING EQUIPMENT INSTRUMENTS

Revised: 2019/12/18

Certificate of Calibration

Method 5 Critical Orifice Set Calibration - Liters (L)

Orifice Information

Set: II
Series: 40-73

Factors and Conversions

Std Temp (K): 293.15
Std Press (mm Hg): 760
K_1 (K/mm Hg): 0.3857
Altitude (ft): 414.0
Alt. Correction Factor (in): -0.414

Reference Wet Test Meter and Thermometers

WTM Model: W-NKoDa-5B
WTM Cal. Due Date: 28-Feb-21
Ambient Therm.: Traceable
Amb. Therm. Serial #: 192274437
Amb. Therm. Cert. Due Date: 24-Jun-21

WTM Serial: 546258
WTM Gamma: 0.9992
WTM Therm.: Internal
WTM Therm. Serial #: N/A
WTM Therm. Cert. Due Date: 28-Feb-2021

Date and Technician

Date Started: 15-Dec-2020
Date Finished: 15-Dec-2020
Calibration Tech: Jake Bush

Calibration Data

Orifice ID	Run Time (seconds)	Volume (L)				Outlet Temp. (°C)		Vacuum (inches Hg)	Vacuum[1] (mm Hg)	Meter Press. (mm H_2O)	Ambient Temp. (°C)		Bar. Press. (in Hg)	Theoretical Critical Vacuum[1] (mm Hg)	% RH
		Initial	Final	Total	Stand.	Initial	Final				Initial	Final			
#	Θ	V_{mi}	V_{mf}	V_m	V_{std}	t_{mi}	t_{mf}			P_m	$t_{amb(i)}$	$t_{amb(f)}$	P_B		
II-40	168.178	0.00	25.00	25.00	24.718	22.3	22.3	23.3	591.82	-2.00	23.5	23.7	30.26	357.818	55
II-40	168.220	0.00	25.00	25.00	24.718	22.3	22.3	23.3	591.82	-2.00	23.7	24.0	30.26	357.818	55
II-40	168.218	0.00	25.00	25.00	24.718	22.3	22.3	23.3	591.82	-2.00	24.0	23.9	30.26	357.818	55
														Average	
II-48	116.864	0.00	25.00	25.00	24.716	22.3	22.3	22.0	558.80	-3.00	23.9	23.7	30.26	357.818	55
II-48	116.859	0.00	25.00	25.00	24.712	22.3	22.4	22.0	558.80	-3.00	23.7	23.7	30.26	357.818	55
II-48	116.825	0.00	25.00	25.00	24.708	22.4	22.4	22.0	558.80	-3.00	23.7	23.7	30.26	357.818	55
														Average	
II-55	88.691	0.00	25.00	25.00	24.705	22.4	22.4	20.5	520.70	-4.00	23.7	23.7	30.26	357.818	55
II-55	88.668	0.00	25.00	25.00	24.705	22.4	22.4	20.5	520.70	-4.00	23.7	23.7	30.26	357.818	55
II-55	88.692	0.00	25.00	25.00	24.705	22.4	22.4	20.5	520.70	-4.00	23.7	23.7	30.26	357.818	55
														Average	
II-63	68.701	0.00	25.00	25.00	24.696	22.4	22.5	18.8	477.52	-6.00	23.7	23.7	30.26	357.818	55
II-63	68.690	0.00	25.00	25.00	24.692	22.5	22.5	18.8	477.52	-6.00	23.7	23.7	30.26	357.818	55
II-63	68.681	0.00	25.00	25.00	24.692	22.5	22.5	18.8	477.52	-6.00	23.7	23.7	30.26	357.818	55
														Average	
II-73	50.127	0.00	25.00	25.00	24.678	22.5	22.5	16.3	414.02	-12.00	23.7	23.8	30.26	357.818	55
II-73	50.127	0.00	25.00	25.00	24.678	22.5	22.5	16.3	414.02	-12.00	23.8	23.8	30.26	357.818	55
II-73	50.110	0.00	25.00	25.00	24.678	22.5	22.5	16.3	414.02	-12.00	23.8	23.8	30.26	357.818	55
														Average	

Critical Orifice Results

K' Coefficient		Variation (<0.5%)	Stand. Flow (m^3/min)	Standardized Flow (ft^3/min)
Metric[2]	English[3]	%	Q_{std}	Q_{std}
2.004E-04	0.2412	0.017	8.819E-03	0.3114
2.004E-04	0.2412	0.000	8.816E-03	0.3113
2.005E-04	0.2412	0.018	8.817E-03	0.3113
2.004E-04	**0.2412**		8.817E-03	0.3113
2.884E-04	0.3471	0.016	1.269E-02	0.4481
2.884E-04	0.3470	0.014	1.269E-02	0.4480
2.884E-04	0.3471	0.002	1.269E-02	0.4481
2.884E-04	**0.3471**		1.269E-02	0.4481
3.798E-04	0.4571	0.008	1.671E-02	0.5901
3.799E-04	0.4572	0.018	1.672E-02	0.5903
3.798E-04	0.4571	0.009	1.671E-02	0.5901
3.799E-04	**0.4572**		1.671E-02	0.5902
4.902E-04	0.5899	0.012	2.157E-02	0.7616
4.902E-04	0.5899	0.013	2.157E-02	0.7616
4.903E-04	0.5900	0.000	2.157E-02	0.7617
4.902E-04	**0.5899**		2.157E-02	0.7616
6.714E-04	0.8080	0.017	2.954E-02	1.0430
6.714E-04	0.8080	0.009	2.954E-02	1.0430
6.717E-04	0.8083	0.025	2.955E-02	1.0433
6.715E-04	**0.8081**		2.954E-02	1.0431

Notes:

[1]For valid test results, the Actual Vacuum must be 25 mmHg greater than the Theoretical Critical Vacuum.
[2]The Critical Orifice Coefficient, K', in Metric units, $(m^3 * K^{1/2}) / (mm\ Hg * min)$.
[3]The Critical Orifice Coefficient, K', in English units, $(ft^3 * R^{1/2}) / (in\ Hg * min)$.

Technician: Jake Bush
Signature: Jake Bush
Date: December 15, 2020

I certify that the above Orifice Set was calibrated in accordance with US EPA Methods, CFR 40 Part 60, Appendix A, Method 5, Section 16.2.

The instruments listed and described on this certificate have been calibrated against standards traceable to the National Institute of Standards and Technology (N.I.S.T.).

Apex Instruments - Address: 204 Technology Park Ln., Fuquay-Varina, NC 27526 USA | Tel: (919) 557-7300 Web: www.apexinst.com

DGM Temperature Calibration

Date of Calibration: 29-Dec-20

Ambient Temp: 66ºF **Reference:** Thermocouple Calibrator

Sampling Train ID: Console A

	Thermocouple Calibrator Setting	Reference Temperature Thermometer (T_R) ˚F	Reference Temperature Thermometer (T_R) ˚K	Actual Temperature Thermocouple (Tm) ˚F	Actual Temperature Thermocouple (Tm) ˚K	Temperature Difference [1] %
STACK	1	-4	253.0	-2	254.1	0.44
	2	32	273.0	32	273.0	0.00
	3	41	278.0	41	278.0	0.00
	4	212	373.0	213	373.6	0.15
	5	428	493.0	428	493.0	0.00
PROBE	1	-4	253.0	-1	254.7	0.66
	2	32	273.0	32	273.0	0.00
	3	41	278.0	41	278.0	0.00
	4	212	373.0	214	374.1	0.30
	5	428	493.0	429	493.6	0.11
FILTER	1	-4	253.0	-2	254.1	0.44
	2	32	273.0	32	273.0	0.00
	3	41	278.0	41	278.0	0.00
	4	212	373.0	213	373.6	0.15
	5	428	493.0	428	493.0	0.00
DRYER	1	-4	253.0	-3	253.6	0.22
	2	32	273.0	31	272.4	-0.20
	3	41	278.0	40	277.4	-0.20
	4	212	373.0	212	373.0	0.00
	5	428	493.0	427	492.4	-0.11
AUX 5	1	-4	253.0	-2	254.1	0.44
	2	32	273.0	31	272.4	-0.20
	3	41	278.0	40	277.4	-0.20
	4	212	373.0	213	373.6	0.15
	5	428	493.0	428	493.0	0.00
AUX 6	1	-4	253.0	-2	254.1	0.44
	2	32	273.0	32	273.0	0.00
	3	41	278.0	41	278.0	0.00
	4	212	373.0	213	373.6	0.15
	5	428	493.0	428	493.0	0.00
	DGM In/Out	66	291.9	63	290.2	-0.57

Note: [1] Sensor readings must be within 1.5% of the known absolute temperature

[2] DGM inlet/outlet calibrated to ambient temperature only

$$\%Difference = \frac{T_m - T_R}{T_R} \times 100$$

Technologist: JV

DGM Temperature Calibration

Date of Calibration: 29-Dec-20

Ambient Temp: 66ºF **Reference:** Thermocouple Calibrator

Sampling Train ID: Console B

	Thermocouple Calibrator Setting	Reference Temperature Thermometer (T_R) ˚F	Reference Temperature Thermometer (T_R) ˚K	Actual Temperature Thermocouple (Tm) ˚F	Actual Temperature Thermocouple (Tm) ˚K	Temperature Difference [1] %
STACK	1	-4	253.0	-5	252.4	-0.22
	2	32	273.0	31	272.4	-0.20
	3	41	278.0	40	277.4	-0.20
	4	212	373.0	211	372.4	-0.15
	5	428	493.0	427	492.4	-0.11
PROBE	1	-4	253.0	-5	252.4	-0.22
	2	32	273.0	31	272.4	-0.20
	3	41	278.0	40	277.4	-0.20
	4	212	373.0	211	372.4	-0.15
	5	428	493.0	427	492.4	-0.11
FILTER	1	-4	253.0	-5	252.4	-0.22
	2	32	273.0	31	272.4	-0.20
	3	41	278.0	40	277.4	-0.20
	4	212	373.0	211	372.4	-0.15
	5	428	493.0	427	492.4	-0.11
EXIT	1	-4	253.0	-5	252.4	-0.22
	2	32	273.0	31	272.4	-0.20
	3	41	278.0	40	277.4	-0.20
	4	212	373.0	211	372.4	-0.15
	5	428	493.0	427	492.4	-0.11
AUX	1	-4	253.0	-4	253.0	0.00
	2	32	273.0	31	272.4	-0.20
	3	41	278.0	40	277.4	-0.20
	4	212	373.0	211	372.4	-0.15
	5	428	493.0	427	492.4	-0.11
	DGM In/Out	66	291.9	65	291.3	-0.19

Note: [1] Sensor readings must be within 1.5% of the known absolute temperature

[2] DGM inlet/outlet calibrated to ambient temperature only

$$\%Difference = \frac{T_m - T_R}{T_R} \times 100$$

Technologist: JV

Dry Gas Meter Calibration

Console ID:	**DETROIT A**	
Operator:	JV	
Date:	9/30/2021	
Barometric pressure	30.23	(in. Hg)
Site Elevation (Rochester Hills office)	800	(ft)
Site Barometric Pressure:	29.43	(in. Hg)
Theoretical Critical Vacuum:	13.88	(in. Hg)

ΔH (in. H2O)	Time (min)	Volume			Initial DGM Temperature	
		Initial ft^3	Final ft^3	Total ft^3	Inlet (°F)	Outlet (°F)
0.27	17.00	517.13	522.44	5.31	66.0	66.0
0.60	15.00	522.44	529.21	6.77	67.0	67.0
1.10	12.00	529.21	536.38	7.17	69.0	69.0
1.85	10.00	536.46	544.22	7.76	71.0	71.0
3.50	8.00	544.22	552.77	8.55	72.0	72.0

Final DGM Temperature		Critical Orifice (Serial Apex II 4073)	K' Orifice Coefficient	Actual Vacuum (in. Hg)	Ambient Temperature		
Inlet (°F)	Outlet (°F)				Initial (°F)	Final (°F)	Average (°F)
67.0	67.0	#40	0.2412	15	69	69	69.0
69.0	69.0	#48	0.3471	15	69	69	69.0
71.0	71.0	#55	0.4572	15	69	69	69.0
72.0	72.0	#63	0.5899	15	69	69	69.0
74.0	74.0	#73	0.8081	15	69	69	69.0

RESULTS

Dry Gas Meter		Orifice			Average Temperatures		
Volume Corrected Vm(std) ft^3	Volume Corrected Vm(std) liters	Volume Corrected Vcr (std) ft^3	Volume Corrected Vcr (std) (liters)	Volume Nominal Vcr (ft^3)	DGM Outlet (°R)	DGM Overall (°R)	Ambient Temperature (°R)
5.239	148.379	5.247	148.587	5.346	526.5	526.5	529.0
6.666	188.794	6.662	188.669	6.789	528.0	528.0	529.0
7.042	199.442	7.020	198.812	7.153	530.0	530.0	529.0
7.615	215.647	7.548	213.764	7.691	531.5	531.5	529.0
8.401	237.904	8.272	234.267	8.429	533.0	533.0	529.0

Dry Gas Meter Calibration Factor Y		Orifice Calibration Factor ΔH@		
Variation (number)	Value (number)	Value (in. H2O)	Value (mm H2O)	Variation (in. H2O)
0.007	1.001	1.573	39.9	-0.148
0.005	0.999	1.683	42.7	-0.038
0.002	0.997	1.772	45.0	0.050
-0.003	0.991	1.785	45.3	0.063
-0.010	0.985	1.794	45.6	0.073
Average:	**0.995**	**1.721**	43.7	**Passed**

Dry Gas Meter Calibration

Console ID:	**DETROIT B**	
Operator:	JV	
Date:	9/30/2021	
Barometric pressure	30.23	(in. Hg)
Site Elevation (Rochester Hills office)	800	(ft)
Site Barometric Pressure:	29.43	(in. Hg)
Theoretical Critical Vacuum:	13.88	(in. Hg)

ΔH (in. H2O)	Time (min)	Volume			Initial Temperature	
		Initial ft^3	Final ft^3	Total ft^3	Inlet (°F)	Outlet (°F)
0.34	17.00	147.81	153.27	5.46	68.0	68.0
0.68	15.00	153.27	160.21	6.94	70.0	70.0
1.20	12.00	160.21	167.63	7.42	73.0	73.0
2.00	10.00	167.66	175.51	7.85	73.0	73.0
3.50	8.00	175.51	184.09	8.58	74.0	74.0

Final Temperature		Critical Orifice (Serial Apex II 4073)	K' Orifice Coefficient	Actual Vacuum (in. Hg)	Ambient Temperature		
Inlet (°F)	Outlet (°F)				Initial (°F)	Final (°F)	Average (°F)
70.0	70.0	#40	0.2412	15	69	69	69.0
73.0	73.0	#48	0.3471	15	69	69	69.0
73.0	73.0	#55	0.4572	15	69	69	69.0
74.0	74.0	#63	0.5899	15	69	69	69.0
75.0	75.0	#73	0.8081	13	69	69	69.0

RESULTS

Dry Gas Meter		Orifice			Average Temperatures		
Volume Corrected Vm(std) ft^3	Volume Corrected Vm(std) liters	Volume Corrected Vcr (std) ft^3	Volume Corrected Vcr (std) (liters)	Volume Nominal Vcr (ft^3)	DGM Outlet (°R)	DGM Overall (°R)	Ambient Temperature (°R)
5.363	151.876	5.247	148.587	5.346	529.0	529.0	529.0
6.790	192.298	6.662	188.669	6.789	531.5	531.5	529.0
7.249	205.286	7.020	198.812	7.153	533.0	533.0	529.0
7.677	217.411	7.548	213.764	7.691	533.5	533.5	529.0
8.406	238.069	8.272	234.267	8.429	534.5	534.5	529.0

Dry Gas Meter Calibration Factor Y		Orifice Calibration Factor ΔH@		
Variation (number)	Value (number)	Value (in. H2O)	Value (mm H2O)	Variation (in. H2O)
-0.001	0.978	1.971	50.1	0.071
0.002	0.981	1.895	48.1	-0.005
-0.011	0.968	1.922	48.8	0.022
0.004	0.983	1.922	48.8	0.022
0.005	0.984	1.789	45.4	-0.111
Average:	**0.979**	**1.900**	**48.255**	**Passed**

RWDI-TYPE S PITOT TUBE INSPECTION DATA FORM

Probe Identification Number: Mick 1

Pitot Tube Assembly Level: ✓ adequate ____ inadequate

Damage to Pitot Tube Ends: ____ yes ✓ no

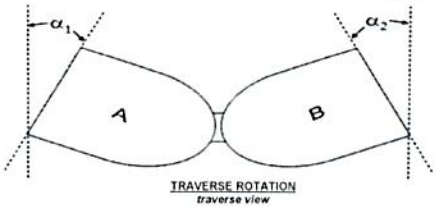
Explain (if damaged): ____

		Specifications
α_1 =	1°	° (≤10°)
β_1 =	0°	° (≤5°)

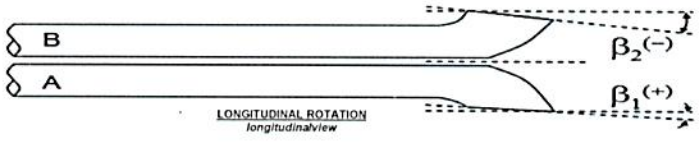
		Specifications
α_2 =	0	° (≤10°)
β_2 =	0	° (≤5°)

			Specifications
Z =	0	inches	≤ 0.125"
W =	0	inches	≤ 0.03125"
D_t =	.250	inches	0.1875" to 0.375"
P_A =	.266	inches	None
P_A / D_t =	1.05		1.05 to 1.5
P_B =	.265	inches	None
P_B / D_t =	1.06		1.05 to 1.5

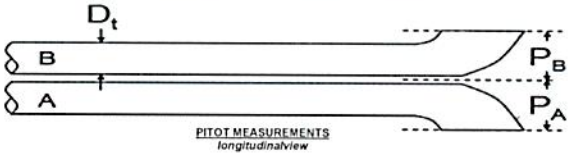
SIGNATURE: _____ DATE: 10.26.21



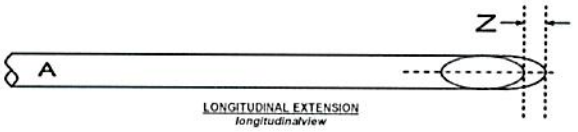
TRAVERSE ROTATION
traverse view



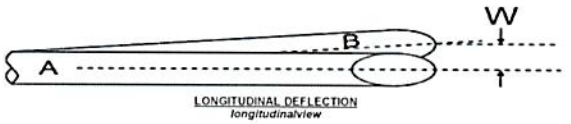
LONGITUDINAL ROTATION
longitudinalview



PITOT MEASUREMENTS
longitudinalview



LONGITUDINAL EXTENSION
longitudinalview



LONGITUDINAL DEFLECTION
longitudinalview

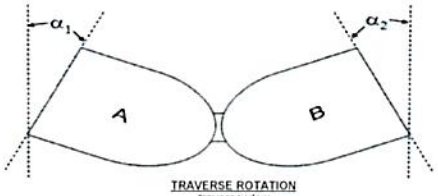
RWDI-TYPE S PITOT TUBE INSPECTION DATA FORM

Probe Identification Number	Nick 1	
Pitot Tube Assembly Level	✓ adequate	inadequate
Damage to Pitot Tube Ends	yes	✓ no
Explain (if damaged) :		

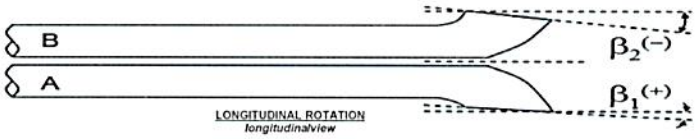
		Specifications
α_1 =	1 °	(≤10°)
β_1 =	0 °	(≤5°)
α_2 =	0 °	(≤10°)
β_2 =	0 °	(≤5°)

			Specifications
Z =	0	inches	≤ 0.125"
W =	0	inches	≤ 0.03125"
D_t =	.250	inches	0.1875" to 0.375"
P_A =	.266	inches	None
P_A / D_t =	1.05		1.05 to 1.5
P_B =	.265	inches	None
P_B / D_t =	1.06		1.05 to 1.5

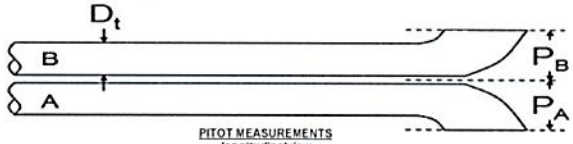
SIGNATURE: _____ DATE: 10·28·21



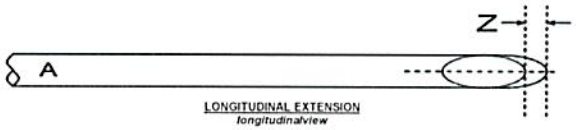
TRAVERSE ROTATION
traverse view



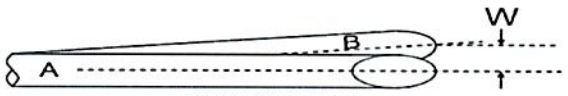
LONGITUDINAL ROTATION
longitudinalview



PITOT MEASUREMENTS
longitudinalview



LONGITUDINAL EXTENSION
longitudinalview



LONGITUDINAL DEFLECTION
longitudinalview

RWDI-TYPE S PITOT TUBE INSPECTION DATA FORM

Probe Identification Number: Nick 2

Pitot Tube Assembly Level: ✓ adequate ____ inadequate

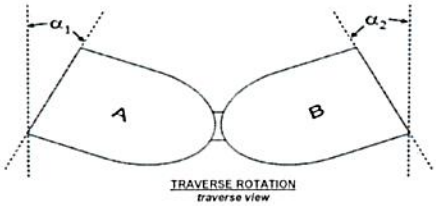
Damage to Pitot Tube Ends: ____ yes ✓ no

Explain (if damaged) : ____

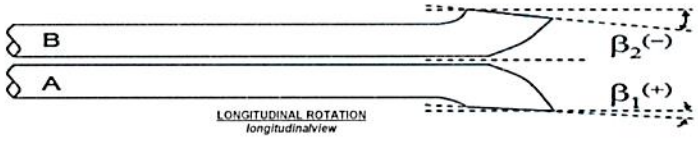
		Specifications
α_1 =	0 °	(≤10°)
β_1 =	0 °	(≤5°)
α_2 =	0 °	(≤10°)
β_2 =	0 °	(≤5°)

			Specifications
Z =	0	inches	≤ 0.125"
W =	0	inches	≤ 0.03125"
D_t =	0.373	inches	0.1875" to 0.375"
P_A =	0.45	inches	None
P_A / D_t =	1.2		1.05 to 1.5
P_B =	0.45	inches	None
P_B / D_t =	1.2		1.05 to 1.5

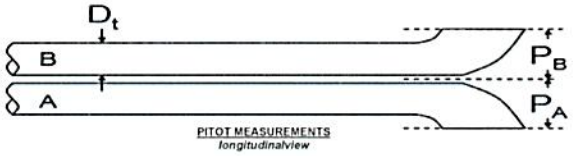
SIGNATURE: _____ DATE: 10-26-21



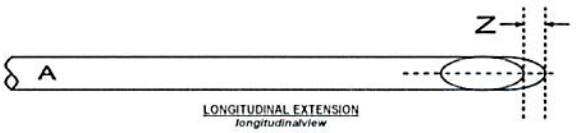
TRAVERSE ROTATION
traverse view



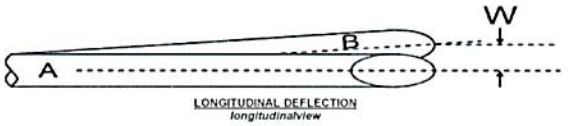
LONGITUDINAL ROTATION
longitudinalview



PITOT MEASUREMENTS
longitudinalview



LONGITUDINAL EXTENSION
longitudinalview



LONGITUDINAL DEFLECTION
longitudinalview

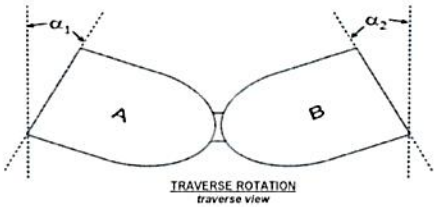
RWDI-TYPE S PITOT TUBE INSPECTION DATA FORM

Probe Identification Number	Nick 2	
Pitot Tube Assembly Level	✓ adequate	inadequate
Damage to Pitot Tube Ends	yes	✓ no
Explain (if damaged) :		

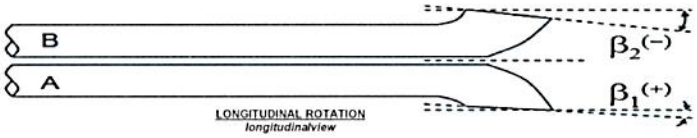
		Specifications
α_1 =	0 °	(≤10°)
β_1 =	0 °	(≤5°)
α_2 =	0 °	(≤10°)
β_2 =	0 °	(≤5°)

			Specifications
Z =	0	inches	≤ 0.125"
W =	0	inches	≤ 0.03125"
D_t =	0.373	inches	0.1875" to 0.375"
P_A =	.45	inches	None
P_A / D_t =	1.2		1.05 to 1.5
P_B =	.45	inches	None
P_B / D_t =	1.2		1.05 to 1.5

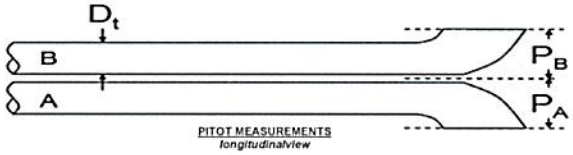
SIGNATURE: _____ DATE: 10-28-21



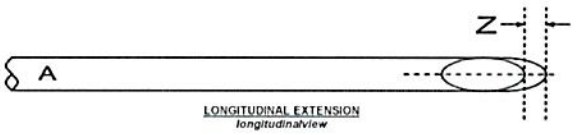
TRAVERSE ROTATION
traverse view



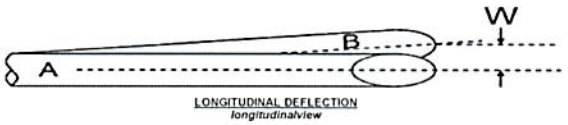
LONGITUDINAL ROTATION
longitudinalview



PITOT MEASUREMENTS
longitudinalview



LONGITUDINAL EXTENSION
longitudinalview



LONGITUDINAL DEFLECTION
longitudinalview

Environics®

SERIES 4040

System S/N 9111

ENVIRONICS FLOW CONTROLLER CALIBRATION SHEET

MFC # 1 Size: 10000 SCCM

MFC Serial Number: 0963707023

This flow controller was calibrated using a NIST-traceable Flow Standard. This calibration was performed with Nitrogen at a standard reference temperature and pressure of 32°F and 29.92 in. Hg. The Flow Calibration Data is not performance data. This data is used by the system operating mode to improve the flow accuracy. The Flow Verification Data is performance data.

Flow Calibration Data

	Set Flow	True Flow
5%	500	503.743
10%	1000	1022.202
20%	2000	2096.544
30%	3000	3148.105
40%	4000	4176.166
50%	5000	5211.372
60%	6000	6237.708
70%	7000	7281.110
80%	8000	8300.125
90%	9000	9321.551
100%	10000	10344.211

All values in SCCM

Flow Verification Data

	Set Flow	True Flow
99%	9900	9910.392
85%	8500	8503.795
55%	5500	5517.057
25%	2500	2490.377
10%	1000	1003.202

All values in SCCM

Verified by: Jenni Lundmark Date: 4-8-21

Gas Mixing / Dilution / Calibration Systems
Environics Inc. • 69 Industrial Park Road East • Tolland, CT 06084 • (860) 872-1111 • Fax: (860) 870-9333
http://www.environics.com • info@environics.com

Environics®

SERIES 4040

System S/N 9111

ENVIRONICS FLOW CONTROLLER CALIBRATION SHEET

MFC # 2 Size: 10000 SCCM

MFC Serial Number: 0963707024

This flow controller was calibrated using a NIST-traceable Flow Standard. This calibration was performed with Nitrogen at a standard reference temperature and pressure of 32°F and 29.92 in. Hg. The Flow Calibration Data is not performance data. This data is used by the system operating mode to improve the flow accuracy. The Flow Verification Data is performance data.

Flow Calibration Data

	Set Flow	True Flow
5%	500	521.027
10%	1000	1062.798
20%	2000	2144.854
30%	3000	3212.516
40%	4000	4255.505
50%	5000	5292.486
60%	6000	6327.256
70%	7000	7345.174
80%	8000	8348.061
90%	9000	9350.690
100%	10000	10336.689

All values in SCCM

Flow Verification Data

	Set Flow	True Flow
99%	9900	9909.654
85%	8500	8503.333
55%	5500	5507.907
25%	2500	2498.798
10%	1000	996.155

All values in SCCM

Verified by: Terri Lundmark Date: 4-8-21

Gas Mixing / Dilution / Calibration Systems
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http://www.environics.com • info@environics.com

Environics®

SERIES 4040

System S/N 9111

ENVIRONICS FLOW CONTROLLER CALIBRATION SHEET

MFC # 3 Size: 1000 SCCM

MFC Serial Number: 0963709007

This flow controller was calibrated using a NIST-traceable Flow Standard. This calibration was performed with Nitrogen at a standard reference temperature and pressure of 32°F and 29.92 in. Hg. The Flow Calibration Data is not performance data. This data is used by the system operating mode to improve the flow accuracy. The Flow Verification Data is performance data.

Flow Calibration Data

	Set Flow	True Flow
5%	50	48.312
10%	100	100.089
20%	200	204.183
30%	300	308.859
40%	400	412.314
50%	500	515.742
60%	600	618.327
70%	700	721.395
80%	800	823.660
90%	900	925.907
100%	1000	1027.242

All values in SCCM

Flow Verification Data

	Set Flow	True Flow
99%	990	990.332
85%	850	849.371
55%	550	550.262
25%	250	249.991
10%	100	99.716

All values in SCCM

Verified by: Tamie Lundmark Date: 4-8-21

Gas Mixing / Dilution / Calibration Systems
Environics Inc. • 69 Industrial Park Road East • Tolland, CT 06084 • (860) 872-1111 • Fax: (860) 870-9333
http://www.environics.com • info@environics.com

Environics®

SERIES 4040

System S/N 9111

ENVIRONICS FLOW CONTROLLER CALIBRATION SHEET

MFC # 4 Size: 100 SCCM

MFC Serial Number: 0963711001

This flow controller was calibrated using a NIST-traceable Flow Standard. This calibration was performed with Nitrogen at a standard reference temperature and pressure of 32°F and 29.92 in. Hg. The Flow Calibration Data is not performance data. This data is used by the system operating mode to improve the flow accuracy. The Flow Verification Data is performance data.

Flow Calibration Data

	Set Flow	True Flow
5%	5	4.959
10%	10	10.148
20%	20	20.596
30%	30	31.018
40%	40	41.273
50%	50	51.546
60%	60	61.769
70%	70	71.986
80%	80	82.285
90%	90	92.696
100%	100	102.981

All values in SCCM

Flow Verification Data

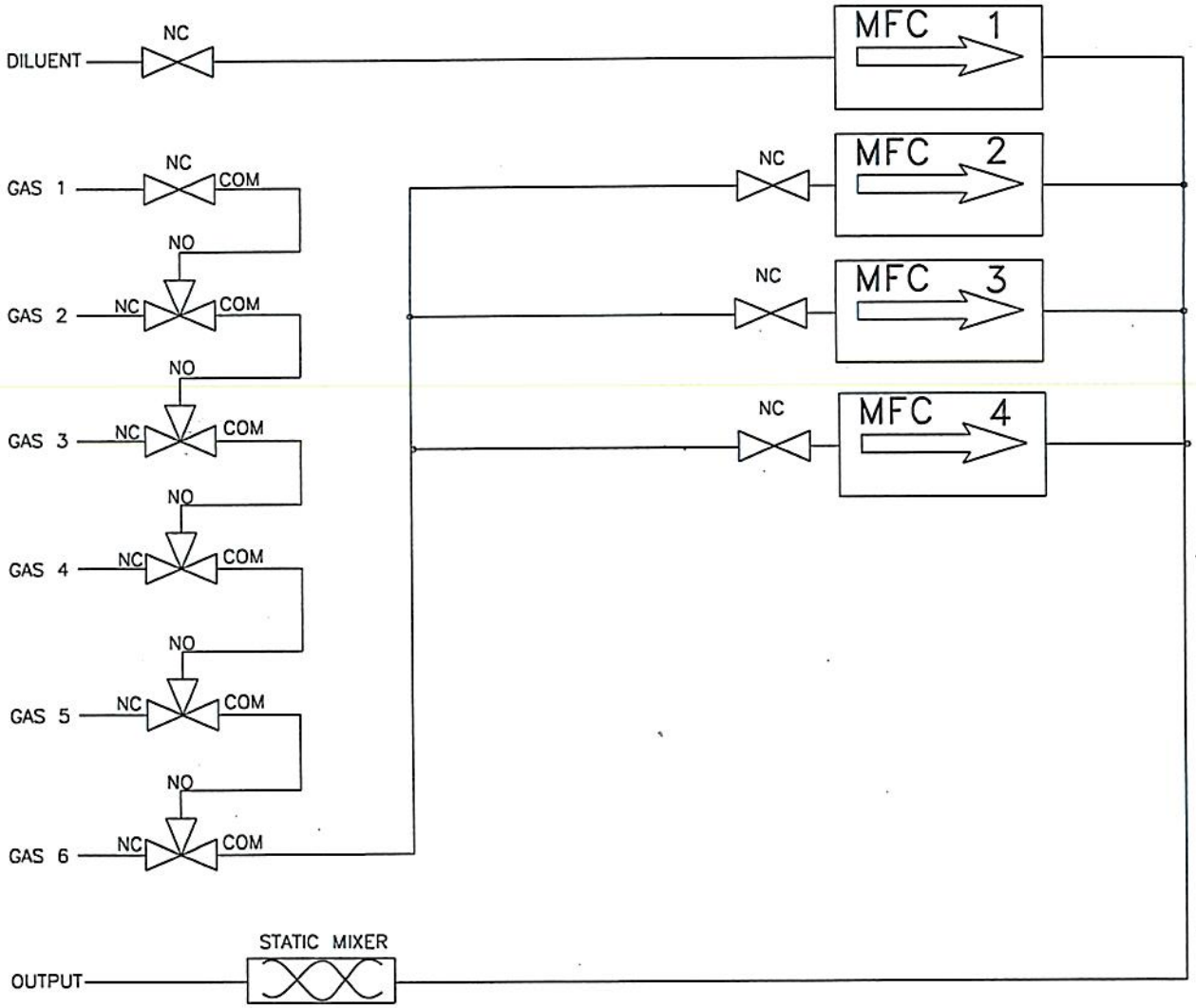
	Set Flow	True Flow
99%	99	98.995
85%	85	85.070
55%	55	55.005
25%	25	25.011
10%	10	9.988

All values in SCCM

Verified by: Jenni Lundmark Date: 4-8-21

Gas Mixing / Dilution / Calibration Systems
Environics Inc. • 69 Industrial Park Road East • Tolland, CT 06084 • (860) 872-1111 • Fax: (860) 870-9333
http://www.environics.com • info@environics.com

REVISIONS					
LTR	E.C.N. NO.	DESCRIPTION	BY	DATE	APP.
A		INITIAL RELEASE	PSS	4/18/18	



DRWN BY	P Smith	DATE 4/18/18	Environics Inc	
CHECK BY				
ENGR. BY			TITLE S4040 4MFC 6 SPAN	
DSGND.BY				
RELSE BY				
			SIZE C	CODE IDENT NO.
			DRAWING NUMBER 4040-4-6.	
MICROFILM	YES ☐ NO ☐	DATE	SCALE:	CUST.NAME & S/N.
				SH 1 OF 1

PRAXAIR
Making our planet more productive

DocNumber: 428784

Praxair Distribution, Inc.
6055 Brent Drive
Toledo OH 43611
Tel: +1 (419) 729-7732
Fax: +1 (419) 729-2411
PGVP ID: F12021

CERTIFICATE OF ANALYSIS / EPA PROTOCOL GAS

Customer & Order Information

PRAXAIR PKG DETROIT MI H
12820 EVERGREEN RD
DETROIT MI 48223-3439

Certificate Issuance Date: 09/27/2021
Praxair Order Number: 71830218
Part Number: NI CD20O3E-AS
Customer PO Number: 79829987

Fill Date: 09/16/2021
Lot Number: 700011259F9
Cylinder Style & Outlet: AS CGA 590
Cylinder Pressure and Volume: 2000 psig 140 ft3

Certified Concentration

ProSpec EZ Cert

Expiration Date:	09/27/2029	NIST Traceable
Cylinder Number:	EB0119153	Expanded Uncertainty
19.85 %	Carbon dioxide	± 0.04 %
20.93 %	Oxygen	± 0.03 %
Balance	Nitrogen	

Certification Information:

Certification Date: 09/27/2021 *Term:* 96 Months *Expiration Date:* 09/27/2029

This cylinder was certified according to the 2012 EPA Traceability Protocol, Document #EPA-600/R-12/531, using Procedure G1. Uncertainty above is expressed as absolute expanded uncertainty at a level of confidence of approximately 95% with a coverage factor k = 2. Do Not Use this Standard if Pressure is less than 100 PSIG.

O2 responses have been corrected for CO2 interference.

Analytical Data:

(R=Reference Standard, Z=Zero Gas, C=Gas Candidate)

1. ***Component:*** **Carbon dioxide**

Requested Concentration: 20.0 %
Certified Concentration: 19.85 %
Instrument Used: MKS 2031
Analytical Method: FTIR
Last Multipoint Calibration: 08/26/2021

Reference Standard: Type / Cylinder #: GMIS / DT0033247
Concentration / Uncertainty: 19.99 % ±0.04 %
Expiration Date: 01/02/2028
Traceable to: SRM # / Sample # / Cylinder #: PRM / 3222577.01 / FF27613
SRM Concentration (enter with units) / Uncertainty: 20.008% / ±0.028
SRM Expiration Date: 04/01/2020

First Analysis Data:						Date	09/27/2021
Z:	0	R:	14.6	C:	14.5	Conc:	19.85
R:	14.6	Z:	0	C:	14.5	Conc:	19.85
Z:	0	C:	14.5	R:	14.6	Conc:	19.85
UOM:	ppm			Mean Test Assay:			19.85 %

Second Analysis Data:						Date	
Z:	0	R:	0	C:	0	Conc:	0
R:	0	Z:	0	C:	0	Conc:	0
Z:	0	C:	0	R:	0	Conc:	0
UOM:	ppm			Mean Test Assay:			%

2. ***Component:*** **Oxygen**

Requested Concentration: 21.0 %
Certified Concentration: 20.93 %
Instrument Used: Servomex 575
Analytical Method: Paramagnetic
Last Multipoint Calibration: 09/02/2021

Reference Standard: Type / Cylinder #: GMIS / CC257802
Concentration / Uncertainty: 22.5 % ±0.0 %
Expiration Date: 12/02/2027
Traceable to: SRM # / Sample # / Cylinder #: 2659a / 71-D-04 / CAL015785
SRM Concentration (enter with units) / Uncertainty: 20.72% / ±0.043%
SRM Expiration Date: 08/23/2021

First Analysis Data:						Date	09/27/2021
Z:	0	R:	22.5	C:	20.9	Conc:	20.9
R:	22.5	Z:	0	C:	20.9	Conc:	20.9
Z:	0	C:	21	R:	22.5	Conc:	21
UOM:	%			Mean Test Assay:			20.93 %

Second Analysis Data:						Date	
Z:	0	R:	0	C:	0	Conc:	0
R:	0	Z:	0	C:	0	Conc:	0
Z:	0	C:	0	R:	0	Conc:	0
UOM:	%			Mean Test Assay:			%

Analyzed By: **Mike Monnette**

Certified By: **Edward E Zucal**

Information contained herein has been prepared at your request by qualified experts within Praxair Distribution, Inc. While we believe that the information is accurate within the limits of the analytical methods employed and is complete to the extent of the specific analyses performed, we make no warranty or representation as to the suitability of the use of the information for any purpose. The information is offered with the understanding that any use of the information is at the sole discretion and risk of the user. In no event shall the liability of Praxair Distribution, Inc., arising out of the use of the information contained herein exceed the fee established for providing such information.

Airgas
an Air Liquide company

Airgas Specialty Gases
Airgas USA, LLC
12722 S. Wentworth Ave.
Chicago, IL 60628
Airgas.com

CERTIFICATE OF ANALYSIS

Grade of Product: EPA Protocol

Part Number:	E02NI99E15A1004	Reference Number:	54-402023857-1
Cylinder Number:	CC124834	Cylinder Volume:	144.4 CF
Laboratory:	124 - Chicago (SAP) - IL	Cylinder Pressure:	2015 PSIG
PGVP Number:	B12021	Valve Outlet:	660
Gas Code:	SO2,BALN	Certification Date:	Feb 17, 2021

Expiration Date: Feb 17, 2029

Certification performed in accordance with "EPA Traceability Protocol for Assay and Certification of Gaseous Calibration Standards (May 2012)" document EPA 600/R-12/531, using the assay procedures listed. Analytical Methodology does not require correction for analytical interference. This cylinder has a total analytical uncertainty as stated below with a confidence level of 95%. There are no significant impurities which affect the use of this calibration mixture. All concentrations are on a mole/mole basis unless otherwise noted.

Do Not Use This Cylinder below 100 psig, i.e. 0.7 megapascals.

ANALYTICAL RESULTS

Component	Requested Concentration	Actual Concentration	Protocol Method	Total Relative Uncertainty	Assay Dates
SULFUR DIOXIDE	190.0 PPM	191.8 PPM	G1	+/- 0.8% NIST Traceable	02/09/2021, 02/17/2021
NITROGEN	Balance				

CALIBRATION STANDARDS

Type	Lot ID	Cylinder No	Concentration	Uncertainty	Expiration Date
NTRM	19060709	EB0112913	246.6 PPM SULFUR DIOXIDE/NITROGEN	+/- 0.4	Jul 13, 2021

ANALYTICAL EQUIPMENT

Instrument/Make/Model	Analytical Principle	Last Multipoint Calibration
Nicolet 6700 AHR0801332	FTIR	Feb 12, 2021

Triad Data Available Upon Request

Approved for Release

PRAXAIR
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Praxair Distribution. Inc.
59624 Linden Road
South Bend, IN 46614
Tel: 574 299-9567
Fax: 574 299-9581

Customer & Order Information:

PRAXAIR PKG DETROIT MI H
12820 EVERGREEN RD,
DETROIT, MI 48223-3439

Praxair Order Number: **71429922**
Customer PO Number: **79422825**

Certificate Issuance Date: **8/14/2020**

Certification Date: **8/14/2020**
Lot Number: **U70716022742**
Part Number: **NI EY100C-AS**
DocNumber: **239182**
Expiration Date: **8/14/2025**

CERTIFICATE OF ANALYSIS

Certified Standard

Component	Requested Concentration (Molar)	Certified Concentration (Molar)	Analytical Reference	Analytical Uncertainty
Ethylene	**100 ppm**	**99.2 ppm**	**2**	**± 2% REL**
Nitrogen	**Balance**	**Balance**		
Analytes	Specification	Analytical Results	Analytical Reference	Analytical Uncertainty
Ethylene	**Confirming**	**Pass**	**1**	**Meets**

Cylinder Style: **AS**
Cylinder Pressure @ 70: **2000 psig**
Cylinder Volume: **142 ft3**
Valve Outlet Connection: **CGA 350**
Cylinder Number(s): **CC52216**

Fill Date: **8/14/2020**

Filling Method: **Gravimetric**

Approved Signer: **Sean Conley-Chemical Lab Technician**

Key to Analytical Techniques:

Reference	Analytical Instrument - Analytical Principle
1	Gow Mac 580 FID - Gas Chromatography with FID
2	Mettler Toledo PR8002 - Gravimetric Method

The gas calibration cylinder standard prepared by Praxair Distribution, Inc. is considered a certified standard. It is prepared by gravimetric, volumetric, or partial pressure techniques. The calibration standard provided is certified against Praxair Distribution, Inc. Reference Materials which are traceable to the International System of Units (SI) through either weights traceable to the National Institute of Standards and Technology (NIST) or Measurement Canada, or through NIST Standard Reference Materials or equivalent where available.

Note: All expressions for concentration (e.g., % or ppm) are for gas phase, by volume (e.g., ppmv) unless otherwise noted. Analytical uncertainty is expressed as a Relative % unless otherwise noted.

IMPORTANT
The information contained herein has been prepared at your request by personnel within Praxair Distribution, Inc.. While we believe the information is accurate within the limits of the analytical methods employed and is complete to the extent of the specific analyses performed, we make no warranty or representation as to the suitability of the use of the information for any particular purpose. The information is offered with the understanding that any use of the information is at the sole discretion and risk of the user. In no event shall liability of Praxair Distribution, Inc. arising out of the use of the information contained herein exceed the fee established for providing such information.

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DocNumber: 408678

Praxair Distribution, Inc.
6055 Brent Drive
Toledo OH 43611
Tel: +1 (419) 729-7732
Fax: +1 (419) 729-2411
PGVP ID: F12021

CERTIFICATE OF ANALYSIS / EPA PROTOCOL GAS

Customer & Order Information

PRAXAIR PKG DETROIT MI H
12820 EVERGREEN RD
DETROIT MI 48223-3439

Certificate Issuance Date: 04/29/2021
Praxair Order Number: 71673336
Part Number: AI ME1500E-AS
Customer PO Number: 79671182

Fill Date: 04/20/2021
Lot Number: 700011110GA
Cylinder Style & Outlet: AS CGA 590
Cylinder Pressure and Volume: 2000 psig 140 ft3

Certified Concentration

ProSpec EZ Cert

Expiration Date:	04/26/2029	NIST Traceable
Cylinder Number:	DT0021719	Expanded Uncertainty
1513.0 ppm	Methane	± 3.4 ppm
Balance	Air	

Certification Information: *Certification Date:* 04/26/2021 *Term:* 96 Months *Expiration Date:* 04/26/2029

This cylinder was certified according to the 2012 EPA Traceability Protocol, Document #EPA-600/R-12/531, using Procedure G1. Uncertainty above is expressed as absolute expanded uncertainty at a level of confidence of approximately 95% with a coverage factor k = 2. Do Not Use this Standard if Pressure is less than 100 PSIG.

Analytical Data:

(R=Reference Standard, Z=Zero Gas, C=Gas Candidate)

1. ***Component:*** **Methane**

Requested Concentration: 1500 ppm
Certified Concentration: 1513.0 ppm
Instrument Used: CAI - 300S
Analytical Method: FID Total Hydrocarbon Analyzer
Last Multipoint Calibration: 09/26/2018

Reference Standard: Type / Cylinder #: GMIS / CC19172
Concentration / Uncertainty: 2522 ppm ±5 ppm
Expiration Date: 04/03/2025
Traceable to: SRM # / Sample # / Cylinder #: RGM / N/A / CC364721
SRM Concentration (enter with units) / 4965.6 PPM / ±9 PPM
SRM Expiration Date: 07/09/2021

First Analysis Data:								**Date**	04/26/2021
Z:	0	**R:**	2522	**C:**	1513	**Conc:**	1513		
R:	2522	**Z:**	0	**C:**	1513	**Conc:**	1513		
Z:	0	**C:**	1513	**R:**	2522	**Conc:**	1513		
UOM:	ppm				**Mean Test Assay:**		1513	ppm	

Second Analysis Data:								**Date**	
Z:	0	**R:**	0	**C:**	0	**Conc:**	0		
R:	0	**Z:**	0	**C:**	0	**Conc:**	0		
Z:	0	**C:**	0	**R:**	0	**Conc:**	0		
UOM:	ppm				**Mean Test Assay:**			ppm	

Analyzed By **Colton Mathes**

Certified By **Edward E Zucal**

Information contained herein has been prepared at your request by qualified experts within Praxair Distribution, Inc. While we believe that the information is accurate within the limits of the analytical methods employed and is complete to the extent of the specific analyses performed, we make no warranty or representation as to the suitability of the use of the information for any purpose. The information is offered with the understanding that any use of the information is at the sole discretion and risk of the user. In no event shall the liability of Praxair Distribution, Inc., arising out of the use of the information contained herein exceed the fee established for providing such information.

PRAXAIR
Making our planet more productive

DocNumber: 408937

Praxair Distribution, Inc.
6055 Brent Drive
Toledo OH 43611
Tel: +1 (419) 729-7732
Fax: +1 (419) 729-2411
PGVP ID: F12021

CERTIFICATE OF ANALYSIS / EPA PROTOCOL GAS

Customer & Order Information

PRAXAIR PKG DETROIT MI H
12820 EVERGREEN RD
DETROIT MI 48223-3439

Certificate Issuance Date: 04/28/2021
Praxair Order Number: 71673336
Part Number: AI PR100E-AS
Customer PO Number: 79671182

Fill Date: 04/21/2021
Lot Number: 700011111UB
Cylinder Style & Outlet: AS CGA 590
Cylinder Pressure and Volume: 2000 psig 140 ft3

Certified Concentration

ProSpec EZ Cert

Expiration Date:	04/28/2029	NIST Traceable
Cylinder Number:	EB0004470	Expanded Uncertainty
101.0 ppm	Propane	± 3.3 ppm
Balance	Air	

Certification Information:

Certification Date: 04/28/2021 *Term:* 96 Months *Expiration Date:* 04/28/2029

This cylinder was certified according to the 2012 EPA Traceability Protocol, Document #EPA-600/R-12/531, using Procedure G1. Uncertainty above is expressed as absolute expanded uncertainty at a level of confidence of approximately 95% with a coverage factor k = 2. Do Not Use this Standard if Pressure is less than 100 PSIG.

Analytical Data:

(R=Reference Standard, Z=Zero Gas, C=Gas Candidate)

1. ***Component:*** **Propane**

Requested Concentration: 100 ppm
Certified Concentration: 101.0 ppm
Instrument Used: CAI - 300S
Analytical Method: FID Total Hydrocarbon Analyzer
Last Multipoint Calibration: 06/26/2018

Reference Standard: Type / Cylinder #: GMIS / CC167694
Concentration / Uncertainty: 100.9 ppm ±0.3 ppm
Expiration Date: 07/06/2026
Traceable to: SRM # / Sample # / Cylinder #: 1668b / 82-K-12 / CAL017534
SRM Concentration (enter with units) / 98.74 ppm / ±0.23 ppm
SRM Expiration Date: 09/09/2019

First Analysis Data:								**Date**	04/28/2021
Z:	0	**R:**	100.9	**C:**	101	**Conc:**	101		
R:	100.9	**Z:**	0	**C:**	101	**Conc:**	101		
Z:	0	**C:**	101	**R:**	100.9	**Conc:**	101		
UOM:	ppm					**Mean Test Assay:**		101	ppm

Second Analysis Data:								**Date**	
Z:	0	**R:**	0	**C:**	0	**Conc:**	0		
R:	0	**Z:**	0	**C:**	0	**Conc:**	0		
Z:	0	**C:**	0	**R:**	0	**Conc:**	0		
UOM:	ppm					**Mean Test Assay:**			ppm

Analyzed By **Colton Mathes**

Certified By **Edward E Zucal**

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PRAXAIR
Making our planet more productive

DocNumber: 408952

Praxair Distribution, Inc.
6055 Brent Drive
Toledo OH 43611
Tel: +1 (419) 729-7732
Fax: +1 (419) 729-2411
PGVP ID: F12021

CERTIFICATE OF ANALYSIS / EPA PROTOCOL GAS

Customer & Order Information

PRAXAIR PKG DETROIT MI H
12820 EVERGREEN RD
DETROIT MI 48223-3439

Certificate Issuance Date: 04/29/2021
Praxair Order Number: 71673336
Part Number: AI PR1500E-AS
Customer PO Number: 79671182

Fill Date: 04/21/2021
Lot Number: 700011111UA
Cylinder Style & Outlet: AS CGA 590
Cylinder Pressure and Volume: 2000 psig 140 ft3

Certified Concentration

ProSpec EZ Cert

Expiration Date:	04/28/2029	NIST Traceable
Cylinder Number:	CC112755	Expanded Uncertainty
1509.7 ppm	Propane	± 9.5 ppm
Balance	Air	

Certification Information:

Certification Date: 04/28/2021 *Term:* 96 Months *Expiration Date:* 04/28/2029

This cylinder was certified according to the 2012 EPA Traceability Protocol, Document #EPA-600/R-12/531, using Procedure G1. Uncertainty above is expressed as absolute expanded uncertainty at a level of confidence of approximately 95% with a coverage factor k = 2. Do Not Use this Standard if Pressure is less than 100 PSIG.

Analytical Data:

(R=Reference Standard, Z=Zero Gas, C=Gas Candidate)

1. ***Component:*** **Propane**

Requested Concentration: 1500 ppm
Certified Concentration: 1509.7 ppm
Instrument Used: MKS 2031
Analytical Method: FTIR
Last Multipoint Calibration: 01/04/2021

Reference Standard: Type / Cylinder #: GMIS / SA5860
Concentration / Uncertainty: 2506 ppm ±15 ppm
Expiration Date: 12/08/2023
Traceable to: SRM # / Sample # / Cylinder #: 2647a / 104-C-47 / XF000216B
SRM Concentration (enter with units) / : 2467 PPM / ±13 PPM
SRM Expiration Date: 05/02/2024

First Analysis Data:							**Date**	04/28/2021
Z:	0	**R:**	2506	**C:**	1509.7	**Conc:**	1509.7	
R:	2506	**Z:**	0	**C:**	1509.7	**Conc:**	1509.7	
Z:	0	**C:**	1509.7	**R:**	2506	**Conc:**	1509.7	
UOM:	ppm					**Mean Test Assay:**		1509.7 ppm

Second Analysis Data:							**Date**	
Z:	0	**R:**	0	**C:**	0	**Conc:**	0	
R:	0	**Z:**	0	**C:**	0	**Conc:**	0	
Z:	0	**C:**	0	**R:**	0	**Conc:**	0	
UOM:	ppm					**Mean Test Assay:**		ppm

Analyzed By **Colton Mathes**

Certified By **Edward E Zucal**

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APPENDIX I

60 NORTHLAND ROAD, UNIT 1
WATERLOO, ON N2V 2B8
Phone: (519) 886-6910
Fax: (519) 886-9047
Toll Free: 1-800-668-9878

AIR QUALITY CHAIN OF CUSTODY FORM - Canister/Tube/Gas Bag

Note: All TAT Quoted is in business days which exclude statutory holidays and weekends. TAT of samples received past 3:00 pm or Saturday / Sunday begin the next day.

DATE REQUIRED

SERVICE REQUESTED
- 10 day (regular) ☑
- Rush 5 day (50%) ☐
- Rush 3 day (100%) ☐
- Rush 2 day (200%) ☐
- Rush 1 day (300%) - Enquire ☐

All rush work requires lab approval before sample submission

COMPANY NAME	RWDI
OFFICE	2239 Star Ct, Rochester Hills, MI
PROJECT MANAGER	Mason Sakshaug
PROJECT #	2200515
PHONE	FAX
ACCOUNT #	
QUOTATION #	PO #

REGULATION
CRITERIA
OTHER INFORMATION

REPORT FORMAT/DISTRIBUTION

EMAIL ✓ FAX ____ BOTH ____
SELECT: PDF ____ DIGITAL ____ BOTH ____
EMAIL 1 Mason.Sakshaug@RWDI.com
EMAIL 2 Ben.Durham@RWDI.com

SUBMISSION #:
ENTERED BY:
DATE/TIME ENTERED:
BIN #:

SAMPLING INFORMATION

Sample Date/Time: Date (dd-mmm-yy)	Time (24hr) (hh:mm)	Canister or Tube ID# (e.g. 060000-XXXX or G0XXXXXXSVI)	Regulator Serial # CS1200-XXXX or GXX	Matrix Type	SAMPLE DESCRIPTION TO APPEAR ON REPORT	TUBE AIR VOLUME - L ☐ or m³ ☑	TO-15	Recycle					STARTING PRESSURE - Pre-Sampling ("Hg)	ENDING PRESSURE - Post Sampling ("Hg)	COLLECTION TIME (HRS)	Field Conditions (Rain/Wind/Dust/Odour) Field PID Reading	LAB ID
10-26-21	12:00	060000-0182	02892	AA	Eco Waste - Incinerator - T1	6	✓						29"	7"	4:10	AA	
10-27-21	12:00	0600-0437	04292	AA	Eco Waste - Incinerator - T2	6	✓						29"	10"	4:00	AA	
10-28-21	12:00	060000-0388	02896	AA	Eco Waste - Incinerator - T3	6	✓						30"	16"	4:00	AA	
N/A	N/A	060000-0525	N/A	NA	N/A	6	~~✓~~	✓					—	—	—	N/A	

SPECIAL INSTRUCTIONS/COMMENTS

This Chain of Custody Form is only to be used for Air Quality Samples

Matrix Type: Soil Gas Vapour = SG; Indoor Air = IA; Ambient Air = AA; Industrial Hygiene = IH

SAMPLE CONDITION AS RECEIVED
- FROZEN ☐
- COLD ☐
- COOLING INITIATED ☐
- AMBIENT ☐

MEAN TEMP

SAMPLED BY: Mason Sakshaug	DATE & TIME 11-3-21 14:25	RECEIVED BY:	DATE & TIME
RELINQUISHED BY: Benjamin Durham	DATE & TIME 11-3-21 14:25	RECEIVED AT LAB BY:	DATE & TIME

OBSERVATIONS Yes ☐ No ☐ If yes add SIF

INIT

Notes

1. Quote number must be provided to ensure proper pricing
2. TAT may vary dependent on complexity of analysis and lab workload at time of submission. Please contact the lab to confirm TATs.
3. Any known or suspected hazards relating to a sample must be noted on the chain of custody in comments section.

1435 Norjohn Court, Unit 1, Burlington ON, L7L 0E6
Phone: 905-331-3111, FAX: 905-331-4567

Certificate of Analysis

ALS Project Contact:	Claire Kocharakkal	**Client Name:**	RWDI Air Inc
ALS Project ID:	23601	**Client Address:**	2239 Star Court
ALS WO#:	L2659099		Rochester Hills, MI 48309
Date of Report	4-Jan-22		United States of America
Date of Sample Receipt	3-Nov-21	**Client Contact:**	Alec Smith
		Client Project ID:	2200515.01

COMMENTS: **PAH by CARB method 429 (LR option)- Isotope dilution**

Chysene co-elutes with triphenylene such that chrysene results may have a contribution from triphenylene.

Cyclopenta[cd]pyrene coelutes with benz[a]anthracene, such that benz[a]anthracene results may have a contribution from cyclopenta[cd]pyrene.

Certified by:

Bradley Reimer
GC/MS Laboratory Senior Technical Specialist

Results in this certificate relate only to the samples as submitted to the laboratory.
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ALS Life Sciences

Sample Analysis Summary Report

Sample Name	Method Blank - Media		Method Blank - Reagent		ECO WASTE - INCINERATOR - M23 · T1 (1 THRU 3)		ECO WASTE - INCINERATOR - M23 · T2 (1 THRU 3)		ECO WASTE - INCINERATOR - M23 · T3 (1 THRU 3)		ECO WASTE - INCINERATOR - M23 - ACETONE/ HEXANE BLANK	
ALS Sample ID	WG3652547-1		WG3652547-4		L2659099-9		L2659099-10		L2659099-11		L2659099-12	
Sample Size	1		1		1		1		1		1	
Sample units	sample		sample		sample		sample		sample		sample	
Moisture Content	n/a		n/a		n/a		n/a		n/a		n/a	
Matrix	QC		QC		Stack		Stack		Stack		Stack	
Sampling Date	n/a		n/a		26-Oct-21		27-Oct-21		28-Oct-21		28-Oct-21	
Extraction Date	16-Nov-21		16-Nov-21		16-Nov-21		16-Nov-21		16-Nov-21		16-Nov-21	
Target Analytes	**ng/sample**		**ng/sample**		**ng/sample**		**ng/sample**		**ng/sample**		**ng/sample**	
Naphthalene	54.0		8.07	B	3920		2060		4070		70.6	B
2-Methylnaphthalene	<6.0	U	<6.0	U	79.7		46.0		68.3		15.8	M
Acenaphthylene	<6.0	U	<6.0	U	171		67.4		142		<6.0	U
Acenaphthene	15.7	R	12.8	RB	19.4	RB	<6.0	U	15.5	RB	19.2	RB
Fluorene	<6.0	U	<6.0	U	333		104		250		<6.0	U
Phenanthrene	<6.0	U	<6.0	U	3700		1380		3030		<6.0	U
Anthracene	<6.0	U	<6.0	U	97.3		37.3		24.1		<6.0	U
Fluoranthene	<6.0	U	<6.0	U	184		78.8	M	98.6	M	<6.0	U
Pyrene	<6.0	U	<6.0	U	88.7	M,R	23.4	R	21.6	M	<6.0	U
Benzo(a)Anthracene	<6.0	U	<6.0	U	6.87	M	<6.0	U	<6.0	U	<6.0	U
Chrysene	<6.0	U	<6.0	U	8920		3180		7330		<6.0	U
Benzo(b)Fluoranthene	<6.0	U	<6.0	U	39.6	M	15.5	M	21.9	M	<6.0	U
Benzo(k)Fluoranthene	<6.0	U	<6.0	U	<6.0	U	6.60	M	<6.0	U	<6.0	U
Benzo(e)Pyrene	<6.0	U	<6.0	U	47.5	M	13.2	M	26.8		<6.0	U
Benzo(a)Pyrene	<6.0	U	<6.0	U	<6.0	U	10.9	M	11.0	M	<6.0	U
Perylene	<6.0	U	<6.0	U	16.9	M	<6.0	U	11.5	M	<6.0	U
Indeno(1,2,3-cd)Pyrene	<6.0	U	<6.0	U	9.51	M	<6.0	U	<6.0	U	<6.0	U
Dibenzo(a,h)Anthracene	<6.0	U	<6.0	U	<6.0	U	<6.0	U	<6.0	U	<6.0	U
Benzo(g,h,i)Perylene	<6.0	U	<6.0	U	<6.0	U	<6.0	U	<6.0	U	<6.0	U
Field Sampling Standards	**% Rec**		**% Rec**		**% Rec**		**% Rec**		**% Rec**		**% Rec**	
1-Methylnaphthalene-D10	NS		NS		60		63		64		NS	
Fluorene D10	NS		NS		87		87		87		NS	
Terphenyl D14(Surr.)	NS		NS		191		150		188		NS	
Extraction Standards	**% Rec**		**% Rec**		**% Rec**		**% Rec**		**% Rec**		**% Rec**	
Naphthalene D8	73		58		59		66		70		80	
2-Methylnaphthalene-D10	104		90		95		99		104		107	
Acenaphthylene D8	62		59		58		60		62		56	
Phenanthrene D10	113		117		96	M	102	M	101		106	
Anthracene-D10	76		78		64		65	M	61		62	
Fluoranthene D10	99		105		96		94		102	M	92	
Benz(a)Anthracene-D12	66		72		67		61		72		60	
Chrysene D12	80	M	91	M	87	M	84	M	99	M,R	76	
Benzo(b)Fluoranthene-D12	112		116		98	M	96	M	106	M	80	
Benzo(k)Fluoranthene-D12	69		76		72	M	69	M	78	M	60	M
Benzo(a)Pyrene D12	58		67	M	67	M	58	M	60	M	45	M
Perylene D12	42	M	52	M	57		29	M	42	M	41	M
Indeno(1,2,3,cd)Pyrene-D12	107		120		89		88		93		76	
Dibenz(a,h)Anthracene-D14	99		112		86		84		95		72	
Benzo(g,h,i)Perylene D12	113		125		96		95		102		81	

U	Indicates that this compound was not detected above the LOD.
M	Indicates that a peak has been manually integrated.
B	Indicates that this compound was detected in the method blank at greater than 10% of the sample value.
R	Indicates that the ion abundance ratio for this compound did not meet the acceptance criterion.
NS	Indicates that the compound was not added to the sample

ALS Life Sciences

Sample Analysis Summary Report

Sample Name	Laboratory Control Sample	
ALS Sample ID	WG3652547-2	
Sample Size	1	
Sample units	n/a	
Moisture Content	n/a	
Matrix	QC	
Sampling Date	n/a	
Extraction Date	16-Nov-21	
Target Analytes	**%**	
Naphthalene	115	
2-Methylnaphthalene	79	
Acenaphthylene	96	
Acenaphthene	87	
Fluorene	88	
Phenanthrene	98	
Anthracene	107	
Fluoranthene	88	
Pyrene	90	
Benzo(a)Anthracene	92	
Chrysene	101	
Benzo(b)Fluoranthene	80	
Benzo(k)Fluoranthene	107	
Benzo(e)Pyrene	101	
Benzo(a)Pyrene	86	
Perylene	113	
Indeno(1,2,3-cd)Pyrene	72	
Dibenzo(a,h)Anthracene	86	
Benzo(g,h,i)Perylene	71	
Field Sampling Standards	**% Rec**	
1-Methylnaphthalene-D10	NS	
Fluorene D10	NS	
Terphenyl D14(Surr.)	NS	
Extraction Standards	**% Rec**	
Naphthalene D8	55	
2-Methylnaphthalene-D10	82	
Acenaphthylene D8	51	
Phenanthrene D10	94	
Anthracene-D10	63	
Fluoranthene D10	88	
Benz(a)Anthracene-D12	64	
Chrysene D12	80	
Benzo(b)Fluoranthene-D12	98	
Benzo(k)Fluoranthene-D12	66	
Benzo(a)Pyrene D12	61	
Perylene D12	34	M
Indeno(1,2,3,cd)Pyrene-D12	102	
Dibenz(a,h)Anthracene-D14	97	
Benzo(g,h,i)Perylene D12	106	

NS	Indicates that the compound was not added to the sample
M	Indicates that a peak has been manually integrated.

ALS Life Sciences

Laboratory Method Blank Analysis Report

Sample Name	**Method Blank**	Sampling Date	n/a
ALS Sample ID	WG3652547-1	Extraction Date	16-Nov-21
Analysis Method	PAH by CARB 429		
Analysis Type	blank		
Sample Matrix	QC		
Sample Size	1 sample		
Percent Moisture	n/a		
Split Ratio	3	Workgroup	WG3652547

Approved:
Peter Nguyen
--e-signature--
13-Dec-2021

Run Information	**Run 1**
Filename	211207074.D
Run Date	12/9/2021 9:37
Final Volume	1 mL
Dilution Factor	1
Analysis Units	ng/sample
Instrument	MSD-5
Column	HP-5MS US1306512H

Target Analytes	**Ret. Time**	**Concentration ng/sample**	**Flags**
Naphthalene	2.82	54.0	
2-Methylnaphthalene	3.40	<6.0	U
Acenaphthylene	NotFnd	<6.0	U
Acenaphthene	4.95	15.7	R
Fluorene	5.76	<6.0	U
Phenanthrene	7.96	<6.0	U
Anthracene	8.08	<6.0	U
Fluoranthene	NotFnd	<6.0	U
Pyrene	12.00	<6.0	U
Benzo(a)Anthracene	NotFnd	<6.0	U
Chrysene	16.03	<6.0	
Benzo(b)Fluoranthene	NotFnd	<6.0	U
Benzo(k)Fluoranthene	NotFnd	<6.0	U
Benzo(e)Pyrene	NotFnd	<6.0	U
Benzo(a)Pyrene	NotFnd	<6.0	U
Perylene	NotFnd	<6.0	U
Indeno(1,2,3-cd)Pyrene	NotFnd	<6.0	U
Dibenzo(a,h)Anthracene	NotFnd	<6.0	U
Benzo(g,h,i)Perylene	NotFnd	<6.0	U

Field Sampling Standards	**ng spiked**	**% Rec**
1-Methylnaphthalene-D10		NS
Fluorene D10		NS
Terphenyl D14(Surr.)		NS

Extraction Standards			**% Rec**		**Limits**
Naphthalene D8	300	2.81	73		50-150
2-Methylnaphthalene-D10	300	3.37	104		50-150
Acenaphthylene D8	300	4.53	62		50-150
Phenanthrene D10	300	7.91	113		50-150
Anthracene-D10	300	8.03	76		50-150
Fluoranthene D10	300	11.31	99		50-150
Benz(a)Anthracene-D12	300	15.84	66		50-150
Chrysene D12	300	15.94	80	M	50-150
Benzo(b)Fluoranthene-D12	300	19.17	112		50-150
Benzo(k)Fluoranthene-D12	300	19.25	69		50-150
Benzo(a)Pyrene D12	300	20.05	58		50-150
Perylene D12	300	20.29	42	M	50-150
Indeno(1,2,3,cd)Pyrene-D12	300	23.74	107		50-150
Dibenz(a,h)Anthracene-D14	300	23.91	99		50-150
Benzo(g,h,i)Perylene D12	300	24.71	113		50-150

M	Indicates that a peak has been manually integrated.
U	Indicates that this compound was not detected above the MDL.
R	Indicates that the ion abundance ratio for this compound did not meet the acceptance criterion.
NS	Indicates that this compound was not spiked

ALS Life Sciences

Laboratory Method Blank Analysis Report

Sample Name	**Method Blank**	Sampling Date	n/a
ALS Sample ID	WG3652547-4	Extraction Date	16-Nov-21
Analysis Method	PAH by CARB 429		
Analysis Type	blank		
Sample Matrix	QC		
Sample Size	1 sample		
Percent Moisture	n/a		
Split Ratio	3	Workgroup	WG3652547

Approved:
Peter Nguyen
--e-signature--
13-Dec-2021

Run Information	**Run 1**
Filename	211207075.D
Run Date	12/9/2021 10:15
Final Volume	1 mL
Dilution Factor	1
Analysis Units	ng/sample
Instrument	MSD-5
Column	HP-5MS US1306512H

Target Analytes	**Ret. Time**	**Concentration ng/sample**	**Flags**
Naphthalene	2.82	8.07	B
2-Methylnaphthalene	3.41	<6.0	U
Acenaphthylene	NotFnd	<6.0	U
Acenaphthene	4.95	12.8	R B
Fluorene	5.77	<6.0	U
Phenanthrene	7.96	<6.0	U
Anthracene	NotFnd	<6.0	U
Fluoranthene	NotFnd	<6.0	U
Pyrene	NotFnd	<6.0	U
Benzo(a)Anthracene	NotFnd	<6.0	U
Chrysene	NotFnd	<6.0	
Benzo(b)Fluoranthene	NotFnd	<6.0	U
Benzo(k)Fluoranthene	NotFnd	<6.0	U
Benzo(e)Pyrene	NotFnd	<6.0	U
Benzo(a)Pyrene	NotFnd	<6.0	U
Perylene	NotFnd	<6.0	U
Indeno(1,2,3-cd)Pyrene	NotFnd	<6.0	U
Dibenzo(a,h)Anthracene	NotFnd	<6.0	U
Benzo(g,h,i)Perylene	NotFnd	<6.0	U

Field Sampling Standards	**ng spiked**	**% Rec**
1-Methylnaphthalene-D10		NS
Fluorene D10		NS
Terphenyl D14(Surr.)		NS

Extraction Standards			**% Rec**		**Limits**
Naphthalene D8	300	2.81	58		50-150
2-Methylnaphthalene-D10	300	3.37	90		50-150
Acenaphthylene D8	300	4.53	59		50-150
Phenanthrene D10	300	7.91	117		50-150
Anthracene-D10	300	8.03	78		50-150
Fluoranthene D10	300	11.31	105		50-150
Benz(a)Anthracene-D12	300	15.84	72		50-150
Chrysene D12	300	15.95	91	M	50-150
Benzo(b)Fluoranthene-D12	300	19.17	116		50-150
Benzo(k)Fluoranthene-D12	300	19.26	76		50-150
Benzo(a)Pyrene D12	300	20.05	67	M	50-150
Perylene D12	300	20.29	52	M	50-150
Indeno(1,2,3,cd)Pyrene-D12	300	23.74	120		50-150
Dibenz(a,h)Anthracene-D14	300	23.91	112		50-150
Benzo(g,h,i)Perylene D12	300	24.70	125		50-150

M	Indicates that a peak has been manually integrated.
U	Indicates that this compound was not detected above the MDL.
B	Indicates that this compound was detected in the method blank at greater than 10% of the sample value.
R	Indicates that the ion abundance ratio for this compound did not meet the acceptance criterion.
NS	Indicates that this compound was not spiked

ALS Life Sciences

Sample Analysis Report

Sample Name	**ECO WASTE - INCINERATOR - M23 - T1 (1 THRU 3)**	Sampling Date	26-Oct-21 12:00
ALS Sample ID	L2659099-9	Extraction Date	16-Nov-21
Analysis Method	PAH by CARB 429		
Analysis Type	sample		
Sample Matrix	Stack		
Sample Size	1 sample		
Percent Moisture	n/a		
Split Ratio	3	Workgroup	WG3652547

Approved:
Peter Nguyen
--e-signature--
13-Dec-2021

Run Information	**Run 1**
Filename	211207077.D
Run Date	12/9/2021 11:31
Final Volume	1 mL
Dilution Factor	1
Analysis Units	ng/sample
Instrument	MSD-5
Column	HP-5MS US1306512H

Target Analytes	**Ret. Time**	**Concentration ng/sample**	**Flags**
Naphthalene	2.82	3920	
2-Methylnaphthalene	3.40	79.7	
Acenaphthylene	4.55	171	
Acenaphthene	4.84	19.4	R B
Fluorene	5.76	333	
Phenanthrene	7.96	3700	
Anthracene	8.07	97.3	
Fluoranthene	11.36	184	
Pyrene	12.00	88.7 M	R
Benzo(a)Anthracene	15.90	6.87 M	
Chrysene	16.00	8920	
Benzo(b)Fluoranthene	19.24	39.6 M	
Benzo(k)Fluoranthene	NotFnd	<6.0	U
Benzo(e)Pyrene	19.98	47.5 M	
Benzo(a)Pyrene	20.11	<6.0	U
Perylene	20.32	16.9 M	
Indeno(1,2,3-cd)Pyrene	23.83	9.51 M	
Dibenzo(a,h)Anthracene	NotFnd	<6.0	U
Benzo(g,h,i)Perylene	NotFnd	<6.0	U

Field Sampling Standards	**ng spiked**		**% Rec**	
1-Methylnaphthalene-D10	300	3.48	60.2	
Fluorene D10	300	5.71	86.6	
Terphenyl D14(Surr.)	300	12.79	191.4	
Extraction Standards			**% Rec**	**Limits**
Naphthalene D8	300	2.81	59	50-150
2-Methylnaphthalene-D10	300	3.37	95	50-150
Acenaphthylene D8	300	4.53	58	50-150
Phenanthrene D10	300	7.91	96 M	50-150
Anthracene-D10	300	8.03	64	50-150
Fluoranthene D10	300	11.30	96	50-150
Benz(a)Anthracene-D12	300	15.84	67	50-150
Chrysene D12	300	15.94	87 M	50-150
Benzo(b)Fluoranthene-D12	300	19.17	98 M	50-150
Benzo(k)Fluoranthene-D12	300	19.25	72 M	50-150
Benzo(a)Pyrene D12	300	20.05	67 M	50-150
Perylene D12	300	20.28	57	50-150
Indeno(1,2,3,cd)Pyrene-D12	300	23.74	89	50-150
Dibenz(a,h)Anthracene-D14	300	23.90	86	50-150
Benzo(g,h,i)Perylene D12	300	24.70	96	50-150

M	Indicates that a peak has been manually integrated.
U	Indicates that this compound was not detected above the MDL.
B	Indicates that this compound was detected in the method blank at greater than 10% of the sample value.
R	Indicates that the ion abundance ratio for this compound did not meet the acceptance criterion.

ALS Life Sciences

Sample Analysis Report

Sample Name	**ECO WASTE - INCINERATOR - M23 - T2 (1 THRU 3)**	Sampling Date	27-Oct-21 12:00
ALS Sample ID	L2659099-10	Extraction Date	16-Nov-21
Analysis Method	PAH by CARB 429		
Analysis Type	sample		
Sample Matrix	Stack		
Sample Size	1 sample		
Percent Moisture	n/a		
Split Ratio	3	Workgroup	WG3652547

Approved:
Peter Nguyen
--e-signature--
13-Dec-2021

Run Information	**Run 1**
Filename	211207078.D
Run Date	12/9/2021 12:09
Final Volume	1 mL
Dilution Factor	1
Analysis Units	ng/sample
Instrument	MSD-5
Column	HP-5MS US1306512H

Target Analytes	**Ret. Time**	**Concentration ng/sample**	**Flags**
Naphthalene	2.82	2060	
2-Methylnaphthalene	3.40	46.0	
Acenaphthylene	4.54	67.4	
Acenaphthene	4.84	<6.0	U
Fluorene	5.76	104	
Phenanthrene	7.96	1380	
Anthracene	8.07	37.3	
Fluoranthene	11.36	78.8	M
Pyrene	12.00	23.4	R
Benzo(a)Anthracene	15.90	<6.0	U
Chrysene	16.00	3180	
Benzo(b)Fluoranthene	19.24	15.5	M
Benzo(k)Fluoranthene	19.28	6.60	M
Benzo(e)Pyrene	19.98	13.2	M
Benzo(a)Pyrene	20.11	10.9	M
Perylene	NotFnd	<6.0	U
Indeno(1,2,3-cd)Pyrene	23.82	<6.0	U
Dibenzo(a,h)Anthracene	24.01	<6.0	U
Benzo(g,h,i)Perylene	24.81	<6.0	U

Field Sampling Standards	**ng spiked**		**% Rec**	
1-Methylnaphthalene-D10	300	3.48	62.6	
Fluorene D10	300	5.71	86.7	
Terphenyl D14(Surr.)	300	12.80	150.4	

Extraction Standards			**% Rec**		**Limits**
Naphthalene D8	300	2.81	66		50-150
2-Methylnaphthalene-D10	300	3.37	99		50-150
Acenaphthylene D8	300	4.53	60		50-150
Phenanthrene D10	300	7.90	102	M	50-150
Anthracene-D10	300	8.03	65	M	50-150
Fluoranthene D10	300	11.31	94		50-150
Benz(a)Anthracene-D12	300	15.84	61		50-150
Chrysene D12	300	15.95	84	M	50-150
Benzo(b)Fluoranthene-D12	300	19.17	96	M	50-150
Benzo(k)Fluoranthene-D12	300	19.25	69	M	50-150
Benzo(a)Pyrene D12	300	20.05	58	M	50-150
Perylene D12	300	20.28	29	M	50-150
Indeno(1,2,3,cd)Pyrene-D12	300	23.73	88		50-150
Dibenz(a,h)Anthracene-D14	300	23.90	84		50-150
Benzo(g,h,i)Perylene D12	300	24.71	95		50-150

M	Indicates that a peak has been manually integrated.
U	Indicates that this compound was not detected above the MDL.
R	Indicates that the ion abundance ratio for this compound did not meet the acceptance criterion.

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Sample Analysis Report

Sample Name	**ECO WASTE - INCINERATOR - M23 - T3 (1 THRU 3)**	Sampling Date	28-Oct-21 12:00
ALS Sample ID	L2659099-11	Extraction Date	16-Nov-21
Analysis Method	PAH by CARB 429		
Analysis Type	sample		
Sample Matrix	Stack		
Sample Size	1 sample		
Percent Moisture	n/a		
Split Ratio	3	Workgroup	WG3652547

Approved:
Peter Nguyen
--e-signature--
13-Dec-2021

Run Information	**Run 1**
Filename	211207079.D
Run Date	12/9/2021 12:47
Final Volume	1 mL
Dilution Factor	1
Analysis Units	ng/sample
Instrument	MSD-5
Column	HP-5MS US1306512H

Target Analytes	**Ret. Time**	**Concentration ng/sample**	**Flags**
Naphthalene	2.82	4070	
2-Methylnaphthalene	3.40	68.3	
Acenaphthylene	4.55	142	
Acenaphthene	4.84	15.5	R B
Fluorene	5.76	250	
Phenanthrene	7.96	3030	
Anthracene	8.15	24.1	
Fluoranthene	11.36	98.6	M
Pyrene	11.97	21.6	M
Benzo(a)Anthracene	NotFnd	<6.0	U
Chrysene	16.00	7330	
Benzo(b)Fluoranthene	19.24	21.9	M
Benzo(k)Fluoranthene	NotFnd	<6.0	U
Benzo(e)Pyrene	19.98	26.8	
Benzo(a)Pyrene	20.12	11.0	M
Perylene	20.32	11.5	M
Indeno(1,2,3-cd)Pyrene	NotFnd	<6.0	U
Dibenzo(a,h)Anthracene	24.03	<6.0	U
Benzo(g,h,i)Perylene	NotFnd	<6.0	U

Field Sampling Standards	**ng spiked**		**% Rec**			
1-Methylnaphthalene-D10	300	3.48	64.1			
Fluorene D10	300	5.71	87			
Terphenyl D14(Surr.)	300	12.80	188.1			
Extraction Standards			**% Rec**			**Limits**
Naphthalene D8	300	2.81	70			50-150
2-Methylnaphthalene-D10	300	3.37	104			50-150
Acenaphthylene D8	300	4.53	62			50-150
Phenanthrene D10	300	7.91	101			50-150
Anthracene-D10	300	8.03	61			50-150
Fluoranthene D10	300	11.31	102	M		50-150
Benz(a)Anthracene-D12	300	15.84	72			50-150
Chrysene D12	300	15.94	99	M	R	50-150
Benzo(b)Fluoranthene-D12	300	19.17	106	M		50-150
Benzo(k)Fluoranthene-D12	300	19.25	78	M		50-150
Benzo(a)Pyrene D12	300	20.05	60	M		50-150
Perylene D12	300	20.28	42	M		50-150
Indeno(1,2,3,cd)Pyrene-D12	300	23.73	93			50-150
Dibenz(a,h)Anthracene-D14	300	23.90	95			50-150
Benzo(g,h,i)Perylene D12	300	24.71	102			50-150

M	Indicates that a peak has been manually integrated.
U	Indicates that this compound was not detected above the MDL.
B	Indicates that this compound was detected in the method blank at greater than 10% of the sample value.
R	Indicates that the ion abundance ratio for this compound did not meet the acceptance criterion.

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Sample Analysis Report

Sample Name	**ECO WASTE - INCINERATOR - M23 - ACETONE/HEXANE BLANK**	Sampling Date	28-Oct-21 12:00
ALS Sample ID	L2659099-12	Extraction Date	16-Nov-21
Analysis Method	PAH by CARB 429		
Analysis Type	sample		
Sample Matrix	Stack		
Sample Size	1 sample		
Percent Moisture	n/a		
Split Ratio	3	Workgroup	WG3652547

Approved:
Peter Nguyen
--e-signature--
13-Dec-2021

Run Information	**Run 1**
Filename	211207076.D
Run Date	12/9/2021 10:53
Final Volume	1 mL
Dilution Factor	1
Analysis Units	ng/sample
Instrument	MSD-5
Column	HP-5MS US1306512H

Target Analytes	**Ret. Time**	**Concentration ng/sample**	**Flags**
Naphthalene	2.82	70.6	B
2-Methylnaphthalene	3.41	15.8 M	
Acenaphthylene	NotFnd	<6.0 U	
Acenaphthene	4.94	19.2 R	B
Fluorene	5.76	<6.0 U	
Phenanthrene	7.96	<6.0 U	
Anthracene	NotFnd	<6.0 U	
Fluoranthene	NotFnd	<6.0 U	
Pyrene	NotFnd	<6.0 U	
Benzo(a)Anthracene	NotFnd	<6.0 U	
Chrysene	NotFnd	<6.0	
Benzo(b)Fluoranthene	NotFnd	<6.0 U	
Benzo(k)Fluoranthene	NotFnd	<6.0 U	
Benzo(e)Pyrene	NotFnd	<6.0 U	
Benzo(a)Pyrene	NotFnd	<6.0 U	
Perylene	NotFnd	<6.0 U	
Indeno(1,2,3-cd)Pyrene	NotFnd	<6.0 U	
Dibenzo(a,h)Anthracene	NotFnd	<6.0 U	
Benzo(g,h,i)Perylene	NotFnd	<6.0 U	

Field Sampling Standards	**ng spiked**	**% Rec**
1-Methylnaphthalene-D10		NS
Fluorene D10		NS
Terphenyl D14(Surr.)		NS

Extraction Standards			**% Rec**		**Limits**
Naphthalene D8	300	2.81	80		50-150
2-Methylnaphthalene-D10	300	3.37	107		50-150
Acenaphthylene D8	300	4.53	56		50-150
Phenanthrene D10	300	7.91	106		50-150
Anthracene-D10	300	8.03	62		50-150
Fluoranthene D10	300	11.31	92		50-150
Benz(a)Anthracene-D12	300	15.84	60		50-150
Chrysene D12	300	15.95	76		50-150
Benzo(b)Fluoranthene-D12	300	19.17	80		50-150
Benzo(k)Fluoranthene-D12	300	19.26	60	M	50-150
Benzo(a)Pyrene D12	300	20.05	45	M	50-150
Perylene D12	300	20.29	41	M	50-150
Indeno(1,2,3,cd)Pyrene-D12	300	23.74	76		50-150
Dibenz(a,h)Anthracene-D14	300	23.91	72		50-150
Benzo(g,h,i)Perylene D12	300	24.71	81		50-150

M	Indicates that a peak has been manually integrated.
U	Indicates that this compound was not detected above the MDL.
B	Indicates that this compound was detected in the method blank at greater than 10% of the sample value.
R	Indicates that the ion abundance ratio for this compound did not meet the acceptance criterion.
NS	Indicates that this compound was not spiked

ALS Life Sciences

Laboratory Control Sample Analysis Report

Sample Name	**Laboratory Control Sample**	Sampling Date	n/a
ALS Sample ID	WG3652547-2	Extraction Date	16-Nov-21
Analysis Method	PAH by CARB 429		
Analysis Type	LCS		
Sample Matrix	QC		
Sample Size	1 n/a		
Percent Moisture	n/a		
Split Ratio	3	Workgroup	WG3652547

Approved:
Peter Nguyen
--e-signature--
13-Dec-2021

Run Information	**Run 1**
Filename	211207072.D
Run Date	12/9/2021 8:21
Final Volume	1 mL
Dilution Factor	1
Analysis Units	%
Instrument	MSD-5
Column	HP-5MS US1306512H

Target Analytes	**ug spiked**	**Ret. Time**	**%**	**Flags**	**Limits**
Naphthalene	300	2.82	115	B	50-150
2-Methylnaphthalene	300	3.40	79		50-150
Acenaphthylene	300	4.55	96		50-150
Acenaphthene	300	4.84	87	B	50-150
Fluorene	300	5.76	88		50-150
Phenanthrene	300	7.96	98		50-150
Anthracene	300	8.08	107		50-150
Fluoranthene	300	11.36	88		50-150
Pyrene	300	12.00	90		50-150
Benzo(a)Anthracene	300	15.90	92		50-150
Chrysene	300	16.02	101		50-150
Benzo(b)Fluoranthene	300	19.24	80		50-150
Benzo(k)Fluoranthene	300	19.31	107		50-150
Benzo(e)Pyrene	300	19.98	101		50-150
Benzo(a)Pyrene	300	20.10	86		50-150
Perylene	300	20.34	113		50-150
Indeno(1,2,3-cd)Pyrene	300	23.82	72		50-150
Dibenzo(a,h)Anthracene	300	24.02	86		50-150
Benzo(g,h,i)Perylene	300	24.81	71		50-150

Field Sampling Standards	**ng spiked**	**% Rec**
1-Methylnaphthalene-D10		NS
Fluorene D10		NS
Terphenyl D14(Surr.)		NS

Extraction Standards			**% Rec**		**Limits**
Naphthalene D8	300	2.81	55		30-150
2-Methylnaphthalene-D10	300	3.37	82		30-150
Acenaphthylene D8	300	4.53	51		30-150
Phenanthrene D10	300	7.91	94		50-150
Anthracene-D10	300	8.03	63		50-150
Fluoranthene D10	300	11.31	88		50-150
Benz(a)Anthracene-D12	300	15.84	64		50-150
Chrysene D12	300	15.94	80		50-150
Benzo(b)Fluoranthene-D12	300	19.17	98		50-150
Benzo(k)Fluoranthene-D12	300	19.25	66		50-150
Benzo(a)Pyrene D12	300	20.05	61		30-150
Perylene D12	300	20.28	34	M	50-150
Indeno(1,2,3,cd)Pyrene-D12	300	23.73	102		50-150
Dibenz(a,h)Anthracene-D14	300	23.90	97		50-150
Benzo(g,h,i)Perylene D12	300	24.70	106		50-150

M	Indicates that a peak has been manually integrated.
B	Indicates that this compound was detected in the method blank at greater than 10% of the sample value.
R	Indicates that the ion abundance ratio for this compound did not meet the acceptance criterion.
NS	Indicates that this compound was not spiked

1435 Norjohn Court, Unit 1, Burlington ON, L7L 0E6
Phone: 905-331-3111, FAX: 905-331-4567

Certificate of Analysis

ALS Project Contact:	Claire Kocharakkal	**Client Name:**	RWDI AIR INC. (Guelph)
ALS Project ID:	23601	**Client Address:**	2239 Star Court
ALS WO#:	L2659099		Rochester Hills, MI 48309
Date of Report	6-Dec-21		United States
Date of Sample Receipt	3-Nov-21	**Client Contact:**	Alec Smith
		Client Project ID:	2200515.01

COMMENTS:

Sample Particulate Analysis via Gravimetric USEPA Method 5 (LL4 16-NOV-2021)

REPORT FLAGS:

J - The value is uncertain and below what can be reliably identified as positive with a ≥99% confidence limit (i.e. below the laboratory determined MDL).

LCB = Laboratory Control Blank
CVS = Continuing Verification Standard Sample (limits: ±2 in the last decimal)
LOR = Limit of Reporting

Certified by: Breanne Dusureault

Breanne Dusureault
Project Manager

Results in this certificate relate only to the samples as submitted to the laboratory.

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Sample Analysis Summary Report

Sample Name		ECO WASTE - INCINERATOR - M5/29 - T1 (1 THRU 5C)	ECO WASTE - INCINERATOR - M5/29 - T2 (1 THRU 5C)	ECO WASTE - INCINERATOR - M5/29 - T3 (1 THRU 5C)	ECO WASTE - INCINERATOR - M5/29 - ACETONE BLANK		MB
ALS Sample ID		L2659099-1	L2659099-2	L2659099-3	L2659099-4		L2659099-MB
Matrix		Stack	Stack	Stack	Stack		n/a
Analysis type		Sample	Sample	Sample	Sample		Sample
Sampling Date/Time		26-Oct-21	27-Oct-21	28-Oct-21	28-Oct-21		n/a
Date of Receipt		3-Nov-21	3-Nov-21	3-Nov-21	3-Nov-21		n/a
PM via Gravimetric Analysis	**LOR**						
Method 5	**mg**	**mg**	**mg**	**mg**	**mg**		**mg**
Filter Particulate Matter	0.8	20.6	25.9	29.7	-		<0.1
Acetone Particulate Matter	0.4	2.9	6.3	5.4	0.3	**J**	<0.1
	g	**g**	**g**	**g**	**g**		**g**
Acetone Mass	0.02	93.9	51.5	72.7	93.5		29.8

1435 Norjohn Court, Unit 1, Burlington ON, L7L 0E6
Phone: 905-331-3111, FAX: 905-331-4567

Certificate of Analysis

ALS Project Contact:	Claire Kocharakkal	**Client Name:**	RWDI Air Inc.
ALS Project ID:	23601	**Client Address:**	600 Southgate Drive
ALS WO#:	L2659099		Guelph, ON N1G 4P6
Date of Report	6-Dec-21		Canada
Date of Sample Receipt	3-Nov-21	**Client Contact:**	Alec Smith
		Client Project ID:	2200515.01

COMMENTS:

F as HF Anion Analyzed via Ion Chromatography USEPA Method 26/26A (GN 20-Nov-21)
Cl as HCl Anion Analyzed via Ion Chromatography USEPA Method 26/26A (GN 20-Nov-21)
Br as HBr Anion Analyzed via Ion Chromatography USEPA Method 26/26A (GN 20-Nov-21)

ANALYST COMMENTS:

HBr samples were analyzed at a higher-than-normal dilution to reduce interference from the closely-eluting sulfate peak. The LOR has been raised for this analyte to account for the higher dilution. **PE 23-Nov-21**

LOR = Limit of Reporting
MB = Laboratory Control Blank (limits: <LOR)
LCS = Laboratory Control Sample (limits: 90-110%)
MS = Matrix Spike Sample (limits: 90-110%, NH_3: 85-115%)
RPD = Relative Percent Difference (limits: <20% for sample duplicate, <10% for duplicate injection)

Certified by: Breanne Dusureault

Breanne Dusureault
Project Manager

Results in this certificate relate only to the samples as submitted to the laboratory.
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ALS Environmental

Sample Analysis Summary Report

Sample Name	ECO WASTE - INCINERATOR - M26 - H2SO4 - T1 CONT.1	ECO WASTE - INCINERATOR - M26 - H2SO4 - T2 CONT.1	ECO WASTE - INCINERATOR - M26 - H2SO4 - T3 CONT.1	ECO WASTE - INCINERATOR - M26 - H2SO4 BLANK
ALS Sample ID	L2659099-5	L2659099-6	L2659099-7	L2659099-8
Matrix	Stack	Stack	Stack	Stack
Analysis type	Sample	Sample	Sample	Sample
Sampling Date/Time	26-Oct-21	27-Oct-21	28-Oct-21	28-Oct-21
Date of Receipt	3-Nov-21	3-Nov-21	3-Nov-21	3-Nov-21
Ion Chromatography Analysis				
USEPA Method 26/26A	**mg**	**mg**	**mg**	**mg**
Total F^- as HF (ave)	0.210	0.251	0.251	<0.0411
Analysis 1	0.210	0.253	0.251	<0.0411
Analysis 2	0.209	0.249	0.251	<0.0411
Total Cl^- as HCl (ave)	9.74	34.2	94.4	<0.0603
Analysis 1	9.75	34.1	94.6	<0.0603
Analysis 2	9.74	34.2	94.2	<0.0603
Total Br^- as HBr (ave)	<1.27	<1.17	<1.42	<0.396
Analysis 1	<1.27	<1.17	<1.42	<0.396
Analysis 2	<1.27	<1.17	<1.42	<0.396

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Sample QC Summary Report

Sample Name	MB	LCS	LCS
ALS Sample ID	MB	LCS	LCS
Matrix	Stack	Stack	Stack
Analysis type	Method Blank	Blank Spike	Blank Spike
Sampling Date/Time	n/a	n/a	n/a
Date of Receipt	n/a	n/a	n/a
Ion Chromatography Analysis			
USEPA Method 26/26A	**mg**	**mg**	**% Rec**
Total F^- as HF (ave)	0.00212	0.0527	96%
Analysis 1	0.00212	0.0528	
Analysis 2	0.00212	0.0527	
Total Cl^- as HCl (ave)	0.00304	0.0775	96%
Analysis 1	0.00304	0.0778	
Analysis 2	0.00304	0.0772	
Total Br^- as HBr (ave)	<0.00791	5.01	97%
Analysis 1	<0.00791	4.98	
Analysis 2	<0.00791	5.04	

ALS Environmental

Sample QC Summary Report

Sample Name	ECO WASTE - INCINERATOR - M26 - H2SO4 - T1 CONT.1	ECO WASTE - INCINERATOR - M26 - H2SO4 - T1 CONT.1	ECO WASTE - INCINERATOR - M26 - H2SO4 - T1 CONT.1	ECO WASTE - INCINERATOR - M26 - H2SO4 - T1 CONT.1
ALS Sample ID	L2659099-5	L2659099-5DUP	L2659099-5MS	L2659099-5MS
Matrix	Stack	Stack	Stack	Stack
Analysis type	Sample	Duplicate	Matrix Spike	Matrix Spike
Sampling Date/Time	26-Oct-21	26-Oct-21	26-Oct-21	26-Oct-21
Date of Receipt	3-Nov-21	3-Nov-21	3-Nov-21	3-Nov-21
Ion Chromatography Analysis				
USEPA Method 26/26A	**mg**	**mg**	**mg**	**% Rec**
Total F^- as HF (ave)	0.210	0.207	4.23	95%
Analysis 1	0.210	0.207	4.23	
Analysis 2	0.209	0.208	4.24	
Total Cl^- as HCl (ave)	9.74	9.55	15.9	101%
Analysis 1	9.75	9.54	15.9	
Analysis 2	9.74	9.56	15.9	
Total Br^- as HBr (ave)	<1.27	<1.27	40.1	97%
Analysis 1	<1.27	<1.27	39.8	
Analysis 2	<1.27	<1.27	40.3	

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Certificate of Analysis

ALS Project Contact:	Claire Kocharakkal	**Client Name:**	RWDI Air Inc.
ALS Project ID:	23601	**Client Address:**	600 Southgate Drive
ALS WO#:	L2659099		Guelph, ON N1G 4P6
Date of Report	6-Dec-21		Canada
Date of Sample Receipt	3-Nov-21	**Client Contact:**	Alec Smith
		Client Project ID:	2200515.01

COMMENTS:

Sample Preparation via USEPA Method 29 (TP 19-Nov-2021)
Mercury Analysis via CVAA using Method USEPA 7470A (GN 23-Nov-2021)

LOR = Limit of Reporting
LCB = Laboratory Control Blank (limits: <LOR)
LCS = Laboratory Control Sample (limits: hivol, solids: 85-115%, stack: 90-110%)
MS = Matrix Spike Sample (limits: 75-125%)
RPD = Relative Percent Difference (limits: <20%)
CCV/CVS = Calibration Verification Standard (limits: 85-115%)

Certified by: Breanne Dusureault

Breanne Dusureault
Project Manager

Results in this certificate relate only to the samples as submitted to the laboratory.
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Sample Analysis Summary Report

Sample Name			ECO WASTE - INCINERATOR - M5/29 - T1 (1 THRU 5C)	ECO WASTE - INCINERATOR - M5/29 - T2 (1 THRU 5C)	ECO WASTE - INCINERATOR - M5/29 - T3 (1 THRU 5C)
ALS Sample ID			L2659099-1	L2659099-2	L2659099-3
Matrix			Stack	Stack	Stack
Analysis type			Sample	Sample	Sample
Sampling Date/Time			26-Oct-21	27-Oct-21	28-Oct-21
Date of Receipt			3-Nov-21	3-Nov-21	3-Nov-21
Mercury via CVAA		**LOR**			
	Method 29	**ug**	**ug**	**ug**	**ug**
	Analytical Fraction 1B	0.015	<0.015	<0.015	<0.015
	Analytical Fraction 2B	0.050	<0.295	<0.3	<0.3
	Analytical Fraction 3A	0.005	<0.007	<0.0048	<0.0032
	Analytical Fraction 3B	0.025	<0.02	<0.02	0.173
	Analytical Fraction 3C	0.25	0.240	0.215	<0.125

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Sample QC Summary Report

Sample Name		LCB	LCS	LCS	LCSD	LCSD
ALS Sample ID		LCB	LCS	LCS	LCSD	LCSD
Analysis type		Method Blank	Blank Spike	Blank Spike	Blank Spike Dup	Blank Spike Dup
Sampling Date/Time		N/A	N/A	N/A	N/A	N/A
Date of Receipt		N/A	N/A	N/A	N/A	N/A
Mercury via CVAA	**LOR**					
Method 29	**ug**	**ug**	**ug**	**% Rec**	**ug**	**% Rec**
Analytical Fraction 1B	0.015	<0.015	0.303	101%	0.315	105%
Analytical Fraction 2B	0.050	<0.05	0.941	94%	0.975	97%
Analytical Fraction 3A	0.005	<0.01	0.193	96%	0.184	92%
Analytical Fraction 3B	0.025	<0.025	0.465	93%	0.472	94%
Analytical Fraction 3C	0.25	<0.25	4.55	91%	4.71	94%

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Sample QC Summary Report

Sample Name		ECO WASTE - INCINERATOR - M5/29 - T1 (1 THRU 5C)	ECO WASTE - INCINERATOR - M5/29 - T1 (1 THRU 5C)	ECO WASTE - INCINERATOR - M5/29 - T1 (1 THRU 5C)	ECO WASTE - INCINERATOR - M5/29 - T1 (1 THRU 5C)	ECO WASTE - INCINERATOR - M5/29 - T1 (1 THRU 5C)	ECO WASTE - INCINERATOR - M5/29 - T1 (1 THRU 5C)
ALS Sample ID		L2659099-1	L2659099-1DUP	L2659099-1MS	L2659099-1MS	L2659099-1MSD	L2659099-1MSD
Matrix		Stack	Stack	Stack	Stack	Stack	Stack
Analysis type		Sample	Duplicate	Matrix Spike	Matrix Spike	Matrix Spike Dup	Matrix Spike Dup
Sampling Date/Time		26-Oct-21	26-Oct-21	26-Oct-21	26-Oct-21	26-Oct-21	26-Oct-21
Date of Receipt		3-Nov-21	3-Nov-21	3-Nov-21	3-Nov-21	3-Nov-21	3-Nov-21
Mercury via CVAA	**LOR**						
Method 29	**ug**	**ug**	**ug**	**ug**	**% Rec**	**ug**	**% Rec**
Analytical Fraction 1B	0.015	<0.015	<0.015	0.300	98%	0.298	98%
Analytical Fraction 2B	0.050	<0.295	<0.295	5.69	94%	5.78	96%
Analytical Fraction 3A	0.005	<0.007	<0.007	0.133	95%	0.134	96%
Analytical Fraction 3B	0.025	<0.02	<0.02	0.364	91%	0.367	92%
Analytical Fraction 3C	0.250	0.240	0.248	2.60	94%	2.73	99%

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Certificate of Analysis

ALS Project Contact:	Claire Kocharakkal	**Client Name:**	RWDI Air Inc
ALS Project ID:	23601	**Client Address:**	2239 Star Court
ALS WO#:	L2659099		Rochester Hills, MI 48309
Date of Report	4-Jan-22		United States of America
Date of Sample Receipt	03-Nov-21	**Client Contact:**	Alec Smith
		Client Project ID:	2200515.01

COMMENTS: **PCDD/F by EPA M23**

Certified by:

Bradley Reimer
GC/MS Laboratory Senior Technical Specialist

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Sample Analysis Summary Report

Sample Name	ECO WASTE - INCINERATOR - M23 - T1 (1 THRU 3)	ECO WASTE - INCINERATOR - M23 - T2 (1 THRU 3)	ECO WASTE - INCINERATOR - M23 - T3 (1 THRU 3)	ECO WASTE - INCINERATOR - M23 - ACETONE/ HEXANE BLANK
ALS Sample ID	L2659099-9	L2659099-10	L2659099-11	L2659099-12
Sample Size	1	1	1	1
Sample size units	sample	sample	sample	sample
Percent Moisture	n/a	n/a	n/a	n/a
Sample Matrix	Stack	Stack	Stack	Stack
Sampling Date	26-Oct-21	27-Oct-21	28-Oct-21	28-Oct-21
Extraction Date	16-Nov-21	16-Nov-21	16-Nov-21	16-Nov-21
Target Analytes	**pg**	**pg**	**pg**	**pg**
2,3,7,8-TCDD	988	772	978	<1.8
1,2,3,7,8-PeCDD	3160	2910	3540	2.20
1,2,3,4,7,8-HxCDD	1390	1320	1540	3.07
1,2,3,6,7,8-HxCDD	2180	1940	2420	<3.9
1,2,3,7,8,9-HxCDD	2910	2370	3050	<2.6
1,2,3,4,6,7,8-HpCDD	5990	5860	7530	37.6
OCDD	2500	3090	4000	<51
2,3,7,8-TCDF	11500	9920	12000	<2.3
1,2,3,7,8-PeCDF	10600	8010	10300	<2.9
2,3,4,7,8-PeCDF	31500	31000	42900	16.8
1,2,3,4,7,8-HxCDF	10100	8350	12600	<13
1,2,3,6,7,8-HxCDF	10600	8020	11700	<12
2,3,4,6,7,8-HxCDF	11300	9190	14200	<26
1,2,3,7,8,9-HxCDF	1880	1620	2330	<6.4
1,2,3,4,6,7,8-HpCDF	15200	12300	19800	70.6
1,2,3,4,7,8,9-HpCDF	1260	940	1480	<6.8
OCDF	1490	1320	2010	14.4
Field Spike Standards	**% Rec**	**% Rec**	**% Rec**	**% Rec**
37Cl4-2,3,7,8-TCDD	102	101	101	NS
13C12-1,2,3,4,7,8-HxCDD	95	83	76	NS
13C12-2,3,4,7,8-PeCDF	117	121	126	NS
13C12-1,2,3,4,7,8-HxCDF	97	98	102	NS
13C12-1,2,3,4,7,8,9-HpCDF	90	94	95	NS
Extraction Standards				
13C12-2,3,7,8-TCDD	90	82	84	78
13C12-1,2,3,7,8-PeCDD	100	92	97	81
13C12-1,2,3,6,7,8-HxCDD	87	83	88	75
13C12-1,2,3,4,6,7,8-HpCDD	82	75	78	82
13C12-OCDD	65	62	69	71
13C12-2,3,7,8-TCDF	112	103	105	88
13C12-1,2,3,7,8-PeCDF	115	99	105	84
13C12-1,2,3,6,7,8-HxCDF	101	89	89	81
13C12-1,2,3,4,6,7,8-HpCDF	98	86	92	91
Cleanup Standard				
13C12-1,2,3,7,8,9-HxCDF	85	79	86	96
Homologue Group Totals	**pg**	**pg**	**pg**	**pg**
Total-TCDD	45200	43100	47100	<1.8
Total-PeCDD	36800	42100	52700	2.20
Total-HxCDD	29700	29600	30400	21.8
Total-HpCDD	12000	12500	15600	72.0
Total-TCDF	441000	397000	494000	9.31
Total-PeCDF	264000	238000	312000	60.3
Total-HxCDF	91800	72700	112000	28.7
Total-HpCDF	16500	16900	27100	80.1
Toxic Equivalency - (WHO 2005)				
Lower Bound PCDD/F TEQ (WHO 2005)	19300	17700	24000	8.63
Mid Point PCDD/F TEQ (WHO 2005)	19300	17700	24000	16.1
Upper Bound PCDD/F TEQ (WHO 2005)	19300	17700	24000	17.2

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Quality Control Summary Report

Sample Name	Method Blank	Method Blank	Laboratory Control Sample
ALS Sample ID	WG3652547-1	WG3652547-4	WG3652547-2
Sample Size	1	1	1
Sample size units	sample	sample	n/a
Percent Moisture	n/a	n/a	n/a
Sample Matrix	QC	QC	QC
Sampling Date	n/a	n/a	n/a
Extraction Date	16-Nov-21	16-Nov-21	16-Nov-21
Target Analytes	**pg**	**pg**	**% Rec**
2,3,7,8-TCDD	<0.76	<0.98	88
1,2,3,7,8-PeCDD	<0.68	<0.55	105
1,2,3,4,7,8-HxCDD	<1.2	<0.85	83
1,2,3,6,7,8-HxCDD	<1.2	<0.87	100
1,2,3,7,8,9-HxCDD	<1.2	<0.87	108
1,2,3,4,6,7,8-HpCDD	<1.9	<1.8	90
OCDD	<24	20.9	89
2,3,7,8-TCDF	<0.48	<0.74	93
1,2,3,7,8-PeCDF	<0.48	<0.49	101
2,3,4,7,8-PeCDF	<0.46	<0.48	97
1,2,3,4,7,8-HxCDF	<0.40	<0.81	84
1,2,3,6,7,8-HxCDF	<0.64	<0.78	105
2,3,4,6,7,8-HxCDF	<0.41	<0.84	92
1,2,3,7,8,9-HxCDF	<1.2	<1.6	110
1,2,3,4,6,7,8-HpCDF	<0.86	<0.57	98
1,2,3,4,7,8,9-HpCDF	<0.69	<0.67	97
OCDF	<5.5	<1.9	98
Field Spike Standards	**% Rec**	**% Rec**	**% Rec**
37Cl4-2,3,7,8-TCDD	NS	NS	NS
13C12-1,2,3,4,7,8-HxCDD	NS	NS	NS
13C12-2,3,4,7,8-PeCDF	NS	NS	NS
13C12-1,2,3,4,7,8-HxCDF	NS	NS	NS
13C12-1,2,3,4,7,8,9-HpCDF	NS	NS	NS
13C12-1,2,3,4,7,8-HxCDF	NS	NS	NS
13C12-1,2,3,4,7,8,9-HpCDF	NS	NS	NS
Extraction Standards			
13C12-2,3,7,8-TCDD	71	63	80
13C12-1,2,3,7,8-PeCDD	68	65	99
13C12-1,2,3,6,7,8-HxCDD	72	62	79
13C12-1,2,3,4,6,7,8-HpCDD	70	66	85
13C12-OCDD	62	54	79
13C12-2,3,7,8-TCDF	78	72	81
13C12-1,2,3,7,8-PeCDF	72	70	91
13C12-1,2,3,6,7,8-HxCDF	76	68	74
13C12-1,2,3,4,6,7,8-HpCDF	81	76	86
Cleanup Standard			
13C12-1,2,3,7,8,9-HxCDF	78	89	73
Homologue Group Totals	**pg**	**pg**	
Total-TCDD	<0.76	<0.98	
Total-PeCDD	<0.68	<0.55	
Total-HxCDD	<1.2	<0.87	
Total-HpCDD	<1.8	<1.8	
Total-TCDF	<0.48	<0.74	
Total-PeCDF	<0.48	<0.49	
Total-HxCDF	<0.52	<1.1	
Total-HpCDF	<0.69	<0.67	
Toxic Equivalency - (WHO 2005)			
Lower Bound PCDD/F TEQ (WHO 2005)	0.00	0.00627	
Mid Point PCDD/F TEQ (WHO 2005)	1.26	1.32	
Upper Bound PCDD/F TEQ (WHO 2005)	2.31	2.46	

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Sample Analysis Report

Sample Name	**ECO WASTE - INCINERATOR - M23 - T1 (1 THRU 3)**	Sampling Date	26-Oct-21		
ALS Sample ID	L2659099-9	Extraction Date	16-Nov-21		Approved:
Analysis Method	EPA M23	Sample Size	1	sample	*K.BERG*
Analysis Type	Sample	Percent Moisture	n/a		--e-signature--
Sample Matrix	Stack	Split Ratio	3		15-Dec-2021

Run Information	**Run 1**
Filename	7-211212A18
Run Date	12-Dec-21 16:27
Final Volume	20 uL
Dilution Factor	1
Analysis Units	pg
Instrument - Column	HRMS 7 DB5MSUS1382023H

Target Analytes	**TEF (WHO 2005)**	**Ret. Time**	**Conc. pg**	**EDL pg**	**Flags**	**EMPC pg**	**LQL**
2,3,7,8-TCDD	1	28.40	988	1.7			30
1,2,3,7,8-PeCDD	1	32.26	3160	4.8			150
1,2,3,4,7,8-HxCDD	0.1	34.26	1390	3.8			150
1,2,3,6,7,8-HxCDD	0.1	34.31	2180	3.8			150
1,2,3,7,8,9-HxCDD	0.1	34.43	2910	3.8			150
1,2,3,4,6,7,8-HpCDD	0.01	35.93	5990	5.3			150
OCDD	0.0003	37.44	2500	4.5			300
2,3,7,8-TCDF	0.1	27.48	11500	3.9			30
1,2,3,7,8-PeCDF	0.03	31.35	10600	4.6			150
2,3,4,7,8-PeCDF	0.3	31.96	31500	4.5			150
1,2,3,4,7,8-HxCDF	0.1	33.78	10100	9.5			150
1,2,3,6,7,8-HxCDF	0.1	33.84	10600	9.1			150
2,3,4,6,7,8-HxCDF	0.1	34.17	11300	9.8			150
1,2,3,7,8,9-HxCDF	0.1	34.61	1880	12			150
1,2,3,4,6,7,8-HpCDF	0.01	35.36	15200	7.9			150
1,2,3,4,7,8,9-HpCDF	0.01	36.19	1260	11			150
OCDF	0.0003	37.54	1490	4.0			300

Field Spike Standards	**pg**		**% Rec**	**Limits**
37Cl4-2,3,7,8-TCDD	600	28.40	102	70-130
13C12-1,2,3,4,7,8-HxCDD	6000	34.25	95	70-130
13C12-2,3,4,7,8-PeCDF	6000	32.04	117	70-130
13C12-1,2,3,4,7,8-HxCDF	6000	33.77	97	70-130
13C12-1,2,3,4,7,8,9-HpCDF	6000	36.18	90	70-130
Extraction Standards				
13C12-2,3,7,8-TCDD	6000	28.37	90	40-130
13C12-1,2,3,7,8-PeCDD	6000	32.24	100	40-130
13C12-1,2,3,6,7,8-HxCDD	6000	34.30	87	40-130
13C12-1,2,3,4,6,7,8-HpCDD	6000	35.91	82	25-130
13C12-OCDD	12000	37.43	65	25-130
13C12-2,3,7,8-TCDF	6000	27.47	112	40-130
13C12-1,2,3,7,8-PeCDF	6000	31.34	115	40-130
13C12-1,2,3,6,7,8-HxCDF	6000	33.83	101	40-130
13C12-1,2,3,4,6,7,8-HpCDF	6000	35.36	98	25-130
Cleanup Standard	**pg**			
13C12-1,2,3,7,8,9-HxCDF	6000	34.58	85	40-130

Homologue Group Totals	**# peaks**	**Conc. pg**	**EDL pg**	
Total-TCDD	17	45200	1.7	30
Total-PeCDD	9	36800	4.8	150
Total-HxCDD	7	29700	3.8	150
Total-HpCDD	2	12000	5.3	150
Total-TCDF	25	441000	3.9	30
Total-PeCDF	19	264000	4.6	150
Total-HxCDF	14	91800	12	150
Total-HpCDF	2	16500	11	150

Toxic Equivalency - (WHO 2005)	**pg**
Lower Bound PCDD/F TEQ (WHO 2005)	19300
Mid Point PCDD/F TEQ (WHO 2005)	19300
Upper Bound PCDD/F TEQ (WHO 2005)	19300

EDL Indicates the Estimated Detection Limit, based on the measured background noise for this target in this sample.
TEF Indicates the Toxic Equivalency Factor TEQ Indicates the Toxic Equivalency

LQL Lower Quantification Limit, based on the lowest calibration level corrected for sample size, splits and dilutions.
EMPC Estimated Maximum Possible Concentration – elevated detection limit due to interference or positive id criterion failure

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Sample Analysis Report

Sample Name	**ECO WASTE - INCINERATOR - M23 - T2 (1 THRU 3)**	Sampling Date	27-Oct-21		
ALS Sample ID	L2659099-10	Extraction Date	16-Nov-21		Approved:
Analysis Method	EPA M23	Sample Size	1	sample	*K.BERG*
Analysis Type	Sample	Percent Moisture	n/a		--e-signature--
Sample Matrix	Stack	Split Ratio	3		15-Dec-2021

Run Information	**Run 1**
Filename	7-211212A19
Run Date	12-Dec-21 17:11
Final Volume	20 uL
Dilution Factor	1
Analysis Units	pg
Instrument - Column	HRMS 7 DB5MSUS1382023H

Target Analytes	**TEF (WHO 2005)**	**Ret. Time**	**Conc. pg**	**EDL pg**	**Flags**	**EMPC pg**	**LQL**
2,3,7,8-TCDD	1	28.41	772	2.6			30
1,2,3,7,8-PeCDD	1	32.26	2910	3.4			150
1,2,3,4,7,8-HxCDD	0.1	34.26	1320	5.0			150
1,2,3,6,7,8-HxCDD	0.1	34.31	1940	5.1			150
1,2,3,7,8,9-HxCDD	0.1	34.44	2370	5.1			150
1,2,3,4,6,7,8-HpCDD	0.01	35.93	5860	10			150
OCDD	0.0003	37.44	3090	5.9			300
2,3,7,8-TCDF	0.1	27.50	9920	4.3			30
1,2,3,7,8-PeCDF	0.03	31.35	8010	13			150
2,3,4,7,8-PeCDF	0.3	31.98	31000	12			150
1,2,3,4,7,8-HxCDF	0.1	33.78	8350	8.3			150
1,2,3,6,7,8-HxCDF	0.1	33.85	8020	8.0			150
2,3,4,6,7,8-HxCDF	0.1	34.17	9190	8.6			150
1,2,3,7,8,9-HxCDF	0.1	34.62	1620	11			150
1,2,3,4,6,7,8-HpCDF	0.01	35.37	12300	5.4			150
1,2,3,4,7,8,9-HpCDF	0.01	36.19	940	7.2			150
OCDF	0.0003	37.54	1320	5.2			300
Field Spike Standards	**pg**		**% Rec**	**Limits**			
37Cl4-2,3,7,8-TCDD	600	28.40	101	70-130			
13C12-1,2,3,4,7,8-HxCDD	6000	34.26	83	70-130			
13C12-2,3,4,7,8-PeCDF	6000	32.05	121	70-130			
13C12-1,2,3,4,7,8-HxCDF	6000	33.77	98	70-130			
13C12-1,2,3,4,7,8,9-HpCDF	6000	36.19	94	70-130			
Extraction Standards							
13C12-2,3,7,8-TCDD	6000	28.38	82	40-130			
13C12-1,2,3,7,8-PeCDD	6000	32.25	92	40-130			
13C12-1,2,3,6,7,8-HxCDD	6000	34.31	83	40-130			
13C12-1,2,3,4,6,7,8-HpCDD	6000	35.93	75	25-130			
13C12-OCDD	12000	37.44	62	25-130			
13C12-2,3,7,8-TCDF	6000	27.48	103	40-130			
13C12-1,2,3,7,8-PeCDF	6000	31.34	99	40-130			
13C12-1,2,3,6,7,8-HxCDF	6000	33.84	89	40-130			
13C12-1,2,3,4,6,7,8-HpCDF	6000	35.36	86	25-130			
Cleanup Standard	**pg**						
13C12-1,2,3,7,8,9-HxCDF	6000	34.59	79	40-130			

Homologue Group Totals	**# peaks**	**Conc. pg**	**EDL pg**	
Total-TCDD	16	43100	2.6	30
Total-PeCDD	10	42100	3.4	150
Total-HxCDD	7	29600	5.1	150
Total-HpCDD	2	12500	10	150
Total-TCDF	26	397000	4.3	30
Total-PeCDF	19	238000	13	150
Total-HxCDF	12	72700	11	150
Total-HpCDF	4	16900	7.2	150

Toxic Equivalency - (WHO 2005)	**pg**
Lower Bound PCDD/F TEQ (WHO 2005)	17700
Mid Point PCDD/F TEQ (WHO 2005)	17700
Upper Bound PCDD/F TEQ (WHO 2005)	17700

EDL Indicates the Estimated Detection Limit, based on the measured background noise for this target in this sample.
TEF Indicates the Toxic Equivalency Factor TEQ Indicates the Toxic Equivalency

LQL Lower Quantification Limit, based on the lowest calibration level corrected for sample size, splits and dilutions.
EMPC Estimated Maximum Possible Concentration – elevated detection limit due to interference or positive id criterion failure

ALS Life Sciences

Sample Analysis Report

Sample Name	**ECO WASTE - INCINERATOR - M23 - T3 (1 THRU 3)**	Sampling Date	28-Oct-21		
ALS Sample ID	L2659099-11	Extraction Date	16-Nov-21		Approved:
Analysis Method	EPA M23	Sample Size	1	sample	*K.BERG*
Analysis Type	Sample	Percent Moisture	n/a		--e-signature--
Sample Matrix	Stack	Split Ratio	3		15-Dec-2021

Run Information	**Run 1**
Filename	7-211212A20
Run Date	12-Dec-21 17:55
Final Volume	20 uL
Dilution Factor	1
Analysis Units	pg
Instrument - Column	HRMS 7 DB5MSUS1382023H

Target Analytes	**TEF (WHO 2005)**	**Ret. Time**	**Conc. pg**	**EDL pg**	**Flags**	**EMPC pg**	**LQL**
2,3,7,8-TCDD	1	28.40	978	3.5			30
1,2,3,7,8-PeCDD	1	32.25	3540	4.4			150
1,2,3,4,7,8-HxCDD	0.1	34.26	1540	4.4			150
1,2,3,6,7,8-HxCDD	0.1	34.31	2420	4.5			150
1,2,3,7,8,9-HxCDD	0.1	34.43	3050	4.5			150
1,2,3,4,6,7,8-HpCDD	0.01	35.93	7530	11			150
OCDD	0.0003	37.43	4000	8.5			300
2,3,7,8-TCDF	0.1	27.50	12000	7.5			30
1,2,3,7,8-PeCDF	0.03	31.35	10300	11			150
2,3,4,7,8-PeCDF	0.3	31.96	42900	10			150
1,2,3,4,7,8-HxCDF	0.1	33.77	12600	8.9			150
1,2,3,6,7,8-HxCDF	0.1	33.84	11700	8.6			150
2,3,4,6,7,8-HxCDF	0.1	34.17	14200	9.2			150
1,2,3,7,8,9-HxCDF	0.1	34.61	2330	12			150
1,2,3,4,6,7,8-HpCDF	0.01	35.36	19800	6.4			150
1,2,3,4,7,8,9-HpCDF	0.01	36.18	1480	8.5			150
OCDF	0.0003	37.54	2010	4.7			300
Field Spike Standards	**pg**		**% Rec**	**Limits**			
37Cl4-2,3,7,8-TCDD	600	28.40	101	70-130			
13C12-1,2,3,4,7,8-HxCDD	6000	34.25	76	70-130			
13C12-2,3,4,7,8-PeCDF	6000	32.04	126	70-130			
13C12-1,2,3,4,7,8-HxCDF	6000	33.77	102	70-130			
13C12-1,2,3,4,7,8,9-HpCDF	6000	36.18	95	70-130			
Extraction Standards							
13C12-2,3,7,8-TCDD	6000	28.38	84	40-130			
13C12-1,2,3,7,8-PeCDD	6000	32.24	97	40-130			
13C12-1,2,3,6,7,8-HxCDD	6000	34.30	88	40-130			
13C12-1,2,3,4,6,7,8-HpCDD	6000	35.91	78	25-130			
13C12-OCDD	12000	37.43	69	25-130			
13C12-2,3,7,8-TCDF	6000	27.47	105	40-130			
13C12-1,2,3,7,8-PeCDF	6000	31.34	105	40-130			
13C12-1,2,3,6,7,8-HxCDF	6000	33.83	89	40-130			
13C12-1,2,3,4,6,7,8-HpCDF	6000	35.35	92	25-130			
Cleanup Standard	**pg**						
13C12-1,2,3,7,8,9-HxCDF	6000	34.58	86	40-130			

Homologue Group Totals	**# peaks**	**Conc. pg**	**EDL pg**	
Total-TCDD	17	47100	3.5	30
Total-PeCDD	10	52700	4.4	150
Total-HxCDD	7	30400	4.5	150
Total-HpCDD	2	15600	11	150
Total-TCDF	23	494000	7.5	30
Total-PeCDF	19	312000	11	150
Total-HxCDF	13	112000	12	150
Total-HpCDF	4	27100	8.5	150

Toxic Equivalency - (WHO 2005)	**pg**
Lower Bound PCDD/F TEQ (WHO 2005)	24000
Mid Point PCDD/F TEQ (WHO 2005)	24000
Upper Bound PCDD/F TEQ (WHO 2005)	24000

EDL Indicates the Estimated Detection Limit, based on the measured background noise for this target in this sample.
TEF Indicates the Toxic Equivalency Factor TEQ Indicates the Toxic Equivalency

LQL Lower Quantification Limit, based on the lowest calibration level corrected for sample size, splits and dilutions.
EMPC Estimated Maximum Possible Concentration – elevated detection limit due to interference or positive id criterion failure

ALS Life Sciences

Sample Analysis Report

Sample Name	**ECO WASTE - INCINERATOR - M23 - ACETONE/HEXANE BLANK**	Sampling Date	28-Oct-21		
ALS Sample ID	L2659099-12	Extraction Date	16-Nov-21		Approved:
Analysis Method	EPA M23	Sample Size	1	sample	*K.BERG*
Analysis Type	Sample	Percent Moisture	n/a		--e-signature--
Sample Matrix	Stack	Split Ratio	3		15-Dec-2021

Run Information	**Run 1**
Filename	7-211212A21
Run Date	12-Dec-21 18:38
Final Volume	20 uL
Dilution Factor	1
Analysis Units	pg
Instrument - Column	HRMS 7 DB5MSUS1382023H

Target Analytes	**TEF (WHO 2005)**	**Ret. Time**	**Conc. pg**	**EDL pg**	**Flags**	**EMPC pg**	**LQL**
2,3,7,8-TCDD	1	NotFnd	<1.8	1.8	U		30
1,2,3,7,8-PeCDD	1	32.24	2.20	1.9	M,J		150
1,2,3,4,7,8-HxCDD	0.1	34.26	3.07	2.6	J		150
1,2,3,6,7,8-HxCDD	0.1	34.31	<3.9	2.6	J,R	3.9	150
1,2,3,7,8,9-HxCDD	0.1	34.44	<2.6	2.6	U	2.5	150
1,2,3,4,6,7,8-HpCDD	0.01	35.91	37.6	1.4	J		150
OCDD	0.0003	37.44	<51	1.6	M,J,R	51	300
2,3,7,8-TCDF	0.1	NotFnd	<2.3	2.3	U		30
1,2,3,7,8-PeCDF	0.03	31.33	<2.9	1.8	M,J,R	2.9	150
2,3,4,7,8-PeCDF	0.3	31.98	16.8	1.8	J		150
1,2,3,4,7,8-HxCDF	0.1	33.77	<13	2.0	J,R	13	150
1,2,3,6,7,8-HxCDF	0.1	33.84	<12	2.0	J,R	12	150
2,3,4,6,7,8-HxCDF	0.1	34.17	<26	2.1	J,R	26	150
1,2,3,7,8,9-HxCDF	0.1	34.60	<6.4	2.7	J,R	6.4	150
1,2,3,4,6,7,8-HpCDF	0.01	35.36	70.6	0.68	J		150
1,2,3,4,7,8,9-HpCDF	0.01	36.19	<6.8	0.91	J,R	6.8	150
OCDF	0.0003	37.53	14.4	1.4	J		300
Field Spike Standards	**pg**		**% Rec**	**Limits**			
37Cl4-2,3,7,8-TCDD	0		NS				
13C12-1,2,3,4,7,8-HxCDD	0		NS				
13C12-2,3,4,7,8-PeCDF	0		NS				
13C12-1,2,3,4,7,8-HxCDF	0		NS				
13C12-1,2,3,4,7,8,9-HpCDF	0		NS				
Extraction Standards							
13C12-2,3,7,8-TCDD	6000	28.37	78	40-130			
13C12-1,2,3,7,8-PeCDD	6000	32.24	81	40-130			
13C12-1,2,3,6,7,8-HxCDD	6000	34.30	75	40-130			
13C12-1,2,3,4,6,7,8-HpCDD	6000	35.91	82	25-130			
13C12-OCDD	12000	37.43	71	25-130			
13C12-2,3,7,8-TCDF	6000	27.47	88	40-130			
13C12-1,2,3,7,8-PeCDF	6000	31.33	84	40-130			
13C12-1,2,3,6,7,8-HxCDF	6000	33.83	81	40-130			
13C12-1,2,3,4,6,7,8-HpCDF	6000	35.35	91	25-130			
Cleanup Standard	**pg**						
13C12-1,2,3,7,8,9-HxCDF	6000	34.58	96	40-130			

Homologue Group Totals	**# peaks**	**Conc. pg**	**EDL pg**		**LQL**
Total-TCDD	0	<1.8	1.8	U	30
Total-PeCDD	1	2.20	1.9		150
Total-HxCDD	2	21.8	2.6		150
Total-HpCDD	2	72.0	1.4		150
Total-TCDF	1	9.31	2.3		30
Total-PeCDF	7	60.3	1.8		150
Total-HxCDF	1	28.7	2.7		150
Total-HpCDF	2	80.1	0.91		150

Toxic Equivalency - (WHO 2005)	**pg**
Lower Bound PCDD/F TEQ (WHO 2005)	8.63
Mid Point PCDD/F TEQ (WHO 2005)	16.1
Upper Bound PCDD/F TEQ (WHO 2005)	17.2

EDL	Indicates the Estimated Detection Limit, based on the measured background noise for this target in this sample.
TEF	Indicates the Toxic Equivalency Factor
TEQ	Indicates the Toxic Equivalency
M	Indicates that a peak has been manually integrated.
U	Indicates that this compound was not detected above the EDL.
J	Indicates that a target analyte was detected below the calibrated range.
R	Indicates that the ion abundance ratio for this compound did not meet the acceptance criterion.
LQL	Lower Quantification Limit, based on the lowest calibration level corrected for sample size, splits and dilutions.
EMPC	Estimated Maximum Possible Concentration – elevated detection limit due to interference or positive id criterion failure

ALS Life Sciences

Laboratory Method Blank Analysis Report

Sample Name	**Method Blank**	Sampling Date	n/a		
ALS Sample ID	WG3652547-1	Extraction Date	16-Nov-21		Approved:
Analysis Method	EPA M23	Sample Size	1	sample	*K.BERG*
Analysis Type	Blank	Percent Moisture	n/a		--e-signature--
Sample Matrix	QC	Split Ratio	3		15-Dec-2021

Run Information	**Run 1**
Filename	7-211212A16
Run Date	12-Dec-21 15:00
Final Volume	20 uL
Dilution Factor	1
Analysis Units	pg
Instrument - Column	HRMS 7 DB5MSUS1382023H

Target Analytes	**TEF (WHO 2005)**	**Ret. Time**	**Conc. pg**	**EDL pg**	**Flags**	**EMPC pg**	**LQL**
2,3,7,8-TCDD	1	NotFnd	<0.76	0.76	U		30
1,2,3,7,8-PeCDD	1	NotFnd	<0.68	0.68	U		150
1,2,3,4,7,8-HxCDD	0.1	NotFnd	<1.2	1.2	U		150
1,2,3,6,7,8-HxCDD	0.1	NotFnd	<1.2	1.2	U		150
1,2,3,7,8,9-HxCDD	0.1	NotFnd	<1.2	1.2	U		150
1,2,3,4,6,7,8-HpCDD	0.01	35.93	<1.9	1.8	M,J,R	1.9	150
OCDD	0.0003	37.45	<24	0.88	J,R	24	300
2,3,7,8-TCDF	0.1	NotFnd	<0.48	0.48	U		30
1,2,3,7,8-PeCDF	0.03	NotFnd	<0.48	0.48	U		150
2,3,4,7,8-PeCDF	0.3	NotFnd	<0.46	0.46	U		150
1,2,3,4,7,8-HxCDF	0.1	33.79	<0.40	0.40	M,U		150
1,2,3,6,7,8-HxCDF	0.1	33.85	<0.64	0.38	J,R	0.64	150
2,3,4,6,7,8-HxCDF	0.1	NotFnd	<0.41	0.41	U		150
1,2,3,7,8,9-HxCDF	0.1	34.61	<1.2	0.52	J,R	1.2	150
1,2,3,4,6,7,8-HpCDF	0.01	35.37	<0.86	0.52	M,J,R	0.86	150
1,2,3,4,7,8,9-HpCDF	0.01	NotFnd	<0.69	0.69	U		150
OCDF	0.0003	37.56	<5.5	1.2	J,R	5.5	300

Field Spike Standards	**pg**		**% Rec**	**Limits**	
37Cl4-2,3,7,8-TCDD	600	NotFnd	0	70-130	
13C12-1,2,3,4,7,8-HxCDD	6000	NotFnd	0	70-130	
13C12-2,3,4,7,8-PeCDF	6000	32.06	0	70-130	R
13C12-1,2,3,4,7,8-HxCDF	6000	NotFnd	0	70-130	
13C12-1,2,3,4,7,8,9-HpCDF	6000	36.19	0	70-130	
Extraction Standards					
13C12-2,3,7,8-TCDD	6000	28.38	71	40-130	
13C12-1,2,3,7,8-PeCDD	6000	32.25	68	40-130	
13C12-1,2,3,6,7,8-HxCDD	6000	34.31	72	40-130	
13C12-1,2,3,4,6,7,8-HpCDD	6000	35.93	70	25-130	
13C12-OCDD	12000	37.44	62	25-130	
13C12-2,3,7,8-TCDF	6000	27.48	78	40-130	
13C12-1,2,3,7,8-PeCDF	6000	31.35	72	40-130	
13C12-1,2,3,6,7,8-HxCDF	6000	33.84	76	40-130	
13C12-1,2,3,4,6,7,8-HpCDF	6000	35.36	81	25-130	
Cleanup Standard	**pg**				
13C12-1,2,3,7,8,9-HxCDF	6000	34.59	78	40-130	

Homologue Group Totals	**# peaks**	**Conc. pg**	**EDL pg**		
Total-TCDD	0	<0.76	0.76	U	30
Total-PeCDD	0	<0.68	0.68	U	150
Total-HxCDD	0	<1.2	1.2	U	150
Total-HpCDD	0	<1.8	1.8	U	150
Total-TCDF	0	<0.48	0.48	U	30
Total-PeCDF	0	<0.48	0.48	U	150
Total-HxCDF	0	<0.52	0.52	U	150
Total-HpCDF	0	<0.69	0.69	U	150

Toxic Equivalency - (WHO 2005)	**pg**
Lower Bound PCDD/F TEQ (WHO 2005)	0.00
Mid Point PCDD/F TEQ (WHO 2005)	1.26
Upper Bound PCDD/F TEQ (WHO 2005)	2.31

EDL	Indicates the Estimated Detection Limit, based on the measured background noise for this target in this sample.
TEF	Indicates the Toxic Equivalency Factor TEQ Indicates the Toxic Equivalency
M	Indicates that a peak has been manually integrated.
U	Indicates that this compound was not detected above the EDL.
J	Indicates that a target analyte was detected below the calibrated range.
R	Indicates that the ion abundance ratio for this compound did not meet the acceptance criterion.
LQL	Lower Quantification Limit, based on the lowest calibration level corrected for sample size, splits and dilutions.
EMPC	Estimated Maximum Possible Concentration – elevated detection limit due to interference or positive id criterion failure

ALS Life Sciences

Laboratory Method Blank Analysis Report

Sample Name	**Method Blank**	Sampling Date	n/a		
ALS Sample ID	WG3652547-4	Extraction Date	16-Nov-21		Approved:
Analysis Method	EPA M23	Sample Size	1	sample	*K.BERG*
Analysis Type	Blank	Percent Moisture	n/a		--e-signature--
Sample Matrix	QC	Split Ratio	3		15-Dec-2021

Run Information	**Run 1**
Filename	7-211212A17
Run Date	12-Dec-21 15:44
Final Volume	20 uL
Dilution Factor	1
Analysis Units	pg
Instrument - Column	HRMS 7 DB5MSUS1382023H

Target Analytes	**TEF (WHO 2005)**	**Ret. Time**	**Conc. pg**	**EDL pg**	**Flags**	**EMPC pg**	**LQL**
2,3,7,8-TCDD	1	NotFnd	<0.98	0.98	U		30
1,2,3,7,8-PeCDD	1	NotFnd	<0.55	0.55	U		150
1,2,3,4,7,8-HxCDD	0.1	NotFnd	<0.85	0.85	U		150
1,2,3,6,7,8-HxCDD	0.1	NotFnd	<0.87	0.87	U		150
1,2,3,7,8,9-HxCDD	0.1	NotFnd	<0.87	0.87	U		150
1,2,3,4,6,7,8-HpCDD	0.01	35.95	<1.8	1.8	M,U	1.2	150
OCDD	0.0003	37.46	20.9	1.7	J		300
2,3,7,8-TCDF	0.1	NotFnd	<0.74	0.74	U		30
1,2,3,7,8-PeCDF	0.03	NotFnd	<0.49	0.49	U		150
2,3,4,7,8-PeCDF	0.3	NotFnd	<0.48	0.48	U		150
1,2,3,4,7,8-HxCDF	0.1	NotFnd	<0.81	0.81	U		150
1,2,3,6,7,8-HxCDF	0.1	NotFnd	<0.78	0.78	U		150
2,3,4,6,7,8-HxCDF	0.1	NotFnd	<0.84	0.84	U		150
1,2,3,7,8,9-HxCDF	0.1	34.61	<1.6	1.1	M,J,R	1.6	150
1,2,3,4,6,7,8-HpCDF	0.01	35.37	<0.57	0.51	M,J,R	0.57	150
1,2,3,4,7,8,9-HpCDF	0.01	NotFnd	<0.67	0.67	U		150
OCDF	0.0003	37.55	<1.9	1.3	M,J,R	1.9	300

Field Spike Standards	**pg**		**% Rec**	**Limits**	
37Cl4-2,3,7,8-TCDD	600	NotFnd	0	70-130	
13C12-1,2,3,4,7,8-HxCDD	6000	NotFnd	0	70-130	
13C12-2,3,4,7,8-PeCDF	6000	32.05	0	70-130	R
13C12-1,2,3,4,7,8-HxCDF	6000	NotFnd	0	70-130	
13C12-1,2,3,4,7,8,9-HpCDF	6000	36.20	0	70-130	
Extraction Standards					
13C12-2,3,7,8-TCDD	6000	28.38	63	40-130	
13C12-1,2,3,7,8-PeCDD	6000	32.25	65	40-130	
13C12-1,2,3,6,7,8-HxCDD	6000	34.31	62	40-130	
13C12-1,2,3,4,6,7,8-HpCDD	6000	35.93	66	25-130	
13C12-OCDD	12000	37.44	54	25-130	
13C12-2,3,7,8-TCDF	6000	27.48	72	40-130	
13C12-1,2,3,7,8-PeCDF	6000	31.35	70	40-130	
13C12-1,2,3,6,7,8-HxCDF	6000	33.84	68	40-130	
13C12-1,2,3,4,6,7,8-HpCDF	6000	35.37	76	25-130	
Cleanup Standard	**pg**				
13C12-1,2,3,7,8,9-HxCDF	6000	34.59	89	40-130	

Homologue Group Totals	**# peaks**	**Conc. pg**	**EDL pg**		
Total-TCDD	0	<0.98	0.98	U	30
Total-PeCDD	0	<0.55	0.55	U	150
Total-HxCDD	0	<0.87	0.87	U	150
Total-HpCDD	0	<1.8	1.8	U	150
Total-TCDF	0	<0.74	0.74	U	30
Total-PeCDF	0	<0.49	0.49	U	150
Total-HxCDF	0	<1.1	1.1	U	150
Total-HpCDF	0	<0.67	0.67	U	150

Toxic Equivalency - (WHO 2005)	**pg**
Lower Bound PCDD/F TEQ (WHO 2005)	0.00627
Mid Point PCDD/F TEQ (WHO 2005)	1.32
Upper Bound PCDD/F TEQ (WHO 2005)	2.46

EDL	Indicates the Estimated Detection Limit, based on the measured background noise for this target in this sample.
TEF	Indicates the Toxic Equivalency Factor TEQ Indicates the Toxic Equivalency
M	Indicates that a peak has been manually integrated.
U	Indicates that this compound was not detected above the EDL.
J	Indicates that a target analyte was detected below the calibrated range.
R	Indicates that the ion abundance ratio for this compound did not meet the acceptance criterion.
LQL	Lower Quantification Limit, based on the lowest calibration level corrected for sample size, splits and dilutions.
EMPC	Estimated Maximum Possible Concentration – elevated detection limit due to interference or positive id criterion failure

ALS Life Sciences

Laboratory Control Sample Analysis Report

Sample Name	**Laboratory Control Sample**	Sampling Date	n/a		
ALS Sample ID	WG3652547-2	Extraction Date	16-Nov-21		Approved:
Analysis Method	EPA M23	Sample Size	1	n/a	*K.BERG*
Analysis Type	LCS	Percent Moisture	n/a		--e-signature--
Sample Matrix	QC	Split Ratio	3		15-Dec-2021

Run Information	**Run 1**
Filename	7-211212A13
Run Date	12-Dec-21 12:53
Final Volume	20 uL
Dilution Factor	1
Analysis Units	n/a
Instrument - Column	HRMS 7 DB5MSUS1382023H

Target Analytes	**pg**	**Ret. Time**	**% Rec**	**Limits**	**Flags**
2,3,7,8-TCDD	600	28.40	88	70-130	
1,2,3,7,8-PeCDD	3000	32.25	105	70-130	
1,2,3,4,7,8-HxCDD	3000	34.25	83	70-130	
1,2,3,6,7,8-HxCDD	3000	34.30	100	70-130	
1,2,3,7,8,9-HxCDD	3000	34.43	108	70-130	
1,2,3,4,6,7,8-HpCDD	3000	35.93	90	70-130	
OCDD	6000	37.43	89	70-130	
2,3,7,8-TCDF	600	27.48	93	70-130	
1,2,3,7,8-PeCDF	3000	31.34	101	70-130	
2,3,4,7,8-PeCDF	3000	32.05	97	70-130	
1,2,3,4,7,8-HxCDF	3000	33.77	84	70-130	
1,2,3,6,7,8-HxCDF	3000	33.84	105	70-130	
2,3,4,6,7,8-HxCDF	3000	34.16	92	70-130	
1,2,3,7,8,9-HxCDF	3000	34.59	110	70-130	
1,2,3,4,6,7,8-HpCDF	3000	35.36	98	70-130	
1,2,3,4,7,8,9-HpCDF	3000	36.18	97	70-130	
OCDF	6000	37.53	98	70-130	
Field Spike Standards	**pg**		**% Rec**	**Limits**	
37Cl4-2,3,7,8-TCDD	600	28.38	0	0	
13C12-1,2,3,4,7,8-HxCDD	6000	NotFnd	0	0	
13C12-2,3,4,7,8-PeCDF	6000	32.04	0	0	R
13C12-1,2,3,4,7,8-HxCDF	6000	NotFnd	0	0	
13C12-1,2,3,4,7,8,9-HpCDF	6000	36.18	1	0	
Extraction Standards					
13C12-2,3,7,8-TCDD	6000	28.37	80	40-130	
13C12-1,2,3,7,8-PeCDD	6000	32.24	99	40-130	
13C12-1,2,3,6,7,8-HxCDD	6000	34.30	79	40-130	
13C12-1,2,3,4,6,7,8-HpCDD	6000	35.91	85	25-130	
13C12-OCDD	12000	37.42	79	25-130	
13C12-2,3,7,8-TCDF	6000	27.47	81	40-130	
13C12-1,2,3,7,8-PeCDF	6000	31.33	91	40-130	
13C12-1,2,3,6,7,8-HxCDF	6000	33.83	74	40-130	
13C12-1,2,3,4,6,7,8-HpCDF	6000	35.35	86	25-130	
Cleanup Standard	**pg**				
13C12-1,2,3,7,8,9-HxCDF	6000	34.58	73	40-130	

R Indicates that the ion abundance ratio for this compound did not meet the acceptance criterion.

1435 Norjohn Court, Unit 1, Burlington ON, L7L 0E6
Phone: 905-331-3111, FAX: 905-331-4567

Certificate of Analysis

ALS Project Contact:	Claire Kocharakkal	**Client Name:**	RWDI AIR INC. (Guelph)
ALS Project ID:	23601	**Client Address:**	2239 Star Court
ALS WO#:	L2659099		Rochester Hills, MI 48309
Date of Report	6-Dec-21		United States
Date of Sample Receipt	3-Nov-21	**Client Contact:**	Alec Smith
		Client Project ID:	2200515.01

COMMENTS:

Metals analysed via ICP-MS Method USEPA 6020B (SA 22-Nov-21)

Sample Preparation via USEPA Method 29 (TPH 19-Nov-21)

ANALYST COMMENTS:

Ni observed in the method blank (MB) at a level significantly above its LOR. Data for this analyte may be biased high as a result of this contribution.

Recovery for Sb in the MS and MSD cannot be quantified due to high levels of the target analyte in the sample, relative to the spiked amount. This is not expected to indicate any compromise to data quality. **PE 25-Nov-21**

LCB = Laboratory Control Blank
LCS = Laboratory Control Sample
LCSD = Laboratory Control Sample Duplicate
LOR = Limit of Reporting

Certified by: Breanne Dusureault

Breanne Dusureault
Project Manager

Results in this certificate relate only to the samples as submitted to the laboratory.

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ALS Environmental

Sample Analysis Summary Report

Sample Name		ECO WASTE - INCINERATOR - M5/29 - T1 (1 THRU 5C)	ECO WASTE - INCINERATOR - M5/29 - T2 (1 THRU 5C)	ECO WASTE - INCINERATOR - M5/29 - T3 (1 THRU 5C)	ECO WASTE - INCINERATOR - M5/29 - ACETONE BLANK	MB
ALS Sample ID		L2659099-1	L2659099-2	L2659099-3	L2659099-4	L2659099-MB
Matrix		Stack	Stack	Stack	Stack	n/a
Analysis Type		Sample	Sample	Sample	Sample	Sample
Sampling Date		26-Oct-21	27-Oct-21	28-Oct-21	28-Oct-21	n/a
Date of Receipt		3-Nov-21	3-Nov-21	3-Nov-21	3-Nov-21	n/a
Multi-Metals via ICP-MS	**LOR**					
	ug	**ug**	**ug**	**ug**	**ug**	**ug**
Combined Analysis Fraction 1A + 2A						
Antimony	0.2	85.2	103	143	<	<
Arsenic	1	<	<	<	<	<
Barium	5	12.5	12.4	10.7	<	<
Beryllium	0.2	<	<	<	<	<
Cadmium	0.1	1.49	2.37	1.95	<	<
Chromium	1	6.13	7.28	7.84	<	1.53
Cobalt	0.2	0.393	0.538	0.602	<	<
Copper	1	48.6	71.1	69.0	<	<
Lead	0.5	49.8	76.1	49.5	<	<
Manganese	0.5	36.9	37.0	29.8	<	<
Nickel	0.2	5.48	6.80	5.41	<	3.11
Phosphorus	100	<	112	<	<	<
Selenium	2	<	2.49	2.90	<	<
Silver	0.2	8.02	11.3	7.79	<	<
Thallium	0.2	0.321	0.388	0.311	<	<
Zinc	6	1090	1420	1140	<	<

ALS Environmental

Sample QC Summary Report

Sample Name		RB	LCS	LCS	LCSD	LCSD
ALS Sample ID		RB	LCS	LCS	LCSD	LCSD
Matrix		STACK	STACK	STACK	STACK	STACK
Analysis Type		Blank	LCS	LCS	LCS	LCS
Sampling Date		n/a	n/a	n/a	n/a	n/a
Date of Receipt		n/a	n/a	n/a	n/a	n/a
Multi-Metals via ICP-MS	**LOR**					
	ug	**ug**	**ug**	**% Rec**	**ug**	**% Rec**
Combined Analysis Fraction 1A + 2A						
Antimony	0.2	<	11.7	98	11.9	99
Arsenic	1	<	61.3	102	60.4	101
Barium	5	<	59.8	100	59.8	100
Beryllium	0.2	<	60.7	101	61.1	102
Cadmium	0.1	<	30.6	102	31.6	105
Chromium	1	<	62.2	104	63.3	105
Cobalt	0.2	<	63.5	106	63.6	106
Copper	1	<	55.6	93	55.3	93
Lead	0.5	<	62.1	104	64.5	108
Manganese	0.5	<	63.6	106	63.8	106
Nickel	0.2	<	63.1	105	62.5	104
Phosphorus	100	<	1500	101	1530	104
Selenium	2	<	62.3	104	64.7	108
Silver	0.2	<	29.8	99	31.0	103
Thallium	0.2	<	62.5	104	66.9	112
Zinc	6	<	125	104	122	101

ALS Environmental

Sample QC Summary Report

Sample Name		ECO WASTE · INCINERATOR - M5/29 - T1 (1 THRU 5C)	ECO WASTE · INCINERATOR - M5/29 - T1 (1 THRU 5C)	ECO WASTE · INCINERATOR - M5/29 - T1 (1 THRU 5C)	ECO WASTE · INCINERATOR - M5/29 - T1 (1 THRU 5C)	ECO WASTE · INCINERATOR - M5/29 - T1 (1 THRU 5C)	ECO WASTE · INCINERATOR - M5/29 - T1 (1 THRU 5C)
ALS Sample ID		L2659099-1	L2659099-1	MS	MS	MSD	MSD
Matrix		Stack	Stack	Stack	Stack	Stack	Stack
Analysis Type		Sample	Duplicate	Matrix Spike	Matrix Spike	Matrix Spike Dup	Matrix Spike Dup
Sampling Date		26-Oct-21	26-Oct-21	26-Oct-21	26-Oct-21	26-Oct-21	26-Oct-21
Date of Receipt		3-Nov-21	3-Nov-21	3-Nov-21	3-Nov-21	3-Nov-21	3-Nov-21
Multi-Metals via ICP-MS	**LOR**	**ug**	**ug**	**ug**	**% Rec**	**ug**	**% Rec**
Combined Analysis Fraction 1A + 2A							
Antimony	0.2	85.2	76.8	104	nq	101	nq
Arsenic	1	<	<	116	97	113	94
Barium	5	12.5	12.6	124	93	118	88
Beryllium	0.2	<	<	120	100	117	98
Cadmium	0.1	1.49	1.49	60.5	98	60.2	98
Chromium	1	6.13	6.34	124	98	122	96
Cobalt	0.2	0.393	0.410	119	99	119	99
Copper	1	48.6	48.8	154	88	152	86
Lead	0.5	49.8	45.1	174	103	169	99
Manganese	0.5	36.9	38.0	156	99	155	99
Nickel	0.2	5.48	5.57	123	98	124	98
Phosphorus	100	<	<	3000	97	2960	96
Selenium	2	<	<	118	97	118	97
Silver	0.2	8.02	7.27	66.7	98	66.2	97
Thallium	0.2	0.321	0.288	126	105	126	104
Zinc	6	1090	1100	1330	nq	1300	nq

Chain of Custody (COC) / Analytical Request Form

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Canada Toll Free: 1 800 668 9878

L2659099-COFC

C Number:

Report To	Contact and company name below will appear on the final report
Company:	RWDI
Contact:	Alec Smith
Phone:	248-891-1751
	Company address below will appear on the final report
Street:	2239 Star Court
City/Province:	Rochester Hills, Michigan
Postal Code:	48309
Invoice To	Same as Report To ☑ YES ☐ NO
	Copy of Invoice with Report ☐ YES ☐ NO
Company:	
Contact:	

Report Format / Distribution	
Select Report Format:	☑ PDF ☑ EXCEL ☐ EDD (DIGITAL)
Quality Control (QC) Report with Report	☑ YES ☐ NO
☐ Compare Results to Criteria on Report - provide details below if box checked	
Select Distribution:	☑ EMAIL ☐ MAIL ☐ FAX
Email 1 or Fax	alec.smith@rwdi.com
Email 2	juan.vargas@rwdi.com
Email 3	brad.bergeron@rwdi.com
Invoice Distribution	
Select Invoice Distribution:	☐ EMAIL ☐ MAIL ☐ FAX
Email 1 or Fax	
Email 2	

Select Service Level Below - Contact your AM to confirm all E&P TATs (surcharges may apply)	
Regular [R]	☑ Standard TAT if received by 3 pm - business days - no surcharges apply
PRIORITY (Business Days) 4 day [P4-20%]	☐
3 day [P3-25%]	☐
2 day [P2-50%]	☐
EMERGENCY 1 Business day [E - 100%]	☐
Same Day, Weekend or Statutory holiday [E2 -200% (Laboratory opening fees may apply)]	☐
Date and Time Required for all E&P TATs:	dd-mmm-yy hh:mm
For tests that can not be performed according to the service level selected, you will be contacted.	

Project Information		Oil and Gas Required Fields (client use)	
ALS Account # / Quote #:		AFE/Cost Center:	PO#
Job #:	2200515.01	Major/Minor Code:	Routing Code:
PO / AFE:		Requisitioner:	
LSD:		Location:	
ALS Lab Work Order # (lab use only):		ALS Contact:	Sampler:

ALS Sample # (lab use only)	Sample Identification and/or Coordinates (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	NUMBER OF CONTAINERS	USEPA Method 29	USEPA Method 5	Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below	SAMPLES ON HOLD	SUSPECTED HAZARD (see Special Instructions)
	Eco Waste - Incinerator - M5/29 - Filter - T1 - Cont. 1	10/26/2021	12:00	Filter	1	R	R			
	Eco Waste - Incinerator - M5/29 - Acetone - T1 - Cont. 2	10/26/2021	12:00	Acetone	1	R	R			
1	Eco Waste - Incinerator - M29 - HNO3 - T1 - Cont. 3	10/26/2021	12:00	HNO3	1	R	R			
	Eco Waste - Incinerator - M29 - HNO3/H2O2 - T1 - Cont. 4	10/26/2021	12:00	HNO3/H2O2	1	R				
	Eco Waste - Incinerator - M29 - HNO3 - T1 - Cont. 5A	10/26/2021	12:00	HNO3	1	R				
	Eco Waste - Incinerator - M29 - KMnO4/H2SO4 - T1 - Cont. 5B	10/26/2021	12:00	KMnO4/H2SO4	1	R				
	Eco Waste - Incinerator - M29 - HCl - T1 - Cont. 5C	10/26/2021	12:00	HCl	1	R				

Drinking Water (DW) Samples[1] (client use)	Special Instructions / Specify Criteria to add on report by clicking on the drop-down list below (electronic COC only)
Are samples taken from a Regulated DW System? ☐ YES ☐ NO	
Are samples for human consumption/ use? ☐ YES ☐ NO	

SAMPLE CONDITION AS RECEIVED (lab use only)					
Frozen	☐	SIF Observations	Yes ☐	No	☒
Ice Packs ☐ Ice Cubes ☐		Custody seal intact	Yes ☒	No	☐
Cooling Initiated	☐				
INITIAL COOLER TEMPERATURES °C		FINAL COOLER TEMPERATURES °C			
16.9°C					

SHIPMENT RELEASE (client use)			INITIAL SHIPMENT RECEPTION (lab use only)			FINAL SHIPMENT RECEPTION (lab use only)		
Released by: Bryan Dueler	Date: 11-3-21	Time: 11:50	Received by: TARA BURTON	0.708333333 3-NOV-2021	Time: 15:50	Received by:	Date:	Time:

REFER TO BACK PAGE FOR ALS LOCATIONS AND SAMPLING INFORMATION

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1. If any water samples are taken from a Regulated Drinking Water (DW) System, please submit using an Authorized DW COC form.

Chain of Custody (COC) / Analytical Request Form

www.alsglobal.com

Canada Toll Free: 1 800 668 9878

L2659099-COFC

Number: 17 -

Report To	Contact and company name below will appear on the final report	Report Format / Distribution		Select Service Level Below - Contact your AM to confirm all E&P TATs (surcharges may apply)
Company:	RWDI	Select Report Format: ☑ PDF ☑ EXCEL ☐ EDD (DIGITAL)		Regular [R] ☑ Standard TAT if received by 3 pm - business days - no surcharges apply
Contact:	Alec Smith	Quality Control (QC) Report with Report ☑ YES ☐ NO		PRIORITY (Business Days): 4 day [P4-20%] ☐ / 3 day [P3-25%] ☐ / 2 day [P2-50%] ☐ — EMERGENCY: 1 Business day [E - 100%] ☐ / Same Day, Weekend or Statutory holiday [E2 -200% (Laboratory opening fees may apply)] ☐
Phone:	248-891-1751	☐ Compare Results to Criteria on Report - provide details below if box checked		
	Company address below will appear on the final report	Select Distribution: ☑ EMAIL ☐ MAIL ☐ FAX		Date and Time Required for all E&P TATs: dd-mmm-yy hh:mm
Street:	2239 Star Court	Email 1 or Fax	alec.smith@rwdi.com	For tests that can not be performed according to the service level selected, you will be contacted.
City/Province:	Rochester Hills, Michigan	Email 2	juan.vargas@rwdi.com	
Postal Code:	48309	Email 3	brad.bergeron@rwdi.com	
Invoice To	Same as Report To ☑ YES ☐ NO	Invoice Distribution		
	Copy of Invoice with Report ☐ YES ☐ NO	Select Invoice Distribution: ☐ EMAIL ☐ MAIL ☐ FAX		
Company:		Email 1 or Fax		
Contact:		Email 2		

Project Information		Oil and Gas Required Fields (client use)	
ALS Account # / Quote #:		AFE/Cost Center:	PO#
Job #:	2200515.01	Major/Minor Code:	Routing Code:
PO / AFE:		Requisitioner:	
LSD:		Location:	
ALS Lab Work Order # (lab use only):		ALS Contact:	Sampler:

ALS Sample # (lab use only)	Sample Identification and/or Coordinates (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	NUMBER OF CONTAINERS: USEPA Method 29	USEPA Method 5	Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below	SAMPLES ON HOLD	SUSPECTED HAZARD (see Special Instructions)
	Eco Waste - Incinerator - M5/29 - Filter - T2 - Cont. 1	10/27/2021	12:00	Filter	1	R	R		
	Eco Waste - Incinerator - M5/29 - Acetone - T2 - Cont. 2	10/27/2021	12:00	Acetone	1	R	R		
	Eco Waste - Incinerator - M29 - HNO3 - T2 - Cont. 3	10/27/2021	12:00	HNO3	1	R	R		
2	Eco Waste - Incinerator - M29 - HNO3/H2O2 - T2 - Cont. 4	10/27/2021	12:00	HNO3/H2O2	1	R			
	Eco Waste - Incinerator - M29 - HNO3 - T2 - Cont. 5A	10/27/2021	12:00	HNO3	1	R			
	Eco Waste - Incinerator - M29 - KMnO4/H2SO4 - T2 - Cont. 5B	10/27/2021	12:00	KMnO4/H2SO4	1	R			
	Eco Waste - Incinerator - M29 - HCl - T2 - Cont. 5C	10/27/2021	12:00	HCl	1	R			

Drinking Water (DW) Samples[1] (client use)	Special Instructions / Specify Criteria to add on report by clicking on the drop-down list below (electronic COC only)
Are samples taken from a Regulated DW System? ☐ YES ☐ NO	
Are samples for human consumption/ use? ☐ YES ☐ NO	

SAMPLE CONDITION AS RECEIVED (lab use only)

Frozen ☐		SIF Observations	Yes ☐	No	☑
Ice Packs ☐	Ice Cubes ☐	Custody seal intact	Yes ☑	No	☐
Cooling Initiated ☐					

INITIAL COOLER TEMPERATURES °C				FINAL COOLER TEMPERATURES °C			
16.9°C							

SHIPMENT RELEASE (client use)			INITIAL SHIPMENT RECEPTION (lab use only)			FINAL SHIPMENT RECEPTION (lab use only)		
Released by:	Date:	Time:	Received by:	Date:	Time:	Received by:	Date:	Time:
Bryan Dunbar	11-3-21	11:50	ADAM BOLTON	3-NOV-2021	16:50			

REFER TO BACK PAGE FOR ALS LOCATIONS AND SAMPLING INFORMATION — WHITE - LABORATORY COPY — YELLOW - CLIENT COPY — NOV 2018 FRONT

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1. If any water samples are taken from a Regulated Drinking Water (DW) System, please submit using an Authorized DW COC form.

Chain of Custody (COC) / Analytical Request Form

L2659099-COFC

Number: 17 -

Page 3 of 5

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Canada Toll Free: 1 800 668 9878

Report To	Contact and company name below will appear on the final report
Company:	RWDI
Contact:	Alec Smith
Phone:	248-891-1751
	Company address below will appear on the final report
Street:	2239 Star Court
City/Province:	Rochester Hills, Michigan
Postal Code:	48309
Invoice To	Same as Report To ☑ YES ☐ NO
	Copy of Invoice with Report ☐ YES ☐ NO
Company:	
Contact:	

Report Format / Distribution	
Select Report Format:	☑ PDF ☑ EXCEL ☐ EDD (DIGITAL)
Quality Control (QC) Report with Report	☑ YES ☐ NO
☐ Compare Results to Criteria on Report - provide details below if box checked	
Select Distribution:	☑ EMAIL ☐ MAIL ☐ FAX
Email 1 or Fax	alec.smith@rwdi.com
Email 2	juan.vargas@rwdi.com
Email 3	brad.bergeron@rwdi.com

Invoice Distribution	
Select Invoice Distribution:	☐ EMAIL ☐ MAIL ☐ FAX
Email 1 or Fax	
Email 2	

Project Information	
ALS Account # / Quote #:	
Job #:	2200515.01
PO / AFE:	
LSD:	

Oil and Gas Required Fields (client use)	
AFE/Cost Center:	PO#
Major/Minor Code:	Routing Code:
Requisitioner:	
Location:	

ALS Lab Work Order # (lab use only): | **ALS Contact:** | **Sampler:**

Select Service Level Below - Contact your AM to confirm all E&P TATs (surcharges may apply)

Regular [R] ☑ Standard TAT if received by 3 pm - business days - no surcharges apply

PRIORITY (Business Days): 4 day [P4-20%] ☐ | 3 day [P3-25%] ☐ | 2 day [P2-50%] ☐

EMERGENCY: 1 Business day [E - 100%] ☐ | Same Day, Weekend or Statutory holiday [E2 -200% (Laboratory opening fees may apply)] ☐

Date and Time Required for all E&P TATs: dd-mmm-yy hh:mm

For tests that can not be performed according to the service level selected, you will be contacted.

Analysis Request

Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below

ALS Sample # (lab use only)	Sample Identification and/or Coordinates (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	NUMBER OF CONTAINERS	USEPA Method 29	USEPA Method 5	SAMPLES ON HOLD	SUSPECTED HAZARD (see Special Instructions)
	Eco Waste - Incinerator - M5/29 - Filter - T3 - Cont. 1	10/28/2021	12:00	Filter	1	R	R		
	Eco Waste - Incinerator - M5/29 - Acetone - T3 - Cont. 2	10/28/2021	12:00	Acetone	1	R	R		
	Eco Waste - Incinerator - M29 - HNO3 - T3 - Cont. 3	10/28/2021	12:00	HNO3	1	R	R		
3	Eco Waste - Incinerator - M29 - HNO3/H2O2 - T3 - Cont. 4	10/28/2021	12:00	HNO3/H2O2	1	R			
	Eco Waste - Incinerator - M29 - HNO3 - T3 - Cont. 5A	10/28/2021	12:00	HNO3	1	R			
	Eco Waste - Incinerator - M29 - KMnO4/H2SO4 - T3 - Cont. 5B	10/28/2021	12:00	KMnO4/H2SO4	1	R			
	Eco Waste - Incinerator - M29 - HCl - T3 - Cont. 5C	10/28/2021	12:00	HCl	1	R			
4	Eco Waste - Incinerator - M5/29 - Acetone Blank	10/28/21	12:00	Acetone	1	R	R		

Drinking Water (DW) Samples[1] (client use)

Are samples taken from a Regulated DW System?

☐ YES ☐ NO

Are samples for human consumption/ use?

☐ YES ☐ NO

Special Instructions / Specify Criteria to add on report by clicking on the drop-down list below (electronic COC only)

SAMPLE CONDITION AS RECEIVED (lab use only)

Frozen	☐	SIF Observations	Yes	☐	No	☑
Ice Packs	☐ Ice Cubes ☐	Custody seal intact	Yes	☑	No	☐
Cooling Initiated	☐					

INITIAL COOLER TEMPERATURES °C				FINAL COOLER TEMPERATURES °C			
16.9°C							

SHIPMENT RELEASE (client use)			INITIAL SHIPMENT RECEPTION (lab use only)			FINAL SHIPMENT RECEPTION (lab use only)		
Released by:	Date:	Time:	Received by:	0.708333333	Time:	Received by:	Date:	Time:
Benjamin Dueller	11-3-21	11:50	HARA BUTLER	3-NOV-2021	15.50			

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1. If any water samples are taken from a Regulated Drinking Water (DW) System, please submit using an Authorized DW COC form.

Chain of Custody (COC) / Analytical Request Form

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Canada Toll Free: 1 800 668 9878

L2659099-COFC

C Number: 17 -

Report To	Contact and company name below will appear on the final report
Company:	RWDI
Contact:	Alec Smith
Phone:	248-891-1751
	Company address below will appear on the final report
Street:	2239 Star Court
City/Province:	Rochester Hills, Michigan
Postal Code:	48309
Invoice To	Same as Report To ☑ YES ☐ NO
	Copy of Invoice with Report ☐ YES ☐ NO
Company:	
Contact:	

Report Format / Distribution	
Select Report Format:	☑ PDF ☑ EXCEL ☐ EDD (DIGITAL)
Quality Control (QC) Report with Report	☑ YES ☐ NO
☐ Compare Results to Criteria on Report - provide details below if box checked	
Select Distribution:	☑ EMAIL ☐ MAIL ☐ FAX
Email 1 or Fax	alec.smith@rwdi.com
Email 2	juan.vargas@rwdi.com
Email 3	brad.bergeron@rwdi.com
Invoice Distribution	
Select Invoice Distribution:	☐ EMAIL ☐ MAIL ☐ FAX
Email 1 or Fax	
Email 2	

Select Service Level Below - Contact your AM to confirm all E&P TATs (surcharges may apply)			
Regular [R]	☑ Standard TAT if received by 3 pm - business days - no surcharges apply		
PRIORITY (Business Days)	4 day [P4-20%] ☐	EMERGENCY	1 Business day [E - 100%] ☐
	3 day [P3-25%] ☐		Same Day, Weekend or Statutory holiday [E2 -200% (Laboratory opening fees may apply)] ☐
	2 day [P2-50%] ☐		
Date and Time Required for all E&P TATs:	dd-mmm-yy hh:mm		
For tests that can not be performed according to the service level selected, you will be contacted.			

Project Information		Oil and Gas Required Fields (client use)	
ALS Account # / Quote #:		AFE/Cost Center:	PO#
Job #:	2200515.01	Major/Minor Code:	Routing Code:
PO / AFE:		Requisitioner:	
LSD:		Location:	
ALS Lab Work Order # (lab use only):		ALS Contact:	Sampler:

ALS Sample # (lab use only)	Sample Identification and/or Coordinates (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	NUMBER OF CONTAINERS	USEPA Method 26	Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below	SAMPLES ON HOLD	SUSPECTED HAZARD (see Special Instructions)
5	Eco Waste - Incinerator - M26 - H2SO4 - T1 - Cont.1	10/26/21	12:00	H2SO4	1	R			
6	Eco Waste - Incinerator - M26 - H2SO4 - T2 - Cont.1	10/27/21	12:00	H2SO4	1	R			
7	Eco Waste - Incinerator - M26 - H2SO4 - T2 - Cont.1	10/28/21	12:00	H2SO4	1	R			
8	Eco Waste - Incinerator - M26 - H2SO4 Blank	10/28/21	12:00	H2SO4	1	R			

Drinking Water (DW) Samples[1] (client use)	Special Instructions / Specify Criteria to add on report by clicking on the drop-down list below (electronic COC only)
Are samples taken from a Regulated DW System? ☐ YES ☐ NO	
Are samples for human consumption/ use? ☐ YES ☐ NO	

SAMPLE CONDITION AS RECEIVED (lab use only)							
Frozen	☐	SIF Observations	Yes	☐	No	☑	
Ice Packs	☐ Ice Cubes ☐	Custody seal intact	Yes	☑	No	☐	
Cooling Initiated	☐						
INITIAL COOLER TEMPERATURES °C				FINAL COOLER TEMPERATURES °C			
16.9°C							

SHIPMENT RELEASE (client use)			INITIAL SHIPMENT RECEPTION (lab use only)			FINAL SHIPMENT RECEPTION (lab use only)		
Released by:	Date:	Time:	Received by:	0.708333333	Time:	Received by:	Date:	Time:
Benjamin Dunbar	11-3-21	11:50	Aaron Bunta	3-NOV-2021	15:50			

REFER TO BACK PAGE FOR ALS LOCATIONS AND SAMPLING INFORMATION

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Failure to complete all portions of this form may delay analysis. Please fill in this form LEGIBLY. By the use of this form the user acknowledges and agrees with the Terms and Conditions as specified on the back page of the white - report copy.

1. If any water samples are taken from a Regulated Drinking Water (DW) System, please submit using an Authorized DW COC form.

Chain of Custody (COC) / Analytical Request Form

www.alsglobal.com

Canada Toll Free: 1 800 668 9878

L2659099-COFC

COC Number: 17 -

Report To	Contact and company name below will appear on the final report
Company:	RWDI
Contact:	Alec Smith
Phone:	248-891-1751
	Company address below will appear on the final report
Street:	2239 Star Court
City/Province:	Rochester Hills, Michigan
Postal Code:	48309
Invoice To	Same as Report To ☑ YES ☐ NO
	Copy of Invoice with Report ☐ YES ☐ NO
Company:	
Contact:	

Report Format / Distribution	
Select Report Format:	☑ PDF ☑ EXCEL ☐ EDD (DIGITAL)
Quality Control (QC) Report with Report	☑ YES ☐ NO
☐ Compare Results to Criteria on Report - provide details below if box checked	
Select Distribution:	☑ EMAIL ☐ MAIL ☐ FAX
Email 1 or Fax	alec.smith@rwdi.com
Email 2	juan.vargas@rwdi.com
Email 3	brad.bergeron@rwdi.com

Invoice Distribution	
Select Invoice Distribution:	☐ EMAIL ☐ MAIL ☐ FAX
Email 1 or Fax	
Email 2	

Project Information		Oil and Gas Required Fields (client use)	
ALS Account # / Quote #:		AFE/Cost Center:	PO#
Job #:	2200515.01	Major/Minor Code:	Routing Code:
PO / AFE:		Requisitioner:	
LSD:		Location:	
ALS Lab Work Order # (lab use only):		ALS Contact:	Sampler:

Select Service Level Below - Contact your AM to confirm all E&P TATs (surcharges may apply)

Regular [R] ☑ Standard TAT if received by 3 pm - business days - no surcharges apply

PRIORITY (Business Days): 4 day [P4-20%] ☐ | 3 day [P3-25%] ☐ | 2 day [P2-50%] ☐

EMERGENCY: 1 Business day [E - 100%] ☐ | Same Day, Weekend or Statutory holiday [E2 -200% (Laboratory opening fees may apply)] ☐

Date and Time Required for all E&P TATs: dd-mmm-yy hh:mm

For tests that can not be performed according to the service level selected, you will be contacted.

Analysis Request

Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below

ALS Sample # (lab use only)	Sample Identification and/or Coordinates (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	NUMBER OF CONTAINERS	SW-846 Method 23	SW-846 Method 10	SAMPLES ON HOLD	SUSPECTED HAZARD (see Special Instructions)
9	Eco Waste - Incinerator - M23 - Filter - T1 - Cont.1	10/26/21	12:00	Filter	1	R			
	Eco Waste - Incinerator - M23 - Acetone/Hexane - T1 - Cont. 2	10/26/21	12:00	Acetone/Hexane	1	R	R		
	Eco Waste - Incinerator - M23 - XAD Trap - T1 - Cont. 3	10/26/21	12:00	XAD Trap	1	R			
10	Eco Waste - Incinerator - M23 - Filter - T2 - Cont.1	10/27/21	12:00	Filter	1	R			
	Eco Waste - Incinerator - M23 - Acetone/Hexane - T2 - Cont. 2	10/27/21	12:00	Acetone/Hexane	1	R	R		
	Eco Waste - Incinerator - M23 - XAD Trap - T2 - Cont. 3	10/27/21	12:00	XAD Trap	1	R			
11	Eco Waste - Incinerator - M23 - Filter - T3 - Cont.1	10/28/21	12:00	Filter	1	R			
	Eco Waste - Incinerator - M23 - Acetone/Hexane - T3 - Cont. 2	10/28/21	12:00	Acetone/Hexane	1	R	R		
	Eco Waste - Incinerator - M23 - XAD Trap - T3 - Cont. 3	10/28/21	12:00	XAD Trap	1	R			
12	Eco Waste - Incinerator - M23 - Acetone/Hexane Blank	10/28/21	12:00	Acetone/Hexane	1	R	R		

Drinking Water (DW) Samples[1] (client use)	Special Instructions / Specify Criteria to add on report by clicking on the drop-down list below (electronic COC only)
Are samples taken from a Regulated DW System? ☐ YES ☐ NO	
Are samples for human consumption/ use? ☐ YES ☐ NO	

SAMPLE CONDITION AS RECEIVED (lab use only)

Frozen ☐ | SIF Observations Yes ☐ No ☒

Ice Packs ☐ Ice Cubes ☐ | Custody seal intact Yes ☒ No ☐

Cooling Initiated ☐

INITIAL COOLER TEMPERATURES °C	FINAL COOLER TEMPERATURES °C
16.9°C	

SHIPMENT RELEASE (client use)			INITIAL SHIPMENT RECEPTION (lab use only)			FINAL SHIPMENT RECEPTION (lab use only)		
Released by:	Date:	Time:	Received by:	0.708333333	Time:	Received by:	Date:	Time:
[signature]	11-3-21	11:50	[signature]	3-NOV-2021	15:50			

REFER TO BACK PAGE FOR ALS LOCATIONS AND SAMPLING INFORMATION

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Failure to complete all portions of this form may delay analysis. Please fill in this form LEGIBLY. By the use of this form the user acknowledges and agrees with the Terms and Conditions as specified on the back page of the white - report copy.

1. If any water samples are taken from a Regulated Drinking Water (DW) System, please submit using an Authorized DW COC form.

Method 29
Antimony
Arsenic
Barium
Beryllium
Cadmium
Chromium
Cobalt
Copper
Lead
Manganese
Nickel
Phosphorus
Selenium
Silver
Thallium
Zinc

Method 0010
Benzop(a)yrene
Perylene
Indeno(1,2,3-cd)pyrene
Dibenz(a,h)anthracene
Benzo(ghi)perylene
Naphthalene
2-Methylnaphthalene
Fluorene
Phenanthrene
Acenaphthene
Acenaphthylene
Anthracene
Fluoranthene
Pyrene
Benzo(a)anthracene
Chrysene
Benzo(b)fluoranthene
Benzo(k)fluoranthene
Benzo(e)pyrene

RWDI AIR INC. (Guelph)
ATTN: MASON SAKSHAUG
2239 Star Court
Rochester Hills MI 48309

Date Received: 04-NOV-21
Report Date: 23-NOV-21 15:17 (MT)
Version: FINAL

Client Phone: --

Certificate of Analysis

Lab Work Order #: L2659780

Project P.O. #: NOT SUBMITTED
Job Reference: 2200515
C of C Numbers:
Legal Site Desc:

Claire Kocharakkal, B.Sc.
Account Manager

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ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L2659780-1 ECO WASTE - INCINERATOR - T1							
Sampled By: CLIENT on 26-OCT-21 @ 12:00							
Matrix: AMBIENT AIR							
Canister EPA TO-15							
1,1,1-Trichloroethane	<1.1		1.1	ug/m3		17-NOV-21	R5653197
1,1,1-Trichloroethane	<0.20		0.20	ppb(V)		17-NOV-21	R5653197
1,1,2,2-Tetrachloroethane	<1.4		1.4	ug/m3		17-NOV-21	R5653197
1,1,2,2-Tetrachloroethane	<0.20		0.20	ppb(V)		17-NOV-21	R5653197
1,1,2-Trichloroethane	<1.1		1.1	ug/m3		17-NOV-21	R5653197
1,1,2-Trichloroethane	<0.20		0.20	ppb(V)		17-NOV-21	R5653197
1,1-Dichloroethane	<0.81		0.81	ug/m3		17-NOV-21	R5653197
1,1-Dichloroethane	<0.20		0.20	ppb(V)		17-NOV-21	R5653197
1,1-Dichloroethene	<0.79		0.79	ug/m3		17-NOV-21	R5653197
1,1-Dichloroethene	<0.20		0.20	ppb(V)		17-NOV-21	R5653197
1,2,4-Trichlorobenzene	2.9		1.5	ug/m3		17-NOV-21	R5653197
1,2,4-Trichlorobenzene	0.40		0.20	ppb(V)		17-NOV-21	R5653197
1,2,4-Trimethylbenzene	6.14		0.98	ug/m3		17-NOV-21	R5653197
1,2,4-Trimethylbenzene	1.25		0.20	ppb(V)		17-NOV-21	R5653197
1,2-Dibromoethane	<1.5		1.5	ug/m3		17-NOV-21	R5653197
1,2-Dibromoethane	<0.20		0.20	ppb(V)		17-NOV-21	R5653197
1,2-Dichlorobenzene	2.3		1.2	ug/m3		17-NOV-21	R5653197
1,2-Dichlorobenzene	0.38		0.20	ppb(V)		17-NOV-21	R5653197
1,2-Dichloroethane	<0.81		0.81	ug/m3		17-NOV-21	R5653197
1,2-Dichloroethane	<0.20		0.20	ppb(V)		17-NOV-21	R5653197
1,2-Dichloropropane	<0.92		0.92	ug/m3		17-NOV-21	R5653197
1,2-Dichloropropane	<0.20		0.20	ppb(V)		17-NOV-21	R5653197
1,3,5-Trimethylbenzene	1.66		0.98	ug/m3		17-NOV-21	R5653197
1,3,5-Trimethylbenzene	0.34		0.20	ppb(V)		17-NOV-21	R5653197
1,3-Butadiene	<0.44		0.44	ug/m3		17-NOV-21	R5653197
1,3-Butadiene	<0.20		0.20	ppb(V)		17-NOV-21	R5653197
1,3-Dichlorobenzene	2.0		1.2	ug/m3		17-NOV-21	R5653197
1,3-Dichlorobenzene	0.34		0.20	ppb(V)		17-NOV-21	R5653197
1,4-Dichlorobenzene	<1.2		1.2	ug/m3		17-NOV-21	R5653197
1,4-Dichlorobenzene	<0.20		0.20	ppb(V)		17-NOV-21	R5653197
1,4-Dioxane	<0.72		0.72	ug/m3		17-NOV-21	R5653197
1,4-Dioxane	<0.20		0.20	ppb(V)		17-NOV-21	R5653197
2-Hexanone	<4.1		4.1	ug/m3		17-NOV-21	R5653197
2-Hexanone	<1.0		1.0	ppb(V)		17-NOV-21	R5653197
4-Ethyltoluene	1.27		0.98	ug/m3		17-NOV-21	R5653197
4-Ethyltoluene	0.26		0.20	ppb(V)		17-NOV-21	R5653197
Acetone	318		59	ug/m3		19-NOV-21	R5653197
Acetone	134		25	ppb(V)		19-NOV-21	R5653197
Allyl chloride	<0.63		0.63	ug/m3		17-NOV-21	R5653197
Allyl chloride	<0.20		0.20	ppb(V)		17-NOV-21	R5653197
Benzene	52.2		1.6	ug/m3		18-NOV-21	R5653197
Benzene	16.3		0.50	ppb(V)		18-NOV-21	R5653197
Benzyl chloride	<1.0		1.0	ug/m3		17-NOV-21	R5653197
Benzyl chloride	<0.20		0.20	ppb(V)		17-NOV-21	R5653197
Bromodichloromethane	<1.3		1.3	ug/m3		17-NOV-21	R5653197
Bromodichloromethane	<0.20		0.20	ppb(V)		17-NOV-21	R5653197
Bromoform	<2.1		2.1	ug/m3		17-NOV-21	R5653197
Bromoform	<0.20		0.20	ppb(V)		17-NOV-21	R5653197
Bromomethane	<9.0	DLQ	9.0	ug/m3		17-NOV-21	R5653197
Bromomethane	<2.3	DLQ	2.3	ppb(V)		17-NOV-21	R5653197

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L2659780-1 ECO WASTE - INCINERATOR - T1							
Sampled By: CLIENT on 26-OCT-21 @ 12:00							
Matrix: AMBIENT AIR							
Canister EPA TO-15							
Carbon Disulfide	3.83		0.62	ug/m3		17-NOV-21	R5653197
Carbon Disulfide	1.23		0.20	ppb(V)		17-NOV-21	R5653197
Carbon Tetrachloride	<1.3		1.3	ug/m3		17-NOV-21	R5653197
Carbon Tetrachloride	<0.20		0.20	ppb(V)		17-NOV-21	R5653197
Chlorobenzene	3.29		0.92	ug/m3		17-NOV-21	R5653197
Chlorobenzene	0.71		0.20	ppb(V)		17-NOV-21	R5653197
Chloroethane	<0.53		0.53	ug/m3		17-NOV-21	R5653197
Chloroethane	<0.20		0.20	ppb(V)		17-NOV-21	R5653197
Chloroform	<0.98		0.98	ug/m3		17-NOV-21	R5653197
Chloroform	<0.20		0.20	ppb(V)		17-NOV-21	R5653197
Chloromethane	7.45		0.41	ug/m3		17-NOV-21	R5653197
Chloromethane	3.61		0.20	ppb(V)		17-NOV-21	R5653197
cis-1,2-Dichloroethene	<0.79		0.79	ug/m3		17-NOV-21	R5653197
cis-1,2-Dichloroethene	<0.20		0.20	ppb(V)		17-NOV-21	R5653197
cis-1,3-Dichloropropene	<0.91		0.91	ug/m3		17-NOV-21	R5653197
cis-1,3-Dichloropropene	<0.20		0.20	ppb(V)		17-NOV-21	R5653197
Cyclohexane	0.89	AI	0.69	ug/m3		17-NOV-21	R5653197
Cyclohexane	0.26	AI	0.20	ppb(V)		17-NOV-21	R5653197
Dibromochloromethane	<1.7		1.7	ug/m3		17-NOV-21	R5653197
Dibromochloromethane	<0.20		0.20	ppb(V)		17-NOV-21	R5653197
Dichlorodifluoromethane	<0.99		0.99	ug/m3		17-NOV-21	R5653197
Dichlorodifluoromethane	<0.20		0.20	ppb(V)		17-NOV-21	R5653197
Ethyl acetate	<0.72		0.72	ug/m3		17-NOV-21	R5653197
Ethyl acetate	<0.20		0.20	ppb(V)		17-NOV-21	R5653197
Ethylbenzene	<0.87		0.87	ug/m3		17-NOV-21	R5653197
Ethylbenzene	<0.20		0.20	ppb(V)		17-NOV-21	R5653197
Freon 113	<1.5		1.5	ug/m3		17-NOV-21	R5653197
Freon 113	<0.20		0.20	ppb(V)		17-NOV-21	R5653197
Freon 114	<1.4		1.4	ug/m3		17-NOV-21	R5653197
Freon 114	<0.20		0.20	ppb(V)		17-NOV-21	R5653197
Hexachlorobutadiene	<2.1		2.1	ug/m3		17-NOV-21	R5653197
Hexachlorobutadiene	<0.20		0.20	ppb(V)		17-NOV-21	R5653197
Isooctane	3.24	AI	0.93	ug/m3		17-NOV-21	R5653197
Isooctane	0.69	AI	0.20	ppb(V)		17-NOV-21	R5653197
Isopropylbenzene	<0.98		0.98	ug/m3		17-NOV-21	R5653197
Isopropylbenzene	<0.20		0.20	ppb(V)		17-NOV-21	R5653197
m&p-Xylene	2.0		1.7	ug/m3		17-NOV-21	R5653197
m&p-Xylene	0.46		0.40	ppb(V)		17-NOV-21	R5653197
Methyl ethyl ketone	8.71		0.59	ug/m3		17-NOV-21	R5653197
Methyl ethyl ketone	2.95		0.20	ppb(V)		17-NOV-21	R5653197
Methyl isobutyl ketone	44.6		4.1	ug/m3		18-NOV-21	R5653197
Methyl isobutyl ketone	10.9		1.0	ppb(V)		18-NOV-21	R5653197
Methylene chloride	5.17		0.69	ug/m3		17-NOV-21	R5653197
Methylene chloride	1.49		0.20	ppb(V)		17-NOV-21	R5653197
MTBE	1.00		0.72	ug/m3		17-NOV-21	R5653197
MTBE	0.28		0.20	ppb(V)		17-NOV-21	R5653197
n-Heptane	2.44	AI	0.82	ug/m3		17-NOV-21	R5653197
n-Heptane	0.59	AI	0.20	ppb(V)		17-NOV-21	R5653197
n-Hexane	70.0		3.5	ug/m3		18-NOV-21	R5653197
n-Hexane	19.8		1.0	ppb(V)		18-NOV-21	R5653197
Naphthalene	3.2		1.0	ug/m3		17-NOV-21	R5653197

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L2659780-1 ECO WASTE - INCINERATOR - T1							
Sampled By: CLIENT on 26-OCT-21 @ 12:00							
Matrix: AMBIENT AIR							
Canister EPA TO-15							
Naphthalene	0.61		0.20	ppb(V)		17-NOV-21	R5653197
o-Xylene	<0.87		0.87	ug/m3		17-NOV-21	R5653197
o-Xylene	<0.20		0.20	ppb(V)		17-NOV-21	R5653197
Propylene	18.6		1.7	ug/m3		18-NOV-21	R5653197
Propylene	10.8		1.0	ppb(V)		18-NOV-21	R5653197
Styrene	<0.85		0.85	ug/m3		17-NOV-21	R5653197
Styrene	<0.20		0.20	ppb(V)		17-NOV-21	R5653197
Tetrachloroethylene	<1.4		1.4	ug/m3		17-NOV-21	R5653197
Tetrachloroethylene	<0.20		0.20	ppb(V)		17-NOV-21	R5653197
Tetrahydrofuran	14.6		2.9	ug/m3		18-NOV-21	R5653197
Tetrahydrofuran	5.0		1.0	ppb(V)		18-NOV-21	R5653197
Toluene	6.73		0.75	ug/m3		17-NOV-21	R5653197
Toluene	1.78		0.20	ppb(V)		17-NOV-21	R5653197
trans-1,2-Dichloroethene	<0.79		0.79	ug/m3		17-NOV-21	R5653197
trans-1,2-Dichloroethene	<0.20		0.20	ppb(V)		17-NOV-21	R5653197
trans-1,3-Dichloropropene	<0.91		0.91	ug/m3		17-NOV-21	R5653197
trans-1,3-Dichloropropene	<0.20		0.20	ppb(V)		17-NOV-21	R5653197
Trichloroethylene	<1.1		1.1	ug/m3		17-NOV-21	R5653197
Trichloroethylene	<0.20		0.20	ppb(V)		17-NOV-21	R5653197
Trichlorofluoromethane	<1.1		1.1	ug/m3		17-NOV-21	R5653197
Trichlorofluoromethane	<0.20		0.20	ppb(V)		17-NOV-21	R5653197
Vinyl acetate	<7.4	DLQ	7.4	ug/m3		17-NOV-21	R5653197
Vinyl acetate	<2.1	DLQ	2.1	ppb(V)		17-NOV-21	R5653197
Vinyl bromide	<0.87		0.87	ug/m3		17-NOV-21	R5653197
Vinyl bromide	<0.20		0.20	ppb(V)		17-NOV-21	R5653197
Vinyl chloride	<0.51		0.51	ug/m3		17-NOV-21	R5653197
Vinyl chloride	<0.20		0.20	ppb(V)		17-NOV-21	R5653197
Surrogate: 4-Bromofluorobenzene	120.3		50-150	%		17-NOV-21	R5653197
Canister Information							
Pressure on Receipt	-6.5		-30	in Hg	12-NOV-21	12-NOV-21	R5644459
Canister ID	06000-0182				12-NOV-21	12-NOV-21	R5644459
Regulator ID	CS1200-0076				12-NOV-21	12-NOV-21	R5644459
Batch Proof ID	210913.112				12-NOV-21	12-NOV-21	R5644459
L2659780-2 ECO WASTE - INCINERATOR - T2							
Sampled By: CLIENT on 27-OCT-21 @ 12:00							
Matrix: AMBIENT AIR							
Canister EPA TO-15							
1,1,1-Trichloroethane	<1.1		1.1	ug/m3		17-NOV-21	R5653197
1,1,1-Trichloroethane	<0.20		0.20	ppb(V)		17-NOV-21	R5653197
1,1,2,2-Tetrachloroethane	<1.4		1.4	ug/m3		17-NOV-21	R5653197
1,1,2,2-Tetrachloroethane	<0.20		0.20	ppb(V)		17-NOV-21	R5653197
1,1,2-Trichloroethane	<1.1		1.1	ug/m3		17-NOV-21	R5653197
1,1,2-Trichloroethane	<0.20		0.20	ppb(V)		17-NOV-21	R5653197
1,1-Dichloroethane	3.21		0.81	ug/m3		17-NOV-21	R5653197
1,1-Dichloroethane	0.79		0.20	ppb(V)		17-NOV-21	R5653197
1,1-Dichloroethene	<0.79		0.79	ug/m3		17-NOV-21	R5653197
1,1-Dichloroethene	<0.20		0.20	ppb(V)		17-NOV-21	R5653197
1,2,4-Trichlorobenzene	4.9		1.5	ug/m3		17-NOV-21	R5653197
1,2,4-Trichlorobenzene	0.66		0.20	ppb(V)		17-NOV-21	R5653197
1,2,4-Trimethylbenzene	2.44		0.98	ug/m3		17-NOV-21	R5653197

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L2659780-2 ECO WASTE - INCINERATOR - T2							
Sampled By: CLIENT on 27-OCT-21 @ 12:00							
Matrix: AMBIENT AIR							
Canister EPA TO-15							
1,2,4-Trimethylbenzene	0.50		0.20	ppb(V)		17-NOV-21	R5653197
1,2-Dibromoethane	<1.5		1.5	ug/m3		17-NOV-21	R5653197
1,2-Dibromoethane	<0.20		0.20	ppb(V)		17-NOV-21	R5653197
1,2-Dichlorobenzene	2.9		1.2	ug/m3		17-NOV-21	R5653197
1,2-Dichlorobenzene	0.48		0.20	ppb(V)		17-NOV-21	R5653197
1,2-Dichloroethane	<0.81		0.81	ug/m3		17-NOV-21	R5653197
1,2-Dichloroethane	<0.20		0.20	ppb(V)		17-NOV-21	R5653197
1,2-Dichloropropane	<0.92		0.92	ug/m3		17-NOV-21	R5653197
1,2-Dichloropropane	<0.20		0.20	ppb(V)		17-NOV-21	R5653197
1,3,5-Trimethylbenzene	<0.98		0.98	ug/m3		17-NOV-21	R5653197
1,3,5-Trimethylbenzene	<0.20		0.20	ppb(V)		17-NOV-21	R5653197
1,3-Butadiene	<2.1	DLQ	2.1	ug/m3		17-NOV-21	R5653197
1,3-Butadiene	<0.94	DLQ	0.94	ppb(V)		17-NOV-21	R5653197
1,3-Dichlorobenzene	2.1		1.2	ug/m3		17-NOV-21	R5653197
1,3-Dichlorobenzene	0.36		0.20	ppb(V)		17-NOV-21	R5653197
1,4-Dichlorobenzene	<1.2		1.2	ug/m3		17-NOV-21	R5653197
1,4-Dichlorobenzene	<0.20		0.20	ppb(V)		17-NOV-21	R5653197
1,4-Dioxane	<0.72		0.72	ug/m3		17-NOV-21	R5653197
1,4-Dioxane	<0.20		0.20	ppb(V)		17-NOV-21	R5653197
2-Hexanone	<4.1		4.1	ug/m3		17-NOV-21	R5653197
2-Hexanone	<1.0		1.0	ppb(V)		17-NOV-21	R5653197
4-Ethyltoluene	<0.98		0.98	ug/m3		17-NOV-21	R5653197
4-Ethyltoluene	<0.20		0.20	ppb(V)		17-NOV-21	R5653197
Acetone	650		150	ug/m3		18-NOV-21	R5653197
Acetone	273		63	ppb(V)		18-NOV-21	R5653197
Allyl chloride	<0.63		0.63	ug/m3		17-NOV-21	R5653197
Allyl chloride	<0.20		0.20	ppb(V)		17-NOV-21	R5653197
Benzene	146		1.6	ug/m3		18-NOV-21	R5653197
Benzene	45.7		0.50	ppb(V)		18-NOV-21	R5653197
Benzyl chloride	<1.0		1.0	ug/m3		17-NOV-21	R5653197
Benzyl chloride	<0.20		0.20	ppb(V)		17-NOV-21	R5653197
Bromodichloromethane	<1.3		1.3	ug/m3		17-NOV-21	R5653197
Bromodichloromethane	<0.20		0.20	ppb(V)		17-NOV-21	R5653197
Bromoform	<2.1		2.1	ug/m3		17-NOV-21	R5653197
Bromoform	<0.20		0.20	ppb(V)		17-NOV-21	R5653197
Bromomethane	10.8	AI	0.78	ug/m3		17-NOV-21	R5653197
Bromomethane	2.78	AI	0.20	ppb(V)		17-NOV-21	R5653197
Carbon Disulfide	17.9		3.1	ug/m3		18-NOV-21	R5653197
Carbon Disulfide	5.8		1.0	ppb(V)		18-NOV-21	R5653197
Carbon Tetrachloride	<1.3		1.3	ug/m3		17-NOV-21	R5653197
Carbon Tetrachloride	<0.20		0.20	ppb(V)		17-NOV-21	R5653197
Chlorobenzene	3.66		0.92	ug/m3		17-NOV-21	R5653197
Chlorobenzene	0.79		0.20	ppb(V)		17-NOV-21	R5653197
Chloroethane	<0.53		0.53	ug/m3		17-NOV-21	R5653197
Chloroethane	<0.20		0.20	ppb(V)		17-NOV-21	R5653197
Chloroform	<0.98		0.98	ug/m3		17-NOV-21	R5653197
Chloroform	<0.20		0.20	ppb(V)		17-NOV-21	R5653197
Chloromethane	11.8		2.1	ug/m3		18-NOV-21	R5653197
Chloromethane	5.7		1.0	ppb(V)		18-NOV-21	R5653197
cis-1,2-Dichloroethene	<0.79		0.79	ug/m3		17-NOV-21	R5653197
cis-1,2-Dichloroethene	<0.20		0.20	ppb(V)		17-NOV-21	R5653197

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ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L2659780-2 ECO WASTE - INCINERATOR - T2							
Sampled By: CLIENT on 27-OCT-21 @ 12:00							
Matrix: AMBIENT AIR							
Canister EPA TO-15							
cis-1,3-Dichloropropene	<0.91		0.91	ug/m3		17-NOV-21	R5653197
cis-1,3-Dichloropropene	<0.20		0.20	ppb(V)		17-NOV-21	R5653197
Cyclohexane	1.71		0.69	ug/m3		17-NOV-21	R5653197
Cyclohexane	0.50		0.20	ppb(V)		17-NOV-21	R5653197
Dibromochloromethane	<1.7		1.7	ug/m3		17-NOV-21	R5653197
Dibromochloromethane	<0.20		0.20	ppb(V)		17-NOV-21	R5653197
Dichlorodifluoromethane	<0.99		0.99	ug/m3		17-NOV-21	R5653197
Dichlorodifluoromethane	<0.20		0.20	ppb(V)		17-NOV-21	R5653197
Ethyl acetate	2.72	AI	0.72	ug/m3		17-NOV-21	R5653197
Ethyl acetate	0.75	AI	0.20	ppb(V)		17-NOV-21	R5653197
Ethylbenzene	<0.87		0.87	ug/m3		17-NOV-21	R5653197
Ethylbenzene	<0.20		0.20	ppb(V)		17-NOV-21	R5653197
Freon 113	<1.5		1.5	ug/m3		17-NOV-21	R5653197
Freon 113	<0.20		0.20	ppb(V)		17-NOV-21	R5653197
Freon 114	<1.4		1.4	ug/m3		17-NOV-21	R5653197
Freon 114	<0.20		0.20	ppb(V)		17-NOV-21	R5653197
Hexachlorobutadiene	<2.1		2.1	ug/m3		17-NOV-21	R5653197
Hexachlorobutadiene	<0.20		0.20	ppb(V)		17-NOV-21	R5653197
Isooctane	17.8	AI	0.93	ug/m3		17-NOV-21	R5653197
Isooctane	3.81	AI	0.20	ppb(V)		17-NOV-21	R5653197
Isopropylbenzene	<0.98		0.98	ug/m3		17-NOV-21	R5653197
Isopropylbenzene	<0.20		0.20	ppb(V)		17-NOV-21	R5653197
m&p-Xylene	<1.7		1.7	ug/m3		17-NOV-21	R5653197
m&p-Xylene	<0.40		0.40	ppb(V)		17-NOV-21	R5653197
Methyl ethyl ketone	15.9		2.9	ug/m3		18-NOV-21	R5653197
Methyl ethyl ketone	5.4		1.0	ppb(V)		18-NOV-21	R5653197
Methyl isobutyl ketone	66.2		4.1	ug/m3		18-NOV-21	R5653197
Methyl isobutyl ketone	16.2		1.0	ppb(V)		18-NOV-21	R5653197
Methylene chloride	4.83		0.69	ug/m3		17-NOV-21	R5653197
Methylene chloride	1.39		0.20	ppb(V)		17-NOV-21	R5653197
MTBE	<0.72		0.72	ug/m3		17-NOV-21	R5653197
MTBE	<0.20		0.20	ppb(V)		17-NOV-21	R5653197
n-Heptane	3.25		0.82	ug/m3		17-NOV-21	R5653197
n-Heptane	0.79		0.20	ppb(V)		17-NOV-21	R5653197
n-Hexane	34.9		3.5	ug/m3		18-NOV-21	R5653197
n-Hexane	9.9		1.0	ppb(V)		18-NOV-21	R5653197
Naphthalene	5.5		1.0	ug/m3		17-NOV-21	R5653197
Naphthalene	1.05		0.20	ppb(V)		17-NOV-21	R5653197
o-Xylene	<0.87		0.87	ug/m3		17-NOV-21	R5653197
o-Xylene	<0.20		0.20	ppb(V)		17-NOV-21	R5653197
Propylene	23.7		1.7	ug/m3		18-NOV-21	R5653197
Propylene	13.8		1.0	ppb(V)		18-NOV-21	R5653197
Styrene	<0.85		0.85	ug/m3		17-NOV-21	R5653197
Styrene	<0.20		0.20	ppb(V)		17-NOV-21	R5653197
Tetrachloroethylene	<1.4		1.4	ug/m3		17-NOV-21	R5653197
Tetrachloroethylene	<0.20		0.20	ppb(V)		17-NOV-21	R5653197
Tetrahydrofuran	9.84		0.59	ug/m3		17-NOV-21	R5653197
Tetrahydrofuran	3.33		0.20	ppb(V)		17-NOV-21	R5653197
Toluene	5.09		0.75	ug/m3		17-NOV-21	R5653197
Toluene	1.35		0.20	ppb(V)		17-NOV-21	R5653197
trans-1,2-Dichloroethene	<0.79		0.79	ug/m3		17-NOV-21	R5653197

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ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L2659780-2 ECO WASTE - INCINERATOR - T2							
Sampled By: CLIENT on 27-OCT-21 @ 12:00							
Matrix: AMBIENT AIR							
Canister EPA TO-15							
trans-1,2-Dichloroethene	<0.20		0.20	ppb(V)		17-NOV-21	R5653197
trans-1,3-Dichloropropene	<0.91		0.91	ug/m3		17-NOV-21	R5653197
trans-1,3-Dichloropropene	<0.20		0.20	ppb(V)		17-NOV-21	R5653197
Trichloroethylene	<1.1		1.1	ug/m3		17-NOV-21	R5653197
Trichloroethylene	<0.20		0.20	ppb(V)		17-NOV-21	R5653197
Trichlorofluoromethane	<1.1		1.1	ug/m3		17-NOV-21	R5653197
Trichlorofluoromethane	<0.20		0.20	ppb(V)		17-NOV-21	R5653197
Vinyl acetate	<4.9	DLQ	4.9	ug/m3		17-NOV-21	R5653197
Vinyl acetate	<1.4	DLQ	1.4	ppb(V)		17-NOV-21	R5653197
Vinyl bromide	<0.87		0.87	ug/m3		17-NOV-21	R5653197
Vinyl bromide	<0.20		0.20	ppb(V)		17-NOV-21	R5653197
Vinyl chloride	<0.51		0.51	ug/m3		17-NOV-21	R5653197
Vinyl chloride	<0.20		0.20	ppb(V)		17-NOV-21	R5653197
Surrogate: 4-Bromofluorobenzene	116.3		50-150	%		17-NOV-21	R5653197
Canister Information							
Pressure on Receipt	-9.4		-30	in Hg	12-NOV-21	12-NOV-21	R5644459
Canister ID	06000-0437				12-NOV-21	12-NOV-21	R5644459
Regulator ID	CS1200-0121				12-NOV-21	12-NOV-21	R5644459
Batch Proof ID	210629.103				12-NOV-21	12-NOV-21	R5644459
L2659780-3 ECO WASTE - INCINERATOR - T3							
Sampled By: CLIENT on 28-OCT-21 @ 12:00							
Matrix: AMBIENT AIR							
Canister EPA TO-15							
1,1,1-Trichloroethane	<1.1		1.1	ug/m3		17-NOV-21	R5653197
1,1,1-Trichloroethane	<0.20		0.20	ppb(V)		17-NOV-21	R5653197
1,1,2,2-Tetrachloroethane	<1.4		1.4	ug/m3		17-NOV-21	R5653197
1,1,2,2-Tetrachloroethane	<0.20		0.20	ppb(V)		17-NOV-21	R5653197
1,1,2-Trichloroethane	<1.1		1.1	ug/m3		17-NOV-21	R5653197
1,1,2-Trichloroethane	<0.20		0.20	ppb(V)		17-NOV-21	R5653197
1,1-Dichloroethane	<0.81		0.81	ug/m3		17-NOV-21	R5653197
1,1-Dichloroethane	<0.20		0.20	ppb(V)		17-NOV-21	R5653197
1,1-Dichloroethene	<0.79		0.79	ug/m3		17-NOV-21	R5653197
1,1-Dichloroethene	<0.20		0.20	ppb(V)		17-NOV-21	R5653197
1,2,4-Trichlorobenzene	4.3		1.5	ug/m3		17-NOV-21	R5653197
1,2,4-Trichlorobenzene	0.58		0.20	ppb(V)		17-NOV-21	R5653197
1,2,4-Trimethylbenzene	2.95		0.98	ug/m3		17-NOV-21	R5653197
1,2,4-Trimethylbenzene	0.60		0.20	ppb(V)		17-NOV-21	R5653197
1,2-Dibromoethane	<1.5		1.5	ug/m3		17-NOV-21	R5653197
1,2-Dibromoethane	<0.20		0.20	ppb(V)		17-NOV-21	R5653197
1,2-Dichlorobenzene	3.0		1.2	ug/m3		17-NOV-21	R5653197
1,2-Dichlorobenzene	0.50		0.20	ppb(V)		17-NOV-21	R5653197
1,2-Dichloroethane	<0.81		0.81	ug/m3		17-NOV-21	R5653197
1,2-Dichloroethane	<0.20		0.20	ppb(V)		17-NOV-21	R5653197
1,2-Dichloropropane	<0.92		0.92	ug/m3		17-NOV-21	R5653197
1,2-Dichloropropane	<0.20		0.20	ppb(V)		17-NOV-21	R5653197
1,3,5-Trimethylbenzene	1.08		0.98	ug/m3		17-NOV-21	R5653197
1,3,5-Trimethylbenzene	0.22		0.20	ppb(V)		17-NOV-21	R5653197
1,3-Butadiene	<0.44		0.44	ug/m3		17-NOV-21	R5653197
1,3-Butadiene	<0.20		0.20	ppb(V)		17-NOV-21	R5653197
1,3-Dichlorobenzene	2.2		1.2	ug/m3		17-NOV-21	R5653197

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ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L2659780-3 ECO WASTE - INCINERATOR - T3							
Sampled By: CLIENT on 28-OCT-21 @ 12:00							
Matrix: AMBIENT AIR							
Canister EPA TO-15							
1,3-Dichlorobenzene	0.36		0.20	ppb(V)		17-NOV-21	R5653197
1,4-Dichlorobenzene	2.4		1.2	ug/m3		17-NOV-21	R5653197
1,4-Dichlorobenzene	0.40		0.20	ppb(V)		17-NOV-21	R5653197
1,4-Dioxane	<0.72		0.72	ug/m3		17-NOV-21	R5653197
1,4-Dioxane	<0.20		0.20	ppb(V)		17-NOV-21	R5653197
2-Hexanone	<4.1		4.1	ug/m3		17-NOV-21	R5653197
2-Hexanone	<1.0		1.0	ppb(V)		17-NOV-21	R5653197
4-Ethyltoluene	<0.98		0.98	ug/m3		17-NOV-21	R5653197
4-Ethyltoluene	<0.20		0.20	ppb(V)		17-NOV-21	R5653197
Acetone	570		140	ug/m3		19-NOV-21	R5653197
Acetone	241		61	ppb(V)		19-NOV-21	R5653197
Allyl chloride	<0.63		0.63	ug/m3		17-NOV-21	R5653197
Allyl chloride	<0.20		0.20	ppb(V)		17-NOV-21	R5653197
Benzene	205		1.6	ug/m3		18-NOV-21	R5653197
Benzene	64.1		0.50	ppb(V)		18-NOV-21	R5653197
Benzyl chloride	<1.0		1.0	ug/m3		17-NOV-21	R5653197
Benzyl chloride	<0.20		0.20	ppb(V)		17-NOV-21	R5653197
Bromodichloromethane	<1.3		1.3	ug/m3		17-NOV-21	R5653197
Bromodichloromethane	<0.20		0.20	ppb(V)		17-NOV-21	R5653197
Bromoform	<2.1		2.1	ug/m3		17-NOV-21	R5653197
Bromoform	<0.20		0.20	ppb(V)		17-NOV-21	R5653197
Bromomethane	<0.78		0.78	ug/m3		17-NOV-21	R5653197
Bromomethane	<0.20		0.20	ppb(V)		17-NOV-21	R5653197
Carbon Disulfide	19.7		3.1	ug/m3		18-NOV-21	R5653197
Carbon Disulfide	6.3		1.0	ppb(V)		18-NOV-21	R5653197
Carbon Tetrachloride	<1.3		1.3	ug/m3		17-NOV-21	R5653197
Carbon Tetrachloride	<0.20		0.20	ppb(V)		17-NOV-21	R5653197
Chlorobenzene	3.97		0.92	ug/m3		17-NOV-21	R5653197
Chlorobenzene	0.86		0.20	ppb(V)		17-NOV-21	R5653197
Chloroethane	0.85		0.53	ug/m3		17-NOV-21	R5653197
Chloroethane	0.32		0.20	ppb(V)		17-NOV-21	R5653197
Chloroform	<0.98		0.98	ug/m3		17-NOV-21	R5653197
Chloroform	<0.20		0.20	ppb(V)		17-NOV-21	R5653197
Chloromethane	10.2		2.1	ug/m3		18-NOV-21	R5653197
Chloromethane	4.9		1.0	ppb(V)		18-NOV-21	R5653197
cis-1,2-Dichloroethene	<0.79		0.79	ug/m3		17-NOV-21	R5653197
cis-1,2-Dichloroethene	<0.20		0.20	ppb(V)		17-NOV-21	R5653197
cis-1,3-Dichloropropene	<0.91		0.91	ug/m3		17-NOV-21	R5653197
cis-1,3-Dichloropropene	<0.20		0.20	ppb(V)		17-NOV-21	R5653197
Cyclohexane	2.00		0.69	ug/m3		17-NOV-21	R5653197
Cyclohexane	0.58		0.20	ppb(V)		17-NOV-21	R5653197
Dibromochloromethane	<1.7		1.7	ug/m3		17-NOV-21	R5653197
Dibromochloromethane	<0.20		0.20	ppb(V)		17-NOV-21	R5653197
Dichlorodifluoromethane	<0.99		0.99	ug/m3		17-NOV-21	R5653197
Dichlorodifluoromethane	<0.20		0.20	ppb(V)		17-NOV-21	R5653197
Ethyl acetate	2.60	AI	0.72	ug/m3		17-NOV-21	R5653197
Ethyl acetate	0.72	AI	0.20	ppb(V)		17-NOV-21	R5653197
Ethylbenzene	<0.87		0.87	ug/m3		17-NOV-21	R5653197
Ethylbenzene	<0.20		0.20	ppb(V)		17-NOV-21	R5653197
Freon 113	<1.5		1.5	ug/m3		17-NOV-21	R5653197
Freon 113	<0.20		0.20	ppb(V)		17-NOV-21	R5653197

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L2659780-3 ECO WASTE - INCINERATOR - T3							
Sampled By: CLIENT on 28-OCT-21 @ 12:00							
Matrix: AMBIENT AIR							
Canister EPA TO-15							
Freon 114	<1.4		1.4	ug/m3		17-NOV-21	R5653197
Freon 114	<0.20		0.20	ppb(V)		17-NOV-21	R5653197
Hexachlorobutadiene	<2.1		2.1	ug/m3		17-NOV-21	R5653197
Hexachlorobutadiene	<0.20		0.20	ppb(V)		17-NOV-21	R5653197
Isooctane	8.98	AI	0.93	ug/m3		17-NOV-21	R5653197
Isooctane	1.92	AI	0.20	ppb(V)		17-NOV-21	R5653197
Isopropylbenzene	<0.98		0.98	ug/m3		17-NOV-21	R5653197
Isopropylbenzene	<0.20		0.20	ppb(V)		17-NOV-21	R5653197
m&p-Xylene	2.1		1.7	ug/m3		17-NOV-21	R5653197
m&p-Xylene	0.48		0.40	ppb(V)		17-NOV-21	R5653197
Methyl ethyl ketone	24.7		2.9	ug/m3		18-NOV-21	R5653197
Methyl ethyl ketone	8.4		1.0	ppb(V)		18-NOV-21	R5653197
Methyl isobutyl ketone	26.6		4.1	ug/m3		18-NOV-21	R5653197
Methyl isobutyl ketone	6.5		1.0	ppb(V)		18-NOV-21	R5653197
Methylene chloride	5.91		0.69	ug/m3		17-NOV-21	R5653197
Methylene chloride	1.70		0.20	ppb(V)		17-NOV-21	R5653197
MTBE	<0.72		0.72	ug/m3		17-NOV-21	R5653197
MTBE	<0.20		0.20	ppb(V)		17-NOV-21	R5653197
n-Heptane	4.51		0.82	ug/m3		17-NOV-21	R5653197
n-Heptane	1.10		0.20	ppb(V)		17-NOV-21	R5653197
n-Hexane	20.9		3.5	ug/m3		18-NOV-21	R5653197
n-Hexane	5.9		1.0	ppb(V)		18-NOV-21	R5653197
Naphthalene	4.4		1.0	ug/m3		17-NOV-21	R5653197
Naphthalene	0.84		0.20	ppb(V)		17-NOV-21	R5653197
o-Xylene	1.13		0.87	ug/m3		17-NOV-21	R5653197
o-Xylene	0.26		0.20	ppb(V)		17-NOV-21	R5653197
Propylene	33.7		1.7	ug/m3		18-NOV-21	R5653197
Propylene	19.6		1.0	ppb(V)		18-NOV-21	R5653197
Styrene	<0.85		0.85	ug/m3		17-NOV-21	R5653197
Styrene	<0.20		0.20	ppb(V)		17-NOV-21	R5653197
Tetrachloroethylene	<1.4		1.4	ug/m3		17-NOV-21	R5653197
Tetrachloroethylene	<0.20		0.20	ppb(V)		17-NOV-21	R5653197
Tetrahydrofuran	16.8		2.9	ug/m3		18-NOV-21	R5653197
Tetrahydrofuran	5.7		1.0	ppb(V)		18-NOV-21	R5653197
Toluene	7.70		0.75	ug/m3		17-NOV-21	R5653197
Toluene	2.04		0.20	ppb(V)		17-NOV-21	R5653197
trans-1,2-Dichloroethene	<0.79		0.79	ug/m3		17-NOV-21	R5653197
trans-1,2-Dichloroethene	<0.20		0.20	ppb(V)		17-NOV-21	R5653197
trans-1,3-Dichloropropene	<0.91		0.91	ug/m3		17-NOV-21	R5653197
trans-1,3-Dichloropropene	<0.20		0.20	ppb(V)		17-NOV-21	R5653197
Trichloroethylene	<1.1		1.1	ug/m3		17-NOV-21	R5653197
Trichloroethylene	<0.20		0.20	ppb(V)		17-NOV-21	R5653197
Trichlorofluoromethane	<1.1		1.1	ug/m3		17-NOV-21	R5653197
Trichlorofluoromethane	<0.20		0.20	ppb(V)		17-NOV-21	R5653197
Vinyl acetate	<35	DLQ	35	ug/m3		18-NOV-21	R5653197
Vinyl acetate	<10	DLQ	10	ppb(V)		18-NOV-21	R5653197
Vinyl bromide	<0.87		0.87	ug/m3		17-NOV-21	R5653197
Vinyl bromide	<0.20		0.20	ppb(V)		17-NOV-21	R5653197
Vinyl chloride	0.56		0.51	ug/m3		17-NOV-21	R5653197
Vinyl chloride	0.22		0.20	ppb(V)		17-NOV-21	R5653197
Surrogate: 4-Bromofluorobenzene	118.4		50-150	%		17-NOV-21	R5653197

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L2659780-3 ECO WASTE - INCINERATOR - T3							
Sampled By: CLIENT on 28-OCT-21 @ 12:00							
Matrix: AMBIENT AIR							
Canister Information							
Pressure on Receipt	-14.9		-30	in Hg	12-NOV-21	12-NOV-21	R5644459
Canister ID	06000-0388				12-NOV-21	12-NOV-21	R5644459
Regulator ID	CS1200-0080				12-NOV-21	12-NOV-21	R5644459
Batch Proof ID	210820.209				12-NOV-21	12-NOV-21	R5644459

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

Reference Information

Sample Parameter Qualifier Key:

Qualifier	Description
AI	Analytical interferences may be present. Result may be biased high.
DLQ	Detection Limit raised due to co-eluting interference. GCMS qualifier ion ratio did not meet acceptance criteria.

Test Method References:

ALS Test Code	Matrix	Test Description	Method Reference**
CAN-DATA-WT	Canister	Canister Information	EPA TO-15
Batch Proof ID, Canister ID, Pressure on Receipt, Regulator ID.			
TO15-GCMS-WT	Canister	Canister EPA TO-15	EPA TO-15

This analysis is performed using procedures adapted from EPA Method TO-15. Air samples are collected into cleaned evacuated canisters. A volume of air sample is transferred from the canister to a preconcentrator system where the analytes are trapped & focused. The analytes are then thermally desorbed into a GC-MSD for analysis. Test results are not blank corrected unless indicated by a qualifier.

Canister samples will be retained for 7 calendar days after final report. If you require a longer canister storage time, please contact your account manager.

"Due to elevated laboratory background levels of IPA resulting from COVID-19 cleaning protocols, ALS is unable to report IPA results until further notice."

** ALS test methods may incorporate modifications from specified reference methods to improve performance.

The last two letters of the above test code(s) indicate the laboratory that performed analytical analysis for that test. Refer to the list below:

Laboratory Definition Code	Laboratory Location
WT	ALS ENVIRONMENTAL - WATERLOO, ONTARIO, CANADA

Chain of Custody Numbers:

GLOSSARY OF REPORT TERMS

Surrogates are compounds that are similar in behaviour to target analyte(s), but that do not normally occur in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery. In reports that display the D.L. column, laboratory objectives for surrogates are listed there.
mg/kg - milligrams per kilogram based on dry weight of sample
mg/kg wwt - milligrams per kilogram based on wet weight of sample
mg/kg lwt - milligrams per kilogram based on lipid-adjusted weight
mg/L - unit of concentration based on volume, parts per million.
< - Less than.
D.L. - The reporting limit.
N/A - Result not available. Refer to qualifier code and definition for explanation.

Test results reported relate only to the samples as received by the laboratory.
UNLESS OTHERWISE STATED, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.
Analytical results in unsigned test reports with the DRAFT watermark are subject to change, pending final QC review.

Quality Control Report

Client: RWDI AIR INC. (Guelph)
2239 Star Court
Rochester Hills MI 48309
Contact: MASON SAKSHAUG

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
CAN-DATA-WT	**Canister**							
Batch R5644459								
WG3656805-1 MB								
Pressure on Receipt			-29.8		in Hg			12-NOV-21
TO15-GCMS-WT	**Canister**							
Batch R5653197								
WG3660644-3 DUP		**L2659780-1**						
1,1,1-Trichloroethane		<0.20	<0.20	RPD-NA	ppb(V)	N/A	30	17-NOV-21
1,1,2,2-Tetrachloroethane		<0.20	<0.20	RPD-NA	ppb(V)	N/A	30	17-NOV-21
1,1,2-Trichloroethane		<0.20	<0.20	RPD-NA	ppb(V)	N/A	30	17-NOV-21
1,1-Dichloroethane		<0.20	<0.20	RPD-NA	ppb(V)	N/A	30	17-NOV-21
1,1-Dichloroethene		<0.20	<0.20	RPD-NA	ppb(V)	N/A	30	17-NOV-21
1,2,4-Trichlorobenzene		0.40	0.40		ppb(V)	0.0	30	17-NOV-21
1,2,4-Trimethylbenzene		1.25	1.25		ppb(V)	0.0	30	17-NOV-21
1,2-Dibromoethane		<0.20	<0.20	RPD-NA	ppb(V)	N/A	30	17-NOV-21
1,2-Dichlorobenzene		0.38	0.38		ppb(V)	0.0	30	17-NOV-21
1,2-Dichloroethane		<0.20	<0.20	RPD-NA	ppb(V)	N/A	30	17-NOV-21
1,2-Dichloropropane		<0.20	<0.20	RPD-NA	ppb(V)	N/A	30	17-NOV-21
1,3,5-Trimethylbenzene		0.34	0.32		ppb(V)	6.1	30	17-NOV-21
1,3-Butadiene		<0.20	0.38	RPD-NA	ppb(V)	N/A	30	17-NOV-21
1,3-Dichlorobenzene		0.34	0.34		ppb(V)	0.0	30	17-NOV-21
1,4-Dichlorobenzene		<0.20	<0.20	RPD-NA	ppb(V)	N/A	30	17-NOV-21
1,4-Dioxane		<0.20	<0.20	RPD-NA	ppb(V)	N/A	30	17-NOV-21
2-Hexanone		<1.0	<1.0	RPD-NA	ppb(V)	N/A	30	17-NOV-21
4-Ethyltoluene		0.26	0.26		ppb(V)	0.0	30	17-NOV-21
Acetone		134	133		ppb(V)	0.7	30	19-NOV-21
Allyl chloride		<0.20	<0.20	RPD-NA	ppb(V)	N/A	30	17-NOV-21
Benzene		16.3	16.0		ppb(V)	2.0	30	18-NOV-21
Benzyl chloride		<0.20	<0.20	RPD-NA	ppb(V)	N/A	30	17-NOV-21
Bromodichloromethane		<0.20	<0.20	RPD-NA	ppb(V)	N/A	30	17-NOV-21
Bromoform		<0.20	<0.20	RPD-NA	ppb(V)	N/A	30	17-NOV-21
Bromomethane		<2.3	<2.2	RPD-NA	ppb(V)	N/A	30	17-NOV-21
Carbon Disulfide		1.23	1.31		ppb(V)	6.3	30	17-NOV-21
Carbon Tetrachloride		<0.20	<0.20	RPD-NA	ppb(V)	N/A	30	17-NOV-21
Chlorobenzene		0.71	0.73		ppb(V)	2.7	30	17-NOV-21
Chloroethane		<0.20	0.22	RPD-NA	ppb(V)	N/A	30	17-NOV-21

Quality Control Report

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
TO15-GCMS-WT	**Canister**							
Batch R5653197								
WG3660644-3 DUP		**L2659780-1**						
Chloroform		<0.20	<0.20	RPD-NA	ppb(V)	N/A	30	17-NOV-21
Chloromethane		3.61	3.63		ppb(V)	0.5	30	17-NOV-21
cis-1,2-Dichloroethene		<0.20	<0.20	RPD-NA	ppb(V)	N/A	30	17-NOV-21
cis-1,3-Dichloropropene		<0.20	<0.20	RPD-NA	ppb(V)	N/A	30	17-NOV-21
Cyclohexane		0.26	0.24		ppb(V)	8.0	30	17-NOV-21
Dibromochloromethane		<0.20	<0.20	RPD-NA	ppb(V)	N/A	30	17-NOV-21
Dichlorodifluoromethane		<0.20	<0.20	RPD-NA	ppb(V)	N/A	30	17-NOV-21
Ethyl acetate		<0.20	<0.20	RPD-NA	ppb(V)	N/A	30	17-NOV-21
Ethylbenzene		<0.20	<0.20	RPD-NA	ppb(V)	N/A	30	17-NOV-21
Freon 113		<0.20	<0.20	RPD-NA	ppb(V)	N/A	30	17-NOV-21
Freon 114		<0.20	<0.20	RPD-NA	ppb(V)	N/A	30	17-NOV-21
Hexachlorobutadiene		<0.20	<0.20	RPD-NA	ppb(V)	N/A	30	17-NOV-21
Isooctane		0.69	0.67		ppb(V)	2.9	30	17-NOV-21
Isopropylbenzene		<0.20	<0.20	RPD-NA	ppb(V)	N/A	50	17-NOV-21
m&p-Xylene		0.46	0.46		ppb(V)	0.0	30	17-NOV-21
Methyl ethyl ketone		2.95	3.11		ppb(V)	5.2	30	17-NOV-21
Methyl isobutyl ketone		10.9	10.8		ppb(V)	0.9	30	18-NOV-21
Methylene chloride		1.49	1.47		ppb(V)	1.3	30	17-NOV-21
MTBE		0.28	0.26		ppb(V)	7.4	30	17-NOV-21
n-Heptane		0.59	0.58		ppb(V)	3.4	30	17-NOV-21
n-Hexane		19.8	19.5		ppb(V)	1.7	30	18-NOV-21
Naphthalene		0.61	0.61		ppb(V)	0.0	30	17-NOV-21
o-Xylene		<0.20	<0.20	RPD-NA	ppb(V)	N/A	30	17-NOV-21
Propylene		10.8	11.0		ppb(V)	1.5	30	18-NOV-21
Styrene		<0.20	<0.20	RPD-NA	ppb(V)	N/A	30	17-NOV-21
Tetrachloroethylene		<0.20	<0.20	RPD-NA	ppb(V)	N/A	30	17-NOV-21
Tetrahydrofuran		5.0	5.1		ppb(V)	3.5	30	18-NOV-21
Toluene		1.78	1.75		ppb(V)	2.2	30	17-NOV-21
trans-1,2-Dichloroethene		<0.20	<0.20	RPD-NA	ppb(V)	N/A	30	17-NOV-21
trans-1,3-Dichloropropene		<0.20	<0.20	RPD-NA	ppb(V)	N/A	30	17-NOV-21
Trichloroethylene		<0.20	<0.20	RPD-NA	ppb(V)	N/A	30	17-NOV-21
Trichlorofluoromethane		<0.20	<0.20	RPD-NA	ppb(V)	N/A	30	17-NOV-21
Vinyl acetate		<2.1	<2.1	RPD-NA	ppb(V)	N/A	30	17-NOV-21
Vinyl bromide		<0.20	<0.20	RPD-NA	ppb(V)	N/A	30	17-NOV-21

Quality Control Report

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
TO15-GCMS-WT	**Canister**							
Batch R5653197								
WG3660644-3 DUP		**L2659780-1**						
Vinyl chloride		<0.20	<0.20	RPD-NA	ppb(V)	N/A	30	17-NOV-21
WG3660644-2 LCS								
1,1,1-Trichloroethane			100.8		%		70-130	16-NOV-21
1,1,2,2-Tetrachloroethane			106.3		%		70-130	16-NOV-21
1,1,2-Trichloroethane			101.6		%		70-130	16-NOV-21
1,1-Dichloroethane			101.8		%		70-130	16-NOV-21
1,1-Dichloroethene			98.8		%		70-130	16-NOV-21
1,2,4-Trichlorobenzene			121.7		%		70-130	16-NOV-21
1,2,4-Trimethylbenzene			123.3		%		70-130	16-NOV-21
1,2-Dibromoethane			102.6		%		70-130	16-NOV-21
1,2-Dichlorobenzene			116.1		%		70-130	16-NOV-21
1,2-Dichloroethane			98.8		%		70-130	16-NOV-21
1,2-Dichloropropane			100.8		%		70-130	16-NOV-21
1,3,5-Trimethylbenzene			118.6		%		70-130	16-NOV-21
1,3-Butadiene			97.0		%		70-130	16-NOV-21
1,3-Dichlorobenzene			113.1		%		70-130	16-NOV-21
1,4-Dichlorobenzene			114.2		%		70-130	16-NOV-21
1,4-Dioxane			112.0		%		70-130	16-NOV-21
2-Hexanone			111.7		%		70-130	16-NOV-21
4-Ethyltoluene			115.8		%		70-130	16-NOV-21
Acetone			99.8		%		70-130	16-NOV-21
Allyl chloride			97.8		%		70-130	16-NOV-21
Benzene			99.8		%		70-130	16-NOV-21
Benzyl chloride			105.6		%		70-130	16-NOV-21
Bromodichloromethane			99.8		%		70-130	16-NOV-21
Bromoform			107.3		%		70-130	16-NOV-21
Bromomethane			97.8		%		70-130	16-NOV-21
Carbon Disulfide			93.0		%		70-130	16-NOV-21
Carbon Tetrachloride			101.7		%		70-130	16-NOV-21
Chlorobenzene			112.0		%		70-130	16-NOV-21
Chloroethane			94.9		%		70-130	16-NOV-21
Chloroform			100.8		%		70-130	16-NOV-21
Chloromethane			95.9		%		70-130	16-NOV-21
cis-1,2-Dichloroethene			98.9		%		70-130	16-NOV-21

Quality Control Report

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
TO15-GCMS-WT	**Canister**							
Batch R5653197								
WG3660644-2 LCS								
cis-1,3-Dichloropropene			99.8		%		70-130	16-NOV-21
Cyclohexane			92.3		%		70-130	16-NOV-21
Dibromochloromethane			102.6		%		70-130	16-NOV-21
Dichlorodifluoromethane			96.8		%		70-130	16-NOV-21
Ethyl acetate			97.9		%		70-130	16-NOV-21
Ethylbenzene			108.0		%		70-130	16-NOV-21
Freon 113			100.8		%		70-130	16-NOV-21
Freon 114			95.6		%		70-130	16-NOV-21
Hexachlorobutadiene			116.9		%		70-130	16-NOV-21
Isooctane			103.6		%		70-130	16-NOV-21
Isopropylbenzene			111.4		%		50-150	16-NOV-21
m&p-Xylene			110.6		%		70-130	16-NOV-21
Methyl ethyl ketone			99.8		%		70-130	16-NOV-21
Methyl isobutyl ketone			106.4		%		70-130	16-NOV-21
Methylene chloride			100.8		%		70-130	16-NOV-21
MTBE			100.7		%		70-130	16-NOV-21
n-Heptane			102.6		%		70-130	16-NOV-21
n-Hexane			102.6		%		70-130	16-NOV-21
Naphthalene			116.9		%		70-130	16-NOV-21
o-Xylene			111.0		%		70-130	16-NOV-21
Propylene			93.3		%		70-130	16-NOV-21
Styrene			113.2		%		70-130	16-NOV-21
Tetrachloroethylene			104.6		%		70-130	16-NOV-21
Tetrahydrofuran			97.9		%		70-130	16-NOV-21
Toluene			104.4		%		70-130	16-NOV-21
trans-1,2-Dichloroethene			100.8		%		70-130	16-NOV-21
trans-1,3-Dichloropropene			103.5		%		70-130	16-NOV-21
Trichloroethylene			102.6		%		70-130	16-NOV-21
Trichlorofluoromethane			99.8		%		70-130	16-NOV-21
Vinyl acetate			106.2		%		70-130	16-NOV-21
Vinyl bromide			96.9		%		70-130	16-NOV-21
Vinyl chloride			95.8		%		70-130	16-NOV-21
WG3660644-1 MB								
1,1,1-Trichloroethane			<0.20		ppb(V)		0.2	16-NOV-21

Quality Control Report

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
TO15-GCMS-WT	**Canister**							
Batch R5653197								
WG3660644-1 MB								
1,1,2,2-Tetrachloroethane			<0.20		ppb(V)		0.2	16-NOV-21
1,1,2-Trichloroethane			<0.20		ppb(V)		0.2	16-NOV-21
1,1-Dichloroethane			<0.20		ppb(V)		0.2	16-NOV-21
1,1-Dichloroethene			<0.20		ppb(V)		0.2	16-NOV-21
1,2,4-Trichlorobenzene			<0.20		ppb(V)		0.2	16-NOV-21
1,2,4-Trimethylbenzene			<0.20		ppb(V)		0.2	16-NOV-21
1,2-Dibromoethane			<0.20		ppb(V)		0.2	16-NOV-21
1,2-Dichlorobenzene			<0.20		ppb(V)		0.2	16-NOV-21
1,2-Dichloroethane			<0.20		ppb(V)		0.2	16-NOV-21
1,2-Dichloropropane			<0.20		ppb(V)		0.2	16-NOV-21
1,3,5-Trimethylbenzene			<0.20		ppb(V)		0.2	16-NOV-21
1,3-Butadiene			<0.20		ppb(V)		0.2	16-NOV-21
1,3-Dichlorobenzene			<0.20		ppb(V)		0.2	16-NOV-21
1,4-Dichlorobenzene			<0.20		ppb(V)		0.2	16-NOV-21
1,4-Dioxane			<0.20		ppb(V)		0.2	16-NOV-21
2-Hexanone			<1.0		ppb(V)		1	16-NOV-21
4-Ethyltoluene			<0.20		ppb(V)		0.2	16-NOV-21
Acetone			<0.50		ppb(V)		0.5	16-NOV-21
Allyl chloride			<0.20		ppb(V)		0.2	16-NOV-21
Benzene			<0.10		ppb(V)		0.1	16-NOV-21
Benzyl chloride			<0.20		ppb(V)		0.2	16-NOV-21
Bromodichloromethane			<0.20		ppb(V)		0.2	16-NOV-21
Bromoform			<0.20		ppb(V)		0.2	16-NOV-21
Bromomethane			<0.20		ppb(V)		0.2	16-NOV-21
Carbon Disulfide			<0.20		ppb(V)		0.2	16-NOV-21
Carbon Tetrachloride			<0.20		ppb(V)		0.2	16-NOV-21
Chlorobenzene			<0.20		ppb(V)		0.2	16-NOV-21
Chloroethane			<0.20		ppb(V)		0.2	16-NOV-21
Chloroform			<0.20		ppb(V)		0.2	16-NOV-21
Chloromethane			<0.20		ppb(V)		0.2	16-NOV-21
cis-1,2-Dichloroethene			<0.20		ppb(V)		0.2	16-NOV-21
cis-1,3-Dichloropropene			<0.20		ppb(V)		0.2	16-NOV-21
Cyclohexane			<0.20		ppb(V)		0.2	16-NOV-21
Dibromochloromethane			<0.20		ppb(V)		0.2	16-NOV-21

Quality Control Report

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
TO15-GCMS-WT	**Canister**							
Batch	**R5653197**							
WG3660644-1	**MB**							
Dichlorodifluoromethane			<0.20		ppb(V)		0.2	16-NOV-21
Ethyl acetate			<0.20		ppb(V)		0.2	16-NOV-21
Ethylbenzene			<0.20		ppb(V)		0.2	16-NOV-21
Freon 113			<0.20		ppb(V)		0.2	16-NOV-21
Freon 114			<0.20		ppb(V)		0.2	16-NOV-21
Hexachlorobutadiene			<0.20		ppb(V)		0.2	16-NOV-21
Isooctane			<0.20		ppb(V)		0.2	16-NOV-21
Isopropylbenzene			<0.20		ppb(V)		0.2	16-NOV-21
m&p-Xylene			<0.40		ppb(V)		0.4	16-NOV-21
Methyl ethyl ketone			<0.20		ppb(V)		0.2	16-NOV-21
Methyl isobutyl ketone			<0.20		ppb(V)		0.2	16-NOV-21
Methylene chloride			<0.20		ppb(V)		0.2	16-NOV-21
MTBE			<0.20		ppb(V)		0.2	16-NOV-21
n-Heptane			<0.20		ppb(V)		0.2	16-NOV-21
n-Hexane			<0.20		ppb(V)		0.2	16-NOV-21
Naphthalene			<0.20		ppb(V)		0.2	16-NOV-21
o-Xylene			<0.20		ppb(V)		0.2	16-NOV-21
Propylene			<0.20		ppb(V)		0.2	16-NOV-21
Styrene			<0.20		ppb(V)		0.2	16-NOV-21
Tetrachloroethylene			<0.20		ppb(V)		0.2	16-NOV-21
Tetrahydrofuran			<0.20		ppb(V)		0.2	16-NOV-21
Toluene			<0.20		ppb(V)		0.2	16-NOV-21
trans-1,2-Dichloroethene			<0.20		ppb(V)		0.2	16-NOV-21
trans-1,3-Dichloropropene			<0.20		ppb(V)		0.2	16-NOV-21
Trichloroethylene			<0.20		ppb(V)		0.2	16-NOV-21
Trichlorofluoromethane			<0.20		ppb(V)		0.2	16-NOV-21
Vinyl acetate			<0.50		ppb(V)		0.5	16-NOV-21
Vinyl bromide			<0.20		ppb(V)		0.2	16-NOV-21
Vinyl chloride			<0.20		ppb(V)		0.2	16-NOV-21
Surrogate: 4-Bromofluorobenzene			89.7		%		50-150	16-NOV-21

Quality Control Report

Legend:

Limit	ALS Control Limit (Data Quality Objectives)
DUP	Duplicate
RPD	Relative Percent Difference
N/A	Not Available
LCS	Laboratory Control Sample
SRM	Standard Reference Material
MS	Matrix Spike
MSD	Matrix Spike Duplicate
ADE	Average Desorption Efficiency
MB	Method Blank
IRM	Internal Reference Material
CRM	Certified Reference Material
CCV	Continuing Calibration Verification
CVS	Calibration Verification Standard
LCSD	Laboratory Control Sample Duplicate

Sample Parameter Qualifier Definitions:

Qualifier	Description
RPD-NA	Relative Percent Difference Not Available due to result(s) being less than detection limit.

Hold Time Exceedances:

All test results reported with this submission were conducted within ALS recommended hold times.

ALS recommended hold times may vary by province. They are assigned to meet known provincial and/or federal government requirements. In the absence of regulatory hold times, ALS establishes recommendations based on guidelines published by the US EPA, APHA Standard Methods, or Environment Canada (where available). For more information, please contact ALS.

The ALS Quality Control Report is provided to ALS clients upon request. ALS includes comprehensive QC checks with every analysis to ensure our high standards of quality are met. Each QC result has a known or expected target value, which is compared against pre-determined data quality objectives to provide confidence in the accuracy of associated test results.

Please note that this report may contain QC results from anonymous Sample Duplicates and Matrix Spikes that do not originate from this Work Order.

Batch Proof Report

Batch ID	Canister ID	Parameters	Value	Units	Date	Analyst
210629.123	06000-0210	1,1,1-Trichloroethane	<0.02	ppb(V)	14-Jul-21	SA10
210629.123	06000-0210	1,1,1,2-Tetrachloroethane	<0.02	ppb(V)	14-Jul-21	SA10
210629.123	06000-0210	1,1,2,2-Tetrachloroethane	<0.02	ppb(V)	14-Jul-21	SA10
210629.123	06000-0210	1,1,2-Trichloroethane	<0.02	ppb(V)	14-Jul-21	SA10
210629.123	06000-0210	1,1-Dichloroethane	<0.02	ppb(V)	14-Jul-21	SA10
210629.123	06000-0210	1,1-Dichloroethene	<0.02	ppb(V)	14-Jul-21	SA10
210629.123	06000-0210	1,2,4-Trichlorobenzene	<0.20	ppb(V)	14-Jul-21	SA10
210629.123	06000-0210	1,2,4-Trimethylbenzene	<0.20	ppb(V)	14-Jul-21	SA10
210629.123	06000-0210	1,2-Dibromoethane	<0.01	ppb(V)	14-Jul-21	SA10
210629.123	06000-0210	1,2-Dichlorobenzene	<0.02	ppb(V)	14-Jul-21	SA10
210629.123	06000-0210	1,2-Dichloroethane	<0.01	ppb(V)	14-Jul-21	SA10
210629.123	06000-0210	1,2-Dichloropropane	<0.02	ppb(V)	14-Jul-21	SA10
210629.123	06000-0210	1,3,5-Trimethylbenzene	<0.20	ppb(V)	14-Jul-21	SA10
210629.123	06000-0210	1,3-Butadiene	<0.20	ppb(V)	14-Jul-21	SA10
210629.123	06000-0210	1,3-Dichlorobenzene	<0.02	ppb(V)	14-Jul-21	SA10
210629.123	06000-0210	1,4-Dichlorobenzene	<0.02	ppb(V)	14-Jul-21	SA10
210629.123	06000-0210	1,4-Dioxane	<0.20	ppb(V)	14-Jul-21	SA10
210629.123	06000-0210	2-Chlorophenol	<0.20	ppb(V)	14-Jul-21	SA10
210629.123	06000-0210	2-Hexanone	<1.0	ppb(V)	14-Jul-21	SA10
210629.123	06000-0210	4-Ethyltoluene	<0.20	ppb(V)	14-Jul-21	SA10
210629.123	06000-0210	Acetone	<0.50	ppb(V)	14-Jul-21	SA10
210629.123	06000-0210	Acrolein	<0.10	ppb(V)	14-Jul-21	SA10
210629.123	06000-0210	Allyl Chloride	<0.20	ppb(V)	14-Jul-21	SA10
210629.123	06000-0210	Benzene	<0.02	ppb(V)	14-Jul-21	SA10
210629.123	06000-0210	Benzyl Chloride	<0.20	ppb(V)	14-Jul-21	SA10
210629.123	06000-0210	Bromodichloromethane	<0.20	ppb(V)	14-Jul-21	SA10
210629.123	06000-0210	Bromobenzene	<0.20	ppb(V)	14-Jul-21	SA10
210629.123	06000-0210	Bromoform	<0.02	ppb(V)	14-Jul-21	SA10
210629.123	06000-0210	Bromomethane	<0.20	ppb(V)	14-Jul-21	SA10
210629.123	06000-0210	Carbon Disulfide	<0.20	ppb(V)	14-Jul-21	SA10
210629.123	06000-0210	Carbon Tetrachloride	<0.02	ppb(V)	14-Jul-21	SA10
210629.123	06000-0210	Chlorobenzene	<0.20	ppb(V)	14-Jul-21	SA10
210629.123	06000-0210	Chloroethane	<0.02	ppb(V)	14-Jul-21	SA10
210629.123	06000-0210	Chloroform	<0.02	ppb(V)	14-Jul-21	SA10
210629.123	06000-0210	Chloromethane	<0.20	ppb(V)	14-Jul-21	SA10
210629.123	06000-0210	cis-1,2-Dichloroethene	<0.02	ppb(V)	14-Jul-21	SA10
210629.123	06000-0210	cis-1,3-Dichloropropene	<0.02	ppb(V)	14-Jul-21	SA10
210629.123	06000-0210	Cyclohexane	<0.20	ppb(V)	14-Jul-21	SA10
210629.123	06000-0210	Dibromochloromethane	<0.20	ppb(V)	14-Jul-21	SA10
210629.123	06000-0210	Dichlorodifluoromethane	<0.20	ppb(V)	14-Jul-21	SA10
210629.123	06000-0210	Ethyl Acetate	<0.20	ppb(V)	14-Jul-21	SA10
210629.123	06000-0210	Ethyl Benzene	<0.02	ppb(V)	14-Jul-21	SA10
210629.123	06000-0210	Freon 113	<0.20	ppb(V)	14-Jul-21	SA10
210629.123	06000-0210	Freon 114	<0.20	ppb(V)	14-Jul-21	SA10
210629.123	06000-0210	Hexachlorobutadiene	<0.02	ppb(V)	14-Jul-21	SA10
210629.123	06000-0210	Isooctane	<0.20	ppb(V)	14-Jul-21	SA10
210629.123	06000-0210	Isopropyl Alcohol	<1.0	ppb(V)	14-Jul-21	SA10
210629.123	06000-0210	Isopropylbenzene	<0.20	ppb(V)	14-Jul-21	SA10
210629.123	06000-0210	m&p-Xylene	<0.04	ppb(V)	14-Jul-21	SA10
210629.123	06000-0210	Methyl Ethyl Ketone	<0.20	ppb(V)	14-Jul-21	SA10
210629.123	06000-0210	Methylcyclohexane	<0.20	ppb(V)	14-Jul-21	SA10
210629.123	06000-0210	Methyl Isobutyl Ketone	<0.20	ppb(V)	14-Jul-21	SA10
210629.123	06000-0210	Methylene Chloride	0.0237	ppb(V)	14-Jul-21	SA10
210629.123	06000-0210	MTBE	<0.20	ppb(V)	14-Jul-21	SA10
210629.123	06000-0210	Naphthalene	<0.05	ppb(V)	14-Jul-21	SA10
210629.123	06000-0210	n-Decane	<0.20	ppb(V)	14-Jul-21	SA10
210629.123	06000-0210	n-Heptane	<0.20	ppb(V)	14-Jul-21	SA10
210629.123	06000-0210	n-Hexane	<0.02	ppb(V)	14-Jul-21	SA10
210629.123	06000-0210	o-Xylene	<0.02	ppb(V)	14-Jul-21	SA10
210629.123	06000-0210	Propylene	<0.20	ppb(V)	14-Jul-21	SA10
210629.123	06000-0210	Styrene	<0.02	ppb(V)	14-Jul-21	SA10
210629.123	06000-0210	Tetrachloroethylene	<0.02	ppb(V)	14-Jul-21	SA10
210629.123	06000-0210	Tetrahydrofuran	<0.20	ppb(V)	14-Jul-21	SA10
210629.123	06000-0210	Toluene	<0.02	ppb(V)	14-Jul-21	SA10
210629.123	06000-0210	trans-1,2-Dichloroethene	<0.02	ppb(V)	14-Jul-21	SA10
210629.123	06000-0210	trans-1,3-Dichloropropene	<0.02	ppb(V)	14-Jul-21	SA10
210629.123	06000-0210	Trichloroethylene	0.1317	ppb(V)	14-Jul-21	SA10

210629.123	06000-0210	Trichlorofluoromethane	<0.20	ppb(V)	14-Jul-21	SA10
210629.123	06000-0210	Vinyl Acetate	<0.50	ppb(V)	14-Jul-21	SA10
210629.123	06000-0210	Vinyl Bromide	<0.20	ppb(V)	14-Jul-21	SA10
210629.123	06000-0210	Vinyl Chloride	<0.02	ppb(V)	14-Jul-21	SA10
210629.123	06000-0210	4-Bromofluorobenzene	92.8	%	14-Jul-21	SA10

Batch Proof Report

Batch ID	Canister ID	Parameters	Value	Units	Date	Analyst
210820.203	06000-0066	1,1,1-Trichloroethane	<0.02	ppb(V)	26-Aug-21	SA10
210820.203	06000-0066	1,1,1,2-Tetrachloroethane	<0.02	ppb(V)	26-Aug-21	SA10
210820.203	06000-0066	1,1,2,2-Tetrachloroethane	<0.02	ppb(V)	26-Aug-21	SA10
210820.203	06000-0066	1,1,2-Trichloroethane	<0.02	ppb(V)	26-Aug-21	SA10
210820.203	06000-0066	1,1-Dichloroethane	<0.02	ppb(V)	26-Aug-21	SA10
210820.203	06000-0066	1,1-Dichloroethene	<0.02	ppb(V)	26-Aug-21	SA10
210820.203	06000-0066	1,2,4-Trichlorobenzene	<0.20	ppb(V)	26-Aug-21	SA10
210820.203	06000-0066	1,2,4-Trimethylbenzene	<0.20	ppb(V)	26-Aug-21	SA10
210820.203	06000-0066	1,2-Dibromoethane	<0.01	ppb(V)	26-Aug-21	SA10
210820.203	06000-0066	1,2-Dichlorobenzene	<0.02	ppb(V)	26-Aug-21	SA10
210820.203	06000-0066	1,2-Dichloroethane	<0.01	ppb(V)	26-Aug-21	SA10
210820.203	06000-0066	1,2-Dichloropropane	<0.02	ppb(V)	26-Aug-21	SA10
210820.203	06000-0066	1,3,5-Trimethylbenzene	<0.20	ppb(V)	26-Aug-21	SA10
210820.203	06000-0066	1,3-Butadiene	<0.20	ppb(V)	26-Aug-21	SA10
210820.203	06000-0066	1,3-Dichlorobenzene	<0.02	ppb(V)	26-Aug-21	SA10
210820.203	06000-0066	1,4-Dichlorobenzene	<0.02	ppb(V)	26-Aug-21	SA10
210820.203	06000-0066	1,4-Dioxane	<0.20	ppb(V)	26-Aug-21	SA10
210820.203	06000-0066	2-Chlorophenol	<0.20	ppb(V)	26-Aug-21	SA10
210820.203	06000-0066	2-Hexanone	<1.0	ppb(V)	26-Aug-21	SA10
210820.203	06000-0066	4-Ethyltoluene	<0.20	ppb(V)	26-Aug-21	SA10
210820.203	06000-0066	Acetone	<0.50	ppb(V)	26-Aug-21	SA10
210820.203	06000-0066	Acrolein	<0.10	ppb(V)	26-Aug-21	SA10
210820.203	06000-0066	Allyl Chloride	<0.20	ppb(V)	26-Aug-21	SA10
210820.203	06000-0066	Benzene	<0.02	ppb(V)	26-Aug-21	SA10
210820.203	06000-0066	Benzyl Chloride	<0.20	ppb(V)	26-Aug-21	SA10
210820.203	06000-0066	Bromodichloromethane	<0.20	ppb(V)	26-Aug-21	SA10
210820.203	06000-0066	Bromobenzene	<0.20	ppb(V)	26-Aug-21	SA10
210820.203	06000-0066	Bromoform	<0.02	ppb(V)	26-Aug-21	SA10
210820.203	06000-0066	Bromomethane	<0.20	ppb(V)	26-Aug-21	SA10
210820.203	06000-0066	Carbon Disulfide	<0.20	ppb(V)	26-Aug-21	SA10
210820.203	06000-0066	Carbon Tetrachloride	<0.02	ppb(V)	26-Aug-21	SA10
210820.203	06000-0066	Chlorobenzene	<0.20	ppb(V)	26-Aug-21	SA10
210820.203	06000-0066	Chloroethane	<0.02	ppb(V)	26-Aug-21	SA10
210820.203	06000-0066	Chloroform	<0.02	ppb(V)	26-Aug-21	SA10
210820.203	06000-0066	Chloromethane	<0.20	ppb(V)	26-Aug-21	SA10
210820.203	06000-0066	cis-1,2-Dichloroethene	<0.02	ppb(V)	26-Aug-21	SA10
210820.203	06000-0066	cis-1,3-Dichloropropene	<0.02	ppb(V)	26-Aug-21	SA10
210820.203	06000-0066	Cyclohexane	<0.20	ppb(V)	26-Aug-21	SA10
210820.203	06000-0066	Dibromochloromethane	<0.20	ppb(V)	26-Aug-21	SA10
210820.203	06000-0066	Dichlorodifluoromethane	<0.20	ppb(V)	26-Aug-21	SA10
210820.203	06000-0066	Ethyl Acetate	<0.20	ppb(V)	26-Aug-21	SA10
210820.203	06000-0066	Ethyl Benzene	<0.02	ppb(V)	26-Aug-21	SA10
210820.203	06000-0066	Freon 113	<0.20	ppb(V)	26-Aug-21	SA10
210820.203	06000-0066	Freon 114	<0.20	ppb(V)	26-Aug-21	SA10
210820.203	06000-0066	Hexachlorobutadiene	<0.02	ppb(V)	26-Aug-21	SA10
210820.203	06000-0066	Isooctane	<0.20	ppb(V)	26-Aug-21	SA10
210820.203	06000-0066	Isopropyl Alcohol	<1.0	ppb(V)	26-Aug-21	SA10
210820.203	06000-0066	Isopropylbenzene	<0.20	ppb(V)	26-Aug-21	SA10
210820.203	06000-0066	m&p-Xylene	<0.04	ppb(V)	26-Aug-21	SA10
210820.203	06000-0066	Methyl Ethyl Ketone	<0.20	ppb(V)	26-Aug-21	SA10
210820.203	06000-0066	Methylcyclohexane	<0.20	ppb(V)	26-Aug-21	SA10
210820.203	06000-0066	Methyl Isobutyl Ketone	<0.20	ppb(V)	26-Aug-21	SA10
210820.203	06000-0066	Methylene Chloride	<0.02	ppb(V)	26-Aug-21	SA10
210820.203	06000-0066	MTBE	<0.20	ppb(V)	26-Aug-21	SA10
210820.203	06000-0066	Naphthalene	<0.05	ppb(V)	26-Aug-21	SA10
210820.203	06000-0066	n-Decane	<0.20	ppb(V)	26-Aug-21	SA10
210820.203	06000-0066	n-Heptane	<0.20	ppb(V)	26-Aug-21	SA10
210820.203	06000-0066	n-Hexane	<0.02	ppb(V)	26-Aug-21	SA10
210820.203	06000-0066	o-Xylene	<0.02	ppb(V)	26-Aug-21	SA10
210820.203	06000-0066	Propylene	<0.20	ppb(V)	26-Aug-21	SA10
210820.203	06000-0066	Styrene	<0.02	ppb(V)	26-Aug-21	SA10
210820.203	06000-0066	Tetrachloroethylene	<0.02	ppb(V)	26-Aug-21	SA10
210820.203	06000-0066	Tetrahydrofuran	<0.20	ppb(V)	26-Aug-21	SA10
210820.203	06000-0066	Toluene	<0.02	ppb(V)	26-Aug-21	SA10
210820.203	06000-0066	trans-1,2-Dichloroethene	<0.02	ppb(V)	26-Aug-21	SA10
210820.203	06000-0066	trans-1,3-Dichloropropene	<0.02	ppb(V)	26-Aug-21	SA10
210820.203	06000-0066	Trichloroethylene	<0.02	ppb(V)	26-Aug-21	SA10

210820.203	06000-0066	Trichlorofluoromethane	<0.20	ppb(V)	26-Aug-21	SA10
210820.203	06000-0066	Vinyl Acetate	<0.50	ppb(V)	26-Aug-21	SA10
210820.203	06000-0066	Vinyl Bromide	<0.20	ppb(V)	26-Aug-21	SA10
210820.203	06000-0066	Vinyl Chloride	<0.02	ppb(V)	26-Aug-21	SA10
210820.203	06000-0066	4-Bromofluorobenzene	98.4	%	26-Aug-21	SA10

Batch Proof Report

Batch ID	Canister ID	Parameters	Value	Units	Date	Analyst
210913.12	06000-0004	1,1,1-Trichloroethane	<0.02	ppb(V)	20-Sep-21	SA10
210913.12	06000-0004	1,1,1,2-Tetrachloroethane	<0.02	ppb(V)	20-Sep-21	SA10
210913.12	06000-0004	1,1,2,2-Tetrachloroethane	<0.02	ppb(V)	20-Sep-21	SA10
210913.12	06000-0004	1,1,2-Trichloroethane	<0.02	ppb(V)	20-Sep-21	SA10
210913.12	06000-0004	1,1-Dichloroethane	<0.02	ppb(V)	20-Sep-21	SA10
210913.12	06000-0004	1,1-Dichloroethene	<0.02	ppb(V)	20-Sep-21	SA10
210913.12	06000-0004	1,2,4-Trichlorobenzene	<0.20	ppb(V)	20-Sep-21	SA10
210913.12	06000-0004	1,2,4-Trimethylbenzene	<0.20	ppb(V)	20-Sep-21	SA10
210913.12	06000-0004	1,2-Dibromoethane	<0.01	ppb(V)	20-Sep-21	SA10
210913.12	06000-0004	1,2-Dichlorobenzene	<0.02	ppb(V)	20-Sep-21	SA10
210913.12	06000-0004	1,2-Dichloroethane	<0.01	ppb(V)	20-Sep-21	SA10
210913.12	06000-0004	1,2-Dichloropropane	<0.02	ppb(V)	20-Sep-21	SA10
210913.12	06000-0004	1,3,5-Trimethylbenzene	<0.20	ppb(V)	20-Sep-21	SA10
210913.12	06000-0004	1,3-Butadiene	<0.20	ppb(V)	20-Sep-21	SA10
210913.12	06000-0004	1,3-Dichlorobenzene	<0.02	ppb(V)	20-Sep-21	SA10
210913.12	06000-0004	1,4-Dichlorobenzene	<0.02	ppb(V)	20-Sep-21	SA10
210913.12	06000-0004	1,4-Dioxane	<0.20	ppb(V)	20-Sep-21	SA10
210913.12	06000-0004	2-Chlorophenol	<0.20	ppb(V)	20-Sep-21	SA10
210913.12	06000-0004	2-Hexanone	<1.0	ppb(V)	20-Sep-21	SA10
210913.12	06000-0004	4-Ethyltoluene	<0.20	ppb(V)	20-Sep-21	SA10
210913.12	06000-0004	Acetone	<0.50	ppb(V)	20-Sep-21	SA10
210913.12	06000-0004	Acrolein	<0.10	ppb(V)	20-Sep-21	SA10
210913.12	06000-0004	Allyl Chloride	<0.20	ppb(V)	20-Sep-21	SA10
210913.12	06000-0004	Benzene	<0.02	ppb(V)	20-Sep-21	SA10
210913.12	06000-0004	Benzyl Chloride	<0.20	ppb(V)	20-Sep-21	SA10
210913.12	06000-0004	Bromodichloromethane	<0.20	ppb(V)	20-Sep-21	SA10
210913.12	06000-0004	Bromobenzene	<0.20	ppb(V)	20-Sep-21	SA10
210913.12	06000-0004	Bromoform	<0.02	ppb(V)	20-Sep-21	SA10
210913.12	06000-0004	Bromomethane	<0.20	ppb(V)	20-Sep-21	SA10
210913.12	06000-0004	Carbon Disulfide	<0.20	ppb(V)	20-Sep-21	SA10
210913.12	06000-0004	Carbon Tetrachloride	<0.02	ppb(V)	20-Sep-21	SA10
210913.12	06000-0004	Chlorobenzene	<0.20	ppb(V)	20-Sep-21	SA10
210913.12	06000-0004	Chloroethane	<0.02	ppb(V)	20-Sep-21	SA10
210913.12	06000-0004	Chloroform	<0.02	ppb(V)	20-Sep-21	SA10
210913.12	06000-0004	Chloromethane	<0.20	ppb(V)	20-Sep-21	SA10
210913.12	06000-0004	cis-1,2-Dichloroethene	<0.02	ppb(V)	20-Sep-21	SA10
210913.12	06000-0004	cis-1,3-Dichloropropene	<0.02	ppb(V)	20-Sep-21	SA10
210913.12	06000-0004	Cyclohexane	<0.20	ppb(V)	20-Sep-21	SA10
210913.12	06000-0004	Dibromochloromethane	<0.20	ppb(V)	20-Sep-21	SA10
210913.12	06000-0004	Dichlorodifluoromethane	<0.20	ppb(V)	20-Sep-21	SA10
210913.12	06000-0004	Ethyl Acetate	<0.20	ppb(V)	20-Sep-21	SA10
210913.12	06000-0004	Ethyl Benzene	<0.02	ppb(V)	20-Sep-21	SA10
210913.12	06000-0004	Freon 113	<0.20	ppb(V)	20-Sep-21	SA10
210913.12	06000-0004	Freon 114	<0.20	ppb(V)	20-Sep-21	SA10
210913.12	06000-0004	Hexachlorobutadiene	<0.02	ppb(V)	20-Sep-21	SA10
210913.12	06000-0004	Isooctane	<0.20	ppb(V)	20-Sep-21	SA10
210913.12	06000-0004	Isopropyl Alcohol	<1.0	ppb(V)	20-Sep-21	SA10
210913.12	06000-0004	Isopropylbenzene	<0.20	ppb(V)	20-Sep-21	SA10
210913.12	06000-0004	m&p-Xylene	<0.04	ppb(V)	20-Sep-21	SA10
210913.12	06000-0004	Methyl Ethyl Ketone	<0.20	ppb(V)	20-Sep-21	SA10
210913.12	06000-0004	Methylcyclohexane	<0.20	ppb(V)	20-Sep-21	SA10
210913.12	06000-0004	Methyl Isobutyl Ketone	<0.20	ppb(V)	20-Sep-21	SA10
210913.12	06000-0004	Methylene Chloride	<0.02	ppb(V)	20-Sep-21	SA10
210913.12	06000-0004	MTBE	<0.20	ppb(V)	20-Sep-21	SA10
210913.12	06000-0004	Naphthalene	<0.05	ppb(V)	20-Sep-21	SA10
210913.12	06000-0004	n-Decane	<0.20	ppb(V)	20-Sep-21	SA10
210913.12	06000-0004	n-Heptane	<0.20	ppb(V)	20-Sep-21	SA10
210913.12	06000-0004	n-Hexane	<0.02	ppb(V)	20-Sep-21	SA10
210913.12	06000-0004	o-Xylene	<0.02	ppb(V)	20-Sep-21	SA10
210913.12	06000-0004	Propylene	<0.20	ppb(V)	20-Sep-21	SA10
210913.12	06000-0004	Styrene	<0.02	ppb(V)	20-Sep-21	SA10
210913.12	06000-0004	Tetrachloroethylene	<0.02	ppb(V)	20-Sep-21	SA10
210913.12	06000-0004	Tetrahydrofuran	<0.20	ppb(V)	20-Sep-21	SA10
210913.12	06000-0004	Toluene	<0.02	ppb(V)	20-Sep-21	SA10
210913.12	06000-0004	trans-1,2-Dichloroethene	<0.02	ppb(V)	20-Sep-21	SA10
210913.12	06000-0004	trans-1,3-Dichloropropene	<0.02	ppb(V)	20-Sep-21	SA10
210913.12	06000-0004	Trichloroethylene	<0.02	ppb(V)	20-Sep-21	SA10
210913.12	06000-0004	Trichlorofluoromethane	<0.20	ppb(V)	20-Sep-21	SA10
210913.12	06000-0004	Vinyl Acetate	<0.50	ppb(V)	20-Sep-21	SA10

210913.12	06000-0004	Vinyl Bromide	<0.20	ppb(V)	20-Sep-21	SA10
210913.12	06000-0004	Vinyl Chloride	<0.02	ppb(V)	20-Sep-21	SA10
210913.12	06000-0004	4-Bromofluorobenzene	98.7	%	20-Sep-21	SA10

60 NORTHLAND ROAD, UNIT 1
WATERLOO, ON N2V 2B8
Phone: (519) 886-6910
Fax: (519) 886-9047
Toll Free: 1-800-668-9878

AIR QUALITY CHAIN OF CUSTODY FORM - Canister/Tube/Gas Bag

Note: All TAT Quoted is in **business days** which exclude statutory holidays and weekends. TAT of samples received **past 3:00 pm or Saturday / Sunday** begin the next day.

DATE REQUIRED

SERVICE REQUESTED
- 10 day (regular) ☑
- Rush 5 day (50%) ☐
- Rush 3 day (100%) ☐
- Rush 2 day (200%) ☐
- Rush 1 day (300%) - Enquire ☐

All rush work requires lab approval before sample submission

COMPANY NAME	RWDI
OFFICE	2239 Star Ct, Rochester Hills, MI
PROJECT MANAGER	Mason Sakshaug
PROJECT #	2200515
PHONE	FAX
ACCOUNT #	
QUOTATION #	PO #

REGULATION
CRITERIA
OTHER INFORMATION

REPORT FORMAT/DISTRIBUTION

EMAIL ✓ FAX ____ BOTH ____
SELECT: PDF ____ DIGITAL ____ BOTH ____
EMAIL 1 Mason.Sakshaug@RWDI.com
EMAIL 2 Ben.Durham@RWDI.com

SUBMISSION #: L2659780
ENTERED BY: R
DATE/TIME ENTERED:
BIN #:

ANALYSIS REQUEST

SAMPLING INFORMATION

Sample Date/Time: Date (dd-mmm-yy)	Time (24hr) (hh:mm)	Canister or Tube ID# (e.g. 060000-XXXX or G0XXXXXXSVI)	Regulator Serial # CS1200-XXXX or GXX	Matrix Type	SAMPLE DESCRIPTION TO APPEAR ON REPORT	TUBE AIR VOLUME - L ☐ or m³ ☐	TO-15	Recycle					STARTING PRESSURE - Pre-Sampling ("Hg)	ENDING PRESSURE - Post Sampling ("Hg)	COLLECTION TIME (HRS)	Field Conditions (Rain/Wind/Dust/Odour) Field PID Reading	LAB ID
10-26-21	12:00	06000-0182	02892	AA	Eco Waste - Incinerator - T1	6	✓						29"	7"	4:10	AA	
10-27-21	12:00	06000-0437	04292	AA	Eco Waste - Incinerator - T2	6	✓						29"	16"	4:00	AA	
10-28-21	12:00	060000-0388	02896	AA	Eco Waste - Incinerator - T3	6	✓						30"	16"	4:00	AA	
N/A	N/A	060000-0525	N/A	NA	N/A	6	✓	✓					—	—	—	N/A	

L2659780-COFC

SPECIAL INSTRUCTIONS/COMMENTS

This Chain of Custody Form ... quality Samples

Matrix Type

Soil Gas Vapour = SG
Ambient Air = AA
Indoor Air = IA
Industrial Hygiene = IH

SAMPLE CONDITION AS RECEIVED

FROZEN ☐
COLD ☐
COOLING INITIATED ☐
AMBIENT ☐
MEAN TEMP

SAMPLED BY: Mason Sakshaug	DATE & TIME 11-3-21 14:25	RECEIVED BY:	DATE & TIME	OBSERVATIONS Yes ☐ No ☐ If yes add SIF
RELINQUISHED BY: Benjamin Durham	DATE & TIME 11-3-21 14:25	RECEIVED AT LAB BY: AP	DATE & TIME NOV 4 21 17:00	INIT

Notes

1. Quote number must be provided to ensure proper pricing

2. TAT may vary dependent on complexity of analysis and lab workload at time of submission. Please contact the lab to confirm TATs.

3. Any known or suspected hazards relating to a sample must be noted on the chain of custody in comments section.

APPENDIX J

Example Calculations

1 Volume of Water Vapor at Standard Conditions, scf

$$V_{wstd} = 0.04707 * V_{lc}$$

2 Percent Moisture, By Volume, as measured in Flue Gas, %

$$\%\ H_2O = 100 * V_{wstd} / (V_{wstd} + V_{mstd})$$

3 Absolute Flue Gas Pressure, Inches of Mercury

$$P_s = P_{Br} + P_g / 13.6$$

4 Percent Moisture Saturation at Flue Gas Conditions, %

$$\%\ H_2O_{sat} = (10^{(6.6911-(3144/(ts+390.86)))})* 100 / P_s$$

5 Dry Mole Fraction of Flue Gas

$$M_{fd} = 1 -(\%\ H_2O / 100)$$

6 Dry Molecular Weight of Flue Gas, lb/lb-mole

$$M_d = 44 * \%CO_2 / 100 + 32 * \%O_2 / 100 + 28 *(100 - \%CO_2 - \%O_2)$$

7 Wet Molecular Weight of the Flue Gas, lb/lb-mole

$$M_s = M_d * M_{fd} + 18 * \%\ H_2O / 100$$

8 Average Flue Gas Velocity, ft/sec

$$v_s = 85.49 * C_p *[(460 + t_s)* \Delta P_{avg} /(P_s * M_s)]^{0.5}$$

9 Dry Volumetric Flue Gas Flow Rate at Standard Conditions, dscfm

$$Q_{sd} = \frac{60 * M_{fd} * (t_{std} + 460)* P_s * v_s * A_s}{(t_s + 460)* P_{std}}$$

10 Dry Volumetric Flue Gas Flow Rate at Standard Conditions, dscmm

$$Q_{msd} = Q_{sd} * 0.02832$$

11 Actual Wet Volumetric Flue Gas Flow Rate at Actual Conditions, acfm

$$Q_{aw} = 60 * v_s * A_s$$

12 Dry Air Flow Rate at Standard Conditions, lb/hr

$$Q_{lb} = \frac{60 * Q_{sd} * M_d *(460 + t_{std})}{(528 * 385.3)}$$

13 Oxygen Correction to 7%

$$C_{s(7\%O2)} = 14*C_{(@actO2)} / 21 - \%O_2$$