AFRL-RQ-WP-TR-2014-0226

RAPID RESPONSE RESEARCH AND DEVELOPMENT (R&D) FOR THE AEROSPACE SYSTEMS DIRECTORATE

Delivery Order 0021: Engineering Research and Technical Analyses of Advanced Airbreathing Propulsion Fuels

Subtask: Fit-For-Purpose (FFP) and Dynamic Seal Testing of Alternative Aviation Fuels

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Southwest Research Institute (SwRI®)

AUGUST 2014
Interim Report

AIR FORCE RESEARCH LABORATORY
AEROSPACE SYSTEMS DIRECTORATE
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AIR FORCE MATERIEL COMMAND
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REPORT DOCUMENTATION PAGE

Form Approved
OMB No. 0704-0188

1. REPORT DATE *(DD-MM-YY)*	2. REPORT TYPE	3. DATES COVERED *(From - To)*
August 2014	Interim	06 December 2011 – 22 July 2014

4. TITLE AND SUBTITLE

RAPID RESPONSE RESEARCH AND DEVELOPMENT (R&D) FOR THE AEROSPACE SYSTEMS DIRECTORATE
Delivery Order 0021: Engineering Research and Technical Analyses of Advanced Airbreathing Propulsion Fuels
Subtask: Fit-For-Purpose (FFP) and Dynamic Seal Testing of Alternative Aviation Fuels

5a. CONTRACT NUMBER
FA8650-08-D-2806-0021

5b. GRANT NUMBER

5c. PROGRAM ELEMENT NUMBER
63216F

6. AUTHOR(S)
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5d. PROJECT NUMBER
2480

5e. TASK NUMBER

5f. WORK UNIT NUMBER
Q0SJ

7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)

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Southwest Research Institute
6220 Culebra Road
San Antonio, TX 78228

For:
Universal Technology Corporation
1270 N. Fairfield Road
Dayton, OH, 45432-2600

8. PERFORMING ORGANIZATION REPORT NUMBER
08.17149

9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)
Air Force Research Laboratory
Aerospace Systems Directorate
Wright-Patterson Air Force Base, OH 45433-7541
Air Force Materiel Command
United States Air Force

10. SPONSORING/MONITORING AGENCY ACRONYM(S)
AFRL/RQTF

11. SPONSORING/MONITORING AGENCY REPORT NUMBER(S)
AFRL-RQ-WP-TR-2014-0226

12. DISTRIBUTION/AVAILABILITY STATEMENT
Approved for public release; distribution unlimited.

13. SUPPLEMENTARY NOTES
PA Case Number: 88ABW-2014-4441; Clearance Date: 24 Sep 2014.

14. ABSTRACT
Alternative aviation fuels derived from a number of emerging synthetic pathways were subjected to fit-for-purpose analysis and other specification testing. The fuels included in the study were of the type: direct sugar-to-hydrocarbon (DSHC), alcohol-to-jet (ATJ), hydrotreated depolymerized cellulosic jet (HDCJ), hydro-deoxygenated synthesized kerosene (HDO-SK), and catalytic hydrothermolysis (CH).

15. SUBJECT TERMS
alternative fuels, fit-for-purpose, seal, material compatibility, DSHC, ATJ, HDCJ, HDO-SK, CH 8

16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT:	18. NUMBER OF PAGES	19a. NAME OF RESPONSIBLE PERSON (Monitor)
a. REPORT	b. ABSTRACT	c. THIS PAGE			James T. Edwards
Unclassified	Unclassified	Unclassified	SAR	294	19b. TELEPHONE NUMBER *(Include Area Code)* N/A

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Preface

This report was prepared for the Universal Technology Corporation (UTC), 1270 North Fairfield Road, Dayton, Ohio, 45432-2600 under Sub Contract Number 12-S590-0021-02-C1 (Contract Number FA8650-08-D-2806 Task Order 0021, SwRI task numbers 1a, 1b, 6) for the Air Force Research Laboratory's Fuel & Energy Branch (AFRL/RQTF). Ms. Michele Puterbaugh (UTC) was the Task Order Program Manager for this effort. Ms. Amanda Welch (UTC) was the Task Order Assistant Program Manager for this effort. Mr. James Klein, (Subcontractor, Klein Consulting LLC), was the technical leader in support of Dr. James T. Edwards, Government Task Order Program Manager and Technical Point of Contact, of the Energy & Fuels Branch, (AFRL/RQTF), Turbine Engine Division, Aerospace Systems Directorate, Air Force Research Laboratory, Wright-Patterson Air Force Base, Ohio. The research reported herein was performed by Southwest Research Institute, 6220 Culebra Road, San Antonio, TX and covers the period of 06 December 2011 – 22 July 2014. This effort was funded by the Air Force Research Laboratory.

1.0 EXECUTIVE SUMMARY

1.1 Effect of Aromatic Content on Dynamic Seal Properties and Performance

The research task was an extension of work that was conducted on dynamic seal test rig under Report No. AFRL-RQ-WP-TM-2013-0010. This report addressed the engineering performance and properties of elastomer O-rings; and compared the results from alternative fuel and alternative fuel blends to conventional jet fuel. The objective of this task was to address the effect of aromatic content on dynamic performance of the O-ring seal and its properties.

The test fuel set consists of two JP-8 fuels, with 24% and 13% aromatic content. The remaining four test fuel set consisted of R-8/JP-8 blends with aromatic content ranging from 8% to 1%. A pair of Buna-N O-rings was tested at 200°F until failure (fuel leak).

Based on the results from the dynamic seal tests, it was concluded that, at higher aromatic content there was a net weight gain by the elastomer due to absorption of fuel, which resulted in increase in percentage thickness and provided the O-ring sufficient squeeze and sealing capability throughout its operation. At higher aromatic content, the hardness increased and provided the O-ring with sufficient elastic modulus along with sufficient volume swell for sealing application. As the aromatic content decreased, the loss of O-ring material into fuel coupled with decreased thickness (elastomer squeeze) and/or insufficient volume swell, resulted in O-ring failure.

The overall conclusion was that the non-linear nature of the elastomer performance curve was directly related to the percentage thickness change and hence, elastomer squeeze of the O-ring. The elastomer weight, hardness and volume swell measurements were used to understand fuel absorption, material loss, modulus of elasticity and nature of dynamic performance of the O-ring. A unique research finding was that different trends emerged with respect to each fuel type in regards to property changes and accounted for the non-linear nature of the elastomer performance curve.

The results were obtained for one pair of Buna-N O-ring per fuel sample. These results provided an insight into the relationship between aromatic content versus dynamic seal performance. Future research should focus on validation studies with statistically relevant number of samples. Besides R-8 blends, other alternative fuel blends must be tested relative to JP-8 fuel with different aromatic levels to gain a complete understanding of the effect of aromatic content on dynamic performance of the elastomer O-ring.

1.2 Fit-For-Purpose (FFP) Testing of Alternative Aviation Fuels

The overall objective of this effort was to provide continued support to UTC/AFRL in the area of alternative aviation fuels. New synthetic pathways continue to emerge for generating blend stocks and drop-in replacement jet fuels. Some of these pathways allow the production of aromatic components simultaneously with paraffins thus overcoming the need to blend with petroleum based fuel. Therefore, the need for fit-for-purpose testing, component/rig testing, engine/pump testing, and material compatibility still play a key role in assessing these new fluids.

The fuels included in this study have been developed by several processes and include samples of the type: Direct Sugar to Hydrocarbon (DSHC), Alcohol-to-Jet (ATJ), Hydrotreated Depolymerized Cellulosic Jet (HDCJ), Hydro-Deoxygenated Synthesized Kerosene (HDO-SK), and Catalytic Hydrothermolysis (CH). From these blend stocks, samples have been obtained containing anywhere from 10% to 100% synthetic jet fuel.

This report contains all of the fit-for-purpose and miscellaneous specification testing performed to date under TO 21. Several of the fuels exhibited excellent jet fuel characteristics that would meet or exceed many of the specification requirements. Others seemed to perform well with only marginal issues that could be handled by adjusting the blend ratios.

1.3 Effect of Fame Contamination on Permittivity and Density

Testing at 400 ppm FAME contamination is required in support of clearance activity for western commercial aviation fuels. Based on an initial assessment of the raw data, both the permittivity and density values appeared to be essentially identical for the neat jet fuel and FAME-additized fuels. The subsequent analysis, provided herein, shows strong linear relationships among permittivity, density, and temperature. There appears to be little hysteresis in the permittivity measurement technique across the full range of test points. The results also appear to fall well within the experience-base provided by the CRC World Fuel Sampling Program. Based on these results, it is a reasonable conclusion that FAME contamination up to 400 ppmw does not significantly affect the measurement of permittivity or density over a relatively wide-temperature range beyond the normal expected variation in the test methods themselves.

2.0 INTRODUCTION

This final report contains a compilation of results for task numbers 1a, 1b, and 6 under Contract Number FA-8650-08-D-2806 Task Order 0021 in partial fulfillment of UTC Subcontract Number 12-S590-0021-02-C1.

Task 1a included various specification testing per ASTM D1655 and MIL-DTL-83133G. Test results are reported with the task 6 evaluations.

Task 1b addressed the effect of aromatic content on dynamic performance of the O-ring seal and its properties using the SwRI dynamic seal test rig.

Task 6 included evaluations of several emerging alternative aviation fuels. Fit-for-purpose (FFP) and other related testing as defined in ASTM D4054 was accomplished. Miscellaneous testing of interest to the Air Force including SAE J1488 fuel/water separation, speed of sound and isentropic bulk modulus, elastomer compatibility, vapor pressure vs. temperature, and lubricity (HFRR, SLBOCLE, BOCLE) vs. CI/LI concentration were also accomplished. The effect of fame contamination on permittivity and density was also determined in support of clearance activity for western commercial aviation fuels.

Appendix A

Task 1B – Dynamic Seal Testing

EFFECT OF AROMATIC CONTENT ON DYNAMIC SEAL PROPERTIES AND PERFORMANCE

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Prepared for

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July 2014

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Executive Summary

The research task was an extension of work that was conducted on dynamic seal test rig under Report No. AFRL-RQ-WP-TR-2013-0010. This report addressed the engineering performance and properties of elastomer O-rings; and compared the results from alternative fuel and alternative fuel blend to conventional jet fuel. The objective of this task was to address the effect of aromatic content on dynamic performance of the O-ring seal and its properties.

The test fuel set consists of two JP-8 fuels, with 24% and 13% aromatic content. The remaining four test fuel set consisted of R-8/JP-8 blends with aromatic content ranging from 8% to 1%. A pair of Buna-N O-rings was tested at 200°F until failure (fuel leak).

Based on the results from the dynamic seal tests, it was concluded that, at higher aromatic content there was a net weight gain by the elastomer due to absorption of fuel, which resulted in increase in percentage thickness and provided the O-ring sufficient squeeze and sealing capability throughout its operation. At higher aromatic content, the hardness increased and provided the O-ring with sufficient elastic modulus along with sufficient volume swell for sealing application. As the aromatic content decreased, the loss of O-ring material into fuel coupled with decreased thickness (elastomer squeeze) and/or insufficient volume swell, resulted in O-ring failure.

The overall conclusion was that the non-linear nature of the elastomer performance curve was directly related to the percentage thickness change and hence, elastomer squeeze of the O-ring. The elastomer weight, hardness and volume swell measurements were used to understand fuel absorption, material loss, modulus of elasticity and nature of dynamic performance of the O-ring. A unique research finding was that different trends emerged with respect to each fuel type in regards to property changes and accounted for the non-linear nature of the elastomer performance curve.

The results were obtained for one pair of Buna-N O-ring per fuel sample. These results provided an insight into the relationship between aromatic content versus dynamic seal performance. Future research should focus on validation studies with statistically relevant number of samples. Besides R-8 blends, other alternative fuel blends must be tested relative to JP-8 fuel with different aromatic levels to gain a complete understanding of the effect of aromatic content on dynamic performance of the elastomer O-ring.

Acronyms & Abbreviations

°F	Fahrenheit
hrs	Hours
SwRI	Southwest Research Institute
ΔH	Change in Hardness
ΔT	Change in Thickness
ΔV	Change in Volume
ΔW	Change in Weight

A.1.0 INTRODUCTION AND OBJECTIVE

The results from the dynamic seal test rig in Report No. AFRL-RQ-WP-TR-2013-0010, have shown that the test was capable of assessing the engineering performance of elastomer O-rings in turbojet fuel systems. It was also established that the test rig was capable of distinguishing the dynamic performance of Fluorosilicone, Buna-N and Viton O-rings. The performance and properties of the three elastomer O-rings under pre-test and post-test conditions were assessed for jet fuel, alternative fuel and a 50/50 jet fuel/alternative fuel blend. This research was effective in addressing the performance elastomer O-rings in alternative fuels and fuel blends relative to conventional jet fuels. However, the outcomes of this research were not sufficient to examine the relationship between aromatic content and elastomer performance. In light of this technical void, the objective of this task was to assess the effect of aromatic content on dynamic performance of elastomer O-ring. In addition, the changes in elastomer properties with aromatic content have been addressed in this research task.

A.2.0 TECHNICAL APPROACH

The test fuel set consisted of two JP-8 fuels provided by AFRL, with 24% aromatic content (POSF 10130) and 13% aromatic content (POSF 9698). The results from these two fuels would indicate if elastomer performance under dynamic conditions and properties are affected by variation in aromatic content with JP-8 fuel. 50/50 R-8/ JP-8 blend (POSF 7386) with an aromatic content of 10.1% and R-8 fuel (POSF 5469) with an aromatic content of 0.9% were used to prepare the remaining four test fuel blends, with aromatic content ranging from 8% to 1%. The test fuels and fuel blends are listed in Table A-1.

A detailed description and working principle of the dynamic seal test rig was provided in Report No. AFRL-RQ-WP-TR-2013-0010. This report provides the test results of three elastomers, namely, Fluorosilicone, Buna-N and Viton O-rings, with Jet-A, R-8 and 50/50 R-8/JP-8 blend. For the current research task, a pair of Buna-N O-rings (AS568-O12) was tested with fuels and fuel blends listed in Table A-1. The O-rings were run at 200°F until failure (fuel leak) was detected. Pre-test and post-test properties such as weight, thickness, and hardness were measured and volume swell was calculated.

Table A-1. Representative Fuel Samples for Dynamic Seal Tests

#	Description	Aromatics (%)
1	JP-8 (POSF 10130)	24
2	JP-8 (POSF 9698)	13
3	R-8/JP-8 Blend (CL13-4964)	8
4	R-8/JP-8 Blend (CL13-4965)	4
5	R-8/JP-8 Blend (CL13-4966)	2
6	R-8/JP-8 Blend (CL13-4967)	1

A.3.0 RESULTS

The results from the dynamic seal tests are listed in Table A-2. The effect of aromatic content in jet fuel on elastomer O-rings have been discussed in terms of dynamic performance, and percent change in elastomer weight (ΔW), thickness (ΔT), hardness (ΔH), and volume (ΔV).

Table A-2. Dynamic Seal Test Results

Aromatic Content (%)	Failure Time (hrs)	Left O-ring Data				Right O-ring Data			
		ΔT (%)	ΔH (%)	ΔV (%)	ΔW (%)	ΔT (%)	ΔH (%)	ΔV %	ΔW %
24	235.3	7.7195	4.1096	6.0255	2.2430	12.2024	2.3256	10.6430	5.9609
13	182.7	7.1215	0.4525	0.2260	-0.4587	9.4912	0.9174	4.7253	1.4097
8	160.5	9.8834	10.9005	1.6018	-1.6529	11.6691	8.8785	4.0526	0.7916
4	162.5	11.6870	7.3394	3.8002	-0.6969	8.8697	3.2258	2.1052	-0.3759
2	68.5	9.6936	5.2381	3.2768	0.0905	8.2049	4.2254	3.2439	-0.5357
1	45.4	6.2284	3.6364	-0.0701	-2.4889	5.2840	2.2727	0.0411	-3.1334

A.3.1 Dynamic Seal Performance

The dynamic seal performance (failure time) was plotted as a function of aromatic content, as shown in Figure A-1. The dynamic performance of the elastomer O-ring was 235.3 hours for JP-8 fuel with 24% aromatic content and 182.7 hours for JP-8 with 13% aromatic content. The performance dropped from 235.3 hours to 162.5 hours as the aromatic content reduced from 24% to 4%, averaging a performance reduction of 3.64 hours for 1% drop in aromatic content. At 8% and 4% aromatic contents, the level of performance remained the same at approximately 160 hours. Below 4%, the performance reduction was approximately 39 hours for every 1% drop in aromatic content. Based on this result, it was concluded that the desirable range for aromatic content was between 23% and 4%. The performance points at 8% and 4% aromatic levels resulted in a non-linear performance curve. The subsequent sections address the non-linearity in O-ring dynamic performance curve in terms of elastomer properties.

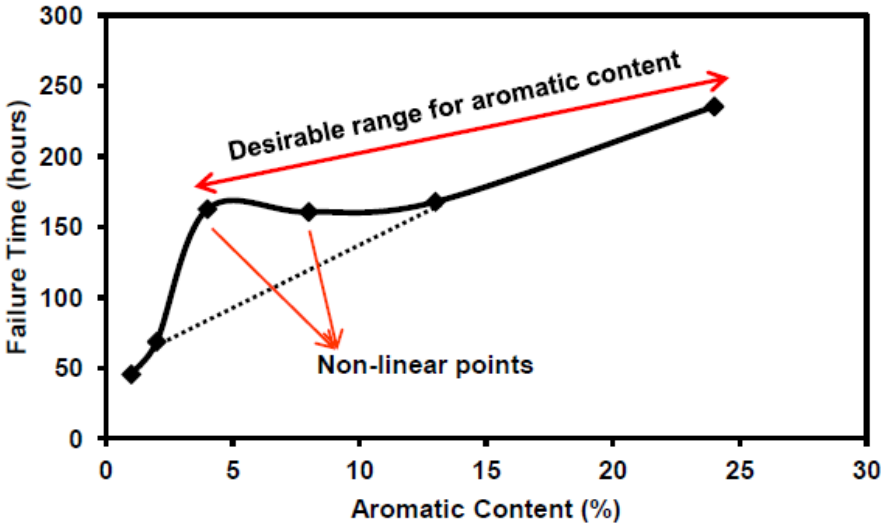

Figure A-1. Dynamic Seal Performance

A.3.2 Elastomer Weight

The percentage weight change of the elastomer O-ring, as a function of aromatic content, is shown in Figure A-2. Since the data was measured for a pair of O-rings, the results are represented in Figure A-2 in the form of a vertical bar.

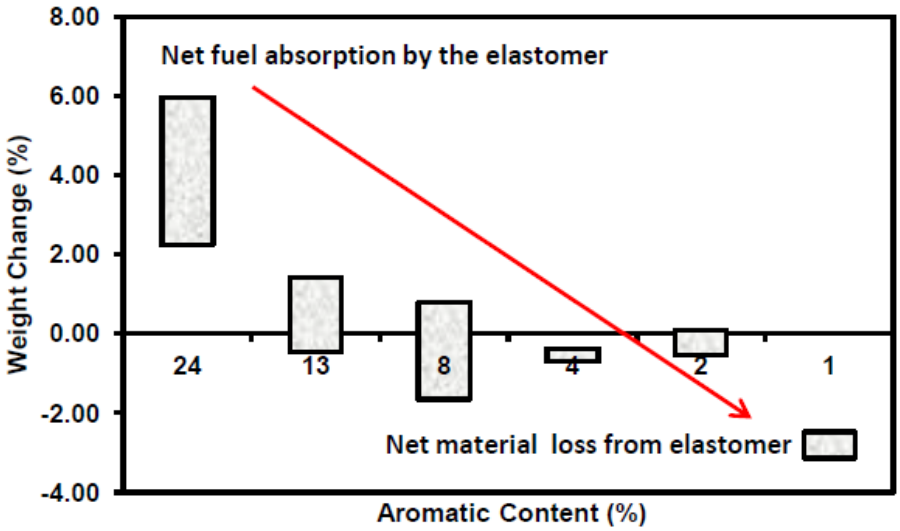

Figure A-2. Elastomer Weight versus Aromatic Content

At 24% aromatic content, there was increase in the weight of the elastomer O-ring indicating that there was a net absorption of fuel by the elastomer. As the aromatic content decreased to 1%, there was a net loss of material from the elastomer into the fuel. It should be noted that the total run time for the low aromatic fuel (1%) is much less than JP-8 with 24% aromatic content and during this short run time, the O-ring had lost a significant amount of material into the fuel.

A.3.3 Elastomer Thickness and Hardness

The elastomer thickness is a direct measure of elastomer squeeze, and hardness is a measure of modulus of elasticity. As the aromatic content decreased, the percentage change in thickness also decreased, indicating a similar trend for elastomer squeeze. Thus, at lower aromatic content, the O-ring will be unable to provide the same sealing capability as that of a high aromatic fuel. The results are shown in Figure A-3. It should be noted that the change in percentage thickness for 8% and 4% aromatic level fuel blends were as high as JP-8 fuel, indicating that the O-rings at these aromatic levels provided the same level of elastomer squeeze providing sealing capability and hence, contributed to increase in performance duration of the O-ring, as indicated by the low rate of failure between 24% and 4% aromatic levels.

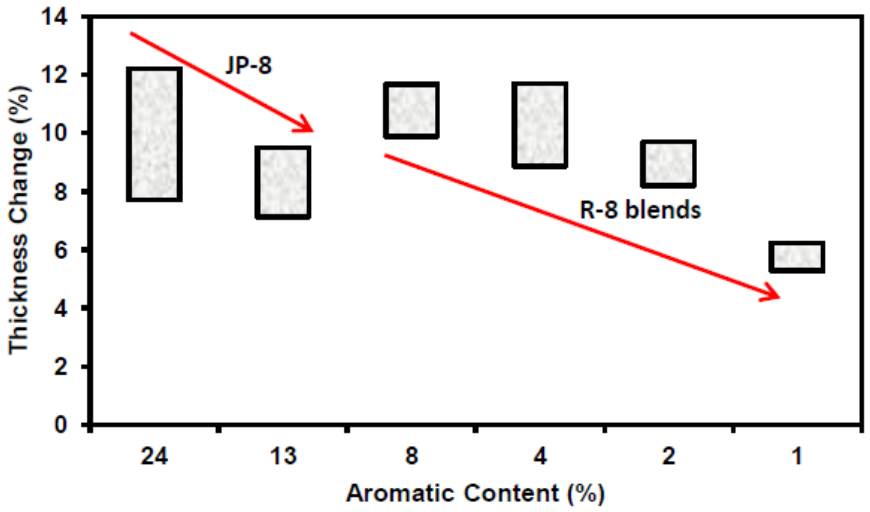

Figure A-3. Elastomer Thickness versus Aromatic Content

The elastomer hardness results shown in Figure A-4, shows that the overall percentage change in hardness and hence modulus of elasticity decreased with decrease in fuel aromatic content. It should be noted that this trend is different for each fuel type, namely, JP-8 and R-8, as shown in Figure A-4. When R-8 fuel is in use, the percentage increase in hardness of the elastomer is much higher, which could possibly explain the higher performance of the O-ring at 8% and 4% despite lower aromatic content. However, at 2% and 1% aromatic levels the percentage change in hardness is comparable to JP-8 fuel. Since the elastomers do not have significantly higher elastomer squeeze or hardness (modulus of elasticity) at these aromatic levels. Based in the trends in Figure A-4, it can be concluded that the percentage change in elastomer thickness and hardness is a function of aromatic content only for a particular type of fuel under investigation and the trend varies for each fuel being tested. This is attributed to the non-linear behavior of the dynamic seal performance curve, in Figure A-1, at 8% and 4% aromatic levels.

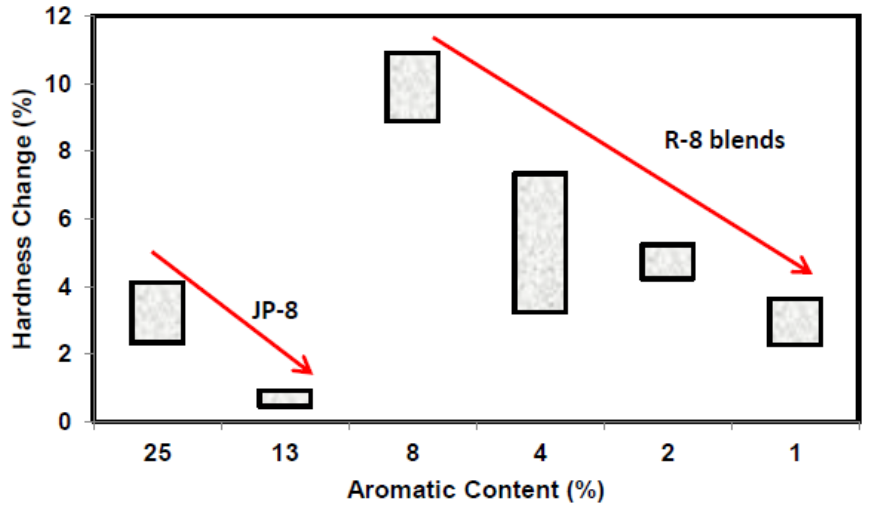

Figure A-4. Elastomer Hardness versus Aromatic Content

A.3.4 Volume Change

The results of volume change as a function of aromatic content is plotted in Figure A-5. As the aromatic level reduced from 24% to 13%, for JP-8 fuel, there was a reduction in volume swell of elastomers that reduced dynamic performance. At 13%, 8%, 4% and 2%, the volume swell values showed a steady decrease. This fact explained the steady decrease in O-ring performance at these aromatic levels, as shown in Figure A-1, except at 2% aromatic level. The drastic reduction in O-ring performance at 2% aromatic level could only be attributed to the low value of percentage thickness change and hence, elastomer squeeze. At 1% aromatic level there is no change in volume. This factor combined with net loss of O-ring material into fuel, as shown in Figure A-2, and lower elastomer squeeze, resulted in insufficient sealing capacity, and contributed to poor dynamic performance at this aromatic level.

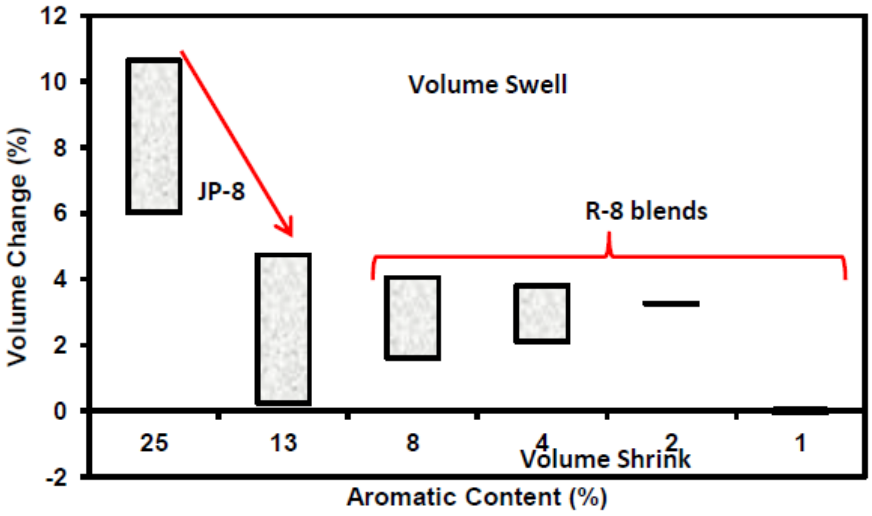

Figure A-5. Aromatic Content versus Volume Change

A.4.0 CONCLUSIONS

For JP-8 fuel, as the aromatic content reduced from 24% to 13%, the reduction in performance of Buna-N O-ring was approximately 22%. As the aromatic content reduced further from 13% to 4%, there was no significant change in dynamic performance. Below 4%, the performance dropped drastically to 45.4 hours at 1% aromatic content. Therefore, it was concluded that the desirable range for aromatic content is 4% to 24% of the given fuel set and that R-8 blends with aromatic content below 4% were not suitable for dynamic seal applications.

The percentage weight change was positive for 24% aromatic content jet fuel indicating net fuel absorption by the elastomer. As the aromatic content reduced further, the percentage weight change became negative indicating a net material loss from the O-ring into the fuel. The trend was uniform for both R-8 blends and JP-8 fuel indicating that the overall weight change was governed by the aromatic content in the given set of test fuels. However, the percentage thickness and hardness change had two trends for each type of fuel, namely, R-8 blends and JP-8. Thickness is a measure of elastomer squeeze, required for providing sufficient sealing for O-ring operation and hardness is a measure of modulus of elasticity. The percentage thickness and hardness decreased as the aromatic content dropped from 24% to 13% for JP-8 fuel. However, at 8% and 4% (R-8 blends), the percentage change in thickness and hardness was significantly higher compared to JP-8 fuel. This implied that the O-rings had sufficient squeeze at those aromatic levels which further explained the slow rate of reduction in dynamic performance at those aromatic levels.

The percentage thickness for R-8 blends at 2% and 1% aromatic levels were lower compared to JP-8 fuel. However, the percentage hardness, at these aromatic levels, was marginally higher than JP-8 fuel. The lower thickness signified lower elastomer squeeze and insufficient sealing capability and hence, the dynamic performance reduced at a drastic rate at these aromatic levels, despite marginally higher percentage hardness. This inference indicated that the dynamic performance was highly dependent on percentage thickness change and elastomer squeeze than on hardness and modulus of elasticity.

Overall, two broad conclusions were reached, based on property measurements. While elastomer weight, hardness and volume swell measurements were important, the non-linear nature of the elastomer performance curve was directly related to the percentage thickness change and hence, elastomer squeeze of the O-ring, for the set of test fuels under study. Secondly, two different trends emerged for each test fuel type, JP-8 fuel and R-8 blends, which needs further investigation with increase in the number of O-ring samples being tested.

A.5.0 RECOMMENDATIONS FOR FUTURE RESEARCH

All the results were obtained by testing one pair of Buna-N O-ring, per fuel sample. In order to validate these results, statistically relevant number of samples must be tested. Besides R-8, other alternative fuels needs to be tested in order to determine the extent to which the alternative fuel type affects the elastomer O-ring properties and hence, its' dynamic performance.

Appendix B

Task 1A & 6 – Fit-For-Purpose and Miscellaneous Testing

FIT-FOR-PURPOSE (FFP) TESTING OF ALTERNATIVE AVIATION FUELS

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July 2014

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Executive Summary

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The fuels included in this study have been developed by several processes and include samples of the type: Direct Sugar to Hydrocarbon (DSHC), Alcohol-to-Jet (ATJ), Hydrotreated Depolymerized Cellulosic Jet (HDCJ), Hydro-Deoxygenated Synthesized Kerosene (HDO-SK), and Catalytic Hydrothermolysis (CH). From these blend stocks, samples have been obtained containing anywhere from 10% to 100% synthetic jet fuel.

This report contains all of the fit-for-purpose and miscellaneous specification testing performed to date under TO 21. Several of the fuels exhibited excellent jet fuel characteristics that would meet or exceed many of the specification requirements. Others seemed to perform well with only marginal issues that could be handled by adjusting the blend ratios.

Acronyms & Abbreviations

°C	Celsius
°F	Fahrenheit
µm	Micrometer
AA	Atomic Absorption
BOCLE	Ball-On-Cylinder Lubricity Evaluator
BTU	British Thermal Unit
CI/LI	Corrosion Inhibitor/Lubricity Improver
cSt	Centistokes
DCN	Derived Cetane Number
DLA	Defense Logistics Agency
EPA	Environmental Protective Agency
FFP	Fit-For-Purpose
FT	Fischer-Tropsch
FTM	Federal Test Method
g	Gram
HDCJ	Hydroprocessed Depolymerized Cellulosic Jet
HEFA	Hydroprocessesd Esters and Fatty Acids
HFRR	High Frequency Reciprocating Rig
HRJ	Hydroprocessed Renewable Jet
Hz	Hertz
ID	Ignition Delay
IPK	Iso-Paraffinic Kerosene
IQT™	Ignition Quality Tester
JFTOT	Jet Fuel Thermal Oxidation Tester
K	Kelvin
kg	Kilogram
kHz	Kilohertz
kJ	Kilojoule
kPa	Kilopascal
L	Liter
lb	Pound
LEL	Lower Explosion Limit
lpm	Liters Per Minute
m	Meter
mg	Milligram
MJ	Mega joule
mJ	Mill joule
mL	Milliliter
mm	Millimeter
mN	Mill newton
MPa	Mega Pascal
ms	Millisecond
NMR	Nuclear Magnetic Resonance
ppb	Parts Per Billion
ppm	Parts Per Million

psi(a or g)	Pounds Per Square Inch (Absolute Or Gauge)
SAE	Society of Automotive Engineers
SDA	Static Dissipater Additive
SK	Synthetic Kerosene
SPK	Synthetic Paraffinic Kerosene
TWO WRE	Time Weighted Average Water Removal Efficiency
UEL	Upper Explosion Limit
W	Watts

B.1.0 INTRODUCTION

The work reported herein is a continuation of prior work to provide fit-for-purpose testing and subject matter expertise to UTC and AFRL in support of emerging synthetic aviation fuels. This report contains information on the following subjects:

- Evaluation of alternative aviation fuels, blends, and blendstocks
    - 50/50 AMJ 700 / Jet A Blend
    - 50/50 Swedish Biofuel / Jet A Blend
    - 30/70 Kior HDCJ / Jet A Blend
    - Neat Kior HDCJ
    - 50/50 Virent SK / Jet A Blend
    - Neat Virent SK
    - ARA ReadiJet
    - Total / Amyris 20/80 Farnesane/Jet A Blend
    - Total / Amyris 10/90 Farnesane/Jet A Blend
- Miscellaneous Analyses
    - O-ring Material Compatibility Testing
    - Viscosity
    - Derived Cetane Number (IQT)

B.2.0 METHODS, ASSUMPTIONS, AND PROCEDURES

B.2.1 Sample Terminology

Throughout this report, various means of identifying samples, fuels, and blendstocks are utilized. The Sample Identifiers, shown below in Table B-1 should be used as the primary sample reference. In figures and tables (where space is limited) and in the text to improve readability, shortened versions of the formal fuel descriptions may appear. Unless noted otherwise, blends denoted in this manner – "Virent SK / JP-8" – are assumed to be 50/50 volumetric blends of the synthetic and petroleum-based fuels. For those blends containing "JP-8" as the petroleum based fraction, the JP-8 additives are assumed to have been added to the proper levels after the blend was prepared.

B.2.2 Test Methods and Specifications

Numerous analytical methods were used in the conduct of this testing. The large majority of those are ASTM "D" and "E" methods. Throughout this document, those methods are simply referenced by their method numbers, e.g. "D4052" and "E2716." Non-ASTM methods, such as Federal Test Methods (FTM) and those maintained by SAE, EPA, etc. are noted accordingly. Standardized test methods are not discussed at length in this document. These can be acquired from the presiding organizations and some are freely available via the Internet (e.g. FTM). Unless noted otherwise, it is assumed that the standardized tests were run as prescribed. New tests, modifications to standardized tests, or non-standardized tests are described in more detail below.

The primary fuel specifications referenced during the conduct of this work are indicated below. Many of these specifications are undergoing extensive modifications to accommodate the new emerging turbine fuels.

- ASTM D1655 Standard Specification for Aviation Turbine Fuels
- ASTM D4054 Standard Practice for Qualification and Approval of New Aviation Turbine Fuels and Fuel Additives
- ASTM D7566 Standard Specification for Aviation Turbine Fuel Containing Synthesized Hydrocarbons
- MIL-DTL-83133H Detail Specification: Turbine Fuel, Aviation, Kerosene Type, JP-8 (NATO F-34), NATO F-35, and JP-8+100 (NATO F-37)
- DEF STAN 91-91 Turbine Fuel, Aviation Kerosene Type, Jet A-1, NATO Code: F-35

B.2.3 Non-Standard Test Methods

The reader is referred to previously published reports [1], [2] describing the use of alternative/modified methods shown below. Having had difficulties obtaining satisfactory data for thermal conductivity, a new instrument was acquired and utilized for this testing. That instrument is described below in Section B.2.3.1.

- Thermal Conductivity (Transient Hot Wire)
- Hot Surface Ignition Temperature (FTM 791-6053)
- True Vapor Pressure (ASTM D6378)

- Specific Heat Capacity (ASTM E2716)
- Surface Tension (ASTM D1331A)
- Dielectric Constant (SwRI)
- Elastomer (O-ring) Evaluations

B.2.3.1 Thermal Conductivity (Transient Hot Wire)

Since most of the literature data for thermal conductivity of liquids is based on hot wire data (referencing ASTM D2717), we sought to acquire an instrument that would provide comparable measurements. One such instrument is the Transient Hot Wire (THW) Liquid Thermal Conductivity Meter from ThermTest, Inc (http://www.thermtest.com/Products/THW.aspx). This instrument uses small test volumes and rapid test times to limit the effects of convection. Verification checks using hydrocarbon standards showed a <2% deviation from literature values across a wide temperature range. The upper temperature limit was generally restricted to less than 50% of the boiling point to avoid non-linear behavior.

In 2014, a method for the use of the THW with liquids was established under ASTM D7896-14.

B.3.0 RESULTS AND DISCUSSION

B.3.1 Sample Cross-Reference

The samples I, Table B-1were the primary focus of the fit-for-purpose testing under this effort. With the exception of the farnesane blends, all of the fuels were supplied by AFRL. Miscellaneous samples received for the analysis are described below. Where available, Certificates of Analysis (CofA) are provided in Appendix BP.

Table B-1. Sample Identifiers

POSF #	SwRI CL#	Description
7708	CL12-3599	50/50 AMJ 700 / Jet A Blend
7658	CL12-3339	50/50 Swedish Biofuel / Jet A Blend
8123	CL12-3883/5832	30/70 Kior HDCJ / Jet A Blend
80076	CL12-4384	Neat Kior HDCJ
9404	CL12-4367	50/50 Virent SK / Jet A Blend
8535	CL12-4370	Neat Virent SK
10136	CL12-4826	ARA ReadiJet
--	CL12-4716	Total / Amyris 20/80 Farnesane/Jet A Blend
--	CL12-4717	Total / Amyris 10/90 Farnesane/Jet A Blend

B.3.2 Evaluation of Alternative Aviation Fuels and Blendstocks

A description of each fuel is provided below. All of the data collected under this effort is tabulated in appendices and noted below.

B.3.2.1 AMJ 700 – Jet A Blend

This fuel was provided as a 50/50 blend of Amyris AMJ 700 with Jet A. AMJ 700 is a fuel derived from engineered microorganisms that operate like living factories to convert sugars into renewable hydrocarbon molecules. This fuel exhibited elevated cycloparaffins but otherwise fell within the JP-8 specification for those properties tested.

Results of FFP testing can found tabulated in Table BA-1 in Appendix BA.

B.3.2.2 Swedish Biofuel / Jet A Blend

Swedish Biofuels fully synthetic jet fuel process incorporates their advanced processes for the conversion of alcohols with LanzaTech's unique gas fermentation process for converting waste gas streams to ethanol. The alcohol conversion process begins with grain/wood being converted to sugar followed by fermentation into a mixture of C2-C5 alcohols. These are then converted to a mixture of C4-C20 hydrocarbons. In testing, this was one of the fuels that had an elevated UEL value of approximately 7.3% but otherwise exhibited good jet fuel characteristics.

Results of FFP testing can found tabulated in Table BB-1 in Appendix BB.

B.3.2.3 Kior HDCJ

The blendstock for this fuel is created from Kior's biofuel process and is known as Hydrotreated Depolymerized Cellulosic Jet or HDCJ and was supplied as a 30/70 HDJC/Jet A blend. The most unusual characteristic of this fuel is it's high aromatic content. Because of the strong relationship between aromatic content and several other fuel properties, the HDCJ blend has

several properties that marginal such as aromatic content, hydrogen content, and heat of combustion. There was also a potential issue with its distillation slope. Many of its properties are exaggerated relative to the other fuels and it was shown to have some impact on material compatibility.

Results of FFP testing can found tabulated in Table BC-1 in Appendix BC.

B.3.2.4 Virent SK / Jet A Blend

This fuel was supplied as a 50/50 blend of Virent Synthetic Kerosene (SK) and Jet A. This version of the SK contained no aromatics and is known as a Hydro-Deoxygenated Synthesized Kerosene or HDO-SK. It is produced using Virent's BioForming® platform which utilizes their Aqueous Phase Reforming (APR) technology. Other than a reduced aromatic content due to blending, this fuel exhibited good characteristics and met all of the JP-8 specification properties that were tested.

Results of FFP testing can found tabulated in Table BD-1 in Appendix BD.

B.3.2.5 ARA ReadiJet

Using a Biofuels ISOCONVERSION (BIC) process based on Catalytic Hydrothermolysis (CH) and hydroprocessing, renewable oil feedstocks are converted into Renewable, Aromatic, Drop-in (Readi) fuels known as ReadiJet. The interesting part of this process is that it also yields aromatics along with cycloparaffins and isoparaffins so no blending is required. Testing revealed that the fuel has a freeze point(approx -43°C) that would not meet the JP-8 specification. This results was verified by two different instruments/methods. It's unknown if this is typical of that fuel or some artifact of that particular sample. Otherwise, the fuel exhibited good characteristics.

Results of FFP testing can found tabulated in Table BE-1 in Appendix BE.

B.3.2.6 Total / Amyris Farnesane Blends

The farnesane blendstock is a Synthesized Iso-Paraffinic Kerosene (SIK). Total/Amyris produce farnesene by fermentation of sugar feedstocks. Farnesene is then converted to farnesane through a combination of hydroprocessing and fractionation steps resulting in nearly total conversion to a branched C15 paraffin. The targeted blends for incorporation into ASTM standards are 10% and 20% farnesane in jet fuel.

Results of FFP testing can found tabulated in Table BF-1 in Appendix BF.

B.3.3 Miscellaneous Testing

B.3.3.1 Additional Amyris Testing

To provide additional support to Amyris for their research report, AFRL authorized some additional testing as outlined below. Results can be found in Appendix BG.

- Amyris Jet A-1 FFP Testing, Table BG-1
- Speed-of-Sound and Bulk Modulus for 10% Farnesane Blend, Table BG-2
- Amyris Viscosity Analysis, Table BG-3

B.3.3.2 Baseline O-Ring Testing

UTC/AFRL authorized another round of O-ring baseline testing for JP-8 and Jet A. The results for tensile strength and volume swell for each fuel can be found in Appendix BH. The results were found to be comparable to those generated under TO 112. The differences between the JP-8 and Jet A appear to be negligible.

B.3.3.3 Additional Testing for Tri-Service Samples

AFRL identified one of the DLA Tri-Service fuel samples (#22) as having nominal Jet A characteristics. To provide additional reference data, AFRL authorized some extended testing on this and a few other Tri-Service samples. Data is tabulated in Appendix BI as follows:

- Additive Compatibility of DLA #22, Table BI-1
- FFP Testing of DLA #22, Table BI-2
- Nitrogen content of Tri-Service samples, Table BI-3
- Surface Tension vs. Temperature for Tri-Service samples, Table BI-4

B.3.3.4 Derived Cetane Number (IQT) Analysis

Three samples were received for IQT analysis:

- R-8 Renewable Jet Fuel, POSF7272 (SwRI CL12-4174)
    - ID: 3.417
    - DCN: 59.1
- HRJ Blend, Bio-Oil Derived SPK, POSF7665, 50:50 Camelina JP-8 (SwRI CL12-4175)
    - ID: 3.924
    - DCN: 52.0
- Jet Fuel JP-8, Valero (SwRI CL12-4176)
    - ID: 4.315
    - DCN: 47.7

B.3.4 Discussion of Selected Fuel Properties

Selected properties of the test fuels are discussed below. Where possible, the data is plotted against reference data such as found in the Handbook of Aviation Fuel Properties [3], fuels from the CRC World Fuel Sampling Program [4], or a nominal Jet A.

B.3.4.1 Speed-of-Sound and Isentropic Bulk Modulus

Speed-of-Sound and Bulk Modulus data are shown in Figure B-1 and Figure B-2, respectively. For the most part, these fuels behave similar to the nominal Jet A (Sample #22). The HDCJ blend could be somewhat deceiving. Its values are approaching that of a diesel fuel. Speed-of-sound and hence bulk modulus are density-driven and therefore strongly tied to aromatic content. Like density, these results tend to follow a linear trend with blending. So, a blend of two fuels will tend to fall proportionally in between each of the blendstocks.

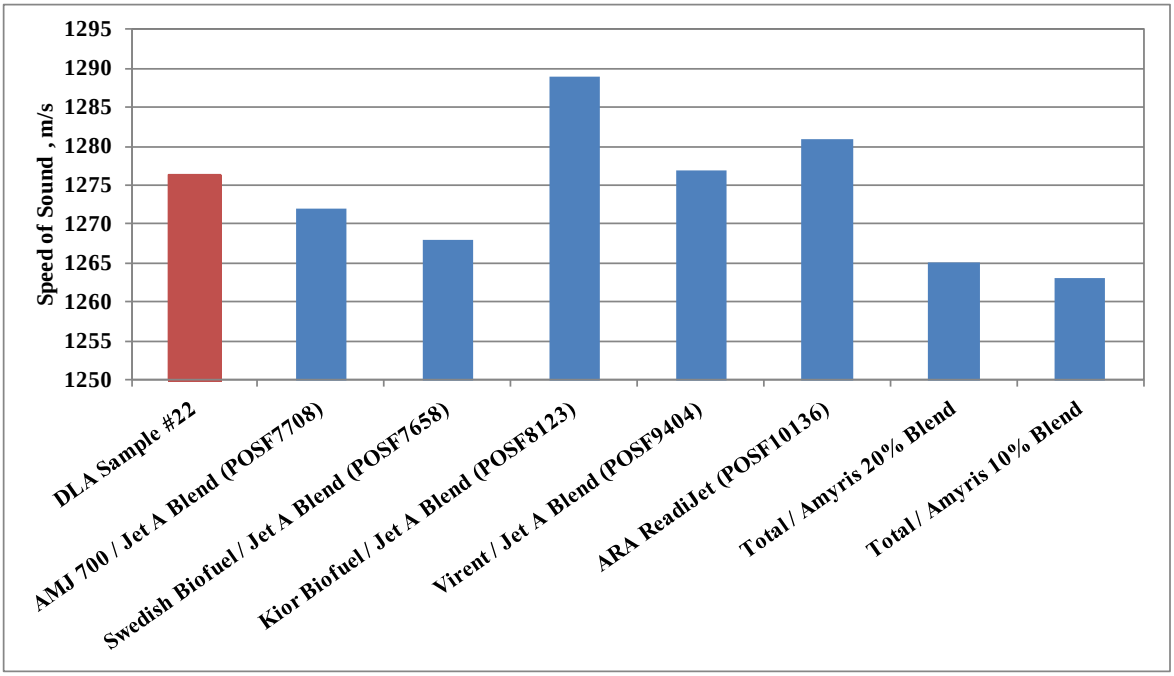

Figure B-1. Speed of Sound (30 °C at Atmospheric Pressure)

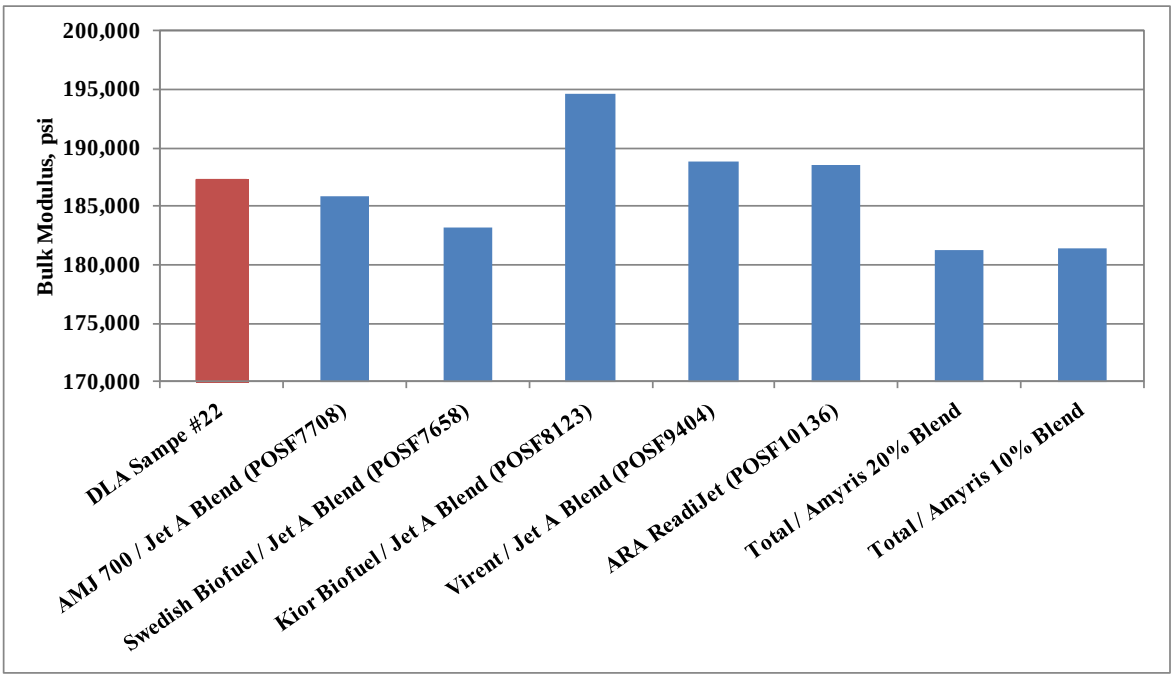

Figure B-2. Isentopic Bulk Modulus (30 °C at Atmospheric Pressure)

B.3.4.2 Distillation (D86)

The distillation curves for the test fuels are shown in Figure B-3. These fuels tend to follow the expected trends see in the literature values.

B.3.4.3 Vapor Pressure (D6378)

Vapor pressure curves are depicted in two ways:

- Pressure (psi) vs. Temperature (°C), Raw data, Figure B-4
- ln(Pressure (kPa) vs. 1/Temperature (K), Figure B-5

The results in Figure B-5 are only plotted for values with vapor pressures ≥1.0 kPa. This data shows good linearity and compares well with the CRC data. The vapor pressures at temperatures below 20°C are very low and therefore less repeatable.

B.3.4.4 Density (D4052)

The density data for the test fuels is shown in Figure B-6. These fuels fall in a small band around the nominal CRC and World Survey data due to variations in chemical composition of the samples.

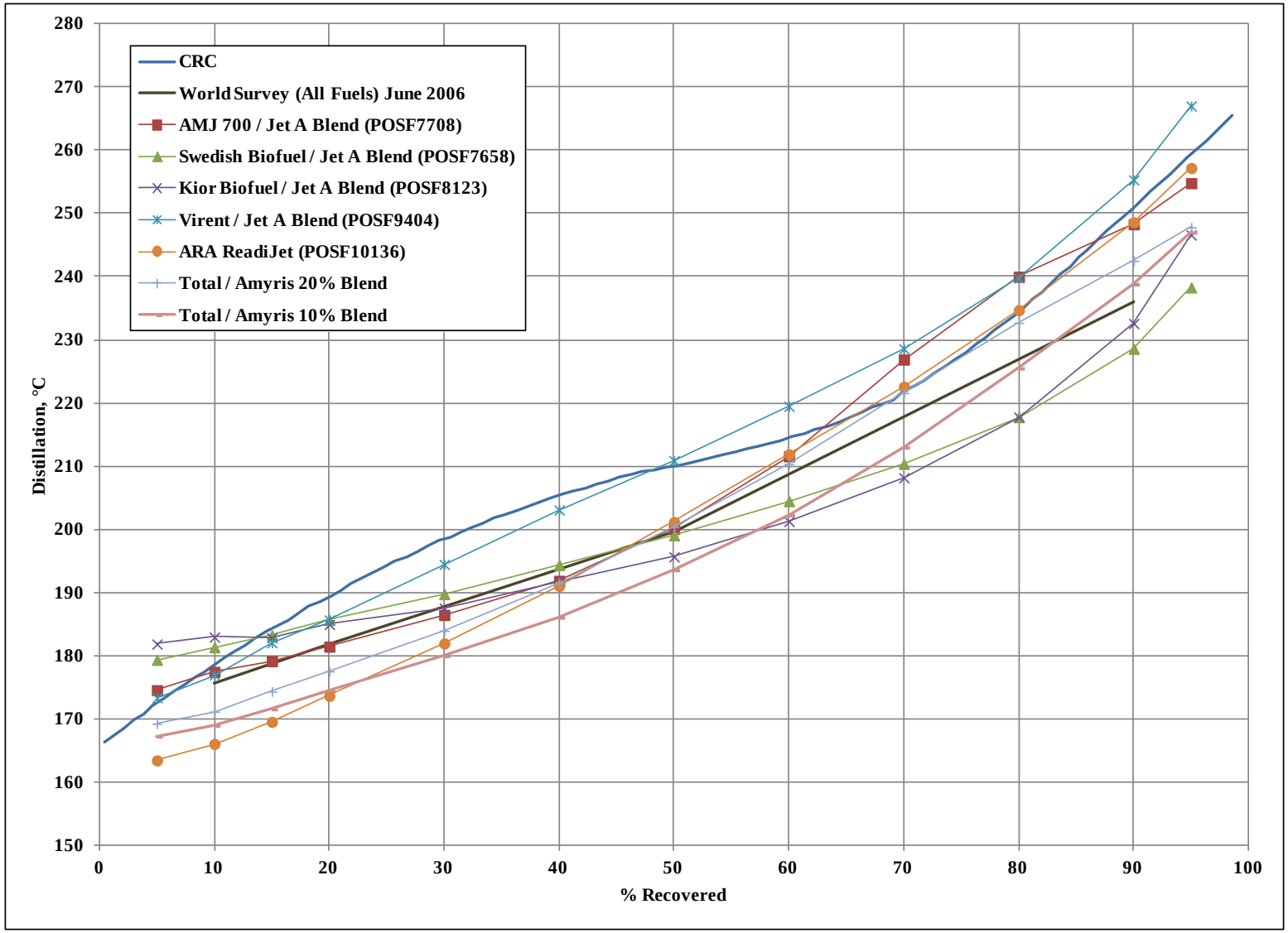

Figure B-3. Distillation (D86)

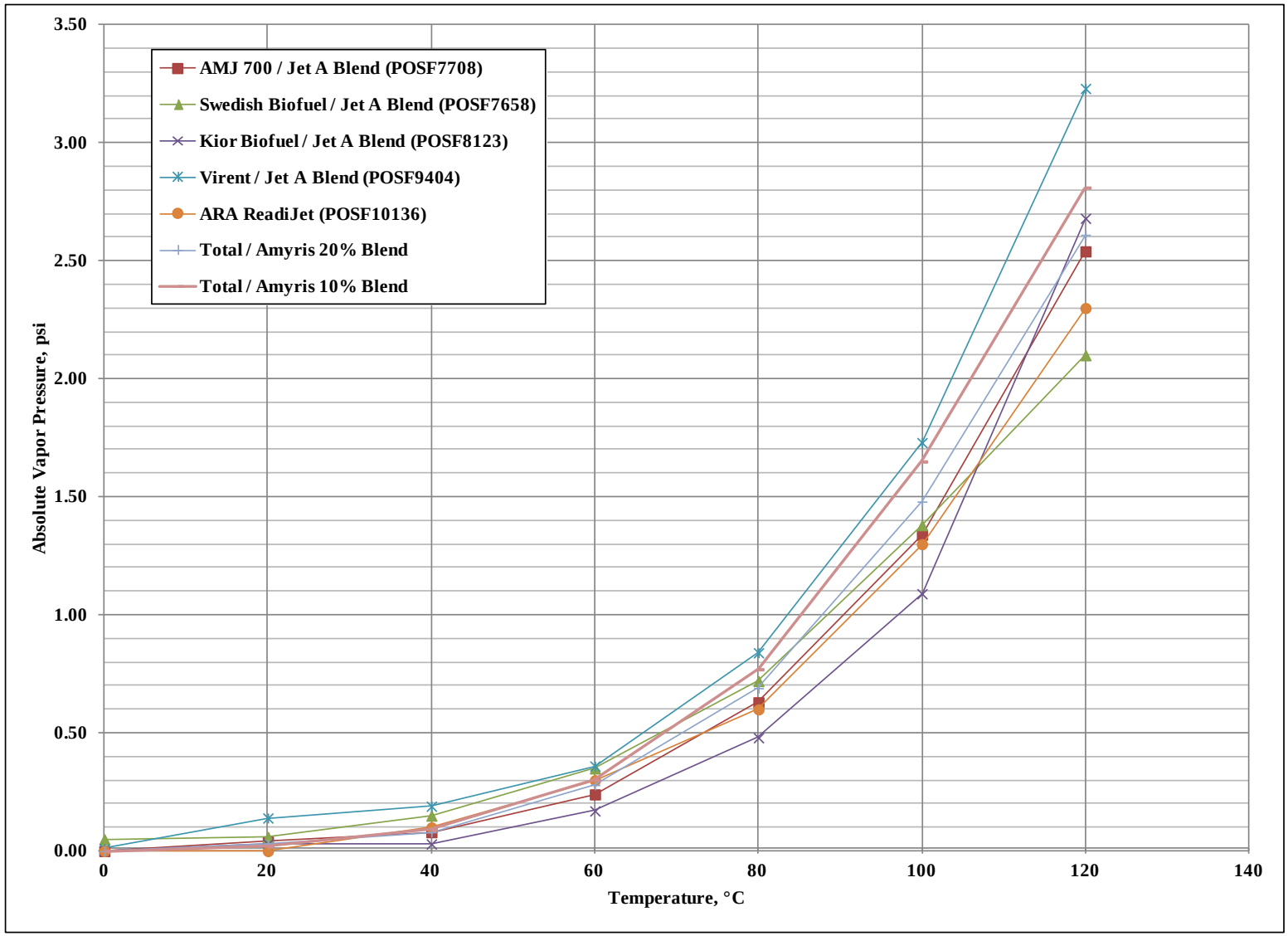

Figure B-4. Absolute Vapor Pressure (D6378) – Raw Data

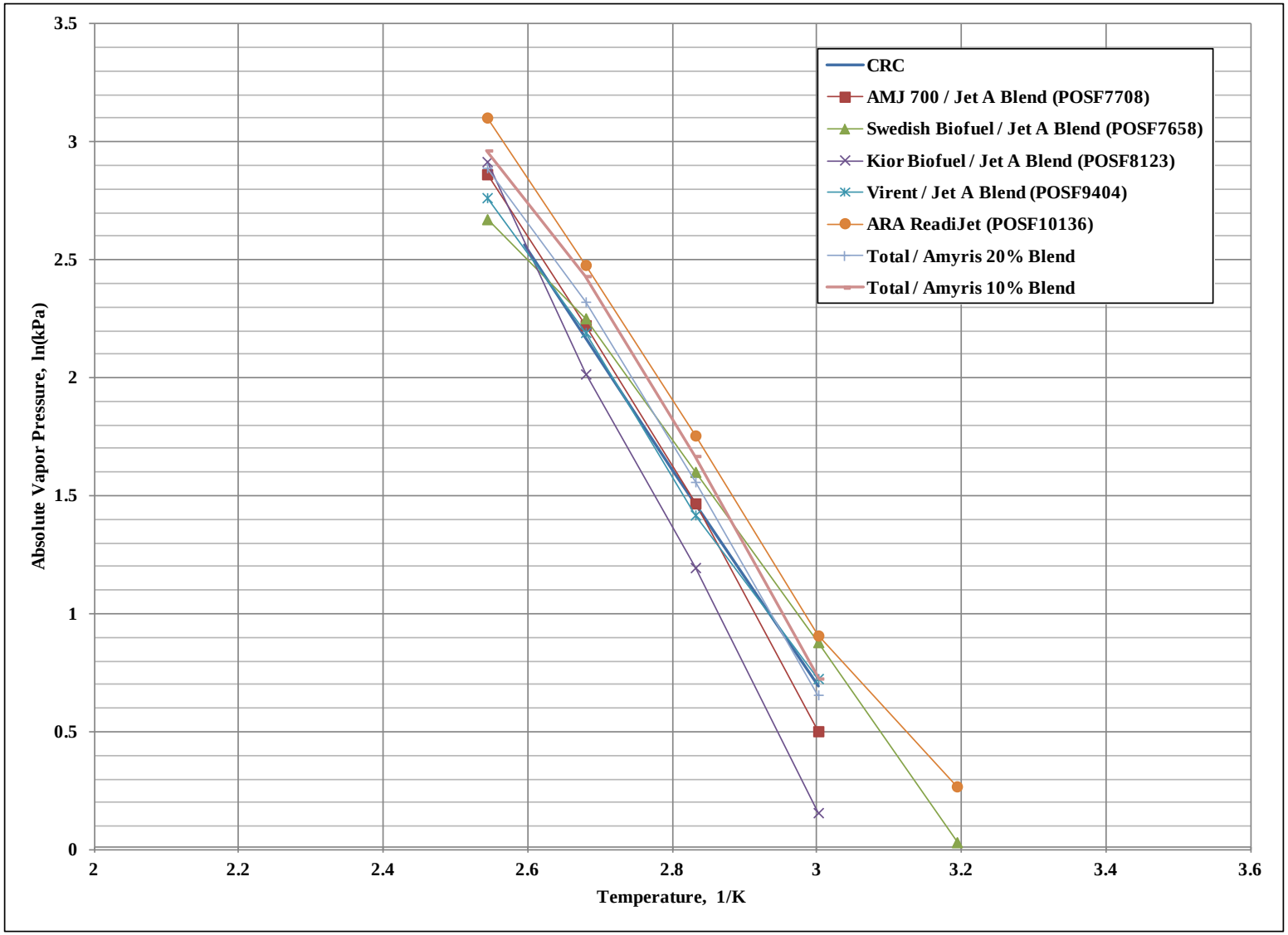

Figure B-5. Absolute Vapor Pressure (D6378) – Arrhenius Plot

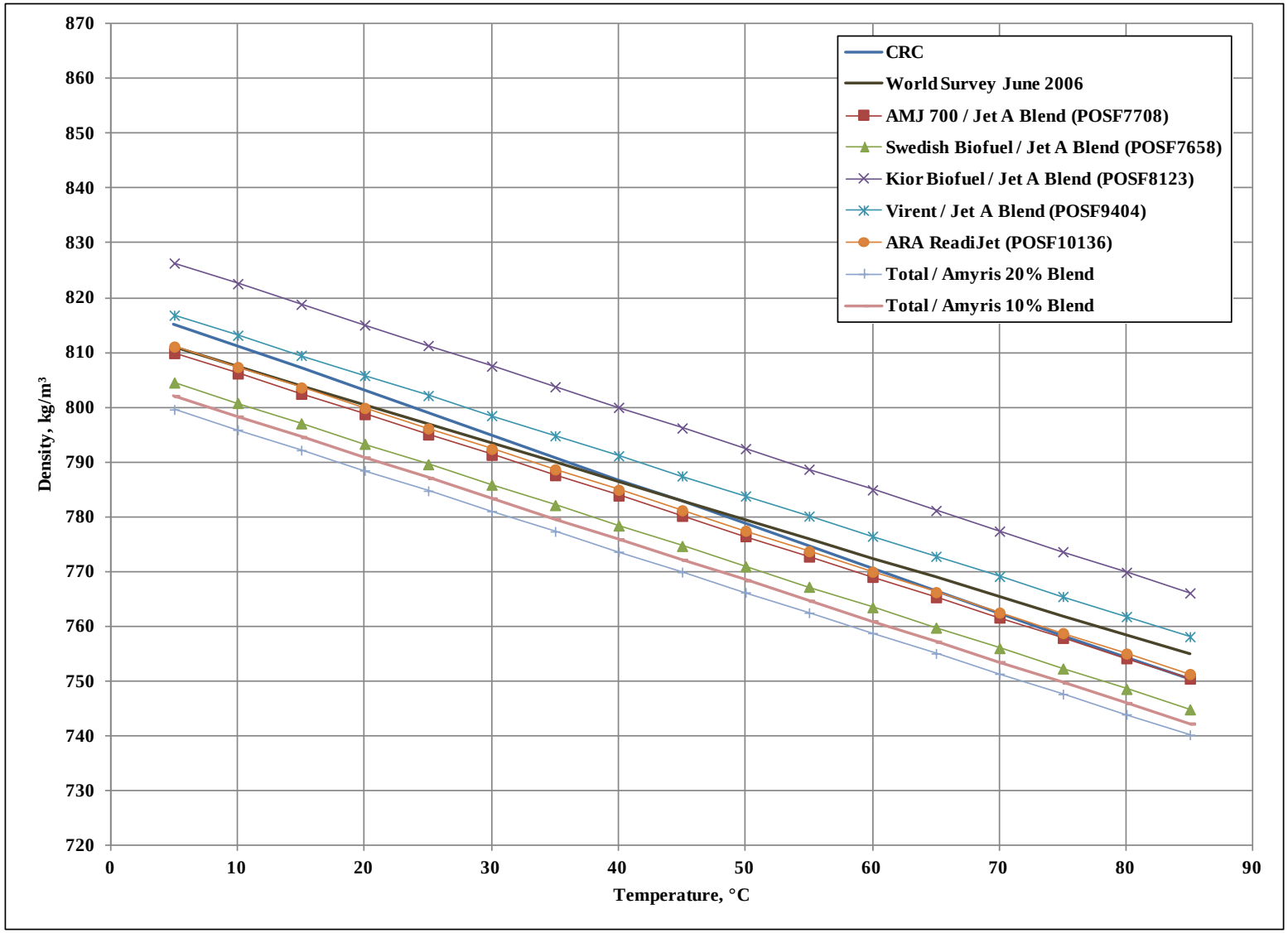

Figure B-6. Density (D4502)

B.3.4.5 Dielectric Constant

The results for dielectric constant are presented below as follows:

Dielectric Constant vs. Temperature, Figure B-7

Dielectric Constant vs. Density, Figure B-8

The measurement of dielectric constant continues to be a hotly debated subject. In part, the debate is over the measurement of density and whether the values collected on an automated densitometer can be extrapolated to low temperature extremes. In unpublished work, we've found that values for hydrocarbons can be extrapolated with good accuracy to meet this need. The dielectric values from CRC and the World Survey spear to be the same data and have a similar slope to the fuels in this study. However, when plotted against density, the slope of the World Survey data deviates substantially. This could be an issue with the density data in the World Survey. The CRC data shows a slope that's very comparable to the data measured in this effort.

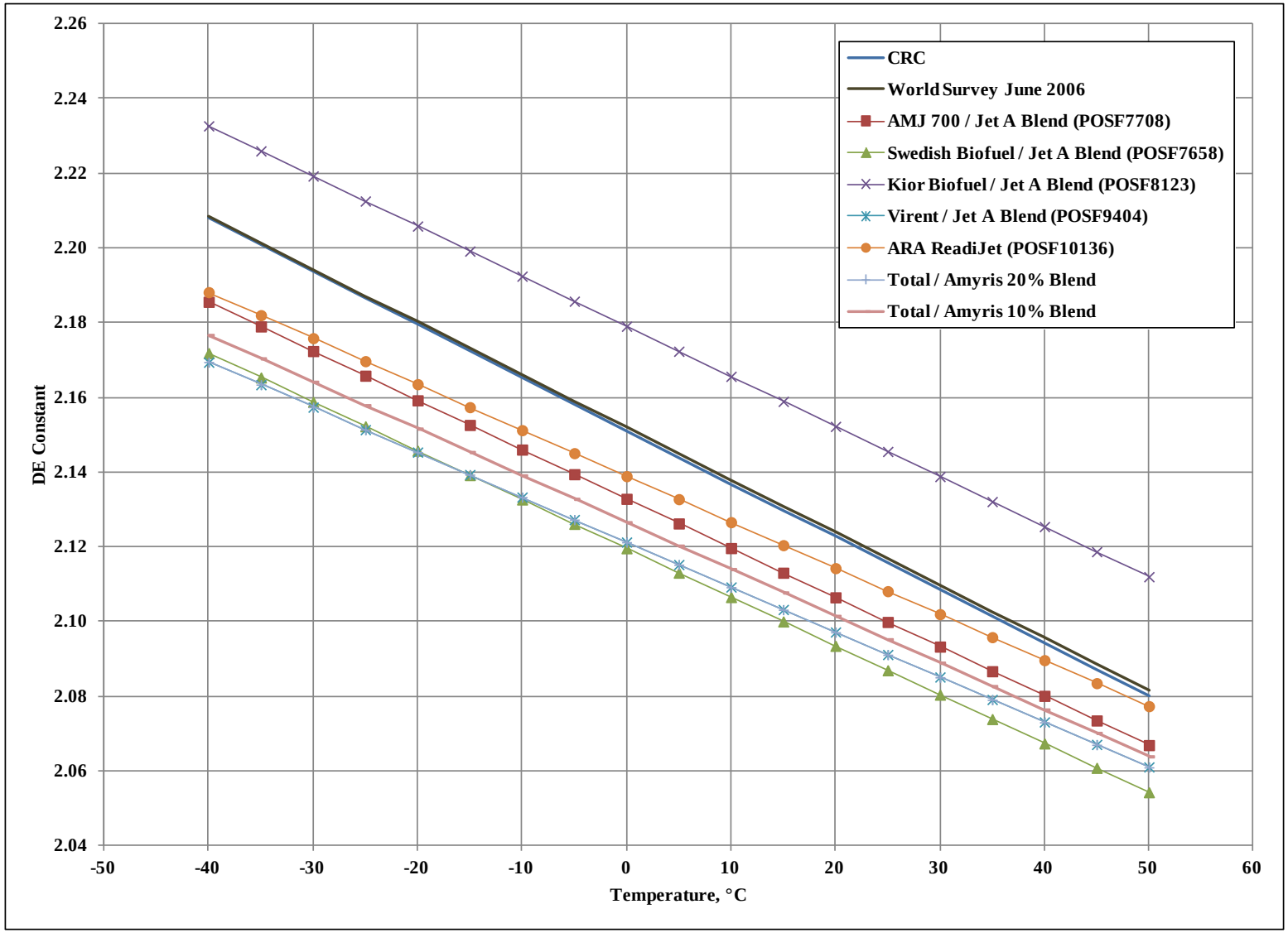

Figure B-7. Dielectric Constant vs. Temperature

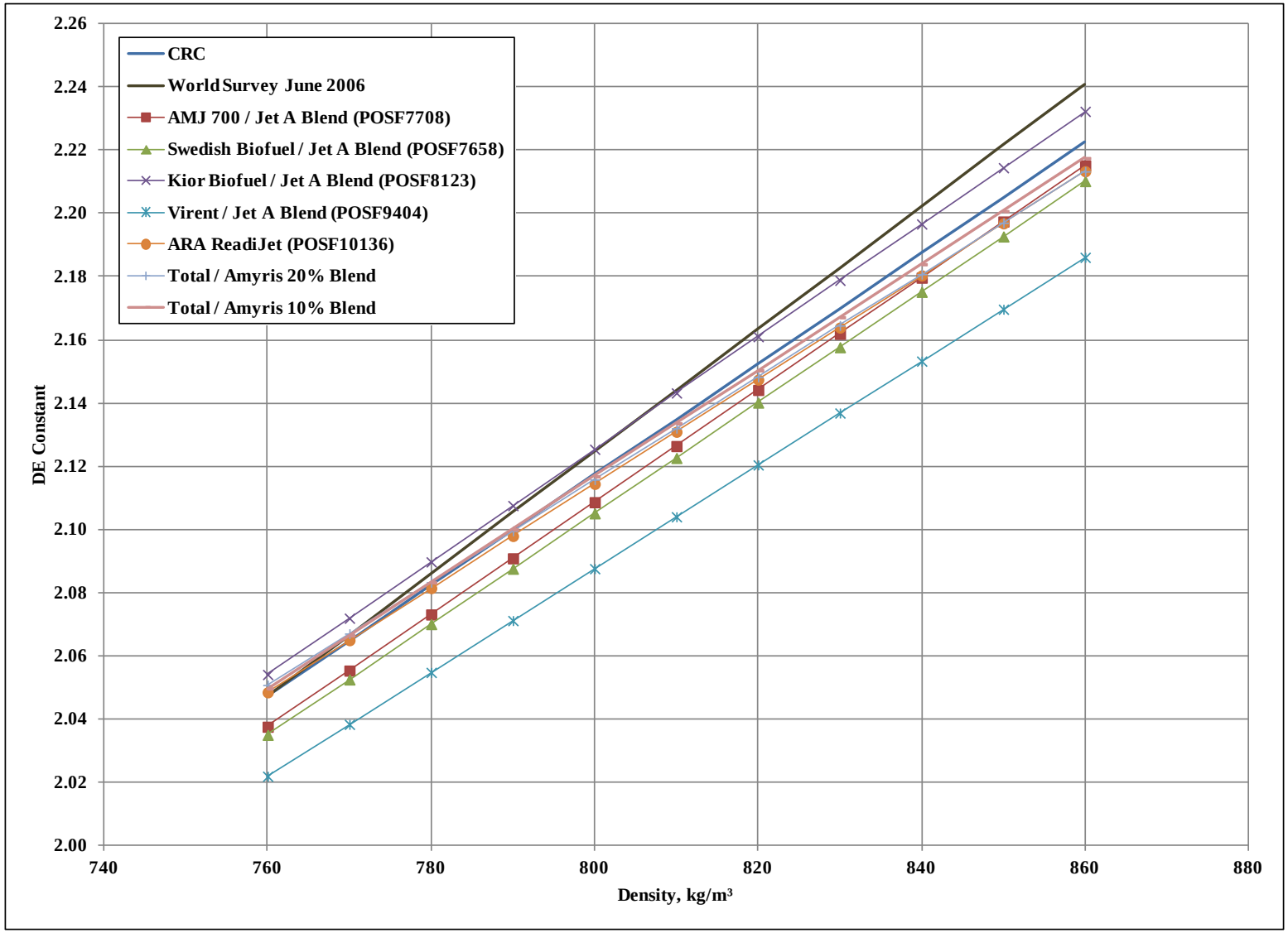

Figure B-8. Dielectric Constant vs. Density

B.3.4.6 Spontaneous Ignition

B.3.4.6.1 Autoignition Temperature (ASTM E659)

With the exception of the HDCJ blend, the fuels in this study fall within 5-10°C of the CRC data (Figure B-9). Curiously, the HDCJ blend autoignition temperature and minimum ignition energy is significantly higher than other fuels while its upper explosion limit it substantially lower.

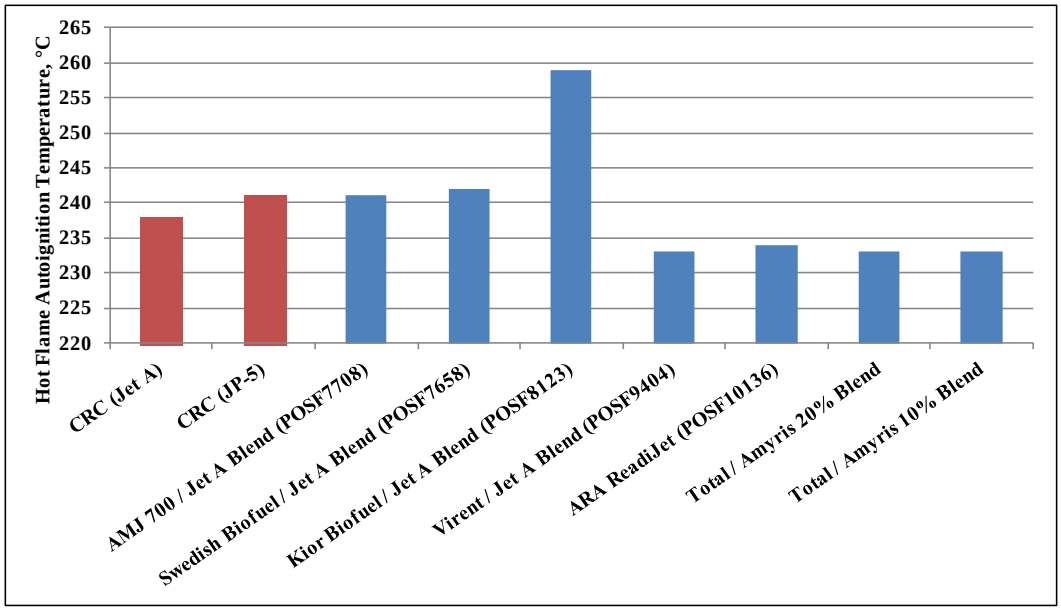

Figure B-9. Autoignition Temperature

B.3.4.6.2 Hot Surface Ignition Temperature (FTM 791-6053)

All of the fuels in this study exhibited a minimum hot surface ignition temperature in the range of 1100-1250°F (Figure B-10). This seems to be a nominal range for most fuels tested by this method to date. As written, this method is a pass/fail test at 1300°F so, strictly speaking, all of these fuels would fail.

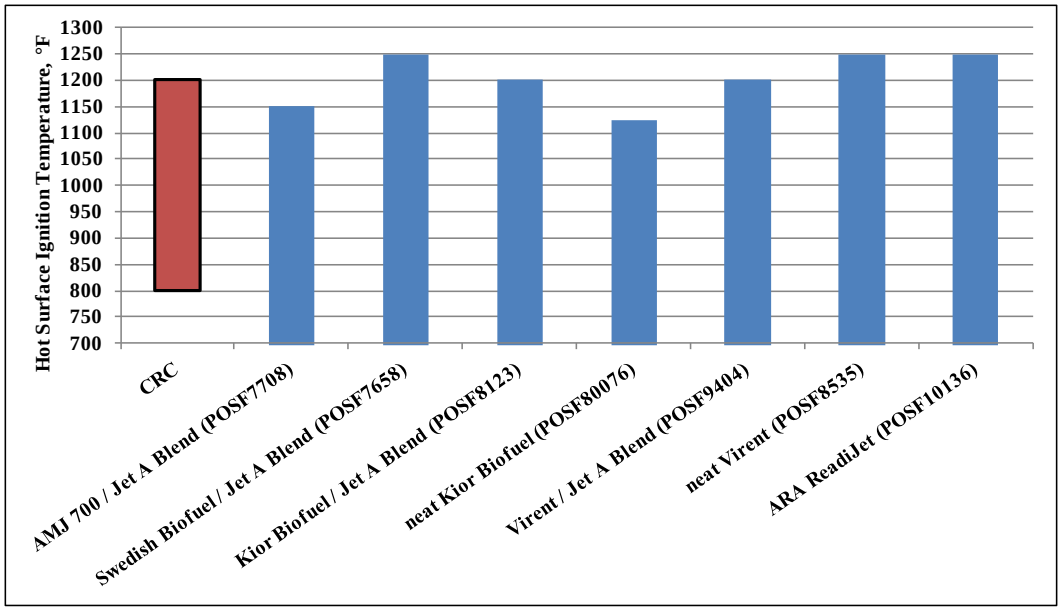

Figure B-10. Hot Surface Ignition Temperature

B.3.4.7 Minimum Ignition Energy (ASTM E582)

With the exception of the HDCJ blend, most of the fuels in this study showed a similar response to this test (Figure B-11). While most of those values are below the expected CRC data, it's uncertain how the CRC data was generated or how the sensitivity of those measurements compare to the modern day instrumentation.

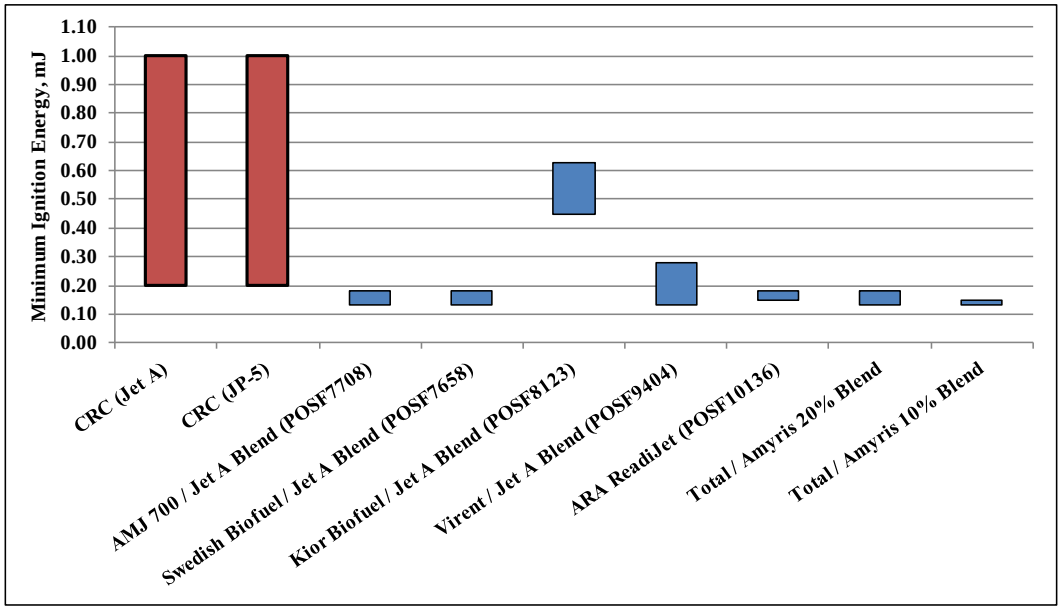

Figure B-11. Minimum Ignition Energy

B.3.4.8 Upper/Lower Explosion Limits (E681)

The upper and lower explosion (a.k.a flammability) limits are shown in Figure B-12. This set of samples showed a wider range of response for the upper limit than had been seen previously. In some cases, the results were checked against a second lab and found to give comparable results. The lower limits all seem to vary between 0.5-1.0% so they present about the same hazards as far as handling is concerned. The HDCJ blend did show a lower upper limit compared to other fuels and lower than the expected CRC values.

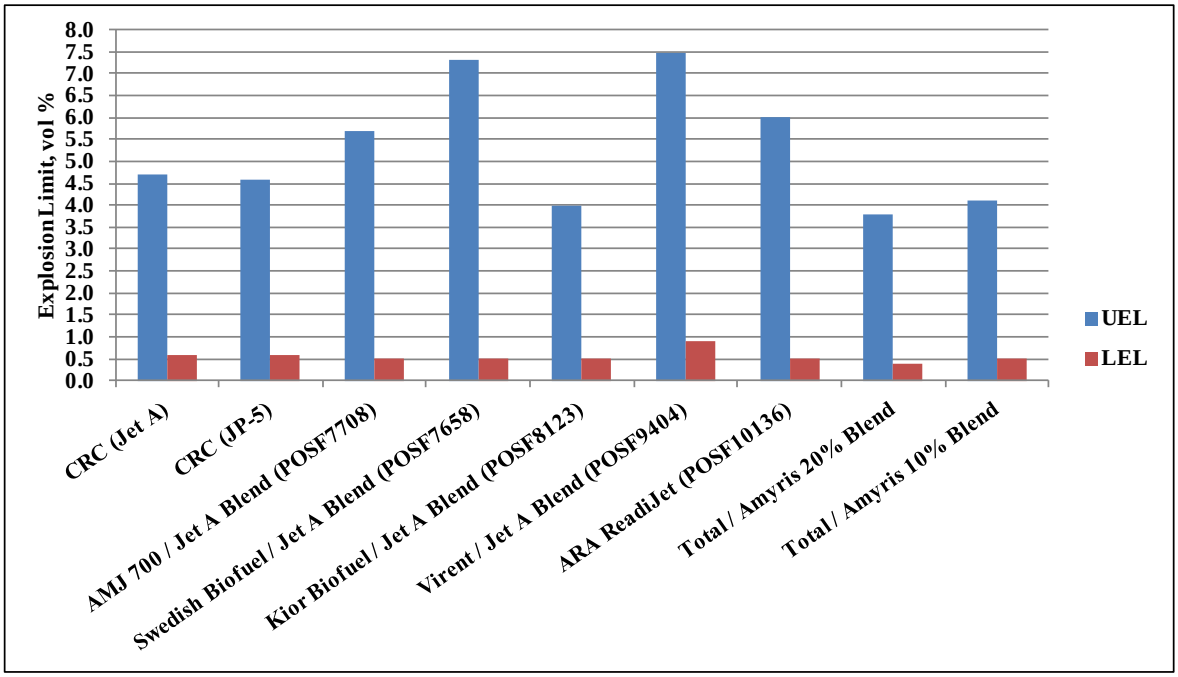

Figure B-12. Explosion Limits

B.3.4.9 Specific Heat Capacity (E2716)

The results for specific heat capacity are tabulated in Table B-2 and shown in Figure B-13. While the slopes of these curves are often in good agreement across many labs, the bias has been cause for concern. Based on our experience with this method, we would estimate the repeatability to be in the range of 5-10%.

Table B-2. Reversing Heat Capacity

SwRI Sample ID	Reversing Heat Capacity (kJ/kg.K)						Equation
	-25°C	0°C	25°C	50°C	100°C	150°C	
CL12-3599	1.880	1.966	2.062	2.163	2.346	2.563	y=(0.00389)*x+1.96863
CL12-3339	1.810	1.880	1.970	2.050	2.200	2.380	y=(0.00325)*x+1.88598
CL12-3883	1.601	1.684	1.764	1.849	2.042	2.249	y=(0.00370)*x+1.67983
CL12-4367	1.702	1.793	1.892	1.983	2.176	2.398	y=(0.00395)*x+1.79302
CL13-4826	1.703	1.790	1.870	1.960	2.160	2.370	y=(0.00372)*x+1.79412
CL12-4716	1.953	2.032	2.136	2.244	2.445	2.673	y=(0.00414)*x+2.03993
CL13-4717	1.976	2.058	2.146	2.242	2.470	2.676	y=(0.00406)*x+2.05816

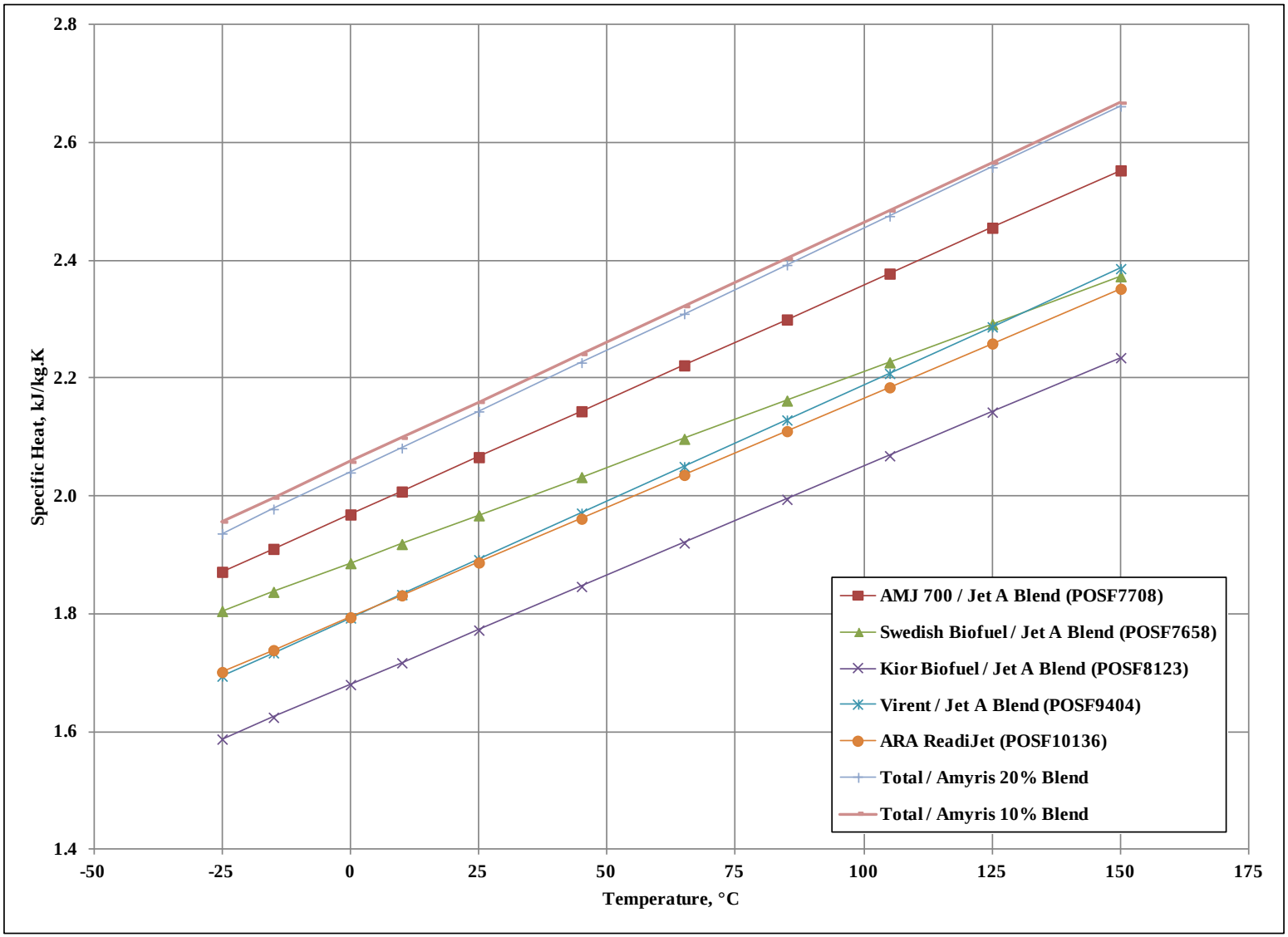

Figure B-13. Reversing Heat Capacity

B.3.4.10 Thermal Conductivity (Transient Hot Wire)

Using the new transient hot wire device, the thermal conductivity data, Figure B-14, appears more consistent with values for typical hydrocarbons and the samples in this study appear to fall about both sides a of typical Jet A (DLA Sample #22). Like other hydrocarbon properties, thermal conductivity appears to follow expected trends and shows only a slight variation across a wide temperature range.

B.3.4.11 Surface Tension (D1331A)

The trends in surface tension were similar for all of the fuels and compared well to the CRC data (Figure B-15). The apparent bias of 2-3 mN/m units relative to the CRC data is negligible. Additive treatment alone can result in much larger changes (5-25mN/m) in surface tension.

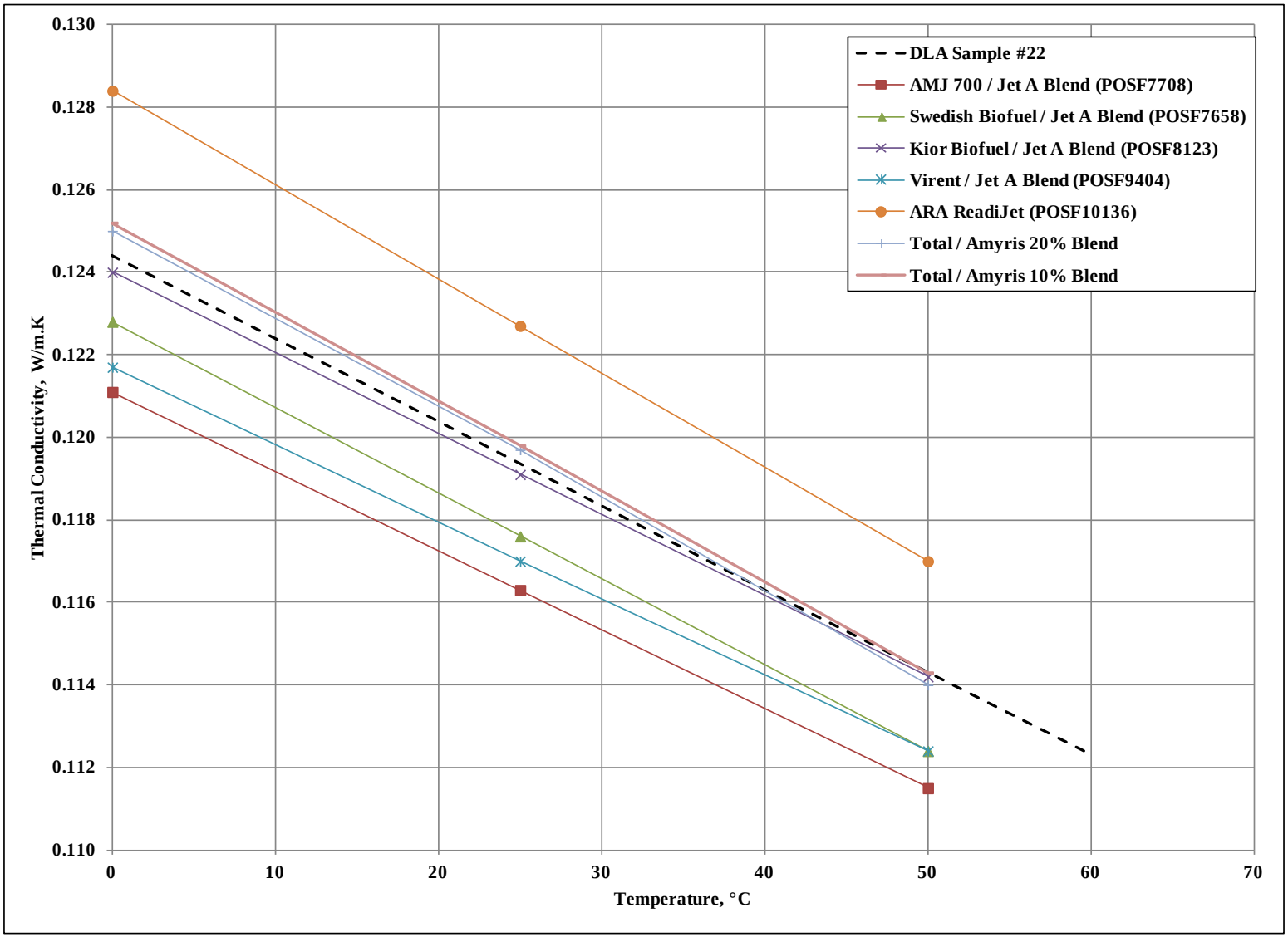

Figure B-14. Thermal Conductivity

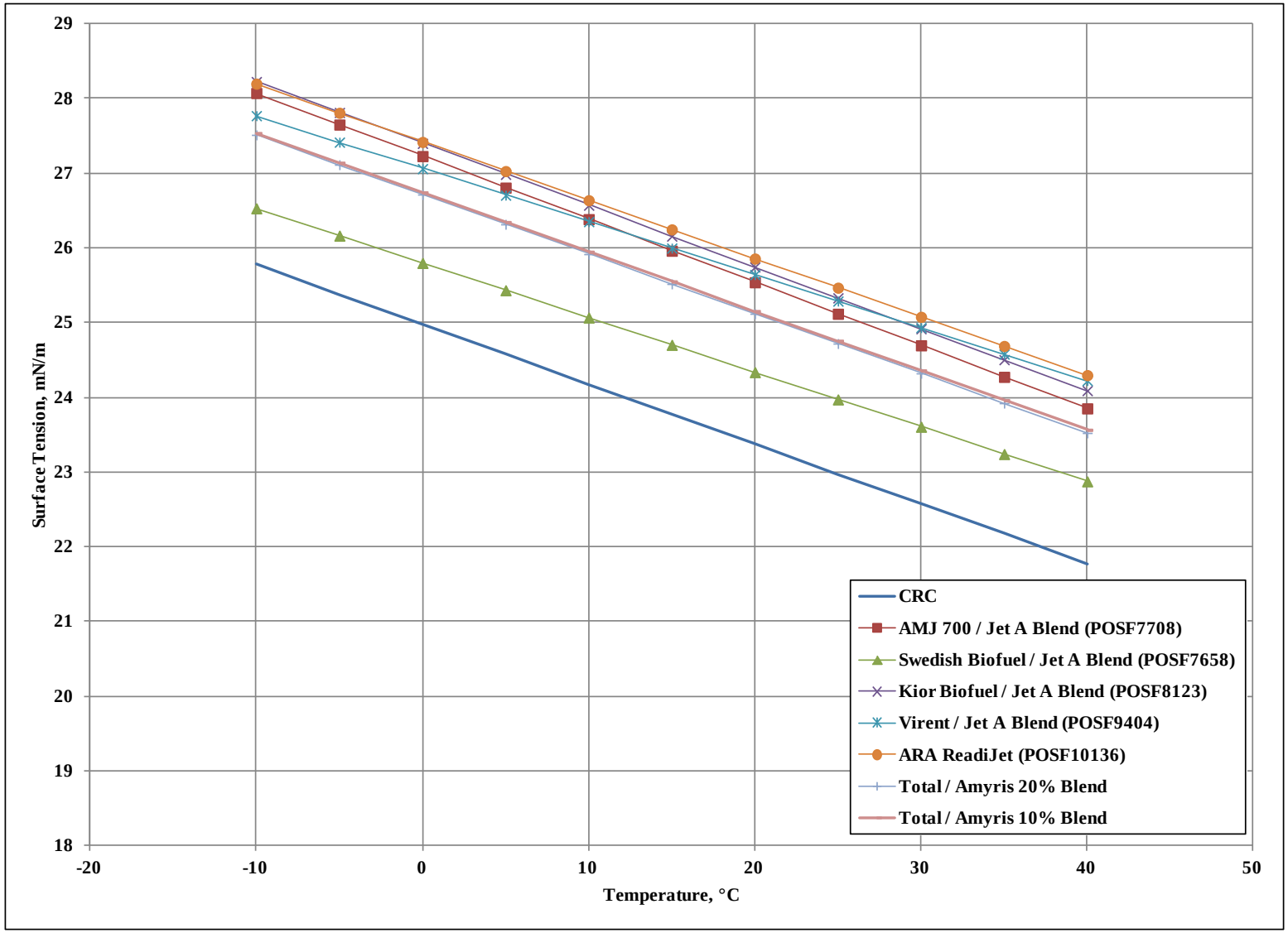

Figure B-15. Surface Tension (D1331A) vs. Temperature

B.3.4.12 BOCLE (D5001 vs. Ci/LI Concentration (DCI-4A)

Most of the fuels in this study had an inherent baseline lubricity at or slightly above the 0.65 mm wear scar limit established in MIL-PRF-25017. While all of the fuels showed a fairly linear response to treatment with DCI-4A (Figure B-16), most required up to 20 mg/L to achieve a value at or below 0.65 mm.

B.3.4.13 Water Content (D6304) vs. Temperature

Water Content vs. Temperature data is often debated due to the inconsistent nature of the testing. The inconsistencies stem from the lack of an established procedure resulting in slight differences in methodology and sampling technique. Repeatability of the D6304 test is also suspect. As one might expect, all fuels show an increased affinity for water with an increase in temperature (Figure B-17). More important would be the fuel/water separation characteristics of these fuels which have not been sufficiently tested to date. In previous research, tallow-based fuels showed an affinity for water and subsequent fuel/water separation tests confirmed that it was difficult to remove that water using standard filtration equipment.

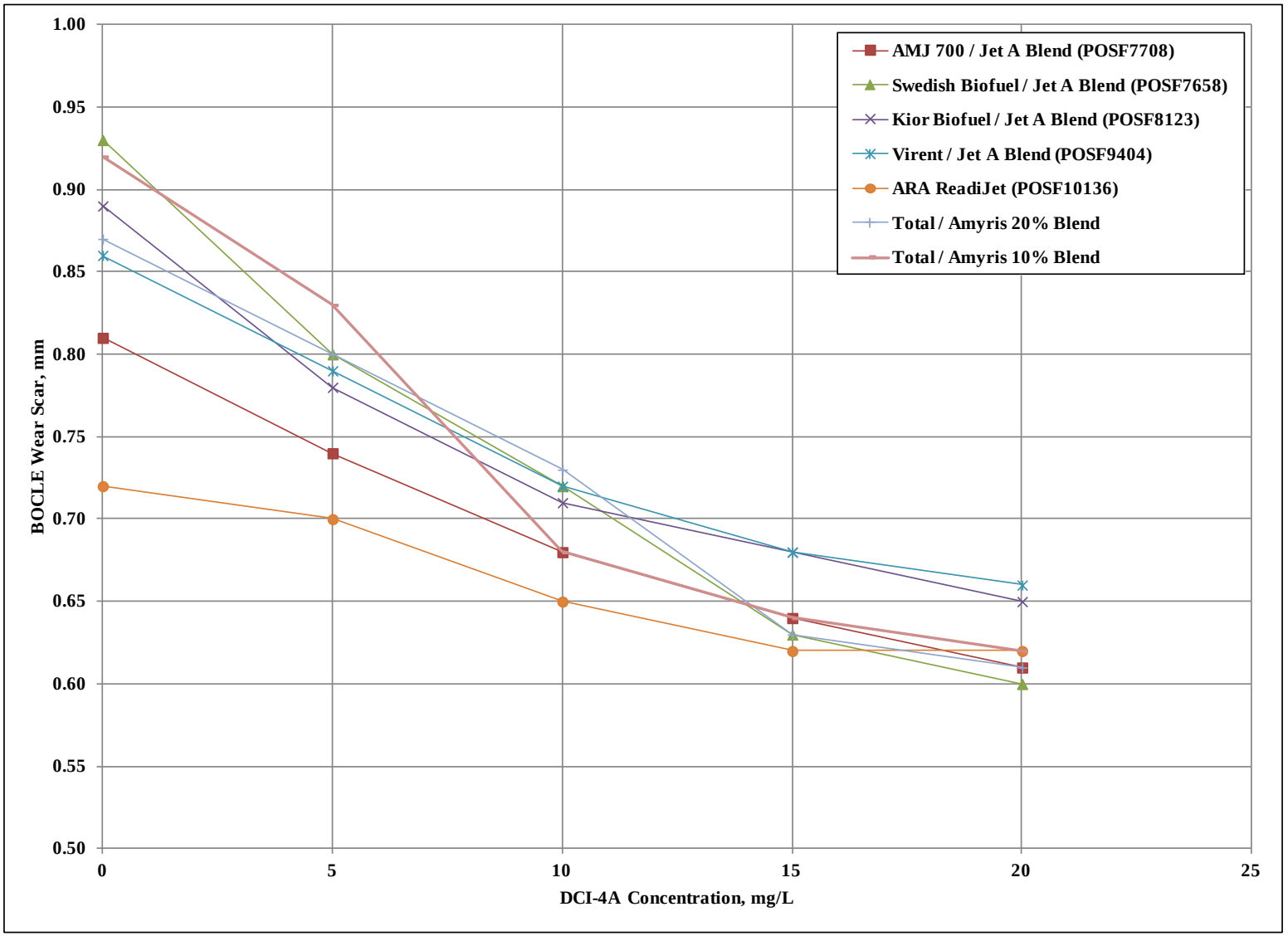

Figure B-16. BOCLE (D5001) vs. CI/LI Concentration (DCI-4A)

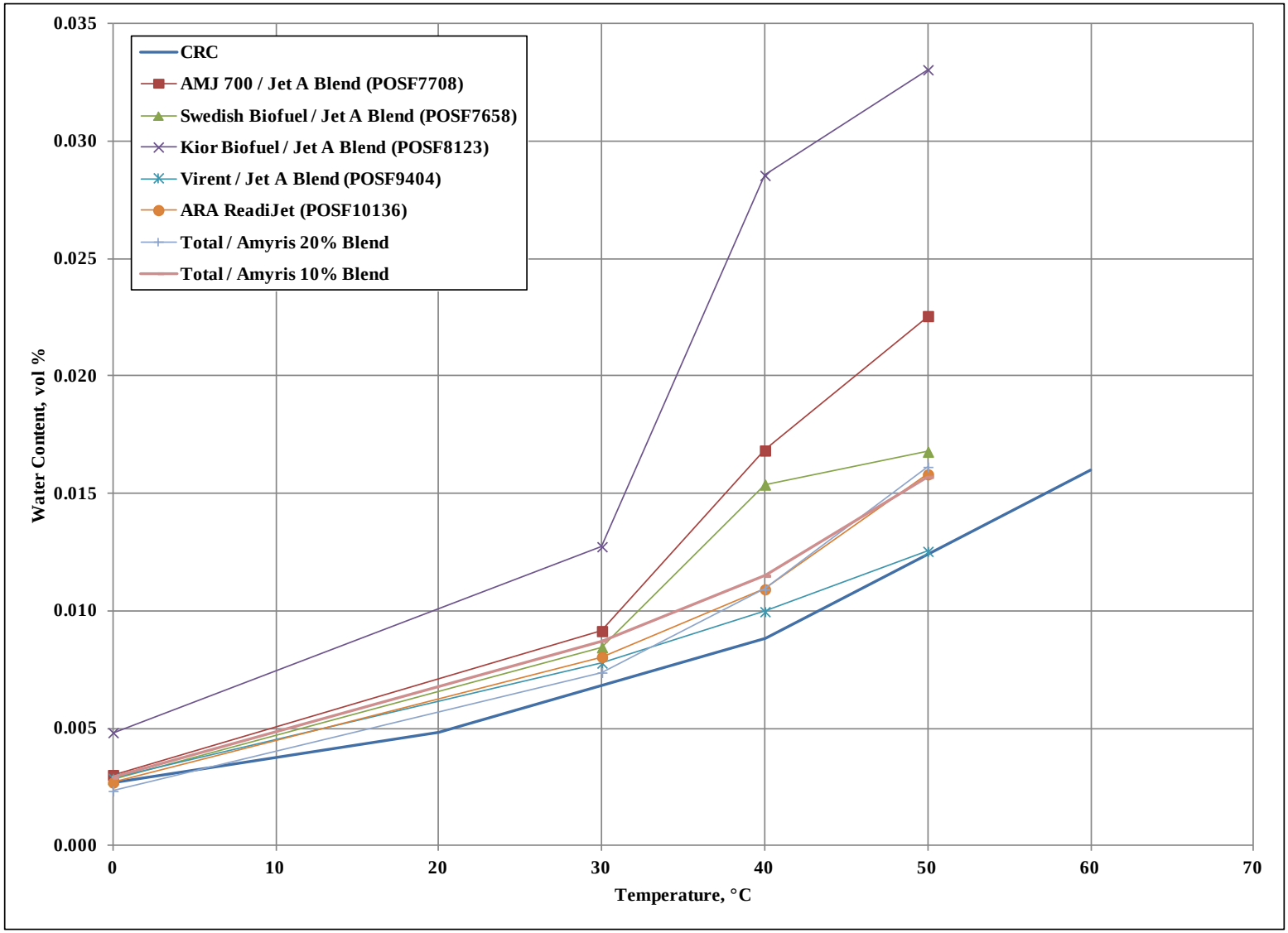

Figure B-17. Water Content (D6304) vs. Temperature

B.3.4.14 Kinematic Viscosity (D445)

Three different views of viscosity data are provided below:

- Raw data on a log scale, Figure B-19
- Viscosity vs. Temperature on a linear scale with artificial x and y axes, Figure B-20
- Viscosity vs. Temperature, linearized and extrapolated on a log scale, Figure B-18

The last figure was generated using the MATAB script designed for the Navy. These fuels follow the general trends see in the World Survey Data and fall well within the upper limit of 8 cSt required for JP-8.

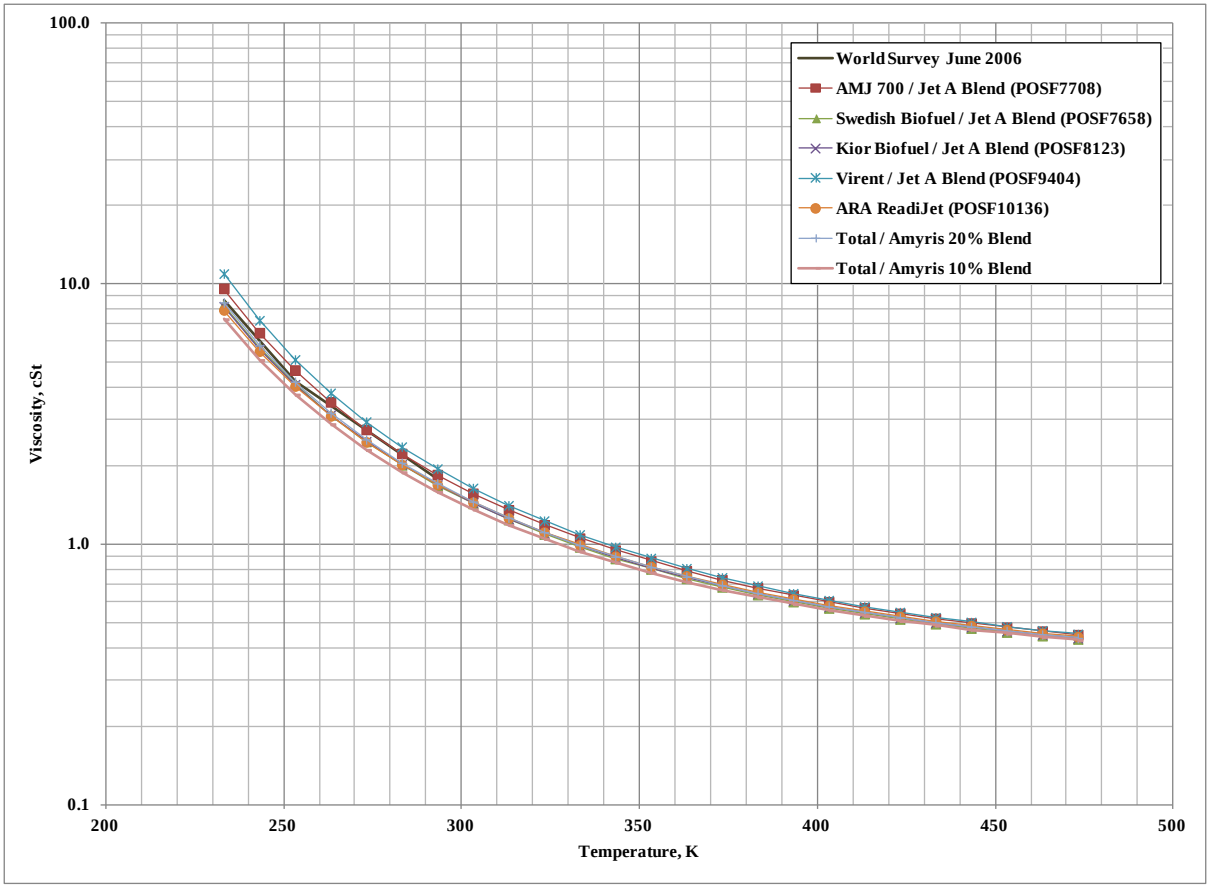

Figure B-18. Kinematic Viscosity (D445)

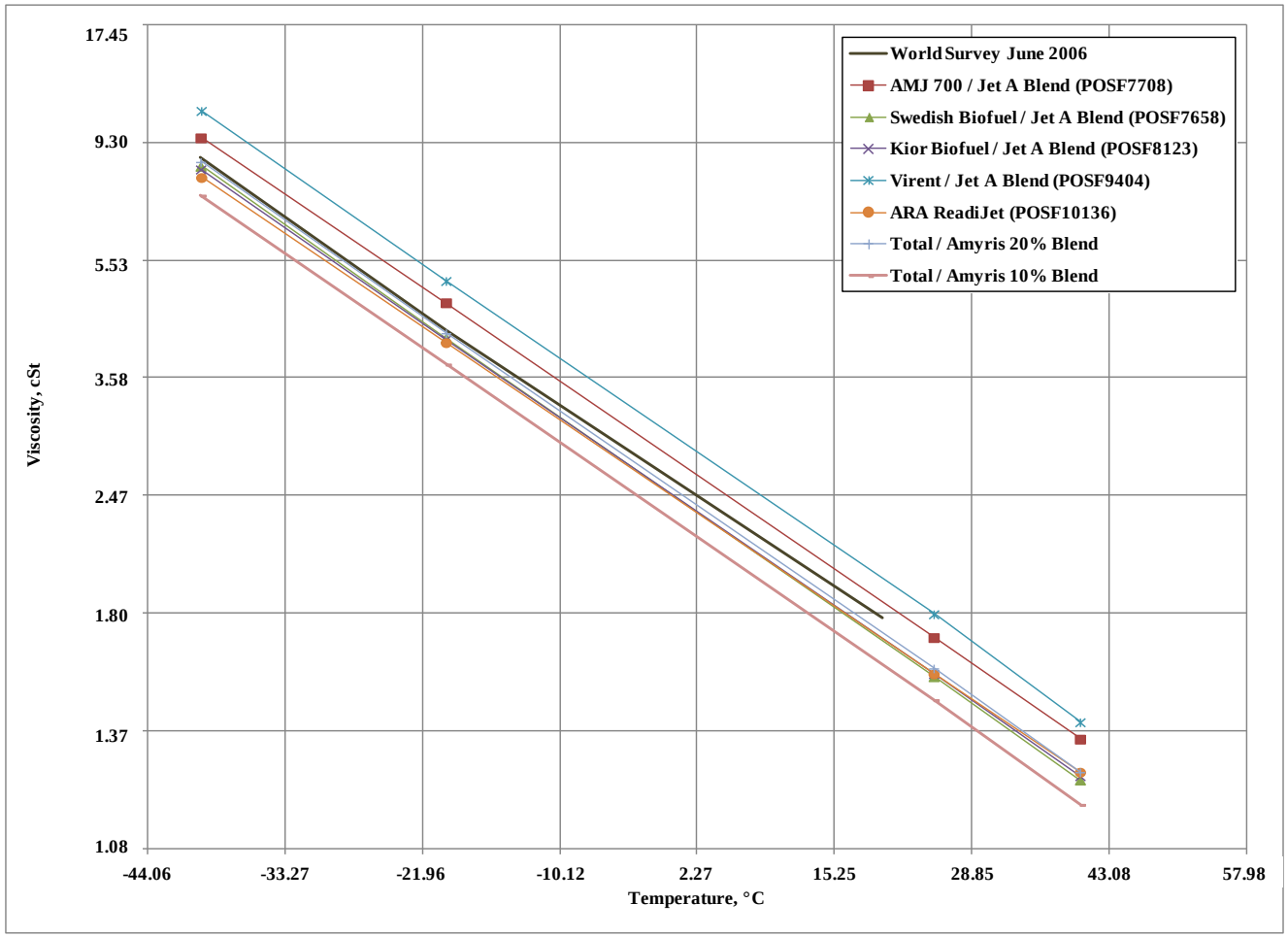

Figure B-19. Kinematic Viscosity by ASTM D445/D341

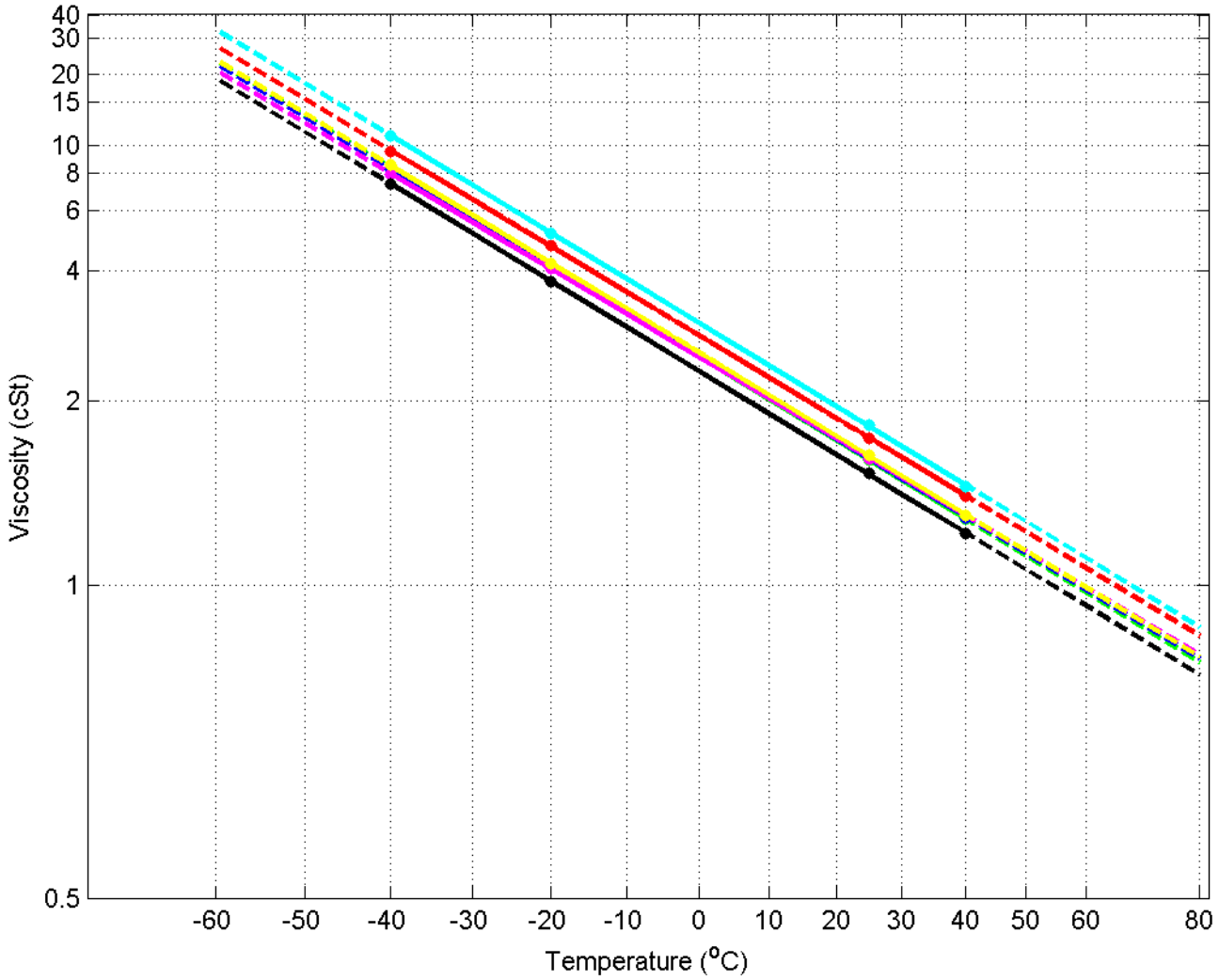

Figure B-20. Kinematic Viscosity by ASTM D445/D341

B.3.4.15 Electrical Conductivity (D2624) vs. SDA Concentration (Stadis 450)

The fuels in this effort showed a good response to treatment with static dissipater additive (Figure B-21). Most showed a linear response and 1 mg/L was sufficient to bring the electrical conductivity into the JP-8 range. The distinct clustering of the samples into two groups seemed odd; however, no systematic variation could be found. The samples were analyzed over a wide period of time, using up to three different meters and some samples that were run at the same time fell into different clusters.

B.3.4.16 Electrical Conductivity vs. Temperature

Apparently, most of the fuels in this effort contained no static dissipater as evidenced by their lack of baseline electrical conductivity and little response to temperature (Figure B-22). The Swedish biofuel had a baseline conductivity falling in the JP-8 range and responded to temperature changes. Only above 30°C did it exceed 600 pS/m.

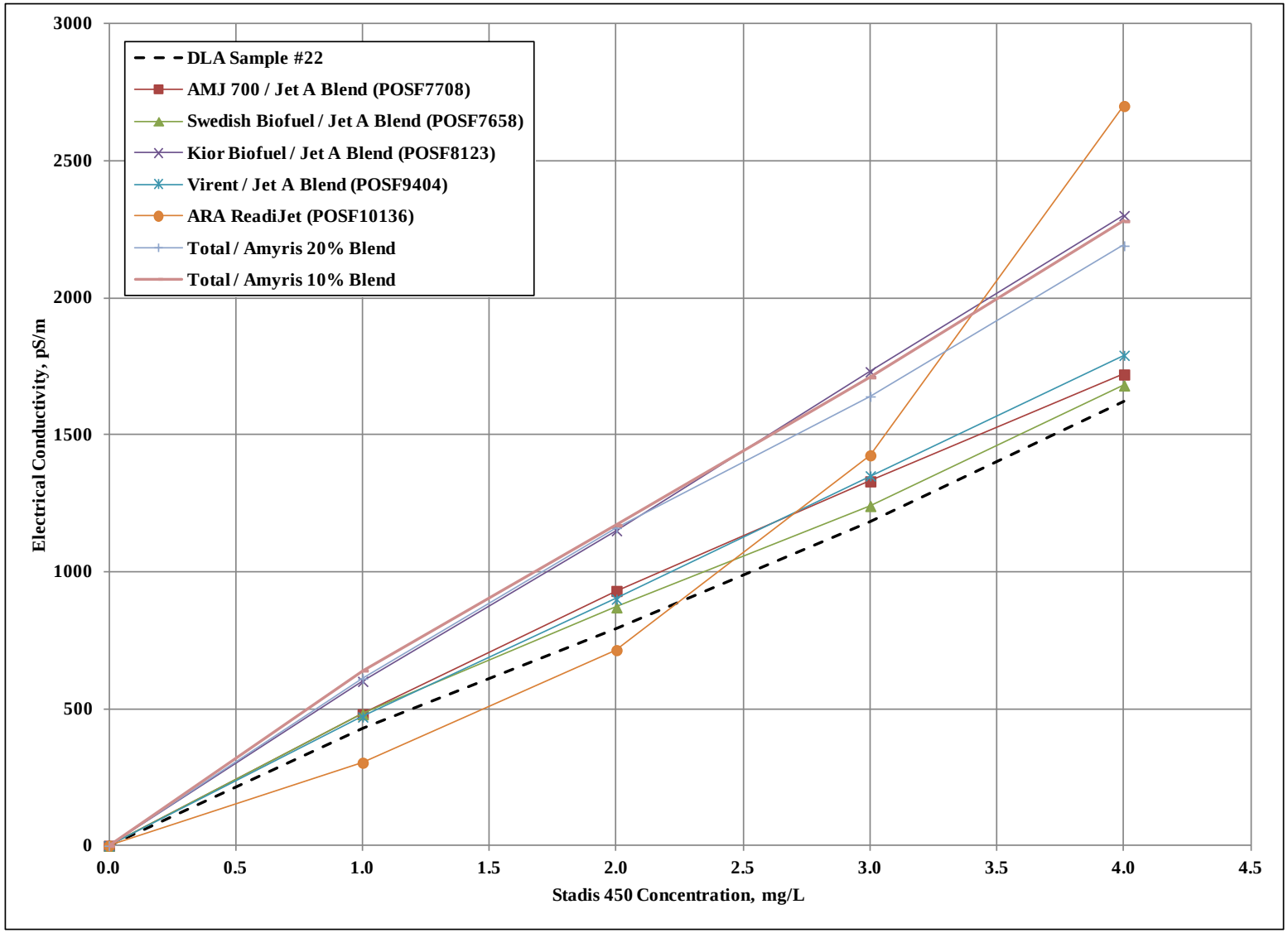

Figure B-21. Electrical Conductivity vs. Stadis 450 Concentration

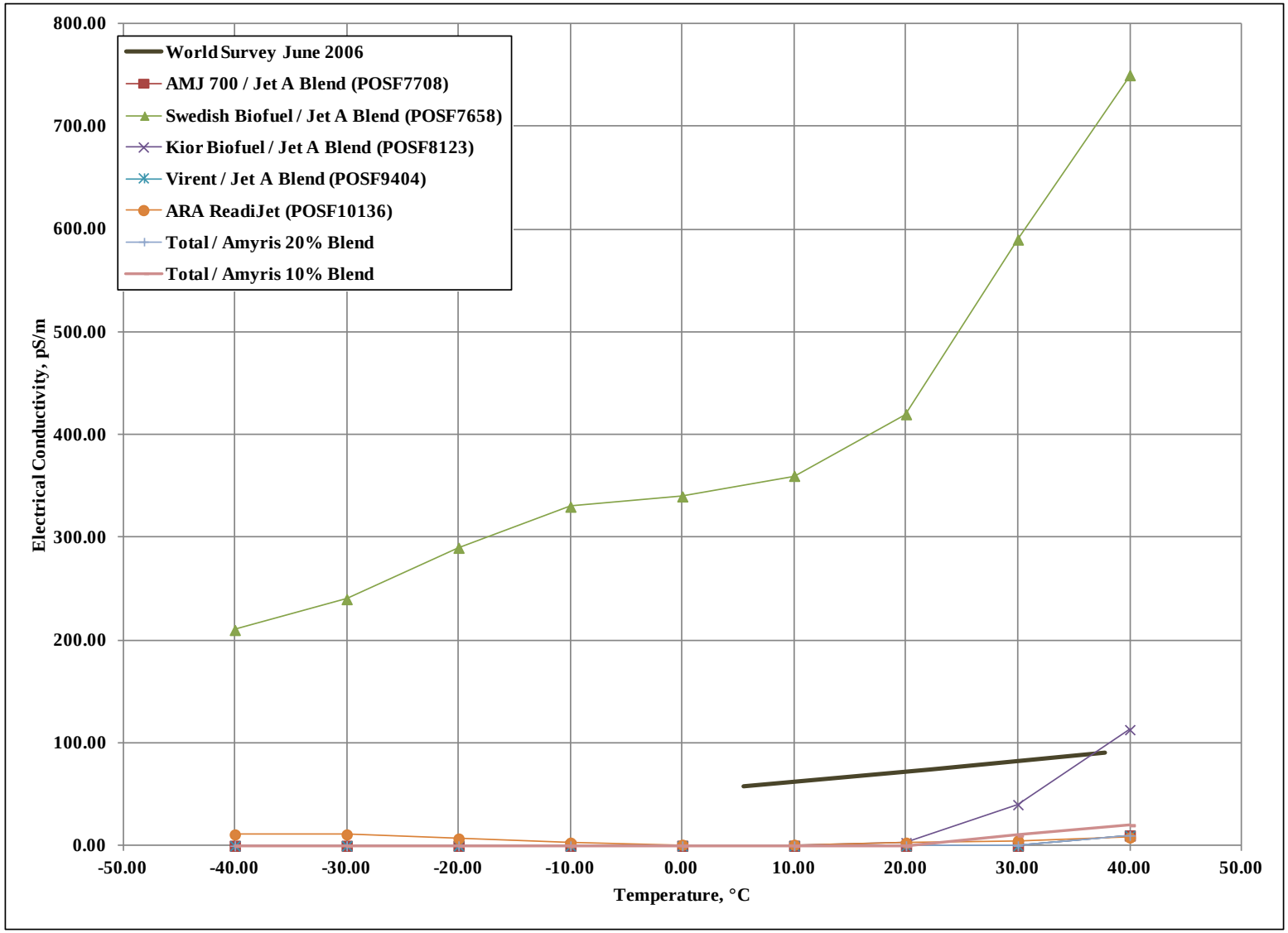

Figure B-22. Electrical Conductivity vs. Temperature

B.3.4.17 Elastomer Compatibility

Figure B-23 and Figure B-24 provides a summary of the tensile strength and volume change, respectively, following immersion in each fuel. This chart is compiled from the individual figures in the appendices and includes Jet A as a reference. Other than the high aromatic HDCJ fuels, fluorosilicone seems to be impervious to changes in fuel composition. The HDCJ also appears to impact tensile strength for viton and all three materials with respect to volume change.

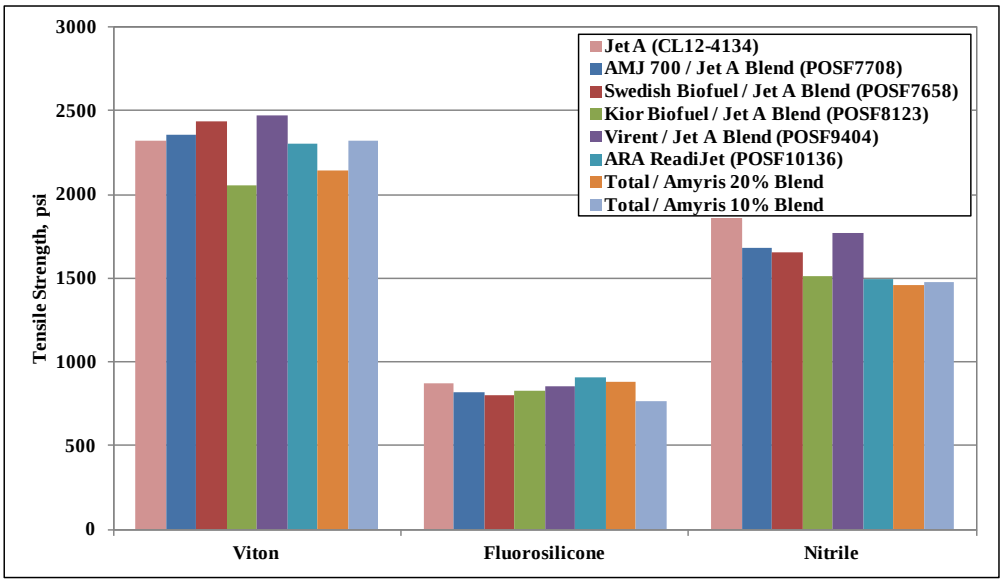

Figure B-23. Elastomer Compatibility – Tensile Strength

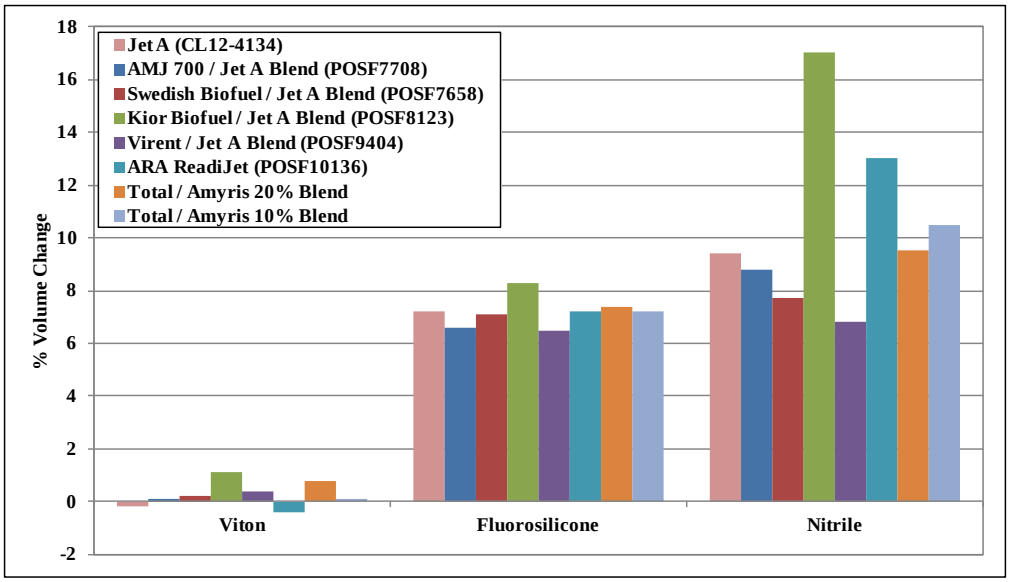

Figure B-24. Elastomer Compatibility – Volume Change

B.3.5 PQIS Comparison

Utilizing the PQIS 2013 Annual Report database, fuel quality data for Jet A, Jet A-1, JP-8, and JP-5 was extracted and plotted for comparison against the samples evaluated under this effort. Figures for selected properties are shown in Figure B-24 through Figure B-43 and indicate where the test fuels fall within the distribution of data in the PQIS database. When reading the x-axis, the lower bound is inclusive and the upper bound is exclusive. For example, in Figure B-24 the second column indicates the % of total sample volume that has an IBP between 90.00 and 99.99. The textboxes indicate to which bin the data point for each of those samples belongs.

Note that the PQIS values for net heat of combustion are calculated (D3338/4529) and some properties are a mix of data from several methods. Generally, the data shows that the values for these samples fall within the range of values found in the PQIS database. A few properties such as low aromatic content for the Virent Blend and high aromatic content / high density for the Kior HDCJ Blend lie at the furthest extremes of their respective distribution curves. These properties are not unexpected given the composition of the blendstocks.

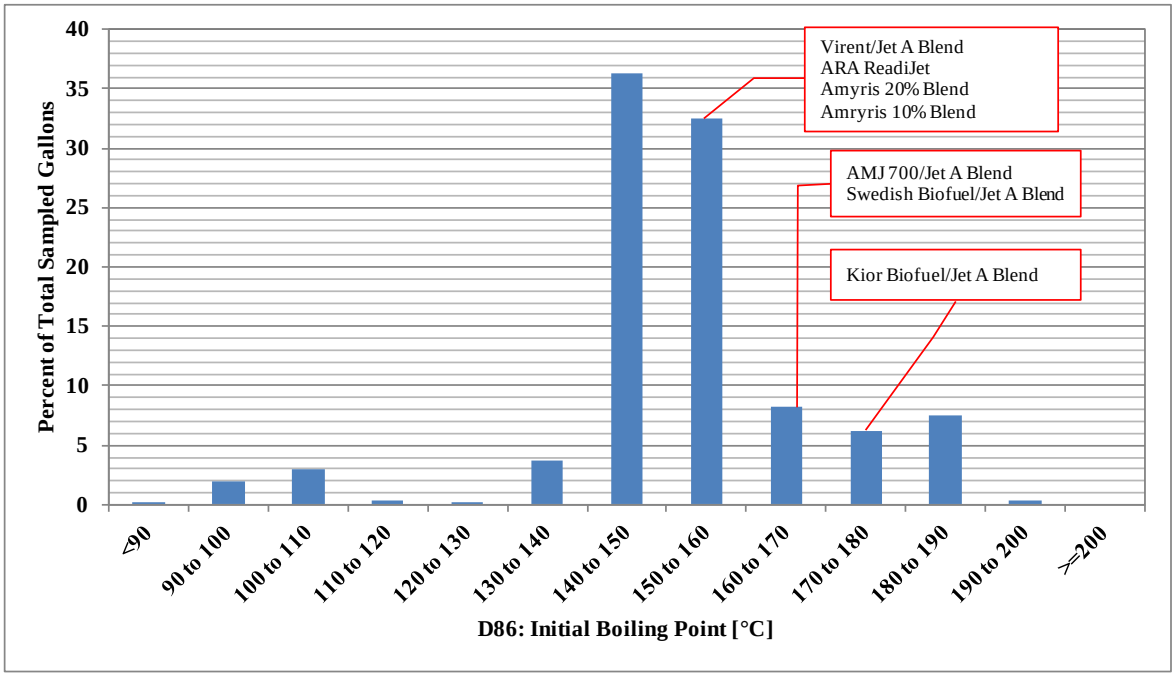

Figure B-25. PQIS Comparison: Initial Boiling Point

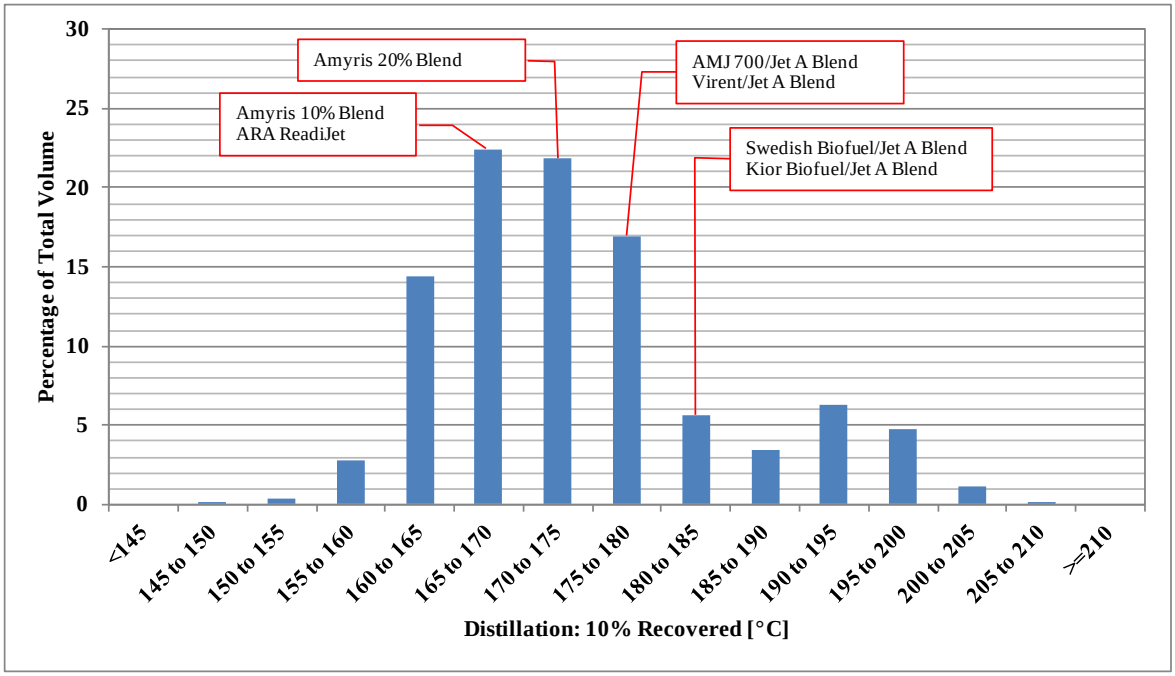

Figure B-26. PQIS Comparison: 10% Recovered

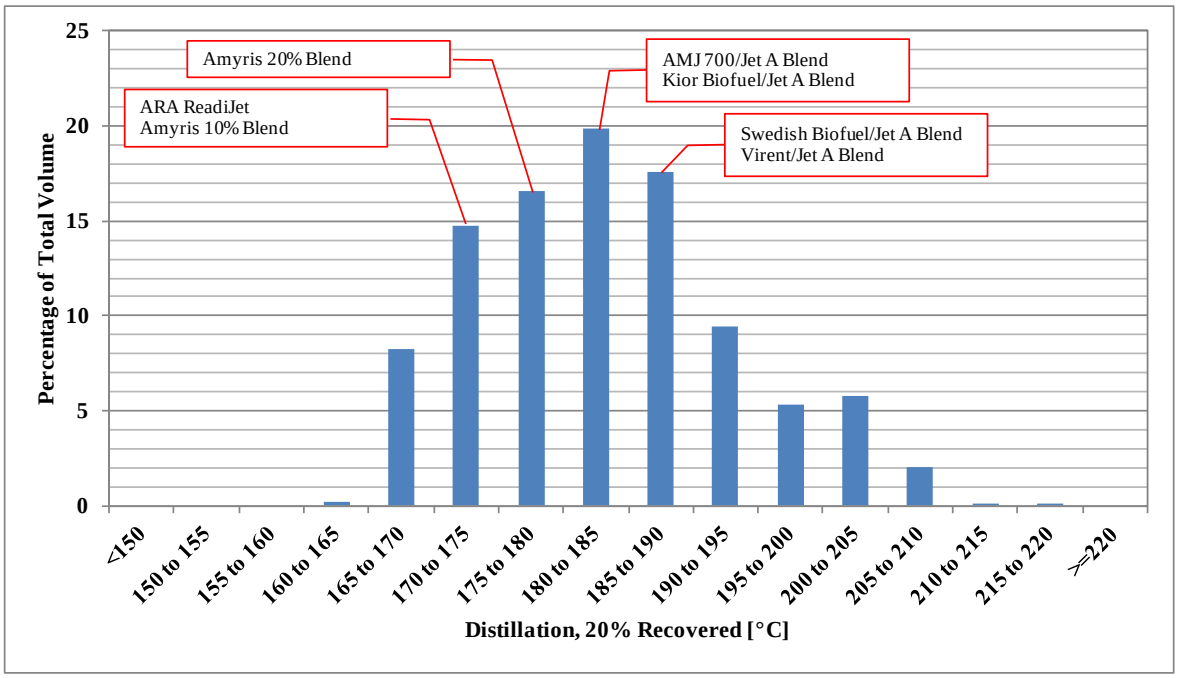

Figure B-27. PQIS Comparison: 20% Recovered

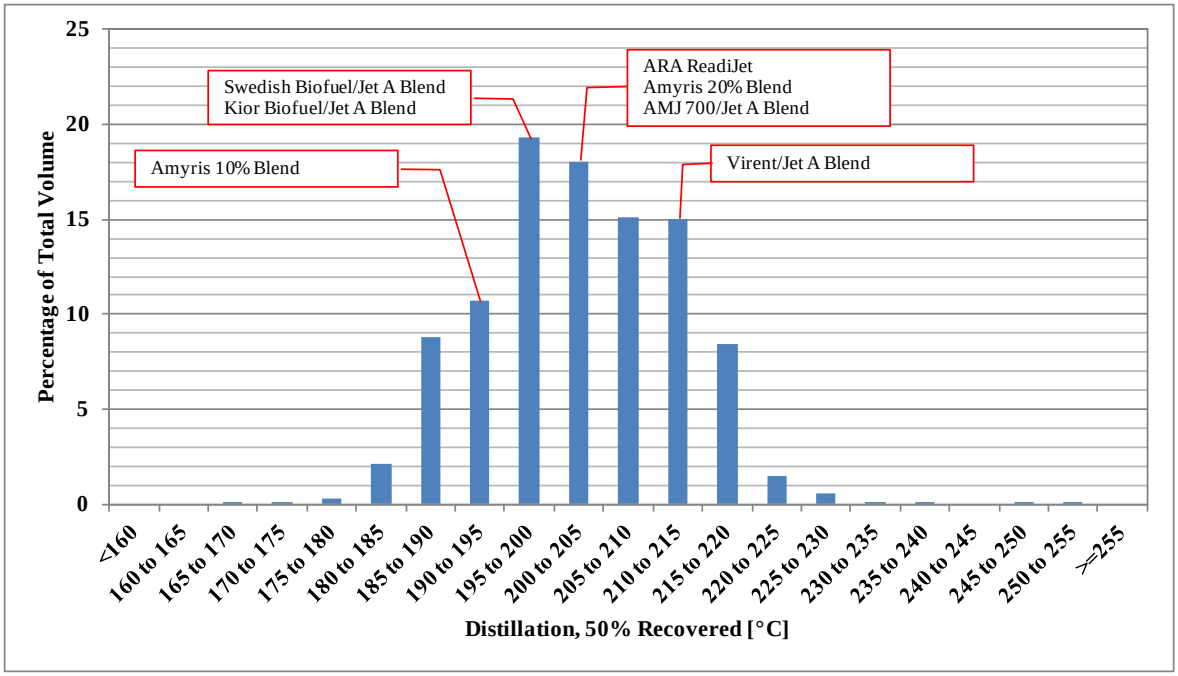

Figure B-28. PQIS Comparison: 50% Recovered

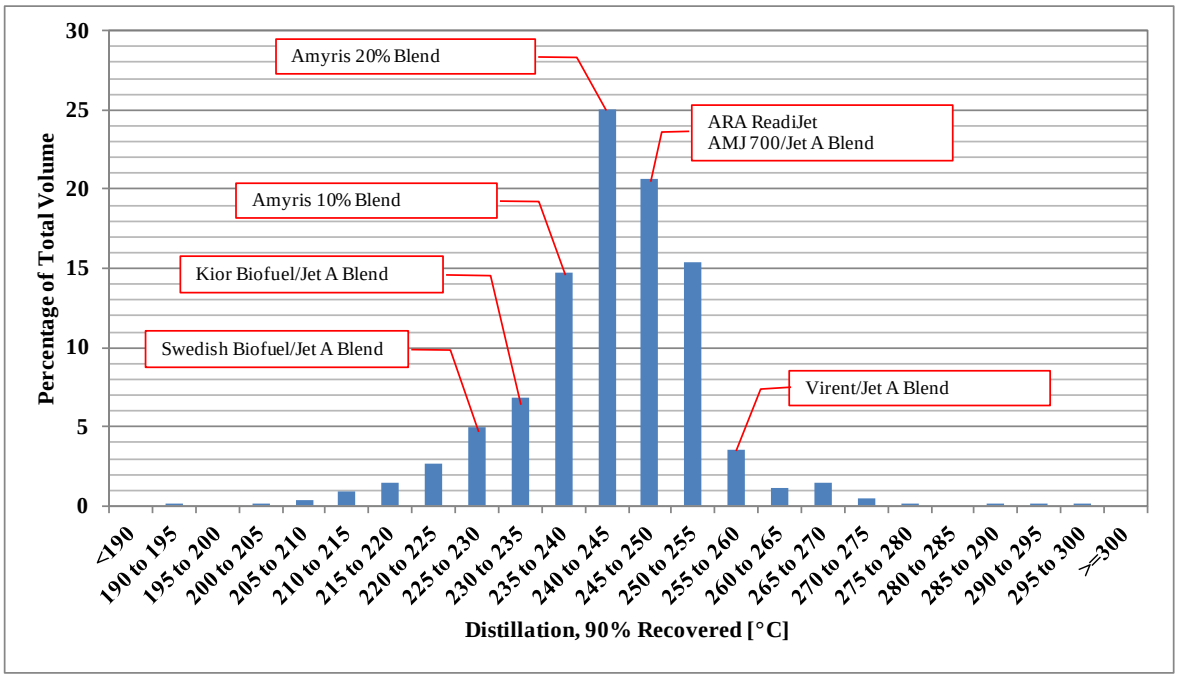

Figure B-29. PQIS Comparison: 90% Recovered

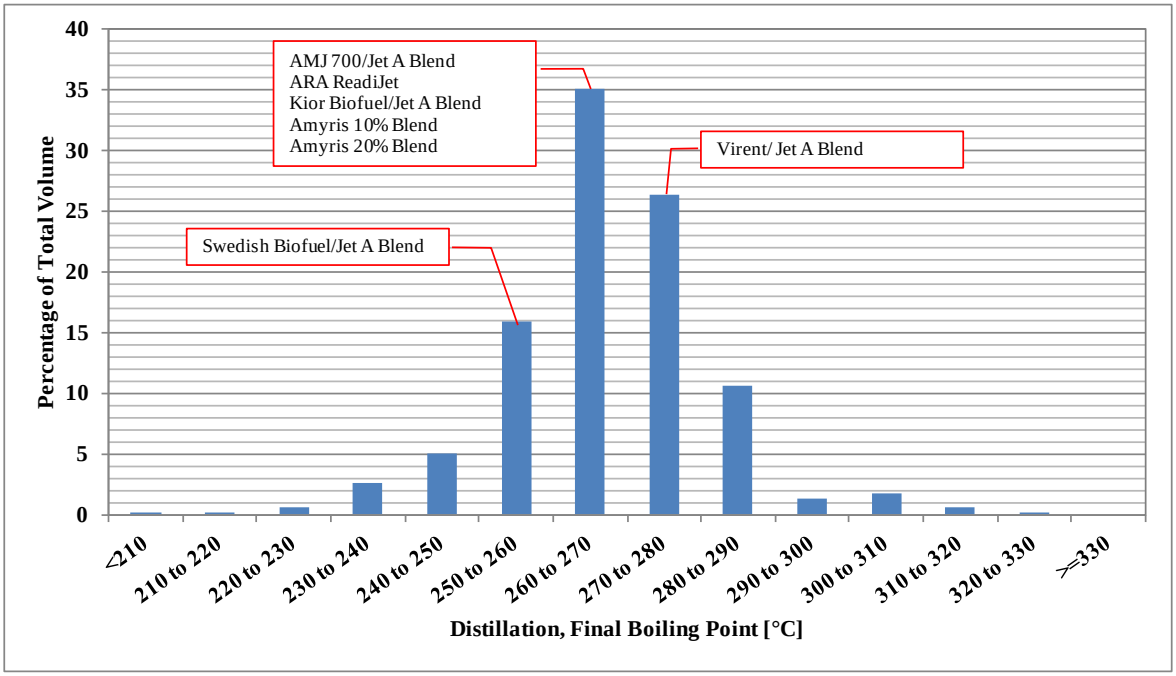

Figure B-30. PQIS Comparison: Final Boiling Point

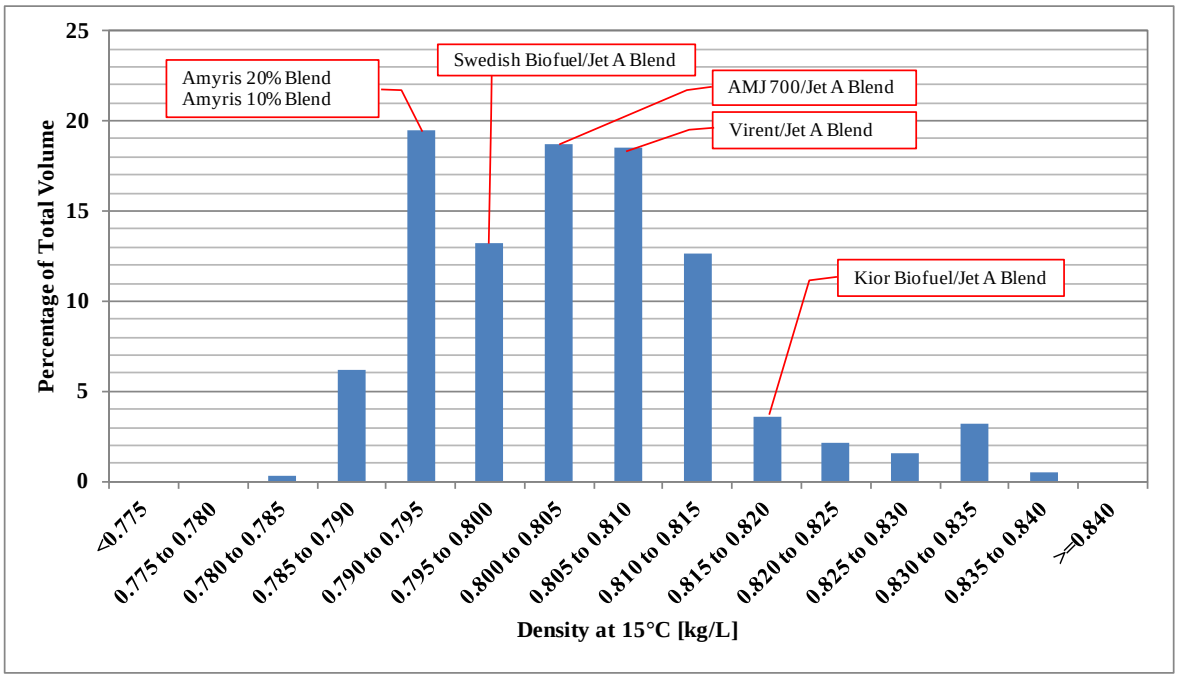

Figure B-31. PQIS Comparison: Density (D4052)

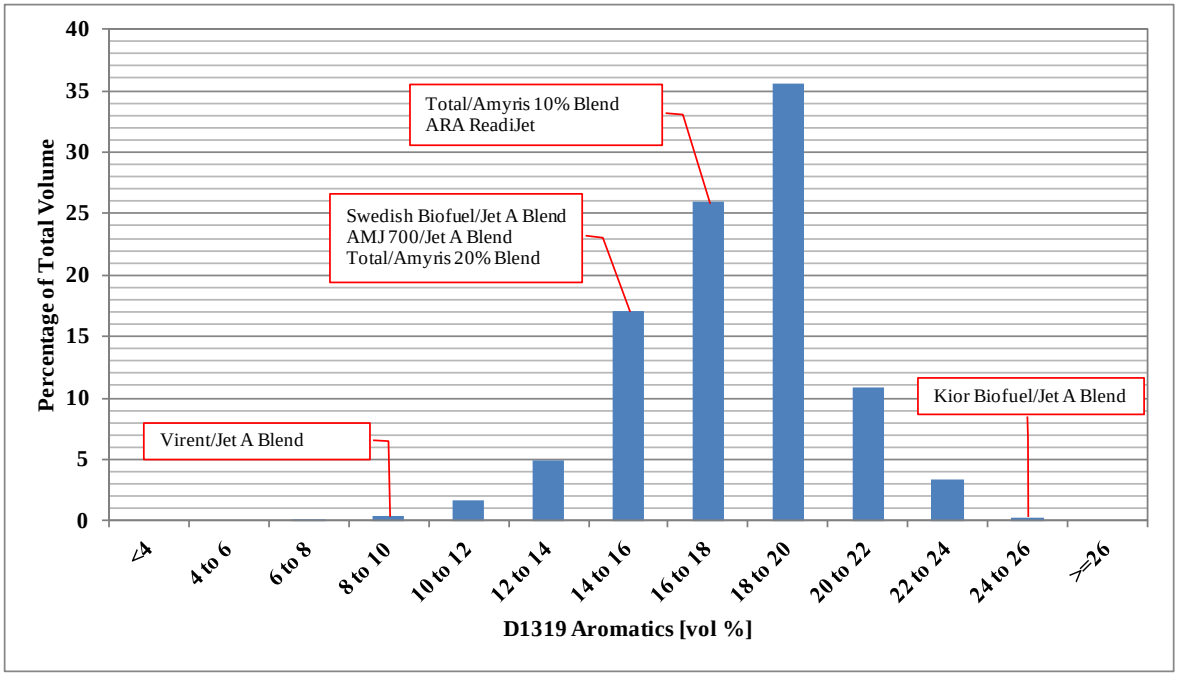

Figure B-32. PQIS Comparison: Aromatics (D1319)

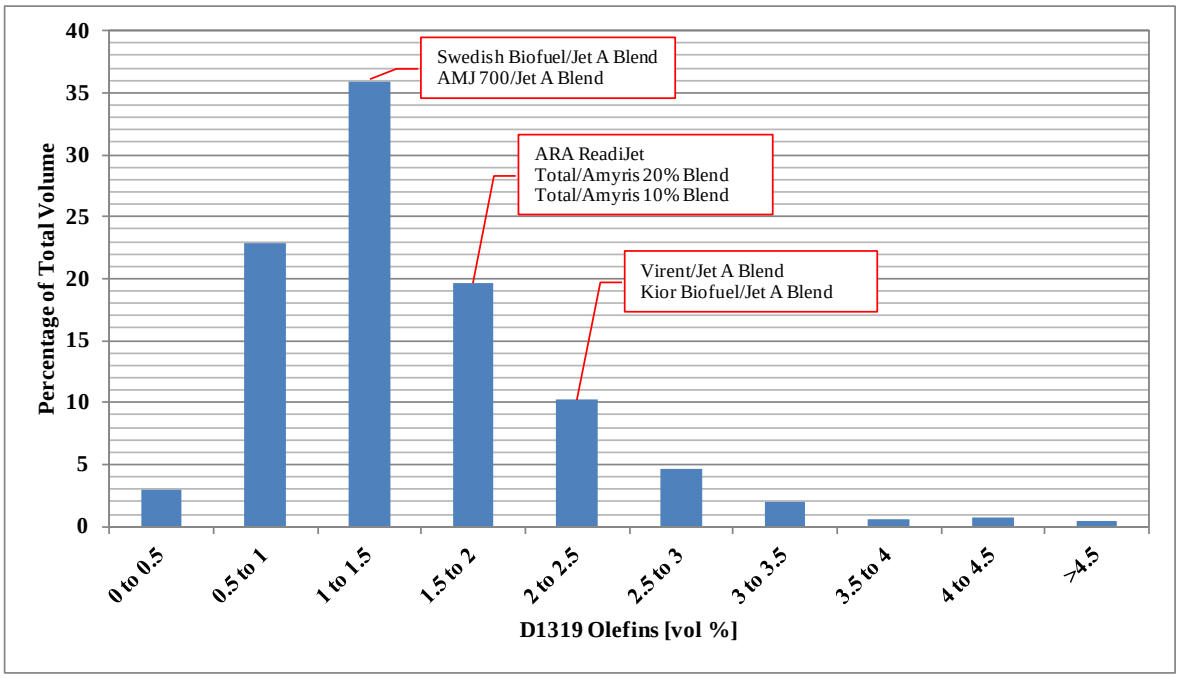

Figure B-33. PQIS Comparison: Olefins (D1319)

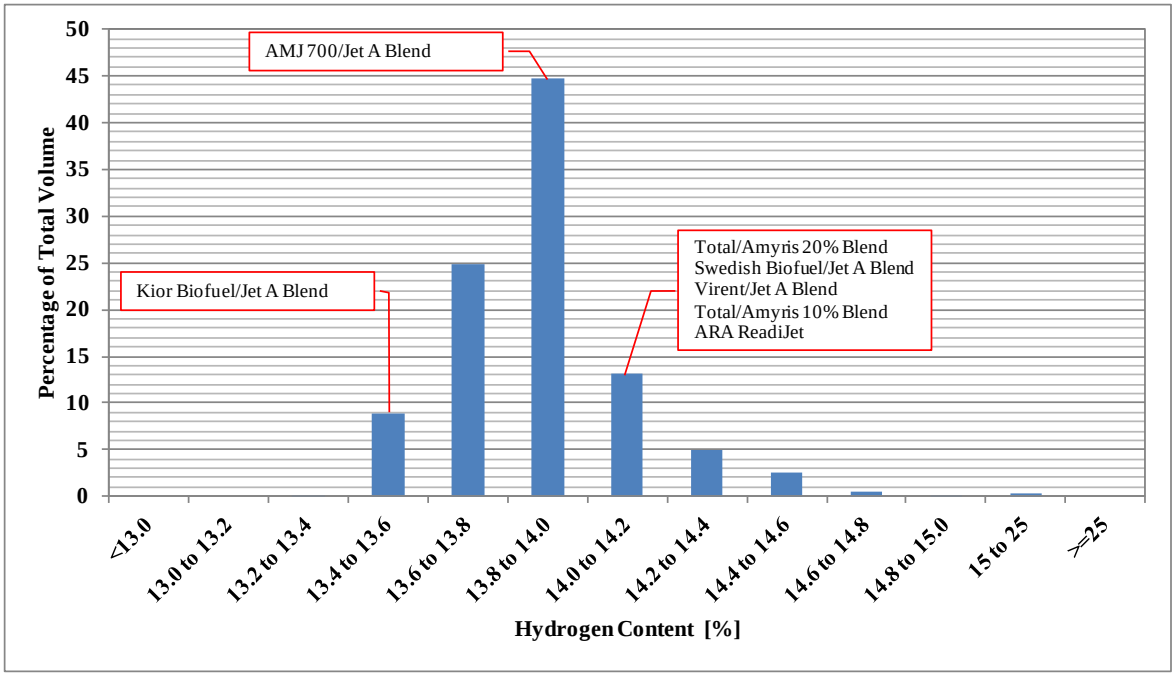

Figure B-34. PQIS Comparison: Hydrogen Content (D3701)

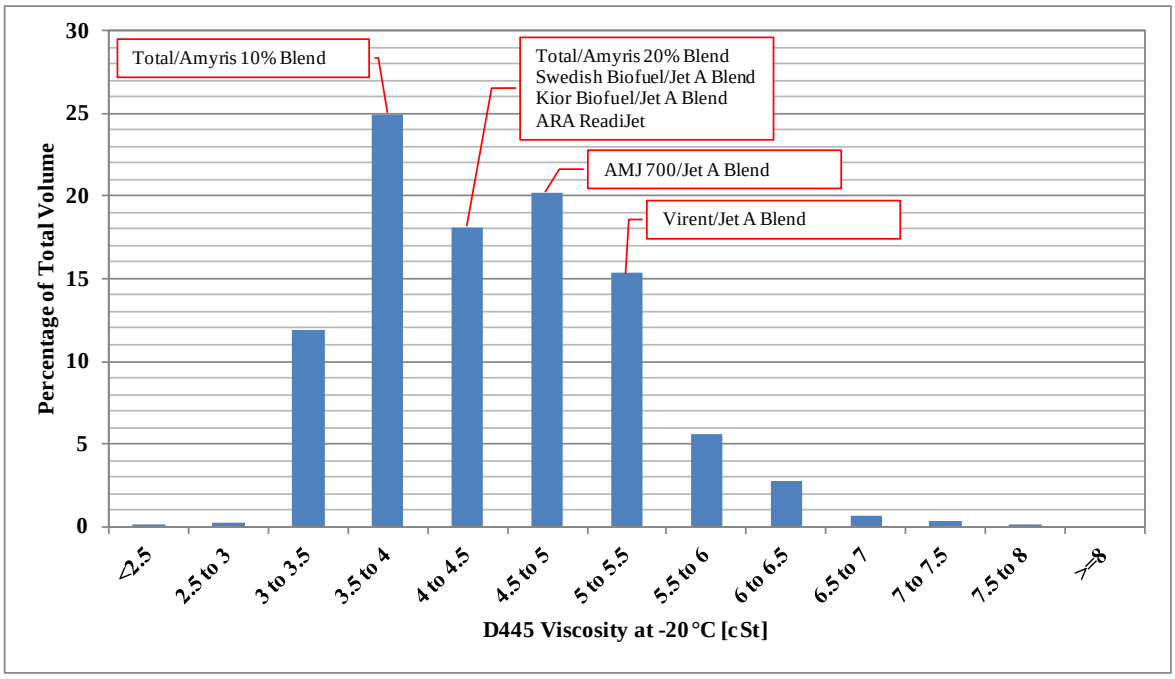

Figure B-35. PQIS Comparison: Viscosity at -20°C (D445)

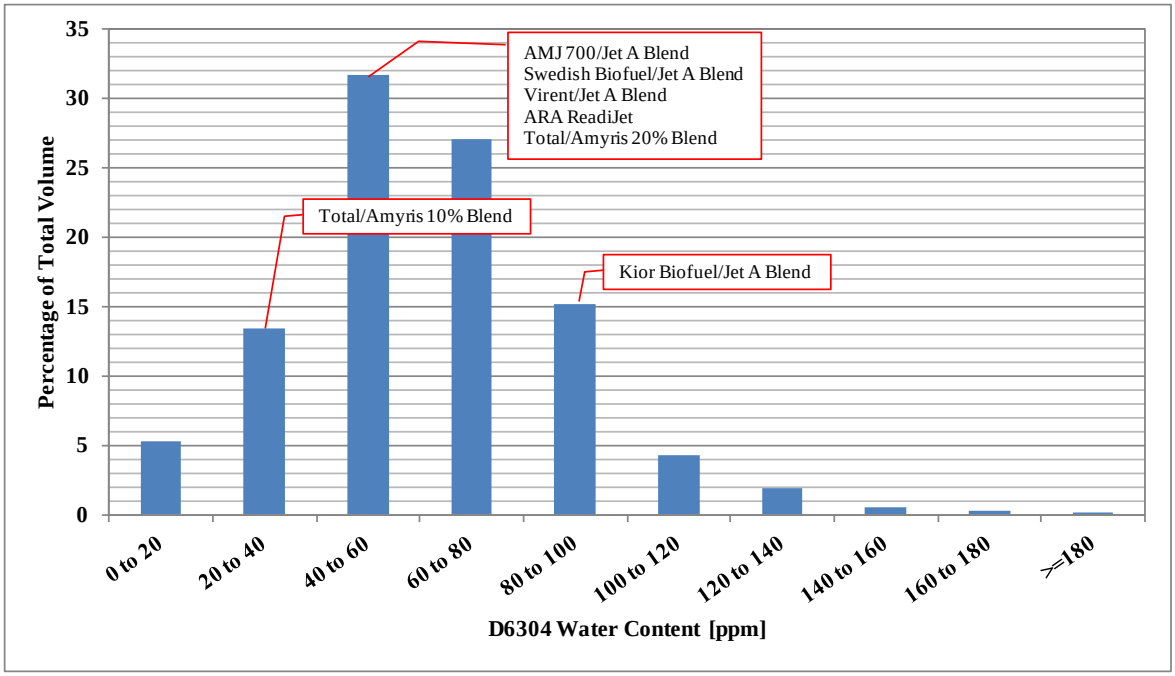

Figure B-36. PQIS Comparison: Water Content (D6304)

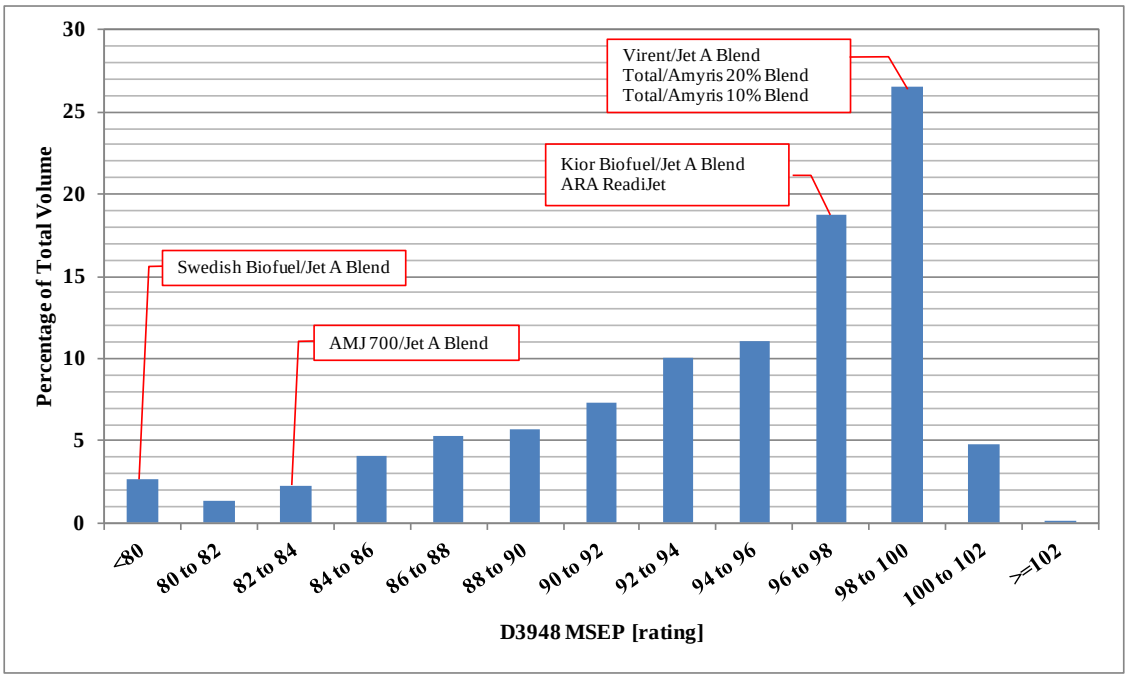

Figure B-37. PQIS Comparison: Microseparometer (D3948)

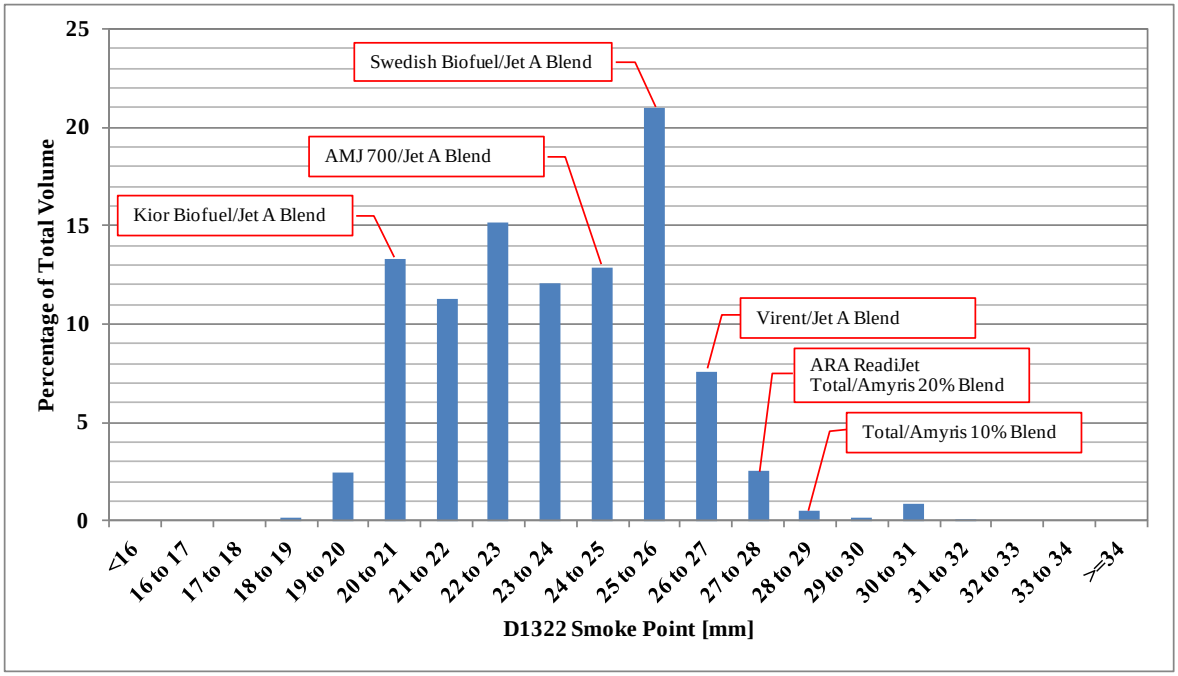

Figure B-38. PQIS Comparison: Smoke Point (D1322)

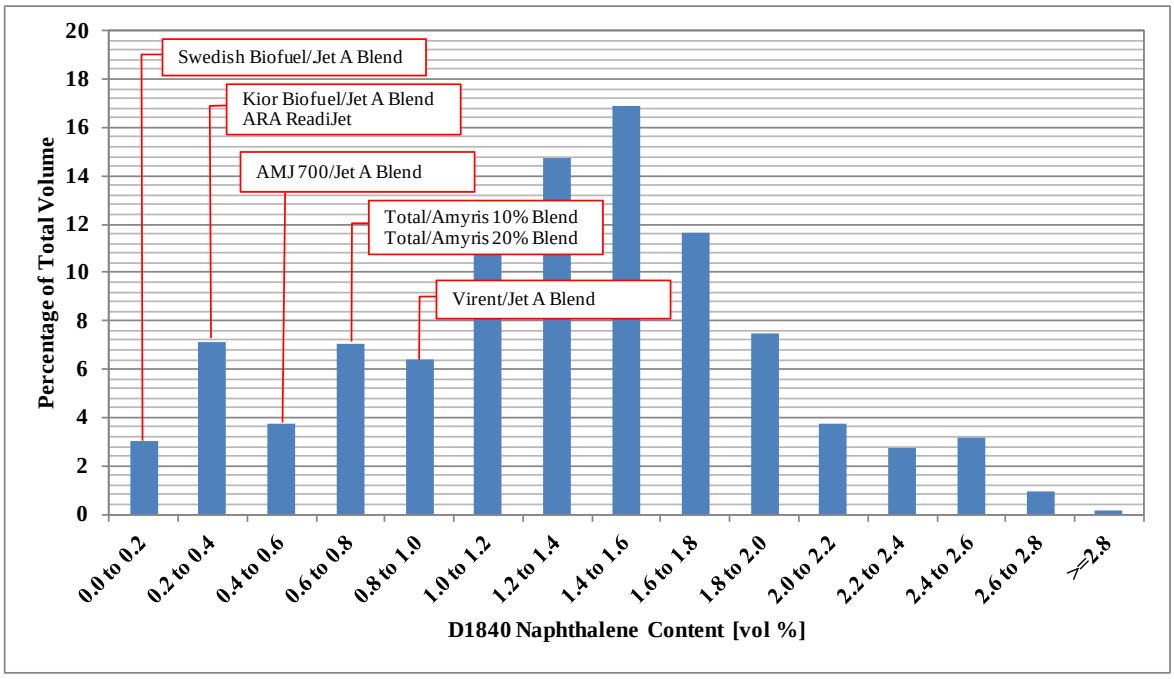

Figure B-39. PQIS Comparison: Naphthalene Content (D1840)

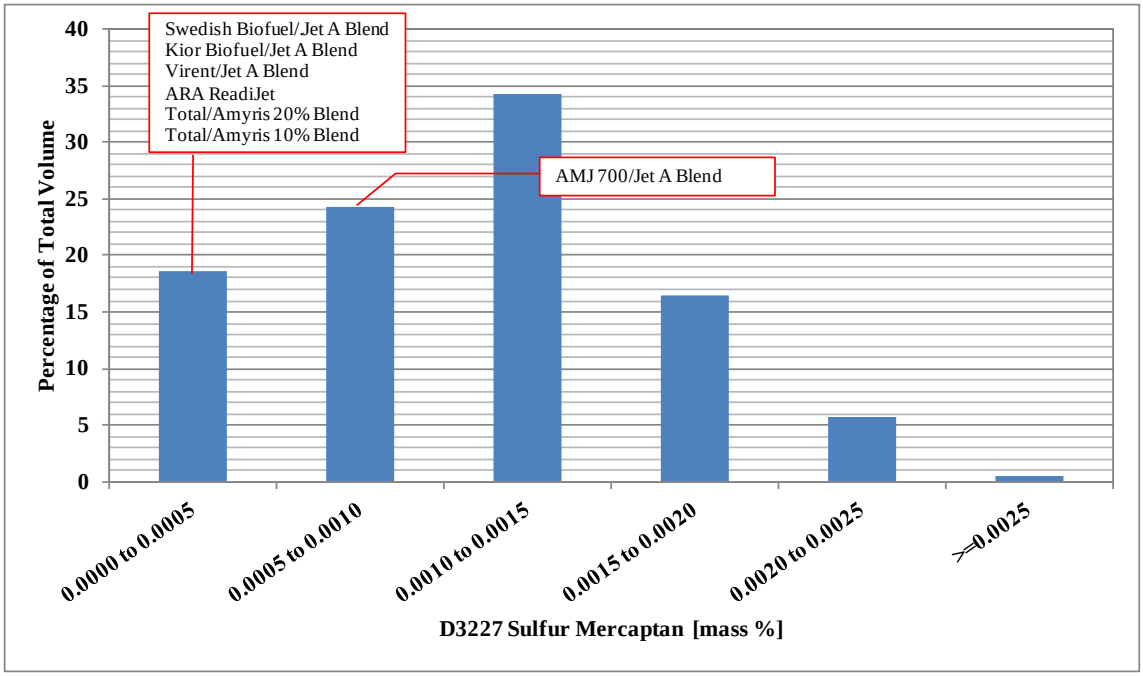

Figure B-40. PQIS Comparison: Sulfur Mercaptan (D3227)

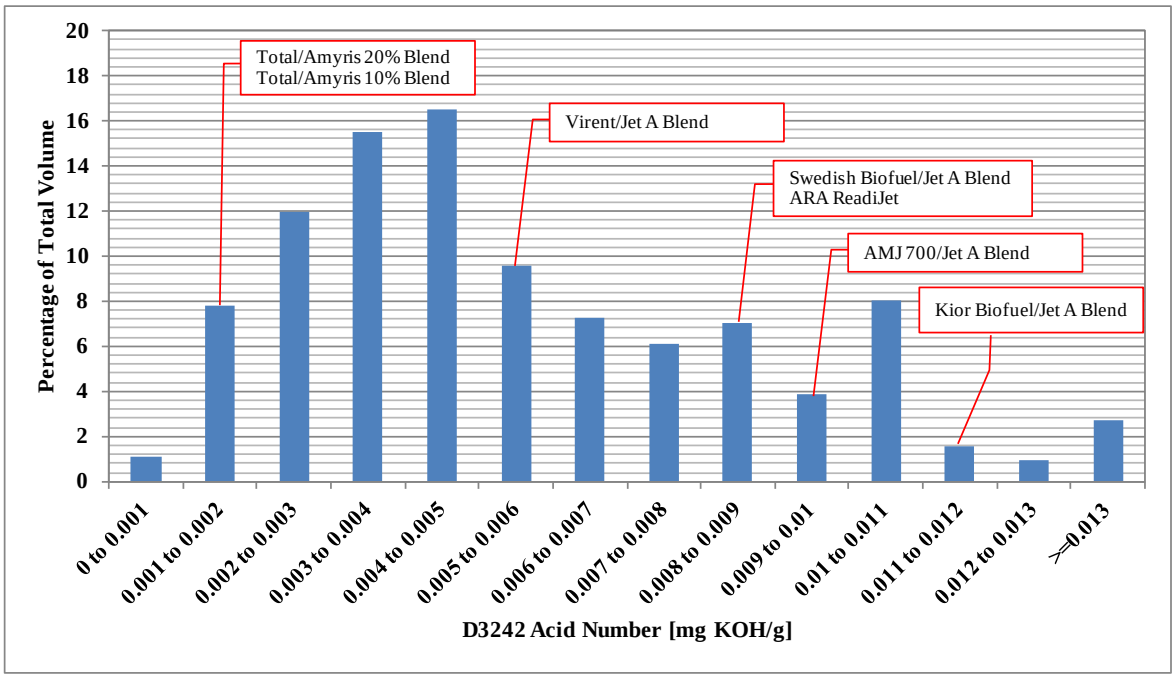

Figure B-41. PQIS Comparison: Acid Number (D3242)

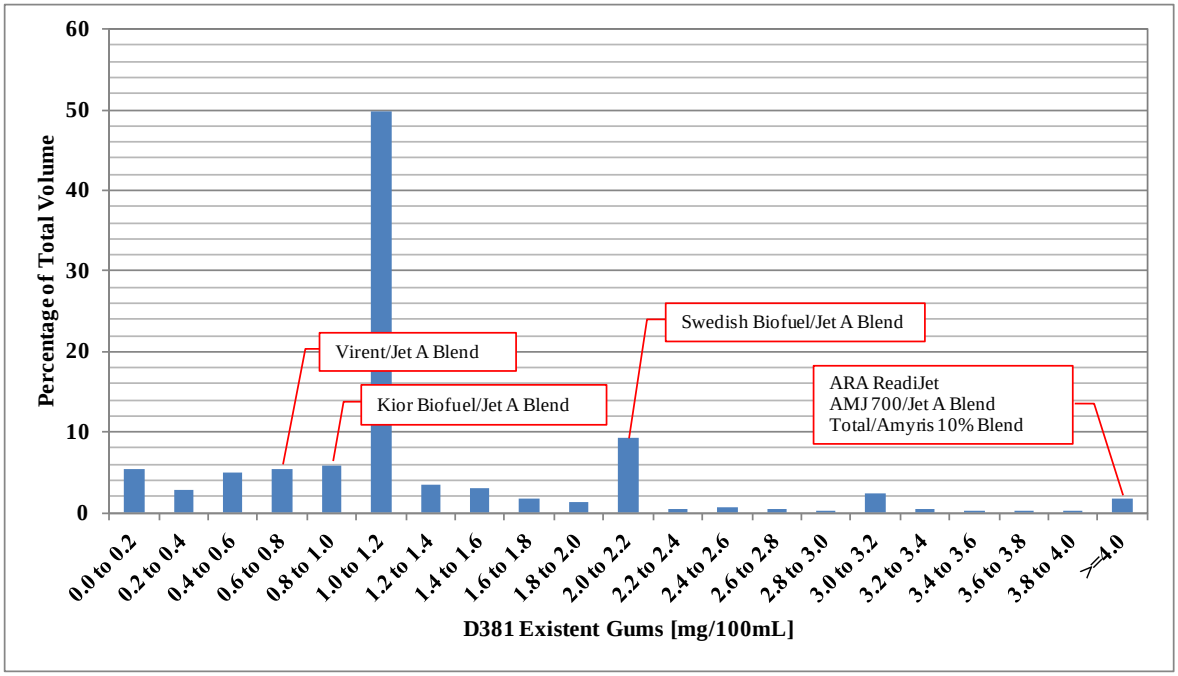

Figure B-42. PQIS Comparison: Existent Gums (D381)

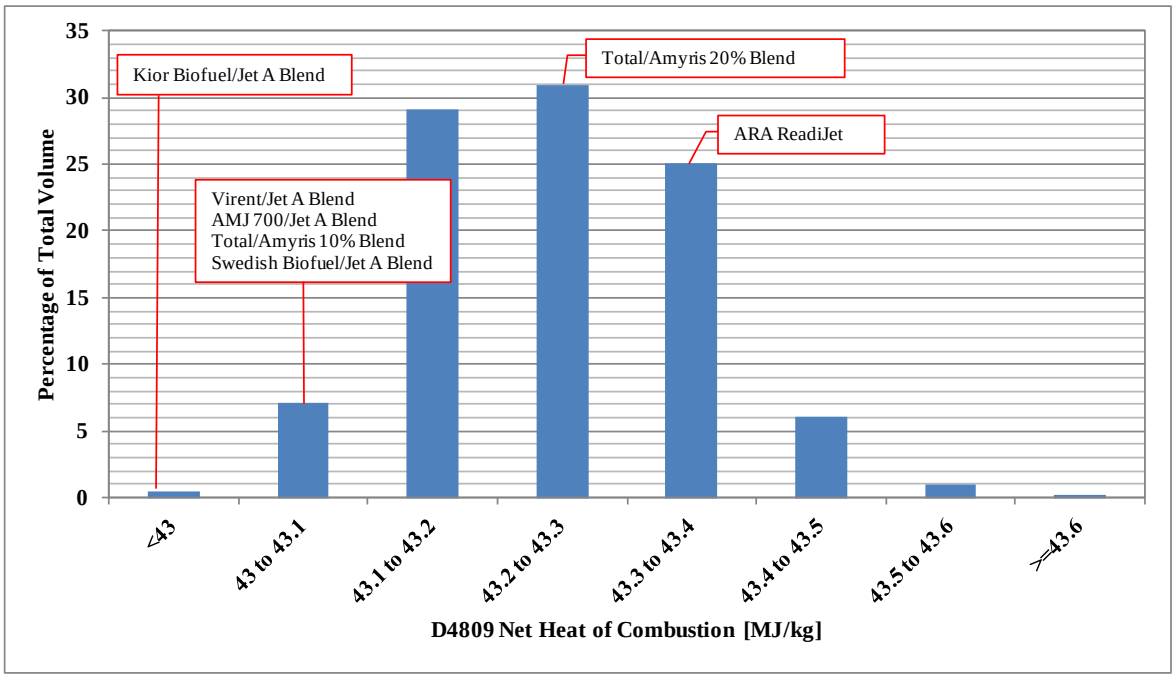

Figure B-43. PQIS Comparison: Net Heat of Combustion (D4809)

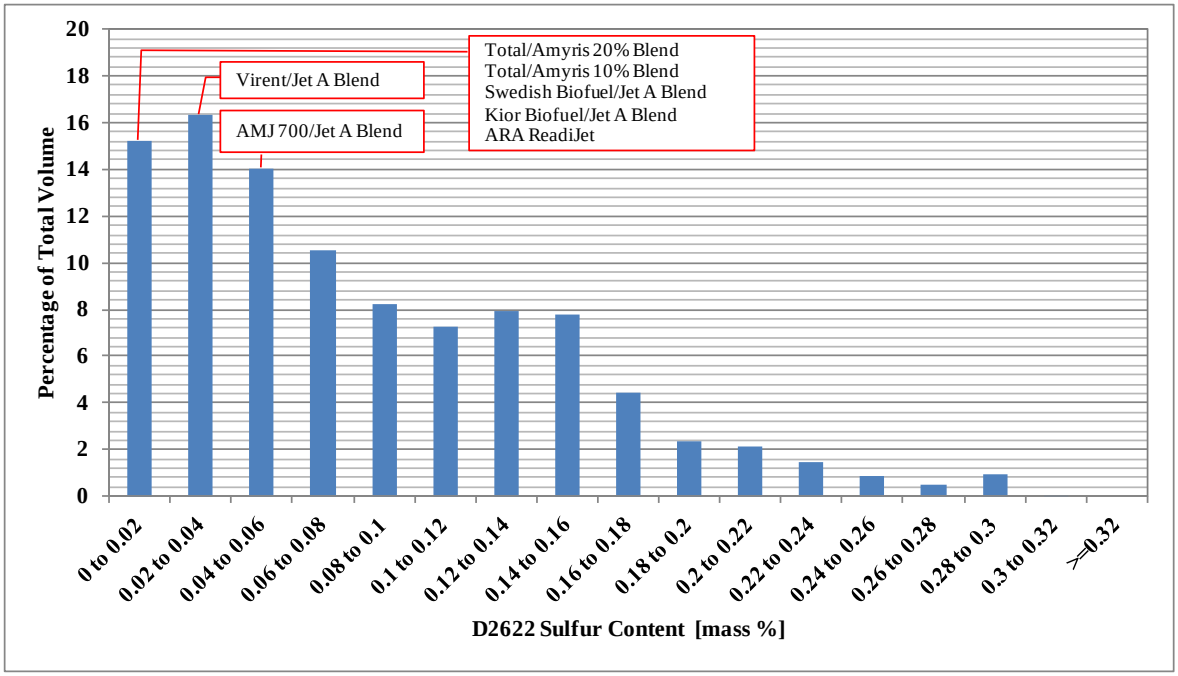

Figure B-44. PQIS Comparison: Sulfur Content (D2622)

B.4.0 CONCLUSIONS

The testing performed under this effort provided the opportunity to see blendstocks from several different synthetic pathways used to create alternative aviation fuel. One fuel, the ARA ReadiJet, was a supplied as a fully synthetic drop-in fuel since its process also yields aromatics in addition to paraffins. The Swedish Biofuel, derived from an ATJ process and the Virent HDO-SK were both supplied as 50/50 blends with Jet A and both exhibited good jet fuel characteristics. This version of the Virent blendstock contained no aromatics so the blend concentration was just above the 8 vol% minimum. The Total/Amyris blends derived from a DSHC process were supplied as 10% and 20% blends in Jet A and seemed to perform well. The Kior fuel stood out the most because of its high aromatic content. This affected the properties one might expect: density, speed-of-sound, hydrogen content, heat of combustion, cetane number, distillation slope, material compatibility etc. These properties were all marginal and could probably be corrected with a modified blend ratio. In general, most of the candidate fuels performed remarkably well, only showing marginal results in one or two properties.

B.5.0 RECOMMENDATIONS

It's clear that the vast amount of data being collected on candidate fuels has provided a wealth of information and contributed to the on-going research and approval process. The state-of-the-art for historical methods has improved over the last few years to the point they are becoming more routine and better understood. There are perhaps some areas that have received less attention but are nonetheless critical to the industry. Fuel/water separation is one area that has critical ramifications to the airline industry. While some types of fuels, like the FT-SPKs, have demonstrated excellent fuel/water separation, others derived from bio-based processes or sourced from biomass have revealed possible issues. The MSEP test or Water Solubility test has identified these problems in the past. The likely problem is that natural compounds from the feedstock that have survived the fuel processing can behave as surfactants and change the interfacial tension of the fuel. As a minimum, it might be wise to add interfacial tension to the FFP testing. A step beyond that would be to include a screening test like SAE J1488 and ultimately a full scale EI 1581 test.

B.6.0 REFERENCES

[1] Propulsion and Power Rapid Response Research and Development (R&D) Support - Delivery Order 0011: Analysis of Synthetic Aviation Fuels, AFRL-RZ-WP-TR-2011-2084, April 2011.

[2] Propulsion and Power Rapid Response Research and Development (R&D) Support Delivery Order 0011: Advanced Propulsion Fuels R&D Subtask: Advanced Propulsion Fuels Research and Development Support to AFRL/RQTF, AFRL-RQ-WP-TM-2013-0010, December 2012.

[3] Handbook of Aviation Fuel Properties, CRC Report No. 635, 3rd Edition, Coordinating Research Council, Alpharetta, GA, 2004.

[4] CRC World Fuel Sampling Program, CRC Report No. 647, Coordinating Research Council, Alpharetta, GA, 2006.

Appendix BA

Amyris AMJ 700 / Jet A Evaluations

Table BA-1. Amyris AMJ 700 / Jet A Evaluations

Test	Method	Units	CL12-3599 AMJ 700 / Jet A Blend (POSF7708)	MIL DTL 83133H Table 1 Limits
Chemistry				
Hydrocarbon Types by Mass Spec	D2425			
Paraffins		mass%	40.6	
Monocycloparaffins		mass%	44.1	
Dicycloparaffins		mass%	0.0	
Tricycloparaffins		mass%	0.0	
TOTAL SATURATES		mass%	84.7	
Alkylbenzenes		mass%	10.4	
Indans/Tetralins		mass%	3.0	
Indenes		mass%	0.3	
Naphthalene		mass%	0.2	
Naphthalene, Alkyl		mass%	1.1	
Acenaphthenes		mass%	0.2	
Acenaphthylenes		mass%	0.1	
Tricyclic Aromatics		mass%	0.0	
TOTAL AROMATICS		mass%	15.3	
Aromatic Content	D1319			
Aromatics		vol%	14.5	25.0 max
Olefins		vol%	1.1	
Saturates		vol%	84.4	
Carbon/Hydrogen	D5291			
Carbon		%	85.85	
Hydrogen		%	14.05	
Hydrogen Content (NMR)	D3701	mass%	13.98	13.4 min
Carbonyls, Alcohols, Esters, Phenols				
Alcohols	EPA 8015B	mg/kg	Appendix BJ	
Carbonyls, Esters	EPA 8260B	mg/kg		
Phenols	EPA 8270C	mg/kg		
Nitrogen Content	D4629	mg/kg	2	
Copper by AA	D3237M	ppb	0.01	
Elemental Analysis	D7111			
Al		ppb	145 ppb	
Ba		ppb	<100 ppb	
Ca		ppb	<100 ppb	
Cr		ppb	<100 ppb	
Cu		ppb	<100 ppb	
Fe		ppb	<100 ppb	
Li		ppb	<100 ppb	
Pb		ppb	<100 ppb	
Mg		ppb	<100 ppb	
Mn		ppb	<100 ppb	
Mo		ppb	<100 ppb	
Ni		ppb	<100 ppb	
K			<1 ppm	
Na			<1 ppm	
Si			1.3 ppm	
Ag		ppb	<100 ppb	
Ti		ppb	<100 ppb	
V		ppb	<100 ppb	
Zn		ppb	<100 ppb	
Bulk Physical and Performance Properties				
Distillation	D86			
IBP		°C	164.9	
5%		°C	174.6	
10%		°C	177.5	205 max
15%		°C	179.2	
20%		°C	181.5	

Table BA-1. Amyris AMJ 700 / Jet A Evaluations

Test	Method	Units	CL12-3599 AMJ 700 / Jet A Blend (POSF7708)	MIL DTL 83133H Table 1 Limits
30%		°C	186.5	
40%		°C	191.9	
50%		°C	200.1	
60%		°C	211.6	
70%		°C	226.9	
80%		°C	240	
90%		°C	248.3	
95%		°C	254.8	
FBP		°C	269.8	300 max
Residue		%	1.3	1.5 max
Loss		%	0.4	1.5 max
T50-T10		°C	22.6	
T90-T10		°C	70.8	
Simulated Distillation	D2887			
IBP		°C	118.3	
5%		°C	157.9	
10%		°C	166.9	
15%		°C	168.5	
20%		°C	169.4	
25%		°C	170.6	
30%		°C	172.1	
35%		°C	173.2	
40%		°C	179.5	
45%		°C	183.7	
50%		°C	196.2	
55%		°C	208.4	
60%		°C	219	
65%		°C	234.5	
70%		°C	247.1	
75%		°C	250.3	
80%		°C	251.3	
85%		°C	251.9	
90%		°C	253.4	
95%		°C	269	
FBP		°C	305.7	
Vapor pressure (Absolute)	D6378			
0 °C		psi	0.0	
20 °C		psi	0.04	
40 °C		psi	0.08	
60 °C		psi	0.24	
80 °C		psi	0.63	
100 °C		psi	1.34	
120 °C		psi	2.54	
JFTOT Breakpoint	D3241BP	°C		
Test Temperature		°C	290.0	
ASTM Code		rating	<2	<3 max
Maximum Pressure Drop		mm Hg	0.1	25 max
Lubricity (BOCLE) as received	D5001	mm	0.66	
Lubricity (BOCLE) vs. CI/LI Concentration	D5001			
0 mg/L		mm	0.81	
5 mg/L		mm	0.74	
10 mg/L		mm	0.68	
15 mg/L		mm	0.64	
20 mg/L		mm	0.61	
Lubricity (HFRR)	D6079	µm	0.71	
Lubricity (HFRR) vs. CI/LI Concentration	D6079			
0 mg/L		µm	0.69	
5 mg/L		µm	0.70	
10 mg/L		µm	0.72	
15 mg/L		µm	0.72	

Table BA-1. Amyris AMJ 700 / Jet A Evaluations

Test	Method	Units	CL12-3599 AMJ 700 / Jet A Blend (POSF7708)	MIL DTL 83133H Table 1 Limits
20 mg/L		µm	0.73	
Lubricity (Scuffing Load BOCLE)	D6078	g	2850	
Lubricity (Scuffing Load BOCLE) vs. CI/LI Concentration	D6078			
0 mg/L		g	1600	
5 mg/L		g	1900	
10 mg/L		g	2900	
15 mg/L		g	2850	
20 mg/L		g	3200	
Kinematic Viscosity	D445			
-40		cSt	9.53	
-20		cSt	4.69	8.0 max
25°C		cSt	1.70	
40°C		cSt	1.35	
Specific Heat Capacity	E2716			
-25°C		kJ/kg.K	1.880	
0°C		kJ/kg.K	1.966	
25°C		kJ/kg.K	2.062	
50°C		kJ/kg.K	2.163	
100°C		kJ/kg.K	2.346	
150°C		kJ/kg.K	2.563	
Density	D4052			
5°C		g/cm^3	0.8099	
15°C		g/cm^3	0.8024	0.775 to 0.840
40°C		g/cm^3	0.7840	
60°C		g/cm^3	0.7692	
80°C		g/cm^3	0.7541	
Surface tension	D1331A			
-10°C		mN/m	28.1	
22°C		mN/m	25.3	
40°C		mN/m	23.9	
Speed of Sound @ 30°C		m/s	1272	
Isentropic Bulk Modulus @ 30°C		psi	185853	
Thermal Conductivity	SwRI			
0°C		W/m.K	0.1211	
25°C		W/m.K	0.1163	
50°C		W/m.K	0.1115	
Water Content	D6304	ppm	59	
Water Content	D6304			
°C		ppm	37	
30°C		ppm	115	
40°C		ppm	213	
50°C		ppm	287	
Water Content	D6304			
-10°C		ppm		
40°C		ppm		
50°C		ppm		
Flash Point - Tag Closed	D56	°C	47	38 min
Freeze Point (manual)	D2386	°C	-58	-47 max
Freeze Point	D5972	°C	-53.3	
Electrical Properties				
Dielectric Constant (10kHz)	SwRI			
-40.2°C		---	2.187	
-20.0°C		---	2.160	
0.9°C		---	2.129	
30.0°C		---	2.092	
50.0°C		---	2.069	
-40°C		---		
-20°C		---		
0°C		---		
30°C		---		

Table BA-1. Amyris AMJ 700 / Jet A Evaluations

Test	Method	Units	CL12-3599 AMJ 700 / Jet A Blend (POSF7708)	MIL DTL 83133H Table 1 Limits
50°C		---		
Electrical Conductivity (as received)	D2624	pS/m	0	
Electrical Conductivity vs. SDA Concentration	D2624			
0 mg/L		pS/m	0	
1 mg/L		pS/m	480	
2 mg/L		pS/m	930	
3 mg/L		pS/m	1330	
4 mg/L		pS/m	1720	
Electrical Conductivity vs. Temperature	D2624			
-40		pS/m	0.0	
-30		pS/m	0.0	
-20		pS/m	0.0	
-10		pS/m	0.0	
0		pS/m	0.0	
10		pS/m	0.0	
20		pS/m	0.0	
30		pS/m	0.0	
40		pS/m	10.0	
Ground Handling Properties and Safety				
MSEP	D3948	rating	83	70-90 min
Storage Stability - Peroxides @65°C	D3703			
0 week		mg/kg	1.44	
1 week		mg/kg	3.40	
2 week		mg/kg	3.72	
3 week		mg/kg	4.04	
6 week		mg/kg	4.12	
Storage Stability – Potential Gums	D5304			
16 hours		mg/100mL	0.0	
Upper Explosion Limit (UEL), @100°C	E681	%	5.7 ± 0.1	
Lower Explosion Limit (LEL), @100°C	E681	%	0.5 ± 0.1	
Autoignition temperature	E659			
Hot Flame Autoignition Temperature		°C	241.0	
Hot Flame Lag Time		seconds	52.0	
Cool Flame Autoignition Temperature		°C	229.0	
Cool Flame Lag Time		seconds	273.0	
Barometric Pressure		mm Hg	739.8	
Reaction Threshold Temperature		°C	223.0	
Hot surface ignition	FTM 791-6053	°F	1150 (burns on tube and in pan)	
Compatibility				
Fuel/Additive Compatibility (2x treat rate)	D4054B			
FSII, DIEGME (0.3 vol%)		effect	• large droplets after initial cold soak • not present after raising temperature above room temperature	
SDA, Stadis 450 (10 mg/L)		effect	• no issues observed	
CI/LI, DCI-4A (46 mg/L)		effect	• no issues observed	
Metal Deactivator, DMD (11.4 mg/L)		effect	• no issues observed	
Antioxidant, AO-30 (48 mg/L)		effect	• no issues observed	
Thermal Stability, +100 (512 mg/L)		effect	• no issues observed	
Additive Cocktail (DMD, AO-30, Stadis 450, DCI-4A, DIEGME, +100) *(same concentrations as above)*		effect	• thin film on bottom after initial cold soak • not present after raising temperature above room temperature	
Elastomer Compatibility (O-Ring Tests)	SwRI		See Figure B-45 and Figure B-46	

Table BA-1. Amyris AMJ 700 / Jet A Evaluations

Test	Method	Units	CL12-3599 AMJ 700 / Jet A Blend (POSF7708)	MIL DTL 83133H Table 1 Limits
Miscellaneous				
Copper Strip Corrosion (100°C for 2 hours)	D130	rating	1A	No. 1 max
Smoke Point	D1322	mm	24	25.0 min or 19.0 min
Naphthalene Content	D1840	vol%	0.57	3.0 max
Sulfur - Mercaptan	D3227	mass%	0.0006	0.002 max
Acid Number	D3242	mg KOH/g	0.009	0.015 max
Existent Gums	D381	mg/100mL	4	7.0 max
Heat of Combustion	D4809			
BTUHeat_Net		BTU/lb	18516.8	18400.7 min
MJHeat_Net		MJ/kg	43.07	42.8 min
Sulfur Content - (Antek)	D5453	ppm	423.9	0.30 mass % max
Ignition Quality Test (IQT)	D6890			
Ignition Delay, ID		ms	4.793	
Derived Cetane Number, DCN			43.39	
Minimum Ignition Energy @ 100°C	E582	mJ	0.13 - 0.18	
Sulfur Content - (XRY)	D2622	ppm	444.8	0.30 mass % max

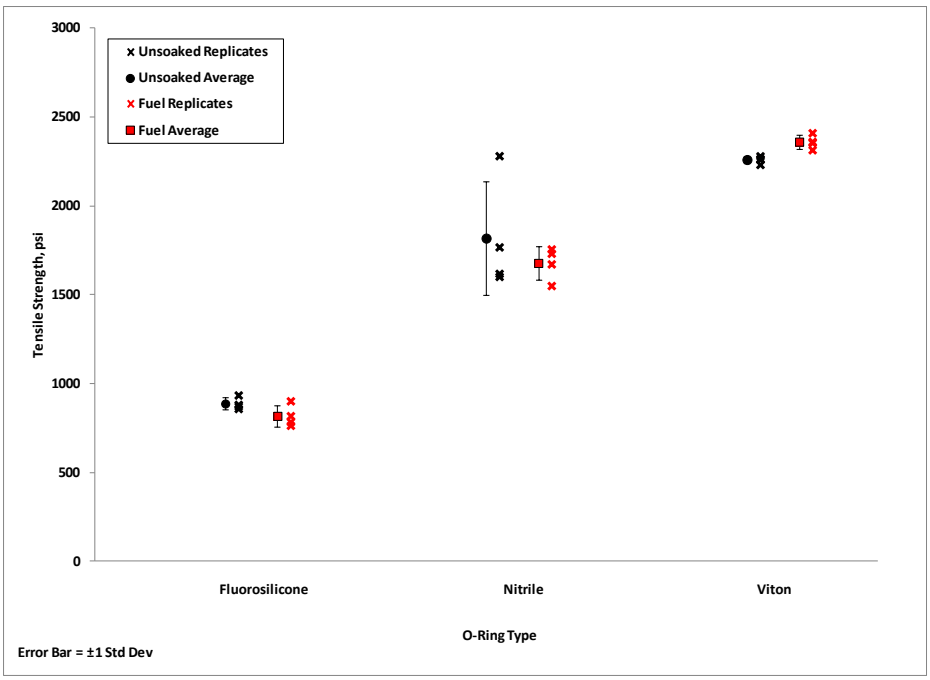

Figure BA-1. Tensile Strength – Amyris AMJ 700 / Jet A Blend

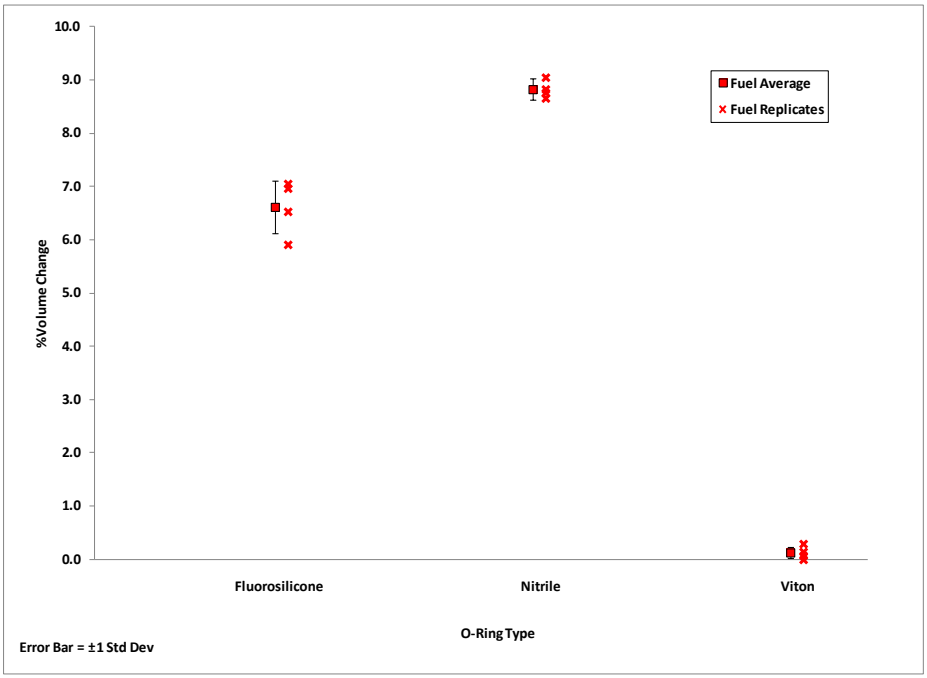

Figure BA-2. Volume Change – Amyris AMJ 100 / Jet A Blend

Appendix BB

Swedish Biofuel / Jet A Data

Table BB-1. Swedish Biofuel / Jet A Evaluations

Test	Method	Units	CL12-3339 Swedish Biofuel / Jet A Blend (POSF7658)	MIL DTL 83133H Table 1 Limits
Chemistry				
Hydrocarbon Types by Mass Spec	D2425			
Paraffins		mass%	44.0	
Monocycloparaffins		mass%	37.4	
Dicycloparaffins		mass%	0.0	
Tricycloparaffins		mass%	0.0	
TOTAL SATURATES		mass%	81.4	
Alkylbenzenes		mass%	13.8	
Indans/Tetralins		mass%	4.0	
Indenes		mass%	0.0	
Naphthalene		mass%	0.3	
Naphthalene, Alkyl		mass%	0.2	
Acenaphthenes		mass%	0.1	
Acenaphthylenes		mass%	0.2	
Tricyclic Aromatics		mass%	0.0	
TOTAL AROMATICS		mass%	18.6	
Aromatic Content	D1319			
Aromatics		vol%	15.6	25.0 max
Olefins		vol%	1.2	
Saturates		vol%	83.2	
Carbon/Hydrogen	D5291			
Carbon		%	85.67	
Hydrogen		%	14.04	
Hydrogen Content (NMR)	D3701	mass%	14.12	13.4 min
Carbonyls, Alcohols, Esters, Phenols				
Alcohols	EPA 8015B	mg/kg	Appendix BJ	
Carbonyls, Esters	EPA 8260B	mg/kg		
Phenols	EPA 8270C	mg/kg		
Nitrogen Content	D4629	mg/kg	<1	
Copper by AA	D3237M	ppb	0.006	
Elemental Analysis	D7111			
Al		ppb	<100 ppb	
Ba		ppb	<100 ppb	
Ca		ppb	<100 ppb	
Cr		ppb	<100 ppb	
Cu		ppb	<100 ppb	
Fe		ppb	<100 ppb	
Li		ppb	<100 ppb	
Pb		ppb	<100 ppb	
Mg		ppb	<100 ppb	
Mn		ppb	<100 ppb	
Mo		ppb	<100 ppb	
Ni		ppb	<100 ppb	
K			<1 ppm	
Na			<1 ppm	
Si			3.1 ppm	
Ag		ppb	<100 ppb	
Ti		ppb	<100 ppb	
V		ppb	<100 ppb	
Zn		ppb	<100 ppb	
Bulk Physical and Performance Properties				
Distillation	D86			
IBP		°C	169.4	
5%		°C	179.4	

Table BB-1. Swedish Biofuel / Jet A Evaluations

Test	Method	Units	CL12-3339 Swedish Biofuel / Jet A Blend (POSF7658)	MIL DTL 83133H Table 1 Limits
10%		°C	181.4	205 max
15%		°C	183.3	
20%		°C	185.7	
30%		°C	189.8	
40%		°C	194.4	
50%		°C	199.1	
60%		°C	204.5	
70%		°C	210.4	
80%		°C	217.8	
90%		°C	228.6	
95%		°C	238.3	
FBP		°C	250.3	300 max
Residue		%	1.2	1.5 max
Loss		%	0.7	1.5 max
T50-T10		°C	17.7	
T90-T10		°C	47.2	
Simulated Distillation	D2887			
IBP		°C	122.1	
5%		°C	150.2	
10%		°C	162.7	
15%		°C	168.7	
20%		°C	174.2	
25%		°C	179.8	
30%		°C	186.2	
35%		°C	190.3	
40%		°C	194.3	
45%		°C	197.3	
50%		°C	201.1	
55%		°C	206.5	
60%		°C	210.2	
65%		°C	214.8	
70%		°C	217.7	
75%		°C	223	
80%		°C	228.9	
85%		°C	235.1	
90%		°C	241.4	
95%		°C	253.2	
FBP		°C	282.1	
Vapor pressure (Absolute)	D6378			
0 °C		psi	0.05	
20 °C		psi	0.06	
40 °C		psi	0.15	
60 °C		psi	0.35	
80 °C		psi	0.72	
100 °C		psi	1.38	
120 °C		psi	2.10	
JFTOT Breakpoint	D3241BP	°C		
Test Temperature		°C	305	
ASTM Code		rating	2.0	<3 max
Maximum Pressure Drop		mm Hg	0.0	25 max
Lubricity (BOCLE) as received	D5001	mm	0.61	
Lubricity (BOCLE) vs. CI/LI Concentration	D5001			
0 mg/L		mm	0.93	
5 mg/L		mm	0.80	
10 mg/L		mm	0.72	
15 mg/L		mm	0.63	
20 mg/L		mm	0.60	
Lubricity (HFRR)	D6079	µm	0.70	
Lubricity (HFRR) vs. CI/LI Concentration	D6079			
0 mg/L		µm	0.70	
5 mg/L		µm	0.69	

Table BB-1. Swedish Biofuel / Jet A Evaluations

Test	Method	Units	CL12-3339 Swedish Biofuel / Jet A Blend (POSF7658)	MIL DTL 83133H Table 1 Limits
10 mg/L		µm	0.67	
15 mg/L		µm	0.67	
20 mg/L		µm	0.67	
Lubricity (Scuffing Load BOCLE)	D6078	g	1450	
Lubricity (Scuffing Load BOCLE) vs. CI/LI Concentration	D6078			
0 mg/L		g	1150	
5 mg/L		g	1100	
10 mg/L		g	1300	
15 mg/L		g	1650	
20 mg/L		g	2050	
Kinematic Viscosity	D445			
-40		cSt	8.32	
-20		cSt	4.12	8.0 max
25°C		cSt	1.55	
40°C		cSt	1.24	
Specific Heat Capacity	E2716			
-25°C		kJ/kg.K	1.81	
0°C		kJ/kg.K	1.88	
25°C		kJ/kg.K	1.97	
50°C		kJ/kg.K	2.05	
100°C		kJ/kg.K	2.20	
150°C		kJ/kg.K	2.38	
Density	D4052			
5°C		g/cm^3	0.8045	
15°C		g/cm^3	0.7970	0.775 to 0.840
40°C		g/cm^3	0.7786	
60°C		g/cm^3	0.7636	
80°C		g/cm^3	0.7485	
Surface tension	D1331A			
-10°C		mN/m	26.6	
22°C		mN/m	24.0	
40°C		mN/m	23.0	
Speed of Sound @ 30°C		m/s	1268	
Isentropic Bulk Modulus @ 30°C		psi	183217	
Thermal Conductivity	SwRI			
0°C		W/m.K	0.1228	
25°C		W/m.K	0.1176	
50°C		W/m.K	0.1124	
Water Content	D6304	ppm	58	
Water Content	D6304			
0°C		ppm	35	
30°C		ppm	107	
40°C		ppm	196	
50°C		ppm	215	
Water Content	D6304			
-10°C		ppm		
40°C		ppm		
50°C		ppm		
Flash Point - Tag Closed	D56	°C	55	38 min
Freeze Point (manual)	D2386	°C	-48	-47 max
Freeze Point	D5972	°C	-61.3	
Electrical Properties				
Dielectric Constant (10kHz)	SwRI			
-40°C		---	2.174	
-20°C		---	2.146	
0°C		---	2.116	
30°C		---	2.079	
50°C		---	2.057	
Electrical Conductivity	D2624	pS/m	410	
Electrical Conductivity vs. SDA Concentration	D2624			

Table BB-1. Swedish Biofuel / Jet A Evaluations

Test	Method	Units	CL12-3339 Swedish Biofuel / Jet A Blend (POSF7658)	MIL DTL 83133H Table 1 Limits
0 mg/L		pS/m	0	
1 mg/L		pS/m	480	
2 mg/L		pS/m	870	
3 mg/L		pS/m	1240	
4 mg/L		pS/m	1680	
Electrical Conductivity vs. Temperature	D2624			
-40		pS/m	210	
-30		pS/m	240	
-20		pS/m	290	
-10		pS/m	330	
0		pS/m	340	
10		pS/m	360	
20		pS/m	420	
30		pS/m	590	
40		pS/m	750	
Ground Handling Properties and Safety				
MSEP	D3948	rating	74	70-90 min
Storage Stability - Peroxides @65°C	D3703			
0 week		mg/kg	1.6	
1 week		mg/kg	2.28	
2 week		mg/kg	3.56	
3 week		mg/kg	3.96	
6 week		mg/kg	4.04	
Storage Stability – Potential Gums	D5304			
16 hours		mg/100mL	0.0	
Upper Explosion Limit (UEL), @100°C	E681	%	7.3 ± 0.1 (re-run 7.48)	
Lower Explosion Limit (LEL), @100°C	E681	%	0.5 ± 0.1 (re-run 0.96)	
Autoignition temperature	E659			
Hot Flame Autoignition Temperature		°C	242	
Hot Flame Lag Time		seconds	60	
Cool Flame Autoignition Temperature		°C	236	
Cool Flame Lag Time		seconds	110	
Barometric Pressure		mm Hg	735.5	
Reaction Threshold Temperature		°C	203	
Hot surface ignition	FTM 791-6053	°F	1250 (burns on tube and in pan)	
Compatibility				
Fuel/Additive Compatibility (2x treat rate)	D4054B			
FSII, DIEGME (0.3 vol%)		effect	• small droplets after initial cold soak • not present after raising temperature above room temperature	
SDA, Stadis 450 (10 mg/L)		effect	• no issues observed	
CI/LI, DCI-4A (46 mg/L)		effect	• no issues observed	
Metal Deactivator, DMD (11.4 mg/L)		effect	• no issues observed	
Antioxidant, AO-30 (48 mg/L)		effect	• anomalous large droplet seen at room temperature • not present after raising temperature above room temperature	
Thermal Stability, +100 (512 mg/L)		effect	• no issues observed	
Additive Cocktail (DMD, AO-30, Stadis 450, DCI-4A, DIEGME, +100) *(same concentrations as above)*		effect	• thin film on bottom after initial cold soak • not present after raising temperature above room temperature	
Elastomer Compatibility (O-Ring Tests)	SwRI		See Figure BB-1 and Figure BB-2	
Miscellaneous				
Copper Strip Corrosion (100°C for 2 hours)	D130	rating	1A	No. 1 max

Table BB-1. Swedish Biofuel / Jet A Evaluations

Test	Method	Units	CL12-3339 Swedish Biofuel / Jet A Blend (POSF7658)	MIL DTL 83133H Table 1 Limits
Smoke Point	D1322	mm	25	25.0 min or 19.0 min
Naphthalene Content	D1840	vol%	0.18	3.0 max
Sulfur - Mercaptan	D3227	mass%	<0.0003	0.002 max
Acid Number	D3242	mg KOH/g	0.008	0.015 max
Existent Gums	D381	mg/100mL	2	7.0 max
Heat of Combustion	D4809			
BTUHeat_Net		BTU/lb	18489.3	18400.7 min
MJHeat_Net		MJ/kg	43.00	42.8 min
Sulfur Content - (Antek)	D5453	ppm	40.7	0.30 mass % max
Ignition Quality Test (IQT)	D6890			
Ignition Delay, ID		ms	4.893	
Derived Cetane Number, DCN			42.60	
Minimum Ignition Energy @ 100°C	E582	mJ	0.13 – 0.18	
Sulfur Content - (XRY)	D2622	ppm	45.8	

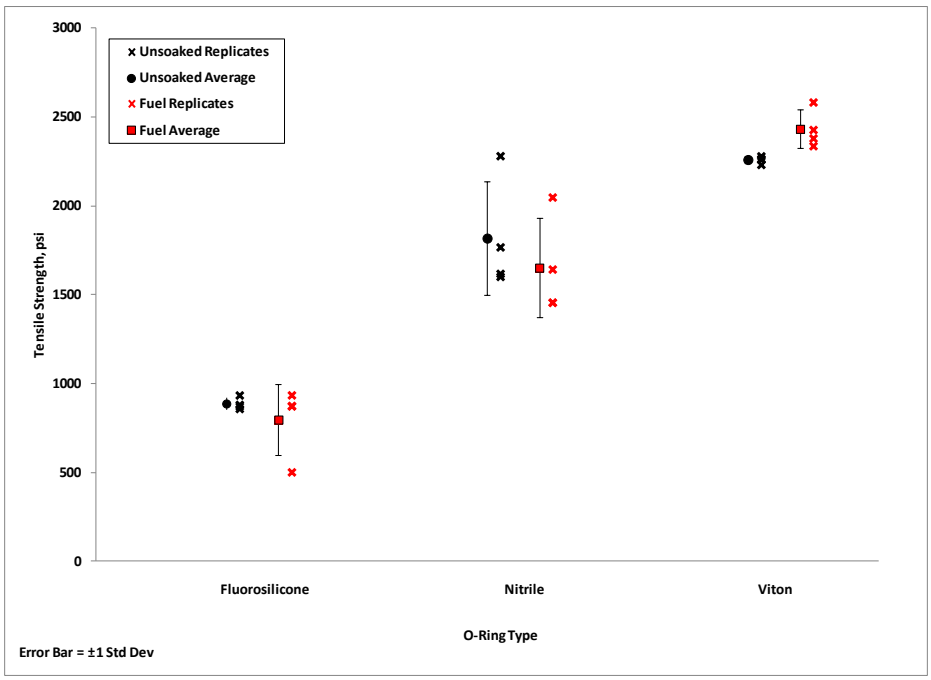

Figure BB-1. Tensile Strength – Swedish Biofuel / Jet A Blend

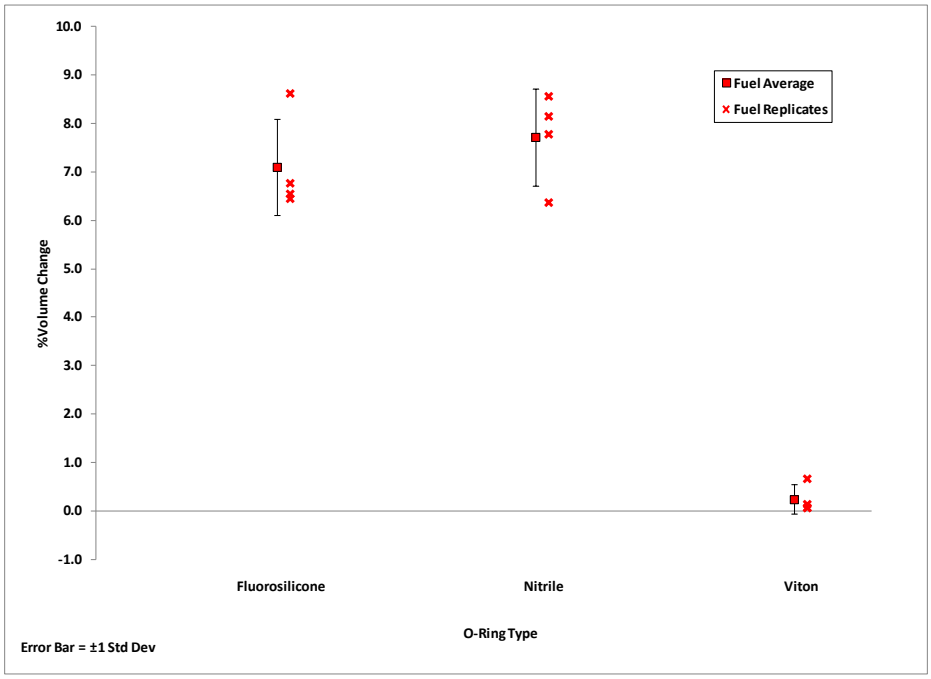

Figure BB-2. Volume Change – Swedish Biofuel / Jet A Blend

Appendix BC

Kior HDCJ Evaluations

Table BC-1. Kior HDCJ Evaluations

Test	Method	Units	CL12-3883/5832 Kior HDCJ/Jet A Blend (POSF8123)	CL12-4384 neat Kior HDCJ (POSF8076)	MIL DTL 83133H Table 1 Limits
Chemistry					
Hydrocarbon Types by Mass Spec	D2425				
Paraffins		mass%	34.8	0.0	
Monocycloparaffins		mass%	37.2	See Table Footnote (1)	
Dicycloparaffins		mass%			
Tricycloparaffins		mass%			
TOTAL SATURATES		mass%	72.0	49.3	
Alkylbenzenes		mass%	11.0	7.1	
Indans/Tetralins		mass%	13.2	32.8	
Indenes		mass%	2.1	6.7	
Naphthalene		mass%	1.2	2.9	
Naphthalene, Alkyl		mass%		--	
Acenaphthenes		mass%	0.3	0.7	
Acenaphthylenes		mass%	0.2	0.5	
Tricyclic Aromatics		mass%		--	
TOTAL AROMATICS		mass%	28.0	50.7	
Aromatic Content	D1319				
Aromatics		vol%	25.6	45.7	25.0 max
Olefins		vol%	2.0	2.2	
Saturates		vol%	72.4	52.1	
Carbon/Hydrogen	D5291				
Carbon		%	85.99	88.0	
Hydrogen		%	13.33	11.8	
Hydrogen Content (NMR)	D3701	mass%	13.46	13.9	13.4 min
Carbonyls, Alcohols, Esters, Phenols					
Alcohols	EPA 8015B	mg/kg	Appendix BK	N/A	
Carbonyls, Esters	EPA 8260B	mg/kg			
Phenols	EPA 8270C	mg/kg			
Nitrogen Content	D4629	mg/kg	<0.3	<1	
Copper by AA	D3237M	ppb	0.007	N/A	
Elemental Analysis	D7111				
Al		ppb	<100	286.0	
Ba		ppb	<100	<100	
Ca		ppb	<100	<100	
Cr		ppb	<100	<100	
Cu		ppb	<100	<100	
Fe		ppb	<100	<100	
Li		ppb	<100	<100	
Pb		ppb	<100	<100	
Mg		ppb	<100	<100	
Mn		ppb	<100	<100	
Mo		ppb	<100	<100	
Ni		ppb	<100	<100	
K		ppm	<1	<1	
Na		ppm	<1	<1	
Si		ppm	<100	<100	
Ag		ppb	<100	<100	
Ti		ppb	<100	<100	
V		ppb	<100	<100	
Zn		ppb	<100	<100	
Bulk Physical and Performance Properties					
Distillation	D86				
IBP		°C	177.5 (175.2)	N/A	

Table BC-1. Kior HDCJ Evaluations

Test	Method	Units	CL12-3883/5832 Kior HDCJ/Jet A Blend (POSF8123)	CL12-4384 neat Kior HDCJ (POSF8076)	MIL DTL 83133H Table 1 Limits
5%		°C	181.9 (181.8)	N/A	
10%		°C	183.0 (182.5)	N/A	205 max
15%		°C	182.9 (183.2)	N/A	
20%		°C	185.0 (184.9)	N/A	
30%		°C	187.6 (188.0)	N/A	
40%		°C	191.8 (191.6)	N/A	
50%		°C	195.7 (195.7)	N/A	
60%		°C	201.3 (201.1)	N/A	
70%		°C	208.2 (207.9)	N/A	
80%		°C	217.8 (217.2)	N/A	
90%		°C	232.6 (232.4)	N/A	
95%		°C	246.6 (246.8)	N/A	
FBP		°C	264.1 (263.1)	N/A	300 max
Residue		%	1.2 (1.1)	N/A	1.5 max
Loss		%	0.3 (0.3)	N/A	1.5 max
T50-T10		°C	12.7 (13.2)	N/A	
T90-T10		°C	49.6 (49.9)	N/A	
Simulated Distillation	D2887				
IBP		°C	143.3	N/A	
5%		°C	159.7	N/A	
10%		°C	167.0	N/A	
15%		°C	171.5	N/A	
20%		°C	174.8	N/A	
25%		°C	179.0	N/A	
30%		°C	182.7	N/A	
35%		°C	187.6	N/A	
40%		°C	192.0	N/A	
45%		°C	196.1	N/A	
50%		°C	198.2	N/A	
55%		°C	204.0	N/A	
60%		°C	208.6	N/A	
65%		°C	213.4	N/A	
70%		°C	217.2	N/A	
75%		°C	222.3	N/A	
80%		°C	229.8	N/A	
85%		°C	236.6	N/A	
90%		°C	248.0	N/A	
95%		°C	265.4	N/A	
FBP		°C	293.3	N/A	
Vapor pressure (Absolute)	D6378				
0°C		psi	0.00	N/A	
20°C		psi	0.03	N/A	
40°C		psi	0.03	N/A	
60°C		psi	0.17	N/A	
80°C		psi	0.48	N/A	
100°C		psi	1.09	N/A	
120°C		psi	2.68	N/A	
JFTOT Breakpoint	D3241BP	°C			
Test Temperature		°C	300	N/A	
ASTM Code		rating	2.0	N/A	<3 max
Maximum Pressure Drop		mm Hg	0.4	N/A	25 max
Lubricity (BOCLE) as received	D5001	mm	0.720	N/A	
Lubricity (BOCLE) vs. CI/LI Concentration	D5001				
0 mg/L		mm	0.890	N/A	
5 mg/L		mm	0.780	N/A	
10 mg/L		mm	0.710	N/A	
15 mg/L		mm	0.680	N/A	
20 mg/L		mm	0.650	N/A	
Lubricity (HFRR)	D6079	µm	710	N/A	
Lubricity (HFRR) vs. CI/LI	D6079				

Table BC-1. Kior HDCJ Evaluations

Test	Method	Units	CL12-3883/5832 Kior HDCJ/Jet A Blend (POSF8123)	CL12-4384 neat Kior HDCJ (POSF8076)	MIL DTL 83133H Table 1 Limits
Concentration					
0 mg/L		µm	745	N/A	
5 mg/L		µm	735	N/A	
10 mg/L		µm	738	N/A	
15 mg/L		µm	727	N/A	
20 mg/L		µm	696	N/A	
Lubricity (Scuffing Load BOCLE)	D6078	g	1650	N/A	
Lubricity (Scuffing Load BOCLE) vs. CI/LI Concentration	D6078				
0 mg/L		g	1550	N/A	
5 mg/L		g	1550	N/A	
10 mg/L		g	1750	N/A	
15 mg/L		g	1800	N/A	
20 mg/L		g	1950	N/A	
Kinematic Viscosity	D445				
-40		cSt	8.20	N/A	
-20		cSt	4.10	N/A	8.0 max
25°C		cSt	1.56	N/A	
40°C		cSt	1.25	N/A	
Specific Heat Capacity	E2716				
-25°C		kJ/kg.K	1.601	N/A	
0°C		kJ/kg.K	1.684	N/A	
25°C		kJ/kg.K	1.764	N/A	
50°C		kJ/kg.K	1.849	N/A	
100°C		kJ/kg.K	2.042	N/A	
150°C		kJ/kg.K	2.249	N/A	
Density	D4052				
5°C		g/cm^3	0.8262	N/A	
15°C		g/cm^3	0.8189	N/A	0.775 to 0.840
40°C		g/cm^3	0.8001	N/A	
60°C		g/cm^3	0.7850	N/A	
80°C		g/cm^3	0.7698	N/A	
Surface tension	D1331A				
-10°C		mN/m	28.4	N/A	
22°C		mN/m	25.1	N/A	
40°C		mN/m	24.4	N/A	
Speed of Sound @ 30°C		m/s	1289	N/A	
Isentropic Bulk Modulus @ 30°C		psi	194592	N/A	
Thermal Conductivity	SwRI				
0°C		W/m.K	0.1240	N/A	
25°C		W/m.K	0.1191	N/A	
50°C		W/m.K	0.1142	N/A	
Water Content	D6304	ppm	93	90	
Water Content	D6304				
0°C		ppm	58	N/A	
30°C			157	N/A	
40°C		ppm	354	N/A	
50°C		ppm	412	N/A	
Flash Point - Tag Closed	D56	°C	55	N/A	38 min
Freeze Point (manual)	D2386	°C	-58	N/A	-47 max
Freeze Point	D5972	°C	-63.2	N/A	
Electrical Properties					
Dielectric Constant (10kHz)	SwRI				
-40°C		---	2.234	N/A	
-20°C		---	2.206	N/A	
-0.4°C		---	2.177	N/A	
30°C		---	2.139	N/A	
50°C		---	2.113	N/A	
Electrical Conductivity	D2624	pS/m	3.0	N/A	
Electrical Conductivity vs. SDA Concentration	D2624				

Table BC-1. Kior HDCJ Evaluations

Test	Method	Units	CL12-3883/5832 Kior HDCJ/Jet A Blend (POSF8123)	CL12-4384 neat Kior HDCJ (POSF8076)	MIL DTL 83133H Table 1 Limits
0 mg/L		pS/m	0	N/A	
1 mg/L		pS/m	600	N/A	
2 mg/L		pS/m	1150	N/A	
3 mg/L		pS/m	1730	N/A	
4 mg/L		pS/m	2300	N/A	
Electrical Conductivity vs. Temperature	D2624				
-40		pS/m	0	N/A	
-30		pS/m	0	N/A	
-20		pS/m	0	N/A	
-10		pS/m	0	N/A	
0		pS/m	0	N/A	
10		pS/m	0	N/A	
20		pS/m	3	N/A	
30		pS/m	40	N/A	
40		pS/m	113	N/A	
Ground Handling Properties and Safety					
MSEP	D3948	rating	97	N/A	70-90 min
Storage Stability - Peroxides @65°C	D3703				
0 week		mg/kg	0.36	N/A	
1 week		mg/kg	0.76	N/A	
2 week		mg/kg	1.56	N/A	
3 week		mg/kg	2.08	N/A	
6 week		mg/kg	6.28	N/A	
Storage Stability – Potential Gums	D5304				
16 hours		mg/100mL	0.1	N/A	
Upper Explosion Limit (UEL), @100°C	E681	%	4.0±0.1%	N/A	
Lower Explosion Limit (LEL), @100°C	E681	%	0.5±0.1%	N/A	
Autoignition temperature	E659				
Hot Flame Autoignition Temperature		°C	259	N/A	
Hot Flame Lag Time		seconds	33	N/A	
Cool Flame Autoignition Temperature		°C	--	N/A	
Cool Flame Lag Time		seconds	--	N/A	
Barometric Pressure		mm Hg	740.2	N/A	
Reaction Threshold Temperature		°C	238	N/A	
Hot surface ignition	FTM 791-6053	°F	1200 (burns on tube and pan)	N/A	
Compatibility					
Fuel/Additive Compatibility (2x treat rate)	D4054B				
FSII, DIEGME (0.3 vol%)		effect	• large droplets after initial cold soak • went back into solution only upon heating to 100°F	N/A	
SDA, Stadis 450 (10 mg/L)		effect	• no issues observed	N/A	
CI/LI, DCI-4A (46 mg/L)		effect	• no issues observed	N/A	
Metal Deactivator, DMD (11.4 mg/L)		effect	• no issues observed	N/A	
Antioxidant, AO-30 (48 mg/L)		effect	• no issues observed	N/A	
Thermal Stability, +100 (512 mg/L)		effect	• no issues observed	N/A	
Additive Cocktail (DMD, AO-30, Stadis 450, DCI-4A, DIEGME, +100) *(same concentrations as above)*		effect	• thin film on bottom after initial cold soak • went back into solution only upon heating to 100°F	N/A	
Elastomer Compatibility (O-Ring Tests)	SwRI		See Figure BC-1 and Figure BC-2	N/A	

Table BC-1. Kior HDCJ Evaluations

Test	Method	Units	CL12-3883/5832 Kior HDCJ/Jet A Blend (POSF8123)	CL12-4384 neat Kior HDCJ (POSF8076)	MIL DTL 83133H Table 1 Limits
Miscellaneous					
Copper Strip Corrosion (100°C for 2 hours)	D130	rating	1A	N/A	No. 1 max
Smoke Point	D1322	mm	20.5	N/A	25.0 min or 19.0 min
Naphthalene Content	D1840	vol%	0.32	N/A	3.0 max
Sulfur - Mercaptan	D3227	mass%	<0.003	N/A	0.002 max
Acid Number	D3242	mg KOH/g	0.011	0.019	0.015 max
Existent Gums	D381	mg/100mL	0.8	0.5	7.0 max
Heat of Combustion	D4809				
BTUHeat_Net		BTU/lb	18402.0	N/A	18400.7 min
MJHeat_Net		MJ/kg	42.80	N/A	42.8 min
Sulfur Content - (Antek)	D5453	ppm	51	5.8	0.30 mass % max
Ignition Quality Test (IQT)	D6890				
Ignition Delay, ID		ms	5.38	N/A	
Derived Cetane Number, DCN			39.2	N/A	
Minimum Ignition Energy @ 100°C	E582	mJ	0.45 - 0.63	N/A	
Sulfur Content - (XRY)	D2622	ppm	59.4	10.2	
FAME Content	IP585	ppm	<4.5	N/A	

(1) ASTM D2425 - Duplicate runs gave conflicting results. ASTM D2425 does not distinguish well between mono/di/tri cycloparaffins. One run showed all mono and the other run was spread across mono/di/tri. The Total value was similar in both cases so only that is being reported.

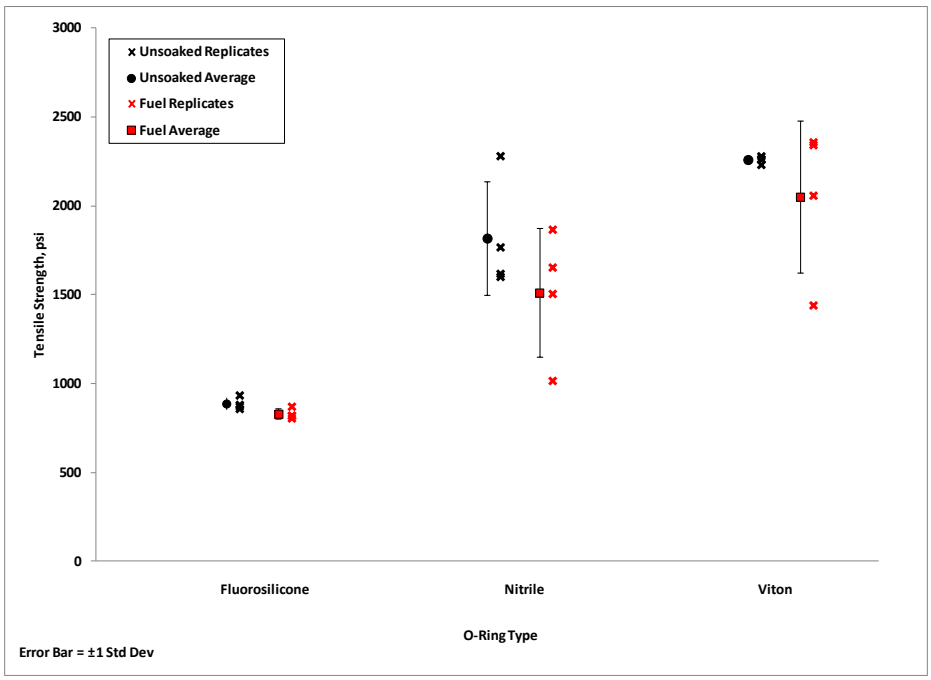

Figure BC-1. Tensile Strength – Kior HDCJ / Jet A Blend

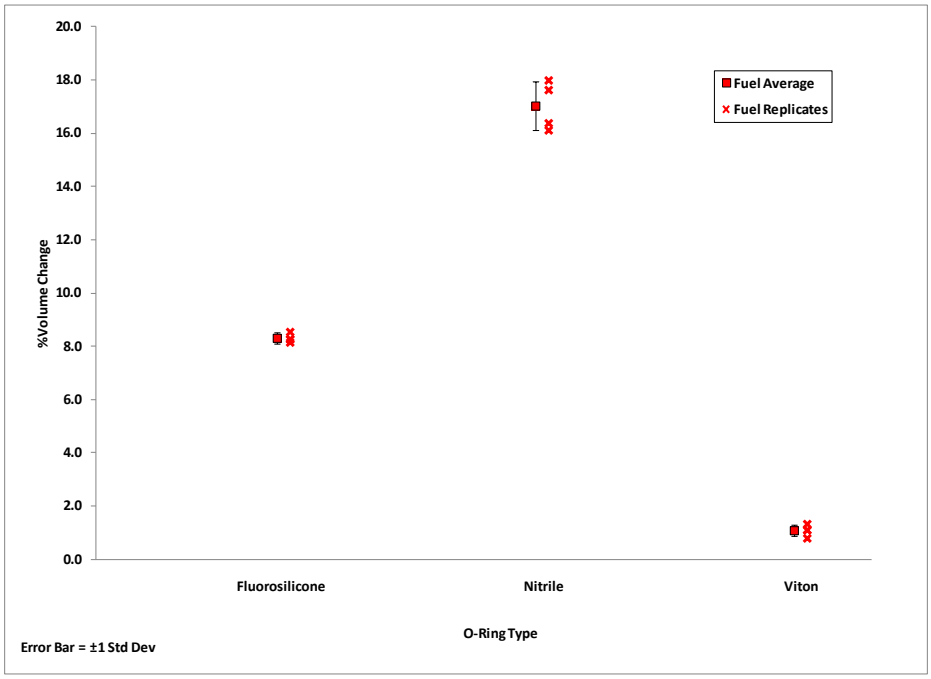

Figure BC-2. Volume Change – Kior HDCJ / Jet A Blend

Appendix BD

Virent Evaluations

Table BD-1. Virent Evaluations

Test	Method	Units	CL12-4367 Virent / Jet A Blend (POSF9404)	CL12-4370 neat Virent (POSF8535)	MIL DTL 83133H Table 1 Limits
Chemistry					
Hydrocarbon Types by Mass Spec	D2425				
Paraffins		mass%	33.9	17.0	
Monocycloparaffins		mass%	24.9	42.5	
Dicycloparaffins		mass%	26.2	36.2	
Tricycloparaffins		mass%	5.6	4.2	
TOTAL SATURATES		mass%	90.6	99.9	
Alkylbenzenes		mass%	4.1	-	
Indans/Tetralins		mass%	2.5	-	
Indenes		mass%	0.5	-	
Naphthalene		mass%	0.3	-	
Naphthalene, Alkyl		mass%	1.5	-	
Acenaphthenes		mass%	0.3	0.1	
Acenaphthylenes		mass%	0.2	-	
Tricyclic Aromatics		mass%	-	-	
TOTAL AROMATICS		mass%	9.4	0.1	
Aromatic Content	D1319				
Aromatics		vol%	8.3	0.7	25.0 max
Olefins		vol%	2.3	1.2	
Saturates		vol%	89.4	98.1	
Carbon/Hydrogen	D5291				
Carbon		%	85.4	85.7	
Hydrogen		%	14.0	14.2	
Hydrogen Content (NMR)	D3701	mass%	14.1	14.3	13.4 min
Carbonyls, Alcohols, Esters, Phenols					
Alcohols	EPA 8015B		Appendix BL	*N/A*	
Carbonyls, Esters	EPA 8260B			*N/A*	
Phenols	EPA 8270C			*N/A*	
Nitrogen Content	D4629	mg/kg	<1	<1	
Copper by AA	D3237M	ppb	<0.005	*N/A*	
Elemental Analysis	D7111				
Al		ppb	311	287	
Ba		ppb	<100	<100	
Ca		ppb	<100	<100	
Cr		ppb	<100	<100	
Cu		ppb	<100	<100	
Fe		ppb	<100	<100	
Li		ppb	<100	<100	
Pb		ppb	<100	<100	
Mg		ppb	<100	<100	
Mn		ppb	<100	<100	
Mo		ppb	<100	<100	
Ni		ppb	<100	<100	
K		ppm	<1	<1	
Na		ppm	<1	<1	
Si		ppm	<100	102	
Ag		ppb	<100	<100	
Ti		ppb	<100	<100	
V		ppb	<100	<100	
Zn		ppb	<100	<100	
Bulk Physical and Performance Properties					
Distillation	D86				
IBP		°C	159.7	*N/A*	
5%		°C	173.4	*N/A*	
10%		°C	177.0	*N/A*	205 max
15%		°C	182.1	*N/A*	

Table BD-1. Virent Evaluations

Test	Method	Units	CL12-4367 Virent / Jet A Blend (POSF9404)	CL12-4370 neat Virent (POSF8535)	MIL DTL 83133H Table 1 Limits
Chemistry					
20%		°C	185.7	*N/A*	
30%		°C	194.5	*N/A*	
40%		°C	203.1	*N/A*	
50%		°C	210.9	*N/A*	
60%		°C	219.5	*N/A*	
70%		°C	228.6	*N/A*	
80%		°C	239.8	*N/A*	
90%		°C	255.3	*N/A*	
95%		°C	267.0	*N/A*	
FBP		°C	279.4	*N/A*	300 max
Residue		%	1.3	*N/A*	1.5 max
Loss		%	0.1	*N/A*	1.5 max
T50-T10		°C	33.9	*N/A*	
T90-T10		°C	78.3	*N/A*	
Simulated Distillation	D2887				
IBP		°C	113.7	*N/A*	
5%		°C	146.4	*N/A*	
10%		°C	157.6	*N/A*	
15%		°C	169.2	*N/A*	
20%		°C	175.5	*N/A*	
25%		°C	184.6	*N/A*	
30%		°C	192.6	*N/A*	
35%		°C	196.8	*N/A*	
40%		°C	204.1	*N/A*	
45%		°C	209.1	*N/A*	
50%		°C	215.3	*N/A*	
55%		°C	218.4	*N/A*	
60%		°C	225.7	*N/A*	
65%		°C	232.1	*N/A*	
70%		°C	238.3	*N/A*	
75%		°C	246.7	*N/A*	
80%		°C	254.2	*N/A*	
85%		°C	263.6	*N/A*	
90%		°C	272.4	*N/A*	
95%		°C	287.0	*N/A*	
FBP		°C	314.3	*N/A*	
Vapor pressure (Absolute)	D6378				
0 °C		psi	0.0	*N/A*	
20 °C		psi	0.0	*N/A*	
40 °C		psi	0.1	*N/A*	
60 °C		psi	0.3	*N/A*	
80 °C		psi	0.6	*N/A*	
100 °C		psi	1.3	*N/A*	
120 °C		psi	2.3	*N/A*	
JFTOT Breakpoint	D3241BP	°C			
Test Temperature		°C	335	*N/A*	
ASTM Code		rating	<3	*N/A*	<3 max
Maximum Pressure Drop		mm Hg	0.0	*N/A*	25 max
Lubricity (BOCLE)	D5001	mm	0.75	*N/A*	
Lubricity (BOCLE) vs. CI/LI Concentration	D5001				
0 mg/L		mm	0.86	*N/A*	
5 mg/L		mm	0.79	*N/A*	
10 mg/L		mm	0.72	*N/A*	
15 mg/L		mm	0.68	*N/A*	
20 mg/L		mm	0.66	*N/A*	
Lubricity (HFRR)	D6079	µm	0.70	*N/A*	
Lubricity (HFRR) vs. CI/LI Concentration	D6079				
0 mg/L		µm	0.70	*N/A*	

Table BD-1. Virent Evaluations

Test	Method	Units	CL12-4367 Virent / Jet A Blend (POSF9404)	CL12-4370 neat Virent (POSF8535)	MIL DTL 83133H Table 1 Limits
Chemistry					
5 mg/L		µm	0.71	*N/A*	
10 mg/L		µm	0.65	*N/A*	
15 mg/L		µm	0.63	*N/A*	
20 mg/L		µm	0.65	*N/A*	
Lubricity (Scuffing Load BOCLE)	D6078	mm	1700	*N/A*	
Lubricity (Scuffing Load BOCLE) vs. CI/LI Concentration	D6078				
0 mg/L		g	1600	*N/A*	
5 mg/L		g	1450	*N/A*	
10 mg/L		g	1400	*N/A*	
15 mg/L		g	1850	*N/A*	
20 mg/L		g	1900	*N/A*	
Kinematic Viscosity	D445				
-39.95°C		cSt	10.9	*N/A*	
-20.0°C		cSt	5.1	*N/A*	8.0 max
25°C		cSt	1.8	*N/A*	
40°C		cSt	1.4	*N/A*	
Specific Heat Capacity	E2716				
-25°C		kJ/kg.K	1.702	*N/A*	
0°C		kJ/kg.K	1.793	*N/A*	
25°C		kJ/kg.K	1.892	*N/A*	
50°C		kJ/kg.K	1.983	*N/A*	
100°C		kJ/kg.K	2.176	*N/A*	
150°C		kJ/kg.K	2.398	*N/A*	
Density	D4052				
5°C		g/cm^3	0.8168	*N/A*	
15°C		g/cm^3	0.8095	*N/A*	0.775 to 0.840
40°C		g/cm^3	0.7912	*N/A*	
60°C		g/cm^3	0.7765	*N/A*	
80°C		g/cm^3	0.7618	*N/A*	
Surface tension	D1331A				
-10.0°C		mN/m	27.7	*N/A*	
22°C		mN/m	25.7	*N/A*	
40.0°C		mN/m	24.1	*N/A*	
Speed of Sound @ 30°C		m/s	1277	*N/A*	
Isentropic Bulk Modulus @ 30°C		psi	188813	*N/A*	
Thermal Conductivity	SwRI				
0°C		W/m.K	0.1217	*N/A*	
25°C		W/m.K	0.1170	*N/A*	
50°C		W/m.K	0.1124	*N/A*	
Water Content	D6304	ppm	54.0	43.0	
Water Content	D6304				
0°C		ppm	35	*N/A*	
30°C		ppm	97	*N/A*	
40°C		ppm	125	*N/A*	
50°C		ppm	158	*N/A*	
Flash Point - Tag Closed	D56	°C	47.0	*N/A*	38 min
Freeze Point (manual)	D2386	°C	-56.0	*N/A*	-47 max
Freeze Point	D5972	°C	-52.7	*N/A*	
Electrical Properties					
Dielectric Constant (10kHz)	SwRI				
-34.3°C		---	2.1650	*N/A*	
-20°C		---	2.1437	*N/A*	
0.0°C		---	2.1190	*N/A*	
30°C		---	2.0865	*N/A*	
50°C		---	2.0613	*N/A*	
Electrical Conductivity	D2624	pS/m	0.0	*N/A*	
Electrical Conductivity vs. SDA Concentration	D2624				
0 mg/L		pS/m	0.0	*N/A*	

Table BD-1. Virent Evaluations

Test	Method	Units	CL12-4367 Virent / Jet A Blend (POSF9404)	CL12-4370 neat Virent (POSF8535)	MIL DTL 83133H Table 1 Limits
Chemistry					
1 mg/L		pS/m	470.0	*N/A*	
2 mg/L		pS/m	900.0	*N/A*	
3 mg/L		pS/m	1350.0	*N/A*	
4 mg/L		pS/m	1790.0	*N/A*	
Electrical Conductivity vs. Temperature	D2624				
-40		pS/m	0.0	*N/A*	
-30		pS/m	0.0	*N/A*	
-20		pS/m	0.0	*N/A*	
-10		pS/m	0.0	*N/A*	
0		pS/m	0.0	*N/A*	
10		pS/m	0.0	*N/A*	
20		pS/m	0.0	*N/A*	
30		pS/m	0.0	*N/A*	
40		pS/m	10.0	*N/A*	
Ground Handling Properties and Safety					
MSEP	D3948	rating	99	*N/A*	70-90 min
Storage Stability - Peroxides @65°C	D3703				
0 week		mg/kg	1.2	*N/A*	
1 week		mg/kg	1.5	*N/A*	
2 week		mg/kg	2.0	*N/A*	
3 week		mg/kg	2.2	*N/A*	
6 week		mg/kg	3.2	*N/A*	
Storage Stability – Potential Gums	D5304				
16 hours		mg/100mL	0.0	*N/A*	
Upper Explosion Limit (UEL), @100°C	E681	%	7.2 ± 0.2 (re-run 7.46)	*N/A*	
Lower Explosion Limit (LEL), @100°C	E681	%	0.5 ± 0.1 (re-run 0.92)	*N/A*	
Autoignition temperature	E659				
Hot Flame Autoignition Temperature		°C	233	*N/A*	
Hot Flame Lag Time		seconds	179	*N/A*	
Cool Flame Autoignition Temperature		°C	--	*N/A*	
Cool Flame Lag Time		seconds	--	*N/A*	
Barometric Pressure		mm Hg	739.5	*N/A*	
Reaction Threshold Temperature		°C	223	*N/A*	
Hot surface ignition	FTM 791-6053	°F	1125 (burns on tube and pan)	*N/A*	
Compatibility					
Fuel/Additive Compatibility (2x treat rate)	D4054B				
FSII, DIEGME (0.3 vol%)		effect	• large droplets after initial cold soak • small droplet remaining at room temperature • went back into solution only upon heating to 100°F	*N/A*	
SDA, Stadis 450 (10 mg/L)		effect	• no issues observed	*N/A*	
CI/LI, DCI-4A (46 mg/L)		effect	• no issues observed	*N/A*	
Metal Deactivator, DMD (11.4 mg/L)		effect	• no issues observed	*N/A*	
Antioxidant, AO-30 (48 mg/L)		effect	• no issues	*N/A*	

Table BD-1. Virent Evaluations

Test	Method	Units	CL12-4367 Virent / Jet A Blend (POSF9404)	CL12-4370 neat Virent (POSF8535)	MIL DTL 83133H Table 1 Limits
Chemistry					
			observed		
Thermal Stability, +100 (512 mg/L)		effect	• no issues observed	*N/A*	
Additive Cocktail (DMD, AO-30, Stadis 450, DCI-4A, DIEGME, +100) *(same concentrations as above)*		effect	• thin film on bottom after initial cold soak • small droplet remaining at room temperature • went back into solution only upon heating to 100°F	*N/A*	
Elastomer Compatibility (O-Ring Tests)	SwRI		See Figure BD-1 and Figure BD-2	*N/A*	
Miscellaneous					
Copper Strip Corrosion (100°C for 2 hours)	D130	rating	1A	*N/A*	No. 1 max
Smoke Point	D1322	mm	26.0	*N/A*	25.0 min or 19.0 min
Naphthalene Content	D1840	vol%	0.9	*N/A*	3.0 max
Sulfur - Mercaptan	D3227	mass%	<0.0003	*N/A*	0.002 max
Acid Number	D3242	mg KOH/g	0.005	0.003	0.015 max
Existent Gums	D381	mg/100mL	0.6	1.4	7.0 max
Heat of Combustion	D4809				
BTUHeat_Net		BTU/lb	18522.4	*N/A*	18400.7 min
MJHeat_Net		MJ/kg	43.08	*N/A*	42.8 min
Sulfur Content - (Antek)	D5453	ppm	341.4	0.5	0.30 mass % max
Ignition Quality Test (IQT)	D6890				
Ignition Delay, ID		ms	4.6	*N/A*	
Derived Cetane Number, DCN			44.9	*N/A*	
Minimum Ignition Energy @ 100°C	E582	mJ	0.13-0.28	*N/A*	
Sulfur Content - (XRY)	D2622	ppm	352.2	2.8	

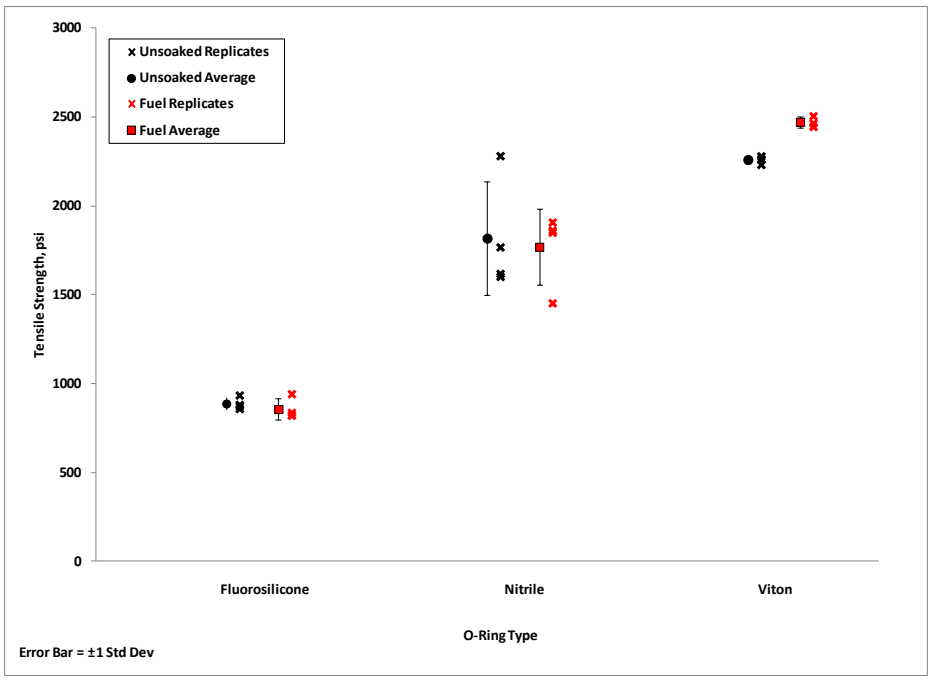

Figure BD-1. Tensile Strength – Virent / Jet A Blend

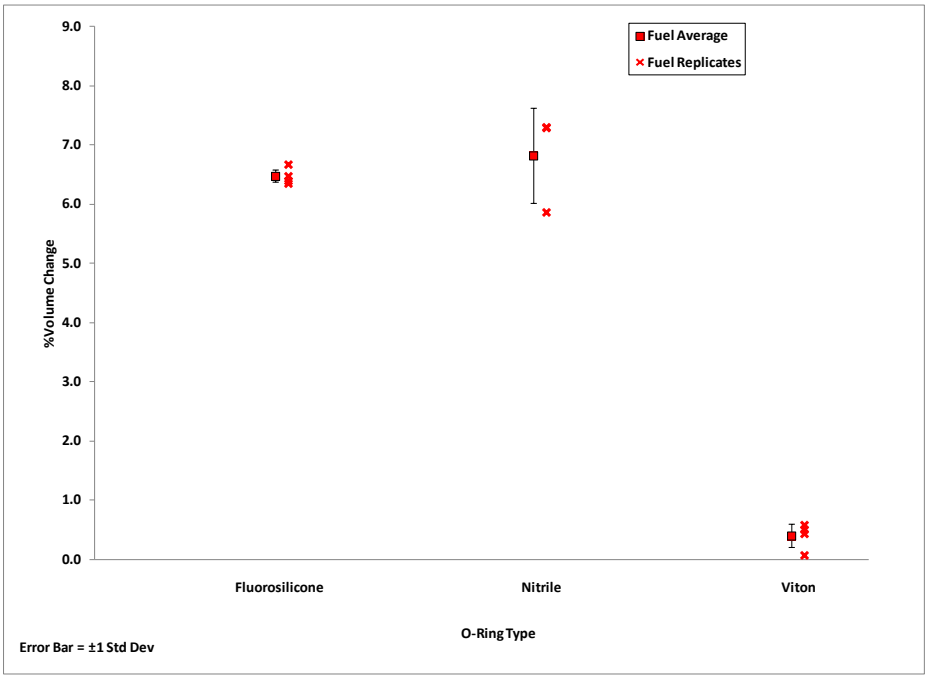

Figure BD-2. Volume Change – Virent / Jet A Blend

Appendix BE

ARA (ReadiJet) Evaluations

Table BE-1. ARA (ReadiJet) Evaluations

Test	Method	Units	CL13-4826 ARA ReadiJet (POSF10136)	MIL DTL 83133H Table 1 Limits
Chemistry				
Hydrocarbon Types by Mass Spec	D2425			
Paraffins		mass%	33.1	
Monocycloparaffins		mass%	35.2	
Dicycloparaffins		mass%	10.0	
Tricycloparaffins		mass%	1.9	
TOTAL SATURATES		mass%	80.2	
Alkylbenzenes		mass%	9.3	
Indans/Tetralins		mass%	8.5	
Indenes		mass%	0.9	
Naphthalene		mass%	0.7	
Naphthalene, Alkyl		mass%	0.2	
Acenaphthenes		mass%	0.1	
Acenaphthylenes		mass%	0.1	
Tricyclic Aromatics		mass%	0.0	
TOTAL AROMATICS		mass%	19.8	
Aromatic Content	D1319			
Aromatics		vol%	16.9	25.0 max
Olefins		vol%	1.9	
Saturates		vol%	81.2	
Carbon/Hydrogen	D5291			
Carbon		%	86.1	
Hydrogen		%	13.9	
Hydrogen Content (NMR)	D3701	mass%	14.0	13.4 min
Carbonyls, Alcohols, Esters, Phenols				
Alcohols	EPA 8015B		Appendix BM	
Carbonyls, Esters	EPA 8260B			
Phenols	EPA 8270C			
Nitrogen Content	D4629	mg/kg	<1	
Copper by AA	D3237M	ppb	<5	
Elemental Analysis	D7111			
Al		ppb	211.0	
Ba		ppb	<100	
Ca		ppb	220.0	
Cr		ppb	<100	
Cu		ppb	<100	
Fe		ppb	<100	
Li		ppb	<100	
Pb		ppb	<100	
Mg		ppb	<100	
Mn		ppb	<100	
Mo		ppb	<100	
Ni		ppb	<100	
K		ppm	<1	
Na		ppm	<1	
Si		ppm	<100	
Ag		ppb	<100	
Ti		ppb	<100	
V		ppb	<100	
Zn		ppb	<100	
Bulk Physical and Performance Properties				
Distillation	D86			
IBP		°C	152.3	
5%		°C	163.5	
10%		°C	166.1	205 max
15%		°C	169.6	
20%		°C	173.7	

Table BE-1. ARA (ReadiJet) Evaluations

Test	Method	Units	CL13-4826 ARA ReadiJet (POSF10136)	MIL DTL 83133H Table 1 Limits
30%		°C	182.0	
40%		°C	191.1	
50%		°C	201.2	
60%		°C	211.9	
70%		°C	222.6	
80%		°C	234.7	
90%		°C	248.6	
95%		°C	257.2	
FBP		°C	267.2	300 max
Residue		%	1.2	1.5 max
Loss		%	0.2	1.5 max
T50-T10		°C	35.1	
T90-T10		°C	82.5	
Simulated Distillation	D2887			
IBP		°C	122.3	
5%		°C	136.1	
10%		°C	150.2	
15%		°C	152.0	
20%		°C	163.6	
25%		°C	172.1	
30%		°C	175.1	
35%		°C	184.7	
40%		°C	193.2	
45%		°C	196.4	
50%		°C	203.1	
55%		°C	210.3	
60%		°C	216.2	
65%		°C	224.4	
70%		°C	232.7	
75%		°C	239.4	
80%		°C	247.6	
85%		°C	255.0	
90%		°C	264.3	
95%		°C	273.3	
FBP		°C	304.3	
Vapor pressure (Absolute)	D6378			
0 °C		psi	0.01	
20 °C		psi	0.14	
40 °C		psi	0.19	
60 °C		psi	0.36	
80 °C		psi	0.84	
100 °C		psi	1.73	
120 °C		psi	3.23	
JFTOT Breakpoint	D3241BP	°C		
Test Temperature		°C	295	
ASTM Code		rating	2	<3 max
Maximum Pressure Drop		mm Hg	0	25 max
Lubricity (BOCLE)	D5001	mm	0.68	
Lubricity (BOCLE) vs. CI/LI Concentration	D5001			
0 mg/L		mm	0.72	
5 mg/L		mm	0.70	
10 mg/L		mm	0.65	
15 mg/L		mm	0.62	
20 mg/L		mm	0.62	
Lubricity (HFRR)	D6079	µm	642	
Lubricity (HFRR) vs. CI/LI Concentration	D6079			
0 mg/L		µm	712	
5 mg/L		µm	704	
10 mg/L		µm	719	
15 mg/L		µm	722	
20 mg/L		µm	736	

Table BE-1. ARA (ReadiJet) Evaluations

Test	Method	Units	CL13-4826 ARA ReadiJet (POSF10136)	MIL DTL 83133H Table 1 Limits
Lubricity (Scuffing Load BOCLE)	D6078	mm	2150	
Lubricity (Scuffing Load BOCLE) vs. CI/LI Concentration	D6078			
0 mg/L		g	1700	
5 mg/L		g	2200	
10 mg/L		g	2100	
15 mg/L		g	2050	
20 mg/L		g	2200	
Kinematic Viscosity	D445			
-39.95°C		cSt	7.90	
-20.0°C		cSt	4.05	8.0 max
25°C		cSt	1.56	
40°C		cSt	1.26	
Specific Heat Capacity	E2716			
-25°C		kJ/kg.K	1.73	
0°C		kJ/kg.K	1.79	
25°C		kJ/kg.K	1.87	
50°C		kJ/kg.K	1.96	
100°C		kJ/kg.K	2.16	
150°C		kJ/kg.K	2.37	
Density	D4052			
5°C		g/cm^3	0.8111	
15°C		g/cm^3	0.8036	0.775 to 0.840
25°C		g/cm^3	0.7962	
35°C		g/cm^3	0.7887	
45°C		g/cm^3	0.7812	
55°C		g/cm^3	0.7736	
65°C		g/cm^3	0.7661	
75°C		g/cm^3	0.7585	
85°C		g/cm^3	0.7508	
Surface tension	D1331A			
-10.0°C		mN/m	28.2	
22°C		mN/m	25.7	
40.0°C		mN/m	24.3	
Speed of Sound @ 30°C		m/s	1281	
Isentropic Bulk Modulus @ 30°C		psi	188541	
Thermal Conductivity	SwRI			
0°C		W/m.K	0.1284	
25°C		W/m.K	0.1227	
50°C		W/m.K	0.1170	
Water Content	D6304	ppm	52	
Water Content	D6304			
0°C		ppm	33	
30°C		ppm	101	
40°C		ppm	138	
50°C		ppm	201	
Flash Point - Tag Closed	D56	°C	42.0	38 min
Freeze Point (manual)	D2386	°C	-43.0	-47 max
Freeze Point	D5972	°C	-43.9	
Electrical Properties				
Dielectric Constant (10kHz)	SwRI			
-40°C		---	2.191	
-20°C		---	2.161	
0.0°C		---	2.137	
30°C		---	2.103	
50°C		---	2.078	
Electrical Conductivity	D2624	pS/m	0.0	
Electrical Conductivity vs. SDA Concentration	D2624			
0 mg/L		pS/m	0	
1 mg/L		pS/m	303	
2 mg/L		pS/m	714	

Table BE-1. ARA (ReadiJet) Evaluations

Test	Method	Units	CL13-4826 ARA ReadiJet (POSF10136)	MIL DTL 83133H Table 1 Limits
3 mg/L		pS/m	1425	
4 mg/L		pS/m	2700	
Electrical Conductivity vs. Temperature	D2624			
-40		pS/m	11	
-30		pS/m	11	
-20		pS/m	7	
-10		pS/m	3	
0		pS/m	1	
10		pS/m	1	
20		pS/m	3	
30		pS/m	5	
40		pS/m	8	
Ground Handling Properties and Safety				
MSEP	D3948	rating	97.0	70-90 min
Storage Stability - Peroxides @65°C	D3703			
0 week		mg/kg	1.08	
1 week		mg/kg	1.92	
2 week		mg/kg	2.16	
3 week		mg/kg	2.76	
6 week		mg/kg	3.00	
Storage Stability – Potential Gums	D5304			
16 hours		mg/100mL	0.4	
Upper Explosion Limit (UEL), @100°C	E681	%	6.0 +/- 0.1	
Lower Explosion Limit (LEL), @100°C	E681	%	0.5 +/- 0.1	
Autoignition temperature	E659			
Hot Flame Autoignition Temperature		°C	234	
Hot Flame Lag Time		seconds	209	
Cool Flame Autoignition Temperature		°C	N/A	
Cool Flame Lag Time		seconds	0	
Barometric Pressure		mm Hg	741	
Reaction Threshold Temperature		°C	217	
Hot surface ignition	FTM 791-6053	°F	1200 (burns on tube and pan)	
Compatibility				
Fuel/Additive Compatibility (2x treat rate)	D4054B			
FSII, DIEGME (0.3 vol%)		effect	Large droplets after cold soak	
SDA, Stadis 450 (10 mg/L)		effect	No issues	
CI/LI, DCI-4A (46 mg/L)		effect	No issues	
Metal Deactivator, DMD (11.4 mg/L)		effect	No issues	
Antioxidant, AO-30 (48 mg/L)		effect	No issues	
Thermal Stability, +100 (512 mg/L)		effect	No issues	
Additive Cocktail (DMD, AO-30, Stadis 450, DCI-4A, DIEGME, +100) *(same concentrations as above)*		effect	No issues	
Elastomer Compatibility (O-Ring Tests)	SwRI		See Figure BE-1 and Figure BE-2	
Miscellaneous				
Copper Strip Corrosion (100°C for 2 hours)	D130	rating	1A	No. 1 max
Smoke Point	D1322	mm	27.5	25.0 min or 19.0 min
Naphthalene Content	D1840	vol%	0.32	3.0 max
Sulfur - Mercaptan	D3227	mass%	<0.0003	0.002 max
Acid Number	D3242	mg KOH/g	0.008	0.015 max
Existent Gums	D381	mg/100mL	5.0	7.0 max
Heat of Combustion	D4809			
BTUHeat_Net		BTU/lb	18604	18400.7 min
MJHeat_Net		MJ/kg	43.3	42.8 min
Sulfur Content - (Antek)	D5453	ppm	1.3	0.30 mass % max
Ignition Quality Test (IQT)	D6890			
Ignition Delay, ID		ms	4.1	
Derived Cetane Number, DCN			49.9	

Table BE-1. ARA (ReadiJet) Evaluations

Test	Method	Units	CL13-4826 ARA ReadiJet (POSF10136)	MIL DTL 83133H Table 1 Limits
Minimum Ignition Energy @ 100°C	E582	mJ	0.15-0.18	
Sulfur Content - (XRY)	D2622	ppm	<1.0	

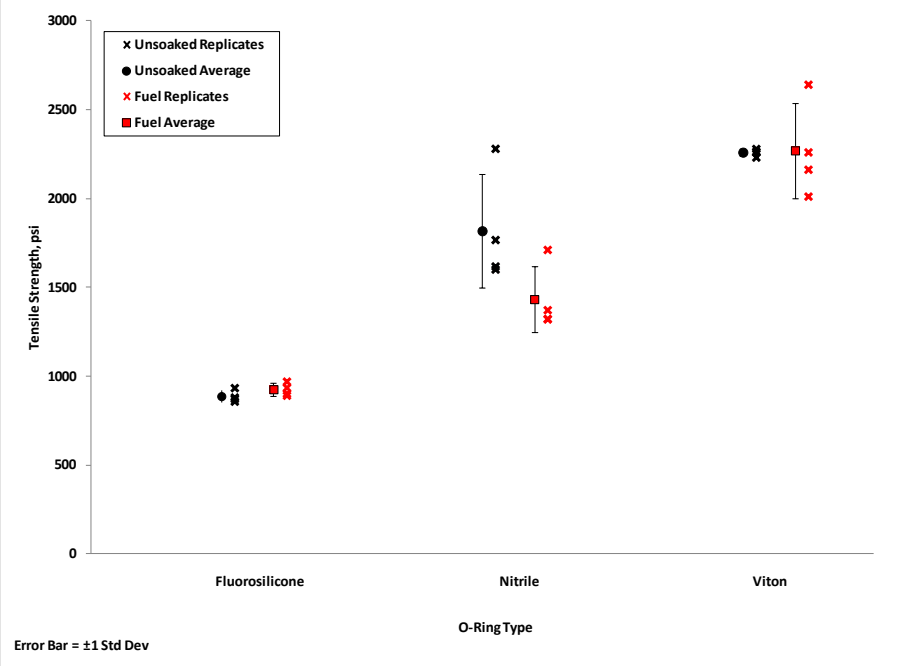

Figure BE-1. Tensile Strength – ARA ReadiJet

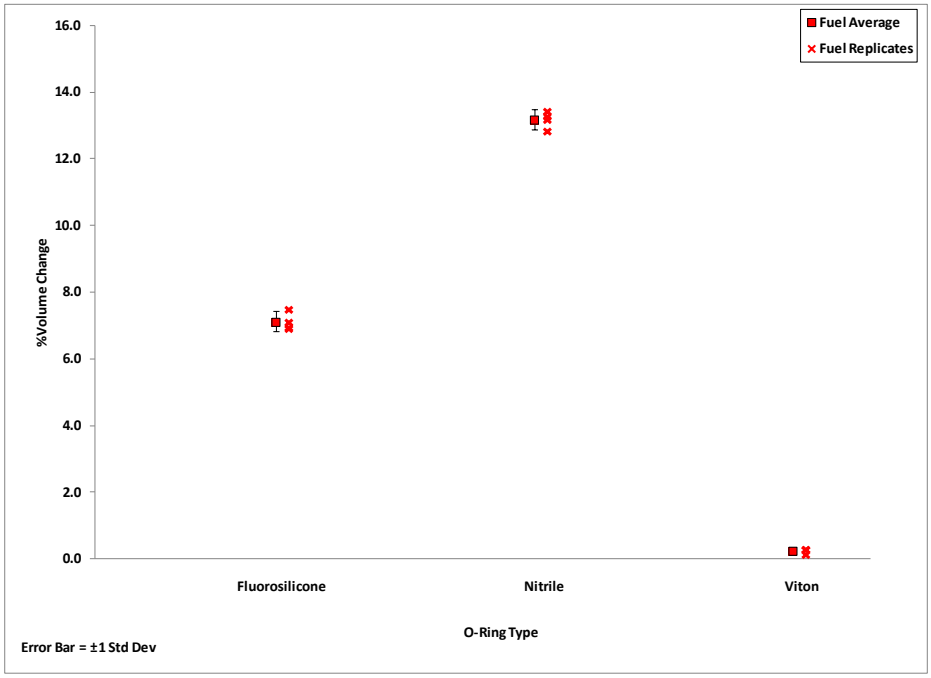

Figure BE-2. Volume Change – ARA ReadiJet

Appendix BF

Total / Amyris Blends

Table BF-1. Total / Amyris Blends Evaluations

Test	Method	Units	CL12-4716 Total / Amyris 20% Blend	CL12-4717 Total / Amyris 10% Blend	MIL DTL 83133H Table 1 Limits
Chemistry					
Hydrocarbon Types by Mass Spec	D2425				
Paraffins		mass%	56.1	50.2	
Monocycloparaffins		mass%	25.9	28.8	
Dicycloparaffins		mass%	0.0	0.0	
Tricycloparaffins		mass%	0.0	0.0	
TOTAL NAPTHENES		mass%	25.9	28.8	
TOTAL SATURATES		mass%	82.0	79.0	
Alkylbenzenes		mass%	13.4	15.4	
Indans/Tetralins		mass%	3.5	4.2	
Indenes		mass%	0.0	0.0	
Naphthalene		mass%	0.2	0.3	
Naphthalene, Alklyl		mass%	0.7	0.9	
Acenaphthenes		mass%	0.1	0.1	
Acenaphthylenes		mass%	0.1	0.1	
Tricyclic Aromatics		mass%	0.0	0.0	
TOTAL PNAs		mass%	1.1	1.4	
TOTAL AROMATICS		mass%	18.0	21.0	
Aromatic Content	D1319				
Aromatics		vol%	14.5	17.2	25.0 max
Olefins		vol%	1.7	1.5	
Saturates		vol%	83.8	81.3	
Carbon/Hydrogen	D5291				
Carbon		%	86.02	86.23	
Hydrogen		%	14.07	13.93	
Hydrogen Content (NMR)	D3701	mass%	14.13	14.06	13.4 min
Carbonyls, Alcohols, Esters, Phenols					
Carbonyls, Esters	EPA 8260B		Appendix BN		
Phenols	EPA 8270C				
Nitrogen Content	D4629	mg/kg	<1	<1	
Copper by AA	D3237M	ppb	<0.01	<0.01	
Elemental Analysis	D7111				
Al		ppb	<100	104	
Ba		ppb	<100	<100	
Ca		ppb	<100	<100	
Cr		ppb	<100	<100	
Cu		ppb	<100	<100	
Fe		ppb	<100	<100	
Li		ppb	<100	<100	
Pb		ppb	<100	<100	
Mg		ppb	<100	<100	
Mn		ppb	<100	<100	
Mo		ppb	<100	<100	
Ni		ppb	<100	<100	
K		ppm	<1	<1	
Na		ppm	<1	<1	
Si		ppb	152	166	
Ag		ppb	<100	<100	
Ti		ppb	<100	<100	
V		ppb	<100	<100	
Zn		ppb	<100	<100	
Bulk Physical and Performance Properties					
Distillation	D86				

Table BF-1. Total / Amyris Blends Evaluations

Test	Method	Units	CL12-4716 Total / Amyris 20% Blend	CL12-4717 Total / Amyris 10% Blend	MIL DTL 83133H Table 1 Limits
IBP		°C	158.2	157.4	
5%		°C	169.3	167.3	
10%		°C	171.2	169.0	205 max
15%		°C	174.4	171.6	
20%		°C	177.6	174.6	
30%		°C	184.0	180.0	
40%		°C	191.6	186.1	
50%		°C	200.4	193.6	
60%		°C	210.4	202.3	
70%		°C	221.6	213.0	
80%		°C	232.7	225.5	
90%		°C	242.5	238.8	
95%		°C	247.8	247.0	
FBP		°C	260.7	261.1	300 max
Residue		%	1.3	1.3	1.5 max
Loss		%	0.0	0.1	1.5 max
T50-T10		°C	29.2	24.6	
T90-T10		°C	71.3	69.8	
Simulated Distillation	D2887				
IBP		°C	92.7	84.0	
5%		°C	142.9	142.4	
10%		°C	151.2	150.8	
15%		°C	159.3	158.0	
20%		°C	166.0	164.9	
25%		°C	172.0	168.5	
30%		°C	174.7	173.7	
35%		°C	180.8	177.1	
40%		°C	188.2	182.7	
45%		°C	195.1	189.2	
50%		°C	200.3	195.5	
55%		°C	208.5	200.1	
60%		°C	215.9	207.8	
65%		°C	223.8	215.0	
70%		°C	234.7	219.8	
75%		°C	246.1	230.2	
80%		°C	248.6	239.7	
85%		°C	249.8	248.3	
90%		°C	250.7	250.1	
95%		°C	259.5	258.6	
FBP		°C	330.2	304.2	
Vapor pressure (Absolute)	D6378				
0 °C		psi	0.00	0.00	
20 °C		psi	0.03	0.02	
40 °C		psi	0.08	0.09	
60 °C		psi	0.28	0.30	
80 °C		psi	0.69	0.77	
100 °C		psi	1.48	1.65	
120 °C		psi	2.61	2.81	
JFTOT Breakpoint	D3241BP				
Test Temperature		°C	310	295	
ASTM Code		rating	2	<2	<3 max
Maximum Pressure Drop		mm Hg	0	0	25 max
Lubricity (BOCLE)	D5001	mm	0.730	0.780	
Lubricity (BOCLE) vs. CI/LI Concentration	D5001				
0 mg/L		mm	0.870	0.920	
5 mg/L		mm	0.800	0.830	
10 mg/L		mm	0.730	0.680	
15 mg/L		mm	0.630	0.640	
20 mg/L		mm	0.610	0.620	
Lubricity (HFRR)	D6079	µm	768	758	

Table BF-1. Total / Amyris Blends Evaluations

Test	Method	Units	CL12-4716 Total / Amyris 20% Blend	CL12-4717 Total / Amyris 10% Blend	MIL DTL 83133H Table 1 Limits
Lubricity (HFRR) vs. CI/LI Concentration	D6079				
0 mg/L		µm	726	755	
5 mg/L		µm	719	741	
10 mg/L		µm	723	749	
15 mg/L		µm	715	689	
20 mg/L		µm	717	695	
Lubricity (Scuffing Load BOCLE)	D6078	g	1700	2100	
Lubricity (Scuffing Load BOCLE) vs. CI/LI Concentration	D6078				
0 mg/L		g	1300	1150	
5 mg/L		g	1400	1500	
10 mg/L		g	1600	1350	
15 mg/L		g	1950	1650	
20 mg/L		g	1950	2050	
Kinematic Viscosity	D445				
-40°C		cSt	8.49	7.28	
-20°C		cSt	4.19	3.75	8.0 max
25°C		cSt	1.58	1.47	
40°C		cSt	1.26	1.18	
Specific Heat Capacity	E2716				
-25°C		kJ/kg.K	1.953	1.976	
0°C		kJ/kg.K	2.032	2.058	
25°C		kJ/kg.K	2.136	2.146	
50°C		kJ/kg.K	2.244	2.242	
100°C		kJ/kg.K	2.445	2.470	
150°C		kJ/kg.K	2.673	2.676	
Density	D4052				
5°C		g/cm^3	0.7996	0.8020	
15°C		g/cm^3	0.7922	0.7946	0.775 to 0.840
25°C		g/cm^3	0.7848	0.7872	
35°C		g/cm^3	0.7774	0.7797	
45°C		g/cm^3	0.7699	0.7721	
55°C		g/cm^3	0.7624	0.7646	
65°C		g/cm^3	0.7549	0.7570	
75°C		g/cm^3	0.7473	0.7493	
85°C		g/cm^3	0.7396	0.7416	
Surface tension	D1331A				
-10.0°C		mN/m	27.5	27.5	
22°C		mN/m	25.0	25.1	
40.0°C		mN/m	23.5	23.5	
Speed of Sound @ 30°C and atm pressure	SwRI	m/s	1265	1263	
Isentropic Bulk Modulus @ 30°C and atm pressure	SwRI	psi	181175	181325	
Thermal Conductivity – THW	SwRI				
0°C		W/m.K	0.1250	0.1252	
25°C		W/m.K	0.1197	0.1198	
50°C		W/m.K	0.1144	0.1143	
Water Content	D6304	ppm	42	37	
Water Content	D6304				
0°C		ppm	29	36	
30°C		ppm	94	111	
40°C		ppm	140	147	
50°C		ppm	208	202	
Flash Point - Tag Closed	D56	°C	44	43	38 min
Freeze Point (manual)	D2386	°C	-54.0	-55.0	-47 max
Freeze Point	D5972	°C	-58.1	-57.2	
Electrical Properties					
Dielectric Constant (10kHz)	SwRI				
-40°C		---	2.172		

Table BF-1. Total / Amyris Blends Evaluations

Test	Method	Units	CL12-4716 Total / Amyris 20% Blend	CL12-4717 Total / Amyris 10% Blend	MIL DTL 83133H Table 1 Limits
-20°C		---	2.143		
0.0°C		---	2.120		
30°C		---	2.085		
50.1°C		---	2.062		
-40.1°C		---		2.179	
-20°C		---		2.150	
0.0°C		---		2.125	
30°C		---		2.089	
50°C		---		2.065	
Electrical Conductivity	D2624	pS/m	0.0	0.0	
Electrical Conductivity vs. SDA Concentration	D2624				
0 mg/L		pS/m	0	0.0	
1 mg/L		pS/m	610	640.0	
2 mg/L		pS/m	1160	1170.0	
3 mg/L		pS/m	1640	1710.0	
4 mg/L		pS/m	2190	2280.0	
Electrical Conductivity vs. Temperature	D2624				
-40		pS/m	0.0	0.0	
-30		pS/m	0.0	0.0	
-20		pS/m	0.0	0.0	
-10		pS/m	0.0	0.0	
0		pS/m	0.0	0.0	
10		pS/m	0.0	0.0	
20		pS/m	0.0	0.0	
30		pS/m	10.0	10.0	
40		pS/m	20.0	20.0	
Ground Handling Properties and Safety					
MSEP - Alumicel	D3948	rating	99.0	99.0	70-90 min
Storage Stability - Peroxides @65°C	D3703				
0 week		mg/kg	0.44	1.12	
1 week		mg/kg	1.08	1.80	
2 week		mg/kg	1.24	2.00	
3 week		mg/kg	1.80	2.12	
6 week		mg/kg	2.08	2.68	
Storage Stability – Potential Gums	D5304				
16 hours		mg/100mL	0.4	0.5	
Upper Explosion Limit (UEL), @100°C	E681	%	3.8	4.1	
Lower Explosion Limit (LEL), @100°C	E681	%	0.4	0.5	
Autoignition temperature	E659				
Hot Flame Autoignition Temperature		°C	233	233	
Hot Flame Lag Time		seconds	147.0	165.1	
Cool Flame Autoignition Temperature		°C	0	0	
Cool Flame Lag Time		seconds	0.0	0.0	
Barometric Pressure		mm Hg	743.2	743.2	
Reaction Threshold Temperature		°C	217	217	
Hot surface ignition	FTM 791-6053	°F	1250 (burns on tube and in pan)	1250 (burns on tube and in pan)	
Compatiblity					
Fuel/Additive Compatibility (4x treat rate)	D4054B				
FSII		effect	Large droplets after cold soak	Large droplets after cold soak	
SDA		effect	no issues	no issues	
CI/LI		effect	no issues	no issues	
MDA		effect	no issues	no issues	
AO-30		effect	no issues	no issues	
+100		effect	no issues	no issues	
Additive Cocktail (MDA, AO, SDA, CI/LI, FSII,+100)		effect	no issues	no issues	

Table BF-1. Total / Amyris Blends Evaluations

Test	Method	Units	CL12-4716 Total / Amyris 20% Blend	CL12-4717 Total / Amyris 10% Blend	MIL DTL 83133H Table 1 Limits
Elastomer Compatibility (O-Ring Tests)	SwRI		See Figure BF-1 and Figure BF-2	See Figure BF-3 and Figure BF-4	
Miscellaneous					
Copper Strip Corrosion (100°C for 2 hours)	D130	rating	1A	1A	No. 1 max
Smoke Point	D1322	mm	27.5	28.0	25.0 min or 19.0 min
Naphthalene Content	D1840	vol%	0.63	0.62	3.0 max
Sulfur - Mercaptan	D3227	mass%	<0.0003	<0.0003	0.002 max
Acid Number	D3242	mg KOH/g	0.001	0.001	0.015 max
Existent Gums	D381	mg/100mL	<1	4.0	7.0 max
Heat of Combustion	D4809				
BTUHeat_Net		BTU/lb	18586.0	18509.1	18400.7 min
MJHeat_Net		MJ/kg	43.231	43.052	42.8 min
Sulfur Content - (Antek)	D5453	ppm	4.8	5.1	0.30 mass % max
Ignition Quality Test (IQT)	D6890				
Ignition Delay, ID		ms	4.609	4.772	
Derived Cetane Number, DCN			44.95	43.57	
Minimum Ignition Energy @ 100°C	E582	mJ	0.13 - 0.18	0.13 - 0.15	
Sulfur Content - (XRY)	D2622	ppm	5.8	6.6	

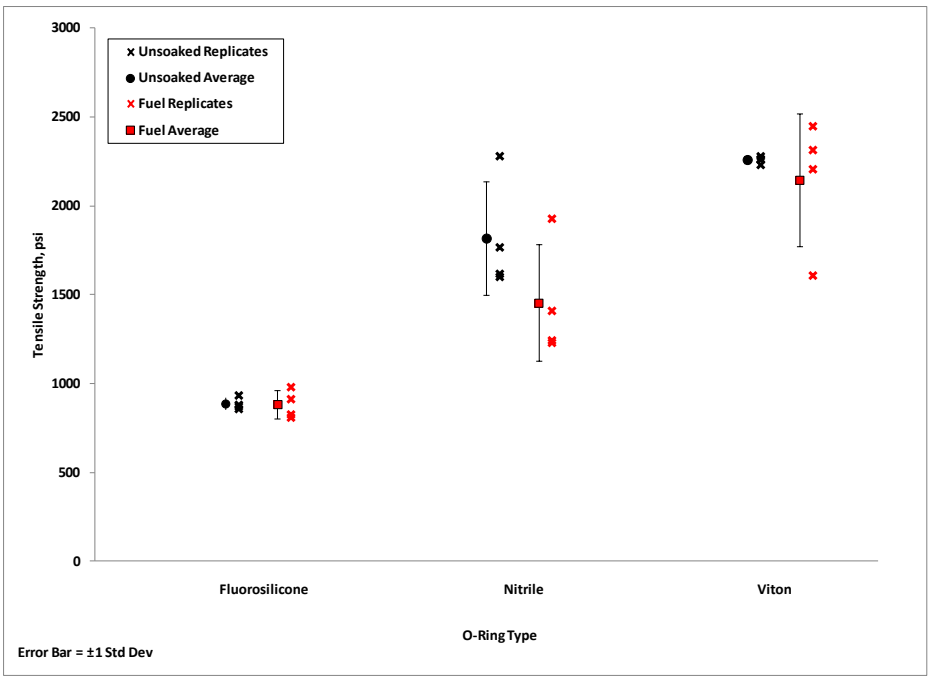

Figure BF-1. Tensile Strength – Total / Amyris 20% Blend

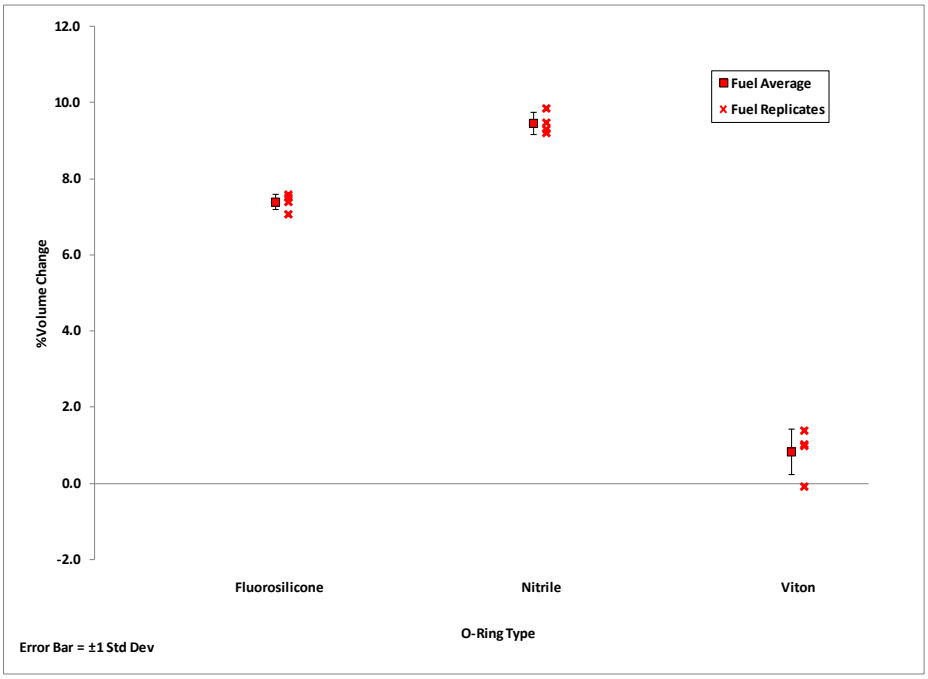

Figure BF-2. Volume Change – Total / Amyris 20% Blend

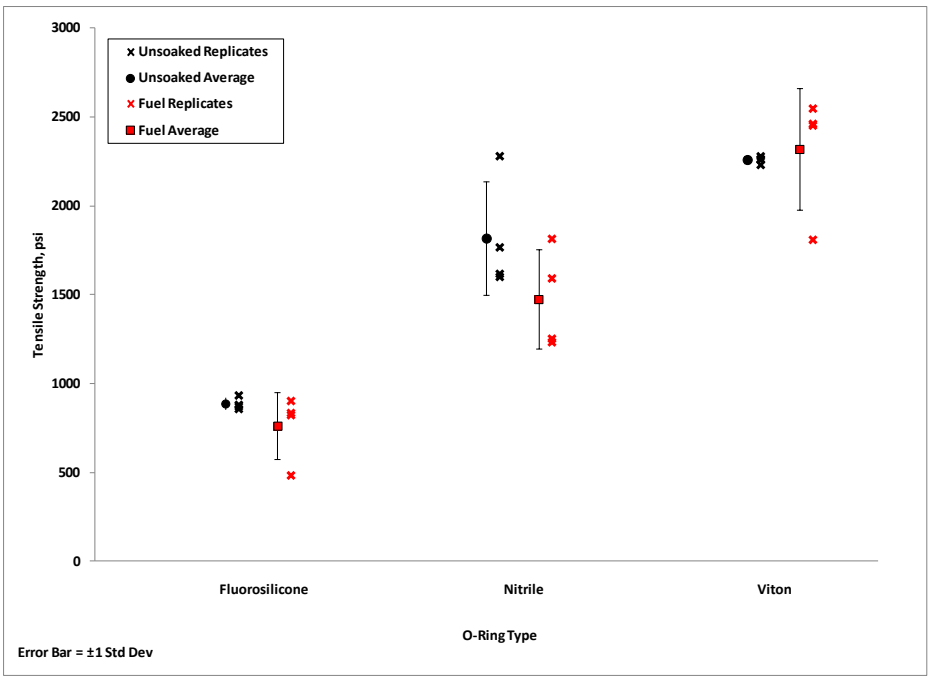

Figure BF-3. Tensile Strength – Total / Amyris 10% Blend

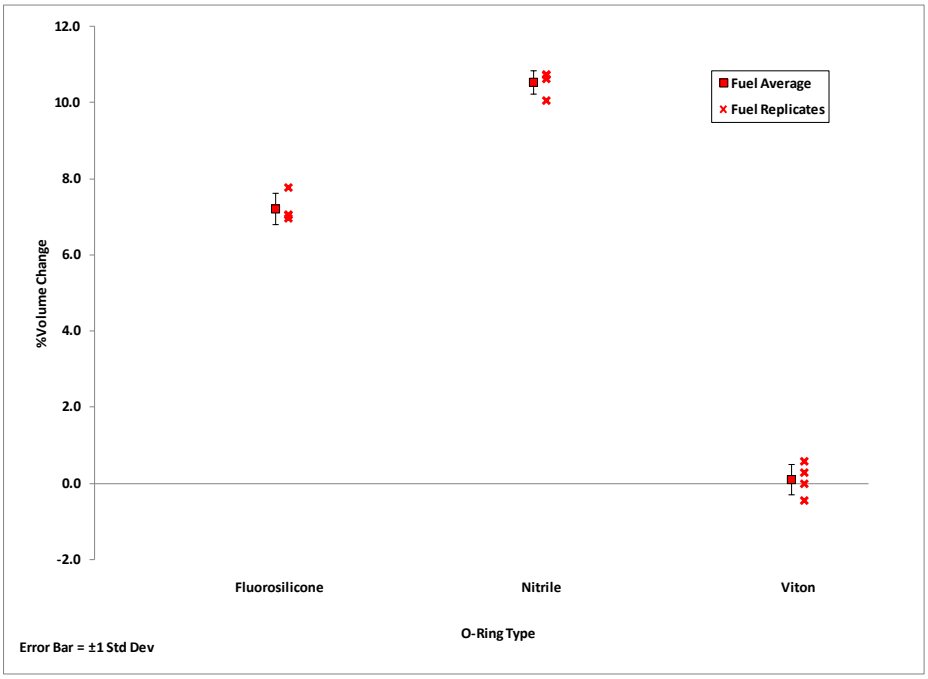

Figure BF-4. Volume Change – Total / Amyris 10% Blend

Appendix BG

Miscellaneous Amyris Testing

Table BG-1. Amyris Jet A-1 (CL13-5265)

Test	Method	Units	SwRI Sample ID CL13-5265 Result
JFTOT Breakpoint	**D3241**		
Test Temperature		**°C**	**335**
ASTM Code		**rating**	**2**
Maximum Pressure Drop		**mm Hg**	**0**
Lubricity (BOCLE) vs. Concentration	**D5001**		
0 ppm CI/LI		**mm**	**0.90**
5 ppm CI/LI		**mm**	**0.80**
10 ppm CI/LI		**mm**	**0.70**
15 ppm CI/LI		**mm**	**0.67**
20 ppm CI/LI		**mm**	**0.63**
Kinematic Viscosity	**D445**		
40°C		**cSt**	**1.11**
25°C		**cSt**	**1.37**
-20°C		**cSt**	**3.29**
-40°C		**cSt**	**6.36**
Specific Heat Capacity	**E2716**		
-25°C		**kJ/kg.K**	**1.663**
0°C		**kJ/kg.K**	**1.722**
25°C		**kJ/kg.K**	**1.797**
50°C		**kJ/kg.K**	**1.887**
100°C		**kJ/kg.K**	**2.071**
150°C		**kJ/kg.K**	**2.285**
Dielectric Constant	**SwRI**		
50°C		**--**	**2.066**
30°C		**--**	**2.090**
0°C		**--**	**2.126**
-19.8°C		**--**	**2.158**
-40°C		**--**	**2.186**
Density (5°-85°C)	**D4052**		
5°C		**g/mL**	**0.8042**
15°C		**g/mL**	**0.7968**
25°C		**g/mL**	**0.7892**
35°C		**g/mL**	**0.7817**
45°C		**g/mL**	**0.7741**
55°C		**g/mL**	**0.7665**
65°C		**g/mL**	**0.7588**
75°C		**g/mL**	**0.7512**
85°C		**g/mL**	**0.7434**
Extrapolated Density (for Dielectric Constant)	**SwRI**		
50°C		**g/mL**	**0.7702**
30°C		**g/mL**	**0.7854**
0°C		**g/mL**	**0.8082**
-19.8°C		**g/mL**	**0.8232**
-40°C		**g/mL**	**0.8386**
Surface Tension	**D1331A**		
-10°C		**mN/m**	**27.4**
22°C		**mN/m**	**25.1**
40°C		**mN/m**	**23.5**
Water Solubility vs. Temperature	**D6304**		
0°C		**ppm**	**37**
30°C		**ppm**	**109**
40°C		**ppm**	**155**
50°C		**ppm**	**189**
Minimum Ignition Energy	**E582**		
Minimum Ignition Energy		**mJ**	**0.11-0.18**
Sample Concentration		**mg/cm³**	**0.14-0.19**

Table BG-1. Amyris Jet A-1 (CL13-5265)

Test	Method	Units	SwRI Sample ID CL13-5265
			Result
Carbonyls/Esters	EPA 8260B	mg/kg	Appendix BN
Phenols	EPA 8270C	mg/kg	
Upper Explosion Limits (UEL) at 100°C	E681	%	7.70
Lower Explosion Limits (LEL) at 100°C	E681	%	0.84
Electrical Conductivity vs. SDA Concentration	D2624		
0 mg/L Stadis 450		pS/m	0
1 mg/L Stadis 450		pS/m	520
2 mg/L Stadis 450		pS/m	970
3 mg/L Stadis 450		pS/m	1460
4 mg/L Stadis 450		pS/m	1980
Speed-of-Sound (atmospheric pressure)	SwRI		
3.8°C		m/s	1370.8
21.8°C		m/s	1294.9
29.8°C		m/s	1263.6
50.2°C		m/s	1183.8
Isentropic Bulk Modulus (atmospheric pressure)	SwRI		
3.8°C		psi	219,464
21.8°C		psi	192,524
29.8°C		psi	181,923
50.2°C		psi	156,523

Table BG-2. Additional Results for Amyris 10% Farnesane Blend (CL13-4717)

Test	Method	Units	SwRI Sample ID# CL13-4717 Results
Speed-of-Sound (atmospheric pressure)	SwRI		
4°C		m/s	1370.8
22.2°C		m/s	1294.7
29.8°C		m/s	1264.5
50.2°C		m/s	1186.2
Isentropic Bulk Modulus (atmospheric pressure)	SwRI		
4°C		psi	218,848
22.2°C		psi	191,866
29.8°C		psi	181,693
50.2°C		psi	156,788

Table BG-3. Amyris Viscosity Analysis of Seven Fuels

Method	Parameter	Units	Takreer-10	10:90-Biojet	20:80-Biojet	Concord-Jet	Honeywell-Jet-A	10%-Amyris-Blend	20%-Amyris-Blend
D2532	Visc @ 35 min	cSt	3.39	4.37	4.9	3.99	4.57	5	5.59
	Visc @ 3 hours	cSt	3.39	4.39	4.9	3.98	4.57	4.99	5.58
	Visc @ 72 hours	cSt	3.38	4.41	4.91	3.98	4.57	4.99	5.58
	Temp	°C	-20	-20	-20	-20	-20	-20	-20
	Visc @ 35 min	cSt	6.41	9.25	10.58	8.13	8.45	10.97	12.55
	Visc @ 3 hours	cSt	6.41	9.27	10.57	8.13	8.44	10.97	12.55
	Visc @ 72 hours	cSt	6.41	9.23	10.55	8.13	8.45	11.02	12.6
	Temp	°C	-40	-40	-40	-40	-40	-40	-40
D2983 -20°C	Visc	cPs	--	--	--	--	--	--	--
	RPM	rpm	60	60	60	60	60	60	60
D2983 -40°C	Visc	cPs	--	--	--	--	--	--	--
	RPM	rpm	60	60	60	60	60	60	60
D445	Visc	cSt	3.41	4.47	4.91	4.07	4.61	5.1	5.57
	Temp	°C	-20	-20	-20	-20	-20	-20	-20
	Visc	cSt	6.42	9.26	10.58	8.12	9.67	10.76	12.31
	Temp	°C	-40	-40	-40	-40	-40	-40	-40
D5133	Gelation Index	.	--	--	--	--	--	--	--
	Gelation Temp	°C	--	--	--	--	--	--	--
	Temp @ 5,000 cPs	°C	<-40	<-40	<-40	<-40	<-40	<-40	<-40
	Temp @ 10,000 cPs	°C	<-40	<-40	<-40	<-40	<-40	<-40	<-40
	Temp @ 20,000 cPs	°C	<-40	<-40	<-40	<-40	<-40	<-40	<-40
	Temp @ 30,000 cPs	°C	<-40	<-40	<-40	<-40	<-40	<-40	<-40
	Temp @ 40,000 cPs	°C	<-40	<-40	<-40	<-40	<-40	<-40	<-40

Note: No usable data could be obtained from D2983 and D5133 as a result of the viscosity being too low to measure.

Appendix BH
O-Ring Material Compatibility Testing

The following O-ring material compatibility evaluations were performed:

- Jet A (CL12-4134, sourced at SwRI)
    - Tensile Strength – Figure BH-1
    - Volume Change – Figure BH-2
- JP-8 (CL11-2680, POSF4751)
    - Tensile Strength – Figure BH-3
    - Volume Change – Figure BH-4

An O-ring material compatibility test was performed using a blend of low aromatic JP-8 (CL13-5864, 11.3 % ArH) and GEVO ATJ (CL14-5998)

- Tensile Strength
    - Figure BH-5
    - The tensile strength appears to be relatively unaffected for all materials
- Volume Swell
    - Figure BH-6
    - Although some spread in the individual replicates was observed, the average for the fluorosilicone was nearly the same as a baseline JP-8 (Figure BH-4). However, compared to the same JP-8, the nitrile and viton O-rings were more severely impacted. The nitrile O-rings were reduced from ~10% to ~4% swell and the viton O-rings increased from approximately -0.5% swell to ~3% swell.

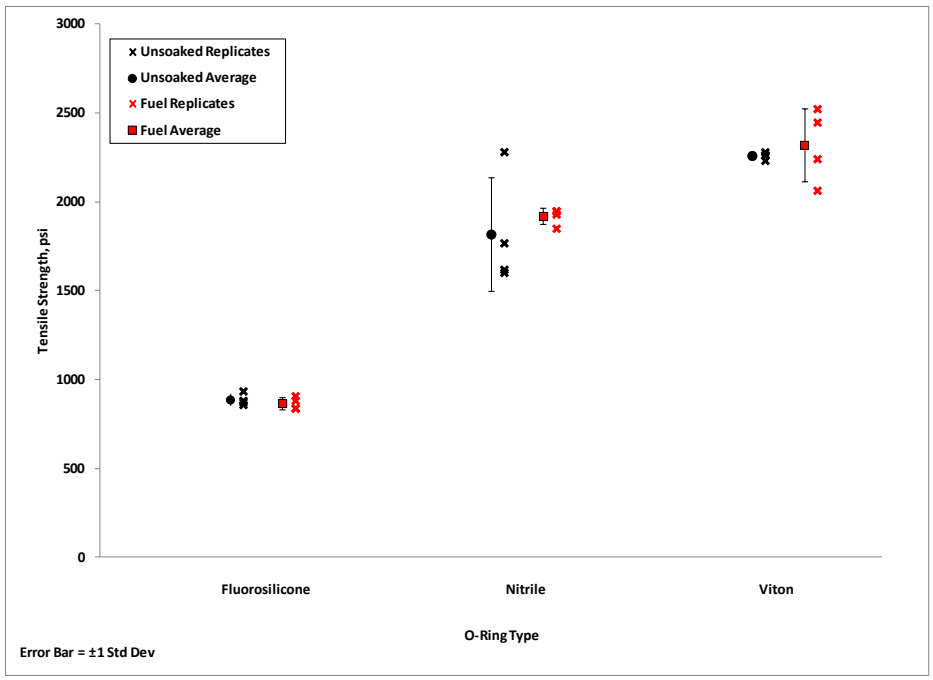

Figure BH-1. Tensile Strength – Jet A (CL12-4134)

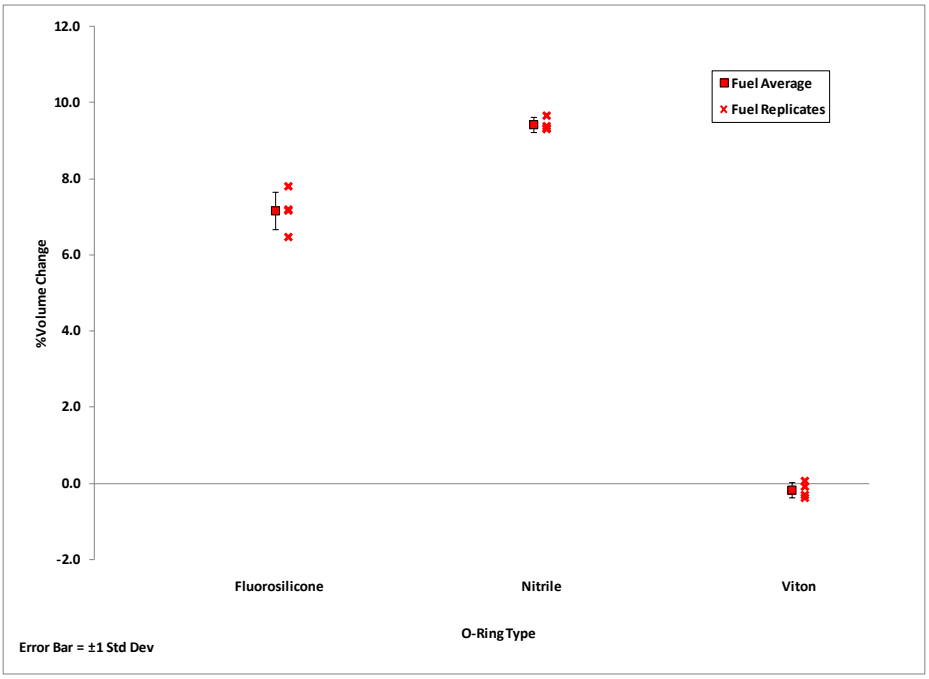

Figure BH-2. Volume Change – Jet A (CL12-4134)

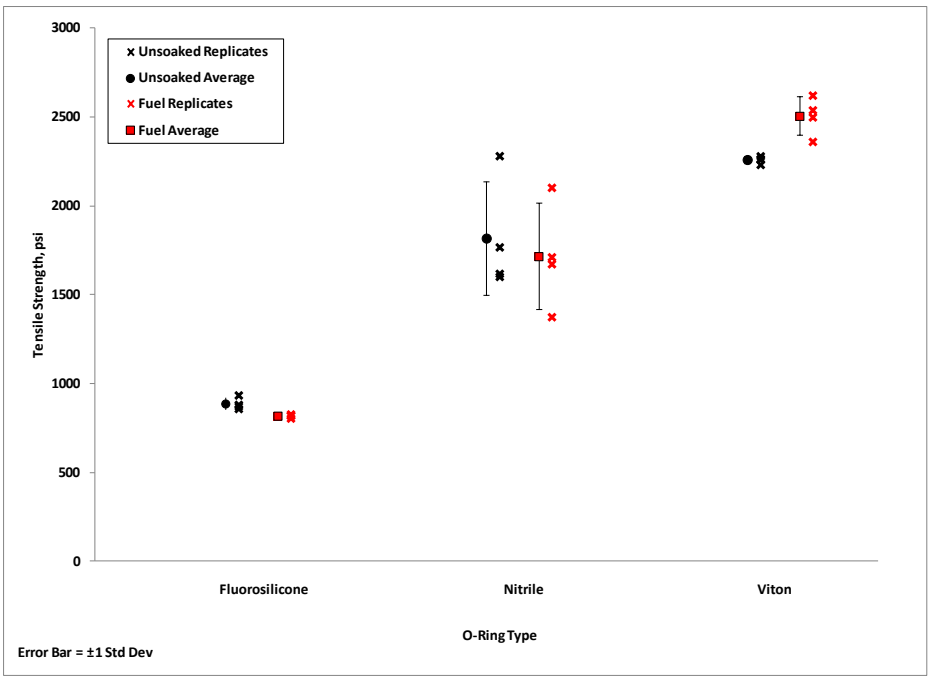

Figure BH-3. Tensile Strength – JP-8 (CL11-2680, POSF4751)

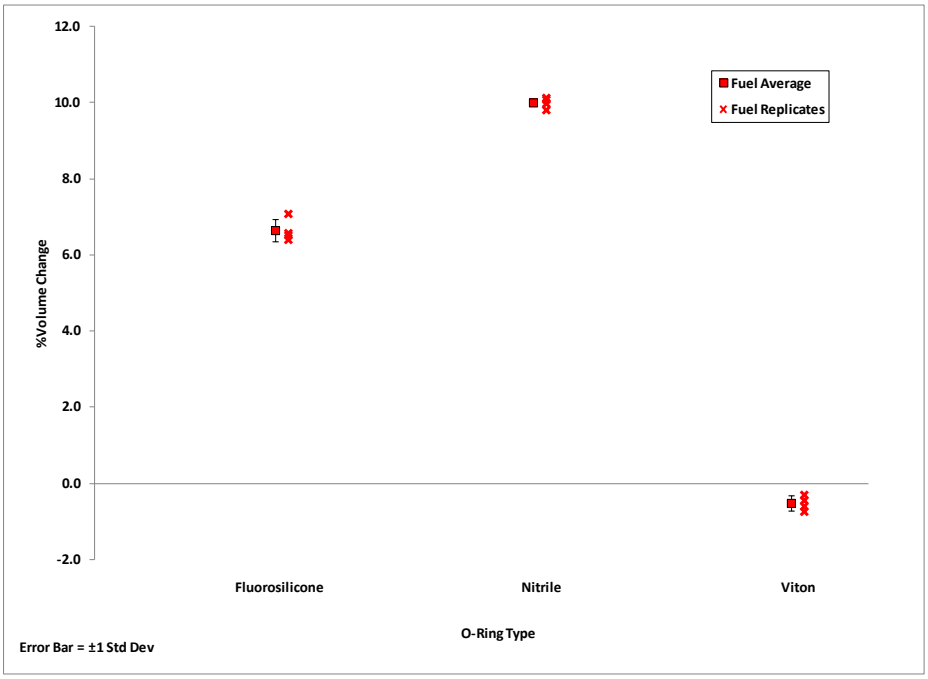

Figure BH-4. Volume Change – JP-8 (CL11-2680, POSF4751)

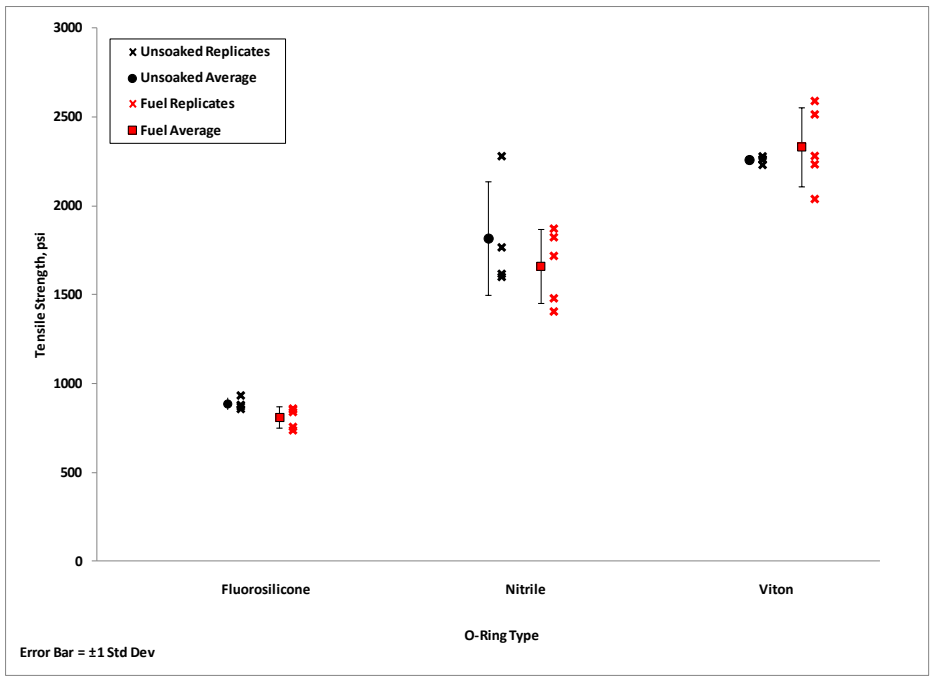

Figure BH-5. Tensile Strength – 50/50 GEVO ATJ / Low ArH JP8

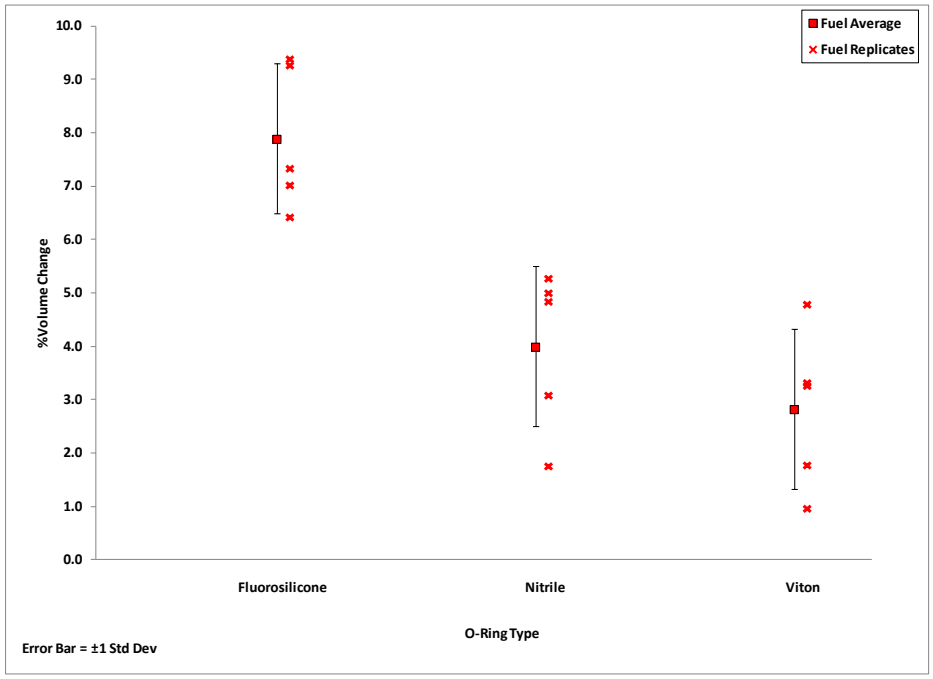

Figure BH-6. Volume Change – 50/50 GEVO ATJ / Low ArH JP8

Appendix BI

Miscellaneous Tri-Service Sample Testing

Table BI-1. Additive Compatibility for Nominal Jet A (DLA #22, CL13-5892)

Fuel/Additive Compatibility (2x treat rate)		
FSII, DIEGME (0.2 vol%)	effect	• large droplets after initial cold soak and at room temperature • not present after100°F soak
SDA, Stadis 450 (10 mg/L)	effect	• no issues observed
CI/LI, DCI-4A (46 mg/L)	effect	• no issues observed
Metal Deactivator, DMD (11.4 mg/L)	effect	• no issues observed
Antioxidant, AO-30 (48 mg/L)	effect	• no issues observed
Thermal Stability, +100 (512 mg/L)	effect	• no issues observed
Additive Cocktail (DMD, AO-30, Stadis 450, DCI-4A, DIEGME, +100) *(same concentrations as above)*	effect	• no issues observed

Table BI-2. Additional Results for Nominal Jet A (DLA Sample #22, CL13-5892)

Test	Method	Units	SwRI Sample ID# CL13-5892
Electrical Conductivity	**D2624**		
0 mg/L SDA, 20.9°C		pS/m	0
1 mg/L SDA, 22.2°C		pS/m	430
2 mg/L SDA, 21.4°C		pS/m	790
3 mg/L SDA, 21.7°C		pS/m	1180
4 mg/L SDA, 22.2°C		pS/m	1620
Peroxides (at 65°C)	**D3703**		
0 week		mg/kg	0.360
1 weeks		mg/kg	0.960
2 weeks		mg/kg	1.120
3 weeks		mg/kg	2.360
6 weeks		mg/kg	2.96
Dielectric Constants (at 10 kHz)	**SwRI**		
-40.1°C			2.192
-20.0°C			2.163
0.2°C			2.136
30.0°C			2.099
50.0°C			2.073
Minimum Ignition Energy	**E582**		
Minimum Ignition Energy		mJ	0.63-0.69
Upper Explosion Limits (UEL) at 100°C	**E681**	%	7.58
Lower Explosion Limits (LEL) at 100°C	**E681**	%	1.02
Thermal Conductivity (transient hot wire)	**SwRI**		
0°C		W/mK	0.1244
20°C		W/mK	0.1204
40°C		W/mK	0.1163
60°C		W/mK	0.1123
Speed-of-Sound (atmospheric pressure)	**SwRI**		
2.4°C		m/s	1388.3
21.0°C		m/s	1310.2
29.8°C		m/s	1276.4
50.1°C		m/s	1197.2
Isentropic Bulk Modulus (atmospheric pressure)	**SwRI**		
2.4°C		psi	227,167
21.0°C		psi	198,860
29.8°C		psi	187,188
50.1°C		Psi	161,543

Table BI-3. Nitrogen Results for DLA Samples

SwRI Sample ID#	DLA Sample #	Description	D4629 Nitrogen Content [ppm]
CL13-5471	23	Best case Jet A (3.4 cSt, 40 C, 14% ArH)	<1.0
CL13-5231	14	Jet A - PADD 1	4.2
CL13-4901	15	Jet A - PADD 2	10.1
CL13-4848	16	Jet A - PADD 3	2.0
CL13-5508	17	Jet A - PADD 4	3.3
CL13-4928	18	Jet A - PADD 5	8.9
CL13-5441	13	Jet-A (FAME Sensitive, POSF 9326)	<1.0
CL13-5352	19	JP-5 - Supplier 1 (Valero?)	4.1
CL13-5351	8	JP-8 - PADD 1	3.9
CL13-5111	9	JP-8 - PADD 2	2.2
CL13-4851	10	JP-8 - PADD 3	<1.0
CL13-5092	11	JP-8 - PADD 4	<1.0
CL13-5059	12	JP-8 - PADD 5	2.8
CL13-5440	7	JP-8 (Blend Stock for above)	2.2
CL13-5892	22	Nominal Jet A (4.5 cSt, 50 C flash, 17% ArH)	1.3
CL13-5470	24	Worst case JP-5 (6.5 cSt, 66 C, 21% ArH)	2.4
CL13-5443	25	WPAFB JP-8 (13% ArH, POSF 9698)	2.4

Table BI-4. Surface Tension Results for Three (3) Tri-Service Samples

Surface Tension (D1331A) vs. Temperature					
JP-5		JP-8		Jet A	
POSF 10289		POSF 10264		POSF 10325	
SwRI CL13-5470		SwRI CL13-5471		SwRI CL13-5472	
Temp (°C)	mN/m	Temp (°C)	mN/m	Temp (°C)	mN/m
40	24.7	40	22.8	40	23.6
22	25.7	22	23.8	22	24.8
-10	28.4	-10	25.8	-10	28.0

Appendix BJ
EPA Testing Reports: CL12-3339 and CL12-3599

Analytical Report 441475

for

Southwest Research Institute

Project Manager: Scott Hutzler

17149.26.001

SO091904E

10-MAY-12

Collected By: Client

Celebrating 20 Years of commitment to excellence in Environmental Testing Services

4143 Greenbriar Dr., Stafford, TX 77477

Xenco-Houston (EPA Lab code: TX00122):
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Illinois (002082), Indiana (C-TX-02), Iowa (392), Kansas (E-10380), Kentucky (45), Louisiana (03054)
New Hampshire (297408), New Jersey (TX007), New York (11763), Oklahoma (9218), Pennsylvania (68-03610)
Rhode Island (LAO00312), USDA (S-44102), DoD (L11-54)

Xenco-Atlanta (EPA Lab Code: GA00046):
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Xenco-Phoenix Mobile (EPA Lab code: AZ00901): Arizona (AZM757)
Xenco Tucson (EPA Lab code:AZ000989): Arizona (AZ0758)

10-MAY-12

Project Manager: **Scott Hutzler**
Southwest Research Institute
6220 Culebra Road
P.O. Box 28510
San Antonio, TX 78228

Reference: XENCO Report No: **441475**
17149.26.001
Project Address:

Scott Hutzler :

We are reporting to you the results of the analyses performed on the samples received under the project name referenced above and identified with the XENCO Report Number 441475. All results being reported under this Report Number apply to the samples analyzed and properly identified with a Laboratory ID number. Subcontracted analyses are identified in this report with either the NELAC certification number of the subcontract lab in the analyst ID field, or the complete subcontracted report attached to this report.

Unless otherwise noted in a Case Narrative, all data reported in this Analytical Report are in compliance with NELAC standards. Estimation of data uncertainty for this report is found in the quality control section of this report unless otherwise noted. Should insufficient sample be provided to the laboratory to meet the method and NELAC Matrix Duplicate and Matrix Spike requirements, then the data will be analyzed, evaluated and reported using all other available quality control measures.

The validity and integrity of this report will remain intact as long as it is accompanied by this letter and reproduced in full, unless written approval is granted by XENCO Laboratories. This report will be filed for at least 5 years in our archives after which time it will be destroyed without further notice, unless otherwise arranged with you. The samples received, and described as recorded in Report No. 441475 will be filed for 60 days, and after that time they will be properly disposed without further notice, unless otherwise arranged with you. We reserve the right to return to you any unused samples, extracts or solutions related to them if we consider so necessary (e.g., samples identified as hazardous waste, sample sizes exceeding analytical standard practices, controlled substances under regulated protocols, etc).

We thank you for selecting XENCO Laboratories to serve your analytical needs. If you have any questions concerning this report, please feel free to contact us at any time.

Respectfully,

Skip Harden
Project Manager

Recipient of the Prestigious Small Business Administration Award of Excellence in 1994.
Certified and approved by numerous States and Agencies.
A Small Business and Minority Status Company that delivers SERVICE and QUALITY

Houston - Dallas - Odessa - San Antonio - Tampa - Lakeland - Atlanta - Phoenix - Oklahoma - Latin America

Sample receipt non conformances and comments:
None

Sample receipt non conformances and comments per sample:

None

Analytical non nonformances and comments:

Batch: LBA-887395 VOAs by SW-846 8260B
S10:
Due to matrix interference, the surrogate recovered above acceptance criteria.

Flagging Criteria

Arizona Flags

All method blanks, laboratory spikes, and/or matrix spikes met quality control objectives for the parameters associated with this Work Order except as detailed below or on the Data Qualifier page of this report. Data Qualifiers used in this report are in accordance with ADEQ Arizona Data Qualifiers, Revision 3.0 9/20/2007. Data qualifiers (flags) contained within this analytical report have been issued to explain a quality control deficiency, and do not affect the quality (validity) of the data unless noted otherwise in the case narrative.

D1 Sample required dilution due to matrix.

D2 Sample required dilution due to high concentration of target analyte.

L1 The associated blank spike recovery was above laboratory acceptance limits.

L2 The associated blank spike recovery was below laboratory acceptance limits.

M2 Matrix spike recovery was low; the associated blank spike recovery was acceptable.

M3 The spike recovery value is unusable since the analyte concentration in the sample is disproportionate to spike level. The associated blank spike recovery was acceptable.

S1 Surrogate recovery was above laboratory acceptance limits, but within method acceptance limits.

S10 Surrogate recovery was above laboratory and method acceptance limits. See case narrative.

S8 The analysis of the sample required a dilution such that the surrogate recovery calculation does not provide any useful information. The associated blank spike recovery was acceptable.

T4 Tentatively identified compound. Concentration is estimated and based on the closest internal standard.

Sample Cross Reference 441475

Southwest Research Institute, San Antonio, TX

17149.26.001

Sample Id	Matrix	Date Collected	Sample Depth	Lab Sample Id
CL12-3339	W	04-23-12 00:00		441475-001
CL12-3599	W	04-23-12 00:00		441475-002

XENCO Laboratories

Certificate of Analytical Results 441475

Southwest Research Institute, San Antonio, TX

17149.26.001

Sample Id: CL12-3339	**Matrix:** Product	**Date Received:** Apr-26-12 09:30
Lab Sample Id: 441475-001	**Date Collected:** Apr-23-12 00:00	

Analytical Method:	SVOAs by SW-846 8270C	**Prep Method:**	SW3580A
Tech:	LRA	**% Moisture:**	
Analyst:	MCH	**Date Prep:**	Apr-30-12 10:18
Seq Number:	886890		

Parameter	Cas Number	Result	RL	Units	Analysis Date	Flag	Dil
Acenaphthene	83-32-9	BRL	472	mg/kg	04/30/12 17:35	D1	10
Acenaphthylene	208-96-8	BRL	472	mg/kg	04/30/12 17:35	D1	10
Aniline (Phenylamine, Aminobenzene)	62-53-3	BRL	472	mg/kg	04/30/12 17:35	D1	10
Anthracene	120-12-7	BRL	472	mg/kg	04/30/12 17:35	D1	10
Benzo(a)anthracene	56-55-3	BRL	472	mg/kg	04/30/12 17:35	D1	10
Benzo(a)pyrene	50-32-8	BRL	472	mg/kg	04/30/12 17:35	D1	10
Benzo(b)fluoranthene	205-99-2	BRL	472	mg/kg	04/30/12 17:35	D1	10
Benzo(g,h,i)perylene	191-24-2	BRL	472	mg/kg	04/30/12 17:35	D1	10
Benzo(k)fluoranthene	207-08-9	BRL	472	mg/kg	04/30/12 17:35	D1	10
Benzoic Acid	65-85-0	BRL	2830	mg/kg	04/30/12 17:35	D1L1	10
Benzyl Butyl Phthalate	85-68-7	BRL	472	mg/kg	04/30/12 17:35	D1	10
bis(2-chloroethoxy) methane	111-91-1	BRL	472	mg/kg	04/30/12 17:35	D1	10
bis(2-chloroethyl) ether	111-44-4	BRL	472	mg/kg	04/30/12 17:35	D1	10
bis(2-chloroisopropyl) ether	108-60-1	BRL	472	mg/kg	04/30/12 17:35	D1	10
bis(2-ethylhexyl) phthalate	117-81-7	BRL	472	mg/kg	04/30/12 17:35	D1	10
4-Bromophenyl-phenylether	101-55-3	BRL	472	mg/kg	04/30/12 17:35	D1	10
Di-n-butylphthalate	84-74-2	BRL	472	mg/kg	04/30/12 17:35	D1	10
4-chloro-3-methylphenol	59-50-7	BRL	472	mg/kg	04/30/12 17:35	D1	10
4-Chloroaniline	106-47-8	BRL	472	mg/kg	04/30/12 17:35	D1	10
2-Chloronaphthalene	91-58-7	BRL	472	mg/kg	04/30/12 17:35	D1L1	10
2-Chlorophenol	95-57-8	BRL	472	mg/kg	04/30/12 17:35	D1	10
4-Chlorophenyl Phenyl Ether	7005-72-3	BRL	472	mg/kg	04/30/12 17:35	D1	10
Chrysene	218-01-9	BRL	472	mg/kg	04/30/12 17:35	D1	10
Dibenz(a,h)anthracene	53-70-3	BRL	472	mg/kg	04/30/12 17:35	D1	10
Dibenzofuran	132-64-9	BRL	472	mg/kg	04/30/12 17:35	D1	10
1,2-Dichlorobenzene	95-50-1	BRL	472	mg/kg	04/30/12 17:35	D1	10
1,3-Dichlorobenzene	541-73-1	BRL	472	mg/kg	04/30/12 17:35	D1	10
1,4-Dichlorobenzene	106-46-7	BRL	472	mg/kg	04/30/12 17:35	D1	10
3,3-Dichlorobenzidine	91-94-1	BRL	472	mg/kg	04/30/12 17:35	D1	10
2,4-Dichlorophenol	120-83-2	BRL	472	mg/kg	04/30/12 17:35	D1	10
Diethylphthalate	84-66-2	BRL	472	mg/kg	04/30/12 17:35	D1	10
Dimethyl Phthalate	131-11-3	BRL	472	mg/kg	04/30/12 17:35	D1	10
2,4-Dimethylphenol	105-67-9	BRL	472	mg/kg	04/30/12 17:35	D1	10
4,6-dinitro-2-methyl phenol	534-52-1	BRL	472	mg/kg	04/30/12 17:35	D1L2	10
2,4-Dinitrophenol	51-28-5	BRL	472	mg/kg	04/30/12 17:35	D1L2	10
2,4-Dinitrotoluene	121-14-2	BRL	472	mg/kg	04/30/12 17:35	D1	10
2,6-Dinitrotoluene	606-20-2	BRL	472	mg/kg	04/30/12 17:35	D1L1	10
Fluoranthene	206-44-0	BRL	472	mg/kg	04/30/12 17:35	D1	10
Fluorene	86-73-7	BRL	472	mg/kg	04/30/12 17:35	D1	10
Hexachlorobenzene	118-74-1	BRL	472	mg/kg	04/30/12 17:35	D1	10

Project: Standard List of Methods

XENCO Laboratories

Certificate of Analytical Results 441475

Southwest Research Institute, San Antonio, TX

17149.26.001

Sample Id: CL12-3339	**Matrix:** Product	**Date Received:** Apr-26-12 09:30
Lab Sample Id: 441475-001	**Date Collected:** Apr-23-12 00:00	

Analytical Method: SVOAs by SW-846 8270C
Prep Method: SW3580A
Tech: LRA
% Moisture:
Analyst: MCH
Date Prep: Apr-30-12 10:18
Seq Number: 886890

Parameter	Cas Number	Result	RL	Units	Analysis Date	Flag	Dil
Hexachlorobutadiene	87-68-3	BRL	472	mg/kg	04/30/12 17:35	D1	10
Hexachlorocyclopentadiene	77-47-4	BRL	472	mg/kg	04/30/12 17:35	D1L2	10
Hexachloroethane	67-72-1	BRL	472	mg/kg	04/30/12 17:35	D1	10
Indeno(1,2,3-c,d)Pyrene	193-39-5	BRL	472	mg/kg	04/30/12 17:35	D1	10
Isophorone	78-59-1	BRL	472	mg/kg	04/30/12 17:35	D1	10
2-Methylnaphthalene	91-57-6	BRL	472	mg/kg	04/30/12 17:35	D1	10
2-methylphenol	95-48-7	BRL	472	mg/kg	04/30/12 17:35	D1	10
3&4-Methylphenol	15831-10-4	BRL	472	mg/kg	04/30/12 17:35	D1	10
Naphthalene	91-20-3	BRL	472	mg/kg	04/30/12 17:35	D1	10
4-Nitroaniline	100-01-6	BRL	472	mg/kg	04/30/12 17:35	D1	10
3-Nitroaniline	99-09-2	BRL	472	mg/kg	04/30/12 17:35	D1	10
2-Nitroaniline	88-74-4	BRL	472	mg/kg	04/30/12 17:35	D1	10
Nitrobenzene	98-95-3	BRL	472	mg/kg	04/30/12 17:35	D1	10
2-Nitrophenol	88-75-5	BRL	472	mg/kg	04/30/12 17:35	D1	10
4-Nitrophenol	100-02-7	BRL	472	mg/kg	04/30/12 17:35	D1L1	10
N-Nitrosodi-n-Propylamine	621-64-7	BRL	472	mg/kg	04/30/12 17:35	D1	10
N-Nitrosodiphenylamine	86-30-6	BRL	472	mg/kg	04/30/12 17:35	D1	10
di-n-Octyl Phthalate	117-84-0	BRL	472	mg/kg	04/30/12 17:35	D1	10
Pentachlorophenol	87-86-5	BRL	472	mg/kg	04/30/12 17:35	D1	10
Phenanthrene	85-01-8	BRL	472	mg/kg	04/30/12 17:35	D1	10
Phenol	108-95-2	BRL	472	mg/kg	04/30/12 17:35	D1	10
Pyrene	129-00-0	BRL	472	mg/kg	04/30/12 17:35	D1	10
Pyridine	110-86-1	BRL	472	mg/kg	04/30/12 17:35	D1L1	10
1,2,4-Trichlorobenzene	120-82-1	BRL	472	mg/kg	04/30/12 17:35	D1	10
2,4,6-Trichlorophenol	88-06-2	BRL	472	mg/kg	04/30/12 17:35	D1	10
2,4,5-Trichlorophenol	95-95-4	BRL	472	mg/kg	04/30/12 17:35	D1	10
Tetradecane (CAS); n-Tetradecane; (TIC) *	TIC	**5890**		mg/kg	04/30/12 17:35	D2T4	10
Nonane, 2,6-dimethyl-; 2,6-Dimethy (TIC) *	TIC	**5430**		mg/kg	04/30/12 17:35	D2T4	10
Undecane (CAS); n-Undecane; Hendec (TIC) *	TIC	**16000**		mg/kg	04/30/12 17:35	D2T4	10
Undecane, 5-methyl- (TIC) *	TIC	**4340**		mg/kg	04/30/12 17:35	D2T4	10
Benzene, 1-methyl-3-(1-methylethyl (TIC) *	TIC	**7070**		mg/kg	04/30/12 17:35	D2T4	10
Undecane, 3-methyl-; 3-Methylundec (TIC) *	TIC	**4030**		mg/kg	04/30/12 17:35	D2T4	10
Decane, 3-methyl-; 3-Methyldecane; (TIC) *	TIC	**3940**		mg/kg	04/30/12 17:35	D2T4	10
Benzene, 1,2,3-trimethyl- (TIC) *	TIC	**4480**		mg/kg	04/30/12 17:35	D2T4	10
Tridecane (CAS); n-Tridecane; Trid (TIC) *	TIC	**10300**		mg/kg	04/30/12 17:35	D2T4	10
Heptadecane, 2,6,10,15-tetramethyl (TIC) *	TIC	**3690**		mg/kg	04/30/12 17:35	D2T4	10

Surrogate	Cas Number	% Recovery	Units	Limits	Analysis Date	Flag
2-Fluorobiphenyl	321-60-8	100	%	30-115	04/30/12 17:35	
2-Fluorophenol	367-12-4	294	%	25-121	04/30/12 17:35	S8

Project: Standard List of Methods

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Certificate of Analytical Results 441475

Southwest Research Institute, San Antonio, TX

17149.26.001

Sample Id: CL12-3339	**Matrix:** Product	**Date Received:** Apr-26-12 09:30
Lab Sample Id: 441475-001	**Date Collected:** Apr-23-12 00:00	

Analytical Method:	SVOAs by SW-846 8270C	**Prep Method:**	SW3580A
Tech:	LRA	**% Moisture:**	
Analyst:	MCH	**Date Prep:**	Apr-30-12 10:18
Seq Number:	886890		

Surrogate	Cas Number	% Recovery			Analysis Date	Flag
Nitrobenzene-d5	4165-60-0	266	%	23-120	04/30/12 17:35	S8
Phenol-d6	13127-88-3	146	%	24-113	04/30/12 17:35	S8
Terphenyl-D14	1718-51-0	94	%	18-137	04/30/12 17:35	
2,4,6-Tribromophenol	118-79-6	82	%	19-122	04/30/12 17:35	

Project: Standard List of Methods

XENCO Laboratories

Certificate of Analytical Results 441475

Southwest Research Institute, San Antonio, TX

17149.26.001

Sample Id: CL12-3339	**Matrix:** Product	**Date Received:** Apr-26-12 09:30
Lab Sample Id: 441475-001	**Date Collected:** Apr-23-12 00:00	

Analytical Method:	VOAs by SW-846 8260	**Prep Method:**	SW5030B
Tech:	CYE	**% Moisture:**	
Analyst:	CYE	**Date Prep:** May-04-12 18:43	**Basis:** Wet Weight
Seq Number:	887395		

Parameter	Cas Number	Result	RL	Units	Analysis Date	Flag	Dil
Benzene	71-43-2	BRL	50.0	mg/kg	05/04/12 22:06	D1	10000
Bromobenzene	108-86-1	BRL	50.0	mg/kg	05/04/12 22:06	D1	10000
Bromochloromethane	74-97-5	BRL	50.0	mg/kg	05/04/12 22:06	D1	10000
Bromodichloromethane	75-27-4	BRL	50.0	mg/kg	05/04/12 22:06	D1	10000
Bromoform	75-25-2	BRL	50.0	mg/kg	05/04/12 22:06	D1	10000
Methyl bromide	74-83-9	BRL	50.0	mg/kg	05/04/12 22:06	D1	10000
MTBE	1634-04-4	BRL	50.0	mg/kg	05/04/12 22:06	D1	10000
tert-Butylbenzene	98-06-6	BRL	50.0	mg/kg	05/04/12 22:06	D1	10000
Sec-Butylbenzene	135-98-8	**715**	50.0	mg/kg	05/04/12 22:06	D2	10000
n-Butylbenzene	104-51-8	**1240**	50.0	mg/kg	05/04/12 22:06	D2	10000
Carbon Tetrachloride	56-23-5	BRL	50.0	mg/kg	05/04/12 22:06	D1	10000
Chlorobenzene	108-90-7	BRL	50.0	mg/kg	05/04/12 22:06	D1	10000
Chloroethane	75-00-3	BRL	100	mg/kg	05/04/12 22:06	D1	10000
Chloroform	67-66-3	BRL	50.0	mg/kg	05/04/12 22:06	D1	10000
Methyl Chloride	74-87-3	BRL	100	mg/kg	05/04/12 22:06	D1	10000
2-Chlorotoluene	95-49-8	BRL	50.0	mg/kg	05/04/12 22:06	D1	10000
4-Chlorotoluene	106-43-4	BRL	50.0	mg/kg	05/04/12 22:06	D1	10000
p-Cymene (p-Isopropyltoluene)	99-87-6	**1050**	50.0	mg/kg	05/04/12 22:06	D2	10000
1,2-Dibromo-3-Chloropropane	96-12-8	BRL	50.0	mg/kg	05/04/12 22:06	D1	10000
Dibromochloromethane	124-48-1	BRL	50.0	mg/kg	05/04/12 22:06	D1	10000
1,2-Dibromoethane	106-93-4	BRL	50.0	mg/kg	05/04/12 22:06	D1	10000
Methylene bromide	74-95-3	BRL	50.0	mg/kg	05/04/12 22:06	D1	10000
1,2-Dichlorobenzene	95-50-1	BRL	50.0	mg/kg	05/04/12 22:06	D1	10000
1,3-Dichlorobenzene	541-73-1	BRL	50.0	mg/kg	05/04/12 22:06	D1	10000
1,4-Dichlorobenzene	106-46-7	BRL	50.0	mg/kg	05/04/12 22:06	D1	10000
Dichlorodifluoromethane	75-71-8	BRL	50.0	mg/kg	05/04/12 22:06	D1	10000
1,2-Dichloroethane	107-06-2	BRL	50.0	mg/kg	05/04/12 22:06	D1	10000
1,1-Dichloroethane	75-34-3	BRL	50.0	mg/kg	05/04/12 22:06	D1	10000
trans-1,2-dichloroethylene	156-60-5	BRL	50.0	mg/kg	05/04/12 22:06	D1	10000
cis-1,2-Dichloroethylene	156-59-2	BRL	50.0	mg/kg	05/04/12 22:06	D1	10000
1,1-Dichloroethene	75-35-4	BRL	50.0	mg/kg	05/04/12 22:06	D1	10000
2,2-Dichloropropane	594-20-7	BRL	50.0	mg/kg	05/04/12 22:06	D1	10000
1,3-Dichloropropane	142-28-9	BRL	50.0	mg/kg	05/04/12 22:06	D1	10000
1,2-Dichloropropane	78-87-5	BRL	50.0	mg/kg	05/04/12 22:06	D1	10000
trans-1,3-dichloropropene	10061-02-6	BRL	50.0	mg/kg	05/04/12 22:06	D1	10000
1,1-Dichloropropene	563-58-6	BRL	50.0	mg/kg	05/04/12 22:06	D1	10000
cis-1,3-Dichloropropene	10061-01-5	BRL	50.0	mg/kg	05/04/12 22:06	D1	10000
Ethylbenzene	100-41-4	**308**	50.0	mg/kg	05/04/12 22:06	D2	10000
Hexachlorobutadiene	87-68-3	BRL	50.0	mg/kg	05/04/12 22:06	D1	10000
Naphthalene	91-20-3	**163**	100	mg/kg	05/04/12 22:06	D2	10000

Project: Standard List of Methods

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Certificate of Analytical Results 441475

Southwest Research Institute, San Antonio, TX

17149.26.001

Sample Id: CL12-3339	**Matrix:** Product	**Date Received:** Apr-26-12 09:30
Lab Sample Id: 441475-001	**Date Collected:** Apr-23-12 00:00	

Analytical Method:	VOAs by SW-846 8260	**Prep Method:**	SW5030B
Tech:	CYE	**% Moisture:**	
Analyst:	CYE	**Date Prep:** May-04-12 18:43	**Basis:** Wet Weight
Seq Number:	887395		

Parameter	Cas Number	Result	RL	Units	Analysis Date	Flag	Dil
Isopropylbenzene	98-82-8	**229**	50.0	mg/kg	05/04/12 22:06	D2	10000
Methylene Chloride	75-09-2	BRL	200	mg/kg	05/04/12 22:06	D1	10000
n-Propylbenzene	103-65-1	**661**	50.0	mg/kg	05/04/12 22:06	D2	10000
Styrene	100-42-5	BRL	50.0	mg/kg	05/04/12 22:06	D1	10000
1,1,1,2-Tetrachloroethane	630-20-6	BRL	50.0	mg/kg	05/04/12 22:06	D1	10000
1,1,2,2-Tetrachloroethane	79-34-5	BRL	50.0	mg/kg	05/04/12 22:06	D1	10000
Tetrachloroethylene	127-18-4	BRL	50.0	mg/kg	05/04/12 22:06	D1	10000
Toluene	108-88-3	**123**	50.0	mg/kg	05/04/12 22:06	D2	10000
1,2,4-Trichlorobenzene	120-82-1	BRL	50.0	mg/kg	05/04/12 22:06	D1	10000
1,2,3-Trichlorobenzene	87-61-6	BRL	50.0	mg/kg	05/04/12 22:06	D1	10000
1,1,2-Trichloroethane	79-00-5	BRL	50.0	mg/kg	05/04/12 22:06	D1	10000
1,1,1-Trichloroethane	71-55-6	BRL	50.0	mg/kg	05/04/12 22:06	D1	10000
Trichloroethylene	79-01-6	BRL	50.0	mg/kg	05/04/12 22:06	D1	10000
Trichlorofluoromethane	75-69-4	BRL	50.0	mg/kg	05/04/12 22:06	D1	10000
1,2,3-Trichloropropane	96-18-4	BRL	50.0	mg/kg	05/04/12 22:06	D1	10000
1,2,4-Trimethylbenzene	95-63-6	**8380**	500	mg/kg	05/04/12 22:27	D2	100000
1,3,5-Trimethylbenzene	108-67-8	**713**	50.0	mg/kg	05/04/12 22:06	D2	10000
Vinyl Chloride	75-01-4	BRL	20.0	mg/kg	05/04/12 22:06	D1	10000
o-Xylene	95-47-6	**648**	50.0	mg/kg	05/04/12 22:06	D2	10000
m,p-Xylenes	179601-23-1	**1070**	100	mg/kg	05/04/12 22:06	D2	10000
Hexadecane (TIC)	TIC	**3210**	10.0	mg/kg	05/04/12 22:06	D2T4	10000
Undecane (TIC)	TIC	**1530**	10.0	mg/kg	05/04/12 22:06	D2T4	10000
Formaldehyde, (1-methylethyl)(2-propenyl)hyd (T	TIC	**3690**	10.0	mg/kg	05/04/12 22:06	D2T4	10000
Octane, 2,3-dimethyl- (TIC)	TIC	**2000**	10.0	mg/kg	05/04/12 22:06	D2T4	10000
Nonane, 3-methyl- (TIC)	TIC	**2280**	10.0	mg/kg	05/04/12 22:06	D2T4	10000
Cyclohexane, 1-ethyl-4-methyl-, cis- (TIC)	TIC	**1020**	10.0	mg/kg	05/04/12 22:06	D2T4	10000
Nonane, 3-methyl- (TIC)	TIC	**1920**	10.0	mg/kg	05/04/12 22:06	D2T4	10000
Octane, 3-methyl- (TIC)	TIC	**1710**	10.0	mg/kg	05/04/12 22:06	D2T4	10000
Cyclohexane, 1-ethyl-4-methyl-, cis- (TIC)	TIC	**1650**	10.0	mg/kg	05/04/12 22:06	D2T4	10000
Heptane, 3-methyl- (TIC)	TIC	**997**	10.0	mg/kg	05/04/12 22:06	D2T4	10000

Surrogate	Cas Number	% Recovery	Units	Limits	Analysis Date	Flag
4-Bromofluorobenzene	460-00-4	111	%	58-152	05/04/12 22:06	
Dibromofluoromethane	1868-53-7	96	%	74-126	05/04/12 22:06	
1,2-Dichloroethane-D4	17060-07-0	97	%	80-120	05/04/12 22:06	
Toluene-D8	2037-26-5	129	%	73-132	05/04/12 22:06	

Project: Standard List of Methods

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Certificate of Analytical Results 441475

Southwest Research Institute, San Antonio, TX

17149.26.001

Sample Id: CL12-3599	**Matrix:** Product	**Date Received:** Apr-26-12 09:30
Lab Sample Id: 441475-002	**Date Collected:** Apr-23-12 00:00	

Analytical Method:	SVOAs by SW-846 8270C	**Prep Method:**	SW3580A
Tech:	LRA	**% Moisture:**	
Analyst:	MCH	**Date Prep:**	Apr-30-12 10:24
Seq Number:	886890		

Parameter	Cas Number	Result	RL	Units	Analysis Date	Flag	Dil
Acenaphthene	83-32-9	BRL	442	mg/kg	04/30/12 17:58	D1	10
Acenaphthylene	208-96-8	BRL	442	mg/kg	04/30/12 17:58	D1	10
Aniline (Phenylamine, Aminobenzene)	62-53-3	BRL	442	mg/kg	04/30/12 17:58	D1	10
Anthracene	120-12-7	BRL	442	mg/kg	04/30/12 17:58	D1	10
Benzo(a)anthracene	56-55-3	BRL	442	mg/kg	04/30/12 17:58	D1	10
Benzo(a)pyrene	50-32-8	BRL	442	mg/kg	04/30/12 17:58	D1	10
Benzo(b)fluoranthene	205-99-2	BRL	442	mg/kg	04/30/12 17:58	D1	10
Benzo(g,h,i)perylene	191-24-2	BRL	442	mg/kg	04/30/12 17:58	D1	10
Benzo(k)fluoranthene	207-08-9	BRL	442	mg/kg	04/30/12 17:58	D1	10
Benzoic Acid	65-85-0	BRL	2650	mg/kg	04/30/12 17:58	D1L1	10
Benzyl Butyl Phthalate	85-68-7	BRL	442	mg/kg	04/30/12 17:58	D1	10
bis(2-chloroethoxy) methane	111-91-1	BRL	442	mg/kg	04/30/12 17:58	D1	10
bis(2-chloroethyl) ether	111-44-4	BRL	442	mg/kg	04/30/12 17:58	D1	10
bis(2-chloroisopropyl) ether	108-60-1	BRL	442	mg/kg	04/30/12 17:58	D1	10
bis(2-ethylhexyl) phthalate	117-81-7	BRL	442	mg/kg	04/30/12 17:58	D1	10
4-Bromophenyl-phenylether	101-55-3	BRL	442	mg/kg	04/30/12 17:58	D1	10
Di-n-butylphthalate	84-74-2	BRL	442	mg/kg	04/30/12 17:58	D1	10
4-chloro-3-methylphenol	59-50-7	BRL	442	mg/kg	04/30/12 17:58	D1	10
4-Chloroaniline	106-47-8	BRL	442	mg/kg	04/30/12 17:58	D1	10
2-Chloronaphthalene	91-58-7	BRL	442	mg/kg	04/30/12 17:58	D1L1	10
2-Chlorophenol	95-57-8	BRL	442	mg/kg	04/30/12 17:58	D1	10
4-Chlorophenyl Phenyl Ether	7005-72-3	BRL	442	mg/kg	04/30/12 17:58	D1	10
Chrysene	218-01-9	BRL	442	mg/kg	04/30/12 17:58	D1	10
Dibenz(a,h)anthracene	53-70-3	BRL	442	mg/kg	04/30/12 17:58	D1	10
Dibenzofuran	132-64-9	BRL	442	mg/kg	04/30/12 17:58	D1	10
1,2-Dichlorobenzene	95-50-1	BRL	442	mg/kg	04/30/12 17:58	D1	10
1,3-Dichlorobenzene	541-73-1	BRL	442	mg/kg	04/30/12 17:58	D1	10
1,4-Dichlorobenzene	106-46-7	BRL	442	mg/kg	04/30/12 17:58	D1	10
3,3-Dichlorobenzidine	91-94-1	BRL	442	mg/kg	04/30/12 17:58	D1	10
2,4-Dichlorophenol	120-83-2	BRL	442	mg/kg	04/30/12 17:58	D1	10
Diethylphthalate	84-66-2	BRL	442	mg/kg	04/30/12 17:58	D1	10
Dimethyl Phthalate	131-11-3	BRL	442	mg/kg	04/30/12 17:58	D1	10
2,4-Dimethylphenol	105-67-9	BRL	442	mg/kg	04/30/12 17:58	D1	10
4,6-dinitro-2-methyl phenol	534-52-1	BRL	442	mg/kg	04/30/12 17:58	D1L2	10
2,4-Dinitrophenol	51-28-5	BRL	442	mg/kg	04/30/12 17:58	D1L2	10
2,4-Dinitrotoluene	121-14-2	BRL	442	mg/kg	04/30/12 17:58	D1	10
2,6-Dinitrotoluene	606-20-2	BRL	442	mg/kg	04/30/12 17:58	D1L1	10
Fluoranthene	206-44-0	BRL	442	mg/kg	04/30/12 17:58	D1	10
Fluorene	86-73-7	BRL	442	mg/kg	04/30/12 17:58	D1	10
Hexachlorobenzene	118-74-1	BRL	442	mg/kg	04/30/12 17:58	D1	10

Project: Standard List of Methods

XENCO Laboratories

Certificate of Analytical Results 441475

Southwest Research Institute, San Antonio, TX

17149.26.001

Sample Id: CL12-3599	**Matrix:** Product	**Date Received:** Apr-26-12 09:30
Lab Sample Id: 441475-002	**Date Collected:** Apr-23-12 00:00	

Analytical Method:	SVOAs by SW-846 8270C	**Prep Method:**	SW3580A
Tech:	LRA	**% Moisture:**	
Analyst:	MCH	**Date Prep:**	Apr-30-12 10:24
Seq Number:	886890		

Parameter	Cas Number	Result	RL	Units	Analysis Date	Flag	Dil
Hexachlorobutadiene	87-68-3	BRL	442	mg/kg	04/30/12 17:58	D1	10
Hexachlorocyclopentadiene	77-47-4	BRL	442	mg/kg	04/30/12 17:58	D1L2	10
Hexachloroethane	67-72-1	BRL	442	mg/kg	04/30/12 17:58	D1	10
Indeno(1,2,3-c,d)Pyrene	193-39-5	BRL	442	mg/kg	04/30/12 17:58	D1	10
Isophorone	78-59-1	BRL	442	mg/kg	04/30/12 17:58	D1	10
2-Methylnaphthalene	91-57-6	**1340**	442	mg/kg	04/30/12 17:58	D2	10
2-methylphenol	95-48-7	BRL	442	mg/kg	04/30/12 17:58	D1	10
3&4-Methylphenol	15831-10-4	BRL	442	mg/kg	04/30/12 17:58	D1	10
Naphthalene	91-20-3	**687**	442	mg/kg	04/30/12 17:58	D2	10
4-Nitroaniline	100-01-6	BRL	442	mg/kg	04/30/12 17:58	D1	10
3-Nitroaniline	99-09-2	BRL	442	mg/kg	04/30/12 17:58	D1	10
2-Nitroaniline	88-74-4	BRL	442	mg/kg	04/30/12 17:58	D1	10
Nitrobenzene	98-95-3	BRL	442	mg/kg	04/30/12 17:58	D1	10
2-Nitrophenol	88-75-5	BRL	442	mg/kg	04/30/12 17:58	D1	10
4-Nitrophenol	100-02-7	BRL	442	mg/kg	04/30/12 17:58	D1L1	10
N-Nitrosodi-n-Propylamine	621-64-7	BRL	442	mg/kg	04/30/12 17:58	D1	10
N-Nitrosodiphenylamine	86-30-6	BRL	442	mg/kg	04/30/12 17:58	D1	10
di-n-Octyl Phthalate	117-84-0	BRL	442	mg/kg	04/30/12 17:58	D1	10
Pentachlorophenol	87-86-5	BRL	442	mg/kg	04/30/12 17:58	D1	10
Phenanthrene	85-01-8	BRL	442	mg/kg	04/30/12 17:58	D1	10
Phenol	108-95-2	BRL	442	mg/kg	04/30/12 17:58	D1	10
Pyrene	129-00-0	BRL	442	mg/kg	04/30/12 17:58	D1	10
Pyridine	110-86-1	BRL	442	mg/kg	04/30/12 17:58	D1L1	10
1,2,4-Trichlorobenzene	120-82-1	BRL	442	mg/kg	04/30/12 17:58	D1	10
2,4,6-Trichlorophenol	88-06-2	BRL	442	mg/kg	04/30/12 17:58	D1	10
2,4,5-Trichlorophenol	95-95-4	BRL	442	mg/kg	04/30/12 17:58	D1	10
Octane, 3,6-dimethyl- (TIC) *	TIC	**9080**		mg/kg	04/30/12 17:58	D2T4	10
Benzene, 2-ethyl-1,4-dimethyl- (CA (TIC) *	TIC	**4350**		mg/kg	04/30/12 17:58	D2T4	10
Benzene, 1,2,3-trimethyl- (TIC) *	TIC	**5330**		mg/kg	04/30/12 17:58	D2T4	10
Tetradecane (TIC) *	TIC	**11200**		mg/kg	04/30/12 17:58	D2T4	10
Benzene, 1-methyl-4-(1-methylethyl (TIC) *	TIC	**39400**		mg/kg	04/30/12 17:58	D2T4	10
Benzene, 1,4-dimethyl- (CAS); p-Xy (TIC) *	TIC	**4220**		mg/kg	04/30/12 17:58	D2T4	10
Nonane (CAS); n-Nonane; Shellsol 1 (TIC) *	TIC	**7470**		mg/kg	04/30/12 17:58	D2T4	10
1-Methyl-4-(1-methylethyl)-cyclohe (TIC) *	TIC	**84100**		mg/kg	04/30/12 17:58	D2T4	10
Decane (TIC) *	TIC	**13000**		mg/kg	04/30/12 17:58	D2T4	10
Undecane (TIC) *	TIC	**16600**		mg/kg	04/30/12 17:58	D2T4	10

Surrogate	Cas Number	% Recovery	Units	Limits	Analysis Date	Flag
2-Fluorobiphenyl	321-60-8	104	%	30-115	04/30/12 17:58	
2-Fluorophenol	367-12-4	156	%	25-121	04/30/12 17:58	S8

Project: Standard List of Methods

XENCO Laboratories

Certificate of Analytical Results 441475

Southwest Research Institute, San Antonio, TX

17149.26.001

Sample Id: CL12-3599	**Matrix:** Product	**Date Received:** Apr-26-12 09:30
Lab Sample Id: 441475-002	**Date Collected:** Apr-23-12 00:00	

Analytical Method:	SVOAs by SW-846 8270C		**Prep Method:** SW3580A
Tech:	LRA		**% Moisture:**
Analyst:	MCH	**Date Prep:** Apr-30-12 10:24	
Seq Number:	886890		

Surrogate	Cas Number	% Recovery			Analysis Date	Flag
Nitrobenzene-d5	4165-60-0	556	%	23-120	04/30/12 17:58	S8
Phenol-d6	13127-88-3	0	%	24-113	04/30/12 17:58	S8
Terphenyl-D14	1718-51-0	96	%	18-137	04/30/12 17:58	
2,4,6-Tribromophenol	118-79-6	84	%	19-122	04/30/12 17:58	

Project: Standard List of Methods

XENCO Laboratories

Certificate of Analytical Results 441475

Southwest Research Institute, San Antonio, TX

17149.26.001

Sample Id: CL12-3599	**Matrix:** Product	**Date Received:** Apr-26-12 09:30
Lab Sample Id: 441475-002	**Date Collected:** Apr-23-12 00:00	

Analytical Method:	VOAs by SW-846 8260	**Prep Method:**	SW5030B
Tech:	CYE	**% Moisture:**	
Analyst:	CYE	**Date Prep:** May-04-12 18:45	**Basis:** Wet Weight
Seq Number:	887395		

Parameter	Cas Number	Result	RL	Units	Analysis Date	Flag	Dil
Benzene	71-43-2	BRL	50.0	mg/kg	05/04/12 22:49	D1	10000
Bromobenzene	108-86-1	BRL	50.0	mg/kg	05/04/12 22:49	D1	10000
Bromochloromethane	74-97-5	BRL	50.0	mg/kg	05/04/12 22:49	D1	10000
Bromodichloromethane	75-27-4	BRL	50.0	mg/kg	05/04/12 22:49	D1	10000
Bromoform	75-25-2	BRL	50.0	mg/kg	05/04/12 22:49	D1	10000
Methyl bromide	74-83-9	BRL	50.0	mg/kg	05/04/12 22:49	D1	10000
MTBE	1634-04-4	BRL	50.0	mg/kg	05/04/12 22:49	D1	10000
tert-Butylbenzene	98-06-6	BRL	50.0	mg/kg	05/04/12 22:49	D1	10000
Sec-Butylbenzene	135-98-8	**443**	50.0	mg/kg	05/04/12 22:49	D2	10000
n-Butylbenzene	104-51-8	**909**	50.0	mg/kg	05/04/12 22:49	D2	10000
Carbon Tetrachloride	56-23-5	BRL	50.0	mg/kg	05/04/12 22:49	D1	10000
Chlorobenzene	108-90-7	BRL	50.0	mg/kg	05/04/12 22:49	D1	10000
Chloroethane	75-00-3	BRL	100	mg/kg	05/04/12 22:49	D1	10000
Chloroform	67-66-3	BRL	50.0	mg/kg	05/04/12 22:49	D1	10000
Methyl Chloride	74-87-3	BRL	100	mg/kg	05/04/12 22:49	D1	10000
2-Chlorotoluene	95-49-8	BRL	50.0	mg/kg	05/04/12 22:49	D1	10000
4-Chlorotoluene	106-43-4	BRL	50.0	mg/kg	05/04/12 22:49	D1	10000
p-Cymene (p-Isopropyltoluene)	99-87-6	**41300**	10000	mg/kg	05/07/12 21:27	D2	2000000
1,2-Dibromo-3-Chloropropane	96-12-8	BRL	50.0	mg/kg	05/04/12 22:49	D1	10000
Dibromochloromethane	124-48-1	BRL	50.0	mg/kg	05/04/12 22:49	D1	10000
1,2-Dibromoethane	106-93-4	BRL	50.0	mg/kg	05/04/12 22:49	D1	10000
Methylene bromide	74-95-3	BRL	50.0	mg/kg	05/04/12 22:49	D1	10000
1,2-Dichlorobenzene	95-50-1	BRL	50.0	mg/kg	05/04/12 22:49	D1	10000
1,3-Dichlorobenzene	541-73-1	BRL	50.0	mg/kg	05/04/12 22:49	D1	10000
1,4-Dichlorobenzene	106-46-7	BRL	50.0	mg/kg	05/04/12 22:49	D1	10000
Dichlorodifluoromethane	75-71-8	BRL	50.0	mg/kg	05/04/12 22:49	D1	10000
1,2-Dichloroethane	107-06-2	BRL	50.0	mg/kg	05/04/12 22:49	D1	10000
1,1-Dichloroethane	75-34-3	BRL	50.0	mg/kg	05/04/12 22:49	D1	10000
trans-1,2-dichloroethylene	156-60-5	BRL	50.0	mg/kg	05/04/12 22:49	D1	10000
cis-1,2-Dichloroethylene	156-59-2	BRL	50.0	mg/kg	05/04/12 22:49	D1	10000
1,1-Dichloroethene	75-35-4	BRL	50.0	mg/kg	05/04/12 22:49	D1	10000
2,2-Dichloropropane	594-20-7	BRL	50.0	mg/kg	05/04/12 22:49	D1	10000
1,3-Dichloropropane	142-28-9	BRL	50.0	mg/kg	05/04/12 22:49	D1	10000
1,2-Dichloropropane	78-87-5	BRL	50.0	mg/kg	05/04/12 22:49	D1	10000
trans-1,3-dichloropropene	10061-02-6	BRL	50.0	mg/kg	05/04/12 22:49	D1	10000
1,1-Dichloropropene	563-58-6	BRL	50.0	mg/kg	05/04/12 22:49	D1	10000
cis-1,3-Dichloropropene	10061-01-5	BRL	50.0	mg/kg	05/04/12 22:49	D1	10000
Ethylbenzene	100-41-4	**637**	50.0	mg/kg	05/04/12 22:49	D2	10000
Hexachlorobutadiene	87-68-3	BRL	50.0	mg/kg	05/04/12 22:49	D1	10000
Naphthalene	91-20-3	**666**	100	mg/kg	05/04/12 22:49	D2	10000

Project: Standard List of Methods

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Certificate of Analytical Results 441475

Southwest Research Institute, San Antonio, TX

17149.26.001

Sample Id: CL12-3599	**Matrix:** Product	**Date Received:** Apr-26-12 09:30
Lab Sample Id: 441475-002	**Date Collected:** Apr-23-12 00:00	

Analytical Method:	VOAs by SW-846 8260	**Prep Method:**	SW5030B
Tech:	CYE	**% Moisture:**	
Analyst:	CYE	**Date Prep:** May-04-12 18:45	**Basis:** Wet Weight
Seq Number:	887395		

Parameter	Cas Number	Result	RL	Units	Analysis Date	Flag	Dil
Isopropylbenzene	98-82-8	**321**	50.0	mg/kg	05/04/12 22:49	D2	10000
Methylene Chloride	75-09-2	BRL	200	mg/kg	05/04/12 22:49	D1	10000
n-Propylbenzene	103-65-1	**782**	50.0	mg/kg	05/04/12 22:49	D2	10000
Styrene	100-42-5	BRL	50.0	mg/kg	05/04/12 22:49	D1	10000
1,1,1,2-Tetrachloroethane	630-20-6	BRL	50.0	mg/kg	05/04/12 22:49	D1	10000
1,1,2,2-Tetrachloroethane	79-34-5	BRL	50.0	mg/kg	05/04/12 22:49	D1	10000
Tetrachloroethylene	127-18-4	BRL	50.0	mg/kg	05/04/12 22:49	D1	10000
Toluene	108-88-3	**606**	50.0	mg/kg	05/04/12 22:49	D2	10000
1,2,4-Trichlorobenzene	120-82-1	BRL	50.0	mg/kg	05/04/12 22:49	D1	10000
1,2,3-Trichlorobenzene	87-61-6	BRL	50.0	mg/kg	05/04/12 22:49	D1	10000
1,1,2-Trichloroethane	79-00-5	BRL	50.0	mg/kg	05/04/12 22:49	D1	10000
1,1,1-Trichloroethane	71-55-6	BRL	50.0	mg/kg	05/04/12 22:49	D1	10000
Trichloroethylene	79-01-6	BRL	50.0	mg/kg	05/04/12 22:49	D1	10000
Trichlorofluoromethane	75-69-4	BRL	50.0	mg/kg	05/04/12 22:49	D1	10000
1,2,3-Trichloropropane	96-18-4	BRL	50.0	mg/kg	05/04/12 22:49	D1	10000
1,2,4-Trimethylbenzene	95-63-6	**5160**	500	mg/kg	05/04/12 23:11	D2	100000
1,3,5-Trimethylbenzene	108-67-8	**1240**	50.0	mg/kg	05/04/12 22:49	D2	10000
Vinyl Chloride	75-01-4	BRL	20.0	mg/kg	05/04/12 22:49	D1	10000
o-Xylene	95-47-6	**1270**	50.0	mg/kg	05/04/12 22:49	D2	10000
m,p-Xylenes	179601-23-1	**2340**	100	mg/kg	05/04/12 22:49	D2	10000
Cyclohexane, methyl- (TIC)	TIC	**500**	10.0	mg/kg	05/04/12 22:49	D2T4	10000
Heptane, 2-methyl- (TIC)	TIC	**362**	10.0	mg/kg	05/04/12 22:49	D2T4	10000
Hexyl octyl ether (TIC)	TIC	**747**	10.0	mg/kg	05/04/12 22:49	D2T4	10000
Octane, 3-methyl- (TIC)	TIC	**500**	10.0	mg/kg	05/04/12 22:49	D2T4	10000
Heptane, 3-methyl- (TIC)	TIC	**422**	10.0	mg/kg	05/04/12 22:49	D2T4	10000
Cyclohexane, 1,1,3-trimethyl- (TIC)	TIC	**301**	10.0	mg/kg	05/04/12 22:49	D2T4	10000
Cyclohexane, propyl- (TIC)	TIC	**1050**	10.0	mg/kg	05/04/12 22:49	D2T4	10000
Octane (TIC)	TIC	**555**	10.0	mg/kg	05/04/12 22:49	D2T4	10000
m-Menthane, (1S,3S)-(+)- (TIC)	TIC	**870**	10.0	mg/kg	05/04/12 22:49	D2T4	10000
Nonane, 3-methyl- (TIC)	TIC	**1580**	10.0	mg/kg	05/04/12 22:49	D2T4	10000

Surrogate	Cas Number	% Recovery	Units	Limits	Analysis Date	Flag
4-Bromofluorobenzene	460-00-4	137	%	58-152	05/04/12 22:49	
Dibromofluoromethane	1868-53-7	97	%	74-126	05/04/12 22:49	
1,2-Dichloroethane-D4	17060-07-0	98	%	80-120	05/04/12 22:49	
Toluene-D8	2037-26-5	119	%	73-132	05/04/12 22:49	

Project: Standard List of Methods

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QC Summary 441475

Southwest Research Institute, San Antonio, TX

17149.26.001

Analytical Method: SVOAs by SW-846 8270C — Prep Method: SW3580A

Seq Number: 886890 — Matrix: Oil — Date Prep: 04/30/2012

MB Sample Id: 621152-1-BLK — LCS Sample Id: 621152-1-BKS — LCSD Sample Id: 621152-1-BSD

Parameter	MB Result	Spike Amount	LCS Result	LCS %Rec	LCSD Result	LCSD %Rec	Limits	%RPD	RPD Limit	Units	Analysis Date	Flag
Acenaphthene	<15.0	50.0	50.1	100	51.1	102	41-134	2	25	mg/kg	04/30/12 16:47	
Acenaphthylene	<15.0	50.0	49.0	98	50.5	101	65-135	3	25	mg/kg	04/30/12 16:47	
Aniline (Phenylamine, Aminobenzene)	<15.0	50.0	29.4	59	29.4	59	2-145	0	25	mg/kg	04/30/12 16:47	
Anthracene	<15.0	50.0	48.9	98	48.7	97	65-135	0	25	mg/kg	04/30/12 16:47	
Benzo(a)anthracene	<15.0	50.0	51.6	103	53.0	106	44-126	3	25	mg/kg	04/30/12 16:47	
Benzo(a)pyrene	<15.0	50.0	48.9	98	48.9	98	65-135	0	25	mg/kg	04/30/12 16:47	
Benzo(b)fluoranthene	<15.0	50.0	46.9	94	48.3	97	65-135	3	25	mg/kg	04/30/12 16:47	
Benzo(g,h,i)perylene	<15.0	50.0	46.8	94	47.9	96	65-135	2	25	mg/kg	04/30/12 16:47	
Benzo(k)fluoranthene	<15.0	50.0	50.5	101	47.6	95	25-125	6	25	mg/kg	04/30/12 16:47	
Benzoic Acid	<150	150	186	124	206	137	50-125	10	25	mg/kg	04/30/12 16:47	L1
bis(2-chloroethoxy) methane	<15.0	50.0	50.4	101	50.6	101	65-135	0	25	mg/kg	04/30/12 16:47	
bis(2-chloroethyl) ether	<15.0	50.0	51.6	103	52.1	104	65-135	1	25	mg/kg	04/30/12 16:47	
bis(2-chloroisopropyl) ether	<15.0	50.0	45.1	90	43.9	88	65-135	3	25	mg/kg	04/30/12 16:47	
bis(2-ethylhexyl) phthalate	<15.0	50.0	56.4	113	55.5	111	65-135	2	25	mg/kg	04/30/12 16:47	
4-Bromophenyl-phenylether	<15.0	50.0	50.7	101	47.3	95	65-135	7	25	mg/kg	04/30/12 16:47	
Di-n-butylphthalate	<15.0	50.0	53.7	107	52.2	104	65-135	3	25	mg/kg	04/30/12 16:47	
4-chloro-3-methylphenol	<15.0	50.0	47.0	94	45.2	90	28-134	4	25	mg/kg	04/30/12 16:47	
4-Chloroaniline	<15.0	50.0	37.7	75	36.1	72	4-149	4	25	mg/kg	04/30/12 16:47	
2-Chloronaphthalene	<15.0	50.0	70.8	142	70.4	141	65-135	1	25	mg/kg	04/30/12 16:47	L1
2-Chlorophenol	<15.0	50.0	50.0	100	51.2	102	25-140	2	25	mg/kg	04/30/12 16:47	
4-Chlorophenyl Phenyl Ether	<15.0	50.0	50.8	102	51.7	103	65-135	2	25	mg/kg	04/30/12 16:47	
Chrysene	<15.0	50.0	52.9	106	52.5	105	65-135	1	25	mg/kg	04/30/12 16:47	
Dibenz(a,h)anthracene	<15.0	50.0	48.8	98	48.9	98	65-135	0	25	mg/kg	04/30/12 16:47	
Dibenzofuran	<15.0	50.0	51.9	104	51.6	103	65-135	1	25	mg/kg	04/30/12 16:47	
1,2-Dichlorobenzene	<15.0	50.0	51.3	103	48.8	98	65-135	5	25	mg/kg	04/30/12 16:47	
1,3-Dichlorobenzene	<15.0	50.0	49.1	98	50.5	101	65-135	3	25	mg/kg	04/30/12 16:47	
1,4-Dichlorobenzene	<15.0	50.0	49.8	100	51.0	102	36-134	2	25	mg/kg	04/30/12 16:47	
3,3-Dichlorobenzidine	<15.0	50.0	46.9	94	47.6	95	20-140	1	25	mg/kg	04/30/12 16:47	
2,4-Dichlorophenol	<15.0	50.0	47.4	95	41.4	83	65-135	14	25	mg/kg	04/30/12 16:47	
Diethylphthalate	<15.0	50.0	52.9	106	51.2	102	37-125	3	25	mg/kg	04/30/12 16:47	
2,4-Dimethylphenol	<15.0	50.0	47.3	95	46.1	92	65-135	3	25	mg/kg	04/30/12 16:47	
4,6-dinitro-2-methyl phenol	<15.0	50.0	<15.0	0	<15.0	0	65-135	NC	25	mg/kg	04/30/12 16:47	L2
2,4-Dinitrophenol	<15.0	50.0	<15.0	0	<15.0	0	65-135	NC	25	mg/kg	04/30/12 16:47	L2
2,4-Dinitrotoluene	<15.0	50.0	46.1	92	43.6	87	40-130	6	25	mg/kg	04/30/12 16:47	
2,6-Dinitrotoluene	<15.0	50.0	46.9	94	46.0	92	28-89	2	25	mg/kg	04/30/12 16:47	L1
Fluoranthene	<15.0	50.0	51.8	104	52.4	105	65-135	1	25	mg/kg	04/30/12 16:47	
Fluorene	<15.0	50.0	49.8	100	51.0	102	65-135	2	25	mg/kg	04/30/12 16:47	
Hexachlorobenzene	<15.0	50.0	52.2	104	51.6	103	65-135	1	25	mg/kg	04/30/12 16:47	
Hexachlorobutadiene	<15.0	50.0	49.3	99	52.4	105	65-135	6	25	mg/kg	04/30/12 16:47	
Hexachlorocyclopentadiene	<15.0	50.0	<15.0	0	<15.0	0	65-135	NC	25	mg/kg	04/30/12 16:47	L2
Hexachloroethane	<15.0	50.0	43.8	88	43.8	88	65-135	0	25	mg/kg	04/30/12 16:47	
Indeno(1,2,3-c,d)Pyrene	<15.0	50.0	44.4	89	45.8	92	65-135	3	25	mg/kg	04/30/12 16:47	
Isophorone	<15.0	50.0	49.7	99	48.7	97	65-135	2	25	mg/kg	04/30/12 16:47	
2-Methylnaphthalene	<15.0	50.0	52.0	104	49.6	99	25-175	5	25	mg/kg	04/30/12 16:47	
2-methylphenol	<15.0	50.0	47.6	95	47.8	96	65-135	0	25	mg/kg	04/30/12 16:47	
3&4-Methylphenol	<15.0	50.0	45.0	90	43.4	87	65-135	4	25	mg/kg	04/30/12 16:47	

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QC Summary 441475

Southwest Research Institute, San Antonio, TX

17149.26.001

Analytical Method: SVOAs by SW-846 8270C — Prep Method: SW3580A

Seq Number: 886890 — Matrix: Oil — Date Prep: 04/30/2012

MB Sample Id: 621152-1-BLK — LCS Sample Id: 621152-1-BKS — LCSD Sample Id: 621152-1-BSD

Parameter	MB Result	Spike Amount	LCS Result	LCS % Rec	LCSD Result	LCSD % Rec	Limits	% RPD	RPD Limit	Units	Analysis Date	Flag
Naphthalene	<15.0	50.0	50.0	100	50.8	102	65-135	2	25	mg/kg	04/30/12 16:47	
4-Nitroaniline	<15.0	50.0	54.4	109	55.5	111	65-135	2	25	mg/kg	04/30/12 16:47	
3-Nitroaniline	<15.0	50.0	46.7	93	47.9	96	65-135	3	25	mg/kg	04/30/12 16:47	
2-Nitroaniline	<15.0	50.0	45.2	90	49.3	99	65-135	9	25	mg/kg	04/30/12 16:47	
Nitrobenzene	<15.0	50.0	49.2	98	47.3	95	65-135	4	25	mg/kg	04/30/12 16:47	
2-Nitrophenol	<15.0	50.0	46.2	92	43.6	87	65-135	6	25	mg/kg	04/30/12 16:47	
4-Nitrophenol	<15.0	50.0	64.5	129	53.8	108	13-106	18	25	mg/kg	04/30/12 16:47	L1
N-Nitrosodi-n-Propylamine	<15.0	50.0	49.6	99	48.2	96	53-130	3	25	mg/kg	04/30/12 16:47	
N-Nitrosodiphenylamine	<15.0	50.0	46.6	93	49.0	98	65-135	5	25	mg/kg	04/30/12 16:47	
di-n-Octyl Phthalate	<15.0	50.0	53.3	107	53.3	107	65-135	0	25	mg/kg	04/30/12 16:47	
Pentachlorophenol	<15.0	50.0	39.9	80	36.3	73	14-111	9	25	mg/kg	04/30/12 16:47	
Phenanthrene	<15.0	50.0	49.2	98	49.8	100	65-135	1	25	mg/kg	04/30/12 16:47	
Phenol	<15.0	50.0	47.0	94	48.6	97	27-127	3	25	mg/kg	04/30/12 16:47	
Pyrene	<15.0	50.0	47.2	94	46.4	93	41-144	2	25	mg/kg	04/30/12 16:47	
Pyridine	<15.0	50.0	50.4	101	48.5	97	39-98	4	25	mg/kg	04/30/12 16:47	L1
1,2,4-Trichlorobenzene	<15.0	50.0	51.6	103	51.2	102	37-133	1	25	mg/kg	04/30/12 16:47	
2,4,6-Trichlorophenol	<15.0	50.0	53.3	107	53.9	108	65-135	1	25	mg/kg	04/30/12 16:47	
2,4,5-Trichlorophenol	<15.0	50.0	53.0	106	51.8	104	65-135	2	25	mg/kg	04/30/12 16:47	

Surrogate	MB % Rec	MB Flag	LCS % Rec	LCS Flag	LCSD % Rec	LCSD Flag	Limits	Units	Analysis Date
2-Fluorobiphenyl	98		100		98		30-115	%	04/30/12 16:47
2-Fluorophenol	119		118		115		25-121	%	04/30/12 16:47
Nitrobenzene-d5	95		97		95		23-120	%	04/30/12 16:47
Phenol-d6	104		114	S1	115	S1	24-113	%	04/30/12 16:47
Terphenyl-D14	99		97		91		18-137	%	04/30/12 16:47
2,4,6-Tribromophenol	116		128	S1	121		19-122	%	04/30/12 16:47

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QC Summary 441475

Southwest Research Institute, San Antonio, TX

17149.26.001

Analytical Method: VOAs by SW-846 8260 | Prep Method: SW5030B

Seq Number: 887395 | Matrix: Solid | Date Prep: 05/04/2012

MB Sample Id: 621552-1-BLK | LCS Sample Id: 621552-1-BKS

Parameter	MB Result	Spike Amount	LCS Result	LCS % Rec	Limits	Units	Analysis Date	Flag
Benzene	<0.000450	0.0500	0.0539	108	66-142	mg/kg	05/04/12 13:28	
Bromobenzene	<0.000259	0.0500	0.0512	102	75-125	mg/kg	05/04/12 13:28	
Bromochloromethane	<0.000645	0.0500	0.0541	108	73-125	mg/kg	05/04/12 13:28	
Bromodichloromethane	<0.000364	0.0500	0.0517	103	75-125	mg/kg	05/04/12 13:28	
Bromoform	<0.000442	0.0500	0.0512	102	75-125	mg/kg	05/04/12 13:28	
Methyl bromide	<0.000811	0.0500	0.0460	92	65-135	mg/kg	05/04/12 13:28	
MTBE	<0.000166	0.0500	0.0558	112	65-135	mg/kg	05/04/12 13:28	
tert-Butylbenzene	<0.000223	0.0500	0.0514	103	75-125	mg/kg	05/04/12 13:28	
Sec-Butylbenzene	<0.0000840	0.0500	0.0517	103	75-125	mg/kg	05/04/12 13:28	
n-Butylbenzene	<0.000297	0.0500	0.0496	99	75-125	mg/kg	05/04/12 13:28	
Carbon Tetrachloride	<0.000161	0.0500	0.0499	100	62-125	mg/kg	05/04/12 13:28	
Chlorobenzene	<0.000290	0.0500	0.0540	108	60-133	mg/kg	05/04/12 13:28	
Chloroethane	<0.000757	0.0500	0.0392	78	65-135	mg/kg	05/04/12 13:28	
Chloroform	<0.000398	0.0500	0.0512	102	74-125	mg/kg	05/04/12 13:28	
Methyl Chloride	<0.000362	0.0500	0.0395	79	65-135	mg/kg	05/04/12 13:28	
2-Chlorotoluene	<0.000247	0.0500	0.0536	107	73-125	mg/kg	05/04/12 13:28	
4-Chlorotoluene	<0.000183	0.0500	0.0497	99	74-125	mg/kg	05/04/12 13:28	
p-Cymene (p-Isopropyltoluene)	<0.000171	0.0500	0.0508	102	75-125	mg/kg	05/04/12 13:28	
1,2-Dibromo-3-Chloropropane	<0.00290	0.0500	0.0451	90	59-125	mg/kg	05/04/12 13:28	
Dibromochloromethane	<0.000532	0.0500	0.0535	107	73-125	mg/kg	05/04/12 13:28	
1,2-Dibromoethane	<0.000480	0.0500	0.0537	107	73-125	mg/kg	05/04/12 13:28	
Methylene bromide	<0.000553	0.0500	0.0570	114	69-127	mg/kg	05/04/12 13:28	
1,2-Dichlorobenzene	<0.000329	0.0500	0.0531	106	75-125	mg/kg	05/04/12 13:28	
1,3-Dichlorobenzene	<0.000270	0.0500	0.0515	103	75-125	mg/kg	05/04/12 13:28	
1,4-Dichlorobenzene	<0.00100	0.0500	0.0515	103	75-125	mg/kg	05/04/12 13:28	
Dichlorodifluoromethane	<0.000248	0.0500	0.0437	87	65-135	mg/kg	05/04/12 13:28	
1,2-Dichloroethane	<0.000523	0.0500	0.0495	99	68-127	mg/kg	05/04/12 13:28	
1,1-Dichloroethane	<0.000281	0.0500	0.0505	101	72-125	mg/kg	05/04/12 13:28	
trans-1,2-dichloroethylene	<0.000227	0.0500	0.0508	102	75-125	mg/kg	05/04/12 13:28	
cis-1,2-Dichloroethylene	<0.000413	0.0500	0.0552	110	75-125	mg/kg	05/04/12 13:28	
1,1-Dichloroethene	<0.000445	0.0500	0.0525	105	59-172	mg/kg	05/04/12 13:28	
2,2-Dichloropropane	<0.000380	0.0500	0.0471	94	75-125	mg/kg	05/04/12 13:28	
1,3-Dichloropropane	<0.000304	0.0500	0.0517	103	75-125	mg/kg	05/04/12 13:28	
1,2-Dichloropropane	<0.000348	0.0500	0.0512	102	74-125	mg/kg	05/04/12 13:28	
trans-1,3-dichloropropene	<0.00108	0.0500	0.0449	90	66-125	mg/kg	05/04/12 13:28	
1,1-Dichloropropene	<0.000366	0.0500	0.0515	103	75-125	mg/kg	05/04/12 13:28	
cis-1,3-Dichloropropene	<0.000315	0.0500	0.0467	93	74-125	mg/kg	05/04/12 13:28	
Ethylbenzene	<0.000200	0.0500	0.0535	107	75-125	mg/kg	05/04/12 13:28	
Hexachlorobutadiene	<0.000270	0.0500	0.0506	101	75-125	mg/kg	05/04/12 13:28	
Isopropylbenzene	<0.000228	0.0500	0.0518	104	75-125	mg/kg	05/04/12 13:28	
Naphthalene	<0.00100	0.0500	0.0490	98	70-130	mg/kg	05/04/12 13:28	
Methylene Chloride	0.00228	0.0500	0.0596	119	75-125	mg/kg	05/04/12 13:28	
n-Propylbenzene	<0.000233	0.0500	0.0521	104	75-125	mg/kg	05/04/12 13:28	
Styrene	<0.000201	0.0500	0.0514	103	75-125	mg/kg	05/04/12 13:28	
1,1,1,2-Tetrachloroethane	<0.000325	0.0500	0.0525	105	72-125	mg/kg	05/04/12 13:28	
1,1,2,2-Tetrachloroethane	<0.000214	0.0500	0.0516	103	74-125	mg/kg	05/04/12 13:28	

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17149.26.001

Analytical Method: VOAs by SW-846 8260 — Prep Method: SW5030B
Seq Number: 887395 — Matrix: Solid — Date Prep: 05/04/2012
MB Sample Id: 621552-1-BLK — LCS Sample Id: 621552-1-BKS

Parameter	MB Result	Spike Amount	LCS Result	LCS % Rec	Limits	Units	Analysis Date	Flag
Tetrachloroethylene	0.00108	0.0500	0.0556	111	71-125	mg/kg	05/04/12 13:28	
Toluene	<0.000321	0.0500	0.0505	101	59-139	mg/kg	05/04/12 13:28	
1,2,4-Trichlorobenzene	<0.000348	0.0500	0.0488	98	75-135	mg/kg	05/04/12 13:28	
1,2,3-Trichlorobenzene	<0.000347	0.0500	0.0492	98	75-137	mg/kg	05/04/12 13:28	
1,1,2-Trichloroethane	<0.000380	0.0500	0.0504	101	75-127	mg/kg	05/04/12 13:28	
1,1,1-Trichloroethane	<0.000276	0.0500	0.0519	104	75-125	mg/kg	05/04/12 13:28	
Trichloroethylene	<0.000440	0.0500	0.0520	104	62-137	mg/kg	05/04/12 13:28	
Trichlorofluoromethane	<0.000248	0.0500	0.0573	115	67-125	mg/kg	05/04/12 13:28	
1,2,3-Trichloropropane	<0.000384	0.0500	0.0472	94	75-125	mg/kg	05/04/12 13:28	
1,2,4-Trimethylbenzene	<0.000142	0.0500	0.0515	103	75-125	mg/kg	05/04/12 13:28	
1,3,5-Trimethylbenzene	<0.000131	0.0500	0.0515	103	70-130	mg/kg	05/04/12 13:28	
Vinyl Chloride	<0.000500	0.0500	0.0434	87	65-135	mg/kg	05/04/12 13:28	
o-Xylene	<0.000206	0.0500	0.0546	109	75-125	mg/kg	05/04/12 13:28	
m,p-Xylenes	<0.000321	0.100	0.105	105	75-125	mg/kg	05/04/12 13:28	

Surrogate	MB % Rec	MB Flag	LCS % Rec	LCS Flag	Limits	Units	Analysis Date
4-Bromofluorobenzene	95		95		58-152	%	05/04/12 13:28
Dibromofluoromethane	104		107		74-126	%	05/04/12 13:28
1,2-Dichloroethane-D4	103		108		80-120	%	05/04/12 13:28
Toluene-D8	103		103		73-132	%	05/04/12 13:28

Analytical Method: VOAs by SW-846 8260 — Prep Method: SW5030B
Seq Number: 887436 — Matrix: Solid — Date Prep: 05/07/2012
MB Sample Id: 621569-1-BLK — LCS Sample Id: 621569-1-BKS

Parameter	MB Result	Spike Amount	LCS Result	LCS % Rec	Limits	Units	Analysis Date	Flag
p-Cymene (p-Isopropyltoluene)	<0.000171	0.0500	0.0550	110	75-125	mg/kg	05/07/12 15:46	

Surrogate	MB % Rec	MB Flag	LCS % Rec	LCS Flag	Limits	Units	Analysis Date
4-Bromofluorobenzene	110		99		58-152	%	05/07/12 15:46
Dibromofluoromethane	93		105		74-126	%	05/07/12 15:46
1,2-Dichloroethane-D4	101		106		80-120	%	05/07/12 15:46
Toluene-D8	109		102		73-132	%	05/07/12 15:46

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QC Summary 441475

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17149.26.001

Analytical Method: VOAs by SW-846 8260 — Prep Method: SW5030B

Seq Number: 887395 — Matrix: Solid — Date Prep: 05/04/2012

Parent Sample Id: 441276-004 — MS Sample Id: 441276-004 S — MSD Sample Id: 441276-004 SD

Parameter	Parent Result	Spike Amount	MS Result	MS %Rec	MSD Result	MSD %Rec	Limits	%RPD	RPD Limit	Units	Analysis Date	Flag
Benzene	<4.50	500	505	101	505	101	66-142	0	25	mg/kg	05/04/12 18:22	
Bromobenzene	<2.59	500	511	102	529	106	75-125	3	25	mg/kg	05/04/12 18:22	
Bromochloromethane	<6.45	500	488	98	483	97	73-125	1	25	mg/kg	05/04/12 18:22	
Bromodichloromethane	<3.64	500	455	91	449	90	75-125	1	25	mg/kg	05/04/12 18:22	
Bromoform	<4.42	500	386	77	368	74	75-125	5	25	mg/kg	05/04/12 18:22	M2
Methyl bromide	<8.11	500	275	55	260	52	65-135	6	25	mg/kg	05/04/12 18:22	M2
MTBE	61.1	500	621	112	576	103	65-135	8	25	mg/kg	05/04/12 18:22	
tert-Butylbenzene	<2.23	500	541	108	557	111	75-125	3	25	mg/kg	05/04/12 18:22	
Sec-Butylbenzene	<0.840	500	534	107	532	106	75-125	0	25	mg/kg	05/04/12 18:22	
n-Butylbenzene	<2.97	500	507	101	513	103	75-125	1	25	mg/kg	05/04/12 18:22	
Carbon Tetrachloride	<1.61	500	412	82	396	79	62-125	4	25	mg/kg	05/04/12 18:22	
Chlorobenzene	<2.90	500	521	104	519	104	60-133	0	25	mg/kg	05/04/12 18:22	
Chloroethane	<7.57	500	329	66	287	57	65-135	14	25	mg/kg	05/04/12 18:22	M2
Chloroform	4.80	500	466	92	473	94	74-125	1	25	mg/kg	05/04/12 18:22	
Methyl Chloride	<3.62	500	316	63	308	62	65-135	3	25	mg/kg	05/04/12 18:22	M2
2-Chlorotoluene	<2.47	500	510	102	518	104	73-125	2	25	mg/kg	05/04/12 18:22	
4-Chlorotoluene	<1.83	500	507	101	518	104	74-125	2	25	mg/kg	05/04/12 18:22	
p-Cymene (p-Isopropyltoluene)	<1.71	500	555	111	544	109	75-125	2	25	mg/kg	05/04/12 18:22	
1,2-Dibromo-3-Chloropropane	<29.0	500	435	87	385	77	59-125	12	25	mg/kg	05/04/12 18:22	
Dibromochloromethane	<5.32	500	417	83	421	84	73-125	1	25	mg/kg	05/04/12 18:22	
1,2-Dibromoethane	<4.80	500	529	106	492	98	73-125	7	25	mg/kg	05/04/12 18:22	
Methylene bromide	<5.53	500	532	106	513	103	69-127	4	25	mg/kg	05/04/12 18:22	
1,2-Dichlorobenzene	<3.29	500	513	103	506	101	75-125	1	25	mg/kg	05/04/12 18:22	
1,3-Dichlorobenzene	<2.70	500	513	103	510	102	75-125	1	25	mg/kg	05/04/12 18:22	
1,4-Dichlorobenzene	<10.0	500	499	100	503	101	75-125	1	25	mg/kg	05/04/12 18:22	
Dichlorodifluoromethane	<2.48	500	312	62	294	59	65-135	6	25	mg/kg	05/04/12 18:22	M2
1,2-Dichloroethane	<5.23	500	467	93	440	88	68-127	6	25	mg/kg	05/04/12 18:22	
1,1-Dichloroethane	<2.81	500	469	94	463	93	72-125	1	25	mg/kg	05/04/12 18:22	
trans-1,2-dichloroethylene	<2.27	500	432	86	428	86	75-125	1	25	mg/kg	05/04/12 18:22	
cis-1,2-Dichloroethylene	<4.13	500	498	100	493	99	75-125	1	25	mg/kg	05/04/12 18:22	
1,1-Dichloroethene	<4.45	500	517	103	500	100	59-172	3	25	mg/kg	05/04/12 18:22	
2,2-Dichloropropane	<3.80	500	448	90	451	90	75-125	1	25	mg/kg	05/04/12 18:22	
1,3-Dichloropropane	<3.04	500	533	107	513	103	75-125	4	25	mg/kg	05/04/12 18:22	
1,2-Dichloropropane	<3.48	500	467	93	463	93	74-125	1	25	mg/kg	05/04/12 18:22	
trans-1,3-dichloropropene	<10.8	500	410	82	414	83	66-125	1	25	mg/kg	05/04/12 18:22	
1,1-Dichloropropene	<3.66	500	498	100	491	98	75-125	1	25	mg/kg	05/04/12 18:22	
cis-1,3-Dichloropropene	<3.15	500	463	93	459	92	74-125	1	25	mg/kg	05/04/12 18:22	
Ethylbenzene	2.20	500	525	105	530	106	75-125	1	25	mg/kg	05/04/12 18:22	
Hexachlorobutadiene	<2.70	500	534	107	529	106	75-125	1	25	mg/kg	05/04/12 18:22	
Isopropylbenzene	7.80	500	531	105	535	105	75-125	1	25	mg/kg	05/04/12 18:22	
Naphthalene	<10.0	500	525	105	485	97	70-130	8	25	mg/kg	05/04/12 18:22	
Methylene Chloride	14500	500	14100	0	13500	0	75-125	4	25	mg/kg	05/04/12 18:22	M3
n-Propylbenzene	<2.33	500	547	109	544	109	75-125	1	25	mg/kg	05/04/12 18:22	
Styrene	<2.01	500	512	102	495	99	75-125	3	25	mg/kg	05/04/12 18:22	
1,1,1,2-Tetrachloroethane	<3.25	500	434	87	430	86	72-125	1	25	mg/kg	05/04/12 18:22	
1,1,2,2-Tetrachloroethane	<2.14	500	487	97	458	92	74-125	6	25	mg/kg	05/04/12 18:22	

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17149.26.001

Analytical Method: VOAs by SW-846 8260 | Prep Method: SW5030B

Seq Number: 887395 | Matrix: Solid | Date Prep: 05/04/2012

Parent Sample Id: 441276-004 | MS Sample Id: 441276-004 S | MSD Sample Id: 441276-004 SD

Parameter	Parent Result	Spike Amount	MS Result	MS %Rec	MSD Result	MSD %Rec	Limits	%RPD	RPD Limit	Units	Analysis Date	Flag
Tetrachloroethylene	17.9	500	543	105	572	111	71-125	5	25	mg/kg	05/04/12 18:22	
Toluene	443	500	901	92	896	91	59-139	1	25	mg/kg	05/04/12 18:22	
1,2,4-Trichlorobenzene	<3.48	500	521	104	508	102	75-135	3	25	mg/kg	05/04/12 18:22	
1,2,3-Trichlorobenzene	<3.47	500	505	101	485	97	75-137	4	25	mg/kg	05/04/12 18:22	
1,1,2-Trichloroethane	<3.80	500	490	98	458	92	75-127	7	25	mg/kg	05/04/12 18:22	
1,1,1-Trichloroethane	<2.76	500	463	93	464	93	75-125	0	25	mg/kg	05/04/12 18:22	
Trichloroethylene	<4.40	500	501	100	489	98	62-137	2	25	mg/kg	05/04/12 18:22	
Trichlorofluoromethane	<2.48	500	569	114	529	106	67-125	7	25	mg/kg	05/04/12 18:22	
1,2,3-Trichloropropane	<3.84	500	449	90	435	87	75-125	3	25	mg/kg	05/04/12 18:22	
1,2,4-Trimethylbenzene	2.10	500	533	106	534	106	75-125	0	25	mg/kg	05/04/12 18:22	
1,3,5-Trimethylbenzene	<1.31	500	532	106	532	106	70-130	0	25	mg/kg	05/04/12 18:22	
Vinyl Chloride	<5.00	500	396	79	376	75	65-135	5	25	mg/kg	05/04/12 18:22	
o-Xylene	3.30	500	522	104	521	104	75-125	0	25	mg/kg	05/04/12 18:22	
m,p-Xylenes	8.20	1000	1030	102	1060	105	75-125	3	25	mg/kg	05/04/12 18:22	

Surrogate	MS %Rec	MS Flag	MSD %Rec	MSD Flag	Limits	Units	Analysis Date
4-Bromofluorobenzene	99		101		58-152	%	05/04/12 18:22
Dibromofluoromethane	100		99		74-126	%	05/04/12 18:22
1,2-Dichloroethane-D4	189	S10	198	S10	80-120	%	05/04/12 18:22
Toluene-D8	101		100		73-132	%	05/04/12 18:22

ANALYSIS REQUEST & CHAIN OF CUSTODY RECORD

XENCO Laboratories

☐ 4143 Greenbriar Drive, Stafford, TX 77477 **281-240-4200** ☐ 9701 Harry Hines Blvd., Dallas, TX 75220 **214-902-0300**

☐ 5332, Blackberry Drive, San Antonio, TX 78238 **210-509-3334** ☐ 12600 West I-20 East, Odessa, TX 79765 **432-563-1800**

Serial #: 314277 Page of

Lab Only: 441475-11

Company-City, Phone	Southwest Research Institute
Project Name-Location	17149.26.001 ☐ Previously done at XENCO **Project ID**
Proj. State: TX, AL, FL, GA, LA, MS, NC, NJ, PA, SC, TN, UT Other	**Proj. Manager (PM)** Scott Hutzler
E-mail Results to	Scott.Hutzler@swri.org ☐PM and **Fax No:**
Invoice to	☐ Accounting ☐ Inc. Invoice with Final Report ☐ Invoice must have a P.O. Bill to:
Quote/Pricing:	**P.O. No:** ☐ Call for P.O.
Reg Program:	UST DRY-CLEAN Land-Fill Waste-Disp NPDES DW **TRRP**
	QAPP Per-Contract CLP AGCEE NAVY DOE DOD USACE OTHER:
Special DLs	(GW DW QAPP MDLs RLs See Lab PM Included Call PM)
Sampler Name	**Signature**

TAT: ASAP 5h 12h 24h 48h 3d 5d 7d 10d 21d Standard TAT is project specific.
It is typically 5-7 Working Days for level II and 10+ Working days for level III and IV data.

	Sample ID	Sampling Date	Time	Depth ft' in" m	Matrix	Composite	Grab	# Containers	Container Size	Container Type	Preservatives	VOA: Full-List BTEX-MTBE EtOH Oxyg VOHs VOAs	VOA: PP TCL DW Appdx-1 Appdx-2 CALL Other:	PAHs SIM 8310 8270	TX-1005 DRO GRO MA EPH MA VPH	SVOCs: Full-List DW BN&AE TCLP PP Appdx-2 CALL	OC Pesticides PCBs Herbicides OP Pesticides	Metals: RCRA-8 RCRA-4 Pb 13PP 23TAL Appdx 1 Appdx2	SPLP - TCLP (Metals VOCs SVOCs Pest. Herb. PCBs)	EDB / DBCP	8260B	8270C	TAT ASAP 5h 12h 24h 48h 3d 5d 7d 10d 21d	Addn: PAH above mg/L W, mg/Kg S Highest Hit	Hold Samples (Surcharges will apply and are pre-approved)	Remarks: Sample Clean-ups are pre-approved as needed	Addn: Date Rcv. by: From:	
1	CL12-3339	4/23/12						1													X	X						1
2	CL12-3599	4/23/12						1													X	X						2
3																												3
4																												4
5																												5
6																												6
7																												7
8																												8
9																												9
10																												10

	Relinquished by (Initials and Sign)	Date & Time	Relinquished to (Initials and Sign)	Date & Time
1	1)		2)	
2	3)		4)	
3	5)		6)	4-26-12 9:30

Total Containers per COC: 2 Cooler Temp: Ambient

Otherwise agreed on writing. Reports are the Intellectual Property of XENCO until paid. Samples will be held 30 days after final report is e-mailed unless hereby requested. Rush Charges and Collection Fees are pre-approved if needed.

Preservatives: Various (**V**), HCl pH<2 (**H**), H2SO4 pH<2 (**S**), HNO3 pH<2 (**N**), Ascb Acid&NaOH (**A**), ZnAc&NaOH (**Z**), (Cool, <4C) (**C**), None (**NA**),See Label (**L**), Other (**O**) _____

Cont. Size: 4oz (**4**), 8oz (**8**), 32oz (**32**), 40ml VOA (**40**), 1L (**1**), 500ml (**5**), Ziplar Bag (**B**), Various (**V**), Other _____ **Cont. Type:** Glass Amb (**A**), Glass Clear (**C**), Plastic (**P**), Various (**V**)

Matrix: Air (**A**), Product (**P**), Solid (**S**), Water (**W**), Liquid (**L**)

Committed to Excellence in Service and Quality *www.xenco.com*

XENCO Laboratories

Prelogin/Nonconformance Report- Sample Log-In

Client: Southwest Research Institute

Date/ Time Received: 04/26/2012 09:30:00 AM

Work Order #: 441475

Acceptable Temperature Range: 0 - 6 degC
Air and Metal samples Acceptable Range: Ambient

Temperature Measuring device used : R-66

Sample Receipt Checklist	Comments
#1 *Temperature of cooler(s)?	20
#2 *Shipping container in good condition?	Yes
#3 *Samples received on ice?	No
#4 *Custody Seals intact on shipping container/ cooler?	N/A
#5 Custody Seals intact on sample bottles/ container?	N/A
#6 *Custody Seals Signed and dated for Containers/coolers	N/A
#7 *Chain of Custody present?	Yes
#8 Sample instructions complete on Chain of Custody?	Yes
#9 Any missing/extra samples?	No
#10 Chain of Custody signed when relinquished/ received?	Yes
#11 Chain of Custody agrees with sample label(s)?	Yes
#12 Container label(s) legible and intact?	Yes
#13 Sample matrix/ properties agree with Chain of Custody?	Yes
#14 Samples in proper container/ bottle?	Yes
#15 Samples properly preserved?	Yes
#16 Sample container(s) intact?	Yes
#17 Sufficient sample amount for indicated test(s)?	Yes
#18 All samples received within hold time?	Yes
#19 Subcontract of sample(s)?	No
#20 VOC samples have zero headspace (less than 1/4 inch bubble)?	N/A
#21 <2 for all samples preserved with HNO3,HCL, H2SO4?	No
#22 >10 for all samples preserved with NaAsO2+NaOH, ZnAc+NaOH?	N/A

*** Must be completed for after-hours delivery of samples prior to placing in the refrigerator**

Analyst: AM	PH Device/Lot#:

Checklist completed by: Angel Morales Date: 04/27/2012

Checklist reviewed by: Date: 04/27/2012

Appendix BK
EPA Testing Report: CL12-3883

Analytical Report 444478

for

Southwest Research Institute

Project Manager: Scott Hutzler

16246.05.001

02-JUL-12

Collected By: Client

Celebrating 20 Years of commitment to excellence in Environmental Testing Services

4143 Greenbriar Dr., Stafford, TX 77477

Xenco-Houston (EPA Lab code: TX00122):
Texas (T104704215-10-6-TX), Arizona (AZ0765), Arkansas (08-039-0), Connecticut (PH-0102), Florida (E871002)
Illinois (002082), Indiana (C-TX-02), Iowa (392), Kansas (E-10380), Kentucky (45), Louisiana (03054)
New Hampshire (297408), New Jersey (TX007), New York (11763), Oklahoma (9218), Pennsylvania (68-03610)
Rhode Island (LAO00312), USDA (S-44102), DoD (L11-54)

Xenco-Atlanta (EPA Lab Code: GA00046):
Florida (E87429), North Carolina (483), South Carolina (98015), Kentucky (85), DoD (L10-135)
Louisiana (04176), USDA (P330-07-00105)

Xenco-Tampa Mobile (EPA Lab code: FL01212): Florida (E84900)
Xenco-Lakeland: Florida (E84098)
Xenco-Odessa (EPA Lab code: TX00158): Texas (T104704400-TX)
Xenco-Dallas (EPA Lab code: TX01468): Texas (T104704295-TX)
Xenco Phoenix (EPA Lab Code: AZ00901): Arizona(AZ0757)
Xenco-Phoenix Mobile (EPA Lab code: AZ00901): Arizona (AZM757)
Xenco Tucson (EPA Lab code:AZ000989): Arizona (AZ0758)

02-JUL-12

Project Manager: **Scott Hutzler**
Southwest Research Institute
6220 Culebra Road
P.O. Box 28510
San Antonio, TX 78228

Reference: XENCO Report No: **444478**
16246.05.001
Project Address:

Scott Hutzler :

We are reporting to you the results of the analyses performed on the samples received under the project name referenced above and identified with the XENCO Report Number 444478. All results being reported under this Report Number apply to the samples analyzed and properly identified with a Laboratory ID number. Subcontracted analyses are identified in this report with either the NELAC certification number of the subcontract lab in the analyst ID field, or the complete subcontracted report attached to this report.

Unless otherwise noted in a Case Narrative, all data reported in this Analytical Report are in compliance with NELAC standards. Estimation of data uncertainty for this report is found in the quality control section of this report unless otherwise noted. Should insufficient sample be provided to the laboratory to meet the method and NELAC Matrix Duplicate and Matrix Spike requirements, then the data will be analyzed, evaluated and reported using all other available quality control measures.

The validity and integrity of this report will remain intact as long as it is accompanied by this letter and reproduced in full, unless written approval is granted by XENCO Laboratories. This report will be filed for at least 5 years in our archives after which time it will be destroyed without further notice, unless otherwise arranged with you. The samples received, and described as recorded in Report No. 444478 will be filed for 60 days, and after that time they will be properly disposed without further notice, unless otherwise arranged with you. We reserve the right to return to you any unused samples, extracts or solutions related to them if we consider so necessary (e.g., samples identified as hazardous waste, sample sizes exceeding analytical standard practices, controlled substances under regulated protocols, etc).

We thank you for selecting XENCO Laboratories to serve your analytical needs. If you have any questions concerning this report, please feel free to contact us at any time.

Respectfully,

Skip Harden
Project Manager

CASE NARRATIVE

Client Name: Southwest Research Institute
Project Name: 16246.05.001

Project ID:
Work Order Number: 444478

Report Date: 02-JUL-12
Date Received: 06/14/2012

Sample receipt non conformances and comments:
None

Sample receipt non conformances and comments per sample:

None

Analytical non nonformances and comments:

Batch: LBA-891280 SVOAs by SW-846 8270C
S10:
The surrogate was above acceptance criteria due to matrix interference.

Arizona Flags

All method blanks, laboratory spikes, and/or matrix spikes met quality control objectives for the parameters associated with this Work Order except as detailed below or on the Data Qualifier page of this report. Data Qualifiers used in this report are in accordance with ADEQ Arizona Data Qualifiers, Revision 3.0 9/20/2007. Data qualifiers (flags) contained within this analytical report have been issued to explain a quality control deficiency, and do not affect the quality (validity) of the data unless noted otherwise in the case narrative.

D1	Sample required dilution due to matrix.
D2	Sample required dilution due to high concentration of target analyte.
L1	The associated blank spike recovery was above laboratory acceptance limits.
L2	The associated blank spike recovery was below laboratory acceptance limits.
M1	Matrix spike recovery was high; the associated blank spike recovery was acceptable.
M2	Matrix spike recovery was low; the associated blank spike recovery was acceptable.
R5	MS/MSD RPD exceeded the laboratory acceptance limit. Recovery met acceptance criteria.
S10	Surrogate recovery was above laboratory and method acceptance limits. See case narrative.
T4	Tentatively identified compound. Concentration is estimated and based on the closest internal standard.

Sample Cross Reference 444478

Southwest Research Institute, San Antonio, TX

16246.05.001

Sample Id	Matrix	Date Collected	Sample Depth	Lab Sample Id
CL12-3883	W	06-13-12 00:00		444478-001

XENCO Laboratories

Certificate of Analytical Results 444478

Southwest Research Institute, San Antonio, TX

16246.05.001

Sample Id: CL12-3883	**Matrix:** Product	**Date Received:** Jun-14-12 10:24
Lab Sample Id: 444478-001	**Date Collected:** Jun-13-12 00:00	

Analytical Method:	SVOAs by SW-846 8270C	**Prep Method:**	SW3580A
Tech:	LEB	**% Moisture:**	
Analyst:	MCH	**Date Prep:**	Jun-26-12 10:24
Seq Number:	891280		

Parameter	Cas Number	Result	RL	Units	Analysis Date	Flag	Dil
Acenaphthene	83-32-9	<240	240	mg/kg	06/29/12 22:07	D1	5
Acenaphthylene	208-96-8	<240	240	mg/kg	06/29/12 22:07	D1	5
Aniline (Phenylamine, Aminobenzene)	62-53-3	<240	240	mg/kg	06/29/12 22:07	D1	5
Anthracene	120-12-7	<240	240	mg/kg	06/29/12 22:07	D1	5
Benzo(a)anthracene	56-55-3	<240	240	mg/kg	06/29/12 22:07	D1	5
Benzo(a)pyrene	50-32-8	<240	240	mg/kg	06/29/12 22:07	D1	5
Benzo(b)fluoranthene	205-99-2	<240	240	mg/kg	06/29/12 22:07	D1	5
Benzo(g,h,i)perylene	191-24-2	<240	240	mg/kg	06/29/12 22:07	D1	5
Benzo(k)fluoranthene	207-08-9	<240	240	mg/kg	06/29/12 22:07	D1	5
Benzoic Acid	65-85-0	<1440	1440	mg/kg	06/29/12 22:07	D1	5
Benzyl Butyl Phthalate	85-68-7	<240	240	mg/kg	06/29/12 22:07	D1	5
bis(2-chloroethoxy) methane	111-91-1	<240	240	mg/kg	06/29/12 22:07	D1	5
bis(2-chloroethyl) ether	111-44-4	<240	240	mg/kg	06/29/12 22:07	D1	5
bis(2-chloroisopropyl) ether	108-60-1	<240	240	mg/kg	06/29/12 22:07	D1	5
bis(2-ethylhexyl) phthalate	117-81-7	<240	240	mg/kg	06/29/12 22:07	D1	5
4-Bromophenyl-phenylether	101-55-3	<240	240	mg/kg	06/29/12 22:07	D1	5
Di-n-butylphthalate	84-74-2	<240	240	mg/kg	06/29/12 22:07	D1	5
4-chloro-3-methylphenol	59-50-7	<240	240	mg/kg	06/29/12 22:07	D1	5
4-Chloroaniline	106-47-8	<240	240	mg/kg	06/29/12 22:07	D1	5
2-Chloronaphthalene	91-58-7	<240	240	mg/kg	06/29/12 22:07	D1	5
2-Chlorophenol	95-57-8	<240	240	mg/kg	06/29/12 22:07	D1	5
4-Chlorophenyl Phenyl Ether	7005-72-3	<240	240	mg/kg	06/29/12 22:07	D1	5
Chrysene	218-01-9	<240	240	mg/kg	06/29/12 22:07	D1	5
Dibenz(a,h)anthracene	53-70-3	<240	240	mg/kg	06/29/12 22:07	D1L2	5
Dibenzofuran	132-64-9	<240	240	mg/kg	06/29/12 22:07	D1	5
1,2-Dichlorobenzene	95-50-1	<240	240	mg/kg	06/29/12 22:07	D1	5
1,3-Dichlorobenzene	541-73-1	<240	240	mg/kg	06/29/12 22:07	D1	5
1,4-Dichlorobenzene	106-46-7	<240	240	mg/kg	06/29/12 22:07	D1	5
3,3-Dichlorobenzidine	91-94-1	<240	240	mg/kg	06/29/12 22:07	D1	5
2,4-Dichlorophenol	120-83-2	<240	240	mg/kg	06/29/12 22:07	D1	5
Diethylphthalate	84-66-2	<240	240	mg/kg	06/29/12 22:07	D1	5
Dimethyl Phthalate	131-11-3	<240	240	mg/kg	06/29/12 22:07	D1	5
2,4-Dimethylphenol	105-67-9	<240	240	mg/kg	06/29/12 22:07	D1	5
4,6-dinitro-2-methyl phenol	534-52-1	<240	240	mg/kg	06/29/12 22:07	D1L2	5
2,4-Dinitrophenol	51-28-5	<240	240	mg/kg	06/29/12 22:07	D1L2	5
2,4-Dinitrotoluene	121-14-2	<240	240	mg/kg	06/29/12 22:07	D1	5
2,6-Dinitrotoluene	606-20-2	<240	240	mg/kg	06/29/12 22:07	D1	5
Fluoranthene	206-44-0	<240	240	mg/kg	06/29/12 22:07	D1	5
Fluorene	86-73-7	<240	240	mg/kg	06/29/12 22:07	D1	5
Hexachlorobenzene	118-74-1	<240	240	mg/kg	06/29/12 22:07	D1	5

XENCO Laboratories

Certificate of Analytical Results 444478

Southwest Research Institute, San Antonio, TX

16246.05.001

Sample Id: CL12-3883	**Matrix:** Product	**Date Received:** Jun-14-12 10:24
Lab Sample Id: 444478-001	**Date Collected:** Jun-13-12 00:00	

Analytical Method:	SVOAs by SW-846 8270C	**Prep Method:**	SW3580A
Tech:	LEB	**% Moisture:**	
Analyst:	MCH	**Date Prep:**	Jun-26-12 10:24
Seq Number:	891280		

Parameter	Cas Number	Result	RL	Units	Analysis Date	Flag	Dil
Hexachlorobutadiene	87-68-3	<240	240	mg/kg	06/29/12 22:07	D1	5
Hexachlorocyclopentadiene	77-47-4	<240	240	mg/kg	06/29/12 22:07	D1L2	5
Hexachloroethane	67-72-1	<240	240	mg/kg	06/29/12 22:07	D1	5
Indeno(1,2,3-c,d)Pyrene	193-39-5	<240	240	mg/kg	06/29/12 22:07	D1	5
Isophorone	78-59-1	<240	240	mg/kg	06/29/12 22:07	D1	5
2-Methylnaphthalene	91-57-6	**349**	240	mg/kg	06/29/12 22:07	D2	5
2-methylphenol	95-48-7	<240	240	mg/kg	06/29/12 22:07	D1	5
3&4-Methylphenol	15831-10-4	<240	240	mg/kg	06/29/12 22:07	D1	5
Naphthalene	91-20-3	**958**	240	mg/kg	06/29/12 22:07	D2	5
4-Nitroaniline	100-01-6	<240	240	mg/kg	06/29/12 22:07	D1	5
3-Nitroaniline	99-09-2	<240	240	mg/kg	06/29/12 22:07	D1	5
2-Nitroaniline	88-74-4	<240	240	mg/kg	06/29/12 22:07	D1	5
Nitrobenzene	98-95-3	<240	240	mg/kg	06/29/12 22:07	D1	5
2-Nitrophenol	88-75-5	<240	240	mg/kg	06/29/12 22:07	D1	5
4-Nitrophenol	100-02-7	<240	240	mg/kg	06/29/12 22:07	D1L2	5
N-Nitrosodi-n-Propylamine	621-64-7	<240	240	mg/kg	06/29/12 22:07	D1	5
N-Nitrosodiphenylamine	86-30-6	<240	240	mg/kg	06/29/12 22:07	D1	5
di-n-Octyl Phthalate	117-84-0	<240	240	mg/kg	06/29/12 22:07	D1	5
Pentachlorophenol	87-86-5	<240	240	mg/kg	06/29/12 22:07	D1	5
Phenanthrene	85-01-8	<240	240	mg/kg	06/29/12 22:07	D1	5
Phenol	108-95-2	<240	240	mg/kg	06/29/12 22:07	D1	5
Pyrene	129-00-0	<240	240	mg/kg	06/29/12 22:07	D1	5
Pyridine	110-86-1	<240	240	mg/kg	06/29/12 22:07	D1L1	5
1,2,4-Trichlorobenzene	120-82-1	<240	240	mg/kg	06/29/12 22:07	D1	5
2,4,6-Trichlorophenol	88-06-2	<240	240	mg/kg	06/29/12 22:07	D1	5
2,4,5-Trichlorophenol	95-95-4	<240	240	mg/kg	06/29/12 22:07	D1	5
Benzene, 1,2-diethyl- (CAS); 1,2-D (TIC) *	TIC	**22800**		mg/kg	06/29/12 22:07	D2T4	5
Nonane, 2-methyl-; 2-Methylnonane (TIC) *	TIC	**14500**		mg/kg	06/29/12 22:07	D2T4	5
Nonane (CAS); n-Nonane; Shellsol 1 (TIC) *	TIC	**13100**		mg/kg	06/29/12 22:07	D2T4	5
Decane; n-Decane; n-C10H22; UN 224 (TIC) *	TIC	**41500**		mg/kg	06/29/12 22:07	D2T4	5
Benzene, 1-ethyl-2-methyl- (CAS); (TIC) *	TIC	**22000**		mg/kg	06/29/12 22:07	D2T4	5
Cyclohexane, 1-methyl-3-propyl-; 1 (TIC) *	TIC	**13800**		mg/kg	06/29/12 22:07	D2T4	5
Benzene, 1,2,4-trimethyl- (CAS); 1 (TIC) *	TIC	**17600**		mg/kg	06/29/12 22:07	D2T4	5
Nonane, 3-methyl- (TIC) *	TIC	**12600**		mg/kg	06/29/12 22:07	D2T4	5
Indane; 1H-Indene, 2,3-dihydro-; I (TIC) *	TIC	**22100**		mg/kg	06/29/12 22:07	D2T4	5
Benzene, 1-methyl-2-propyl- (CAS); (TIC) *	TIC	**15900**		mg/kg	06/29/12 22:07	D2T4	5

Surrogate	Cas Number	% Recovery	Units	Limits	Analysis Date	Flag
2-Fluorobiphenyl	321-60-8	112	%	30-115	06/29/12 22:07	
2-Fluorophenol	367-12-4	29	%	25-121	06/29/12 22:07	

Project: 16246.05.001

XENCO Laboratories

Certificate of Analytical Results 444478

Southwest Research Institute, San Antonio, TX

16246.05.001

Sample Id: CL12-3883	**Matrix:** Product	**Date Received:** Jun-14-12 10:24
Lab Sample Id: 444478-001	**Date Collected:** Jun-13-12 00:00	

Analytical Method:	SVOAs by SW-846 8270C	**Prep Method:**	SW3580A
Tech:	LEB	**% Moisture:**	
Analyst:	MCH	**Date Prep:**	Jun-26-12 10:24
Seq Number:	891280		

Surrogate	Cas Number	% Recovery			Analysis Date	Flag
Nitrobenzene-d5	4165-60-0	526	%	23-120	06/29/12 22:07	S10
Phenol-d6	13127-88-3	29	%	24-113	06/29/12 22:07	
Terphenyl-D14	1718-51-0	82	%	18-137	06/29/12 22:07	
2,4,6-Tribromophenol	118-79-6	80	%	19-122	06/29/12 22:07	

XENCO Laboratories

Certificate of Analytical Results 444478

Southwest Research Institute, San Antonio, TX

16246.05.001

Sample Id: CL12-3883	**Matrix:** Product	**Date Received:** Jun-14-12 10:24
Lab Sample Id: 444478-001	**Date Collected:** Jun-13-12 00:00	

Analytical Method:	VOAs by SW-846 8260	**Prep Method:**	SW5030B
Tech:	ROL	**% Moisture:**	
Analyst:	ROL	**Date Prep:** Jun-28-12 10:54	**Basis:** Wet Weight
Seq Number:	891213		

Parameter	Cas Number	Result	RL	Units	Analysis Date	Flag	Dil
Benzene	71-43-2	<49.6	49.6	mg/kg	06/28/12 20:14	D1	10000
Bromobenzene	108-86-1	<49.6	49.6	mg/kg	06/28/12 20:14	D1	10000
Bromochloromethane	74-97-5	<49.6	49.6	mg/kg	06/28/12 20:14	D1	10000
Bromodichloromethane	75-27-4	<49.6	49.6	mg/kg	06/28/12 20:14	D1	10000
Bromoform	75-25-2	<49.6	49.6	mg/kg	06/28/12 20:14	D1	10000
Bromomethane	74-83-9	<49.6	49.6	mg/kg	06/28/12 20:14	D1	10000
MTBE	1634-04-4	<49.6	49.6	mg/kg	06/28/12 20:14	D1	10000
tert-Butylbenzene	98-06-6	<49.6	49.6	mg/kg	06/28/12 20:14	D1	10000
Sec-Butylbenzene	135-98-8	**243**	49.6	mg/kg	06/28/12 20:14	D2	10000
n-Butylbenzene	104-51-8	**652**	49.6	mg/kg	06/28/12 20:14	D2	10000
Carbon Tetrachloride	56-23-5	<49.6	49.6	mg/kg	06/28/12 20:14	D1	10000
Chlorobenzene	108-90-7	<49.6	49.6	mg/kg	06/28/12 20:14	D1	10000
Chloroethane	75-00-3	<99.2	99.2	mg/kg	06/28/12 20:14	D1	10000
Chloroform	67-66-3	<49.6	49.6	mg/kg	06/28/12 20:14	D1	10000
Chloromethane	74-87-3	<99.2	99.2	mg/kg	06/28/12 20:14	D1	10000
2-Chlorotoluene	95-49-8	<49.6	49.6	mg/kg	06/28/12 20:14	D1	10000
4-Chlorotoluene	106-43-4	<49.6	49.6	mg/kg	06/28/12 20:14	D1	10000
p-Cymene (p-Isopropyltoluene)	99-87-6	**376**	49.6	mg/kg	06/28/12 20:14	D2	10000
1,2-Dibromo-3-Chloropropane	96-12-8	<49.6	49.6	mg/kg	06/28/12 20:14	D1	10000
Dibromochloromethane	124-48-1	<49.6	49.6	mg/kg	06/28/12 20:14	D1	10000
1,2-Dibromoethane	106-93-4	<49.6	49.6	mg/kg	06/28/12 20:14	D1	10000
Dibromomethane	74-95-3	<49.6	49.6	mg/kg	06/28/12 20:14	D1	10000
1,2-Dichlorobenzene	95-50-1	<49.6	49.6	mg/kg	06/28/12 20:14	D1	10000
1,3-Dichlorobenzene	541-73-1	<49.6	49.6	mg/kg	06/28/12 20:14	D1	10000
1,4-Dichlorobenzene	106-46-7	<49.6	49.6	mg/kg	06/28/12 20:14	D1	10000
Dichlorodifluoromethane	75-71-8	<49.6	49.6	mg/kg	06/28/12 20:14	D1	10000
1,2-Dichloroethane	107-06-2	<49.6	49.6	mg/kg	06/28/12 20:14	D1	10000
1,1-Dichloroethane	75-34-3	<49.6	49.6	mg/kg	06/28/12 20:14	D1	10000
trans-1,2-dichloroethene	156-60-5	<49.6	49.6	mg/kg	06/28/12 20:14	D1	10000
cis-1,2-Dichloroethene	156-59-2	<49.6	49.6	mg/kg	06/28/12 20:14	D1	10000
1,1-Dichloroethene	75-35-4	<49.6	49.6	mg/kg	06/28/12 20:14	D1	10000
2,2-Dichloropropane	594-20-7	<49.6	49.6	mg/kg	06/28/12 20:14	D1	10000
1,3-Dichloropropane	142-28-9	<49.6	49.6	mg/kg	06/28/12 20:14	D1	10000
1,2-Dichloropropane	78-87-5	<49.6	49.6	mg/kg	06/28/12 20:14	D1	10000
trans-1,3-dichloropropene	10061-02-6	<49.6	49.6	mg/kg	06/28/12 20:14	D1	10000
1,1-Dichloropropene	563-58-6	<49.6	49.6	mg/kg	06/28/12 20:14	D1	10000
cis-1,3-Dichloropropene	10061-01-5	<49.6	49.6	mg/kg	06/28/12 20:14	D1	10000
Ethylbenzene	100-41-4	**75.5**	49.6	mg/kg	06/28/12 20:14	D2	10000
Hexachlorobutadiene	87-68-3	<49.6	49.6	mg/kg	06/28/12 20:14	D1	10000
isopropylbenzene	98-82-8	**113**	49.6	mg/kg	06/28/12 20:14	D2	10000

Project: 16246.05.001

XENCO Laboratories

Certificate of Analytical Results 444478

Southwest Research Institute, San Antonio, TX

16246.05.001

Sample Id: CL12-3883	**Matrix:** Product	**Date Received:** Jun-14-12 10:24
Lab Sample Id: 444478-001	**Date Collected:** Jun-13-12 00:00	

Analytical Method:	VOAs by SW-846 8260		**Prep Method:** SW5030B
Tech:	ROL		**% Moisture:**
Analyst:	ROL	**Date Prep:** Jun-28-12 10:54	**Basis:** Wet Weight
Seq Number:	891213		

Parameter	Cas Number	Result	RL	Units	Analysis Date	Flag	Dil
Naphthalene	91-20-3	**243**	99.2	mg/kg	06/28/12 20:14	D2	10000
Methylene Chloride	75-09-2	<198	198	mg/kg	06/28/12 20:14	D1	10000
n-Propylbenzene	103-65-1	**764**	49.6	mg/kg	06/28/12 20:14	D1	10000
Styrene	100-42-5	<49.6	49.6	mg/kg	06/28/12 20:14	D1	10000
1,1,1,2-Tetrachloroethane	630-20-6	<49.6	49.6	mg/kg	06/28/12 20:14	D1	10000
1,1,2,2-Tetrachloroethane	79-34-5	<49.6	49.6	mg/kg	06/28/12 20:14	D1	10000
Tetrachloroethylene	127-18-4	<49.6	49.6	mg/kg	06/28/12 20:14	D1	10000
Toluene	108-88-3	<49.6	49.6	mg/kg	06/28/12 20:14	D1	10000
1,2,4-Trichlorobenzene	120-82-1	<49.6	49.6	mg/kg	06/28/12 20:14	D1	10000
1,2,3-Trichlorobenzene	87-61-6	<49.6	49.6	mg/kg	06/28/12 20:14	D1	10000
1,1,2-Trichloroethane	79-00-5	<49.6	49.6	mg/kg	06/28/12 20:14	D1	10000
1,1,1-Trichloroethane	71-55-6	<49.6	49.6	mg/kg	06/28/12 20:14	D1	10000
Trichloroethene	79-01-6	<49.6	49.6	mg/kg	06/28/12 20:14	D1	10000
Trichlorofluoromethane	75-69-4	<49.6	49.6	mg/kg	06/28/12 20:14	D1	10000
1,2,3-Trichloropropane	96-18-4	<49.6	49.6	mg/kg	06/28/12 20:14	D1	10000
1,2,4-Trimethylbenzene	95-63-6	**2410**	496	mg/kg	06/29/12 17:13	D2	100000
1,3,5-Trimethylbenzene	108-67-8	**511**	49.6	mg/kg	06/28/12 20:14	D2	10000
Vinyl Chloride	75-01-4	<19.8	19.8	mg/kg	06/28/12 20:14	D1	10000
o-Xylene	95-47-6	**255**	49.6	mg/kg	06/28/12 20:14	D2	10000
m,p-Xylenes	179601-23-1	**289**	99.2	mg/kg	06/28/12 20:14	D2	10000
Total Xylenes	1330-20-7	**544**	49.6	mg/kg	06/28/12 20:14	D2	10000
Napthalene derivated (TIC)	TIC	**1110**	9.92	mg/kg	06/28/12 20:14	D2T4	10000
Benzene derivated (TIC)	TIC	**864**	9.92	mg/kg	06/28/12 20:14	D2T4	10000
Cyclohexane-propyl (TIC)	TIC	**2260**	9.92	mg/kg	06/28/12 20:14	D2T4	10000
Undecane (TIC)	TIC	**1850**	9.92	mg/kg	06/28/12 20:14	D2T4	10000
Dodecane (TIC)	TIC	**1210**	9.92	mg/kg	06/28/12 20:14	D2T4	10000
Benzene derivated (TIC)	TIC	**942**	9.92	mg/kg	06/28/12 20:14	D2T4	10000
Benzene derivated (TIC)	TIC	**833**	9.92	mg/kg	06/28/12 20:14	D2T4	10000
Benzene derivated (TIC)	TIC	**2280**	9.92	mg/kg	06/28/12 20:14	D2T4	10000
Octane, 2,6-dimethyl (TIC)	TIC	**865**	9.92	mg/kg	06/28/12 20:14	D2T4	10000

Surrogate	Cas Number	% Recovery	Units	Limits	Analysis Date	Flag
4-Bromofluorobenzene	460-00-4	104	%	68-152	06/28/12 20:14	
Dibromofluoromethane	1868-53-7	94	%	53-142	06/28/12 20:14	
1,2-Dichloroethane-D4	17060-07-0	95	%	56-150	06/28/12 20:14	
Toluene-D8	2037-26-5	103	%	70-130	06/28/12 20:14	

Project: 16246.05.001

Southwest Research Institute, San Antonio, TX

16246.05.001

Analytical Method: SVOAs by SW-846 8270C — Prep Method: SW3580A

Seq Number: 891280 — Matrix: Oil — Date Prep: 06/26/2012

MB Sample Id: 623705-1-BLK — LCS Sample Id: 623705-1-BKS — LCSD Sample Id: 623705-1-BSD

Parameter	MB Result	Spike Amount	LCS Result	LCS %Rec	LCSD Result	LCSD %Rec	Limits	%RPD	RPD Limit	Units	Analysis Date	Flag
Acenaphthene	<15.0	50.0	46.0	92	44.3	89	41-134	4	25	mg/kg	06/29/12 21:18	
Acenaphthylene	<15.0	50.0	43.5	87	42.4	85	65-135	3	25	mg/kg	06/29/12 21:18	
Aniline (Phenylamine, Aminobenzene)	<15.0	50.0	40.2	80	39.6	79	2-145	2	25	mg/kg	06/29/12 21:18	
Anthracene	<15.0	50.0	45.4	91	42.4	85	65-135	7	25	mg/kg	06/29/12 21:18	
Benzo(a)anthracene	<15.0	50.0	46.5	93	45.1	90	44-126	3	25	mg/kg	06/29/12 21:18	
Benzo(a)pyrene	<15.0	50.0	40.7	81	39.0	78	65-135	4	25	mg/kg	06/29/12 21:18	
Benzo(b)fluoranthene	<15.0	50.0	45.0	90	44.3	89	65-135	2	25	mg/kg	06/29/12 21:18	
Benzo(g,h,i)perylene	<15.0	50.0	37.4	75	35.7	71	65-135	5	25	mg/kg	06/29/12 21:18	
Benzo(k)fluoranthene	<15.0	50.0	43.6	87	40.5	81	25-125	7	25	mg/kg	06/29/12 21:18	
Benzoic Acid	<150	150	151	101	156	104	50-125	3	25	mg/kg	06/29/12 21:18	
bis(2-chloroethoxy) methane	<15.0	50.0	43.9	88	43.8	88	65-135	0	25	mg/kg	06/29/12 21:18	
bis(2-chloroethyl) ether	<15.0	50.0	43.9	88	45.4	91	65-135	3	25	mg/kg	06/29/12 21:18	
bis(2-chloroisopropyl) ether	<15.0	50.0	50.7	101	47.4	95	65-135	7	25	mg/kg	06/29/12 21:18	
bis(2-ethylhexyl) phthalate	<15.0	50.0	41.8	84	41.1	82	65-135	2	25	mg/kg	06/29/12 21:18	
4-Bromophenyl-phenylether	<15.0	50.0	41.4	83	40.6	81	65-135	2	25	mg/kg	06/29/12 21:18	
Di-n-butylphthalate	<15.0	50.0	43.2	86	41.2	82	65-135	5	25	mg/kg	06/29/12 21:18	
4-chloro-3-methylphenol	<15.0	50.0	43.5	87	45.2	90	28-134	4	25	mg/kg	06/29/12 21:18	
4-Chloroaniline	<15.0	50.0	40.7	81	42.7	85	4-149	5	25	mg/kg	06/29/12 21:18	
2-Chloronaphthalene	<15.0	50.0	48.4	97	47.4	95	65-135	2	25	mg/kg	06/29/12 21:18	
2-Chlorophenol	<15.0	50.0	44.9	90	43.2	86	25-140	4	25	mg/kg	06/29/12 21:18	
4-Chlorophenyl Phenyl Ether	<15.0	50.0	44.7	89	42.8	86	65-135	4	25	mg/kg	06/29/12 21:18	
Chrysene	<15.0	50.0	43.9	88	41.5	83	65-135	6	25	mg/kg	06/29/12 21:18	
Dibenz(a,h)anthracene	<15.0	50.0	33.0	66	32.1	64	65-135	3	25	mg/kg	06/29/12 21:18	L2
Dibenzofuran	<15.0	50.0	45.8	92	44.2	88	65-135	4	25	mg/kg	06/29/12 21:18	
1,2-Dichlorobenzene	<15.0	50.0	47.8	96	46.0	92	65-135	4	25	mg/kg	06/29/12 21:18	
1,3-Dichlorobenzene	<15.0	50.0	46.4	93	45.5	91	65-135	2	25	mg/kg	06/29/12 21:18	
1,4-Dichlorobenzene	<15.0	50.0	48.4	97	46.4	93	36-134	4	25	mg/kg	06/29/12 21:18	
3,3-Dichlorobenzidine	<15.0	50.0	36.6	73	35.6	71	20-140	3	25	mg/kg	06/29/12 21:18	
2,4-Dichlorophenol	<15.0	50.0	44.1	88	41.9	84	65-135	5	25	mg/kg	06/29/12 21:18	
Diethylphthalate	<15.0	50.0	43.6	87	42.6	85	37-125	2	25	mg/kg	06/29/12 21:18	
2,4-Dimethylphenol	<15.0	50.0	47.7	95	42.6	85	65-135	11	25	mg/kg	06/29/12 21:18	
4,6-dinitro-2-methyl phenol	<15.0	50.0	<15.0	0	<15.0	0	65-135	NC	25	mg/kg	06/29/12 21:18	L2
2,4-Dinitrophenol	<15.0	50.0	<15.0	0	<15.0	0	65-135	NC	25	mg/kg	06/29/12 21:18	L2
2,4-Dinitrotoluene	<15.0	50.0	45.0	90	42.6	85	40-130	5	25	mg/kg	06/29/12 21:18	
2,6-Dinitrotoluene	<15.0	50.0	42.0	84	41.6	83	28-89	1	25	mg/kg	06/29/12 21:18	
Fluoranthene	<15.0	50.0	46.1	92	42.0	84	65-135	9	25	mg/kg	06/29/12 21:18	
Fluorene	<15.0	50.0	43.9	88	42.7	85	65-135	3	25	mg/kg	06/29/12 21:18	
Hexachlorobenzene	<15.0	50.0	42.6	85	41.6	83	65-135	2	25	mg/kg	06/29/12 21:18	
Hexachlorobutadiene	<15.0	50.0	45.2	90	43.8	88	65-135	3	25	mg/kg	06/29/12 21:18	
Hexachlorocyclopentadiene	<15.0	50.0	<15.0	0	<15.0	0	65-135	NC	25	mg/kg	06/29/12 21:18	L2
Hexachloroethane	<15.0	50.0	45.6	91	45.2	90	65-135	1	25	mg/kg	06/29/12 21:18	
Indeno(1,2,3-c,d)Pyrene	<15.0	50.0	40.4	81	38.1	76	65-135	6	25	mg/kg	06/29/12 21:18	
Isophorone	<15.0	50.0	46.3	93	43.9	88	65-135	5	25	mg/kg	06/29/12 21:18	
2-Methylnaphthalene	<15.0	50.0	43.9	88	42.3	85	25-175	4	25	mg/kg	06/29/12 21:18	
2-methylphenol	<15.0	50.0	42.3	85	40.2	80	65-135	5	25	mg/kg	06/29/12 21:18	
3&4-Methylphenol	<15.0	50.0	46.7	93	47.6	95	65-135	2	25	mg/kg	06/29/12 21:18	

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QC Summary 444478

Southwest Research Institute, San Antonio, TX

16246.05.001

Analytical Method: SVOAs by SW-846 8270C — Prep Method: SW3580A

Seq Number: 891280 — Matrix: Oil — Date Prep: 06/26/2012

MB Sample Id: 623705-1-BLK — LCS Sample Id: 623705-1-BKS — LCSD Sample Id: 623705-1-BSD

Parameter	MB Result	Spike Amount	LCS Result	LCS %Rec	LCSD Result	LCSD %Rec	Limits	%RPD	RPD Limit	Units	Analysis Date	Flag
Naphthalene	<15.0	50.0	47.6	95	44.8	90	65-135	6	25	mg/kg	06/29/12 21:18	
4-Nitroaniline	<15.0	50.0	44.5	89	40.9	82	65-135	8	25	mg/kg	06/29/12 21:18	
3-Nitroaniline	<15.0	50.0	42.2	84	37.2	74	65-135	13	25	mg/kg	06/29/12 21:18	
2-Nitroaniline	<15.0	50.0	41.5	83	41.4	83	65-135	0	25	mg/kg	06/29/12 21:18	
Nitrobenzene	<15.0	50.0	47.9	96	43.7	87	65-135	9	25	mg/kg	06/29/12 21:18	
2-Nitrophenol	<15.0	50.0	38.0	76	35.4	71	65-135	7	25	mg/kg	06/29/12 21:18	
4-Nitrophenol	<15.0	50.0	<15.0	0	<15.0	0	13-106	NC	25	mg/kg	06/29/12 21:18	L2
N-Nitrosodi-n-Propylamine	<15.0	50.0	47.4	95	46.4	93	53-130	2	25	mg/kg	06/29/12 21:18	
N-Nitrosodiphenylamine	<15.0	50.0	45.0	90	42.7	85	65-135	5	25	mg/kg	06/29/12 21:18	
di-n-Octyl Phthalate	<15.0	50.0	39.8	80	39.2	78	65-135	2	25	mg/kg	06/29/12 21:18	
Pentachlorophenol	<15.0	50.0	34.3	69	35.0	70	14-111	2	25	mg/kg	06/29/12 21:18	
Phenanthrene	<15.0	50.0	45.1	90	43.4	87	65-135	4	25	mg/kg	06/29/12 21:18	
Phenol	<15.0	50.0	44.3	89	46.1	92	27-127	4	25	mg/kg	06/29/12 21:18	
Pyrene	<15.0	50.0	44.7	89	42.6	85	41-144	5	25	mg/kg	06/29/12 21:18	
Pyridine	<15.0	50.0	50.1	100	49.5	99	39-98	1	25	mg/kg	06/29/12 21:18	L1
1,2,4-Trichlorobenzene	<15.0	50.0	45.2	90	43.5	87	37-133	4	25	mg/kg	06/29/12 21:18	
2,4,6-Trichlorophenol	<15.0	50.0	41.9	84	38.5	77	65-135	8	25	mg/kg	06/29/12 21:18	
2,4,5-Trichlorophenol	<15.0	50.0	45.2	90	42.4	85	65-135	6	25	mg/kg	06/29/12 21:18	

Surrogate	MB %Rec	MB Flag	LCS %Rec	LCS Flag	LCSD %Rec	LCSD Flag	Limits	Units	Analysis Date
2-Fluorobiphenyl	103		98		90		30-115	%	06/29/12 21:18
2-Fluorophenol	124	S10	107		106		25-121	%	06/29/12 21:18
Nitrobenzene-d5	103		99		91		23-120	%	06/29/12 21:18
Phenol-d6	89		111		107		24-113	%	06/29/12 21:18
Terphenyl-D14	96		88		84		18-137	%	06/29/12 21:18
2,4,6-Tribromophenol	95		103		97		19-122	%	06/29/12 21:18

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QC Summary 444478

Southwest Research Institute, San Antonio, TX

16246.05.001

Analytical Method: VOAs by SW-846 8260 | Prep Method: SW5030B

Seq Number: 891213 | Matrix: Solid | Date Prep: 06/28/2012

MB Sample Id: 623909-1-BLK | LCS Sample Id: 623909-1-BKS

Parameter	MB Result	Spike Amount	LCS Result	LCS %Rec	Limits	Units	Analysis Date	Flag
Benzene	<0.000450	0.0500	0.0449	90	66-142	mg/kg	06/28/12 10:50	
Bromobenzene	<0.000259	0.0500	0.0580	116	75-125	mg/kg	06/28/12 10:50	
Bromochloromethane	<0.000645	0.0500	0.0464	93	73-125	mg/kg	06/28/12 10:50	
Bromodichloromethane	<0.000364	0.0500	0.0476	95	75-125	mg/kg	06/28/12 10:50	
Bromoform	<0.000442	0.0500	0.0501	100	75-125	mg/kg	06/28/12 10:50	
Bromomethane	<0.000811	0.0500	0.0411	82	65-135	mg/kg	06/28/12 10:50	
MTBE	<0.000166	0.100	0.0862	86	65-135	mg/kg	06/28/12 10:50	
tert-Butylbenzene	<0.000223	0.0500	0.0596	119	75-125	mg/kg	06/28/12 10:50	
Sec-Butylbenzene	<0.0000840	0.0500	0.0575	115	75-125	mg/kg	06/28/12 10:50	
n-Butylbenzene	<0.000297	0.0500	0.0544	109	75-125	mg/kg	06/28/12 10:50	
Carbon Tetrachloride	<0.000161	0.0500	0.0454	91	62-125	mg/kg	06/28/12 10:50	
Chlorobenzene	<0.000290	0.0500	0.0544	109	60-133	mg/kg	06/28/12 10:50	
Chloroethane	<0.000757	0.0500	0.0518	104	65-135	mg/kg	06/28/12 10:50	
Chloroform	<0.000398	0.0500	0.0488	98	74-125	mg/kg	06/28/12 10:50	
Chloromethane	<0.000362	0.0500	0.0450	90	65-135	mg/kg	06/28/12 10:50	
2-Chlorotoluene	<0.000247	0.0500	0.0587	117	73-125	mg/kg	06/28/12 10:50	
4-Chlorotoluene	<0.000183	0.0500	0.0575	115	74-125	mg/kg	06/28/12 10:50	
p-Cymene (p-Isopropyltoluene)	<0.000171	0.0500	0.0575	115	75-125	mg/kg	06/28/12 10:50	
1,2-Dibromo-3-Chloropropane	<0.00290	0.0500	0.0507	101	59-125	mg/kg	06/28/12 10:50	
Dibromochloromethane	<0.000532	0.0500	0.0547	109	73-125	mg/kg	06/28/12 10:50	
1,2-Dibromoethane	<0.000480	0.0500	0.0554	111	73-125	mg/kg	06/28/12 10:50	
Dibromomethane	<0.000553	0.0500	0.0470	94	69-127	mg/kg	06/28/12 10:50	
1,2-Dichlorobenzene	<0.000329	0.0500	0.0525	105	75-125	mg/kg	06/28/12 10:50	
1,3-Dichlorobenzene	<0.000270	0.0500	0.0553	111	75-125	mg/kg	06/28/12 10:50	
1,4-Dichlorobenzene	<0.00100	0.0500	0.0533	107	75-125	mg/kg	06/28/12 10:50	
Dichlorodifluoromethane	<0.000248	0.0500	0.0372	74	65-135	mg/kg	06/28/12 10:50	
1,2-Dichloroethane	<0.000523	0.0500	0.0446	89	68-127	mg/kg	06/28/12 10:50	
1,1-Dichloroethane	<0.000281	0.0500	0.0453	91	72-125	mg/kg	06/28/12 10:50	
trans-1,2-dichloroethene	<0.000227	0.0500	0.0391	78	75-125	mg/kg	06/28/12 10:50	
cis-1,2-Dichloroethene	<0.000413	0.0500	0.0481	96	75-125	mg/kg	06/28/12 10:50	
1,1-Dichloroethene	<0.000445	0.0500	0.0459	92	59-172	mg/kg	06/28/12 10:50	
2,2-Dichloropropane	<0.000380	0.0500	0.0397	79	75-125	mg/kg	06/28/12 10:50	
1,3-Dichloropropane	<0.000304	0.0500	0.0597	119	75-125	mg/kg	06/28/12 10:50	
1,2-Dichloropropane	<0.000348	0.0500	0.0485	97	74-125	mg/kg	06/28/12 10:50	
trans-1,3-dichloropropene	<0.00108	0.0500	0.0530	106	66-125	mg/kg	06/28/12 10:50	
1,1-Dichloropropene	<0.000366	0.0500	0.0454	91	75-125	mg/kg	06/28/12 10:50	
cis-1,3-Dichloropropene	<0.000315	0.0500	0.0566	113	74-125	mg/kg	06/28/12 10:50	
Ethylbenzene	<0.000200	0.0500	0.0522	104	75-125	mg/kg	06/28/12 10:50	
Hexachlorobutadiene	<0.000270	0.0500	0.0507	101	75-125	mg/kg	06/28/12 10:50	
Naphthalene	<0.00100	0.0500	0.0540	108	70-130	mg/kg	06/28/12 10:50	
isopropylbenzene	<0.000228	0.0500	0.0558	112	75-125	mg/kg	06/28/12 10:50	
Methylene Chloride	<0.000526	0.0500	0.0408	82	75-125	mg/kg	06/28/12 10:50	
n-Propylbenzene	<0.000233	0.0500	0.0604	121	75-125	mg/kg	06/28/12 10:50	
Styrene	<0.000201	0.0500	0.0523	105	75-125	mg/kg	06/28/12 10:50	
1,1,1,2-Tetrachloroethane	<0.000325	0.0500	0.0481	96	72-125	mg/kg	06/28/12 10:50	
1,1,2,2-Tetrachloroethane	<0.000214	0.0500	0.0603	121	74-125	mg/kg	06/28/12 10:50	

Southwest Research Institute, San Antonio, TX

16246.05.001

Analytical Method: VOAs by SW-846 8260 — Prep Method: SW5030B
Seq Number: 891213 — Matrix: Solid — Date Prep: 06/28/2012
MB Sample Id: 623909-1-BLK — LCS Sample Id: 623909-1-BKS

Parameter	MB Result	Spike Amount	LCS Result	LCS %Rec	Limits	Units	Analysis Date	Flag
Tetrachloroethylene	0.000220	0.0500	0.0562	112	71-125	mg/kg	06/28/12 10:50	
Toluene	<0.000321	0.0500	0.0484	97	59-139	mg/kg	06/28/12 10:50	
1,2,4-Trichlorobenzene	<0.000348	0.0500	0.0522	104	75-135	mg/kg	06/28/12 10:50	
1,2,3-Trichlorobenzene	<0.000347	0.0500	0.0523	105	75-137	mg/kg	06/28/12 10:50	
1,1,2-Trichloroethane	<0.000380	0.0500	0.0515	103	75-127	mg/kg	06/28/12 10:50	
1,1,1-Trichloroethane	<0.000276	0.0500	0.0390	78	75-125	mg/kg	06/28/12 10:50	
Trichloroethene	<0.000440	0.0500	0.0486	97	62-137	mg/kg	06/28/12 10:50	
Trichlorofluoromethane	<0.000248	0.0500	0.0515	103	67-125	mg/kg	06/28/12 10:50	
1,2,3-Trichloropropane	<0.000384	0.0500	0.0586	117	75-125	mg/kg	06/28/12 10:50	
1,3,5-Trimethylbenzene	<0.000131	0.0500	0.0577	115	70-130	mg/kg	06/28/12 10:50	
Vinyl Chloride	<0.000500	0.0500	0.0525	105	65-135	mg/kg	06/28/12 10:50	
o-Xylene	<0.000206	0.0500	0.0476	95	75-125	mg/kg	06/28/12 10:50	
m,p-Xylenes	<0.000321	0.100	0.102	102	75-125	mg/kg	06/28/12 10:50	

Surrogate	MB %Rec	MB Flag	LCS %Rec	LCS Flag	Limits	Units	Analysis Date
4-Bromofluorobenzene	103		110		68-152	%	06/28/12 10:50
Dibromofluoromethane	90		88		53-142	%	06/28/12 10:50
1,2-Dichloroethane-D4	93		89		56-150	%	06/28/12 10:50
Toluene-D8	95		98		70-130	%	06/28/12 10:50

Analytical Method: VOAs by SW-846 8260 — Prep Method: SW5030B
Seq Number: 891270 — Matrix: Solid — Date Prep: 06/29/2012
MB Sample Id: 623949-1-BLK — LCS Sample Id: 623949-1-BKS

Parameter	MB Result	Spike Amount	LCS Result	LCS %Rec	Limits	Units	Analysis Date	Flag
1,2,4-Trimethylbenzene	<0.000142	0.0500	0.0563	113	75-125	mg/kg	06/29/12 12:31	

Surrogate	MB %Rec	MB Flag	LCS %Rec	LCS Flag	Limits	Units	Analysis Date
4-Bromofluorobenzene	103		107		68-152	%	06/29/12 12:31
Dibromofluoromethane	89		86		53-142	%	06/29/12 12:31
1,2-Dichloroethane-D4	92		85		56-150	%	06/29/12 12:31
Toluene-D8	96		100		70-130	%	06/29/12 12:31

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QC Summary 444478

Southwest Research Institute, San Antonio, TX

16246.05.001

Analytical Method: VOAs by SW-846 8260 — Prep Method: SW5030B
Seq Number: 891213 — Matrix: Soil — Date Prep: 06/28/2012
Parent Sample Id: 444290-002 — MS Sample Id: 444290-002 S — MSD Sample Id: 444290-002 SD

Parameter	Parent Result	Spike Amount	MS Result	MS %Rec	MSD Result	MSD %Rec	Limits	%RPD	RPD Limit	Units	Analysis Date	Flag
Benzene	<0.000554	0.0616	0.0503	82	0.0506	82	66-142	1	25	mg/kg	06/28/12 13:43	
Bromobenzene	<0.000319	0.0616	0.0751	122	0.0760	123	75-125	1	25	mg/kg	06/28/12 13:43	
Bromochloromethane	<0.000794	0.0616	0.0544	88	0.0571	93	73-125	5	25	mg/kg	06/28/12 13:43	
Bromodichloromethane	<0.000448	0.0616	0.0527	86	0.0539	88	75-125	2	25	mg/kg	06/28/12 13:43	
Bromoform	<0.000544	0.0616	0.0585	95	0.0615	100	75-125	5	25	mg/kg	06/28/12 13:43	
Bromomethane	<0.000999	0.0616	0.0496	81	0.0479	78	65-135	3	25	mg/kg	06/28/12 13:43	
MTBE	<0.000204	0.123	0.108	88	0.116	94	65-135	7	25	mg/kg	06/28/12 13:43	
tert-Butylbenzene	<0.000275	0.0616	0.0686	111	0.0705	114	75-125	3	25	mg/kg	06/28/12 13:43	
Sec-Butylbenzene	<0.000103	0.0616	0.0623	101	0.0632	103	75-125	1	25	mg/kg	06/28/12 13:43	
n-Butylbenzene	<0.000366	0.0616	0.0491	80	0.0507	82	75-125	3	25	mg/kg	06/28/12 13:43	
Carbon Tetrachloride	<0.000198	0.0616	0.0487	79	0.0488	79	62-125	0	25	mg/kg	06/28/12 13:43	
Chlorobenzene	<0.000357	0.0616	0.0593	96	0.0591	96	60-133	0	25	mg/kg	06/28/12 13:43	
Chloroethane	<0.000932	0.0616	0.0610	99	0.0608	99	65-135	0	25	mg/kg	06/28/12 13:43	
Chloroform	<0.000490	0.0616	0.0542	88	0.0551	89	74-125	2	25	mg/kg	06/28/12 13:43	
Chloromethane	<0.000446	0.0616	0.0511	83	0.0533	87	65-135	4	25	mg/kg	06/28/12 13:43	
2-Chlorotoluene	<0.000304	0.0616	0.0724	118	0.0713	116	73-125	2	25	mg/kg	06/28/12 13:43	
4-Chlorotoluene	<0.000225	0.0616	0.0686	111	0.0678	110	74-125	1	25	mg/kg	06/28/12 13:43	
p-Cymene (p-Isopropyltoluene)	<0.000211	0.0616	0.0599	97	0.0608	99	75-125	1	25	mg/kg	06/28/12 13:43	
1,2-Dibromo-3-Chloropropane	<0.00357	0.0616	0.0783	127	0.0892	145	59-125	13	25	mg/kg	06/28/12 13:43	M1
Dibromochloromethane	<0.000655	0.0616	0.0671	109	0.0683	111	73-125	2	25	mg/kg	06/28/12 13:43	
1,2-Dibromoethane	<0.000591	0.0616	0.0746	121	0.0770	125	73-125	3	25	mg/kg	06/28/12 13:43	
Dibromomethane	<0.000681	0.0616	0.0576	94	0.0590	96	69-127	2	25	mg/kg	06/28/12 13:43	
1,2-Dichlorobenzene	<0.000405	0.0616	0.0547	89	0.0549	89	75-125	0	25	mg/kg	06/28/12 13:43	
1,3-Dichlorobenzene	<0.000333	0.0616	0.0584	95	0.0586	95	75-125	0	25	mg/kg	06/28/12 13:43	
1,4-Dichlorobenzene	<0.00123	0.0616	0.0553	90	0.0564	92	75-125	2	25	mg/kg	06/28/12 13:43	
Dichlorodifluoromethane	<0.000305	0.0616	0.0446	72	0.0448	73	65-135	0	25	mg/kg	06/28/12 13:43	
1,2-Dichloroethane	<0.000644	0.0616	0.0530	86	0.0549	89	68-127	4	25	mg/kg	06/28/12 13:43	
1,1-Dichloroethane	<0.000346	0.0616	0.0519	84	0.0527	86	72-125	2	25	mg/kg	06/28/12 13:43	
trans-1,2-dichloroethene	<0.000280	0.0616	0.0442	72	0.0444	72	75-125	0	25	mg/kg	06/28/12 13:43	M2
cis-1,2-Dichloroethene	<0.000509	0.0616	0.0539	88	0.0545	88	75-125	1	25	mg/kg	06/28/12 13:43	
1,1-Dichloroethene	<0.000548	0.0616	0.0523	85	0.0516	84	59-172	1	25	mg/kg	06/28/12 13:43	
2,2-Dichloropropane	<0.000468	0.0616	0.0444	72	0.0445	72	75-125	0	25	mg/kg	06/28/12 13:43	M2
1,3-Dichloropropane	<0.000374	0.0616	0.0781	127	0.0834	135	75-125	7	25	mg/kg	06/28/12 13:43	M1
1,2-Dichloropropane	<0.000429	0.0616	0.0564	92	0.0566	92	74-125	0	25	mg/kg	06/28/12 13:43	
trans-1,3-dichloropropene	<0.00133	0.0616	0.0574	93	0.0595	97	66-125	4	25	mg/kg	06/28/12 13:43	
1,1-Dichloropropene	<0.000451	0.0616	0.0495	80	0.0499	81	75-125	1	25	mg/kg	06/28/12 13:43	
cis-1,3-Dichloropropene	<0.000388	0.0616	0.0589	96	0.0617	100	74-125	5	25	mg/kg	06/28/12 13:43	
Ethylbenzene	<0.000246	0.0616	0.0576	94	0.0557	90	75-125	3	25	mg/kg	06/28/12 13:43	
Hexachlorobutadiene	<0.000333	0.0616	0.0264	43	0.0311	50	75-125	16	25	mg/kg	06/28/12 13:43	M2
Naphthalene	<0.00123	0.0616	0.0411	67	0.0442	72	70-130	7	25	mg/kg	06/28/12 13:43	M2
isopropylbenzene	<0.000281	0.0616	0.0730	119	0.0741	120	75-125	1	25	mg/kg	06/28/12 13:43	
Methylene Chloride	<0.000648	0.0616	0.0464	75	0.0478	78	75-125	3	25	mg/kg	06/28/12 13:43	
n-Propylbenzene	<0.000287	0.0616	0.0728	118	0.0729	118	75-125	0	25	mg/kg	06/28/12 13:43	
Styrene	<0.000248	0.0616	0.0538	87	0.0536	87	75-125	0	25	mg/kg	06/28/12 13:43	
1,1,1,2-Tetrachloroethane	<0.000400	0.0616	0.0543	88	0.0548	89	72-125	1	25	mg/kg	06/28/12 13:43	
1,1,2,2-Tetrachloroethane	<0.000264	0.0616	0.101	164	0.109	177	74-125	8	25	mg/kg	06/28/12 13:43	M1

Southwest Research Institute, San Antonio, TX

16246.05.001

Analytical Method: VOAs by SW-846 8260 — Prep Method: SW5030B
Seq Number: 891213 — Matrix: Soil — Date Prep: 06/28/2012
Parent Sample Id: 444290-002 — MS Sample Id: 444290-002 S — MSD Sample Id: 444290-002 SD

Parameter	Parent Result	Spike Amount	MS Result	MS %Rec	MSD Result	MSD %Rec	Limits	%RPD	RPD Limit	Units	Analysis Date	Flag
Tetrachloroethylene	0.000244	0.0616	0.118	191	0.0667	108	71-125	56	25	mg/kg	06/28/12 13:43	M1R5
Toluene	<0.000395	0.0616	0.0508	82	0.0500	81	59-139	2	25	mg/kg	06/28/12 13:43	
1,2,4-Trichlorobenzene	<0.000429	0.0616	0.0303	49	0.0324	53	75-135	7	25	mg/kg	06/28/12 13:43	M2
1,2,3-Trichlorobenzene	<0.000427	0.0616	0.0285	46	0.0296	48	75-137	4	25	mg/kg	06/28/12 13:43	M2
1,1,2-Trichloroethane	<0.000468	0.0616	0.0604	98	0.0625	101	75-127	3	25	mg/kg	06/28/12 13:43	
1,1,1-Trichloroethane	<0.000340	0.0616	0.0439	71	0.0440	71	75-125	0	25	mg/kg	06/28/12 13:43	M2
Trichloroethene	<0.000542	0.0616	0.0576	94	0.0525	85	62-137	9	25	mg/kg	06/28/12 13:43	
Trichlorofluoromethane	<0.000305	0.0616	0.0597	97	0.0597	97	67-125	0	25	mg/kg	06/28/12 13:43	
1,2,3-Trichloropropane	<0.000473	0.0616	0.0929	151	0.102	166	75-125	9	25	mg/kg	06/28/12 13:43	M1
1,3,5-Trimethylbenzene	<0.000161	0.0616	0.0687	112	0.0700	114	70-130	2	25	mg/kg	06/28/12 13:43	
Vinyl Chloride	<0.000616	0.0616	0.0601	98	0.0612	99	65-135	2	25	mg/kg	06/28/12 13:43	
o-Xylene	<0.000254	0.0616	0.0518	84	0.0512	83	75-125	1	25	mg/kg	06/28/12 13:43	
m,p-Xylenes	<0.000395	0.123	0.110	89	0.109	89	75-125	1	25	mg/kg	06/28/12 13:43	

Surrogate	MS %Rec	MS Flag	MSD %Rec	MSD Flag	Limits	Units	Analysis Date
4-Bromofluorobenzene	124		129		68-152	%	06/28/12 13:43
Dibromofluoromethane	90		90		53-142	%	06/28/12 13:43
1,2-Dichloroethane-D4	95		101		56-150	%	06/28/12 13:43
Toluene-D8	96		95		70-130	%	06/28/12 13:43

Analytical Method: VOAs by SW-846 8260 — Prep Method: SW5030B
Seq Number: 891270 — Matrix: Soil — Date Prep: 06/29/2012
Parent Sample Id: 444290-003 — MS Sample Id: 444290-003 S — MSD Sample Id: 444290-003 SD

Parameter	Parent Result	Spike Amount	MS Result	MS %Rec	MSD Result	MSD %Rec	Limits	%RPD	RPD Limit	Units	Analysis Date	Flag
1,2,4-Trimethylbenzene	0.000215	0.0540	0.0475	88	0.0473	87	75-125	0	25	mg/kg	06/29/12 16:08	

Surrogate	MS %Rec	MS Flag	MSD %Rec	MSD Flag	Limits	Units	Analysis Date
4-Bromofluorobenzene	139		144		68-152	%	06/29/12 16:08
Dibromofluoromethane	99		93		53-142	%	06/29/12 16:08
1,2-Dichloroethane-D4	107		100		56-150	%	06/29/12 16:08
Toluene-D8	92		90		70-130	%	06/29/12 16:08

XENCO Laboratories

Prelogin/Nonconformance Report- Sample Log-In

Client: Southwest Research Institute

Date/ Time Received: 06/11/2012 10:24:00 AM

Work Order #: 444478

Acceptable Temperature Range: 0 - 6 degC
Air and Metal samples Acceptable Range: Ambient

Temperature Measuring device used :

Sample Receipt Checklist	Comments
#1 *Temperature of cooler(s)?	20
#2 *Shipping container in good condition?	Yes
#3 *Samples received on ice?	No
#4 *Custody Seals intact on shipping container/ cooler?	No
#5 Custody Seals intact on sample bottles/ container?	No
#6 *Custody Seals Signed and dated for Containers/coolers	No
#7 *Chain of Custody present?	No
#8 Sample instructions complete on Chain of Custody?	N/A
#9 Any missing/extra samples?	No
#10 Chain of Custody signed when relinquished/ received?	N/A
#11 Chain of Custody agrees with sample label(s)?	N/A
#12 Container label(s) legible and intact?	Yes
#13 Sample matrix/ properties agree with Chain of Custody?	N/A
#14 Samples in proper container/ bottle?	Yes
#15 Samples properly preserved?	Yes
#16 Sample container(s) intact?	Yes
#17 Sufficient sample amount for indicated test(s)?	Yes
#18 All samples received within hold time?	Yes
#19 Subcontract of sample(s)?	N/A
#20 VOC samples have zero headspace (less than 1/4 inch bubble)?	N/A
#21 <2 for all samples preserved with HNO3,HCL, H2SO4?	N/A
#22 >10 for all samples preserved with NaAsO2+NaOH, ZnAc+NaOH?	N/A

*** Must be completed for after-hours delivery of samples prior to placing in the refrigerator**

Analyst: tt	PH Device/Lot#:

Checklist completed by: Tanya Torres Date: 06/22/2012

Checklist reviewed by: Date: 06/22/2012

Appendix BL
EPA Testing Report: CL12-4367

Analytical Report 451437

for

Southwest Research Institute

Project Manager: Scott Hutzler

SO091904E

CL12-4367

07-NOV-12

Collected By: Client

4143 Greenbriar Dr., Stafford, TX 77477

Xenco-Houston (EPA Lab code: TX00122):
Texas (T104704215-10-6-TX), Arizona (AZ0765), Arkansas (08-039-0), Connecticut (PH-0102), Florida (E871002)
Illinois (002082), Indiana (C-TX-02), Iowa (392), Kansas (E-10380), Kentucky (45), Louisiana (03054)
New Hampshire (297408), New Jersey (TX007), New York (11763), Oklahoma (9218), Pennsylvania (68-03610)
Rhode Island (LAO00312), USDA (S-44102), DoD (L11-54)

Xenco-Atlanta (EPA Lab Code: GA00046):
Florida (E87429), North Carolina (483), South Carolina (98015), Kentucky (85), DoD (L10-135)
Louisiana (04176), USDA (P330-07-00105)

Xenco-Tampa Mobile (EPA Lab code: FL01212): Florida (E84900)
Xenco-Lakeland: Florida (E84098)
Xenco-Odessa (EPA Lab code: TX00158): Texas (T104704400-TX)
Xenco-Dallas (EPA Lab code: TX01468): Texas (T104704295-TX)
Xenco Phoenix (EPA Lab Code: AZ00901): Arizona(AZ0757)
Xenco-Phoenix Mobile (EPA Lab code: AZ00901): Arizona (AZM757)
Xenco Tucson (EPA Lab code:AZ000989): Arizona (AZ0758)

07-NOV-12

Project Manager: **Scott Hutzler**
Southwest Research Institute
6220 Culebra Road
P.O. Box 28510
San Antonio, TX 78228

Reference: XENCO Report No: **451437**
SO091904E
Project Address:

Scott Hutzler :

We are reporting to you the results of the analyses performed on the samples received under the project name referenced above and identified with the XENCO Report Number 451437. All results being reported under this Report Number apply to the samples analyzed and properly identified with a Laboratory ID number. Subcontracted analyses are identified in this report with either the NELAC certification number of the subcontract lab in the analyst ID field, or the complete subcontracted report attached to this report.

Unless otherwise noted in a Case Narrative, all data reported in this Analytical Report are in compliance with NELAC standards. The uncertainty of measurement associated with the results of analysis reported is available upon request. Should insufficient sample be provided to the laboratory to meet the method and NELAC Matrix Duplicate and Matrix Spike requirements, then the data will be analyzed, evaluated and reported using all other available quality control measures.

The validity and integrity of this report will remain intact as long as it is accompanied by this letter and reproduced in full, unless written approval is granted by XENCO Laboratories. This report will be filed for at least 5 years in our archives after which time it will be destroyed without further notice, unless otherwise arranged with you. The samples received, and described as recorded in Report No. 451437 will be filed for 60 days, and after that time they will be properly disposed without further notice, unless otherwise arranged with you. We reserve the right to return to you any unused samples, extracts or solutions related to them if we consider so necessary (e.g., samples identified as hazardous waste, sample sizes exceeding analytical standard practices, controlled substances under regulated protocols, etc).

We thank you for selecting XENCO Laboratories to serve your analytical needs. If you have any questions concerning this report, please feel free to contact us at any time.

Respectfully,

Skip Harden
Project Manager

CASE NARRATIVE

Client Name: Southwest Research Institute
Project Name: SO091904E

Project ID:	CL12-4367	Report Date:	07-NOV-12
Work Order Number:	451437	Date Received:	10/26/2012

Sample receipt non conformances and comments:
None

Sample receipt non conformances and comments per sample:

None

XENCO Laboratories

Flagging Criteria

Arizona Flags

All method blanks, laboratory spikes, and/or matrix spikes met quality control objectives for the parameters associated with this Work Order except as detailed below or on the Data Qualifier page of this report. Data Qualifiers used in this report are in accordance with ADEQ Arizona Data Qualifiers, Revision 3.0 9/20/2007. Data qualifiers (flags) contained within this analytical report have been issued to explain a quality control deficiency, and do not affect the quality (validity) of the data unless noted otherwise in the case narrative.

D1 Sample required dilution due to matrix.

D2 Sample required dilution due to high concentration of target analyte.

L1 The associated blank spike recovery was above laboratory acceptance limits.

M1 Matrix spike recovery was high; the associated blank spike recovery was acceptable.

M2 Matrix spike recovery was low; the associated blank spike recovery was acceptable.

S4 Surrogate recovery was above laboratory and method acceptance limits. No target analytes were detected in the sample.

S8 The analysis of the sample required a dilution such that the surrogate recovery calculation does not provide any useful information. The associated blank spike recovery was acceptable.

T4 Tentatively identified compound. Concentration is estimated and based on the closest internal standard.

Sample Cross Reference 451437

Southwest Research Institute, San Antonio, TX

SO091904E

Sample Id	Matrix	Date Collected	Sample Depth	Lab Sample Id
CL12-4367	L	10-25-12 00:00		451437-001

Certificate of Analytical Results 451437

Southwest Research Institute, San Antonio, TX

SO091904E

Sample Id:	**CL12-4367**	Matrix: Product	Date Received: 10.26.12 09.00
Lab Sample Id:	**451437-001**	Date Collected: 10.25.12 00.00	

Analytical Method:	**SVOCs by EPA 8270C**			Prep Method:	SW3550
Tech:	LEB			% Moisture:	
Analyst:	WEW	Date Prep:	10.30.12 09.53	Basis:	Wet Weight
Seq Number:	899835				

Parameter	Cas Number	Result	RL	Units	Analysis Date	Flag	Dil
1,2,4-Trichlorobenzene	120-82-1	<500	500	mg/kg	10.30.12 18.07	D1	100
1,2-Dichlorobenzene	95-50-1	<500	500	mg/kg	10.30.12 18.07	D1	100
1,3-Dichlorobenzene	541-73-1	<500	500	mg/kg	10.30.12 18.07	D1	100
1,4-Dichlorobenzene	106-46-7	<500	500	mg/kg	10.30.12 18.07	D1	100
2,4,5-Trichlorophenol	95-95-4	<500	500	mg/kg	10.30.12 18.07	D1	100
2,4,6-Trichlorophenol	88-06-2	<500	500	mg/kg	10.30.12 18.07	D1	100
2,4-Dichlorophenol	120-83-2	<500	500	mg/kg	10.30.12 18.07	D1	100
2,4-Dimethylphenol	105-67-9	<500	500	mg/kg	10.30.12 18.07	D1	100
2,4-Dinitrophenol	51-28-5	<1000	1000	mg/kg	10.30.12 18.07	D1	100
2,4-Dinitrotoluene	121-14-2	<500	500	mg/kg	10.30.12 18.07	D1	100
2,6-Dinitrotoluene	606-20-2	<500	500	mg/kg	10.30.12 18.07	D1	100
2-Chloronaphthalene	91-58-7	<500	500	mg/kg	10.30.12 18.07	D1	100
2-Chlorophenol	95-57-8	<500	500	mg/kg	10.30.12 18.07	D1	100
2-Methylnaphthalene	91-57-6	**1670**	500	mg/kg	10.30.12 18.07	D2	100
2-methylphenol	95-48-7	<500	500	mg/kg	10.30.12 18.07	D1	100
2-Nitroaniline	88-74-4	<1000	1000	mg/kg	10.30.12 18.07	D1	100
2-Nitrophenol	88-75-5	<500	500	mg/kg	10.30.12 18.07	D1	100
3&4-Methylphenol	15831-10-4	<500	500	mg/kg	10.30.12 18.07	D1	100
3,3-Dichlorobenzidine	91-94-1	<1000	1000	mg/kg	10.30.12 18.07	D1	100
3-Nitroaniline	99-09-2	<1000	1000	mg/kg	10.30.12 18.07	D1	100
4,6-dinitro-2-methyl phenol	534-52-1	<1000	1000	mg/kg	10.30.12 18.07	D1	100
4-Bromophenyl-phenylether	101-55-3	<500	500	mg/kg	10.30.12 18.07	D1	100
4-chloro-3-methylphenol	59-50-7	<500	500	mg/kg	10.30.12 18.07	D1	100
4-Chloroaniline	106-47-8	<1000	1000	mg/kg	10.30.12 18.07	D1	100
4-Chlorophenyl-phenyl ether	7005-72-3	<500	500	mg/kg	10.30.12 18.07	D1	100
4-Nitroaniline	100-01-6	<1000	1000	mg/kg	10.30.12 18.07	D1	100
4-Nitrophenol	100-02-7	<1000	1000	mg/kg	10.30.12 18.07	D1	100
Acenaphthene	83-32-9	<500	500	mg/kg	10.30.12 18.07	D1	100
Acenaphthylene	208-96-8	<500	500	mg/kg	10.30.12 18.07	D1	100
Aniline (Phenylamine, Aminobenzene)	62-53-3	<1000	1000	mg/kg	10.30.12 18.07	D1	100
Anthracene	120-12-7	<500	500	mg/kg	10.30.12 18.07	D1	100
Benzo(a)anthracene	56-55-3	<500	500	mg/kg	10.30.12 18.07	D1	100
Benzo(a)pyrene	50-32-8	<500	500	mg/kg	10.30.12 18.07	D1	100
Benzo(b)fluoranthene	205-99-2	<500	500	mg/kg	10.30.12 18.07	D1	100
Benzo(g,h,i)perylene	191-24-2	<500	500	mg/kg	10.30.12 18.07	D1	100
Benzo(k)fluoranthene	207-08-9	<500	500	mg/kg	10.30.12 18.07	D1	100
Benzoic Acid	65-85-0	<3000	3000	mg/kg	10.30.12 18.07	D1	100
Benzyl Butyl Phthalate	85-68-7	<500	500	mg/kg	10.30.12 18.07	D1	100
bis(2-chloroethoxy) methane	111-91-1	<500	500	mg/kg	10.30.12 18.07	D1	100
bis(2-chloroethyl) ether	111-44-4	<500	500	mg/kg	10.30.12 18.07	D1	100
bis(2-chloroisopropyl) ether	108-60-1	<500	500	mg/kg	10.30.12 18.07	D1	100

XENCO Laboratories

Certificate of Analytical Results 451437

Southwest Research Institute, San Antonio, TX

SO091904E

Sample Id:	**CL12-4367**	Matrix: Product	Date Received: 10.26.12 09.00
Lab Sample Id:	**451437-001**	Date Collected: 10.25.12 00.00	

Analytical Method:	**SVOCs by EPA 8270C**			Prep Method:	SW3550
Tech:	LEB			% Moisture:	
Analyst:	WEW	Date Prep:	10.30.12 09.53	Basis:	Wet Weight
Seq Number:	899835				

Parameter	Cas Number	Result	RL	Units	Analysis Date	Flag	Dil
bis(2-ethylhexyl) phthalate	117-81-7	<500	500	mg/kg	10.30.12 18.07	D1	100
Chrysene	218-01-9	<500	500	mg/kg	10.30.12 18.07	D1	100
Dibenz(a,h)Anthracene	53-70-3	<500	500	mg/kg	10.30.12 18.07	D1	100
Dibenzofuran	132-64-9	<500	500	mg/kg	10.30.12 18.07	D1	100
Diethyl Phthalate	84-66-2	<500	500	mg/kg	10.30.12 18.07	D1	100
Dimethyl Phthalate	131-11-3	<500	500	mg/kg	10.30.12 18.07	D1	100
di-n-Butyl Phthalate	84-74-2	<500	500	mg/kg	10.30.12 18.07	D1	100
di-n-Octyl Phthalate	117-84-0	<500	500	mg/kg	10.30.12 18.07	D1	100
Fluoranthene	206-44-0	<500	500	mg/kg	10.30.12 18.07	D1	100
Fluorene	86-73-7	<500	500	mg/kg	10.30.12 18.07	D1	100
Hexachlorobenzene	118-74-1	<500	500	mg/kg	10.30.12 18.07	D1	100
Hexachlorobutadiene	87-68-3	<500	500	mg/kg	10.30.12 18.07	D1	100
Hexachlorocyclopentadiene	77-47-4	<500	500	mg/kg	10.30.12 18.07	D1	100
Hexachloroethane	67-72-1	<500	500	mg/kg	10.30.12 18.07	D1	100
Indeno(1,2,3-c,d)Pyrene	193-39-5	<500	500	mg/kg	10.30.12 18.07	D1	100
Isophorone	78-59-1	<500	500	mg/kg	10.30.12 18.07	D1	100
Naphthalene	91-20-3	**1210**	500	mg/kg	10.30.12 18.07	D2	100
Nitrobenzene	98-95-3	<500	500	mg/kg	10.30.12 18.07	D1	100
N-Nitrosodi-n-Propylamine	621-64-7	<500	500	mg/kg	10.30.12 18.07	D1	100
N-Nitrosodiphenylamine	86-30-6	<500	500	mg/kg	10.30.12 18.07	D1	100
Pentachlorophenol	87-86-5	<1000	1000	mg/kg	10.30.12 18.07	D1	100
Phenanthrene	85-01-8	<500	500	mg/kg	10.30.12 18.07	D1	100
Phenol	108-95-2	<1000	1000	mg/kg	10.30.12 18.07	D1	100
Pyrene	129-00-0	<500	500	mg/kg	10.30.12 18.07	D1	100
Pyridine	110-86-1	<1000	1000	mg/kg	10.30.12 18.07	D1	100
Decane, 4-methyl- (CAS); 4-Methyldecane (TIC)	TIC	**6990**		mg/kg	10.30.12 18.07	D2T4	100
Cyclohexane, propyl- (TIC)	TIC	**11600**		mg/kg	10.30.12 18.07	D2T4	100
Undecane (CAS); n-Undecane; Hendecane; n-C11	TIC	**10600**		mg/kg	10.30.12 18.07	D2T4	100
1-Pentene, 2,3-dimethyl- (TIC)	TIC	**7630**		mg/kg	10.30.12 18.07	D2T4	100
Pentadecane (CAS); n-Pentadecane; CH3(CH2)1	TIC	**6630**		mg/kg	10.30.12 18.07	D2T4	100
Decane (TIC)	TIC	**21000**		mg/kg	10.30.12 18.07	D2T4	100
Cyclopentane, 1-ethyl-3-methyl-; 1-Methyl-3- (TI	TIC	**8630**		mg/kg	10.30.12 18.07	D2T4	100
Nonane (CAS); n-Nonane; Shellsol 140; n-C9H2 (	TIC	**14200**		mg/kg	10.30.12 18.07	D2T4	100
Tetradecane (CAS); n-Tetradecane; Isotetrade (T	TIC	**10000**		mg/kg	10.30.12 18.07	D2T4	100

Surrogate	Cas Number	% Recovery	Units	Limits	Analysis Date	Flag
2-Fluorophenol	367-12-4	0	%	25-121	10.30.12 18.07	S8
Phenol-d6	13127-88-3	0	%	24-113	10.30.12 18.07	S8
Nitrobenzene-d5	4165-60-0	0	%	23-120	10.30.12 18.07	S8
2-Fluorobiphenyl	321-60-8	0	%	30-115	10.30.12 18.07	S8
2,4,6-Tribromophenol	118-79-6	0	%	19-122	10.30.12 18.07	S8

Certificate of Analytical Results 451437

Southwest Research Institute, San Antonio, TX

SO091904E

Sample Id:	**CL12-4367**	Matrix: Product	Date Received: 10.26.12 09.00
Lab Sample Id:	**451437-001**	Date Collected: 10.25.12 00.00	

Analytical Method:	**SVOCs by EPA 8270C**			Prep Method:	SW3550
Tech:	LEB			% Moisture:	
Analyst:	WEW	Date Prep:	10.30.12 09.53	Basis:	Wet Weight
Seq Number:	899835				

Surrogate	Cas Number	% Recovery			Analysis Date	Flag
Terphenyl-D14	1718-51-0	0	%	18-137	10.30.12 18.07	S8

Analytical Method:	**TPH DRO by SW846-8015**			Prep Method:	SW3550
Tech:	PJB			% Moisture:	
Analyst:	VIC	Date Prep:	10.31.12 17.09	Basis:	Wet Weight
Seq Number:	899987				

Parameter	Cas Number	Result	RL	Units	Analysis Date	Flag	Dil
TPH-DRO	68334-30-5	**769000**	10000	mg/kg	11.01.12 13.34	D2	200

Surrogate	Cas Number	% Recovery	Units	Limits	Analysis Date	Flag
Pentacosane	629-99-2	111	%	40-130	11.01.12 13.58	

Certificate of Analytical Results 451437

Southwest Research Institute, San Antonio, TX

SO091904E

Sample Id: **CL12-4367** Matrix: Product Date Received: 10.26.12 09.00

Lab Sample Id: **451437-001** Date Collected: 10.25.12 00.00

Analytical Method: **VOAs by SW-846 8260** Prep Method: SW5030B

Tech: MCH % Moisture:

Analyst: MCH Date Prep: 10.31.12 14.22 Basis: Wet Weight

Seq Number: 899983

Parameter	Cas Number	Result	RL	Units	Analysis Date	Flag	Dil
1,1,1,2-Tetrachloroethane	630-20-6	<125	125	mg/kg	10.31.12 16.12	D1	25000
1,1,1-Trichloroethane	71-55-6	<125	125	mg/kg	10.31.12 16.12	D1	25000
1,1,2,2-Tetrachloroethane	79-34-5	<125	125	mg/kg	10.31.12 16.12	D1	25000
1,1,2-Trichloroethane	79-00-5	<125	125	mg/kg	10.31.12 16.12	D1	25000
1,1-Dichloroethane	75-34-3	<125	125	mg/kg	10.31.12 16.12	D1	25000
1,1-Dichloroethene	75-35-4	<125	125	mg/kg	10.31.12 16.12	D1	25000
1,1-Dichloropropene	563-58-6	<125	125	mg/kg	10.31.12 16.12	D1	25000
1,2,3-Trichlorobenzene	87-61-6	<125	125	mg/kg	10.31.12 16.12	D1	25000
1,2,3-Trichloropropane	96-18-4	<125	125	mg/kg	10.31.12 16.12	D1	25000
1,2,4-Trichlorobenzene	120-82-1	<125	125	mg/kg	10.31.12 16.12	D1	25000
1,2,4-Trimethylbenzene	95-63-6	**1960**	125	mg/kg	10.31.12 16.12	D2	25000
1,2-Dibromo-3-Chloropropane	96-12-8	<125	125	mg/kg	10.31.12 16.12	D1	25000
1,2-Dibromoethane	106-93-4	<125	125	mg/kg	10.31.12 16.12	D1	25000
1,2-Dichlorobenzene	95-50-1	<125	125	mg/kg	10.31.12 16.12	D1	25000
1,2-Dichloroethane	107-06-2	<125	125	mg/kg	10.31.12 16.12	D1	25000
1,2-Dichloropropane	78-87-5	<125	125	mg/kg	10.31.12 16.12	D1	25000
1,3,5-Trimethylbenzene	108-67-8	**772**	125	mg/kg	10.31.12 16.12	D2	25000
1,3-Dichlorobenzene	541-73-1	<125	125	mg/kg	10.31.12 16.12	D1	25000
1,3-Dichloropropane	142-28-9	<125	125	mg/kg	10.31.12 16.12	D1	25000
1,4-Dichlorobenzene	106-46-7	<125	125	mg/kg	10.31.12 16.12	D1	25000
2,2-Dichloropropane	594-20-7	<125	125	mg/kg	10.31.12 16.12	D1	25000
2-Butanone	78-93-3	<1250	1250	mg/kg	10.31.12 16.12	D1	25000
2-Chlorotoluene	95-49-8	<125	125	mg/kg	10.31.12 16.12	D1	25000
2-Hexanone	591-78-6	<1250	1250	mg/kg	10.31.12 16.12	D1	25000
4-Chlorotoluene	106-43-4	<125	125	mg/kg	10.31.12 16.12	D1	25000
Acetone	67-64-1	<2500	2500	mg/kg	10.31.12 16.12	D1	25000
Benzene	71-43-2	<125	125	mg/kg	10.31.12 16.12	D1	25000
Bromobenzene	108-86-1	<125	125	mg/kg	10.31.12 16.12	D1	25000
Bromochloromethane	74-97-5	<125	125	mg/kg	10.31.12 16.12	D1	25000
Bromodichloromethane	75-27-4	<125	125	mg/kg	10.31.12 16.12	D1	25000
Bromoform	75-25-2	<125	125	mg/kg	10.31.12 16.12	D1	25000
Bromomethane	74-83-9	<125	125	mg/kg	10.31.12 16.12	D1	25000
Carbon Disulfide	75-15-0	<1250	1250	mg/kg	10.31.12 16.12	D1	25000
Carbon Tetrachloride	56-23-5	<125	125	mg/kg	10.31.12 16.12	D1	25000
Chlorobenzene	108-90-7	<125	125	mg/kg	10.31.12 16.12	D1	25000
Chloroethane	75-00-3	<250	250	mg/kg	10.31.12 16.12	D1	25000
Chloroform	67-66-3	<125	125	mg/kg	10.31.12 16.12	D1	25000
Chloromethane	74-87-3	<250	250	mg/kg	10.31.12 16.12	D1	25000
cis-1,2-Dichloroethene	156-59-2	<125	125	mg/kg	10.31.12 16.12	D1	25000
cis-1,3-Dichloropropene	10061-01-5	<125	125	mg/kg	10.31.12 16.12	D1	25000
Dibromochloromethane	124-48-1	<125	125	mg/kg	10.31.12 16.12	D1	25000

Certificate of Analytical Results 451437

Southwest Research Institute, San Antonio, TX

SO091904E

Sample Id:	**CL12-4367**	Matrix: Product	Date Received: 10.26.12 09.00
Lab Sample Id:	**451437-001**	Date Collected: 10.25.12 00.00	

Analytical Method:	**VOAs by SW-846 8260**			Prep Method:	SW5030B
Tech:	MCH			% Moisture:	
Analyst:	MCH	Date Prep:	10.31.12 14.22	Basis:	Wet Weight
Seq Number:	899983				

Parameter	Cas Number	Result	RL	Units	Analysis Date	Flag	Dil
Dibromomethane	74-95-3	<125	125	mg/kg	10.31.12 16.12	D1	25000
Dichlorodifluoromethane	75-71-8	<125	125	mg/kg	10.31.12 16.12	D1	25000
Ethylbenzene	100-41-4	**294**	125	mg/kg	10.31.12 16.12	D2	25000
Hexachlorobutadiene	87-68-3	<125	125	mg/kg	10.31.12 16.12	D1	25000
Iodomethane (Methyl Iodide)	74-88-4	<499	499	mg/kg	10.31.12 16.12	D1	25000
isopropylbenzene	98-82-8	<125	125	mg/kg	10.31.12 16.12	D1	25000
m,p-Xylenes	179601-23-1	**1610**	250	mg/kg	10.31.12 16.12	D2	25000
Methylene Chloride	75-09-2	<499	499	mg/kg	10.31.12 16.12	D1	25000
MTBE	1634-04-4	<125	125	mg/kg	10.31.12 16.12	D1	25000
Naphthalene	91-20-3	**575**	250	mg/kg	10.31.12 16.12	D1	25000
n-Butylbenzene	104-51-8	**290**	125	mg/kg	10.31.12 16.12	D2	25000
n-Propylbenzene	103-65-1	**219**	125	mg/kg	10.31.12 16.12	D2	25000
o-Xylene	95-47-6	**560**	125	mg/kg	10.31.12 16.12	D2	25000
p-Cymene (p-Isopropyltoluene)	99-87-6	**165**	125	mg/kg	10.31.12 16.12	D2	25000
Sec-Butylbenzene	135-98-8	**138**	125	mg/kg	10.31.12 16.12	D2	25000
Styrene	100-42-5	<125	125	mg/kg	10.31.12 16.12	D1	25000
tert-Butylbenzene	98-06-6	<125	125	mg/kg	10.31.12 16.12	D1	25000
Tetrachloroethylene	127-18-4	<125	125	mg/kg	10.31.12 16.12	D1	25000
Toluene	108-88-3	**551**	125	mg/kg	10.31.12 16.12	D2	25000
Total Xylenes	1330-20-7	**2170**	125	mg/kg	10.31.12 16.12	D2	25000
trans-1,2-dichloroethene	156-60-5	<125	125	mg/kg	10.31.12 16.12	D1	25000
trans-1,3-dichloropropene	10061-02-6	<125	125	mg/kg	10.31.12 16.12	D1	25000
Trichloroethene	79-01-6	<125	125	mg/kg	10.31.12 16.12	D1	25000
Trichlorofluoromethane	75-69-4	<125	125	mg/kg	10.31.12 16.12	D1	25000
Vinyl Acetate	108-05-4	<1250	1250	mg/kg	10.31.12 16.12	D1	25000
Vinyl Chloride	75-01-4	<49.9	49.9	mg/kg	10.31.12 16.12	D1	25000
Benzene, 1-ethyl-3-methyl- (TIC)	TIC	**1510**		mg/kg	10.31.12 16.12	D2T4	25000
Cyclohexane, propyl- (TIC)	TIC	**4460**		mg/kg	10.31.12 16.12	D2T4	25000
Octane (TIC)	TIC	**2640**		mg/kg	10.31.12 16.12	D2T4	25000
Octane, 3-methyl- (TIC)	TIC	**1080**		mg/kg	10.31.12 16.12	D2T4	25000
Cyclohexane, butyl- (TIC)	TIC	**1150**		mg/kg	10.31.12 16.12	D2T4	25000
Octane, 4-methyl- (TIC)	TIC	**2160**		mg/kg	10.31.12 16.12	D2T4	25000
Benzene, 1,2,3-trimethyl- (TIC)	TIC	**893**		mg/kg	10.31.12 16.12	D2T4	25000
Benzene, 1-methyl-3-(1-methylethyl)- (TIC)	TIC	**993**		mg/kg	10.31.12 16.12	D2T4	25000
Undecane (TIC)	TIC	**983**		mg/kg	10.31.12 16.12	D2T4	25000
Cyclohexane, ethyl- (TIC)	TIC	**1580**		mg/kg	10.31.12 16.12	D2T4	25000

Surrogate	Cas Number	% Recovery	Units	Limits	Analysis Date	Flag
Dibromofluoromethane	1868-53-7	92	%	53-142	10.31.12 16.12	
1,2-Dichloroethane-D4	17060-07-0	95	%	56-150	10.31.12 16.12	
Toluene-D8	2037-26-5	103	%	70-130	10.31.12 16.12	

Certificate of Analytical Results 451437

Southwest Research Institute, San Antonio, TX

SO091904E

Sample Id:	**CL12-4367**	Matrix: Product	Date Received: 10.26.12 09.00
Lab Sample Id:	**451437-001**	Date Collected: 10.25.12 00.00	

Analytical Method:	**VOAs by SW-846 8260**			Prep Method:	SW5030B
Tech:	MCH			% Moisture:	
Analyst:	MCH	Date Prep:	10.31.12 14.22	Basis:	Wet Weight
Seq Number:	899983				

Surrogate	Cas Number	% Recovery			Analysis Date	Flag
4-Bromofluorobenzene	460-00-4	97	%	68-152	10.31.12 16.12	

XENCO Laboratories

QC Summary 451437

Southwest Research Institute, San Antonio, TX

SO091904E

Analytical Method: SVOCs by EPA 8270C — Prep Method: SW3550
Seq Number: 899835 — Matrix: Solid — Date Prep: 10/30/2012
MB Sample Id: 629237-1-BLK — LCS Sample Id: 629237-1-BKS — LCSD Sample Id: 629237-1-BSD

Parameter	MB Result	Spike Amount	LCS Result	LCS %Rec	LCSD Result	LCSD %Rec	Limits	%RPD	RPD Limit	Units	Analysis Date	Flag
1,2,4-Trichlorobenzene	<0.0303	1.66	1.64	99	1.60	96	55-106	2	30	mg/kg	10/30/12 12:14	
1,2-Dichlorobenzene	<0.0360	1.66	1.41	85	1.39	84	54-104	1	30	mg/kg	10/30/12 12:14	
1,3-Dichlorobenzene	<0.0304	1.66	1.37	83	1.36	82	53-105	1	30	mg/kg	10/30/12 12:14	
1,4-Dichlorobenzene	<0.0327	1.66	1.36	82	1.34	81	52-104	1	30	mg/kg	10/30/12 12:14	
2,4,5-Trichlorophenol	<0.0389	1.66	1.75	105	1.68	101	53-128	4	30	mg/kg	10/30/12 12:14	
2,4,6-Trichlorophenol	<0.0267	1.66	1.72	104	1.69	102	58-119	2	30	mg/kg	10/30/12 12:14	
2,4-Dichlorophenol	<0.0313	1.66	1.75	105	1.70	102	58-113	3	30	mg/kg	10/30/12 12:14	
2,4-Dimethylphenol	<0.0781	1.66	1.79	108	1.75	105	56-112	2	30	mg/kg	10/30/12 12:14	
2,4-Dinitrophenol	<0.0688	1.66	1.77	107	1.63	98	38-136	8	40	mg/kg	10/30/12 12:14	
2,4-Dinitrotoluene	<0.0317	1.66	1.81	109	1.69	102	59-115	7	30	mg/kg	10/30/12 12:14	
2,6-Dinitrotoluene	<0.0318	1.66	1.73	104	1.65	99	58-114	5	30	mg/kg	10/30/12 12:14	
2-Chloronaphthalene	<0.0263	1.66	1.72	104	1.65	99	40-132	4	30	mg/kg	10/30/12 12:14	
2-Chlorophenol	<0.0322	1.66	1.44	87	1.39	84	53-109	4	30	mg/kg	10/30/12 12:14	
2-Methylnaphthalene	<0.0340	1.66	1.75	105	1.72	104	53-108	2	30	mg/kg	10/30/12 12:14	
2-methylphenol	<0.0431	1.66	1.50	90	1.46	88	48-118	3	30	mg/kg	10/30/12 12:14	
2-Nitroaniline	<0.0292	1.66	1.87	113	1.77	107	54-116	5	40	mg/kg	10/30/12 12:14	
2-Nitrophenol	<0.0227	1.66	1.69	102	1.69	102	54-113	0	30	mg/kg	10/30/12 12:14	
3&4-Methylphenol	<0.0755	1.66	1.54	93	1.49	90	53-115	3	30	mg/kg	10/30/12 12:14	
3,3-Dichlorobenzidine	<0.0455	1.66	1.78	107	1.65	99	55-129	8	40	mg/kg	10/30/12 12:14	
3-Nitroaniline	<0.0345	1.66	1.85	111	1.73	104	57-119	7	40	mg/kg	10/30/12 12:14	
4,6-dinitro-2-methyl phenol	<0.0270	1.66	1.77	107	1.71	103	56-117	3	40	mg/kg	10/30/12 12:14	
4-Bromophenyl-phenylether	<0.0338	1.66	1.76	106	1.72	104	57-118	2	30	mg/kg	10/30/12 12:14	
4-chloro-3-methylphenol	<0.0349	1.66	1.91	115	1.84	111	55-114	4	30	mg/kg	10/30/12 12:14	L1
4-Chloroaniline	<0.0665	1.66	1.77	107	1.72	104	54-112	3	40	mg/kg	10/30/12 12:14	
4-Chlorophenyl-phenyl ether	<0.0334	1.66	1.64	99	1.57	95	57-111	4	30	mg/kg	10/30/12 12:14	
4-Nitroaniline	<0.0299	1.66	1.86	112	1.72	104	56-121	8	40	mg/kg	10/30/12 12:14	
4-Nitrophenol	<0.0310	1.66	2.23	134	2.00	120	42-134	11	40	mg/kg	10/30/12 12:14	
Acenaphthene	<0.0356	1.66	1.70	102	1.64	99	54-112	4	30	mg/kg	10/30/12 12:14	
Acenaphthylene	<0.0336	1.66	1.73	104	1.67	101	54-113	4	30	mg/kg	10/30/12 12:14	
Aniline (Phenylamine, Aminobenzene)	<0.111	1.66	1.50	90	1.45	87	50-112	3	40	mg/kg	10/30/12 12:14	
Anthracene	<0.0256	1.66	1.93	116	1.84	111	57-118	5	30	mg/kg	10/30/12 12:14	
Benzo(a)anthracene	<0.0279	1.66	1.77	107	1.66	100	58-119	6	30	mg/kg	10/30/12 12:14	
Benzo(a)pyrene	<0.0290	1.66	2.06	124	1.68	101	58-127	20	30	mg/kg	10/30/12 12:14	
Benzo(b)fluoranthene	<0.0269	1.66	1.82	110	1.60	96	50-122	13	30	mg/kg	10/30/12 12:14	
Benzo(g,h,i)perylene	<0.0292	1.66	1.94	117	1.62	98	57-125	18	30	mg/kg	10/30/12 12:14	
Benzo(k)fluoranthene	<0.0388	1.66	2.04	123	1.65	99	59-126	21	30	mg/kg	10/30/12 12:14	
Benzoic Acid	<0.0481	4.98	4.58	92	5.26	105	31-133	14	50	mg/kg	10/30/12 12:14	
Benzyl Butyl Phthalate	<0.0258	1.66	1.82	110	1.75	105	55-129	4	30	mg/kg	10/30/12 12:14	
bis(2-chloroethoxy) methane	<0.0371	1.66	1.80	108	1.77	107	49-112	2	30	mg/kg	10/30/12 12:14	
bis(2-chloroethyl) ether	<0.0356	1.66	1.50	90	1.48	89	50-108	1	30	mg/kg	10/30/12 12:14	
bis(2-chloroisopropyl) ether	<0.0333	1.66	1.52	92	1.48	89	45-111	3	30	mg/kg	10/30/12 12:14	
bis(2-ethylhexyl) phthalate	<0.0265	1.66	1.82	110	1.74	105	54-134	4	30	mg/kg	10/30/12 12:14	
Chrysene	<0.0301	1.66	1.82	110	1.69	102	58-120	7	30	mg/kg	10/30/12 12:14	
Dibenz(a,h)Anthracene	<0.0349	1.66	1.84	111	1.60	96	60-121	14	30	mg/kg	10/30/12 12:14	
Dibenzofuran	<0.0327	1.66	1.70	102	1.62	98	56-110	5	30	mg/kg	10/30/12 12:14	
Diethyl Phthalate	<0.0344	1.66	1.75	105	1.65	99	58-113	6	30	mg/kg	10/30/12 12:14	
Dimethyl Phthalate	<0.0342	1.66	1.70	102	1.61	97	58-112	5	30	mg/kg	10/30/12 12:14	
di-n-Butyl Phthalate	<0.0286	1.66	1.98	119	1.87	113	58-126	6	30	mg/kg	10/30/12 12:14	
di-n-Octyl Phthalate	<0.0315	1.66	1.92	116	1.69	102	54-130	13	30	mg/kg	10/30/12 12:14	

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QC Summary 451437

Southwest Research Institute, San Antonio, TX

SO091904E

Analytical Method: SVOCs by EPA 8270C — Prep Method: SW3550
Seq Number: 899835 — Matrix: Solid — Date Prep: 10/30/2012
MB Sample Id: 629237-1-BLK — LCS Sample Id: 629237-1-BKS — LCSD Sample Id: 629237-1-BSD

Parameter	MB Result	Spike Amount	LCS Result	LCS %Rec	LCSD Result	LCSD %Rec	Limits	%RPD	RPD Limit	Units	Analysis Date	Flag
Fluoranthene	<0.0314	1.66	2.03	122	1.86	112	59-119	9	30	mg/kg	10/30/12 12:14	L1
Fluorene	<0.0355	1.66	1.73	104	1.65	99	56-112	5	30	mg/kg	10/30/12 12:14	
Hexachlorobenzene	<0.0291	1.66	1.80	108	1.71	103	58-119	5	30	mg/kg	10/30/12 12:14	
Hexachlorobutadiene	<0.0312	1.66	1.57	95	1.56	94	55-105	1	30	mg/kg	10/30/12 12:14	
Hexachlorocyclopentadiene	<0.0146	1.66	1.17	70	1.16	70	18-119	1	30	mg/kg	10/30/12 12:14	
Hexachloroethane	<0.0372	1.66	1.38	83	1.38	83	54-105	0	30	mg/kg	10/30/12 12:14	
Indeno(1,2,3-c,d)Pyrene	<0.0308	1.66	1.96	118	1.61	97	59-118	20	30	mg/kg	10/30/12 12:14	
Isophorone	<0.0297	1.66	1.79	108	1.74	105	46-116	3	30	mg/kg	10/30/12 12:14	
Naphthalene	<0.0343	1.66	1.70	102	1.67	101	54-106	2	30	mg/kg	10/30/12 12:14	
Nitrobenzene	<0.0290	1.66	1.67	101	1.67	101	44-118	0	30	mg/kg	10/30/12 12:14	
N-Nitrosodi-n-Propylamine	<0.0397	1.66	1.56	94	1.51	91	50-111	3	30	mg/kg	10/30/12 12:14	
N-Nitrosodiphenylamine	<0.0248	1.66	1.85	111	1.79	108	55-119	3	30	mg/kg	10/30/12 12:14	
Pentachlorophenol	<0.0220	1.66	1.89	114	1.79	108	38-128	5	40	mg/kg	10/30/12 12:14	
Phenanthrene	<0.0330	1.66	1.90	114	1.79	108	56-118	6	30	mg/kg	10/30/12 12:14	
Phenol	<0.0357	1.66	1.52	92	1.47	89	50-114	3	40	mg/kg	10/30/12 12:14	
Pyrene	<0.0332	1.66	1.78	107	1.72	104	56-125	3	30	mg/kg	10/30/12 12:14	
Pyridine	<0.0425	1.66	1.36	82	1.30	78	44-102	5	40	mg/kg	10/30/12 12:14	

Surrogate	MB %Rec	MB Flag	LCS %Rec	LCS Flag	LCSD %Rec	LCSD Flag	Limits	Units	Analysis Date
2-Fluorophenol	112		86		85		25-121	%	10/30/12 12:14
Phenol-d6	121	S4	94		92		24-113	%	10/30/12 12:14
Nitrobenzene-d5	123	S4	105		105		23-120	%	10/30/12 12:14
2-Fluorobiphenyl	119	S4	101		97		30-115	%	10/30/12 12:14
2,4,6-Tribromophenol	114		109		106		19-122	%	10/30/12 12:14
Terphenyl-D14	137		107		105		18-137	%	10/30/12 12:14

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QC Summary 451437

Southwest Research Institute, San Antonio, TX

SO091904E

Analytical Method: SVOCs by EPA 8270C — Prep Method: SW3550
Seq Number: 899835 — Matrix: Soil — Date Prep: 10/30/2012
Parent Sample Id: 451440-001 — MS Sample Id: 451440-001 S — MSD Sample Id: 451440-001 SD

Parameter	Parent Result	Spike Amount	MS Result	MS %Rec	MSD Result	MSD %Rec	Limits	%RPD	RPD Limit	Units	Analysis Date	Flag
1,2,4-Trichlorobenzene	<0.0371	2.03	1.29	64	1.45	71	37-133	12	30	mg/kg	10/30/12 13:48	
1,2-Dichlorobenzene	<0.0441	2.03	1.26	62	1.39	68	65-135	10	30	mg/kg	10/30/12 13:48	M2
1,3-Dichlorobenzene	<0.0372	2.03	1.24	61	1.37	67	65-135	10	30	mg/kg	10/30/12 13:48	M2
1,4-Dichlorobenzene	<0.0401	2.03	1.24	61	1.36	67	36-134	9	30	mg/kg	10/30/12 13:48	
2,4,5-Trichlorophenol	<0.0477	2.03	1.65	81	1.71	84	65-135	4	30	mg/kg	10/30/12 13:48	
2,4,6-Trichlorophenol	<0.0327	2.03	1.56	77	1.64	81	65-135	5	30	mg/kg	10/30/12 13:48	
2,4-Dichlorophenol	<0.0383	2.03	1.42	70	1.55	76	65-135	9	30	mg/kg	10/30/12 13:48	
2,4-Dimethylphenol	<0.0956	2.03	1.45	71	1.56	77	65-135	7	30	mg/kg	10/30/12 13:48	
2,4-Dinitrophenol	<0.0842	2.03	1.52	75	1.52	75	65-135	0	40	mg/kg	10/30/12 13:48	
2,4-Dinitrotoluene	<0.0388	2.03	1.62	80	1.69	83	40-130	4	30	mg/kg	10/30/12 13:48	
2,6-Dinitrotoluene	<0.0389	2.03	1.53	75	1.60	79	28-89	4	30	mg/kg	10/30/12 13:48	
2-Chloronaphthalene	<0.0322	2.03	1.47	72	1.47	72	65-135	0	30	mg/kg	10/30/12 13:48	
2-Chlorophenol	<0.0394	2.03	1.32	65	1.41	69	25-140	7	30	mg/kg	10/30/12 13:48	
2-Methylnaphthalene	<0.0417	2.03	1.42	70	1.55	76	25-175	9	30	mg/kg	10/30/12 13:48	
2-methylphenol	<0.0528	2.03	1.38	68	1.49	73	65-135	8	30	mg/kg	10/30/12 13:48	
2-Nitroaniline	<0.0358	2.03	1.72	85	1.75	86	65-135	2	40	mg/kg	10/30/12 13:48	
2-Nitrophenol	<0.0278	2.03	1.35	67	1.49	73	65-135	10	30	mg/kg	10/30/12 13:48	
3&4-Methylphenol	<0.0925	2.03	1.43	70	1.52	75	65-135	6	30	mg/kg	10/30/12 13:48	
3,3-Dichlorobenzidine	<0.0557	2.03	1.67	82	1.70	84	20-140	2	40	mg/kg	10/30/12 13:48	
3-Nitroaniline	<0.0422	2.03	1.70	84	1.70	84	65-135	0	40	mg/kg	10/30/12 13:48	
4,6-dinitro-2-methyl phenol	<0.0331	2.03	1.64	81	1.69	83	65-135	3	40	mg/kg	10/30/12 13:48	
4-Bromophenyl-phenylether	<0.0414	2.03	1.59	78	1.65	81	65-135	4	30	mg/kg	10/30/12 13:48	
4-chloro-3-methylphenol	<0.0427	2.03	1.60	79	1.70	84	28-134	6	30	mg/kg	10/30/12 13:48	
4-Chloroaniline	<0.0815	2.03	1.42	70	1.52	75	4-149	7	40	mg/kg	10/30/12 13:48	
4-Chlorophenyl-phenyl ether	<0.0409	2.03	1.50	74	1.57	77	65-135	5	30	mg/kg	10/30/12 13:48	
4-Nitroaniline	<0.0366	2.03	1.70	84	1.69	83	65-135	1	40	mg/kg	10/30/12 13:48	
4-Nitrophenol	<0.0379	2.03	1.82	90	1.93	95	13-106	6	40	mg/kg	10/30/12 13:48	
Acenaphthene	<0.0436	2.03	1.48	73	1.57	77	41-134	6	30	mg/kg	10/30/12 13:48	
Acenaphthylene	<0.0412	2.03	1.51	74	1.61	79	65-135	6	30	mg/kg	10/30/12 13:48	
Aniline (Phenylamine, Aminobenzene)	<0.136	2.03	1.34	66	1.47	72	2-145	9	40	mg/kg	10/30/12 13:48	
Anthracene	<0.0313	2.03	1.73	85	1.76	87	65-135	2	30	mg/kg	10/30/12 13:48	
Benzo(a)anthracene	<0.0342	2.03	1.73	85	1.77	87	44-126	2	30	mg/kg	10/30/12 13:48	
Benzo(a)pyrene	<0.0355	2.03	1.76	87	1.82	90	65-135	3	30	mg/kg	10/30/12 13:48	
Benzo(b)fluoranthene	<0.0329	2.03	1.70	84	1.79	88	65-135	5	30	mg/kg	10/30/12 13:48	
Benzo(g,h,i)perylene	<0.0358	2.03	1.65	81	1.71	84	65-135	4	30	mg/kg	10/30/12 13:48	
Benzo(k)fluoranthene	<0.0476	2.03	1.69	83	1.90	94	25-125	12	30	mg/kg	10/30/12 13:48	
Benzoic Acid	0.940	6.10	5.07	68	5.22	70	50-125	3	50	mg/kg	10/30/12 13:48	
Benzyl Butyl Phthalate	<0.0316	2.03	1.80	89	1.89	93	65-135	5	30	mg/kg	10/30/12 13:48	
bis(2-chloroethoxy) methane	<0.0454	2.03	1.42	70	1.56	77	65-135	9	30	mg/kg	10/30/12 13:48	
bis(2-chloroethyl) ether	<0.0436	2.03	1.33	66	1.49	73	65-135	11	30	mg/kg	10/30/12 13:48	
bis(2-chloroisopropyl) ether	<0.0407	2.03	1.35	67	1.54	76	65-135	13	30	mg/kg	10/30/12 13:48	
bis(2-ethylhexyl) phthalate	0.0336	2.03	1.82	88	1.94	94	65-135	6	30	mg/kg	10/30/12 13:48	
Chrysene	<0.0369	2.03	1.75	86	1.80	89	65-135	3	30	mg/kg	10/30/12 13:48	
Dibenz(a,h)Anthracene	<0.0428	2.03	1.70	84	1.75	86	65-135	3	30	mg/kg	10/30/12 13:48	
Dibenzofuran	<0.0401	2.03	1.52	75	1.58	78	65-135	4	30	mg/kg	10/30/12 13:48	
Diethyl Phthalate	<0.0421	2.03	1.62	80	1.70	84	37-125	5	30	mg/kg	10/30/12 13:48	
Dimethyl Phthalate	<0.0419	2.03	1.53	75	1.61	79	65-135	5	30	mg/kg	10/30/12 13:48	
di-n-Butyl Phthalate	0.0520	2.03	1.79	86	1.85	89	65-135	3	30	mg/kg	10/30/12 13:48	
di-n-Octyl Phthalate	<0.0386	2.03	1.83	90	1.93	95	65-135	5	30	mg/kg	10/30/12 13:48	

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QC Summary 451437

Southwest Research Institute, San Antonio, TX

SO091904E

Analytical Method: SVOCs by EPA 8270C — Prep Method: SW3550
Seq Number: 899835 — Matrix: Soil — Date Prep: 10/30/2012
Parent Sample Id: 451440-001 — MS Sample Id: 451440-001 S — MSD Sample Id: 451440-001 SD

Parameter	Parent Result	Spike Amount	MS Result	MS %Rec	MSD Result	MSD %Rec	Limits	%RPD	RPD Limit	Units	Analysis Date	Flag
Fluoranthene	<0.0384	2.03	1.75	86	1.75	86	65-135	0	30	mg/kg	10/30/12 13:48	
Fluorene	<0.0434	2.03	1.54	76	1.62	80	65-135	5	30	mg/kg	10/30/12 13:48	
Hexachlorobenzene	<0.0356	2.03	1.59	78	1.66	82	65-135	4	30	mg/kg	10/30/12 13:48	
Hexachlorobutadiene	<0.0382	2.03	1.24	61	1.39	68	65-135	11	30	mg/kg	10/30/12 13:48	M2
Hexachlorocyclopentadiene	<0.0179	2.03	1.07	53	1.16	57	65-135	8	30	mg/kg	10/30/12 13:48	M2
Hexachloroethane	<0.0455	2.03	1.27	63	1.42	70	65-135	11	30	mg/kg	10/30/12 13:48	M2
Indeno(1,2,3-c,d)Pyrene	<0.0377	2.03	1.64	81	1.73	85	65-135	5	30	mg/kg	10/30/12 13:48	
Isophorone	<0.0364	2.03	1.42	70	1.55	76	65-135	9	30	mg/kg	10/30/12 13:48	
Naphthalene	<0.0420	2.03	1.35	67	1.48	73	65-135	9	30	mg/kg	10/30/12 13:48	
Nitrobenzene	<0.0355	2.03	1.36	67	1.46	72	65-135	7	30	mg/kg	10/30/12 13:48	
N-Nitrosodi-n-Propylamine	<0.0486	2.03	1.37	67	1.53	75	53-130	11	30	mg/kg	10/30/12 13:48	
N-Nitrosodiphenylamine	<0.0304	2.03	1.65	81	1.71	84	65-135	4	30	mg/kg	10/30/12 13:48	
Pentachlorophenol	<0.0269	2.03	1.79	88	1.84	91	14-111	3	40	mg/kg	10/30/12 13:48	
Phenanthrene	<0.0405	2.03	1.71	84	1.73	85	65-135	1	30	mg/kg	10/30/12 13:48	
Phenol	<0.0437	2.03	1.41	69	1.50	74	27-127	6	40	mg/kg	10/30/12 13:48	
Pyrene	<0.0406	2.03	1.76	87	1.84	91	41-144	4	30	mg/kg	10/30/12 13:48	
Pyridine	<0.0520	2.03	1.17	58	1.31	65	39-98	11	40	mg/kg	10/30/12 13:48	

Surrogate	MS %Rec	MS Flag	MSD %Rec	MSD Flag	Limits	Units	Analysis Date
2-Fluorophenol	64		68		25-121	%	10/30/12 13:48
Phenol-d6	70		75		24-113	%	10/30/12 13:48
Nitrobenzene-d5	69		75		23-120	%	10/30/12 13:48
2-Fluorobiphenyl	71		75		30-115	%	10/30/12 13:48
2,4,6-Tribromophenol	87		86		19-122	%	10/30/12 13:48
Terphenyl-D14	87		89		18-137	%	10/30/12 13:48

Analytical Method: TPH DRO by SW846-8015 — Prep Method: SW3550
Seq Number: 899987 — Matrix: Solid — Date Prep: 10/31/2012
MB Sample Id: 629323-1-BLK — LCS Sample Id: 629323-1-BKS — LCSD Sample Id: 629323-1-BSD

Parameter	MB Result	Spike Amount	LCS Result	LCS %Rec	LCSD Result	LCSD %Rec	Limits	%RPD	RPD Limit	Units	Analysis Date	Flag
TPH-DRO	<312	1000	1100	110	1080	108	70-130	2	35	mg/kg	11/01/12 12:45	

Surrogate	MB %Rec	MB Flag	LCS %Rec	LCS Flag	LCSD %Rec	LCSD Flag	Limits	Units	Analysis Date
Pentacosane	68		80		79		40-130	%	11/01/12 12:45

XENCO Laboratories

QC Summary 451437

Southwest Research Institute, San Antonio, TX

SO091904E

Analytical Method: VOAs by SW-846 8260 — Prep Method: SW5030B
Seq Number: 899983 — Matrix: Solid — Date Prep: 10/31/2012
MB Sample Id: 629372-1-BLK — LCS Sample Id: 629372-1-BKS — LCSD Sample Id: 629372-1-BSD

Parameter	MB Result	Spike Amount	LCS Result	LCS %Rec	LCSD Result	LCSD %Rec	Limits	%RPD	RPD Limit	Units	Analysis Date	Flag
1,1,1,2-Tetrachloroethane	<0.000148	0.0500	0.0547	109	0.0515	103	81-127	6	25	mg/kg	10/31/12 09:47	
1,1,1-Trichloroethane	<0.000602	0.0500	0.0561	112	0.0468	94	71-124	18	25	mg/kg	10/31/12 09:47	
1,1,2,2-Tetrachloroethane	<0.000194	0.0500	0.0565	113	0.0521	104	75-133	8	25	mg/kg	10/31/12 09:47	
1,1,2-Trichloroethane	<0.000225	0.0500	0.0539	108	0.0523	105	75-131	3	25	mg/kg	10/31/12 09:47	
1,1-Dichloroethane	<0.000125	0.0500	0.0584	117	0.0500	100	73-124	15	25	mg/kg	10/31/12 09:47	
1,1-Dichloroethene	<0.000192	0.0500	0.0568	114	0.0449	90	68-119	23	25	mg/kg	10/31/12 09:47	
1,1-Dichloropropene	<0.000198	0.0500	0.0541	108	0.0475	95	72-118	13	25	mg/kg	10/31/12 09:47	
1,2,3-Trichlorobenzene	<0.000106	0.0500	0.0561	112	0.0531	106	75-131	5	25	mg/kg	10/31/12 09:47	
1,2,3-Trichloropropane	<0.000359	0.0500	0.0531	106	0.0522	104	75-131	2	25	mg/kg	10/31/12 09:47	
1,2,4-Trichlorobenzene	<0.000191	0.0500	0.0565	113	0.0517	103	79-128	9	25	mg/kg	10/31/12 09:47	
1,2,4-Trimethylbenzene	<0.000103	0.0500	0.0565	113	0.0529	106	60-159	7	25	mg/kg	10/31/12 09:47	
1,2-Dibromo-3-Chloropropane	<0.00107	0.0500	0.0548	110	0.0483	97	58-133	13	25	mg/kg	10/31/12 09:47	
1,2-Dibromoethane	<0.000193	0.0500	0.0556	111	0.0538	108	80-127	3	25	mg/kg	10/31/12 09:47	
1,2-Dichlorobenzene	<0.000129	0.0500	0.0541	108	0.0517	103	84-121	5	25	mg/kg	10/31/12 09:47	
1,2-Dichloroethane	<0.000177	0.0500	0.0525	105	0.0485	97	70-123	8	25	mg/kg	10/31/12 09:47	
1,2-Dichloropropane	<0.000162	0.0500	0.0527	105	0.0500	100	75-122	5	25	mg/kg	10/31/12 09:47	
1,3,5-Trimethylbenzene	<0.000166	0.0500	0.0576	115	0.0535	107	61-160	7	25	mg/kg	10/31/12 09:47	
1,3-Dichlorobenzene	<0.000159	0.0500	0.0551	110	0.0523	105	84-124	5	25	mg/kg	10/31/12 09:47	
1,3-Dichloropropane	<0.000227	0.0500	0.0560	112	0.0532	106	82-131	5	25	mg/kg	10/31/12 09:47	
1,4-Dichlorobenzene	<0.0000970	0.0500	0.0515	103	0.0486	97	82-120	6	25	mg/kg	10/31/12 09:47	
2,2-Dichloropropane	<0.000127	0.0500	0.0601	120	0.0505	101	67-137	17	25	mg/kg	10/31/12 09:47	
2-Butanone	<0.00173	0.600	0.567	95	0.528	88	46-137	7	25	mg/kg	10/31/12 09:47	
2-Chlorotoluene	<0.000217	0.0500	0.0572	114	0.0525	105	83-129	9	25	mg/kg	10/31/12 09:47	
2-Hexanone	<0.00112	0.600	0.562	94	0.566	94	52-137	1	25	mg/kg	10/31/12 09:47	
4-Chlorotoluene	<0.000118	0.0500	0.0541	108	0.0501	100	83-125	8	25	mg/kg	10/31/12 09:47	
Acetone	0.00521	0.600	0.567	95	0.521	87	33-148	8	25	mg/kg	10/31/12 09:47	
Benzene	<0.000300	0.0500	0.0553	111	0.0498	100	71-119	10	25	mg/kg	10/31/12 09:47	
Bromobenzene	<0.000198	0.0500	0.0552	110	0.0517	103	84-123	7	25	mg/kg	10/31/12 09:47	
Bromochloromethane	<0.000215	0.0500	0.0543	109	0.0475	95	71-120	13	25	mg/kg	10/31/12 09:47	
Bromodichloromethane	<0.000186	0.0500	0.0550	110	0.0510	102	78-126	8	25	mg/kg	10/31/12 09:47	
Bromoform	<0.000393	0.0500	0.0546	109	0.0512	102	63-136	6	25	mg/kg	10/31/12 09:47	
Bromomethane	<0.000274	0.0500	0.0438	88	0.0414	83	57-118	6	25	mg/kg	10/31/12 09:47	
Carbon Disulfide	<0.0000880	0.550	0.617	112	0.500	91	55-136	21	25	mg/kg	10/31/12 09:47	
Carbon Tetrachloride	<0.000132	0.0500	0.0533	107	0.0453	91	63-135	16	25	mg/kg	10/31/12 09:47	
Chlorobenzene	<0.000104	0.0500	0.0541	108	0.0498	100	83-121	8	25	mg/kg	10/31/12 09:47	
Chloroethane	<0.000254	0.0500	0.0426	85	0.0389	78	57-122	9	25	mg/kg	10/31/12 09:47	
Chloroform	<0.000139	0.0500	0.0553	111	0.0478	96	74-118	15	25	mg/kg	10/31/12 09:47	
Chloromethane	<0.000322	0.0500	0.0435	87	0.0394	79	58-110	10	25	mg/kg	10/31/12 09:47	
cis-1,2-Dichloroethene	<0.000165	0.0500	0.0603	121	0.0525	105	72-131	14	25	mg/kg	10/31/12 09:47	
cis-1,3-Dichloropropene	<0.000128	0.0500	0.0571	114	0.0535	107	74-135	7	25	mg/kg	10/31/12 09:47	
Dibromochloromethane	<0.000422	0.0500	0.0545	109	0.0522	104	77-130	4	25	mg/kg	10/31/12 09:47	
Dibromomethane	<0.000260	0.0500	0.0525	105	0.0493	99	73-126	6	25	mg/kg	10/31/12 09:47	
Dichlorodifluoromethane	<0.000484	0.0500	0.0473	95	0.0415	83	54-122	13	25	mg/kg	10/31/12 09:47	
Ethylbenzene	<0.000104	0.0500	0.0552	110	0.0509	102	80-123	8	25	mg/kg	10/31/12 09:47	
Hexachlorobutadiene	<0.000346	0.0500	0.0572	114	0.0513	103	77-130	11	25	mg/kg	10/31/12 09:47	
Iodomethane (Methyl Iodide)	<0.000200	0.0500	0.0543	109	0.0467	93	63-116	15	25	mg/kg	10/31/12 09:47	
isopropylbenzene	<0.000112	0.0500	0.0541	108	0.0488	98	55-155	10	25	mg/kg	10/31/12 09:47	
m,p-Xylenes	<0.000185	0.100	0.113	113	0.104	104	78-127	8	25	mg/kg	10/31/12 09:47	
Methylene Chloride	0.000650	0.0500	0.0507	101	0.0437	87	57-134	15	25	mg/kg	10/31/12 09:47	

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QC Summary 451437

Southwest Research Institute, San Antonio, TX

SO091904E

Analytical Method: VOAs by SW-846 8260 | Prep Method: SW5030B
Seq Number: 899983 | Matrix: Solid | Date Prep: 10/31/2012
MB Sample Id: 629372-1-BLK | LCS Sample Id: 629372-1-BKS | LCSD Sample Id: 629372-1-BSD

Parameter	MB Result	Spike Amount	LCS Result	LCS %Rec	LCSD Result	LCSD %Rec	Limits	%RPD	RPD Limit	Units	Analysis Date	Flag
MTBE	<0.000142	0.100	0.113	113	0.102	102	64-148	10	25	mg/kg	10/31/12 09:47	
Naphthalene	<0.000148	0.0500	0.0529	106	0.0498	100	53-162	6	25	mg/kg	10/31/12 09:47	
n-Butylbenzene	<0.0000990	0.0500	0.0557	111	0.0500	100	82-127	11	25	mg/kg	10/31/12 09:47	
n-Propylbenzene	<0.000137	0.0500	0.0586	117	0.0533	107	84-131	9	25	mg/kg	10/31/12 09:47	
o-Xylene	<0.000149	0.0500	0.0570	114	0.0524	105	79-125	8	25	mg/kg	10/31/12 09:47	
p-Cymene (p-Isopropyltoluene)	<0.0000800	0.0500	0.0582	116	0.0527	105	84-130	10	25	mg/kg	10/31/12 09:47	
Sec-Butylbenzene	<0.000121	0.0500	0.0577	115	0.0522	104	84-131	10	25	mg/kg	10/31/12 09:47	
Styrene	<0.000158	0.0500	0.0572	114	0.0530	106	80-126	8	25	mg/kg	10/31/12 09:47	
tert-Butylbenzene	<0.0000900	0.0500	0.0582	116	0.0521	104	83-132	11	25	mg/kg	10/31/12 09:47	
Tetrachloroethylene	<0.000173	0.0500	0.0593	119	0.0525	105	79-124	12	25	mg/kg	10/31/12 09:47	
Toluene	<0.000117	0.0500	0.0544	109	0.0491	98	74-122	10	25	mg/kg	10/31/12 09:47	
trans-1,2-dichloroethene	<0.000123	0.0500	0.0572	114	0.0482	96	63-110	17	25	mg/kg	10/31/12 09:47	L1
trans-1,3-dichloropropene	<0.000361	0.0500	0.0513	103	0.0485	97	73-125	6	25	mg/kg	10/31/12 09:47	
Trichloroethene	<0.000147	0.0500	0.0526	105	0.0475	95	78-119	10	25	mg/kg	10/31/12 09:47	
Trichlorofluoromethane	<0.000186	0.0500	0.0571	114	0.0496	99	71-148	14	25	mg/kg	10/31/12 09:47	
Vinyl Acetate	<0.000213	0.500	0.570	114	0.505	101	40-154	12	25	mg/kg	10/31/12 09:47	
Vinyl Chloride	<0.000193	0.0500	0.0445	89	0.0397	79	60-123	11	25	mg/kg	10/31/12 09:47	

Surrogate	MB %Rec	MB Flag	LCS %Rec	LCS Flag	LCSD %Rec	LCSD Flag	Limits	Units	Analysis Date
Dibromofluoromethane	100		101		96		53-142	%	10/31/12 09:47
1,2-Dichloroethane-D4	105		105		99		56-150	%	10/31/12 09:47
Toluene-D8	100		101		102		70-130	%	10/31/12 09:47
4-Bromofluorobenzene	100		98		97		68-152	%	10/31/12 09:47

XENCO Laboratories

QC Summary 451437

Southwest Research Institute, San Antonio, TX

SO091904E

Analytical Method: VOAs by SW-846 8260 | Prep Method: SW5030B
Seq Number: 899983 | Matrix: Oil | Date Prep: 10/31/2012
Parent Sample Id: 451386-002 | MS Sample Id: 451386-002 S | MSD Sample Id: 451386-002 SD

Parameter	Parent Result	Spike Amount	MS Result	MS %Rec	MSD Result	MSD %Rec	Limits	%RPD	RPD Limit	Units	Analysis Date	Flag
1,1,1,2-Tetrachloroethane	<0.0148	4.99	5.00	100	4.73	95	72-125	6	25	mg/kg	10/31/12 17:24	
1,1,1-Trichloroethane	<0.0601	4.99	5.04	101	4.55	91	75-125	10	25	mg/kg	10/31/12 17:24	
1,1,2,2-Tetrachloroethane	<0.0194	4.99	6.01	120	5.30	106	74-125	13	25	mg/kg	10/31/12 17:24	
1,1,2-Trichloroethane	<0.0225	4.99	8.59	172	7.83	157	75-127	9	25	mg/kg	10/31/12 17:24	M1
1,1-Dichloroethane	<0.0125	4.99	5.52	111	4.91	98	72-125	12	25	mg/kg	10/31/12 17:24	
1,1-Dichloroethene	<0.0192	4.99	5.23	105	4.67	94	59-172	11	25	mg/kg	10/31/12 17:24	
1,1-Dichloropropene	<0.0198	4.99	5.11	102	4.57	92	75-125	11	25	mg/kg	10/31/12 17:24	
1,2,3-Trichlorobenzene	<0.0106	4.99	4.50	90	4.40	88	75-137	2	25	mg/kg	10/31/12 17:24	
1,2,3-Trichloropropane	<0.0358	4.99	5.50	110	5.04	101	75-125	9	25	mg/kg	10/31/12 17:24	
1,2,4-Trichlorobenzene	<0.0191	4.99	4.55	91	4.34	87	75-135	5	25	mg/kg	10/31/12 17:24	
1,2,4-Trimethylbenzene	9.35	4.99	14.5	103	14.2	97	75-125	2	25	mg/kg	10/31/12 17:24	
1,2-Dibromo-3-Chloropropane	<0.106	4.99	6.14	123	5.92	119	59-125	4	25	mg/kg	10/31/12 17:24	
1,2-Dibromoethane	<0.0193	4.99	5.44	109	5.12	103	73-125	6	25	mg/kg	10/31/12 17:24	
1,2-Dichlorobenzene	<0.0129	4.99	5.18	104	4.88	98	75-125	6	25	mg/kg	10/31/12 17:24	
1,2-Dichloroethane	<0.0177	4.99	5.05	101	4.38	88	68-127	14	25	mg/kg	10/31/12 17:24	
1,2-Dichloropropane	<0.0162	4.99	5.24	105	4.66	93	74-125	12	25	mg/kg	10/31/12 17:24	
1,3,5-Trimethylbenzene	2.49	4.99	7.98	110	7.52	101	70-130	6	25	mg/kg	10/31/12 17:24	
1,3-Dichlorobenzene	<0.0159	4.99	5.30	106	4.95	99	75-125	7	25	mg/kg	10/31/12 17:24	
1,3-Dichloropropane	<0.0227	4.99	5.54	111	5.02	101	75-125	10	25	mg/kg	10/31/12 17:24	
1,4-Dichlorobenzene	<0.00968	4.99	4.96	99	4.69	94	75-125	6	25	mg/kg	10/31/12 17:24	
2,2-Dichloropropane	<0.0127	4.99	5.04	101	4.65	93	75-125	8	25	mg/kg	10/31/12 17:24	
2-Butanone	2.17	59.9	62.0	100	51.9	83	75-125	18	25	mg/kg	10/31/12 17:24	
2-Chlorotoluene	<0.0217	4.99	5.76	115	5.39	108	73-125	7	25	mg/kg	10/31/12 17:24	
2-Hexanone	<0.112	59.9	54.0	90	50.1	84	75-125	7	25	mg/kg	10/31/12 17:24	
4-Chlorotoluene	<0.0118	4.99	5.47	110	5.21	104	74-125	5	25	mg/kg	10/31/12 17:24	
Acetone	1.05	59.9	58.9	97	47.1	77	50-150	22	25	mg/kg	10/31/12 17:24	
Benzene	0.166	4.99	5.42	105	4.89	95	66-142	10	25	mg/kg	10/31/12 17:24	
Bromobenzene	<0.0198	4.99	5.58	112	5.21	104	75-125	7	25	mg/kg	10/31/12 17:24	
Bromochloromethane	<0.0215	4.99	5.25	105	4.68	94	60-140	11	25	mg/kg	10/31/12 17:24	
Bromodichloromethane	<0.0186	4.99	5.13	103	4.55	91	75-125	12	25	mg/kg	10/31/12 17:24	
Bromoform	<0.0392	4.99	4.81	96	4.47	90	75-125	7	25	mg/kg	10/31/12 17:24	
Bromomethane	<0.0273	4.99	1.42	28	1.40	28	60-140	1	25	mg/kg	10/31/12 17:24	M2
Carbon Disulfide	<0.00878	54.9	56.4	103	50.3	92	60-140	11	25	mg/kg	10/31/12 17:24	
Carbon Tetrachloride	<0.0132	4.99	4.50	90	4.13	83	62-125	9	25	mg/kg	10/31/12 17:24	
Chlorobenzene	<0.0104	4.99	5.27	106	4.97	100	60-133	6	25	mg/kg	10/31/12 17:24	
Chloroethane	<0.0253	4.99	3.70	74	3.38	68	60-140	9	25	mg/kg	10/31/12 17:24	
Chloroform	<0.0139	4.99	5.19	104	4.52	91	74-125	14	25	mg/kg	10/31/12 17:24	
Chloromethane	<0.0321	4.99	4.92	99	4.36	87	60-140	12	25	mg/kg	10/31/12 17:24	
cis-1,2-Dichloroethene	<0.0165	4.99	5.86	117	5.20	104	75-125	12	25	mg/kg	10/31/12 17:24	
cis-1,3-Dichloropropene	<0.0128	4.99	5.46	109	4.87	98	74-125	11	25	mg/kg	10/31/12 17:24	
Dibromochloromethane	<0.0421	4.99	5.16	103	4.69	94	73-125	10	25	mg/kg	10/31/12 17:24	
Dibromomethane	<0.0259	4.99	5.21	104	4.51	90	69-127	14	25	mg/kg	10/31/12 17:24	
Dichlorodifluoromethane	<0.0483	4.99	5.38	108	4.55	91	65-135	17	25	mg/kg	10/31/12 17:24	
Ethylbenzene	2.65	4.99	7.85	104	7.55	98	75-125	4	25	mg/kg	10/31/12 17:24	
Hexachlorobutadiene	<0.0345	4.99	2.77	56	2.60	52	75-125	6	25	mg/kg	10/31/12 17:24	M2
Iodomethane (Methyl Iodide)	<0.0200	4.99	5.33	107	4.72	95	75-125	12	25	mg/kg	10/31/12 17:24	
isopropylbenzene	0.631	4.99	5.94	106	5.64	100	75-125	5	25	mg/kg	10/31/12 17:24	
m,p-Xylenes	8.28	9.98	18.7	104	18.1	98	75-125	3	25	mg/kg	10/31/12 17:24	
Methylene Chloride	0.0529	4.99	4.85	96	4.28	85	75-125	12	25	mg/kg	10/31/12 17:24	

XENCO Laboratories

QC Summary 451437

Southwest Research Institute, San Antonio, TX

SO091904E

Analytical Method: VOAs by SW-846 8260 | Prep Method: SW5030B

Seq Number: 899983 | Matrix: Oil | Date Prep: 10/31/2012

Parent Sample Id: 451386-002 | MS Sample Id: 451386-002 S | MSD Sample Id: 451386-002 SD

Parameter	Parent Result	Spike Amount	MS Result	MS %Rec	MSD Result	MSD %Rec	Limits	%RPD	RPD Limit	Units	Analysis Date	Flag
MTBE	<0.0142	9.98	11.2	112	9.85	99	60-140	13	25	mg/kg	10/31/12 17:24	
Naphthalene	1.85	4.99	7.08	105	6.84	100	70-130	3	25	mg/kg	10/31/12 17:24	
n-Butylbenzene	2.44	4.99	6.90	89	6.72	86	75-125	3	25	mg/kg	10/31/12 17:24	
n-Propylbenzene	2.54	4.99	8.29	115	7.78	105	75-125	6	25	mg/kg	10/31/12 17:24	
o-Xylene	4.16	4.99	9.34	104	9.17	100	75-125	2	25	mg/kg	10/31/12 17:24	
p-Cymene (p-Isopropyltoluene)	0.594	4.99	5.66	102	5.43	97	75-125	4	25	mg/kg	10/31/12 17:24	
Sec-Butylbenzene	0.849	4.99	6.07	105	5.72	98	75-125	6	25	mg/kg	10/31/12 17:24	
Styrene	<0.0158	4.99	5.66	113	5.36	107	75-125	5	25	mg/kg	10/31/12 17:24	
tert-Butylbenzene	<0.00898	4.99	5.50	110	5.20	104	75-125	6	25	mg/kg	10/31/12 17:24	
Tetrachloroethylene	4.50	4.99	9.98	110	9.57	102	71-125	4	25	mg/kg	10/31/12 17:24	
Toluene	5.21	4.99	10.4	104	9.69	90	59-139	7	25	mg/kg	10/31/12 17:24	
trans-1,2-dichloroethene	<0.0123	4.99	5.45	109	4.82	97	75-125	12	25	mg/kg	10/31/12 17:24	
trans-1,3-dichloropropene	<0.0360	4.99	4.65	93	4.32	87	66-125	7	25	mg/kg	10/31/12 17:24	
Trichloroethene	<0.0147	4.99	5.10	102	4.65	93	62-137	9	25	mg/kg	10/31/12 17:24	
Trichlorofluoromethane	<0.0186	4.99	6.06	121	5.38	108	67-125	12	25	mg/kg	10/31/12 17:24	
Vinyl Acetate	<0.0213	49.9	43.9	88	35.7	72	60-140	21	25	mg/kg	10/31/12 17:24	
Vinyl Chloride	<0.0193	4.99	5.03	101	4.55	91	60-140	10	25	mg/kg	10/31/12 17:24	

Surrogate	MS %Rec	MS Flag	MSD %Rec	MSD Flag	Limits	Units	Analysis Date
Dibromofluoromethane	99		96		53-142	%	10/31/12 17:24
1,2-Dichloroethane-D4	99		97		56-150	%	10/31/12 17:24
Toluene-D8	103		101		70-130	%	10/31/12 17:24
4-Bromofluorobenzene	105		104		68-152	%	10/31/12 17:24

Appendix BM
EPA Testing Report: CL13-4826

Analytical Report 457983

for

Southwest Research Institute

Project Manager: Scott Hutzler

Jet Fuel

CL12-4367

28-FEB-13

Collected By: Client

4143 Greenbriar Dr., Stafford, TX 77477

Xenco-Houston (EPA Lab code: TX00122):
Texas (T104704215-10-6-TX), Arizona (AZ0765), Arkansas (08-039-0), Connecticut (PH-0102), Florida (E871002)
Illinois (002082), Indiana (C-TX-02), Iowa (392), Kansas (E-10380), Kentucky (45), Louisiana (03054)
New Hampshire (297408), New Jersey (TX007), New York (11763), Oklahoma (9218), Pennsylvania (68-03610)
Rhode Island (LAO00312), USDA (S-44102), DoD (L11-54)

Xenco-Atlanta (EPA Lab Code: GA00046):
Florida (E87429), North Carolina (483), South Carolina (98015), Kentucky (85), DoD (L10-135)
Louisiana (04176), USDA (P330-07-00105)

Xenco-Tampa Mobile (EPA Lab code: FL01212): Florida (E84900)
Xenco-Lakeland: Florida (E84098)
Xenco-Odessa (EPA Lab code: TX00158): Texas (T104704400-TX)
Xenco-Dallas (EPA Lab code: TX01468): Texas (T104704295-TX)
Xenco Phoenix (EPA Lab Code: AZ00901): Arizona(AZ0757)
Xenco-Phoenix Mobile (EPA Lab code: AZ00901): Arizona (AZM757)
Xenco Tucson (EPA Lab code:AZ000989): Arizona (AZ0758)

28-FEB-13

Project Manager: **Scott Hutzler**
Southwest Research Institute
6220 Culebra Road
P.O. Box 28510
San Antonio, TX 78228

Reference: XENCO Report No(s): **457983**
Jet Fuel
Project Address:

Scott Hutzler :

We are reporting to you the results of the analyses performed on the samples received under the project name referenced above and identified with the XENCO Report Number(s) 457983. All results being reported under this Report Number apply to the samples analyzed and properly identified with a Laboratory ID number. Subcontracted analyses are identified in this report with either the NELAC certification number of the subcontract lab in the analyst ID field, or the complete subcontracted report attached to this report.

Unless otherwise noted in a Case Narrative, all data reported in this Analytical Report are in compliance with NELAC standards. The uncertainty of measurement associated with the results of analysis reported is available upon request. Should insufficient sample be provided to the laboratory to meet the method and NELAC Matrix Duplicate and Matrix Spike requirements, then the data will be analyzed, evaluated and reported using all other available quality control measures.

The validity and integrity of this report will remain intact as long as it is accompanied by this letter and reproduced in full, unless written approval is granted by XENCO Laboratories. This report will be filed for at least 5 years in our archives after which time it will be destroyed without further notice, unless otherwise arranged with you. The samples received, and described as recorded in Report No. 457983 will be filed for 60 days, and after that time they will be properly disposed without further notice, unless otherwise arranged with you. We reserve the right to return to you any unused samples, extracts or solutions related to them if we consider so necessary (e.g., samples identified as hazardous waste, sample sizes exceeding analytical standard practices, controlled substances under regulated protocols, etc).

We thank you for selecting XENCO Laboratories to serve your analytical needs. If you have any questions concerning this report, please feel free to contact us at any time.

Respectfully,

Skip Harden
Project Manager

Sample receipt non conformances and comments:
None

Sample receipt non conformances and comments per sample:

None

Arizona Flags

All method blanks, laboratory spikes, and/or matrix spikes met quality control objectives for the parameters associated with this Work Order except as detailed below or on the Data Qualifier page of this report. Data Qualifiers used in this report are in accordance with ADEQ Arizona Data Qualifiers, Revision 3.0 9/20/2007. Data qualifiers (flags) contained within this analytical report have been issued to explain a quality control deficiency, and do not affect the quality (validity) of the data unless noted otherwise in the case narrative.

D1 Sample required dilution due to matrix.

D2 Sample required dilution due to high concentration of target analyte.

M1 Matrix spike recovery was high; the associated blank spike recovery was acceptable.

M2 Matrix spike recovery was low; the associated blank spike recovery was acceptable.

M3 The spike recovery value is unusable since the analyte concentration in the sample is disproportionate to spike level. The associated blank spike recovery was acceptable.

S8 The analysis of the sample required a dilution such that the surrogate recovery calculation does not provide any useful information. The associated blank spike recovery was acceptable.

T4 Tentatively identified compound. Concentration is estimated and based on the closest internal standard.

Sample Cross Reference 457983

Southwest Research Institute, San Antonio, TX

Jet Fuel

Sample Id	Matrix	Date Collected	Sample Depth	Lab Sample Id
CL13-4826	W	02-19-13 00:00		457983-001
CL13-4826	S	02-19-13 00:00		457983-001

XENCO Laboratories

Certificate of Analytical Results 457983

Southwest Research Institute, San Antonio, TX

Jet Fuel

Sample Id:	**CL13-4826**	Matrix: Product	Date Received: 02.20.13 12.00
Lab Sample Id:	**457983-001**	Date Collected: 02.19.13 00.00	

Analytical Method:	**SVOCs by SW-846 8270C**			Prep Method: SW3550	
Tech:	COR			% Moisture:	
Analyst:	WEW	Date Prep:	02.21.13 10.03	Basis: Wet Weight	
Seq Number:	907636			SUB: TX104704215	

Parameter	Cas Number	Result	RL	Units	Analysis Date	Flag	Dil
1,2,4-Trichlorobenzene	120-82-1	<500	500	mg/kg	02.26.13 15.14	D1	100
1,2-Dichlorobenzene	95-50-1	<500	500	mg/kg	02.26.13 15.14	D1	100
1,3-Dichlorobenzene	541-73-1	<500	500	mg/kg	02.26.13 15.14	D1	100
1,4-Dichlorobenzene	106-46-7	<500	500	mg/kg	02.26.13 15.14	D1	100
2,4,5-Trichlorophenol	95-95-4	<500	500	mg/kg	02.26.13 15.14	D1	100
2,4,6-Trichlorophenol	88-06-2	<500	500	mg/kg	02.26.13 15.14	D1	100
2,4-Dichlorophenol	120-83-2	<500	500	mg/kg	02.26.13 15.14	D1	100
2,4-Dimethylphenol	105-67-9	<500	500	mg/kg	02.26.13 15.14	D1	100
2,4-Dinitrophenol	51-28-5	<1000	1000	mg/kg	02.26.13 15.14	D1	100
2,4-Dinitrotoluene	121-14-2	<500	500	mg/kg	02.26.13 15.14	D1	100
2,6-Dinitrotoluene	606-20-2	<500	500	mg/kg	02.26.13 15.14	D1	100
2-Chloronaphthalene	91-58-7	<500	500	mg/kg	02.26.13 15.14	D1	100
2-Chlorophenol	95-57-8	<500	500	mg/kg	02.26.13 15.14	D1	100
2-Methylnaphthalene	91-57-6	**551**	500	mg/kg	02.26.13 15.14	D2	100
2-methylphenol	95-48-7	<500	500	mg/kg	02.26.13 15.14	D1	100
2-Nitroaniline	88-74-4	<1000	1000	mg/kg	02.26.13 15.14	D1	100
2-Nitrophenol	88-75-5	<500	500	mg/kg	02.26.13 15.14	D1	100
3&4-Methylphenol	15831-10-4	<500	500	mg/kg	02.26.13 15.14	D1	100
3,3-Dichlorobenzidine	91-94-1	<1000	1000	mg/kg	02.26.13 15.14	D1	100
3-Nitroaniline	99-09-2	<1000	1000	mg/kg	02.26.13 15.14	D1	100
4,6-dinitro-2-methyl phenol	534-52-1	<1000	1000	mg/kg	02.26.13 15.14	D1	100
4-Bromophenyl-phenylether	101-55-3	<500	500	mg/kg	02.26.13 15.14	D1	100
4-chloro-3-methylphenol	59-50-7	<500	500	mg/kg	02.26.13 15.14	D1	100
4-Chloroaniline	106-47-8	<1000	1000	mg/kg	02.26.13 15.14	D1	100
4-Chlorophenyl-phenyl ether	7005-72-3	<500	500	mg/kg	02.26.13 15.14	D1	100
4-Nitroaniline	100-01-6	<1000	1000	mg/kg	02.26.13 15.14	D1	100
4-Nitrophenol	100-02-7	<1000	1000	mg/kg	02.26.13 15.14	D1	100
Acenaphthene	83-32-9	<500	500	mg/kg	02.26.13 15.14	D1	100
Acenaphthylene	208-96-8	<500	500	mg/kg	02.26.13 15.14	D1	100
Aniline (Phenylamine, Aminobenzene)	62-53-3	<1000	1000	mg/kg	02.26.13 15.14	D1	100
Anthracene	120-12-7	<500	500	mg/kg	02.26.13 15.14	D1	100
Benzo(a)anthracene	56-55-3	<500	500	mg/kg	02.26.13 15.14	D1	100
Benzo(a)pyrene	50-32-8	<500	500	mg/kg	02.26.13 15.14	D1	100
Benzo(b)fluoranthene	205-99-2	<500	500	mg/kg	02.26.13 15.14	D1	100
Benzo(g,h,i)perylene	191-24-2	<500	500	mg/kg	02.26.13 15.14	D1	100
Benzo(k)fluoranthene	207-08-9	<500	500	mg/kg	02.26.13 15.14	D1	100
Benzoic Acid	65-85-0	<3000	3000	mg/kg	02.26.13 15.14	D1	100
Benzyl Butyl Phthalate	85-68-7	<500	500	mg/kg	02.26.13 15.14	D1	100
bis(2-chloroethoxy) methane	111-91-1	<500	500	mg/kg	02.26.13 15.14	D1	100
bis(2-chloroethyl) ether	111-44-4	<500	500	mg/kg	02.26.13 15.14	D1	100
bis(2-chloroisopropyl) ether	39638-32-9	<500	500	mg/kg	02.26.13 15.14	D1	100

Certificate of Analytical Results 457983

Southwest Research Institute, San Antonio, TX

Jet Fuel

Sample Id:	**CL13-4826**	Matrix: Product	Date Received: 02.20.13 12.00
Lab Sample Id:	**457983-001**	Date Collected: 02.19.13 00.00	

Analytical Method:	**SVOCs by SW-846 8270C**			Prep Method: SW3550	
Tech:	COR			% Moisture:	
Analyst:	WEW	Date Prep:	02.21.13 10.03	Basis: Wet Weight	
Seq Number:	907636			SUB: TX104704215	

Parameter	Cas Number	Result	RL	Units	Analysis Date	Flag	Dil
bis(2-ethylhexyl) phthalate	117-81-7	<500	500	mg/kg	02.26.13 15.14	D1	100
Chrysene	218-01-9	<500	500	mg/kg	02.26.13 15.14	D1	100
Dibenz(a,h)Anthracene	53-70-3	<500	500	mg/kg	02.26.13 15.14	D1	100
Dibenzofuran	132-64-9	<500	500	mg/kg	02.26.13 15.14	D1	100
Diethyl Phthalate	84-66-2	<500	500	mg/kg	02.26.13 15.14	D1	100
Dimethyl Phthalate	131-11-3	<500	500	mg/kg	02.26.13 15.14	D1	100
di-n-Butyl Phthalate	84-74-2	<500	500	mg/kg	02.26.13 15.14	D1	100
di-n-Octyl Phthalate	117-84-0	<500	500	mg/kg	02.26.13 15.14	D1	100
Fluoranthene	206-44-0	<500	500	mg/kg	02.26.13 15.14	D1	100
Fluorene	86-73-7	<500	500	mg/kg	02.26.13 15.14	D1	100
Hexachlorobenzene	118-74-1	<500	500	mg/kg	02.26.13 15.14	D1	100
Hexachlorobutadiene	87-68-3	<500	500	mg/kg	02.26.13 15.14	D1	100
Hexachlorocyclopentadiene	77-47-4	<500	500	mg/kg	02.26.13 15.14	D1	100
Hexachloroethane	67-72-1	<500	500	mg/kg	02.26.13 15.14	D1	100
Indeno(1,2,3-c,d)Pyrene	193-39-5	<500	500	mg/kg	02.26.13 15.14	D1	100
Isophorone	78-59-1	<500	500	mg/kg	02.26.13 15.14	D1	100
Naphthalene	91-20-3	<500	500	mg/kg	02.26.13 15.14	D1	100
Nitrobenzene	98-95-3	<500	500	mg/kg	02.26.13 15.14	D1	100
N-Nitrosodi-n-Propylamine	621-64-7	<500	500	mg/kg	02.26.13 15.14	D1	100
N-Nitrosodiphenylamine	86-30-6	<500	500	mg/kg	02.26.13 15.14	D1	100
Pentachlorophenol	87-86-5	<1000	1000	mg/kg	02.26.13 15.14	D1	100
Phenanthrene	85-01-8	<500	500	mg/kg	02.26.13 15.14	D1	100
Phenol	108-95-2	<1000	1000	mg/kg	02.26.13 15.14	D1	100
Pyrene	129-00-0	<500	500	mg/kg	02.26.13 15.14	D1	100
Pyridine	110-86-1	<1000	1000	mg/kg	02.26.13 15.14	D1	100
3-Octyne, 2,2-dimethyl- (TIC)	TIC	**16100**		mg/kg	02.26.13 15.14	D2T4	100
Benzene, 1-ethyl-2-methyl- (TIC)	TIC	**14200**		mg/kg	02.26.13 15.14	D2T4	100
Benzene, propyl- (TIC)	TIC	**18000**		mg/kg	02.26.13 15.14	D2T4	100
Cyclohexane, (2-methylpropyl)- (TIC)	TIC	**22100**		mg/kg	02.26.13 15.14	D2T4	100
Cyclohexane, 1-ethyl-2-methyl-, tr (TIC)	TIC	**8860**		mg/kg	02.26.13 15.14	D2T4	100
Cyclohexane, ethyl- (TIC)	TIC	**17400**		mg/kg	02.26.13 15.14	D2T4	100
Cyclohexane, propyl- (TIC)	TIC	**29000**		mg/kg	02.26.13 15.14	D2T4	100
Cyclooctane, 1,2-dimethyl- (TIC)	TIC	**20000**		mg/kg	02.26.13 15.14	D2T4	100
Cyclopentane, hexyl- (TIC)	TIC	**12900**		mg/kg	02.26.13 15.14	D2T4	100
Cyclopentane, nonyl- (TIC)	TIC	**12800**		mg/kg	02.26.13 15.14	D2T4	100
Cyclopentanone, 2,4,4-trimethyl- (TIC)	TIC	**9490**		mg/kg	02.26.13 15.14	D2T4	100
Decane (TIC)	TIC	**79800**		mg/kg	02.26.13 15.14	D2T4	100
Ethylbenzene (TIC)	TIC	**12200**		mg/kg	02.26.13 15.14	D2T4	100
Hexadecane (TIC)	TIC	**10600**		mg/kg	02.26.13 15.14	D2T4	100
Indane (TIC)	TIC	**7380**		mg/kg	02.26.13 15.14	D2T4	100
Nonane (TIC)	TIC	**79500**		mg/kg	02.26.13 15.14	D2T4	100

Certificate of Analytical Results 457983

Southwest Research Institute, San Antonio, TX

Jet Fuel

Sample Id:	**CL13-4826**	Matrix: Product	Date Received: 02.20.13 12.00
Lab Sample Id:	**457983-001**	Date Collected: 02.19.13 00.00	

Analytical Method:	**SVOCs by SW-846 8270C**			Prep Method: SW3550	
Tech:	COR			% Moisture:	
Analyst:	WEW	Date Prep:	02.21.13 10.03	Basis: Wet Weight	
Seq Number:	907636			SUB: TX104704215	

Parameter	Cas Number	Result	RL	Units	Analysis Date	Flag	Dil
Octane (TIC)	TIC	**31900**		mg/kg	02.26.13 15.14	D2T4	100
Undecane (TIC)	TIC	**89600**		mg/kg	02.26.13 15.14	D2T4	100
n-Nonylcyclohexane (TIC)	TIC	**7430**		mg/kg	02.26.13 15.14	D2T4	100
o-Xylene (TIC)	TIC	**9060**		mg/kg	02.26.13 15.14	D2T4	100

Surrogate	Cas Number	% Recovery	Units	Limits	Analysis Date	Flag
2-Fluorophenol	367-12-4	0	%	25-121	02.26.13 15.14	S8
Phenol-d6	13127-88-3	0	%	24-113	02.26.13 15.14	S8
Nitrobenzene-d5	4165-60-0	0	%	23-120	02.26.13 15.14	S8
2-Fluorobiphenyl	321-60-8	108	%	30-115	02.26.13 15.14	
2,4,6-Tribromophenol	118-79-6	94	%	19-122	02.26.13 15.14	
Terphenyl-D14	1718-51-0	110	%	18-137	02.26.13 15.14	

XENCO Laboratories

Certificate of Analytical Results 457983

Southwest Research Institute, San Antonio, TX

Jet Fuel

Sample Id: **CL13-4826** Matrix: Product Date Received: 02.20.13 12.00

Lab Sample Id: **457983-001** Date Collected: 02.19.13 00.00

Analytical Method: **VOAs by SW-846 8260B** Prep Method: SW5030B

Tech: ZHO % Moisture:

Analyst: ZHO Date Prep: 02.22.13 15.56 Basis: Wet Weight

Seq Number: 907617 SUB: TX104704215

Parameter	Cas Number	Result	RL	Units	Analysis Date	Flag	Dil
1,1,1,2-Tetrachloroethane	630-20-6	<125	125	mg/kg	02.22.13 16.13	D1	5000
1,1,1-Trichloroethane	71-55-6	<125	125	mg/kg	02.22.13 16.13	D1	5000
1,1,2,2-Tetrachloroethane	79-34-5	<125	125	mg/kg	02.22.13 16.13	D1	5000
1,1,2-Trichloroethane	79-00-5	<125	125	mg/kg	02.22.13 16.13	D1	5000
1,1-Dichloroethane	75-34-3	<125	125	mg/kg	02.22.13 16.13	D1	5000
1,1-Dichloroethene	75-35-4	<125	125	mg/kg	02.22.13 16.13	D1	5000
1,1-Dichloropropene	563-58-6	<125	125	mg/kg	02.22.13 16.13	D1	5000
1,2,3-Trichlorobenzene	87-61-6	<125	125	mg/kg	02.22.13 16.13	D1	5000
1,2,3-Trichloropropane	96-18-4	<125	125	mg/kg	02.22.13 16.13	D1	5000
1,2,4-Trichlorobenzene	120-82-1	<125	125	mg/kg	02.22.13 16.13	D1	5000
1,2,4-Trimethylbenzene	95-63-6	**1480**	125	mg/kg	02.22.13 16.13	D2	5000
1,2-Dibromo-3-Chloropropane	96-12-8	<125	125	mg/kg	02.22.13 16.13	D1	5000
1,2-Dibromoethane	106-93-4	<125	125	mg/kg	02.22.13 16.13	D1	5000
1,2-Dichlorobenzene	95-50-1	<125	125	mg/kg	02.22.13 16.13	D1	5000
1,2-Dichloroethane	107-06-2	<125	125	mg/kg	02.22.13 16.13	D1	5000
1,2-Dichloropropane	78-87-5	<125	125	mg/kg	02.22.13 16.13	D1	5000
1,3,5-Trimethylbenzene	108-67-8	**216**	125	mg/kg	02.22.13 16.13	D2	5000
1,3-Dichlorobenzene	541-73-1	<125	125	mg/kg	02.22.13 16.13	D1	5000
1,3-Dichloropropane	142-28-9	<125	125	mg/kg	02.22.13 16.13	D1	5000
1,4-Dichlorobenzene	106-46-7	<125	125	mg/kg	02.22.13 16.13	D1	5000
2,2-Dichloropropane	594-20-7	<125	125	mg/kg	02.22.13 16.13	D1	5000
2-Butanone	78-93-3	<1250	1250	mg/kg	02.22.13 16.13	D1	5000
2-Chlorotoluene	95-49-8	<125	125	mg/kg	02.22.13 16.13	D1	5000
2-Hexanone	591-78-6	<1250	1250	mg/kg	02.22.13 16.13	D1	5000
4-Chlorotoluene	106-43-4	<125	125	mg/kg	02.22.13 16.13	D1	5000
Acetone	67-64-1	<2500	2500	mg/kg	02.22.13 16.13	D1	5000
Benzene	71-43-2	<125	125	mg/kg	02.22.13 16.13	D1	5000
Bromobenzene	108-86-1	<125	125	mg/kg	02.22.13 16.13	D1	5000
Bromochloromethane	74-97-5	<125	125	mg/kg	02.22.13 16.13	D1	5000
Bromodichloromethane	75-27-4	<125	125	mg/kg	02.22.13 16.13	D1	5000
Bromoform	75-25-2	<125	125	mg/kg	02.22.13 16.13	D1	5000
Bromomethane	74-83-9	<125	125	mg/kg	02.22.13 16.13	D1	5000
Carbon Disulfide	75-15-0	<1250	1250	mg/kg	02.22.13 16.13	D1	5000
Carbon Tetrachloride	56-23-5	<125	125	mg/kg	02.22.13 16.13	D1	5000
Chlorobenzene	108-90-7	<125	125	mg/kg	02.22.13 16.13	D1	5000
Chloroethane	75-00-3	<250	250	mg/kg	02.22.13 16.13	D1	5000
Chloroform	67-66-3	<125	125	mg/kg	02.22.13 16.13	D1	5000
Chloromethane	74-87-3	<250	250	mg/kg	02.22.13 16.13	D1	5000
cis-1,2-Dichloroethene	156-59-2	<125	125	mg/kg	02.22.13 16.13	D1	5000
cis-1,3-Dichloropropene	10061-01-5	<125	125	mg/kg	02.22.13 16.13	D1	5000
Dibromochloromethane	124-48-1	<125	125	mg/kg	02.22.13 16.13	D1	5000

Certificate of Analytical Results 457983

Southwest Research Institute, San Antonio, TX

Jet Fuel

Sample Id: **CL13-4826** Matrix: Product Date Received: 02.20.13 12.00

Lab Sample Id: **457983-001** Date Collected: 02.19.13 00.00

Analytical Method: **VOAs by SW-846 8260B** Prep Method: SW5030B

Tech: ZHO % Moisture:

Analyst: ZHO Date Prep: 02.22.13 15.56 Basis: Wet Weight

Seq Number: 907617 SUB: TX104704215

Parameter	Cas Number	Result	RL	Units	Analysis Date	Flag	Dil
Dibromomethane	74-95-3	<125	125	mg/kg	02.22.13 16.13	D1	5000
Dichlorodifluoromethane	75-71-8	<125	125	mg/kg	02.22.13 16.13	D1	5000
Ethylbenzene	100-41-4	**2230**	125	mg/kg	02.22.13 16.13	D2	5000
Hexachlorobutadiene	87-68-3	<125	125	mg/kg	02.22.13 16.13	D1	5000
Iodomethane (Methyl Iodide)	74-88-4	<500	500	mg/kg	02.22.13 16.13	D1	5000
isopropylbenzene	98-82-8	**270**	125	mg/kg	02.22.13 16.13	D2	5000
m,p-Xylenes	179601-23-1	**2960**	250	mg/kg	02.22.13 16.13	D2	5000
Methylene Chloride	75-09-2	<500	500	mg/kg	02.22.13 16.13	D1	5000
MTBE	1634-04-4	<125	125	mg/kg	02.22.13 16.13	D1	5000
Naphthalene	91-20-3	**340**	250	mg/kg	02.22.13 16.13	D2	5000
n-Butylbenzene	104-51-8	**2190**	125	mg/kg	02.22.13 16.13	D2	5000
n-Propylbenzene	103-65-1	**2670**	125	mg/kg	02.22.13 16.13	D2	5000
o-Xylene	95-47-6	**3110**	125	mg/kg	02.22.13 16.13	D2	5000
p-Cymene (p-Isopropyltoluene)	99-87-6	**165**	125	mg/kg	02.22.13 16.13	D2	5000
Sec-Butylbenzene	135-98-8	**160**	125	mg/kg	02.22.13 16.13	D2	5000
Styrene	100-42-5	<125	125	mg/kg	02.22.13 16.13	D1	5000
tert-Butylbenzene	98-06-6	<125	125	mg/kg	02.22.13 16.13	D1	5000
Tetrachloroethylene	127-18-4	<125	125	mg/kg	02.22.13 16.13	D1	5000
Toluene	108-88-3	**231**	125	mg/kg	02.22.13 16.13	D2	5000
Total Xylenes	1330-20-7	**6070**	125	mg/kg	02.22.13 16.13	D2	5000
trans-1,2-dichloroethene	156-60-5	<125	125	mg/kg	02.22.13 16.13	D1	5000
trans-1,3-dichloropropene	10061-02-6	<125	125	mg/kg	02.22.13 16.13	D1	5000
Trichloroethene	79-01-6	<125	125	mg/kg	02.22.13 16.13	D1	5000
Trichlorofluoromethane	75-69-4	<125	125	mg/kg	02.22.13 16.13	D1	5000
Vinyl Acetate	108-05-4	<1250	1250	mg/kg	02.22.13 16.13	D1	5000
Vinyl Chloride	75-01-4	<50.0	50.0	mg/kg	02.22.13 16.13	D1	5000
Benzene, 1-ethyl-2-methyl- (TIC)	TIC	**5910**		mg/kg	02.22.13 16.13	D2T4	5000
Benzene, 1-propenyl- (TIC)	TIC	**4320**		mg/kg	02.22.13 16.13	D2T4	5000
Benzene, pentyl- (TIC)	TIC	**4500**		mg/kg	02.22.13 16.13	D2T4	5000
Cyclohexane, pentyl- (TIC)	TIC	**3900**		mg/kg	02.22.13 16.13	D2T4	5000
Cyclohexane, propyl- (TIC)	TIC	**7440**		mg/kg	02.22.13 16.13	D2T4	5000
Dodecane (TIC)	TIC	**8870**		mg/kg	02.22.13 16.13	D2T4	5000
Indan, 1-methyl- (TIC)	TIC	**4550**		mg/kg	02.22.13 16.13	D2T4	5000
Octane (TIC)	TIC	**9210**		mg/kg	02.22.13 16.13	D2T4	5000
Tridecane (TIC)	TIC	**5090**		mg/kg	02.22.13 16.13	D2T4	5000
Undecane (TIC)	TIC	**20600**		mg/kg	02.22.13 16.13	D2T4	5000

Surrogate	Cas Number	% Recovery	Units	Limits	Analysis Date	Flag
Dibromofluoromethane	1868-53-7	92	%	53-142	02.22.13 16.13	
1,2-Dichloroethane-D4	17060-07-0	99	%	56-150	02.22.13 16.13	
Toluene-D8	2037-26-5	101	%	70-130	02.22.13 16.13	

Certificate of Analytical Results 457983

Southwest Research Institute, San Antonio, TX

Jet Fuel

Sample Id:	**CL13-4826**	Matrix: Product	Date Received: 02.20.13 12.00
Lab Sample Id:	**457983-001**	Date Collected: 02.19.13 00.00	

Analytical Method:	**VOAs by SW-846 8260B**			Prep Method: SW5030B
Tech:	ZHO			% Moisture:
Analyst:	ZHO	Date Prep:	02.22.13 15.56	Basis: Wet Weight
Seq Number:	907617			SUB: TX104704215

Surrogate	Cas Number	% Recovery			Analysis Date	Flag
4-Bromofluorobenzene	460-00-4	113	%	68-152	02.22.13 16.13	

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QC Summary 457983

Southwest Research Institute

Jet Fuel

Analytical Method: SVOCs by SW-846 8270C — Prep Method: SW3550
Seq Number: 907636 — Matrix: Solid — Date Prep: 02/21/2013
MB Sample Id: 634141-1-BLK — LCS Sample Id: 634141-1-BKS — LCSD Sample Id: 634141-1-BSD

Parameter	MB Result	Spike Amount	LCS Result	LCS %Rec	LCSD Result	LCSD %Rec	Limits	%RPD	RPD Limit	Units	Analysis Date	Flag
1,2,4-Trichlorobenzene	<0.0304	1.67	1.25	75	1.19	71	55-106	5	30	mg/kg	02/22/13 14:43	
1,2-Dichlorobenzene	<0.0362	1.67	1.33	80	1.29	77	54-104	3	30	mg/kg	02/22/13 14:43	
1,3-Dichlorobenzene	<0.0305	1.67	1.29	77	1.25	75	53-105	3	30	mg/kg	02/22/13 14:43	
1,4-Dichlorobenzene	<0.0329	1.67	1.30	78	1.28	77	52-104	2	30	mg/kg	02/22/13 14:43	
2,4,5-Trichlorophenol	<0.0391	1.67	1.49	89	1.50	90	53-128	1	30	mg/kg	02/22/13 14:43	
2,4,6-Trichlorophenol	<0.0268	1.67	1.41	84	1.39	83	58-119	1	30	mg/kg	02/22/13 14:43	
2,4-Dichlorophenol	<0.0314	1.67	1.39	83	1.37	82	58-113	1	30	mg/kg	02/22/13 14:43	
2,4-Dimethylphenol	<0.0784	1.67	1.39	83	1.39	83	56-112	0	30	mg/kg	02/22/13 14:43	
2,4-Dinitrophenol	<0.0691	1.67	1.88	113	1.91	114	38-136	2	40	mg/kg	02/22/13 14:43	
2,4-Dinitrotoluene	<0.0318	1.67	1.53	92	1.51	90	59-115	1	30	mg/kg	02/22/13 14:43	
2,6-Dinitrotoluene	<0.0319	1.67	1.37	82	1.38	83	58-114	1	30	mg/kg	02/22/13 14:43	
2-Chloronaphthalene	<0.0264	1.67	1.34	80	1.32	79	40-132	2	30	mg/kg	02/22/13 14:43	
2-Chlorophenol	<0.0323	1.67	1.38	83	1.37	82	53-109	1	30	mg/kg	02/22/13 14:43	
2-Methylnaphthalene	<0.0342	1.67	1.33	80	1.29	77	53-108	3	30	mg/kg	02/22/13 14:43	
2-methylphenol	<0.0433	1.67	1.51	90	1.48	89	48-118	2	30	mg/kg	02/22/13 14:43	
2-Nitroaniline	<0.0294	1.67	1.21	72	1.23	74	54-116	2	40	mg/kg	02/22/13 14:43	
2-Nitrophenol	<0.0228	1.67	1.35	81	1.35	81	54-113	0	30	mg/kg	02/22/13 14:43	
3&4-Methylphenol	<0.0758	1.67	1.58	95	1.55	93	53-115	2	30	mg/kg	02/22/13 14:43	
3,3-Dichlorobenzidine	<0.0457	1.67	1.45	87	1.45	87	55-129	0	40	mg/kg	02/22/13 14:43	
3-Nitroaniline	<0.0346	1.67	1.38	83	1.40	84	57-119	1	40	mg/kg	02/22/13 14:43	
4,6-dinitro-2-methyl phenol	<0.0271	1.67	1.62	97	1.63	98	56-117	1	40	mg/kg	02/22/13 14:43	
4-Bromophenyl-phenylether	<0.0339	1.67	1.33	80	1.31	78	57-118	2	30	mg/kg	02/22/13 14:43	
4-chloro-3-methylphenol	<0.0350	1.67	1.49	89	1.40	84	55-114	6	30	mg/kg	02/22/13 14:43	
4-Chloroaniline	<0.0668	1.67	1.36	81	1.35	81	54-112	1	40	mg/kg	02/22/13 14:43	
4-Chlorophenyl-phenyl ether	<0.0335	1.67	1.43	86	1.46	87	57-111	2	30	mg/kg	02/22/13 14:43	
4-Nitroaniline	<0.0300	1.67	1.46	87	1.41	84	56-121	3	40	mg/kg	02/22/13 14:43	
4-Nitrophenol	<0.0311	1.67	1.18	71	1.26	75	42-134	7	40	mg/kg	02/22/13 14:43	
Acenaphthene	<0.0358	1.67	1.41	84	1.37	82	54-112	3	30	mg/kg	02/22/13 14:43	
Acenaphthylene	<0.0338	1.67	1.42	85	1.40	84	54-113	1	30	mg/kg	02/22/13 14:43	
Aniline (Phenylamine, Aminobenzene)	<0.111	1.67	1.41	84	1.38	83	50-112	2	40	mg/kg	02/22/13 14:43	
Anthracene	<0.0257	1.67	1.36	81	1.32	79	57-118	3	30	mg/kg	02/22/13 14:43	
Benzo(a)anthracene	<0.0280	1.67	1.40	84	1.43	86	58-119	2	30	mg/kg	02/22/13 14:43	
Benzo(a)pyrene	<0.0291	1.67	1.47	88	1.49	89	58-127	1	30	mg/kg	02/22/13 14:43	
Benzo(b)fluoranthene	<0.0270	1.67	1.50	90	1.49	89	50-122	1	30	mg/kg	02/22/13 14:43	
Benzo(g,h,i)perylene	<0.0294	1.67	1.46	87	1.47	88	57-125	1	30	mg/kg	02/22/13 14:43	
Benzo(k)fluoranthene	<0.0390	1.67	1.36	81	1.43	86	59-126	5	30	mg/kg	02/22/13 14:43	
Benzoic Acid	<0.0483	5.00	6.19	124	5.95	119	31-133	4	50	mg/kg	02/22/13 14:43	
Benzyl Butyl Phthalate	<0.0259	1.67	1.52	91	1.51	90	55-129	1	30	mg/kg	02/22/13 14:43	
bis(2-chloroethoxy) methane	<0.0372	1.67	1.40	84	1.38	83	49-112	1	30	mg/kg	02/22/13 14:43	
bis(2-chloroethyl) ether	<0.0358	1.67	1.49	89	1.43	86	50-108	4	30	mg/kg	02/22/13 14:43	
bis(2-chloroisopropyl) ether	<0.0334	1.67	1.61	96	1.54	92	45-111	4	30	mg/kg	02/22/13 14:43	
bis(2-ethylhexyl) phthalate	<0.0266	1.67	1.59	95	1.58	95	54-134	1	30	mg/kg	02/22/13 14:43	
Chrysene	<0.0303	1.67	1.45	87	1.38	83	58-120	5	30	mg/kg	02/22/13 14:43	
Dibenz(a,h)Anthracene	<0.0351	1.67	1.48	89	1.48	89	60-121	0	30	mg/kg	02/22/13 14:43	
Dibenzofuran	<0.0329	1.67	1.43	86	1.43	86	56-110	0	30	mg/kg	02/22/13 14:43	
Diethyl Phthalate	<0.0345	1.67	1.42	85	1.43	86	58-113	1	30	mg/kg	02/22/13 14:43	
Dimethyl Phthalate	<0.0344	1.67	1.43	86	1.43	86	58-112	0	30	mg/kg	02/22/13 14:43	
di-n-Butyl Phthalate	<0.0287	1.67	1.37	82	1.40	84	58-126	2	30	mg/kg	02/22/13 14:43	
di-n-Octyl Phthalate	<0.0316	1.67	1.53	92	1.59	95	54-130	4	30	mg/kg	02/22/13 14:43	

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QC Summary 457983

Southwest Research Institute

Jet Fuel

Analytical Method: SVOCs by SW-846 8270C — Prep Method: SW3550
Seq Number: 907636 — Matrix: Solid — Date Prep: 02/21/2013
MB Sample Id: 634141-1-BLK — LCS Sample Id: 634141-1-BKS — LCSD Sample Id: 634141-1-BSD

Parameter	MB Result	Spike Amount	LCS Result	LCS %Rec	LCSD Result	LCSD %Rec	Limits	%RPD	RPD Limit	Units	Analysis Date	Flag
Fluoranthene	<0.0315	1.67	1.30	78	1.32	79	59-119	2	30	mg/kg	02/22/13 14:43	
Fluorene	<0.0356	1.67	1.40	84	1.41	84	56-112	1	30	mg/kg	02/22/13 14:43	
Hexachlorobenzene	<0.0292	1.67	1.28	77	1.28	77	58-119	0	30	mg/kg	02/22/13 14:43	
Hexachlorobutadiene	<0.0313	1.67	1.23	74	1.20	72	55-105	2	30	mg/kg	02/22/13 14:43	
Hexachlorocyclopentadiene	<0.0147	1.67	0.683	41	0.644	39	18-119	6	30	mg/kg	02/22/13 14:43	
Hexachloroethane	<0.0373	1.67	1.30	78	1.28	77	54-105	2	30	mg/kg	02/22/13 14:43	
Indeno(1,2,3-c,d)Pyrene	<0.0309	1.67	1.44	86	1.46	87	59-118	1	30	mg/kg	02/22/13 14:43	
Isophorone	<0.0299	1.67	1.44	86	1.43	86	46-116	1	30	mg/kg	02/22/13 14:43	
Naphthalene	<0.0344	1.67	1.30	78	1.27	76	54-106	2	30	mg/kg	02/22/13 14:43	
Nitrobenzene	<0.0291	1.67	1.32	79	1.29	77	44-118	2	30	mg/kg	02/22/13 14:43	
N-Nitrosodi-n-Propylamine	<0.0399	1.67	1.56	93	1.53	92	50-111	2	30	mg/kg	02/22/13 14:43	
N-Nitrosodiphenylamine	<0.0249	1.67	1.39	83	1.35	81	55-119	3	30	mg/kg	02/22/13 14:43	
Pentachlorophenol	<0.0221	1.67	1.38	83	1.38	83	38-128	0	40	mg/kg	02/22/13 14:43	
Phenanthrene	<0.0332	1.67	1.31	78	1.33	80	56-118	2	30	mg/kg	02/22/13 14:43	
Phenol	<0.0358	1.67	1.47	88	1.45	87	50-114	1	40	mg/kg	02/22/13 14:43	
Pyrene	<0.0333	1.67	1.51	90	1.49	89	56-125	1	30	mg/kg	02/22/13 14:43	
Pyridine	<0.0427	1.67	1.30	78	1.27	76	44-102	2	40	mg/kg	02/22/13 14:43	

Surrogate	MB %Rec	MB Flag	LCS %Rec	LCS Flag	LCSD %Rec	LCSD Flag	Limits	Units	Analysis Date
2-Fluorophenol	74		79		79		25-121	%	02/22/13 14:43
Phenol-d6	81		88		89		24-113	%	02/22/13 14:43
Nitrobenzene-d5	65		71		72		23-120	%	02/22/13 14:43
2-Fluorobiphenyl	67		74		76		30-115	%	02/22/13 14:43
2,4,6-Tribromophenol	72		79		81		19-122	%	02/22/13 14:43
Terphenyl-D14	76		78		79		18-137	%	02/22/13 14:43

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QC Summary 457983

Southwest Research Institute

Jet Fuel

Analytical Method: SVOCs by SW-846 8270C — Prep Method: SW3550
Seq Number: 907636 — Matrix: Soil — Date Prep: 02/21/2013
Parent Sample Id: 457936-001 — MS Sample Id: 457936-001 S — MSD Sample Id: 457936-001 SD

Parameter	Parent Result	Spike Amount	MS Result	MS %Rec	MSD Result	MSD %Rec	Limits	%RPD	RPD Limit	Units	Analysis Date	Flag
1,2,4-Trichlorobenzene	<0.0304	1.67	1.18	71	1.15	69	37-133	3	30	mg/kg	02/22/13 15:32	
1,2-Dichlorobenzene	<0.0362	1.67	1.25	75	1.19	71	65-135	5	30	mg/kg	02/22/13 15:32	
1,3-Dichlorobenzene	<0.0305	1.67	1.21	72	1.16	69	65-135	4	30	mg/kg	02/22/13 15:32	
1,4-Dichlorobenzene	<0.0329	1.67	1.24	74	1.18	71	36-134	5	30	mg/kg	02/22/13 15:32	
2,4,5-Trichlorophenol	<0.0391	1.67	1.49	89	1.48	89	65-135	1	30	mg/kg	02/22/13 15:32	
2,4,6-Trichlorophenol	<0.0268	1.67	1.41	84	1.38	83	65-135	2	30	mg/kg	02/22/13 15:32	
2,4-Dichlorophenol	<0.0314	1.67	1.35	81	1.35	81	65-135	0	30	mg/kg	02/22/13 15:32	
2,4-Dimethylphenol	<0.0784	1.67	1.38	83	1.37	82	65-135	1	30	mg/kg	02/22/13 15:32	
2,4-Dinitrophenol	<0.0691	1.67	2.04	122	2.07	124	65-135	1	40	mg/kg	02/22/13 15:32	
2,4-Dinitrotoluene	<0.0318	1.67	1.57	94	1.57	94	40-130	0	30	mg/kg	02/22/13 15:32	
2,6-Dinitrotoluene	<0.0319	1.67	1.39	83	1.39	83	28-89	0	30	mg/kg	02/22/13 15:32	
2-Chloronaphthalene	<0.0264	1.67	1.30	78	1.28	77	65-135	2	30	mg/kg	02/22/13 15:32	
2-Chlorophenol	<0.0323	1.67	1.33	80	1.28	77	25-140	4	30	mg/kg	02/22/13 15:32	
2-Methylnaphthalene	<0.0342	1.67	1.27	76	1.24	74	25-175	2	30	mg/kg	02/22/13 15:32	
2-methylphenol	<0.0433	1.67	1.44	86	1.40	84	65-135	3	30	mg/kg	02/22/13 15:32	
2-Nitroaniline	<0.0294	1.67	1.25	75	1.23	74	65-135	2	40	mg/kg	02/22/13 15:32	
2-Nitrophenol	<0.0228	1.67	1.33	80	1.31	78	65-135	2	30	mg/kg	02/22/13 15:32	
3&4-Methylphenol	<0.0758	1.67	1.51	90	1.48	89	65-135	2	30	mg/kg	02/22/13 15:32	
3,3-Dichlorobenzidine	<0.0457	1.67	1.56	93	1.54	92	20-140	1	40	mg/kg	02/22/13 15:32	
3-Nitroaniline	<0.0346	1.67	1.45	87	1.41	84	65-135	3	40	mg/kg	02/22/13 15:32	
4,6-dinitro-2-methyl phenol	<0.0271	1.67	1.76	105	1.76	105	65-135	0	40	mg/kg	02/22/13 15:32	
4-Bromophenyl-phenylether	<0.0339	1.67	1.33	80	1.33	80	65-135	0	30	mg/kg	02/22/13 15:32	
4-chloro-3-methylphenol	<0.0350	1.67	1.44	86	1.42	85	28-134	1	30	mg/kg	02/22/13 15:32	
4-Chloroaniline	<0.0668	1.67	1.37	82	1.36	81	4-149	1	40	mg/kg	02/22/13 15:32	
4-Chlorophenyl-phenyl ether	<0.0335	1.67	1.39	83	1.42	85	65-135	2	30	mg/kg	02/22/13 15:32	
4-Nitroaniline	<0.0300	1.67	1.44	86	1.53	92	65-135	6	40	mg/kg	02/22/13 15:32	
4-Nitrophenol	<0.0311	1.67	1.43	86	1.35	81	13-106	6	40	mg/kg	02/22/13 15:32	
Acenaphthene	<0.0358	1.67	1.34	80	1.34	80	41-134	0	30	mg/kg	02/22/13 15:32	
Acenaphthylene	<0.0338	1.67	1.39	83	1.36	81	65-135	2	30	mg/kg	02/22/13 15:32	
Aniline (Phenylamine, Aminobenzene)	<0.111	1.67	1.36	81	1.29	77	2-145	5	40	mg/kg	02/22/13 15:32	
Anthracene	<0.0257	1.67	1.41	84	1.39	83	65-135	1	30	mg/kg	02/22/13 15:32	
Benzo(a)anthracene	0.0387	1.67	1.57	92	1.47	86	44-126	7	30	mg/kg	02/22/13 15:32	
Benzo(a)pyrene	0.0340	1.67	1.60	94	1.48	87	65-135	8	30	mg/kg	02/22/13 15:32	
Benzo(b)fluoranthene	0.0450	1.67	1.66	97	1.39	81	65-135	18	30	mg/kg	02/22/13 15:32	
Benzo(g,h,i)perylene	<0.0294	1.67	1.59	95	1.50	90	65-135	6	30	mg/kg	02/22/13 15:32	
Benzo(k)fluoranthene	<0.0390	1.67	1.52	91	1.55	93	25-125	2	30	mg/kg	02/22/13 15:32	
Benzoic Acid	<0.0483	5.00	4.38	88	4.69	94	50-125	7	50	mg/kg	02/22/13 15:32	
Benzyl Butyl Phthalate	<0.0259	1.67	1.60	96	1.59	95	65-135	1	30	mg/kg	02/22/13 15:32	
bis(2-chloroethoxy) methane	<0.0372	1.67	1.35	81	1.32	79	65-135	2	30	mg/kg	02/22/13 15:32	
bis(2-chloroethyl) ether	<0.0358	1.67	1.38	83	1.35	81	65-135	2	30	mg/kg	02/22/13 15:32	
bis(2-chloroisopropyl) ether	<0.0334	1.67	1.51	90	1.43	86	65-135	5	30	mg/kg	02/22/13 15:32	
bis(2-ethylhexyl) phthalate	<0.0266	1.67	1.68	101	1.62	97	65-135	4	30	mg/kg	02/22/13 15:32	
Chrysene	0.0370	1.67	1.52	89	1.51	88	65-135	1	30	mg/kg	02/22/13 15:32	
Dibenz(a,h)Anthracene	<0.0351	1.67	1.59	95	1.52	91	65-135	5	30	mg/kg	02/22/13 15:32	
Dibenzofuran	<0.0329	1.67	1.41	84	1.39	83	65-135	1	30	mg/kg	02/22/13 15:32	
Diethyl Phthalate	<0.0345	1.67	1.46	87	1.44	86	37-125	1	30	mg/kg	02/22/13 15:32	
Dimethyl Phthalate	<0.0344	1.67	1.45	87	1.42	85	65-135	2	30	mg/kg	02/22/13 15:32	
di-n-Butyl Phthalate	<0.0287	1.67	1.51	90	1.41	84	65-135	7	30	mg/kg	02/22/13 15:32	
di-n-Octyl Phthalate	<0.0316	1.67	1.69	101	1.59	95	65-135	6	30	mg/kg	02/22/13 15:32	

XENCO Laboratories

QC Summary 457983

Southwest Research Institute

Jet Fuel

Analytical Method: SVOCs by SW-846 8270C — Prep Method: SW3550
Seq Number: 907636 — Matrix: Soil — Date Prep: 02/21/2013
Parent Sample Id: 457936-001 — MS Sample Id: 457936-001 S — MSD Sample Id: 457936-001 SD

Parameter	Parent Result	Spike Amount	MS Result	MS %Rec	MSD Result	MSD %Rec	Limits	%RPD	RPD Limit	Units	Analysis Date	Flag
Fluoranthene	0.0637	1.67	1.48	85	1.37	78	65-135	8	30	mg/kg	02/22/13 15:32	
Fluorene	<0.0356	1.67	1.42	85	1.37	82	65-135	4	30	mg/kg	02/22/13 15:32	
Hexachlorobenzene	<0.0292	1.67	1.32	79	1.31	78	65-135	1	30	mg/kg	02/22/13 15:32	
Hexachlorobutadiene	<0.0313	1.67	1.17	70	1.14	68	65-135	3	30	mg/kg	02/22/13 15:32	
Hexachlorocyclopentadiene	<0.0147	1.67	0.593	36	0.589	35	65-135	1	30	mg/kg	02/22/13 15:32	M2
Hexachloroethane	<0.0373	1.67	1.25	75	1.17	70	65-135	7	30	mg/kg	02/22/13 15:32	
Indeno(1,2,3-c,d)Pyrene	<0.0309	1.67	1.57	94	1.50	90	65-135	5	30	mg/kg	02/22/13 15:32	
Isophorone	<0.0299	1.67	1.44	86	1.41	84	65-135	2	30	mg/kg	02/22/13 15:32	
Naphthalene	<0.0344	1.67	1.26	75	1.22	73	65-135	3	30	mg/kg	02/22/13 15:32	
Nitrobenzene	<0.0291	1.67	1.27	76	1.25	75	65-135	2	30	mg/kg	02/22/13 15:32	
N-Nitrosodi-n-Propylamine	<0.0399	1.67	1.49	89	1.50	90	53-130	1	30	mg/kg	02/22/13 15:32	
N-Nitrosodiphenylamine	<0.0249	1.67	1.41	84	1.41	84	65-135	0	30	mg/kg	02/22/13 15:32	
Pentachlorophenol	<0.0221	1.67	1.56	93	1.52	91	14-111	3	40	mg/kg	02/22/13 15:32	
Phenanthrene	<0.0332	1.67	1.42	85	1.39	83	65-135	2	30	mg/kg	02/22/13 15:32	
Phenol	<0.0358	1.67	1.41	84	1.35	81	27-127	4	40	mg/kg	02/22/13 15:32	
Pyrene	0.0590	1.67	1.63	94	1.54	89	41-144	6	30	mg/kg	02/22/13 15:32	
Pyridine	<0.0427	1.67	1.20	72	1.23	74	39-98	2	40	mg/kg	02/22/13 15:32	

Surrogate	MS %Rec	MS Flag	MSD %Rec	MSD Flag	Limits	Units	Analysis Date
2-Fluorophenol	75		73		25-121	%	02/22/13 15:32
Phenol-d6	86		84		24-113	%	02/22/13 15:32
Nitrobenzene-d5	69		68		23-120	%	02/22/13 15:32
2-Fluorobiphenyl	73		72		30-115	%	02/22/13 15:32
2,4,6-Tribromophenol	80		83		19-122	%	02/22/13 15:32
Terphenyl-D14	82		81		18-137	%	02/22/13 15:32

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QC Summary 457983

Southwest Research Institute

Jet Fuel

Analytical Method: VOAs by SW-846 8260B — Prep Method: SW5030B

Seq Number: 907617 — Matrix: Solid — Date Prep: 02/22/2013

MB Sample Id: 634196-1-BLK — LCS Sample Id: 634196-1-BKS — LCSD Sample Id: 634196-1-BSD

Parameter	MB Result	Spike Amount	LCS Result	LCS %Rec	LCSD Result	LCSD %Rec	Limits	%RPD	RPD Limit	Units	Analysis Date	Flag
1,1,1,2-Tetrachloroethane	<0.000148	0.0500	0.0542	108	0.0500	100	81-127	8	25	mg/kg	02/22/13 11:36	
1,1,1-Trichloroethane	<0.000602	0.0500	0.0496	99	0.0459	92	71-124	8	25	mg/kg	02/22/13 11:36	
1,1,2,2-Tetrachloroethane	<0.000194	0.0500	0.0520	104	0.0468	94	75-133	11	25	mg/kg	02/22/13 11:36	
1,1,2-Trichloroethane	<0.000225	0.0500	0.0514	103	0.0481	96	75-131	7	25	mg/kg	02/22/13 11:36	
1,1-Dichloroethane	<0.000125	0.0500	0.0497	99	0.0462	92	73-124	7	25	mg/kg	02/22/13 11:36	
1,1-Dichloroethene	<0.000192	0.0500	0.0431	86	0.0398	80	68-119	8	25	mg/kg	02/22/13 11:36	
1,1-Dichloropropene	<0.000198	0.0500	0.0475	95	0.0438	88	72-118	8	25	mg/kg	02/22/13 11:36	
1,2,3-Trichlorobenzene	<0.000106	0.0500	0.0524	105	0.0514	103	75-131	2	25	mg/kg	02/22/13 11:36	
1,2,3-Trichloropropane	<0.000359	0.0500	0.0583	117	0.0529	106	75-131	10	25	mg/kg	02/22/13 11:36	
1,2,4-Trichlorobenzene	<0.000191	0.0500	0.0515	103	0.0510	102	79-128	1	25	mg/kg	02/22/13 11:36	
1,2,4-Trimethylbenzene	<0.000103	0.0500	0.0543	109	0.0505	101	60-159	7	25	mg/kg	02/22/13 11:36	
1,2-Dibromo-3-Chloropropane	<0.00107	0.0500	0.0479	96	0.0458	92	58-133	4	25	mg/kg	02/22/13 11:36	
1,2-Dibromoethane	<0.000193	0.0500	0.0520	104	0.0482	96	80-127	8	25	mg/kg	02/22/13 11:36	
1,2-Dichlorobenzene	<0.000129	0.0500	0.0502	100	0.0464	93	84-121	8	25	mg/kg	02/22/13 11:36	
1,2-Dichloroethane	<0.000177	0.0500	0.0491	98	0.0445	89	70-123	10	25	mg/kg	02/22/13 11:36	
1,2-Dichloropropane	<0.000162	0.0500	0.0483	97	0.0446	89	75-122	8	25	mg/kg	02/22/13 11:36	
1,3,5-Trimethylbenzene	<0.000166	0.0500	0.0548	110	0.0503	101	61-160	9	25	mg/kg	02/22/13 11:36	
1,3-Dichlorobenzene	<0.000159	0.0500	0.0509	102	0.0475	95	84-124	7	25	mg/kg	02/22/13 11:36	
1,3-Dichloropropane	<0.000227	0.0500	0.0514	103	0.0480	96	82-131	7	25	mg/kg	02/22/13 11:36	
1,4-Dichlorobenzene	<0.0000970	0.0500	0.0490	98	0.0461	92	82-120	6	25	mg/kg	02/22/13 11:36	
2,2-Dichloropropane	<0.000127	0.0500	0.0502	100	0.0491	98	67-137	2	25	mg/kg	02/22/13 11:36	
2-Butanone	<0.00173	0.600	0.612	102	0.542	90	46-137	12	25	mg/kg	02/22/13 11:36	
2-Chlorotoluene	<0.000217	0.0500	0.0525	105	0.0478	96	83-129	9	25	mg/kg	02/22/13 11:36	
2-Hexanone	<0.00112	0.600	0.650	108	0.583	97	52-137	11	25	mg/kg	02/22/13 11:36	
4-Chlorotoluene	<0.000118	0.0500	0.0517	103	0.0471	94	83-125	9	25	mg/kg	02/22/13 11:36	
Acetone	0.00535	0.600	0.533	89	0.476	79	33-148	11	25	mg/kg	02/22/13 11:36	
Benzene	<0.000300	0.0500	0.0475	95	0.0433	87	71-119	9	25	mg/kg	02/22/13 11:36	
Bromobenzene	<0.000198	0.0500	0.0505	101	0.0462	92	84-123	9	25	mg/kg	02/22/13 11:36	
Bromochloromethane	<0.000215	0.0500	0.0458	92	0.0426	85	71-120	7	25	mg/kg	02/22/13 11:36	
Bromodichloromethane	<0.000186	0.0500	0.0554	111	0.0509	102	78-126	8	25	mg/kg	02/22/13 11:36	
Bromoform	<0.000393	0.0500	0.0471	94	0.0429	86	63-136	9	25	mg/kg	02/22/13 11:36	
Bromomethane	<0.000274	0.0500	0.0405	81	0.0374	75	57-118	8	25	mg/kg	02/22/13 11:36	
Carbon Disulfide	0.000280	0.550	0.590	107	0.546	99	55-136	8	25	mg/kg	02/22/13 11:36	
Carbon Tetrachloride	<0.000132	0.0500	0.0494	99	0.0455	91	63-135	8	25	mg/kg	02/22/13 11:36	
Chlorobenzene	<0.000104	0.0500	0.0493	99	0.0456	91	83-121	8	25	mg/kg	02/22/13 11:36	
Chloroethane	<0.000254	0.0500	0.0421	84	0.0384	77	57-122	9	25	mg/kg	02/22/13 11:36	
Chloroform	0.000140	0.0500	0.0498	100	0.0455	91	74-118	9	25	mg/kg	02/22/13 11:36	
Chloromethane	<0.000322	0.0500	0.0437	87	0.0398	80	58-110	9	25	mg/kg	02/22/13 11:36	
cis-1,2-Dichloroethene	<0.000165	0.0500	0.0509	102	0.0472	94	72-131	8	25	mg/kg	02/22/13 11:36	
cis-1,3-Dichloropropene	<0.000128	0.0500	0.0564	113	0.0520	104	74-135	8	25	mg/kg	02/22/13 11:36	
Dibromochloromethane	<0.000422	0.0500	0.0453	91	0.0418	84	77-130	8	25	mg/kg	02/22/13 11:36	
Dibromomethane	<0.000260	0.0500	0.0500	100	0.0459	92	73-126	9	25	mg/kg	02/22/13 11:36	
Dichlorodifluoromethane	<0.000484	0.0500	0.0505	101	0.0463	93	54-122	9	25	mg/kg	02/22/13 11:36	
Ethylbenzene	<0.000104	0.0500	0.0509	102	0.0466	93	80-123	9	25	mg/kg	02/22/13 11:36	
Hexachlorobutadiene	<0.000346	0.0500	0.0504	101	0.0495	99	77-130	2	25	mg/kg	02/22/13 11:36	
Iodomethane (Methyl Iodide)	<0.000200	0.0500	0.0457	91	0.0421	84	63-116	8	25	mg/kg	02/22/13 11:36	
isopropylbenzene	<0.000112	0.0500	0.0499	100	0.0464	93	55-155	7	25	mg/kg	02/22/13 11:36	
m,p-Xylenes	<0.000185	0.100	0.106	106	0.0979	98	78-127	8	25	mg/kg	02/22/13 11:36	
Methylene Chloride	0.00649	0.0500	0.0515	103	0.0486	97	57-134	6	25	mg/kg	02/22/13 11:36	

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QC Summary 457983

Southwest Research Institute

Jet Fuel

Analytical Method: VOAs by SW-846 8260B — Prep Method: SW5030B
Seq Number: 907617 — Matrix: Solid — Date Prep: 02/22/2013
MB Sample Id: 634196-1-BLK — LCS Sample Id: 634196-1-BKS — LCSD Sample Id: 634196-1-BSD

Parameter	MB Result	Spike Amount	LCS Result	LCS %Rec	LCSD Result	LCSD %Rec	Limits	%RPD	RPD Limit	Units	Analysis Date	Flag
MTBE	<0.000142	0.100	0.114	114	0.107	107	64-148	6	25	mg/kg	02/22/13 11:36	
Naphthalene	<0.000148	0.0500	0.0491	98	0.0481	96	53-162	2	25	mg/kg	02/22/13 11:36	
n-Butylbenzene	<0.0000990	0.0500	0.0527	105	0.0494	99	82-127	6	25	mg/kg	02/22/13 11:36	
n-Propylbenzene	<0.000137	0.0500	0.0538	108	0.0496	99	84-131	8	25	mg/kg	02/22/13 11:36	
o-Xylene	<0.000149	0.0500	0.0512	102	0.0473	95	79-125	8	25	mg/kg	02/22/13 11:36	
p-Cymene (p-Isopropyltoluene)	<0.0000800	0.0500	0.0548	110	0.0513	103	84-130	7	25	mg/kg	02/22/13 11:36	
Sec-Butylbenzene	<0.000121	0.0500	0.0535	107	0.0494	99	84-131	8	25	mg/kg	02/22/13 11:36	
Styrene	<0.000158	0.0500	0.0554	111	0.0508	102	80-126	9	25	mg/kg	02/22/13 11:36	
tert-Butylbenzene	<0.0000900	0.0500	0.0529	106	0.0490	98	83-132	8	25	mg/kg	02/22/13 11:36	
Tetrachloroethylene	<0.000173	0.0500	0.0493	99	0.0455	91	79-124	8	25	mg/kg	02/22/13 11:36	
Toluene	<0.000117	0.0500	0.0475	95	0.0442	88	74-122	7	25	mg/kg	02/22/13 11:36	
trans-1,2-dichloroethene	<0.000123	0.0500	0.0456	91	0.0420	84	63-110	8	25	mg/kg	02/22/13 11:36	
trans-1,3-dichloropropene	<0.000361	0.0500	0.0440	88	0.0418	84	73-125	5	25	mg/kg	02/22/13 11:36	
Trichloroethene	<0.000147	0.0500	0.0519	104	0.0468	94	78-119	10	25	mg/kg	02/22/13 11:36	
Trichlorofluoromethane	<0.000186	0.0500	0.0448	90	0.0409	82	71-148	9	25	mg/kg	02/22/13 11:36	
Vinyl Acetate	<0.000213	0.500	0.553	111	0.498	100	40-154	10	25	mg/kg	02/22/13 11:36	
Vinyl Chloride	<0.000193	0.0500	0.0411	82	0.0371	74	60-123	10	25	mg/kg	02/22/13 11:36	

Surrogate	MB %Rec	MB Flag	LCS %Rec	LCS Flag	LCSD %Rec	LCSD Flag	Limits	Units	Analysis Date
Dibromofluoromethane	92		102		102		53-142	%	02/22/13 11:36
1,2-Dichloroethane-D4	101		101		98		56-150	%	02/22/13 11:36
Toluene-D8	100		101		101		70-130	%	02/22/13 11:36
4-Bromofluorobenzene	103		101		99		68-152	%	02/22/13 11:36

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QC Summary 457983

Southwest Research Institute

Jet Fuel

Analytical Method: VOAs by SW-846 8260B — Prep Method: SW5030B

Seq Number: 907617 — Matrix: Product — Date Prep: 02/22/2013

Parent Sample Id: 457697-002 — MS Sample Id: 457697-002 S — MSD Sample Id: 457697-002 SD

Parameter	Parent Result	Spike Amount	MS Result	MS %Rec	MSD Result	MSD %Rec	Limits	%RPD	RPD Limit	Units	Analysis Date	Flag
1,1,1,2-Tetrachloroethane	<3.70	1250	1150	92	1160	93	72-125	1	25	mg/kg	02/22/13 14:28	
1,1,1-Trichloroethane	<15.1	1250	1100	88	1110	89	75-125	1	25	mg/kg	02/22/13 14:28	
1,1,2,2-Tetrachloroethane	<4.85	1250	2560	205	2760	221	74-125	8	25	mg/kg	02/22/13 14:28	M1
1,1,2-Trichloroethane	<5.63	1250	1400	112	1460	117	75-127	4	25	mg/kg	02/22/13 14:28	
1,1-Dichloroethane	<3.13	1250	1120	90	1140	91	72-125	2	25	mg/kg	02/22/13 14:28	
1,1-Dichloroethene	<4.80	1250	992	79	998	80	59-172	1	25	mg/kg	02/22/13 14:28	
1,1-Dichloropropene	<4.95	1250	1060	85	1060	85	75-125	0	25	mg/kg	02/22/13 14:28	
1,2,3-Trichlorobenzene	<2.65	1250	1340	107	1400	112	75-137	4	25	mg/kg	02/22/13 14:28	
1,2,3-Trichloropropane	<8.98	1250	1230	98	1270	102	75-125	3	25	mg/kg	02/22/13 14:28	
1,2,4-Trichlorobenzene	<4.78	1250	1310	105	1340	107	75-135	2	25	mg/kg	02/22/13 14:28	
1,2,4-Trimethylbenzene	13500	1250	13200	0	14200	56	75-125	7	25	mg/kg	02/22/13 14:28	M3
1,2-Dibromo-3-Chloropropane	<26.7	1250	1430	114	1530	122	59-125	7	25	mg/kg	02/22/13 14:28	
1,2-Dibromoethane	<4.83	1250	1180	94	1190	95	73-125	1	25	mg/kg	02/22/13 14:28	
1,2-Dichlorobenzene	<3.23	1250	1140	91	1160	93	75-125	2	25	mg/kg	02/22/13 14:28	
1,2-Dichloroethane	<4.43	1250	1070	86	1090	87	68-127	2	25	mg/kg	02/22/13 14:28	
1,2-Dichloropropane	<4.05	1250	1100	88	1130	90	74-125	3	25	mg/kg	02/22/13 14:28	
1,3,5-Trimethylbenzene	3790	1250	4590	64	4830	83	70-130	5	25	mg/kg	02/22/13 14:28	M3
1,3-Dichlorobenzene	<3.98	1250	1150	92	1160	93	75-125	1	25	mg/kg	02/22/13 14:28	
1,3-Dichloropropane	<5.68	1250	1170	94	1200	96	75-125	3	25	mg/kg	02/22/13 14:28	
1,4-Dichlorobenzene	<2.43	1250	1120	90	1130	90	75-125	1	25	mg/kg	02/22/13 14:28	
2,2-Dichloropropane	<3.18	1250	1030	82	1120	90	75-125	8	25	mg/kg	02/22/13 14:28	
2-Butanone	<43.2	15000	13700	91	14100	94	75-125	3	25	mg/kg	02/22/13 14:28	
2-Chlorotoluene	<5.43	1250	1180	94	1190	95	73-125	1	25	mg/kg	02/22/13 14:28	
2-Hexanone	<28.0	15000	13900	93	15900	106	75-125	13	25	mg/kg	02/22/13 14:28	
4-Chlorotoluene	<2.95	1250	1490	119	1510	121	74-125	1	25	mg/kg	02/22/13 14:28	
Acetone	212	15000	11900	78	12400	81	50-150	4	25	mg/kg	02/22/13 14:28	
Benzene	13.3	1250	1070	85	1100	87	66-142	3	25	mg/kg	02/22/13 14:28	
Bromobenzene	<4.95	1250	1140	91	1150	92	75-125	1	25	mg/kg	02/22/13 14:28	
Bromochloromethane	<5.38	1250	1020	82	1060	85	60-140	4	25	mg/kg	02/22/13 14:28	
Bromodichloromethane	<4.65	1250	1190	95	1210	97	75-125	2	25	mg/kg	02/22/13 14:28	
Bromoform	<9.83	1250	926	74	921	74	75-125	1	25	mg/kg	02/22/13 14:28	M2
Bromomethane	<6.85	1250	845	68	857	69	60-140	1	25	mg/kg	02/22/13 14:28	
Carbon Disulfide	4.50	13800	13300	96	13500	98	60-140	1	25	mg/kg	02/22/13 14:28	
Carbon Tetrachloride	<3.30	1250	1070	86	1090	87	62-125	2	25	mg/kg	02/22/13 14:28	
Chlorobenzene	<2.60	1250	1110	89	1120	90	60-133	1	25	mg/kg	02/22/13 14:28	
Chloroethane	<6.35	1250	892	71	893	71	60-140	0	25	mg/kg	02/22/13 14:28	
Chloroform	<3.48	1250	1100	88	1130	90	74-125	3	25	mg/kg	02/22/13 14:28	
Chloromethane	<8.05	1250	968	77	1000	80	60-140	3	25	mg/kg	02/22/13 14:28	
cis-1,2-Dichloroethene	<4.13	1250	1130	90	1160	93	75-125	3	25	mg/kg	02/22/13 14:28	
cis-1,3-Dichloropropene	<3.20	1250	1250	100	1290	103	74-125	3	25	mg/kg	02/22/13 14:28	
Dibromochloromethane	<10.6	1250	965	77	984	79	73-125	2	25	mg/kg	02/22/13 14:28	
Dibromomethane	<6.50	1250	1100	88	1140	91	69-127	4	25	mg/kg	02/22/13 14:28	
Dichlorodifluoromethane	<12.1	1250	1110	89	1140	91	65-135	3	25	mg/kg	02/22/13 14:28	
Ethylbenzene	1570	1250	2540	78	2640	86	75-125	4	25	mg/kg	02/22/13 14:28	
Hexachlorobutadiene	<8.65	1250	1240	99	1240	99	75-125	0	25	mg/kg	02/22/13 14:28	
Iodomethane (Methyl Iodide)	<5.00	1250	1030	82	1040	83	75-125	1	25	mg/kg	02/22/13 14:28	
isopropylbenzene	684	1250	1720	83	1780	88	75-125	3	25	mg/kg	02/22/13 14:28	
m,p-Xylenes	6510	2500	7940	57	8340	73	75-125	5	25	mg/kg	02/22/13 14:28	M2
Methylene Chloride	170	1250	1120	76	1150	78	75-125	3	25	mg/kg	02/22/13 14:28	

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Southwest Research Institute

Jet Fuel

Analytical Method: VOAs by SW-846 8260B | Prep Method: SW5030B

Seq Number: 907617 | Matrix: Product | Date Prep: 02/22/2013

Parent Sample Id: 457697-002 | MS Sample Id: 457697-002 S | MSD Sample Id: 457697-002 SD

Parameter	Parent Result	Spike Amount	MS Result	MS %Rec	MSD Result	MSD %Rec	Limits	%RPD	RPD Limit	Units	Analysis Date	Flag
MTBE	<3.55	2500	2590	104	2690	108	60-140	4	25	mg/kg	02/22/13 14:28	
Naphthalene	1350	1250	2540	95	2740	111	70-130	8	25	mg/kg	02/22/13 14:28	
n-Butylbenzene	1730	1250	2780	84	2960	98	75-125	6	25	mg/kg	02/22/13 14:28	
n-Propylbenzene	2010	1250	3030	82	3180	94	75-125	5	25	mg/kg	02/22/13 14:28	
o-Xylene	3440	1250	4190	60	4400	77	75-125	5	25	mg/kg	02/22/13 14:28	M2
p-Cymene (p-Isopropyltoluene)	708	1250	1850	91	1930	98	75-125	4	25	mg/kg	02/22/13 14:28	
Sec-Butylbenzene	799	1250	1930	90	1990	95	75-125	3	25	mg/kg	02/22/13 14:28	
Styrene	<3.95	1250	1370	110	1390	111	75-125	1	25	mg/kg	02/22/13 14:28	
tert-Butylbenzene	42.5	1250	1270	98	1280	99	75-125	1	25	mg/kg	02/22/13 14:28	
Tetrachloroethylene	<4.33	1250	1100	88	1110	89	71-125	1	25	mg/kg	02/22/13 14:28	
Toluene	662	1250	1670	81	1710	84	59-139	2	25	mg/kg	02/22/13 14:28	
trans-1,2-dichloroethene	<3.08	1250	1020	82	1040	83	75-125	2	25	mg/kg	02/22/13 14:28	
trans-1,3-dichloropropene	<9.03	1250	969	78	1020	82	66-125	5	25	mg/kg	02/22/13 14:28	
Trichloroethene	<3.68	1250	1130	90	1140	91	62-137	1	25	mg/kg	02/22/13 14:28	
Trichlorofluoromethane	<4.65	1250	947	76	983	79	67-125	4	25	mg/kg	02/22/13 14:28	
Vinyl Acetate	<5.33	12500	12000	96	12400	99	60-140	3	25	mg/kg	02/22/13 14:28	
Vinyl Chloride	<4.83	1250	879	70	890	71	60-140	1	25	mg/kg	02/22/13 14:28	

Surrogate	MS %Rec	MS Flag	MSD %Rec	MSD Flag	Limits	Units	Analysis Date
Dibromofluoromethane	100		101		53-142	%	02/22/13 14:28
1,2-Dichloroethane-D4	100		98		56-150	%	02/22/13 14:28
Toluene-D8	105		104		70-130	%	02/22/13 14:28
4-Bromofluorobenzene	109		108		68-152	%	02/22/13 14:28

XENCO Laboratories

Prelogin/Nonconformance Report- Sample Log-In

Client: Southwest Research Institute

Date/ Time Received: 02/20/2013 12:00:00 PM

Work Order #: 457983

Acceptable Temperature Range: 0 - 6 degC
Air and Metal samples Acceptable Range: Ambient

Temperature Measuring device used : r-31

Sample Receipt Checklist		Comments
#1 *Temperature of cooler(s)?	20	
#2 *Shipping container in good condition?	Yes	
#3 *Samples received on ice?	Yes	
#4 *Custody Seals intact on shipping container/ cooler?	No	
#5 Custody Seals intact on sample bottles?	No	
#6 *Custody Seals Signed and dated?	No	
#7 *Chain of Custody present?	Yes	
#8 Sample instructions complete on Chain of Custody?	Yes	
#9 Any missing/extra samples?	No	
#10 Chain of Custody signed when relinquished/ received?	Yes	
#11 Chain of Custody agrees with sample label(s)?	Yes	
#12 Container label(s) legible and intact?	Yes	
#13 Sample matrix/ properties agree with Chain of Custody?	Yes	
#14 Samples in proper container/ bottle?	Yes	
#15 Samples properly preserved?	N/A	
#16 Sample container(s) intact?	Yes	
#17 Sufficient sample amount for indicated test(s)?	Yes	
#18 All samples received within hold time?	Yes	
#19 Subcontract of sample(s)?	N/A	
#20 VOC samples have zero headspace (less than 1/4 inch bubble)?	N/A	
#21 <2 for all samples preserved with HNO3,HCL, H2SO4?	N/A	
#22 >10 for all samples preserved with NaAsO2+NaOH, ZnAc+NaOH?	N/A	

*** Must be completed for after-hours delivery of samples prior to placing in the refrigerator**

Analyst: tt	PH Device/Lot#:

Checklist completed by: Tanya Torres Date: 02/21/2013

Checklist reviewed by: Date: 02/21/2013

Appendix BN
EPA Testing Reports: CL12-4716 and CL12-4717

Analytical Report 457697

for

Southwest Research Institute

Project Manager: Scott Hutzler

Jet Fuel

CL12-4367

25-FEB-13

Collected By: Client

Trans West Analytical Services, LLC

3725 E. Atlanta Ave, Phoenix, AZ 85040
Ph: (602) 437-0330

Xenco-Houston (EPA Lab code: TX00122):
Texas (T104704215-10-6-TX), Arizona (AZ0765), Arkansas (08-039-0), Connecticut (PH-0102), Florida (E871002)
Illinois (002082), Indiana (C-TX-02), Iowa (392), Kansas (E-10380), Kentucky (45), Louisiana (03054)
New Hampshire (297408), New Jersey (TX007), New York (11763), Oklahoma (9218), Pennsylvania (68-03610)
Rhode Island (LAO00312), USDA (S-44102), DoD (L11-54)

Xenco-Atlanta (EPA Lab Code: GA00046):
Florida (E87429), North Carolina (483), South Carolina (98015), Kentucky (85), DoD (L10-135)
Louisiana (04176), USDA (P330-07-00105)

Xenco-Tampa Mobile (EPA Lab code: FL01212): Florida (E84900)
Xenco-Lakeland: Florida (E84098)
Xenco-Odessa (EPA Lab code: TX00158): Texas (T104704400-TX)
Xenco-Dallas (EPA Lab code: TX01468): Texas (T104704295-TX)
Xenco Phoenix (EPA Lab Code: AZ00901): Arizona(AZ0757)
Xenco-Phoenix Mobile (EPA Lab code: AZ00901): Arizona (AZM757)
Xenco Tucson (EPA Lab code:AZ000989): Arizona (AZ0758)

XENCO Laboratories
Trans West Analytical Services, LLC

25-FEB-13

Project Manager: **Scott Hutzler**
Southwest Research Institute
6220 Culebra Road
P.O. Box 28510
San Antonio, TX 78228

Reference: XENCO Report No(s): **457697**
Jet Fuel
Project Address:

Scott Hutzler :

We are reporting to you the results of the analyses performed on the samples received under the project name referenced above and identified with the XENCO Report Number(s) 457697. All results being reported under this Report Number apply to the samples analyzed and properly identified with a Laboratory ID number. Subcontracted analyses are identified in this report with either the NELAC certification number of the subcontract lab in the analyst ID field, or the complete subcontracted report attached to this report.

Unless otherwise noted in a Case Narrative, all data reported in this Analytical Report are in compliance with NELAC standards. The uncertainty of measurement associated with the results of analysis reported is available upon request. Should insufficient sample be provided to the laboratory to meet the method and NELAC Matrix Duplicate and Matrix Spike requirements, then the data will be analyzed, evaluated and reported using all other available quality control measures.

The validity and integrity of this report will remain intact as long as it is accompanied by this letter and reproduced in full, unless written approval is granted by XENCO Laboratories. This report will be filed for at least 5 years in our archives after which time it will be destroyed without further notice, unless otherwise arranged with you. The samples received, and described as recorded in Report No. 457697 will be filed for 60 days, and after that time they will be properly disposed without further notice, unless otherwise arranged with you. We reserve the right to return to you any unused samples, extracts or solutions related to them if we consider so necessary (e.g., samples identified as hazardous waste, sample sizes exceeding analytical standard practices, controlled substances under regulated protocols, etc).

We thank you for selecting XENCO Laboratories to serve your analytical needs. If you have any questions concerning this report, please feel free to contact us at any time.

Respectfully,

Skip Harden
Project Manager

Recipient of the Prestigious Small Business Administration Award of Excellence in 1994.
Certified and approved by numerous States and Agencies.
A Small Business and Minority Status Company that delivers SERVICE and QUALITY

Houston - Dallas - Odessa - San Antonio - Tampa - Lakeland - Atlanta - Phoenix - Oklahoma - Latin America

CASE NARRATIVE

Client Name: Southwest Research Institute
Project Name: Jet Fuel

Project ID:	*CL12-4367*	Report Date:	*25-FEB-13*
Work Order Number(s):	*457697*	Date Received:	*02/14/2013*

Sample receipt non conformances and comments:
None

Sample receipt non conformances and comments per sample:

None

XENCO Laboratories
Trans West Analytical Services, LLC

Flagging Criteria

Arizona Flags

All method blanks, laboratory spikes, and/or matrix spikes met quality control objectives for the parameters associated with this Work Order except as detailed below or on the Data Qualifier page of this report. Data Qualifiers used in this report are in accordance with ADEQ Arizona Data Qualifiers, Revision 3.0 9/20/2007. Data qualifiers (flags) contained within this analytical report have been issued to explain a quality control deficiency, and do not affect the quality (validity) of the data unless noted otherwise in the case narrative.

D1 Sample required dilution due to matrix.

D2 Sample required dilution due to high concentration of target analyte.

M1 Matrix spike recovery was high; the associated blank spike recovery was acceptable.

M2 Matrix spike recovery was low; the associated blank spike recovery was acceptable.

M3 The spike recovery value is unusable since the analyte concentration in the sample is disproportionate to spike level. The associated blank spike recovery was acceptable.

S8 The analysis of the sample required a dilution such that the surrogate recovery calculation does not provide any useful information. The associated blank spike recovery was acceptable.

T4 Tentatively identified compound. Concentration is estimated and based on the closest internal standard.

XENCO Laboratories
Trans West Analytical Services, LLC

Sample Cross Reference 457697

Southwest Research Institute, San Antonio, TX

Jet Fuel

Sample Id	Matrix	Date Collected	Sample Depth	Lab Sample Id
CL12-4716	W	02-13-13 00:00		457697-001
CL12-4717	W	02-13-13 00:00		457697-002

XENCO Laboratories
Trans West Analytical Services, LLC

Certificate of Analytical Results 457697

Southwest Research Institute, San Antonio, TX

Jet Fuel

Sample Id:	**CL12-4716**	Matrix: Product	Date Received: 02.14.13 09.30
Lab Sample Id:	**457697-001**	Date Collected: 02.13.13 00.00	

Analytical Method:	**SVOCs by SW-846 8270C**			Prep Method: SW3550	
Tech:	COR			% Moisture:	
Analyst:	WEW	Date Prep:	02.18.13 08.30	Basis: Wet Weight	
Seq Number:	907226			SUB: AZ0765	

Parameter	Cas Number	Result	RL	Units	Analysis Date	Flag	Dil
1,2,4-Trichlorobenzene	120-82-1	<500	500	mg/kg	02.18.13 18.09	D1	3000
1,2-Dichlorobenzene	95-50-1	<500	500	mg/kg	02.18.13 18.09	D1	3000
1,3-Dichlorobenzene	541-73-1	<500	500	mg/kg	02.18.13 18.09	D1	3000
1,4-Dichlorobenzene	106-46-7	<500	500	mg/kg	02.18.13 18.09	D1	3000
2,4,5-Trichlorophenol	95-95-4	<500	500	mg/kg	02.18.13 18.09	D1	3000
2,4,6-Trichlorophenol	88-06-2	<500	500	mg/kg	02.18.13 18.09	D1	3000
2,4-Dichlorophenol	120-83-2	<500	500	mg/kg	02.18.13 18.09	D1	3000
2,4-Dimethylphenol	105-67-9	<500	500	mg/kg	02.18.13 18.09	D1	3000
2,4-Dinitrophenol	51-28-5	<1000	1000	mg/kg	02.18.13 18.09	D1	3000
2,4-Dinitrotoluene	121-14-2	<500	500	mg/kg	02.18.13 18.09	D1	3000
2,6-Dinitrotoluene	606-20-2	<500	500	mg/kg	02.18.13 18.09	D1	3000
2-Chloronaphthalene	91-58-7	<500	500	mg/kg	02.18.13 18.09	D1	3000
2-Chlorophenol	95-57-8	<500	500	mg/kg	02.18.13 18.09	D1	3000
2-Methylnaphthalene	91-57-6	**1470**	500	mg/kg	02.18.13 18.09	D2	3000
2-methylphenol	95-48-7	<500	500	mg/kg	02.18.13 18.09	D1	3000
2-Nitroaniline	88-74-4	<1000	1000	mg/kg	02.18.13 18.09	D1	3000
2-Nitrophenol	88-75-5	<500	500	mg/kg	02.18.13 18.09	D1	3000
3&4-Methylphenol	15831-10-4	<500	500	mg/kg	02.18.13 18.09	D1	3000
3,3-Dichlorobenzidine	91-94-1	<1000	1000	mg/kg	02.18.13 18.09	D1	3000
3-Nitroaniline	99-09-2	<1000	1000	mg/kg	02.18.13 18.09	D1	3000
4,6-dinitro-2-methyl phenol	534-52-1	<1000	1000	mg/kg	02.18.13 18.09	D1	3000
4-Bromophenyl-phenylether	101-55-3	<500	500	mg/kg	02.18.13 18.09	D1	3000
4-chloro-3-methylphenol	59-50-7	<500	500	mg/kg	02.18.13 18.09	D1	3000
4-Chloroaniline	106-47-8	<1000	1000	mg/kg	02.18.13 18.09	D1	3000
4-Chlorophenyl-phenyl ether	7005-72-3	<500	500	mg/kg	02.18.13 18.09	D1	3000
4-Nitroaniline	100-01-6	<1000	1000	mg/kg	02.18.13 18.09	D1	3000
4-Nitrophenol	100-02-7	<1000	1000	mg/kg	02.18.13 18.09	D1	3000
Acenaphthene	83-32-9	<500	500	mg/kg	02.18.13 18.09	D1	3000
Acenaphthylene	208-96-8	<500	500	mg/kg	02.18.13 18.09	D1	3000
Aniline (Phenylamine, Aminobenzene)	62-53-3	<1000	1000	mg/kg	02.18.13 18.09	D1	3000
Anthracene	120-12-7	<500	500	mg/kg	02.18.13 18.09	D1	3000
Benzo(a)anthracene	56-55-3	<500	500	mg/kg	02.18.13 18.09	D1	3000
Benzo(a)pyrene	50-32-8	<500	500	mg/kg	02.18.13 18.09	D1	3000
Benzo(b)fluoranthene	205-99-2	<500	500	mg/kg	02.18.13 18.09	D1	3000
Benzo(g,h,i)perylene	191-24-2	<500	500	mg/kg	02.18.13 18.09	D1	3000
Benzo(k)fluoranthene	207-08-9	<500	500	mg/kg	02.18.13 18.09	D1	3000
Benzoic Acid	65-85-0	<3000	3000	mg/kg	02.18.13 18.09	D1	3000
Benzyl Butyl Phthalate	85-68-7	<500	500	mg/kg	02.18.13 18.09	D1	3000
bis(2-chloroethoxy) methane	111-91-1	<500	500	mg/kg	02.18.13 18.09	D1	3000
bis(2-chloroethyl) ether	111-44-4	<500	500	mg/kg	02.18.13 18.09	D1	3000
bis(2-chloroisopropyl) ether	39638-32-9	<500	500	mg/kg	02.18.13 18.09	D1	3000

XENCO Laboratories
Trans West Analytical Services, LLC

Certificate of Analytical Results 457697

Southwest Research Institute, San Antonio, TX

Jet Fuel

Sample Id: **CL12-4716** Matrix: Product Date Received: 02.14.13 09.30
Lab Sample Id: **457697-001** Date Collected: 02.13.13 00.00

Analytical Method: **SVOCs by SW-846 8270C** Prep Method: SW3550
Tech: COR % Moisture:
Analyst: WEW Date Prep: 02.18.13 08.30 Basis: Wet Weight
Seq Number: 907226 SUB: AZ0765

Parameter	Cas Number	Result	RL	Units	Analysis Date	Flag	Dil
bis(2-ethylhexyl) phthalate	117-81-7	<500	500	mg/kg	02.18.13 18.09	D1	3000
Chrysene	218-01-9	<500	500	mg/kg	02.18.13 18.09	D1	3000
Dibenz(a,h)Anthracene	53-70-3	<500	500	mg/kg	02.18.13 18.09	D1	3000
Dibenzofuran	132-64-9	<500	500	mg/kg	02.18.13 18.09	D1	3000
Diethyl Phthalate	84-66-2	<500	500	mg/kg	02.18.13 18.09	D1	3000
Dimethyl Phthalate	131-11-3	<500	500	mg/kg	02.18.13 18.09	D1	3000
di-n-Butyl Phthalate	84-74-2	<500	500	mg/kg	02.18.13 18.09	D1	3000
di-n-Octyl Phthalate	117-84-0	<500	500	mg/kg	02.18.13 18.09	D1	3000
Fluoranthene	206-44-0	<500	500	mg/kg	02.18.13 18.09	D1	3000
Fluorene	86-73-7	<500	500	mg/kg	02.18.13 18.09	D1	3000
Hexachlorobenzene	118-74-1	<500	500	mg/kg	02.18.13 18.09	D1	3000
Hexachlorobutadiene	87-68-3	<500	500	mg/kg	02.18.13 18.09	D1	3000
Hexachlorocyclopentadiene	77-47-4	<500	500	mg/kg	02.18.13 18.09	D1	3000
Hexachloroethane	67-72-1	<500	500	mg/kg	02.18.13 18.09	D1	3000
Indeno(1,2,3-c,d)Pyrene	193-39-5	<500	500	mg/kg	02.18.13 18.09	D1	3000
Isophorone	78-59-1	<500	500	mg/kg	02.18.13 18.09	D1	3000
Naphthalene	91-20-3	**1770**	500	mg/kg	02.18.13 18.09	D2	3000
Nitrobenzene	98-95-3	<500	500	mg/kg	02.18.13 18.09	D1	3000
N-Nitrosodi-n-Propylamine	621-64-7	<500	500	mg/kg	02.18.13 18.09	D1	3000
N-Nitrosodiphenylamine	86-30-6	<500	500	mg/kg	02.18.13 18.09	D1	3000
Pentachlorophenol	87-86-5	<1000	1000	mg/kg	02.18.13 18.09	D1	3000
Phenanthrene	85-01-8	<500	500	mg/kg	02.18.13 18.09	D1	3000
Phenol	108-95-2	<1000	1000	mg/kg	02.18.13 18.09	D1	3000
Pyrene	129-00-0	<500	500	mg/kg	02.18.13 18.09	D1	3000
Pyridine	110-86-1	<1000	1000	mg/kg	02.18.13 18.09	D1	3000
2-Octenal, (E)- (TIC)	TIC	**2040**		mg/kg	02.18.13 18.09	D2T4	3000
Benzene, 1,3-dimethyl- (TIC)	TIC	**1520**		mg/kg	02.18.13 18.09	D2T4	3000
Benzene, 1-ethyl-2-methyl- (TIC)	TIC	**4570**		mg/kg	02.18.13 18.09	D2T4	3000
Benzene, 1-ethyl-2-methyl- (TIC)	TIC	**2120**		mg/kg	02.18.13 18.09	D2T4	3000
Benzene, 1-methyl-2-(1-methylethyl)- (TIC)	TIC	**1610**		mg/kg	02.18.13 18.09	D2T4	3000
Benzene, 1-methyl-3-propyl- (TIC)	TIC	**2820**		mg/kg	02.18.13 18.09	D2T4	3000
Benzene, 1-methyl-4-(1-methylethyl)- (TIC)	TIC	**2250**		mg/kg	02.18.13 18.09	D2T4	3000
Cycloheptane, methyl- (TIC)	TIC	**3060**		mg/kg	02.18.13 18.09	D2T4	3000
Cyclohexane, propyl- (TIC)	TIC	**2120**		mg/kg	02.18.13 18.09	D2T4	3000
Cyclooctane, 1,4-dimethyl-, cis- (TIC)	TIC	**1520**		mg/kg	02.18.13 18.09	D2T4	3000
Decane (TIC)	TIC	**8650**		mg/kg	02.18.13 18.09	D2T4	3000
Decane, 3-methyl- (TIC)	TIC	**2350**		mg/kg	02.18.13 18.09	D2T4	3000
Ether, hexyl pentyl (TIC)	TIC	**1500**		mg/kg	02.18.13 18.09	D2T4	3000
Naphthalene, 2,6-dimethyl- (TIC)	TIC	**1840**		mg/kg	02.18.13 18.09	D2T4	3000
Nonane (TIC)	TIC	**6800**		mg/kg	02.18.13 18.09	D2T4	3000
Nonane, 4-methyl- (TIC)	TIC	**2870**		mg/kg	02.18.13 18.09	D2T4	3000

XENCO Laboratories
Trans West Analytical Services, LLC

Certificate of Analytical Results 457697

Southwest Research Institute, San Antonio, TX

Jet Fuel

Sample Id: **CL12-4716** Matrix: Product Date Received: 02.14.13 09.30
Lab Sample Id: **457697-001** Date Collected: 02.13.13 00.00

Analytical Method: **SVOCs by SW-846 8270C** Prep Method: SW3550
Tech: COR % Moisture:
Analyst: WEW Date Prep: 02.18.13 08.30 Basis: Wet Weight
Seq Number: 907226 SUB: AZ0765

Parameter	Cas Number	Result	RL	Units	Analysis Date	Flag	Dil
Octane, 2,6-dimethyl- (TIC)	TIC	**3280**		mg/kg	02.18.13 18.09	D2T4	3000
Tridecane (TIC)	TIC	**1860**		mg/kg	02.18.13 18.09	D2T4	3000
Tridecane (TIC)	TIC	**6040**		mg/kg	02.18.13 18.09	D2T4	3000
Undecane (TIC)	TIC	**5610**		mg/kg	02.18.13 18.09	D2T4	3000

Surrogate	Cas Number	% Recovery	Units	Limits	Analysis Date	Flag
2-Fluorophenol	367-12-4	0	%	25-121	02.18.13 18.09	S8
Phenol-d6	13127-88-3	0	%	24-113	02.18.13 18.09	S8
Nitrobenzene-d5	4165-60-0	0	%	23-120	02.18.13 18.09	S8
2-Fluorobiphenyl	321-60-8	66	%	30-115	02.18.13 18.09	
2,4,6-Tribromophenol	118-79-6	70	%	19-122	02.18.13 18.09	
Terphenyl-D14	1718-51-0	88	%	18-137	02.18.13 18.09	

XENCO Laboratories
Trans West Analytical Services, LLC

Certificate of Analytical Results 457697

Southwest Research Institute, San Antonio, TX

Jet Fuel

Sample Id: **CL12-4716** Matrix: Product Date Received: 02.14.13 09.30
Lab Sample Id: **457697-001** Date Collected: 02.13.13 00.00

Analytical Method: **VOAs by SW-846 8260B** Prep Method: SW5030B
Tech: MCH % Moisture:
Analyst: ZHO Date Prep: 02.21.13 17.10 Basis: Wet Weight
Seq Number: 907536 SUB: AZ0765

Dilution Analysis:
Seq#: 907536 Date Analyzed: 02/21/13 18:32 Date Prep: 02/21/13 17:12

Parameter	Cas Number	Result	RL	Units	Analysis Date	Flag	Dil
1,1,1,2-Tetrachloroethane	630-20-6	<125	125	mg/kg	02.21.13 18.10	D1	25000
1,1,1-Trichloroethane	71-55-6	<125	125	mg/kg	02.21.13 18.10	D1	25000
1,1,2,2-Tetrachloroethane	79-34-5	<125	125	mg/kg	02.21.13 18.10	D1	25000
1,1,2-Trichloroethane	79-00-5	<125	125	mg/kg	02.21.13 18.10	D1	25000
1,1-Dichloroethane	75-34-3	<125	125	mg/kg	02.21.13 18.10	D1	25000
1,1-Dichloroethene	75-35-4	<125	125	mg/kg	02.21.13 18.10	D1	25000
1,1-Dichloropropene	563-58-6	<125	125	mg/kg	02.21.13 18.10	D1	25000
1,2,3-Trichlorobenzene	87-61-6	<125	125	mg/kg	02.21.13 18.10	D1	25000
1,2,3-Trichloropropane	96-18-4	<125	125	mg/kg	02.21.13 18.10	D1	25000
1,2,4-Trichlorobenzene	120-82-1	<125	125	mg/kg	02.21.13 18.10	D1	25000
1,2,4-Trimethylbenzene	95-63-6	**5630**	625	mg/kg	02.21.13 18.32	D2	125000
1,2-Dibromo-3-Chloropropane	96-12-8	<125	125	mg/kg	02.21.13 18.10	D1	25000
1,2-Dibromoethane	106-93-4	<125	125	mg/kg	02.21.13 18.10	D1	25000
1,2-Dichlorobenzene	95-50-1	<125	125	mg/kg	02.21.13 18.10	D1	25000
1,2-Dichloroethane	107-06-2	<125	125	mg/kg	02.21.13 18.10	D1	25000
1,2-Dichloropropane	78-87-5	<125	125	mg/kg	02.21.13 18.10	D1	25000
1,3,5-Trimethylbenzene	108-67-8	**2690**	125	mg/kg	02.21.13 18.10	D2	25000
1,3-Dichlorobenzene	541-73-1	<125	125	mg/kg	02.21.13 18.10	D1	25000
1,3-Dichloropropane	142-28-9	<125	125	mg/kg	02.21.13 18.10	D1	25000
1,4-Dichlorobenzene	106-46-7	<125	125	mg/kg	02.21.13 18.10	D1	25000
2,2-Dichloropropane	594-20-7	<125	125	mg/kg	02.21.13 18.10	D1	25000
2-Butanone	78-93-3	<1250	1250	mg/kg	02.21.13 18.10	D1	25000
2-Chlorotoluene	95-49-8	<125	125	mg/kg	02.21.13 18.10	D1	25000
2-Hexanone	591-78-6	<1250	1250	mg/kg	02.21.13 18.10	D1	25000
4-Chlorotoluene	106-43-4	<125	125	mg/kg	02.21.13 18.10	D1	25000
Acetone	67-64-1	<2500	2500	mg/kg	02.21.13 18.10	D1	25000
Benzene	71-43-2	<125	125	mg/kg	02.21.13 18.10	D1	25000
Bromobenzene	108-86-1	<125	125	mg/kg	02.21.13 18.10	D1	25000
Bromochloromethane	74-97-5	<125	125	mg/kg	02.21.13 18.10	D1	25000
Bromodichloromethane	75-27-4	<125	125	mg/kg	02.21.13 18.10	D1	25000
Bromoform	75-25-2	<125	125	mg/kg	02.21.13 18.10	D1	25000
Bromomethane	74-83-9	<125	125	mg/kg	02.21.13 18.10	D1	25000
Carbon Disulfide	75-15-0	<1250	1250	mg/kg	02.21.13 18.10	D1	25000
Carbon Tetrachloride	56-23-5	<125	125	mg/kg	02.21.13 18.10	D1	25000
Chlorobenzene	108-90-7	<125	125	mg/kg	02.21.13 18.10	D1	25000
Chloroethane	75-00-3	<250	250	mg/kg	02.21.13 18.10	D1	25000
Chloroform	67-66-3	<125	125	mg/kg	02.21.13 18.10	D1	25000
Chloromethane	74-87-3	<250	250	mg/kg	02.21.13 18.10	D1	25000

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Certificate of Analytical Results 457697

Southwest Research Institute, San Antonio, TX

Jet Fuel

Sample Id: **CL12-4716** Matrix: Product Date Received: 02.14.13 09.30
Lab Sample Id: **457697-001** Date Collected: 02.13.13 00.00

Analytical Method: **VOAs by SW-846 8260B** Prep Method: SW5030B
Tech: MCH % Moisture:
Analyst: ZHO Date Prep: 02.21.13 17.10 Basis: Wet Weight
Seq Number: 907536 SUB: AZ0765

Parameter	Cas Number	Result	RL	Units	Analysis Date	Flag	Dil
cis-1,2-Dichloroethene	156-59-2	<125	125	mg/kg	02.21.13 18.10	D1	25000
cis-1,3-Dichloropropene	10061-01-5	<125	125	mg/kg	02.21.13 18.10	D1	25000
Dibromochloromethane	124-48-1	<125	125	mg/kg	02.21.13 18.10	D1	25000
Dibromomethane	74-95-3	<125	125	mg/kg	02.21.13 18.10	D1	25000
Dichlorodifluoromethane	75-71-8	<125	125	mg/kg	02.21.13 18.10	D1	25000
Ethylbenzene	100-41-4	**1130**	125	mg/kg	02.21.13 18.10	D2	25000
Hexachlorobutadiene	87-68-3	<125	125	mg/kg	02.21.13 18.10	D1	25000
Iodomethane (Methyl Iodide)	74-88-4	<500	500	mg/kg	02.21.13 18.10	D1	25000
isopropylbenzene	98-82-8	**481**	125	mg/kg	02.21.13 18.10	D2	25000
m,p-Xylenes	179601-23-1	**4660**	250	mg/kg	02.21.13 18.10	D2	25000
Methylene Chloride	75-09-2	<500	500	mg/kg	02.21.13 18.10	D1	25000
MTBE	1634-04-4	<125	125	mg/kg	02.21.13 18.10	D1	25000
Naphthalene	91-20-3	**1010**	250	mg/kg	02.21.13 18.10	D2	25000
n-Butylbenzene	104-51-8	**1230**	125	mg/kg	02.21.13 18.10	D2	25000
n-Propylbenzene	103-65-1	**1410**	125	mg/kg	02.21.13 18.10	D2	25000
o-Xylene	95-47-6	**2440**	125	mg/kg	02.21.13 18.10	D2	25000
p-Cymene (p-Isopropyltoluene)	99-87-6	**497**	125	mg/kg	02.21.13 18.10	D2	25000
Sec-Butylbenzene	135-98-8	**568**	125	mg/kg	02.21.13 18.10	D2	25000
Styrene	100-42-5	<125	125	mg/kg	02.21.13 18.10	D1	25000
tert-Butylbenzene	98-06-6	<125	125	mg/kg	02.21.13 18.10	D1	25000
Tetrachloroethylene	127-18-4	<125	125	mg/kg	02.21.13 18.10	D1	25000
Toluene	108-88-3	**493**	125	mg/kg	02.21.13 18.10	D2	25000
Total Xylenes	1330-20-7	**7100**	125	mg/kg	02.21.13 18.10	D2	25000
trans-1,2-dichloroethene	156-60-5	<125	125	mg/kg	02.21.13 18.10	D1	25000
trans-1,3-dichloropropene	10061-02-6	<125	125	mg/kg	02.21.13 18.10	D1	25000
Trichloroethene	79-01-6	<125	125	mg/kg	02.21.13 18.10	D1	25000
Trichlorofluoromethane	75-69-4	<125	125	mg/kg	02.21.13 18.10	D1	25000
Vinyl Acetate	108-05-4	<1250	1250	mg/kg	02.21.13 18.10	D1	25000
Vinyl Chloride	75-01-4	<50.0	50.0	mg/kg	02.21.13 18.10	D1	25000
Benzene, 1,2,3-trimethyl- (TIC)	TIC	**3140**		mg/kg	02.21.13 18.10	D2T4	25000
Benzene, 1,2,4,5-tetramethyl- (TIC)	TIC	**3040**		mg/kg	02.21.13 18.10	D2T4	25000
Benzene, 1-ethyl-2-methyl- (TIC)	TIC	**3110**		mg/kg	02.21.13 18.10	D2T4	25000
Benzene, 1-ethyl-3-methyl- (TIC)	TIC	**6870**		mg/kg	02.21.13 18.10	D2T4	25000
Benzene, 1-methyl-3-propyl- (TIC)	TIC	**3110**		mg/kg	02.21.13 18.10	D2T4	25000
Cyclohexane, propyl- (TIC)	TIC	**4100**		mg/kg	02.21.13 18.10	D2T4	25000
Dodecane (TIC)	TIC	**4650**		mg/kg	02.21.13 18.10	D2T4	25000
Dodecane, 2,6,10-trimethyl- (TIC)	TIC	**11200**		mg/kg	02.21.13 18.10	D2T4	25000
Nonane, 3-methyl- (TIC)	TIC	**3660**		mg/kg	02.21.13 18.10	D2T4	25000
Undecane (TIC)	TIC	**6890**		mg/kg	02.21.13 18.10	D2T4	25000

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Certificate of Analytical Results 457697

Southwest Research Institute, San Antonio, TX

Jet Fuel

Sample Id:	**CL12-4716**	Matrix: Product	Date Received: 02.14.13 09.30
Lab Sample Id:	**457697-001**	Date Collected: 02.13.13 00.00	

Analytical Method:	**VOAs by SW-846 8260B**			Prep Method: SW5030B
Tech:	MCH			% Moisture:
Analyst:	ZHO	Date Prep:	02.21.13 17.10	Basis: Wet Weight
Seq Number:	907536			SUB: AZ0765

Surrogate	Cas Number	% Recovery	Units	Limits	Analysis Date	Flag
Dibromofluoromethane	1868-53-7	97	%	53-142	02.21.13 18.10	
1,2-Dichloroethane-D4	17060-07-0	100	%	56-150	02.21.13 18.10	
Toluene-D8	2037-26-5	103	%	70-130	02.21.13 18.10	
4-Bromofluorobenzene	460-00-4	103	%	68-152	02.21.13 18.10	

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Certificate of Analytical Results 457697

Southwest Research Institute, San Antonio, TX

Jet Fuel

Sample Id:	**CL12-4717**	Matrix: Product	Date Received: 02.14.13 09.30
Lab Sample Id:	**457697-002**	Date Collected: 02.13.13 00.00	

Analytical Method:	**SVOCs by SW-846 8270C**			Prep Method: SW3550	
Tech:	COR			% Moisture:	
Analyst:	WEW	Date Prep:	02.18.13 08.33	Basis: Wet Weight	
Seq Number:	907226			SUB: AZ0765	

Parameter	Cas Number	Result	RL	Units	Analysis Date	Flag	Dil
1,2,4-Trichlorobenzene	120-82-1	<500	500	mg/kg	02.18.13 18.25	D1	3000
1,2-Dichlorobenzene	95-50-1	<500	500	mg/kg	02.18.13 18.25	D1	3000
1,3-Dichlorobenzene	541-73-1	<500	500	mg/kg	02.18.13 18.25	D1	3000
1,4-Dichlorobenzene	106-46-7	<500	500	mg/kg	02.18.13 18.25	D1	3000
2,4,5-Trichlorophenol	95-95-4	<500	500	mg/kg	02.18.13 18.25	D1	3000
2,4,6-Trichlorophenol	88-06-2	<500	500	mg/kg	02.18.13 18.25	D1	3000
2,4-Dichlorophenol	120-83-2	<500	500	mg/kg	02.18.13 18.25	D1	3000
2,4-Dimethylphenol	105-67-9	<500	500	mg/kg	02.18.13 18.25	D1	3000
2,4-Dinitrophenol	51-28-5	<1000	1000	mg/kg	02.18.13 18.25	D1	3000
2,4-Dinitrotoluene	121-14-2	<500	500	mg/kg	02.18.13 18.25	D1	3000
2,6-Dinitrotoluene	606-20-2	<500	500	mg/kg	02.18.13 18.25	D1	3000
2-Chloronaphthalene	91-58-7	<500	500	mg/kg	02.18.13 18.25	D1	3000
2-Chlorophenol	95-57-8	<500	500	mg/kg	02.18.13 18.25	D1	3000
2-Methylnaphthalene	91-57-6	**4270**	500	mg/kg	02.18.13 18.25	D2	3000
2-methylphenol	95-48-7	<500	500	mg/kg	02.18.13 18.25	D1	3000
2-Nitroaniline	88-74-4	<1000	1000	mg/kg	02.18.13 18.25	D1	3000
2-Nitrophenol	88-75-5	<500	500	mg/kg	02.18.13 18.25	D1	3000
3&4-Methylphenol	15831-10-4	<500	500	mg/kg	02.18.13 18.25	D1	3000
3,3-Dichlorobenzidine	91-94-1	<1000	1000	mg/kg	02.18.13 18.25	D1	3000
3-Nitroaniline	99-09-2	<1000	1000	mg/kg	02.18.13 18.25	D1	3000
4,6-dinitro-2-methyl phenol	534-52-1	<1000	1000	mg/kg	02.18.13 18.25	D1	3000
4-Bromophenyl-phenylether	101-55-3	<500	500	mg/kg	02.18.13 18.25	D1	3000
4-chloro-3-methylphenol	59-50-7	<500	500	mg/kg	02.18.13 18.25	D1	3000
4-Chloroaniline	106-47-8	<1000	1000	mg/kg	02.18.13 18.25	D1	3000
4-Chlorophenyl-phenyl ether	7005-72-3	<500	500	mg/kg	02.18.13 18.25	D1	3000
4-Nitroaniline	100-01-6	<1000	1000	mg/kg	02.18.13 18.25	D1	3000
4-Nitrophenol	100-02-7	<1000	1000	mg/kg	02.18.13 18.25	D1	3000
Acenaphthene	83-32-9	<500	500	mg/kg	02.18.13 18.25	D1	3000
Acenaphthylene	208-96-8	<500	500	mg/kg	02.18.13 18.25	D1	3000
Aniline (Phenylamine, Aminobenzene)	62-53-3	<1000	1000	mg/kg	02.18.13 18.25	D1	3000
Anthracene	120-12-7	<500	500	mg/kg	02.18.13 18.25	D1	3000
Benzo(a)anthracene	56-55-3	<500	500	mg/kg	02.18.13 18.25	D1	3000
Benzo(a)pyrene	50-32-8	<500	500	mg/kg	02.18.13 18.25	D1	3000
Benzo(b)fluoranthene	205-99-2	<500	500	mg/kg	02.18.13 18.25	D1	3000
Benzo(g,h,i)perylene	191-24-2	<500	500	mg/kg	02.18.13 18.25	D1	3000
Benzo(k)fluoranthene	207-08-9	<500	500	mg/kg	02.18.13 18.25	D1	3000
Benzoic Acid	65-85-0	<3000	3000	mg/kg	02.18.13 18.25	D1	3000
Benzyl Butyl Phthalate	85-68-7	<500	500	mg/kg	02.18.13 18.25	D1	3000
bis(2-chloroethoxy) methane	111-91-1	<500	500	mg/kg	02.18.13 18.25	D1	3000
bis(2-chloroethyl) ether	111-44-4	<500	500	mg/kg	02.18.13 18.25	D1	3000
bis(2-chloroisopropyl) ether	39638-32-9	<500	500	mg/kg	02.18.13 18.25	D1	3000

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Certificate of Analytical Results 457697

Southwest Research Institute, San Antonio, TX

Jet Fuel

Sample Id: **CL12-4717** Matrix: Product Date Received: 02.14.13 09.30
Lab Sample Id: **457697-002** Date Collected: 02.13.13 00.00

Analytical Method: **SVOCs by SW-846 8270C** Prep Method: SW3550
Tech: COR % Moisture:
Analyst: WEW Date Prep: 02.18.13 08.33 Basis: Wet Weight
Seq Number: 907226 SUB: AZ0765

Parameter	Cas Number	Result	RL	Units	Analysis Date	Flag	Dil
bis(2-ethylhexyl) phthalate	117-81-7	<500	500	mg/kg	02.18.13 18.25	D1	3000
Chrysene	218-01-9	<500	500	mg/kg	02.18.13 18.25	D1	3000
Dibenz(a,h)Anthracene	53-70-3	<500	500	mg/kg	02.18.13 18.25	D1	3000
Dibenzofuran	132-64-9	<500	500	mg/kg	02.18.13 18.25	D1	3000
Diethyl Phthalate	84-66-2	<500	500	mg/kg	02.18.13 18.25	D1	3000
Dimethyl Phthalate	131-11-3	<500	500	mg/kg	02.18.13 18.25	D1	3000
di-n-Butyl Phthalate	84-74-2	<500	500	mg/kg	02.18.13 18.25	D1	3000
di-n-Octyl Phthalate	117-84-0	<500	500	mg/kg	02.18.13 18.25	D1	3000
Fluoranthene	206-44-0	<500	500	mg/kg	02.18.13 18.25	D1	3000
Fluorene	86-73-7	<500	500	mg/kg	02.18.13 18.25	D1	3000
Hexachlorobenzene	118-74-1	<500	500	mg/kg	02.18.13 18.25	D1	3000
Hexachlorobutadiene	87-68-3	<500	500	mg/kg	02.18.13 18.25	D1	3000
Hexachlorocyclopentadiene	77-47-4	<500	500	mg/kg	02.18.13 18.25	D1	3000
Hexachloroethane	67-72-1	<500	500	mg/kg	02.18.13 18.25	D1	3000
Indeno(1,2,3-c,d)Pyrene	193-39-5	<500	500	mg/kg	02.18.13 18.25	D1	3000
Isophorone	78-59-1	<500	500	mg/kg	02.18.13 18.25	D1	3000
Naphthalene	91-20-3	**4760**	500	mg/kg	02.18.13 18.25	D2	3000
Nitrobenzene	98-95-3	<500	500	mg/kg	02.18.13 18.25	D1	3000
N-Nitrosodi-n-Propylamine	621-64-7	<500	500	mg/kg	02.18.13 18.25	D1	3000
N-Nitrosodiphenylamine	86-30-6	<500	500	mg/kg	02.18.13 18.25	D1	3000
Pentachlorophenol	87-86-5	<1000	1000	mg/kg	02.18.13 18.25	D1	3000
Phenanthrene	85-01-8	<500	500	mg/kg	02.18.13 18.25	D1	3000
Phenol	108-95-2	<1000	1000	mg/kg	02.18.13 18.25	D1	3000
Pyrene	129-00-0	<500	500	mg/kg	02.18.13 18.25	D1	3000
Pyridine	110-86-1	<1000	1000	mg/kg	02.18.13 18.25	D1	3000
Benzene, 1-ethyl-2-methyl- (TIC)	TIC	**5660**		mg/kg	02.18.13 18.25	D2T4	3000
Benzene, 1-ethyl-2-methyl- (TIC)	TIC	**3120**		mg/kg	02.18.13 18.25	D2T4	3000
Benzene, 1-methyl-3-propyl- (TIC)	TIC	**3820**		mg/kg	02.18.13 18.25	D2T4	3000
Benzene, 1-methyl-4-(1-methylethyl (TIC)	TIC	**2280**		mg/kg	02.18.13 18.25	D2T4	3000
Benzene, 4-ethyl-1,2-dimethyl- (TIC)	TIC	**2810**		mg/kg	02.18.13 18.25	D2T4	3000
Benzene, 4-ethyl-1,2-dimethyl- (TIC)	TIC	**2170**		mg/kg	02.18.13 18.25	D2T4	3000
Benzene, propyl- (TIC)	TIC	**2880**		mg/kg	02.18.13 18.25	D2T4	3000
Cyclohexane, butyl- (TIC)	TIC	**2700**		mg/kg	02.18.13 18.25	D2T4	3000
Decane (TIC)	TIC	**9690**		mg/kg	02.18.13 18.25	D2T4	3000
Decane, 3-methyl- (TIC)	TIC	**3310**		mg/kg	02.18.13 18.25	D2T4	3000
Hexadecane (TIC)	TIC	**2490**		mg/kg	02.18.13 18.25	D2T4	3000
Hexadecane (TIC)	TIC	**6140**		mg/kg	02.18.13 18.25	D2T4	3000
Hexanal, 3,5,5-trimethyl- (TIC)	TIC	**2490**		mg/kg	02.18.13 18.25	D2T4	3000
Naphthalene, 2,3-dimethyl- (TIC)	TIC	**4240**		mg/kg	02.18.13 18.25	D2T4	3000
Nonane (TIC)	TIC	**8730**		mg/kg	02.18.13 18.25	D2T4	3000
Octane, 2,6-dimethyl- (TIC)	TIC	**4360**		mg/kg	02.18.13 18.25	D2T4	3000

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Certificate of Analytical Results 457697

Southwest Research Institute, San Antonio, TX

Jet Fuel

Sample Id: **CL12-4717** Matrix: Product Date Received: 02.14.13 09.30
Lab Sample Id: **457697-002** Date Collected: 02.13.13 00.00

Analytical Method: **SVOCs by SW-846 8270C** Prep Method: SW3550
Tech: COR % Moisture:
Analyst: WEW Date Prep: 02.18.13 08.33 Basis: Wet Weight
Seq Number: 907226 SUB: AZ0765

Parameter	Cas Number	Result	RL	Units	Analysis Date	Flag	Dil
Octane, 4-methyl- (TIC)	TIC	**2100**		mg/kg	02.18.13 18.25	D2T4	3000
Tetradecane (TIC)	TIC	**4470**		mg/kg	02.18.13 18.25	D2T4	3000
Tetradecane (TIC)	TIC	**10600**		mg/kg	02.18.13 18.25	D2T4	3000
p-Xylene (TIC)	TIC	**2260**		mg/kg	02.18.13 18.25	D2T4	3000

Surrogate	Cas Number	% Recovery	Units	Limits	Analysis Date	Flag
2-Fluorophenol	367-12-4	0	%	25-121	02.18.13 18.25	S8
Phenol-d6	13127-88-3	0	%	24-113	02.18.13 18.25	S8
Nitrobenzene-d5	4165-60-0	0	%	23-120	02.18.13 18.25	S8
2-Fluorobiphenyl	321-60-8	52	%	30-115	02.18.13 18.25	
2,4,6-Tribromophenol	118-79-6	64	%	19-122	02.18.13 18.25	
Terphenyl-D14	1718-51-0	86	%	18-137	02.18.13 18.25	

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Trans West Analytical Services, LLC

Certificate of Analytical Results 457697

Southwest Research Institute, San Antonio, TX

Jet Fuel

Sample Id: **CL12-4717** Matrix: Product Date Received: 02.14.13 09.30
Lab Sample Id: **457697-002** Date Collected: 02.13.13 00.00

Analytical Method: **VOAs by SW-846 8260B** Prep Method: SW5030B
Tech: ZHO % Moisture:
Analyst: ZHO Date Prep: 02.22.13 13.14 Basis: Wet Weight
Seq Number: 907617 SUB: AZ0765

Dilution Analysis:
Seq#: 907617 Date Analyzed: 02/22/13 14:06 Date Prep: 02/22/13 13:42

Parameter	Cas Number	Result	RL	Units	Analysis Date	Flag	Dil
1,1,1,2-Tetrachloroethane	630-20-6	<125	125	mg/kg	02.22.13 13.31	D1	25000
1,1,1-Trichloroethane	71-55-6	<125	125	mg/kg	02.22.13 13.31	D1	25000
1,1,2,2-Tetrachloroethane	79-34-5	<125	125	mg/kg	02.22.13 13.31	D1M1	25000
1,1,2-Trichloroethane	79-00-5	<125	125	mg/kg	02.22.13 13.31	D1	25000
1,1-Dichloroethane	75-34-3	<125	125	mg/kg	02.22.13 13.31	D1	25000
1,1-Dichloroethene	75-35-4	<125	125	mg/kg	02.22.13 13.31	D1	25000
1,1-Dichloropropene	563-58-6	<125	125	mg/kg	02.22.13 13.31	D1	25000
1,2,3-Trichlorobenzene	87-61-6	<125	125	mg/kg	02.22.13 13.31	D1	25000
1,2,3-Trichloropropane	96-18-4	<125	125	mg/kg	02.22.13 13.31	D1	25000
1,2,4-Trichlorobenzene	120-82-1	<125	125	mg/kg	02.22.13 13.31	D1	25000
1,2,4-Trimethylbenzene	95-63-6	**15400**	625	mg/kg	02.22.13 14.06	D2M2	125000
1,2-Dibromo-3-Chloropropane	96-12-8	<125	125	mg/kg	02.22.13 13.31	D1	25000
1,2-Dibromoethane	106-93-4	<125	125	mg/kg	02.22.13 13.31	D1	25000
1,2-Dichlorobenzene	95-50-1	<125	125	mg/kg	02.22.13 13.31	D1	25000
1,2-Dichloroethane	107-06-2	<125	125	mg/kg	02.22.13 13.31	D1	25000
1,2-Dichloropropane	78-87-5	<125	125	mg/kg	02.22.13 13.31	D1	25000
1,3,5-Trimethylbenzene	108-67-8	**4350**	625	mg/kg	02.22.13 14.06	D2M2	125000
1,3-Dichlorobenzene	541-73-1	<125	125	mg/kg	02.22.13 13.31	D1	25000
1,3-Dichloropropane	142-28-9	<125	125	mg/kg	02.22.13 13.31	D1	25000
1,4-Dichlorobenzene	106-46-7	<125	125	mg/kg	02.22.13 13.31	D1	25000
2,2-Dichloropropane	594-20-7	<125	125	mg/kg	02.22.13 13.31	D1	25000
2-Butanone	78-93-3	<1250	1250	mg/kg	02.22.13 13.31	D1	25000
2-Chlorotoluene	95-49-8	<125	125	mg/kg	02.22.13 13.31	D1	25000
2-Hexanone	591-78-6	<1250	1250	mg/kg	02.22.13 13.31	D1	25000
4-Chlorotoluene	106-43-4	<125	125	mg/kg	02.22.13 13.31	D1	25000
Acetone	67-64-1	<2500	2500	mg/kg	02.22.13 13.31	D1	25000
Benzene	71-43-2	<125	125	mg/kg	02.22.13 13.31	D1	25000
Bromobenzene	108-86-1	<125	125	mg/kg	02.22.13 13.31	D1	25000
Bromochloromethane	74-97-5	<125	125	mg/kg	02.22.13 13.31	D1	25000
Bromodichloromethane	75-27-4	<125	125	mg/kg	02.22.13 13.31	D1	25000
Bromoform	75-25-2	<125	125	mg/kg	02.22.13 13.31	D1M2	25000
Bromomethane	74-83-9	<125	125	mg/kg	02.22.13 13.31	D1	25000
Carbon Disulfide	75-15-0	<1250	1250	mg/kg	02.22.13 13.31	D1	25000
Carbon Tetrachloride	56-23-5	<125	125	mg/kg	02.22.13 13.31	D1	25000
Chlorobenzene	108-90-7	<125	125	mg/kg	02.22.13 13.31	D1	25000
Chloroethane	75-00-3	<250	250	mg/kg	02.22.13 13.31	D1	25000
Chloroform	67-66-3	<125	125	mg/kg	02.22.13 13.31	D1	25000
Chloromethane	74-87-3	<250	250	mg/kg	02.22.13 13.31	D1	25000

XENCO Laboratories
Trans West Analytical Services, LLC

Certificate of Analytical Results 457697

Southwest Research Institute, San Antonio, TX

Jet Fuel

Sample Id: **CL12-4717** Matrix: Product Date Received: 02.14.13 09.30
Lab Sample Id: **457697-002** Date Collected: 02.13.13 00.00

Analytical Method: **VOAs by SW-846 8260B** Prep Method: SW5030B
Tech: ZHO % Moisture:
Analyst: ZHO Date Prep: 02.22.13 13.14 Basis: Wet Weight
Seq Number: 907617 SUB: AZ0765

Parameter	Cas Number	Result	RL	Units	Analysis Date	Flag	Dil
cis-1,2-Dichloroethene	156-59-2	<125	125	mg/kg	02.22.13 13.31	D1	25000
cis-1,3-Dichloropropene	10061-01-5	<125	125	mg/kg	02.22.13 13.31	D1	25000
Dibromochloromethane	124-48-1	<125	125	mg/kg	02.22.13 13.31	D1	25000
Dibromomethane	74-95-3	<125	125	mg/kg	02.22.13 13.31	D1	25000
Dichlorodifluoromethane	75-71-8	<125	125	mg/kg	02.22.13 13.31	D1	25000
Ethylbenzene	100-41-4	**1570**	125	mg/kg	02.22.13 13.31	D2	25000
Hexachlorobutadiene	87-68-3	<125	125	mg/kg	02.22.13 13.31	D1	25000
Iodomethane (Methyl Iodide)	74-88-4	<500	500	mg/kg	02.22.13 13.31	D1	25000
isopropylbenzene	98-82-8	**684**	125	mg/kg	02.22.13 13.31	D2	25000
m,p-Xylenes	179601-23-1	**6510**	250	mg/kg	02.22.13 13.31	D2M2	25000
Methylene Chloride	75-09-2	<500	500	mg/kg	02.22.13 13.31	D1	25000
MTBE	1634-04-4	<125	125	mg/kg	02.22.13 13.31	D1	25000
Naphthalene	91-20-3	**1350**	250	mg/kg	02.22.13 13.31	D2	25000
n-Butylbenzene	104-51-8	**1730**	125	mg/kg	02.22.13 13.31	D2	25000
n-Propylbenzene	103-65-1	**2010**	125	mg/kg	02.22.13 13.31	D2	25000
o-Xylene	95-47-6	**3440**	125	mg/kg	02.22.13 13.31	D2M2	25000
p-Cymene (p-Isopropyltoluene)	99-87-6	**708**	125	mg/kg	02.22.13 13.31	D2	25000
Sec-Butylbenzene	135-98-8	**799**	125	mg/kg	02.22.13 13.31	D2	25000
Styrene	100-42-5	<125	125	mg/kg	02.22.13 13.31	D1	25000
tert-Butylbenzene	98-06-6	<125	125	mg/kg	02.22.13 13.31	D1	25000
Tetrachloroethylene	127-18-4	<125	125	mg/kg	02.22.13 13.31	D1	25000
Toluene	108-88-3	**662**	125	mg/kg	02.22.13 13.31	D2	25000
Total Xylenes	1330-20-7	**9950**	125	mg/kg	02.22.13 13.31	D2	25000
trans-1,2-dichloroethene	156-60-5	<125	125	mg/kg	02.22.13 13.31	D1	25000
trans-1,3-dichloropropene	10061-02-6	<125	125	mg/kg	02.22.13 13.31	D1	25000
Trichloroethene	79-01-6	<125	125	mg/kg	02.22.13 13.31	D1	25000
Trichlorofluoromethane	75-69-4	<125	125	mg/kg	02.22.13 13.31	D1	25000
Vinyl Acetate	108-05-4	<1250	1250	mg/kg	02.22.13 13.31	D1	25000
Vinyl Chloride	75-01-4	<50.0	50.0	mg/kg	02.22.13 13.31	D1	25000
Benzene, 1-ethyl-2-methyl- (TIC)	TIC	**3850**		mg/kg	02.22.13 13.31	D2T4	25000
Benzene, 1-ethyl-3-methyl- (TIC)	TIC	**8150**		mg/kg	02.22.13 13.31	D2T4	25000
Benzene, 1-methyl-3-propyl- (TIC)	TIC	**3780**		mg/kg	02.22.13 13.31	D2T4	25000
Cyclohexane, propyl- (TIC)	TIC	**6490**		mg/kg	02.22.13 13.31	D2T4	25000
Dodecane (TIC)	TIC	**4920**		mg/kg	02.22.13 13.31	D2T4	25000
Nonane, 3,7-dimethyl- (TIC)	TIC	**5890**		mg/kg	02.22.13 13.31	D2T4	25000
Nonane, 4,5-dimethyl- (TIC)	TIC	**4720**		mg/kg	02.22.13 13.31	D2T4	25000
Octane, 3,6-dimethyl- (TIC)	TIC	**5710**		mg/kg	02.22.13 13.31	D2T4	25000
Octane, 3-methyl- (TIC)	TIC	**3760**		mg/kg	02.22.13 13.31	D2T4	25000
Undecane (TIC)	TIC	**8500**		mg/kg	02.22.13 13.31	D2T4	25000

XENCO Laboratories
Trans West Analytical Services, LLC

Certificate of Analytical Results 457697

Southwest Research Institute, San Antonio, TX

Jet Fuel

Sample Id:	**CL12-4717**	Matrix: Product	Date Received: 02.14.13 09.30
Lab Sample Id:	**457697-002**	Date Collected: 02.13.13 00.00	

Analytical Method:	**VOAs by SW-846 8260B**			Prep Method: SW5030B
Tech:	ZHO			% Moisture:
Analyst:	ZHO	Date Prep:	02.22.13 13.14	Basis: Wet Weight
Seq Number:	907617			SUB: AZ0765

Surrogate	Cas Number	% Recovery	Units	Limits	Analysis Date	Flag
Dibromofluoromethane	1868-53-7	90	%	53-142	02.22.13 13.31	
1,2-Dichloroethane-D4	17060-07-0	96	%	56-150	02.22.13 13.31	
Toluene-D8	2037-26-5	106	%	70-130	02.22.13 13.31	
4-Bromofluorobenzene	460-00-4	105	%	68-152	02.22.13 13.31	

XENCO Laboratories
Trans West Analytical Services, LLC

QC Summary 457697

Southwest Research Institute

Jet Fuel

Analytical Method: SVOCs by SW-846 8270C — Prep Method: SW3550
Seq Number: 907226 — Matrix: Solid — Date Prep: 02/18/2013
MB Sample Id: 633898-1-BLK — LCS Sample Id: 633898-1-BKS — LCSD Sample Id: 633898-1-BSD

Parameter	MB Result	Spike Amount	LCS Result	LCS %Rec	LCSD Result	LCSD %Rec	Limits	%RPD	RPD Limit	Units	Analysis Date	Flag
1,2,4-Trichlorobenzene	<0.0304	1.67	1.02	61	1.05	63	55-106	3	30	mg/kg	02/18/13 16:16	
1,2-Dichlorobenzene	<0.0362	1.67	1.08	65	1.15	69	54-104	6	30	mg/kg	02/18/13 16:16	
1,3-Dichlorobenzene	<0.0305	1.67	1.07	64	1.15	69	53-105	7	30	mg/kg	02/18/13 16:16	
1,4-Dichlorobenzene	<0.0329	1.67	1.08	65	1.14	68	52-104	5	30	mg/kg	02/18/13 16:16	
2,4,5-Trichlorophenol	<0.0391	1.67	1.22	73	1.21	72	53-128	1	30	mg/kg	02/18/13 16:16	
2,4,6-Trichlorophenol	<0.0268	1.67	1.12	67	1.16	69	58-119	4	30	mg/kg	02/18/13 16:16	
2,4-Dichlorophenol	<0.0314	1.67	1.13	68	1.15	69	58-113	2	30	mg/kg	02/18/13 16:16	
2,4-Dimethylphenol	<0.0784	1.67	1.17	70	1.19	71	56-112	2	30	mg/kg	02/18/13 16:16	
2,4-Dinitrophenol	<0.0691	1.67	1.24	74	1.27	76	38-136	2	40	mg/kg	02/18/13 16:16	
2,4-Dinitrotoluene	<0.0318	1.67	1.28	77	1.25	75	59-115	2	30	mg/kg	02/18/13 16:16	
2,6-Dinitrotoluene	<0.0319	1.67	1.16	69	1.14	68	58-114	2	30	mg/kg	02/18/13 16:16	
2-Chloronaphthalene	<0.0264	1.67	1.11	66	1.13	68	40-132	2	30	mg/kg	02/18/13 16:16	
2-Chlorophenol	<0.0323	1.67	1.13	68	1.18	71	53-109	4	30	mg/kg	02/18/13 16:16	
2-Methylnaphthalene	<0.0342	1.67	1.11	66	1.14	68	53-108	3	30	mg/kg	02/18/13 16:16	
2-methylphenol	<0.0433	1.67	1.22	73	1.24	74	48-118	2	30	mg/kg	02/18/13 16:16	
2-Nitroaniline	<0.0294	1.67	1.03	62	1.19	71	54-116	14	40	mg/kg	02/18/13 16:16	
2-Nitrophenol	<0.0228	1.67	0.943	56	1.06	63	54-113	12	30	mg/kg	02/18/13 16:16	
3&4-Methylphenol	<0.0758	1.67	1.29	77	1.29	77	53-115	0	30	mg/kg	02/18/13 16:16	
3,3-Dichlorobenzidine	<0.0457	1.67	1.39	83	1.30	78	55-129	7	40	mg/kg	02/18/13 16:16	
3-Nitroaniline	<0.0346	1.67	1.25	75	1.20	72	57-119	4	40	mg/kg	02/18/13 16:16	
4,6-dinitro-2-methyl phenol	<0.0271	1.67	1.22	73	1.18	71	56-117	3	40	mg/kg	02/18/13 16:16	
4-Bromophenyl-phenylether	<0.0339	1.67	1.19	71	1.10	66	57-118	8	30	mg/kg	02/18/13 16:16	
4-chloro-3-methylphenol	<0.0350	1.67	1.18	71	1.19	71	55-114	1	30	mg/kg	02/18/13 16:16	
4-Chloroaniline	<0.0668	1.67	1.17	70	1.18	71	54-112	1	40	mg/kg	02/18/13 16:16	
4-Chlorophenyl-phenyl ether	<0.0335	1.67	1.19	71	1.15	69	57-111	3	30	mg/kg	02/18/13 16:16	
4-Nitroaniline	<0.0300	1.67	1.29	77	1.23	74	56-121	5	40	mg/kg	02/18/13 16:16	
4-Nitrophenol	<0.0311	1.67	1.41	84	1.33	80	42-134	6	40	mg/kg	02/18/13 16:16	
Acenaphthene	<0.0358	1.67	1.17	70	1.15	69	54-112	2	30	mg/kg	02/18/13 16:16	
Acenaphthylene	<0.0338	1.67	1.14	68	1.15	69	54-113	1	30	mg/kg	02/18/13 16:16	
Aniline (Phenylamine, Aminobenzene)	<0.111	1.67	1.24	74	1.28	77	50-112	3	40	mg/kg	02/18/13 16:16	
Anthracene	<0.0257	1.67	1.28	77	1.14	68	57-118	12	30	mg/kg	02/18/13 16:16	
Benzo(a)anthracene	<0.0280	1.67	1.34	80	1.24	74	58-119	8	30	mg/kg	02/18/13 16:16	
Benzo(a)pyrene	<0.0291	1.67	1.36	81	1.27	76	58-127	7	30	mg/kg	02/18/13 16:16	
Benzo(b)fluoranthene	<0.0270	1.67	1.33	80	1.31	78	50-122	2	30	mg/kg	02/18/13 16:16	
Benzo(g,h,i)perylene	<0.0294	1.67	1.35	81	1.26	75	57-125	7	30	mg/kg	02/18/13 16:16	
Benzo(k)fluoranthene	<0.0390	1.67	1.34	80	1.17	70	59-126	14	30	mg/kg	02/18/13 16:16	
Benzoic Acid	<0.0483	5.00	3.81	76	4.09	82	31-133	7	50	mg/kg	02/18/13 16:16	
Benzyl Butyl Phthalate	<0.0259	1.67	1.35	81	1.28	77	55-129	5	30	mg/kg	02/18/13 16:16	
bis(2-chloroethoxy) methane	<0.0372	1.67	1.15	69	1.18	71	49-112	3	30	mg/kg	02/18/13 16:16	
bis(2-chloroethyl) ether	<0.0358	1.67	1.14	68	1.20	72	50-108	5	30	mg/kg	02/18/13 16:16	
bis(2-chloroisopropyl) ether	<0.0334	1.67	1.29	77	1.33	80	45-111	3	30	mg/kg	02/18/13 16:16	
bis(2-ethylhexyl) phthalate	<0.0266	1.67	1.45	87	1.35	81	54-134	7	30	mg/kg	02/18/13 16:16	
Chrysene	<0.0303	1.67	1.34	80	1.26	75	58-120	6	30	mg/kg	02/18/13 16:16	
Dibenz(a,h)Anthracene	<0.0351	1.67	1.35	81	1.26	75	60-121	7	30	mg/kg	02/18/13 16:16	
Dibenzofuran	<0.0329	1.67	1.16	69	1.16	69	56-110	0	30	mg/kg	02/18/13 16:16	
Diethyl Phthalate	<0.0345	1.67	1.24	74	1.18	71	58-113	5	30	mg/kg	02/18/13 16:16	
Dimethyl Phthalate	<0.0344	1.67	1.21	72	1.15	69	58-112	5	30	mg/kg	02/18/13 16:16	
di-n-Butyl Phthalate	<0.0287	1.67	1.33	80	1.22	73	58-126	9	30	mg/kg	02/18/13 16:16	
di-n-Octyl Phthalate	<0.0316	1.67	1.38	83	1.30	78	54-130	6	30	mg/kg	02/18/13 16:16	

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QC Summary 457697

Southwest Research Institute

Jet Fuel

Analytical Method: SVOCs by SW-846 8270C | Prep Method: SW3550
Seq Number: 907226 | Matrix: Solid | Date Prep: 02/18/2013
MB Sample Id: 633898-1-BLK | LCS Sample Id: 633898-1-BKS | LCSD Sample Id: 633898-1-BSD

Parameter	MB Result	Spike Amount	LCS Result	LCS %Rec	LCSD Result	LCSD %Rec	Limits	%RPD	RPD Limit	Units	Analysis Date	Flag
Fluoranthene	<0.0315	1.67	1.28	77	1.16	69	59-119	10	30	mg/kg	02/18/13 16:16	
Fluorene	<0.0356	1.67	1.19	71	1.16	69	56-112	3	30	mg/kg	02/18/13 16:16	
Hexachlorobenzene	<0.0292	1.67	1.19	71	1.10	66	58-119	8	30	mg/kg	02/18/13 16:16	
Hexachlorobutadiene	<0.0313	1.67	0.986	59	1.05	63	55-105	6	30	mg/kg	02/18/13 16:16	
Hexachlorocyclopentadiene	<0.0147	1.67	0.576	34	0.620	37	18-119	7	30	mg/kg	02/18/13 16:16	
Hexachloroethane	<0.0373	1.67	1.07	64	1.14	68	54-105	6	30	mg/kg	02/18/13 16:16	
Indeno(1,2,3-c,d)Pyrene	<0.0309	1.67	1.35	81	1.24	74	59-118	8	30	mg/kg	02/18/13 16:16	
Isophorone	<0.0299	1.67	1.19	71	1.18	71	46-116	1	30	mg/kg	02/18/13 16:16	
Naphthalene	<0.0344	1.67	1.10	66	1.13	68	54-106	3	30	mg/kg	02/18/13 16:16	
Nitrobenzene	<0.0291	1.67	1.10	66	1.16	69	44-118	5	30	mg/kg	02/18/13 16:16	
N-Nitrosodi-n-Propylamine	<0.0399	1.67	1.32	79	1.31	78	50-111	1	30	mg/kg	02/18/13 16:16	
N-Nitrosodiphenylamine	<0.0249	1.67	1.23	74	1.17	70	55-119	5	30	mg/kg	02/18/13 16:16	
Pentachlorophenol	<0.0221	1.67	1.36	81	1.26	75	38-128	8	40	mg/kg	02/18/13 16:16	
Phenanthrene	<0.0332	1.67	1.22	73	1.15	69	56-118	6	30	mg/kg	02/18/13 16:16	
Phenol	<0.0358	1.67	1.17	70	1.21	72	50-114	3	40	mg/kg	02/18/13 16:16	
Pyrene	<0.0333	1.67	1.37	82	1.28	77	56-125	7	30	mg/kg	02/18/13 16:16	
Pyridine	<0.0427	1.67	1.17	70	1.27	76	44-102	8	40	mg/kg	02/18/13 16:16	

Surrogate	MB %Rec	MB Flag	LCS %Rec	LCS Flag	LCSD %Rec	LCSD Flag	Limits	Units	Analysis Date
2-Fluorophenol	70		66		70		25-121	%	02/18/13 16:16
Phenol-d6	73		75		76		24-113	%	02/18/13 16:16
Nitrobenzene-d5	57		58		60		23-120	%	02/18/13 16:16
2-Fluorobiphenyl	58		61		60		30-115	%	02/18/13 16:16
2,4,6-Tribromophenol	55		72		66		19-122	%	02/18/13 16:16
Terphenyl-D14	69		71		67		18-137	%	02/18/13 16:16

XENCO Laboratories
Trans West Analytical Services, LLC

QC Summary 457697

Southwest Research Institute

Jet Fuel

Analytical Method: SVOCs by SW-846 8270C — Prep Method: SW3550
Seq Number: 907226 — Matrix: Soil — Date Prep: 02/18/2013
Parent Sample Id: 457734-001 — MS Sample Id: 457734-001 S — MSD Sample Id: 457734-001 SD

Parameter	Parent Result	Spike Amount	MS Result	MS %Rec	MSD Result	MSD %Rec	Limits	%RPD	RPD Limit	Units	Analysis Date	Flag
1,2,4-Trichlorobenzene	<0.0334	1.83	1.08	59	1.05	57	37-133	3	30	mg/kg	02/18/13 17:04	
1,2-Dichlorobenzene	<0.0397	1.83	1.17	64	1.10	60	65-135	6	30	mg/kg	02/18/13 17:04	M2
1,3-Dichlorobenzene	<0.0335	1.83	1.14	62	1.06	58	65-135	7	30	mg/kg	02/18/13 17:04	M2
1,4-Dichlorobenzene	<0.0360	1.83	1.14	62	1.07	58	36-134	6	30	mg/kg	02/18/13 17:04	
2,4,5-Trichlorophenol	<0.0429	1.83	1.39	76	1.32	72	65-135	5	30	mg/kg	02/18/13 17:04	
2,4,6-Trichlorophenol	<0.0294	1.83	1.30	71	1.22	67	65-135	6	30	mg/kg	02/18/13 17:04	
2,4-Dichlorophenol	<0.0344	1.83	1.23	67	1.17	64	65-135	5	30	mg/kg	02/18/13 17:04	M2
2,4-Dimethylphenol	<0.0860	1.83	1.29	70	1.22	67	65-135	6	30	mg/kg	02/18/13 17:04	
2,4-Dinitrophenol	<0.0758	1.83	1.46	80	1.32	72	65-135	10	40	mg/kg	02/18/13 17:04	
2,4-Dinitrotoluene	<0.0349	1.83	1.43	78	1.30	71	40-130	10	30	mg/kg	02/18/13 17:04	
2,6-Dinitrotoluene	<0.0350	1.83	1.33	73	1.24	68	28-89	7	30	mg/kg	02/18/13 17:04	
2-Chloronaphthalene	<0.0290	1.83	1.22	67	1.18	64	65-135	3	30	mg/kg	02/18/13 17:04	M2
2-Chlorophenol	<0.0354	1.83	1.24	68	1.18	64	25-140	5	30	mg/kg	02/18/13 17:04	
2-Methylnaphthalene	<0.0375	1.83	1.22	67	1.17	64	25-175	4	30	mg/kg	02/18/13 17:04	
2-methylphenol	<0.0475	1.83	1.35	74	1.27	69	65-135	6	30	mg/kg	02/18/13 17:04	
2-Nitroaniline	<0.0322	1.83	1.16	63	1.29	70	65-135	11	40	mg/kg	02/18/13 17:04	M2
2-Nitrophenol	<0.0250	1.83	1.08	59	1.07	58	65-135	1	30	mg/kg	02/18/13 17:04	M2
3&4-Methylphenol	<0.0832	1.83	1.46	80	1.35	74	65-135	8	30	mg/kg	02/18/13 17:04	
3,3-Dichlorobenzidine	<0.0501	1.83	1.54	84	1.34	73	20-140	14	40	mg/kg	02/18/13 17:04	
3-Nitroaniline	<0.0380	1.83	1.36	74	1.27	69	65-135	7	40	mg/kg	02/18/13 17:04	
4,6-dinitro-2-methyl phenol	<0.0298	1.83	1.33	73	1.21	66	65-135	9	40	mg/kg	02/18/13 17:04	
4-Bromophenyl-phenylether	<0.0372	1.83	1.29	70	1.18	64	65-135	9	30	mg/kg	02/18/13 17:04	M2
4-chloro-3-methylphenol	<0.0384	1.83	1.33	73	1.24	68	28-134	7	30	mg/kg	02/18/13 17:04	
4-Chloroaniline	<0.0733	1.83	1.30	71	1.27	69	4-149	2	40	mg/kg	02/18/13 17:04	
4-Chlorophenyl-phenyl ether	<0.0368	1.83	1.34	73	1.27	69	65-135	5	30	mg/kg	02/18/13 17:04	
4-Nitroaniline	<0.0329	1.83	1.37	75	1.25	68	65-135	9	40	mg/kg	02/18/13 17:04	
4-Nitrophenol	<0.0341	1.83	1.57	86	1.39	76	13-106	12	40	mg/kg	02/18/13 17:04	
Acenaphthene	<0.0392	1.83	1.31	72	1.22	67	41-134	7	30	mg/kg	02/18/13 17:04	
Acenaphthylene	<0.0370	1.83	1.31	72	1.24	68	65-135	5	30	mg/kg	02/18/13 17:04	
Aniline (Phenylamine, Aminobenzene)	<0.122	1.83	1.37	75	1.31	72	2-145	4	40	mg/kg	02/18/13 17:04	
Anthracene	<0.0282	1.83	1.38	75	1.24	68	65-135	11	30	mg/kg	02/18/13 17:04	
Benzo(a)anthracene	<0.0307	1.83	1.42	78	1.24	68	44-126	14	30	mg/kg	02/18/13 17:04	
Benzo(a)pyrene	<0.0319	1.83	1.47	80	1.30	71	65-135	12	30	mg/kg	02/18/13 17:04	
Benzo(b)fluoranthene	<0.0296	1.83	1.52	83	1.17	64	65-135	26	30	mg/kg	02/18/13 17:04	M2
Benzo(g,h,i)perylene	<0.0322	1.83	1.45	79	1.26	69	65-135	14	30	mg/kg	02/18/13 17:04	
Benzo(k)fluoranthene	<0.0428	1.83	1.36	74	1.37	75	25-125	1	30	mg/kg	02/18/13 17:04	
Benzoic Acid	<0.0529	5.48	4.76	87	4.36	79	50-125	9	50	mg/kg	02/18/13 17:04	
Benzyl Butyl Phthalate	<0.0284	1.83	1.47	80	1.32	72	65-135	11	30	mg/kg	02/18/13 17:04	
bis(2-chloroethoxy) methane	<0.0408	1.83	1.24	68	1.20	66	65-135	3	30	mg/kg	02/18/13 17:04	
bis(2-chloroethyl) ether	<0.0392	1.83	1.22	67	1.17	64	65-135	4	30	mg/kg	02/18/13 17:04	M2
bis(2-chloroisopropyl) ether	<0.0366	1.83	1.39	76	1.34	73	65-135	4	30	mg/kg	02/18/13 17:04	
bis(2-ethylhexyl) phthalate	<0.0292	1.83	1.55	85	1.36	74	65-135	13	30	mg/kg	02/18/13 17:04	
Chrysene	<0.0332	1.83	1.48	81	1.31	72	65-135	12	30	mg/kg	02/18/13 17:04	
Dibenz(a,h)Anthracene	<0.0385	1.83	1.45	79	1.29	70	65-135	12	30	mg/kg	02/18/13 17:04	
Dibenzofuran	<0.0360	1.83	1.35	74	1.25	68	65-135	8	30	mg/kg	02/18/13 17:04	
Diethyl Phthalate	<0.0379	1.83	1.37	75	1.25	68	37-125	9	30	mg/kg	02/18/13 17:04	
Dimethyl Phthalate	<0.0377	1.83	1.38	75	1.26	69	65-135	9	30	mg/kg	02/18/13 17:04	
di-n-Butyl Phthalate	<0.0314	1.83	1.39	76	1.23	67	65-135	12	30	mg/kg	02/18/13 17:04	
di-n-Octyl Phthalate	<0.0347	1.83	1.51	83	1.33	73	65-135	13	30	mg/kg	02/18/13 17:04	

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QC Summary 457697

Southwest Research Institute

Jet Fuel

Analytical Method: SVOCs by SW-846 8270C — Prep Method: SW3550
Seq Number: 907226 — Matrix: Soil — Date Prep: 02/18/2013
Parent Sample Id: 457734-001 — MS Sample Id: 457734-001 S — MSD Sample Id: 457734-001 SD

Parameter	Parent Result	Spike Amount	MS Result	MS %Rec	MSD Result	MSD %Rec	Limits	%RPD	RPD Limit	Units	Analysis Date	Flag
Fluoranthene	<0.0346	1.83	1.34	73	1.18	64	65-135	13	30	mg/kg	02/18/13 17:04	M2
Fluorene	<0.0390	1.83	1.35	74	1.27	69	65-135	6	30	mg/kg	02/18/13 17:04	
Hexachlorobenzene	<0.0320	1.83	1.29	70	1.16	63	65-135	11	30	mg/kg	02/18/13 17:04	M2
Hexachlorobutadiene	<0.0343	1.83	1.05	57	1.03	56	65-135	2	30	mg/kg	02/18/13 17:04	M2
Hexachlorocyclopentadiene	<0.0161	1.83	0.587	32	0.579	32	65-135	1	30	mg/kg	02/18/13 17:04	M2
Hexachloroethane	<0.0409	1.83	1.14	62	1.09	60	65-135	4	30	mg/kg	02/18/13 17:04	M2
Indeno(1,2,3-c,d)Pyrene	<0.0339	1.83	1.44	79	1.27	69	65-135	13	30	mg/kg	02/18/13 17:04	
Isophorone	<0.0328	1.83	1.32	72	1.25	68	65-135	5	30	mg/kg	02/18/13 17:04	
Naphthalene	<0.0377	1.83	1.18	64	1.13	62	65-135	4	30	mg/kg	02/18/13 17:04	M2
Nitrobenzene	<0.0319	1.83	1.17	64	1.14	62	65-135	3	30	mg/kg	02/18/13 17:04	M2
N-Nitrosodi-n-Propylamine	<0.0437	1.83	1.47	80	1.37	75	53-130	7	30	mg/kg	02/18/13 17:04	
N-Nitrosodiphenylamine	<0.0273	1.83	1.37	75	1.23	67	65-135	11	30	mg/kg	02/18/13 17:04	
Pentachlorophenol	<0.0242	1.83	1.45	79	1.29	70	14-111	12	40	mg/kg	02/18/13 17:04	
Phenanthrene	<0.0364	1.83	1.31	72	1.20	66	65-135	9	30	mg/kg	02/18/13 17:04	
Phenol	<0.0393	1.83	1.29	70	1.23	67	27-127	5	40	mg/kg	02/18/13 17:04	
Pyrene	<0.0365	1.83	1.49	81	1.32	72	41-144	12	30	mg/kg	02/18/13 17:04	
Pyridine	<0.0468	1.83	1.23	67	1.17	64	39-98	5	40	mg/kg	02/18/13 17:04	

Surrogate	MS %Rec	MS Flag	MSD %Rec	MSD Flag	Limits	Units	Analysis Date
2-Fluorophenol	63		61		25-121	%	02/18/13 17:04
Phenol-d6	73		71		24-113	%	02/18/13 17:04
Nitrobenzene-d5	56		56		23-120	%	02/18/13 17:04
2-Fluorobiphenyl	59		59		30-115	%	02/18/13 17:04
2,4,6-Tribromophenol	69		64		19-122	%	02/18/13 17:04
Terphenyl-D14	70		62		18-137	%	02/18/13 17:04

XENCO Laboratories
Trans West Analytical Services, LLC

QC Summary 457697

Southwest Research Institute

Jet Fuel

Analytical Method: VOAs by SW-846 8260B — Prep Method: SW5030B
Seq Number: 907536 — Matrix: Solid — Date Prep: 02/21/2013
MB Sample Id: 634151-1-BLK — LCS Sample Id: 634151-1-BKS — LCSD Sample Id: 634151-1-BSD

Parameter	MB Result	Spike Amount	LCS Result	LCS %Rec	LCSD Result	LCSD %Rec	Limits	%RPD	RPD Limit	Units	Analysis Date	Flag
1,1,1,2-Tetrachloroethane	<0.000148	0.0500	0.0533	107	0.0529	106	81-127	1	25	mg/kg	02/21/13 12:15	
1,1,1-Trichloroethane	<0.000602	0.0500	0.0515	103	0.0528	106	71-124	2	25	mg/kg	02/21/13 12:15	
1,1,2,2-Tetrachloroethane	<0.000194	0.0500	0.0475	95	0.0459	92	75-133	3	25	mg/kg	02/21/13 12:15	
1,1,2-Trichloroethane	<0.000225	0.0500	0.0476	95	0.0479	96	75-131	1	25	mg/kg	02/21/13 12:15	
1,1-Dichloroethane	<0.000125	0.0500	0.0494	99	0.0495	99	73-124	0	25	mg/kg	02/21/13 12:15	
1,1-Dichloroethene	<0.000192	0.0500	0.0465	93	0.0468	94	68-119	1	25	mg/kg	02/21/13 12:15	
1,1-Dichloropropene	<0.000198	0.0500	0.0491	98	0.0501	100	72-118	2	25	mg/kg	02/21/13 12:15	
1,2,3-Trichlorobenzene	<0.000106	0.0500	0.0486	97	0.0500	100	75-131	3	25	mg/kg	02/21/13 12:15	
1,2,3-Trichloropropane	<0.000359	0.0500	0.0523	105	0.0511	102	75-131	2	25	mg/kg	02/21/13 12:15	
1,2,4-Trichlorobenzene	<0.000191	0.0500	0.0507	101	0.0522	104	79-128	3	25	mg/kg	02/21/13 12:15	
1,2,4-Trimethylbenzene	<0.000103	0.0500	0.0560	112	0.0567	113	60-159	1	25	mg/kg	02/21/13 12:15	
1,2-Dibromo-3-Chloropropane	<0.00107	0.0500	0.0420	84	0.0407	81	58-133	3	25	mg/kg	02/21/13 12:15	
1,2-Dibromoethane	<0.000193	0.0500	0.0484	97	0.0471	94	80-127	3	25	mg/kg	02/21/13 12:15	
1,2-Dichlorobenzene	<0.000129	0.0500	0.0492	98	0.0501	100	84-121	2	25	mg/kg	02/21/13 12:15	
1,2-Dichloroethane	<0.000177	0.0500	0.0455	91	0.0448	90	70-123	2	25	mg/kg	02/21/13 12:15	
1,2-Dichloropropane	<0.000162	0.0500	0.0473	95	0.0472	94	75-122	0	25	mg/kg	02/21/13 12:15	
1,3,5-Trimethylbenzene	<0.000166	0.0500	0.0563	113	0.0573	115	61-160	2	25	mg/kg	02/21/13 12:15	
1,3-Dichlorobenzene	<0.000159	0.0500	0.0515	103	0.0520	104	84-124	1	25	mg/kg	02/21/13 12:15	
1,3-Dichloropropane	<0.000227	0.0500	0.0488	98	0.0476	95	82-131	2	25	mg/kg	02/21/13 12:15	
1,4-Dichlorobenzene	<0.0000970	0.0500	0.0494	99	0.0503	101	82-120	2	25	mg/kg	02/21/13 12:15	
2,2-Dichloropropane	<0.000127	0.0500	0.0581	116	0.0621	124	67-137	7	25	mg/kg	02/21/13 12:15	
2-Butanone	<0.00173	0.600	0.533	89	0.505	84	46-137	5	25	mg/kg	02/21/13 12:15	
2-Chlorotoluene	<0.000217	0.0500	0.0534	107	0.0545	109	83-129	2	25	mg/kg	02/21/13 12:15	
2-Hexanone	<0.00112	0.600	0.580	97	0.554	92	52-137	5	25	mg/kg	02/21/13 12:15	
4-Chlorotoluene	<0.000118	0.0500	0.0529	106	0.0535	107	83-125	1	25	mg/kg	02/21/13 12:15	
Acetone	0.00315	0.600	0.457	76	0.439	73	33-148	4	25	mg/kg	02/21/13 12:15	
Benzene	<0.000300	0.0500	0.0476	95	0.0474	95	71-119	0	25	mg/kg	02/21/13 12:15	
Bromobenzene	<0.000198	0.0500	0.0503	101	0.0499	100	84-123	1	25	mg/kg	02/21/13 12:15	
Bromochloromethane	<0.000215	0.0500	0.0434	87	0.0432	86	71-120	0	25	mg/kg	02/21/13 12:15	
Bromodichloromethane	<0.000186	0.0500	0.0530	106	0.0537	107	78-126	1	25	mg/kg	02/21/13 12:15	
Bromoform	<0.000393	0.0500	0.0424	85	0.0424	85	63-136	0	25	mg/kg	02/21/13 12:15	
Bromomethane	<0.000274	0.0500	0.0446	89	0.0416	83	57-118	7	25	mg/kg	02/21/13 12:15	
Carbon Disulfide	<0.0000880	0.550	0.638	116	0.659	120	55-136	3	25	mg/kg	02/21/13 12:15	
Carbon Tetrachloride	<0.000132	0.0500	0.0515	103	0.0530	106	63-135	3	25	mg/kg	02/21/13 12:15	
Chlorobenzene	<0.000104	0.0500	0.0495	99	0.0494	99	83-121	0	25	mg/kg	02/21/13 12:15	
Chloroethane	<0.000254	0.0500	0.0454	91	0.0422	84	57-122	7	25	mg/kg	02/21/13 12:15	
Chloroform	<0.000139	0.0500	0.0484	97	0.0483	97	74-118	0	25	mg/kg	02/21/13 12:15	
Chloromethane	<0.000322	0.0500	0.0452	90	0.0426	85	58-110	6	25	mg/kg	02/21/13 12:15	
cis-1,2-Dichloroethene	<0.000165	0.0500	0.0502	100	0.0508	102	72-131	1	25	mg/kg	02/21/13 12:15	
cis-1,3-Dichloropropene	<0.000128	0.0500	0.0535	107	0.0544	109	74-135	2	25	mg/kg	02/21/13 12:15	
Dibromochloromethane	<0.000422	0.0500	0.0422	84	0.0425	85	77-130	1	25	mg/kg	02/21/13 12:15	
Dibromomethane	<0.000260	0.0500	0.0459	92	0.0457	91	73-126	0	25	mg/kg	02/21/13 12:15	
Dichlorodifluoromethane	<0.000484	0.0500	0.0544	109	0.0510	102	54-122	6	25	mg/kg	02/21/13 12:15	
Ethylbenzene	<0.000104	0.0500	0.0524	105	0.0525	105	80-123	0	25	mg/kg	02/21/13 12:15	
Hexachlorobutadiene	<0.000346	0.0500	0.0537	107	0.0547	109	77-130	2	25	mg/kg	02/21/13 12:15	
Iodomethane (Methyl Iodide)	<0.000200	0.0500	0.0464	93	0.0489	98	63-116	5	25	mg/kg	02/21/13 12:15	
isopropylbenzene	<0.000112	0.0500	0.0515	103	0.0522	104	55-155	1	25	mg/kg	02/21/13 12:15	
m,p-Xylenes	<0.000185	0.100	0.110	110	0.109	109	78-127	1	25	mg/kg	02/21/13 12:15	
Methylene Chloride	0.00120	0.0500	0.0478	96	0.0472	94	57-134	1	25	mg/kg	02/21/13 12:15	

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QC Summary 457697

Southwest Research Institute

Jet Fuel

Analytical Method: VOAs by SW-846 8260B | Prep Method: SW5030B
Seq Number: 907536 | Matrix: Solid | Date Prep: 02/21/2013
MB Sample Id: 634151-1-BLK | LCS Sample Id: 634151-1-BKS | LCSD Sample Id: 634151-1-BSD

Parameter	MB Result	Spike Amount	LCS Result	LCS %Rec	LCSD Result	LCSD %Rec	Limits	%RPD	RPD Limit	Units	Analysis Date	Flag
MTBE	<0.000142	0.100	0.107	107	0.108	108	64-148	1	25	mg/kg	02/21/13 12:15	
Naphthalene	<0.000148	0.0500	0.0441	88	0.0440	88	53-162	0	25	mg/kg	02/21/13 12:15	
n-Butylbenzene	<0.0000990	0.0500	0.0555	111	0.0567	113	82-127	2	25	mg/kg	02/21/13 12:15	
n-Propylbenzene	<0.000137	0.0500	0.0564	113	0.0576	115	84-131	2	25	mg/kg	02/21/13 12:15	
o-Xylene	<0.000149	0.0500	0.0528	106	0.0528	106	79-125	0	25	mg/kg	02/21/13 12:15	
p-Cymene (p-Isopropyltoluene)	<0.0000800	0.0500	0.0573	115	0.0587	117	84-130	2	25	mg/kg	02/21/13 12:15	
Sec-Butylbenzene	<0.000121	0.0500	0.0563	113	0.0570	114	84-131	1	25	mg/kg	02/21/13 12:15	
Styrene	<0.000158	0.0500	0.0554	111	0.0559	112	80-126	1	25	mg/kg	02/21/13 12:15	
tert-Butylbenzene	<0.0000900	0.0500	0.0549	110	0.0559	112	83-132	2	25	mg/kg	02/21/13 12:15	
Tetrachloroethylene	<0.000173	0.0500	0.0509	102	0.0517	103	79-124	2	25	mg/kg	02/21/13 12:15	
Toluene	<0.000117	0.0500	0.0484	97	0.0492	98	74-122	2	25	mg/kg	02/21/13 12:15	
trans-1,2-dichloroethene	<0.000123	0.0500	0.0469	94	0.0477	95	63-110	2	25	mg/kg	02/21/13 12:15	
trans-1,3-dichloropropene	<0.000361	0.0500	0.0410	82	0.0416	83	73-125	1	25	mg/kg	02/21/13 12:15	
Trichloroethene	<0.000147	0.0500	0.0517	103	0.0530	106	78-119	2	25	mg/kg	02/21/13 12:15	
Trichlorofluoromethane	<0.000186	0.0500	0.0480	96	0.0444	89	71-148	8	25	mg/kg	02/21/13 12:15	
Vinyl Acetate	<0.000213	0.500	0.514	103	0.498	100	40-154	3	25	mg/kg	02/21/13 12:15	
Vinyl Chloride	<0.000193	0.0500	0.0433	87	0.0406	81	60-123	6	25	mg/kg	02/21/13 12:15	

Surrogate	MB %Rec	MB Flag	LCS %Rec	LCS Flag	LCSD %Rec	LCSD Flag	Limits	Units	Analysis Date
Dibromofluoromethane	88		99		100		53-142	%	02/21/13 12:15
1,2-Dichloroethane-D4	89		96		90		56-150	%	02/21/13 12:15
Toluene-D8	105		100		101		70-130	%	02/21/13 12:15
4-Bromofluorobenzene	104		103		101		68-152	%	02/21/13 12:15

XENCO Laboratories
Trans West Analytical Services, LLC

QC Summary 457697

Southwest Research Institute

Jet Fuel

Analytical Method: VOAs by SW-846 8260B — Prep Method: SW5030B
Seq Number: 907617 — Matrix: Solid — Date Prep: 02/22/2013
MB Sample Id: 634196-1-BLK — LCS Sample Id: 634196-1-BKS — LCSD Sample Id: 634196-1-BSD

Parameter	MB Result	Spike Amount	LCS Result	LCS %Rec	LCSD Result	LCSD %Rec	Limits	%RPD	RPD Limit	Units	Analysis Date	Flag
1,1,1,2-Tetrachloroethane	<0.000148	0.0500	0.0542	108	0.0500	100	81-127	8	25	mg/kg	02/22/13 11:36	
1,1,1-Trichloroethane	<0.000602	0.0500	0.0496	99	0.0459	92	71-124	8	25	mg/kg	02/22/13 11:36	
1,1,2,2-Tetrachloroethane	<0.000194	0.0500	0.0520	104	0.0468	94	75-133	11	25	mg/kg	02/22/13 11:36	
1,1,2-Trichloroethane	<0.000225	0.0500	0.0514	103	0.0481	96	75-131	7	25	mg/kg	02/22/13 11:36	
1,1-Dichloroethane	<0.000125	0.0500	0.0497	99	0.0462	92	73-124	7	25	mg/kg	02/22/13 11:36	
1,1-Dichloroethene	<0.000192	0.0500	0.0431	86	0.0398	80	68-119	8	25	mg/kg	02/22/13 11:36	
1,1-Dichloropropene	<0.000198	0.0500	0.0475	95	0.0438	88	72-118	8	25	mg/kg	02/22/13 11:36	
1,2,3-Trichlorobenzene	<0.000106	0.0500	0.0524	105	0.0514	103	75-131	2	25	mg/kg	02/22/13 11:36	
1,2,3-Trichloropropane	<0.000359	0.0500	0.0583	117	0.0529	106	75-131	10	25	mg/kg	02/22/13 11:36	
1,2,4-Trichlorobenzene	<0.000191	0.0500	0.0515	103	0.0510	102	79-128	1	25	mg/kg	02/22/13 11:36	
1,2,4-Trimethylbenzene	<0.000103	0.0500	0.0543	109	0.0505	101	60-159	7	25	mg/kg	02/22/13 11:36	
1,2-Dibromo-3-Chloropropane	<0.00107	0.0500	0.0479	96	0.0458	92	58-133	4	25	mg/kg	02/22/13 11:36	
1,2-Dibromoethane	<0.000193	0.0500	0.0520	104	0.0482	96	80-127	8	25	mg/kg	02/22/13 11:36	
1,2-Dichlorobenzene	<0.000129	0.0500	0.0502	100	0.0464	93	84-121	8	25	mg/kg	02/22/13 11:36	
1,2-Dichloroethane	<0.000177	0.0500	0.0491	98	0.0445	89	70-123	10	25	mg/kg	02/22/13 11:36	
1,2-Dichloropropane	<0.000162	0.0500	0.0483	97	0.0446	89	75-122	8	25	mg/kg	02/22/13 11:36	
1,3,5-Trimethylbenzene	<0.000166	0.0500	0.0548	110	0.0503	101	61-160	9	25	mg/kg	02/22/13 11:36	
1,3-Dichlorobenzene	<0.000159	0.0500	0.0509	102	0.0475	95	84-124	7	25	mg/kg	02/22/13 11:36	
1,3-Dichloropropane	<0.000227	0.0500	0.0514	103	0.0480	96	82-131	7	25	mg/kg	02/22/13 11:36	
1,4-Dichlorobenzene	<0.0000970	0.0500	0.0490	98	0.0461	92	82-120	6	25	mg/kg	02/22/13 11:36	
2,2-Dichloropropane	<0.000127	0.0500	0.0502	100	0.0491	98	67-137	2	25	mg/kg	02/22/13 11:36	
2-Butanone	<0.00173	0.600	0.612	102	0.542	90	46-137	12	25	mg/kg	02/22/13 11:36	
2-Chlorotoluene	<0.000217	0.0500	0.0525	105	0.0478	96	83-129	9	25	mg/kg	02/22/13 11:36	
2-Hexanone	<0.00112	0.600	0.650	108	0.583	97	52-137	11	25	mg/kg	02/22/13 11:36	
4-Chlorotoluene	<0.000118	0.0500	0.0517	103	0.0471	94	83-125	9	25	mg/kg	02/22/13 11:36	
Acetone	0.00535	0.600	0.533	89	0.476	79	33-148	11	25	mg/kg	02/22/13 11:36	
Benzene	<0.000300	0.0500	0.0475	95	0.0433	87	71-119	9	25	mg/kg	02/22/13 11:36	
Bromobenzene	<0.000198	0.0500	0.0505	101	0.0462	92	84-123	9	25	mg/kg	02/22/13 11:36	
Bromochloromethane	<0.000215	0.0500	0.0458	92	0.0426	85	71-120	7	25	mg/kg	02/22/13 11:36	
Bromodichloromethane	<0.000186	0.0500	0.0554	111	0.0509	102	78-126	8	25	mg/kg	02/22/13 11:36	
Bromoform	<0.000393	0.0500	0.0471	94	0.0429	86	63-136	9	25	mg/kg	02/22/13 11:36	
Bromomethane	<0.000274	0.0500	0.0405	81	0.0374	75	57-118	8	25	mg/kg	02/22/13 11:36	
Carbon Disulfide	0.000280	0.550	0.590	107	0.546	99	55-136	8	25	mg/kg	02/22/13 11:36	
Carbon Tetrachloride	<0.000132	0.0500	0.0494	99	0.0455	91	63-135	8	25	mg/kg	02/22/13 11:36	
Chlorobenzene	<0.000104	0.0500	0.0493	99	0.0456	91	83-121	8	25	mg/kg	02/22/13 11:36	
Chloroethane	<0.000254	0.0500	0.0421	84	0.0384	77	57-122	9	25	mg/kg	02/22/13 11:36	
Chloroform	0.000140	0.0500	0.0498	100	0.0455	91	74-118	9	25	mg/kg	02/22/13 11:36	
Chloromethane	<0.000322	0.0500	0.0437	87	0.0398	80	58-110	9	25	mg/kg	02/22/13 11:36	
cis-1,2-Dichloroethene	<0.000165	0.0500	0.0509	102	0.0472	94	72-131	8	25	mg/kg	02/22/13 11:36	
cis-1,3-Dichloropropene	<0.000128	0.0500	0.0564	113	0.0520	104	74-135	8	25	mg/kg	02/22/13 11:36	
Dibromochloromethane	<0.000422	0.0500	0.0453	91	0.0418	84	77-130	8	25	mg/kg	02/22/13 11:36	
Dibromomethane	<0.000260	0.0500	0.0500	100	0.0459	92	73-126	9	25	mg/kg	02/22/13 11:36	
Dichlorodifluoromethane	<0.000484	0.0500	0.0505	101	0.0463	93	54-122	9	25	mg/kg	02/22/13 11:36	
Ethylbenzene	<0.000104	0.0500	0.0509	102	0.0466	93	80-123	9	25	mg/kg	02/22/13 11:36	
Hexachlorobutadiene	<0.000346	0.0500	0.0504	101	0.0495	99	77-130	2	25	mg/kg	02/22/13 11:36	
Iodomethane (Methyl Iodide)	<0.000200	0.0500	0.0457	91	0.0421	84	63-116	8	25	mg/kg	02/22/13 11:36	
isopropylbenzene	<0.000112	0.0500	0.0499	100	0.0464	93	55-155	7	25	mg/kg	02/22/13 11:36	
m,p-Xylenes	<0.000185	0.100	0.106	106	0.0979	98	78-127	8	25	mg/kg	02/22/13 11:36	
Methylene Chloride	0.00649	0.0500	0.0515	103	0.0486	97	57-134	6	25	mg/kg	02/22/13 11:36	

XENCO Laboratories
Trans West Analytical Services, LLC

QC Summary 457697

Southwest Research Institute

Jet Fuel

Analytical Method: VOAs by SW-846 8260B | Prep Method: SW5030B
Seq Number: 907617 | Matrix: Solid | Date Prep: 02/22/2013
MB Sample Id: 634196-1-BLK | LCS Sample Id: 634196-1-BKS | LCSD Sample Id: 634196-1-BSD

Parameter	MB Result	Spike Amount	LCS Result	LCS %Rec	LCSD Result	LCSD %Rec	Limits	%RPD	RPD Limit	Units	Analysis Date	Flag
MTBE	<0.000142	0.100	0.114	114	0.107	107	64-148	6	25	mg/kg	02/22/13 11:36	
Naphthalene	<0.000148	0.0500	0.0491	98	0.0481	96	53-162	2	25	mg/kg	02/22/13 11:36	
n-Butylbenzene	<0.0000990	0.0500	0.0527	105	0.0494	99	82-127	6	25	mg/kg	02/22/13 11:36	
n-Propylbenzene	<0.000137	0.0500	0.0538	108	0.0496	99	84-131	8	25	mg/kg	02/22/13 11:36	
o-Xylene	<0.000149	0.0500	0.0512	102	0.0473	95	79-125	8	25	mg/kg	02/22/13 11:36	
p-Cymene (p-Isopropyltoluene)	<0.0000800	0.0500	0.0548	110	0.0513	103	84-130	7	25	mg/kg	02/22/13 11:36	
Sec-Butylbenzene	<0.000121	0.0500	0.0535	107	0.0494	99	84-131	8	25	mg/kg	02/22/13 11:36	
Styrene	<0.000158	0.0500	0.0554	111	0.0508	102	80-126	9	25	mg/kg	02/22/13 11:36	
tert-Butylbenzene	<0.0000900	0.0500	0.0529	106	0.0490	98	83-132	8	25	mg/kg	02/22/13 11:36	
Tetrachloroethylene	<0.000173	0.0500	0.0493	99	0.0455	91	79-124	8	25	mg/kg	02/22/13 11:36	
Toluene	<0.000117	0.0500	0.0475	95	0.0442	88	74-122	7	25	mg/kg	02/22/13 11:36	
trans-1,2-dichloroethene	<0.000123	0.0500	0.0456	91	0.0420	84	63-110	8	25	mg/kg	02/22/13 11:36	
trans-1,3-dichloropropene	<0.000361	0.0500	0.0440	88	0.0418	84	73-125	5	25	mg/kg	02/22/13 11:36	
Trichloroethene	<0.000147	0.0500	0.0519	104	0.0468	94	78-119	10	25	mg/kg	02/22/13 11:36	
Trichlorofluoromethane	<0.000186	0.0500	0.0448	90	0.0409	82	71-148	9	25	mg/kg	02/22/13 11:36	
Vinyl Acetate	<0.000213	0.500	0.553	111	0.498	100	40-154	10	25	mg/kg	02/22/13 11:36	
Vinyl Chloride	<0.000193	0.0500	0.0411	82	0.0371	74	60-123	10	25	mg/kg	02/22/13 11:36	

Surrogate	MB %Rec	MB Flag	LCS %Rec	LCS Flag	LCSD %Rec	LCSD Flag	Limits	Units	Analysis Date
Dibromofluoromethane	92		102		102		53-142	%	02/22/13 11:36
1,2-Dichloroethane-D4	101		101		98		56-150	%	02/22/13 11:36
Toluene-D8	100		101		101		70-130	%	02/22/13 11:36
4-Bromofluorobenzene	103		101		99		68-152	%	02/22/13 11:36

XENCO Laboratories
Trans West Analytical Services, LLC

QC Summary 457697

Southwest Research Institute

Jet Fuel

Analytical Method: VOAs by SW-846 8260B — Prep Method: SW5030B
Seq Number: 907536 — Matrix: Soil — Date Prep: 02/21/2013
Parent Sample Id: 457772-004 — MS Sample Id: 457772-004 S — MSD Sample Id: 457772-004 SD

Parameter	Parent Result	Spike Amount	MS Result	MS %Rec	MSD Result	MSD %Rec	Limits	%RPD	RPD Limit	Units	Analysis Date	Flag
1,1,1,2-Tetrachloroethane	<0.00102	0.345	0.381	110	0.367	106	72-125	4	25	mg/kg	02/21/13 17:03	
1,1,1-Trichloroethane	<0.00416	0.345	0.324	94	0.298	86	75-125	8	25	mg/kg	02/21/13 17:03	
1,1,2,2-Tetrachloroethane	<0.00134	0.345	0.394	114	0.373	108	74-125	5	25	mg/kg	02/21/13 17:03	
1,1,2-Trichloroethane	<0.00155	0.345	0.358	104	0.342	99	75-127	5	25	mg/kg	02/21/13 17:03	
1,1-Dichloroethane	<0.000864	0.345	0.326	94	0.294	85	72-125	10	25	mg/kg	02/21/13 17:03	
1,1-Dichloroethene	<0.00133	0.345	0.261	76	0.236	68	59-172	10	25	mg/kg	02/21/13 17:03	
1,1-Dichloropropene	<0.00137	0.345	0.279	81	0.261	76	75-125	7	25	mg/kg	02/21/13 17:03	
1,2,3-Trichlorobenzene	<0.000732	0.345	0.372	108	0.358	104	75-137	4	25	mg/kg	02/21/13 17:03	
1,2,3-Trichloropropane	<0.00248	0.345	0.399	116	0.372	108	75-125	7	25	mg/kg	02/21/13 17:03	
1,2,4-Trichlorobenzene	<0.00132	0.345	0.355	103	0.347	101	75-135	2	25	mg/kg	02/21/13 17:03	
1,2,4-Trimethylbenzene	<0.000712	0.345	0.348	101	0.347	101	75-125	0	25	mg/kg	02/21/13 17:03	
1,2-Dibromo-3-Chloropropane	<0.00737	0.345	0.368	107	0.327	95	59-125	12	25	mg/kg	02/21/13 17:03	
1,2-Dibromoethane	<0.00133	0.345	0.340	99	0.325	94	73-125	5	25	mg/kg	02/21/13 17:03	
1,2-Dichlorobenzene	<0.000891	0.345	0.351	102	0.346	100	75-125	1	25	mg/kg	02/21/13 17:03	
1,2-Dichloroethane	<0.00122	0.345	0.330	96	0.307	89	68-127	7	25	mg/kg	02/21/13 17:03	
1,2-Dichloropropane	<0.00112	0.345	0.339	98	0.319	92	74-125	6	25	mg/kg	02/21/13 17:03	
1,3,5-Trimethylbenzene	<0.00115	0.345	0.348	101	0.347	101	70-130	0	25	mg/kg	02/21/13 17:03	
1,3-Dichlorobenzene	<0.00110	0.345	0.342	99	0.339	98	75-125	1	25	mg/kg	02/21/13 17:03	
1,3-Dichloropropane	<0.00157	0.345	0.335	97	0.321	93	75-125	4	25	mg/kg	02/21/13 17:03	
1,4-Dichlorobenzene	<0.000670	0.345	0.335	97	0.330	96	75-125	2	25	mg/kg	02/21/13 17:03	
2,2-Dichloropropane	<0.000878	0.345	0.337	98	0.323	94	75-125	4	25	mg/kg	02/21/13 17:03	
2-Butanone	<0.0119	4.15	3.63	87	3.29	79	75-125	10	25	mg/kg	02/21/13 17:03	
2-Chlorotoluene	<0.00150	0.345	0.345	100	0.349	101	73-125	1	25	mg/kg	02/21/13 17:03	
2-Hexanone	<0.00774	4.15	3.78	91	3.31	80	75-125	13	25	mg/kg	02/21/13 17:03	
4-Chlorotoluene	<0.000815	0.345	0.339	98	0.336	97	74-125	1	25	mg/kg	02/21/13 17:03	
Acetone	0.0259	4.15	3.40	81	3.00	72	50-150	13	25	mg/kg	02/21/13 17:03	
Benzene	<0.00207	0.345	0.297	86	0.284	82	66-142	4	25	mg/kg	02/21/13 17:03	
Bromobenzene	<0.00137	0.345	0.341	99	0.333	97	75-125	2	25	mg/kg	02/21/13 17:03	
Bromochloromethane	<0.00149	0.345	0.332	96	0.288	83	60-140	14	25	mg/kg	02/21/13 17:03	
Bromodichloromethane	<0.00129	0.345	0.381	110	0.355	103	75-125	7	25	mg/kg	02/21/13 17:03	
Bromoform	<0.00272	0.345	0.332	96	0.307	89	75-125	8	25	mg/kg	02/21/13 17:03	
Bromomethane	<0.00189	0.345	0.239	69	0.205	59	60-140	15	25	mg/kg	02/21/13 17:03	M2
Carbon Disulfide	0.000684	3.80	1.80	47	1.59	42	60-140	12	25	mg/kg	02/21/13 17:03	M2
Carbon Tetrachloride	<0.000912	0.345	0.311	90	0.283	82	62-125	9	25	mg/kg	02/21/13 17:03	
Chlorobenzene	<0.000719	0.345	0.325	94	0.312	90	60-133	4	25	mg/kg	02/21/13 17:03	
Chloroethane	<0.00176	0.345	0.249	72	0.215	62	60-140	15	25	mg/kg	02/21/13 17:03	
Chloroform	<0.000960	0.345	0.356	103	0.321	93	74-125	10	25	mg/kg	02/21/13 17:03	
Chloromethane	<0.00222	0.345	0.199	58	0.178	52	60-140	11	25	mg/kg	02/21/13 17:03	M2
cis-1,2-Dichloroethene	<0.00114	0.345	0.332	96	0.298	86	75-125	11	25	mg/kg	02/21/13 17:03	
cis-1,3-Dichloropropene	<0.000884	0.345	0.365	106	0.341	99	74-125	7	25	mg/kg	02/21/13 17:03	
Dibromochloromethane	<0.00292	0.345	0.316	92	0.299	87	73-125	6	25	mg/kg	02/21/13 17:03	
Dibromomethane	<0.00180	0.345	0.331	96	0.304	88	69-127	9	25	mg/kg	02/21/13 17:03	
Dichlorodifluoromethane	<0.00334	0.345	0.191	55	0.165	48	65-135	15	25	mg/kg	02/21/13 17:03	M2
Ethylbenzene	<0.000719	0.345	0.321	93	0.313	91	75-125	3	25	mg/kg	02/21/13 17:03	
Hexachlorobutadiene	<0.00239	0.345	0.327	95	0.330	96	75-125	1	25	mg/kg	02/21/13 17:03	
Iodomethane (Methyl Iodide)	<0.00138	0.345	0.270	78	0.240	70	75-125	12	25	mg/kg	02/21/13 17:03	M2
isopropylbenzene	<0.000774	0.345	0.346	100	0.332	96	75-125	4	25	mg/kg	02/21/13 17:03	
m,p-Xylenes	<0.00128	0.691	0.659	95	0.638	92	75-125	3	25	mg/kg	02/21/13 17:03	
Methylene Chloride	0.0332	0.345	0.297	76	0.267	68	75-125	11	25	mg/kg	02/21/13 17:03	M2

XENCO Laboratories
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QC Summary 457697

Southwest Research Institute

Jet Fuel

Analytical Method: VOAs by SW-846 8260B | Prep Method: SW5030B
Seq Number: 907536 | Matrix: Soil | Date Prep: 02/21/2013
Parent Sample Id: 457772-004 | MS Sample Id: 457772-004 S | MSD Sample Id: 457772-004 SD

Parameter	Parent Result	Spike Amount	MS Result	MS %Rec	MSD Result	MSD %Rec	Limits	%RPD	RPD Limit	Units	Analysis Date	Flag
MTBE	<0.000981	0.691	0.756	109	0.661	96	60-140	13	25	mg/kg	02/21/13 17:03	
Naphthalene	<0.00102	0.345	0.343	99	0.327	95	70-130	5	25	mg/kg	02/21/13 17:03	
n-Butylbenzene	<0.000684	0.345	0.343	99	0.339	98	75-125	1	25	mg/kg	02/21/13 17:03	
n-Propylbenzene	<0.000947	0.345	0.331	96	0.328	95	75-125	1	25	mg/kg	02/21/13 17:03	
o-Xylene	<0.00103	0.345	0.336	97	0.323	94	75-125	4	25	mg/kg	02/21/13 17:03	
p-Cymene (p-Isopropyltoluene)	<0.000553	0.345	0.350	101	0.351	102	75-125	0	25	mg/kg	02/21/13 17:03	
Sec-Butylbenzene	<0.000836	0.345	0.348	101	0.350	101	75-125	1	25	mg/kg	02/21/13 17:03	
Styrene	<0.00109	0.345	0.369	107	0.350	101	75-125	5	25	mg/kg	02/21/13 17:03	
tert-Butylbenzene	<0.000622	0.345	0.350	101	0.353	102	75-125	1	25	mg/kg	02/21/13 17:03	
Tetrachloroethylene	<0.00120	0.345	0.273	79	0.271	79	71-125	1	25	mg/kg	02/21/13 17:03	
Toluene	<0.000808	0.345	0.299	87	0.289	84	59-139	3	25	mg/kg	02/21/13 17:03	
trans-1,2-dichloroethene	<0.000850	0.345	0.266	77	0.240	70	75-125	10	25	mg/kg	02/21/13 17:03	M2
trans-1,3-dichloropropene	<0.00249	0.345	0.305	88	0.293	85	66-125	4	25	mg/kg	02/21/13 17:03	
Trichloroethene	<0.00102	0.345	0.297	86	0.279	81	62-137	6	25	mg/kg	02/21/13 17:03	
Trichlorofluoromethane	<0.00129	0.345	0.268	78	0.239	69	67-125	11	25	mg/kg	02/21/13 17:03	
Vinyl Acetate	<0.00147	3.45	3.59	104	3.31	96	60-140	8	25	mg/kg	02/21/13 17:03	
Vinyl Chloride	<0.00133	0.345	0.219	63	0.194	56	60-140	12	25	mg/kg	02/21/13 17:03	M2

Surrogate	MS %Rec	MS Flag	MSD %Rec	MSD Flag	Limits	Units	Analysis Date
Dibromofluoromethane	106		100		53-142	%	02/21/13 17:03
1,2-Dichloroethane-D4	104		101		56-150	%	02/21/13 17:03
Toluene-D8	100		102		70-130	%	02/21/13 17:03
4-Bromofluorobenzene	103		103		68-152	%	02/21/13 17:03

XENCO Laboratories
Trans West Analytical Services, LLC

QC Summary 457697

Southwest Research Institute

Jet Fuel

Analytical Method: VOAs by SW-846 8260B — Prep Method: SW5030B
Seq Number: 907617 — Matrix: Product — Date Prep: 02/22/2013
Parent Sample Id: 457697-002 — MS Sample Id: 457697-002 S — MSD Sample Id: 457697-002 SD

Parameter	Parent Result	Spike Amount	MS Result	MS %Rec	MSD Result	MSD %Rec	Limits	%RPD	RPD Limit	Units	Analysis Date	Flag
1,1,1,2-Tetrachloroethane	<3.70	1250	1150	92	1160	93	72-125	1	25	mg/kg	02/22/13 14:28	
1,1,1-Trichloroethane	<15.1	1250	1100	88	1110	89	75-125	1	25	mg/kg	02/22/13 14:28	
1,1,2,2-Tetrachloroethane	<4.85	1250	2560	205	2760	221	74-125	8	25	mg/kg	02/22/13 14:28	M1
1,1,2-Trichloroethane	<5.63	1250	1400	112	1460	117	75-127	4	25	mg/kg	02/22/13 14:28	
1,1-Dichloroethane	<3.13	1250	1120	90	1140	91	72-125	2	25	mg/kg	02/22/13 14:28	
1,1-Dichloroethene	<4.80	1250	992	79	998	80	59-172	1	25	mg/kg	02/22/13 14:28	
1,1-Dichloropropene	<4.95	1250	1060	85	1060	85	75-125	0	25	mg/kg	02/22/13 14:28	
1,2,3-Trichlorobenzene	<2.65	1250	1340	107	1400	112	75-137	4	25	mg/kg	02/22/13 14:28	
1,2,3-Trichloropropane	<8.98	1250	1230	98	1270	102	75-125	3	25	mg/kg	02/22/13 14:28	
1,2,4-Trichlorobenzene	<4.78	1250	1310	105	1340	107	75-135	2	25	mg/kg	02/22/13 14:28	
1,2,4-Trimethylbenzene	13500	1250	13200	0	14200	56	75-125	7	25	mg/kg	02/22/13 14:28	M3
1,2-Dibromo-3-Chloropropane	<26.7	1250	1430	114	1530	122	59-125	7	25	mg/kg	02/22/13 14:28	
1,2-Dibromoethane	<4.83	1250	1180	94	1190	95	73-125	1	25	mg/kg	02/22/13 14:28	
1,2-Dichlorobenzene	<3.23	1250	1140	91	1160	93	75-125	2	25	mg/kg	02/22/13 14:28	
1,2-Dichloroethane	<4.43	1250	1070	86	1090	87	68-127	2	25	mg/kg	02/22/13 14:28	
1,2-Dichloropropane	<4.05	1250	1100	88	1130	90	74-125	3	25	mg/kg	02/22/13 14:28	
1,3,5-Trimethylbenzene	3790	1250	4590	64	4830	83	70-130	5	25	mg/kg	02/22/13 14:28	M3
1,3-Dichlorobenzene	<3.98	1250	1150	92	1160	93	75-125	1	25	mg/kg	02/22/13 14:28	
1,3-Dichloropropane	<5.68	1250	1170	94	1200	96	75-125	3	25	mg/kg	02/22/13 14:28	
1,4-Dichlorobenzene	<2.43	1250	1120	90	1130	90	75-125	1	25	mg/kg	02/22/13 14:28	
2,2-Dichloropropane	<3.18	1250	1030	82	1120	90	75-125	8	25	mg/kg	02/22/13 14:28	
2-Butanone	<43.2	15000	13700	91	14100	94	75-125	3	25	mg/kg	02/22/13 14:28	
2-Chlorotoluene	<5.43	1250	1180	94	1190	95	73-125	1	25	mg/kg	02/22/13 14:28	
2-Hexanone	<28.0	15000	13900	93	15900	106	75-125	13	25	mg/kg	02/22/13 14:28	
4-Chlorotoluene	<2.95	1250	1490	119	1510	121	74-125	1	25	mg/kg	02/22/13 14:28	
Acetone	212	15000	11900	78	12400	81	50-150	4	25	mg/kg	02/22/13 14:28	
Benzene	13.3	1250	1070	85	1100	87	66-142	3	25	mg/kg	02/22/13 14:28	
Bromobenzene	<4.95	1250	1140	91	1150	92	75-125	1	25	mg/kg	02/22/13 14:28	
Bromochloromethane	<5.38	1250	1020	82	1060	85	60-140	4	25	mg/kg	02/22/13 14:28	
Bromodichloromethane	<4.65	1250	1190	95	1210	97	75-125	2	25	mg/kg	02/22/13 14:28	
Bromoform	<9.83	1250	926	74	921	74	75-125	1	25	mg/kg	02/22/13 14:28	M2
Bromomethane	<6.85	1250	845	68	857	69	60-140	1	25	mg/kg	02/22/13 14:28	
Carbon Disulfide	4.50	13800	13300	96	13500	98	60-140	1	25	mg/kg	02/22/13 14:28	
Carbon Tetrachloride	<3.30	1250	1070	86	1090	87	62-125	2	25	mg/kg	02/22/13 14:28	
Chlorobenzene	<2.60	1250	1110	89	1120	90	60-133	1	25	mg/kg	02/22/13 14:28	
Chloroethane	<6.35	1250	892	71	893	71	60-140	0	25	mg/kg	02/22/13 14:28	
Chloroform	<3.48	1250	1100	88	1130	90	74-125	3	25	mg/kg	02/22/13 14:28	
Chloromethane	<8.05	1250	968	77	1000	80	60-140	3	25	mg/kg	02/22/13 14:28	
cis-1,2-Dichloroethene	<4.13	1250	1130	90	1160	93	75-125	3	25	mg/kg	02/22/13 14:28	
cis-1,3-Dichloropropene	<3.20	1250	1250	100	1290	103	74-125	3	25	mg/kg	02/22/13 14:28	
Dibromochloromethane	<10.6	1250	965	77	984	79	73-125	2	25	mg/kg	02/22/13 14:28	
Dibromomethane	<6.50	1250	1100	88	1140	91	69-127	4	25	mg/kg	02/22/13 14:28	
Dichlorodifluoromethane	<12.1	1250	1110	89	1140	91	65-135	3	25	mg/kg	02/22/13 14:28	
Ethylbenzene	1570	1250	2540	78	2640	86	75-125	4	25	mg/kg	02/22/13 14:28	
Hexachlorobutadiene	<8.65	1250	1240	99	1240	99	75-125	0	25	mg/kg	02/22/13 14:28	
Iodomethane (Methyl Iodide)	<5.00	1250	1030	82	1040	83	75-125	1	25	mg/kg	02/22/13 14:28	
isopropylbenzene	684	1250	1720	83	1780	88	75-125	3	25	mg/kg	02/22/13 14:28	
m,p-Xylenes	6510	2500	7940	57	8340	73	75-125	5	25	mg/kg	02/22/13 14:28	M2
Methylene Chloride	170	1250	1120	76	1150	78	75-125	3	25	mg/kg	02/22/13 14:28	

XENCO Laboratories
Trans West Analytical Services, LLC

QC Summary 457697

Southwest Research Institute

Jet Fuel

Analytical Method: VOAs by SW-846 8260B — Prep Method: SW5030B
Seq Number: 907617 — Matrix: Product — Date Prep: 02/22/2013
Parent Sample Id: 457697-002 — MS Sample Id: 457697-002 S — MSD Sample Id: 457697-002 SD

Parameter	Parent Result	Spike Amount	MS Result	MS %Rec	MSD Result	MSD %Rec	Limits	%RPD	RPD Limit	Units	Analysis Date	Flag
MTBE	<3.55	2500	2590	104	2690	108	60-140	4	25	mg/kg	02/22/13 14:28	
Naphthalene	1350	1250	2540	95	2740	111	70-130	8	25	mg/kg	02/22/13 14:28	
n-Butylbenzene	1730	1250	2780	84	2960	98	75-125	6	25	mg/kg	02/22/13 14:28	
n-Propylbenzene	2010	1250	3030	82	3180	94	75-125	5	25	mg/kg	02/22/13 14:28	
o-Xylene	3440	1250	4190	60	4400	77	75-125	5	25	mg/kg	02/22/13 14:28	M2
p-Cymene (p-Isopropyltoluene)	708	1250	1850	91	1930	98	75-125	4	25	mg/kg	02/22/13 14:28	
Sec-Butylbenzene	799	1250	1930	90	1990	95	75-125	3	25	mg/kg	02/22/13 14:28	
Styrene	<3.95	1250	1370	110	1390	111	75-125	1	25	mg/kg	02/22/13 14:28	
tert-Butylbenzene	42.5	1250	1270	98	1280	99	75-125	1	25	mg/kg	02/22/13 14:28	
Tetrachloroethylene	<4.33	1250	1100	88	1110	89	71-125	1	25	mg/kg	02/22/13 14:28	
Toluene	662	1250	1670	81	1710	84	59-139	2	25	mg/kg	02/22/13 14:28	
trans-1,2-dichloroethene	<3.08	1250	1020	82	1040	83	75-125	2	25	mg/kg	02/22/13 14:28	
trans-1,3-dichloropropene	<9.03	1250	969	78	1020	82	66-125	5	25	mg/kg	02/22/13 14:28	
Trichloroethene	<3.68	1250	1130	90	1140	91	62-137	1	25	mg/kg	02/22/13 14:28	
Trichlorofluoromethane	<4.65	1250	947	76	983	79	67-125	4	25	mg/kg	02/22/13 14:28	
Vinyl Acetate	<5.33	12500	12000	96	12400	99	60-140	3	25	mg/kg	02/22/13 14:28	
Vinyl Chloride	<4.83	1250	879	70	890	71	60-140	1	25	mg/kg	02/22/13 14:28	

Surrogate	MS %Rec	MS Flag	MSD %Rec	MSD Flag	Limits	Units	Analysis Date
Dibromofluoromethane	100		101		53-142	%	02/22/13 14:28
1,2-Dichloroethane-D4	100		98		56-150	%	02/22/13 14:28
Toluene-D8	105		104		70-130	%	02/22/13 14:28
4-Bromofluorobenzene	109		108		68-152	%	02/22/13 14:28

Appendix BO
EPA Testing Reports: CL13-5265

Analytical Report 476075

for

Southwest Research Institute

Project Manager: Scott Hutzler

Jet Fuel

CL13-5265

30-DEC-13

Collected By: Client

4143 Greenbriar Dr., Stafford, TX 77477

Xenco-Houston (EPA Lab code: TX00122):
Texas (T104704215-13-15-TX), Arizona (AZ0765), Arkansas (08-039-0), Connecticut (PH-0102), Florida (E871002)
Illinois (002082), Indiana (C-TX-02), Iowa (392), Kansas (E-10380), Kentucky (45), Louisiana (03054)
New Hampshire (297408), New Jersey (TX007), New York (11763), Oklahoma (9218), Pennsylvania (68-03610)
Rhode Island (LAO00312), USDA (S-44102), DoD (L11-54)

Xenco-Atlanta (EPA Lab Code: GA00046):
Florida (E87429), North Carolina (483), South Carolina (98015), Kentucky (85), DoD (L10-135)
Louisiana (04176), USDA (P330-07-00105)

Xenco-Tampa Mobile (EPA Lab code: FL01212): Florida (E84900)
Xenco-Lakeland: Florida (E84098)
Xenco-Odessa (EPA Lab code: TX00158): Texas (T104704400-TX)
Xenco-Dallas (EPA Lab code: TX01468): Texas (T104704295-TX)
Xenco Phoenix (EPA Lab Code: AZ00901): Arizona(AZ0757)
Xenco-Phoenix Mobile (EPA Lab code: AZ00901): Arizona (AZM757)
Xenco Tucson (EPA Lab code:AZ000989): Arizona (AZ0758)

30-DEC-13

Project Manager: **Scott Hutzler**
Southwest Research Institute
6220 Culebra Road
P.O. Box 28510
San Antonio, TX 78228

Reference: XENCO Report No(s): **476075**
Jet Fuel
Project Address:

Scott Hutzler :

We are reporting to you the results of the analyses performed on the samples received under the project name referenced above and identified with the XENCO Report Number(s) 476075. All results being reported under this Report Number apply to the samples analyzed and properly identified with a Laboratory ID number. Subcontracted analyses are identified in this report with either the NELAC certification number of the subcontract lab in the analyst ID field, or the complete subcontracted report attached to this report.

Unless otherwise noted in a Case Narrative, all data reported in this Analytical Report are in compliance with NELAC standards. The uncertainty of measurement associated with the results of analysis reported is available upon request. Should insufficient sample be provided to the laboratory to meet the method and NELAC Matrix Duplicate and Matrix Spike requirements, then the data will be analyzed, evaluated and reported using all other available quality control measures.

The validity and integrity of this report will remain intact as long as it is accompanied by this letter and reproduced in full, unless written approval is granted by XENCO Laboratories. This report will be filed for at least 5 years in our archives after which time it will be destroyed without further notice, unless otherwise arranged with you. The samples received, and described as recorded in Report No. 476075 will be filed for 60 days, and after that time they will be properly disposed without further notice, unless otherwise arranged with you. We reserve the right to return to you any unused samples, extracts or solutions related to them if we consider so necessary (e.g., samples identified as hazardous waste, sample sizes exceeding analytical standard practices, controlled substances under regulated protocols, etc).

We thank you for selecting XENCO Laboratories to serve your analytical needs. If you have any questions concerning this report, please feel free to contact us at any time.

Respectfully,

Skip Harden
Project Manager

Sample receipt non conformances and comments:

None

Sample receipt non conformances and comments per sample:

None

Flagging Criteria

Arizona Flags

All method blanks, laboratory spikes, and/or matrix spikes met quality control objectives for the parameters associated with this Work Order except as detailed below or on the Data Qualifier page of this report. Data Qualifiers used in this report are in accordance with ADEQ Arizona Data Qualifiers, Revision 3.0 9/20/2007. Data qualifiers (flags) contained within this analytical report have been issued to explain a quality control deficiency, and do not affect the quality (validity) of the data unless noted otherwise in the case narrative.

D1 Sample required dilution due to matrix.

D2 Sample required dilution due to high concentration of target analyte.

L2 The associated blank spike recovery was below laboratory acceptance limits.

M2 Matrix spike recovery was low; the associated blank spike recovery was acceptable.

S1 Surrogate recovery was above laboratory acceptance limits, but within method acceptance limits.

T4 Tentatively identified compound. Concentration is estimated and based on the closest internal standard.

Sample Cross Reference 476075

Southwest Research Institute, San Antonio, TX

Jet Fuel

Sample Id	Matrix	Date Collected	Sample Depth	Lab Sample Id
CL13-5265	W	12-17-13 00:00		476075-001

Certificate of Analytical Results 476075

Southwest Research Institute, San Antonio, TX

Jet Fuel

Sample Id: **CL13-5265** Matrix: Product Date Received: 12.18.13 10.00
Lab Sample Id: 476075-001 Date Collected: 12.17.13 00.00

Analytical Method: SVOCs by SW-846 8270C Prep Method: SW3580A
Tech: RIM % Moisture:
Analyst: PKH Date Prep: 12.24.13 12.09 Basis: Wet Weight
Seq Number: 930871 SUB: TX104704215

Parameter	Cas Number	Result	RL	Units	Analysis Date	Flag	Dil
1,2,4-Trichlorobenzene	120-82-1	<2500	2500	mg/kg	12.27.13 12.01	D1	50
1,2-Dichlorobenzene	95-50-1	<2500	2500	mg/kg	12.27.13 12.01	D1	50
1,3-Dichlorobenzene	541-73-1	<2500	2500	mg/kg	12.27.13 12.01	D1	50
1,4-Dichlorobenzene	106-46-7	<2500	2500	mg/kg	12.27.13 12.01	D1	50
2,4,5-Trichlorophenol	95-95-4	<2500	2500	mg/kg	12.27.13 12.01	D1	50
2,4,6-Trichlorophenol	88-06-2	<2500	2500	mg/kg	12.27.13 12.01	D1	50
2,4-Dichlorophenol	120-83-2	<2500	2500	mg/kg	12.27.13 12.01	D1	50
2,4-Dimethylphenol	105-67-9	<2500	2500	mg/kg	12.27.13 12.01	D1	50
2,4-Dinitrophenol	51-28-5	<5000	5000	mg/kg	12.27.13 12.01	D1	50
2,4-Dinitrotoluene	121-14-2	<2500	2500	mg/kg	12.27.13 12.01	D1	50
2,6-Dinitrotoluene	606-20-2	<2500	2500	mg/kg	12.27.13 12.01	D1	50
2-Chloronaphthalene	91-58-7	<2500	2500	mg/kg	12.27.13 12.01	D1	50
2-Chlorophenol	95-57-8	<2500	2500	mg/kg	12.27.13 12.01	D1	50
2-Methylnaphthalene	91-57-6	<2500	2500	mg/kg	12.27.13 12.01	D1	50
2-methylphenol	95-48-7	<2500	2500	mg/kg	12.27.13 12.01	D1	50
2-Nitroaniline	88-74-4	<5000	5000	mg/kg	12.27.13 12.01	D1	50
2-Nitrophenol	88-75-5	<2500	2500	mg/kg	12.27.13 12.01	D1	50
3&4-Methylphenol	15831-10-4	<2500	2500	mg/kg	12.27.13 12.01	D1	50
3,3-Dichlorobenzidine	91-94-1	<5000	5000	mg/kg	12.27.13 12.01	D1	50
3-Nitroaniline	99-09-2	<5000	5000	mg/kg	12.27.13 12.01	D1	50
4,6-dinitro-2-methyl phenol	534-52-1	<5000	5000	mg/kg	12.27.13 12.01	D1	50
4-Bromophenyl-phenylether	101-55-3	<2500	2500	mg/kg	12.27.13 12.01	D1	50
4-chloro-3-methylphenol	59-50-7	<2500	2500	mg/kg	12.27.13 12.01	D1	50
4-Chloroaniline	106-47-8	<5000	5000	mg/kg	12.27.13 12.01	D1	50
4-Chlorophenyl-phenyl ether	7005-72-3	<2500	2500	mg/kg	12.27.13 12.01	D1	50
4-Nitroaniline	100-01-6	<5000	5000	mg/kg	12.27.13 12.01	D1	50
4-Nitrophenol	100-02-7	<5000	5000	mg/kg	12.27.13 12.01	D1	50
Acenaphthene	83-32-9	<2500	2500	mg/kg	12.27.13 12.01	D1	50
Acenaphthylene	208-96-8	<2500	2500	mg/kg	12.27.13 12.01	D1	50
Aniline (Phenylamine, Aminobenzene)	62-53-3	<5000	5000	mg/kg	12.27.13 12.01	D1	50
Anthracene	120-12-7	<2500	2500	mg/kg	12.27.13 12.01	D1	50
Benzo(a)anthracene	56-55-3	<2500	2500	mg/kg	12.27.13 12.01	D1	50
Benzo(a)pyrene	50-32-8	<2500	2500	mg/kg	12.27.13 12.01	D1	50
Benzo(b)fluoranthene	205-99-2	<2500	2500	mg/kg	12.27.13 12.01	D1	50
Benzo(g,h,i)perylene	191-24-2	<2500	2500	mg/kg	12.27.13 12.01	D1	50
Benzo(k)fluoranthene	207-08-9	<2500	2500	mg/kg	12.27.13 12.01	D1	50
Benzoic Acid	65-85-0	<15000	15000	mg/kg	12.27.13 12.01	D1L2	50
Benzyl Butyl Phthalate	85-68-7	<2500	2500	mg/kg	12.27.13 12.01	D1	50
bis(2-chloroethoxy) methane	111-91-1	<2500	2500	mg/kg	12.27.13 12.01	D1	50

XENCO Laboratories

Certificate of Analytical Results 476075

Southwest Research Institute, San Antonio, TX

Jet Fuel

Sample Id: **CL13-5265** Matrix: Product Date Received: 12.18.13 10.00
Lab Sample Id: 476075-001 Date Collected: 12.17.13 00.00

Analytical Method: SVOCs by SW-846 8270C Prep Method: SW3580A
Tech: RIM % Moisture:
Analyst: PKH Date Prep: 12.24.13 12.09 Basis: Wet Weight
Seq Number: 930871 SUB: TX104704215

Parameter	Cas Number	Result	RL	Units	Analysis Date	Flag	Dil
bis(2-chloroethyl) ether	111-44-4	<2500	2500	mg/kg	12.27.13 12.01	D1	50
bis(2-chloroisopropyl) ether	108-60-1	<2500	2500	mg/kg	12.27.13 12.01	D1	50
bis(2-ethylhexyl) phthalate	117-81-7	<2500	2500	mg/kg	12.27.13 12.01	D1	50
Chrysene	218-01-9	<2500	2500	mg/kg	12.27.13 12.01	D1	50
Dibenz(a,h)Anthracene	53-70-3	<2500	2500	mg/kg	12.27.13 12.01	D1	50
Dibenzofuran	132-64-9	<2500	2500	mg/kg	12.27.13 12.01	D1	50
Diethyl Phthalate	84-66-2	<2500	2500	mg/kg	12.27.13 12.01	D1	50
Dimethyl Phthalate	131-11-3	<2500	2500	mg/kg	12.27.13 12.01	D1	50
di-n-Butyl Phthalate	84-74-2	<2500	2500	mg/kg	12.27.13 12.01	D1	50
di-n-Octyl Phthalate	117-84-0	<2500	2500	mg/kg	12.27.13 12.01	D1	50
Fluoranthene	206-44-0	<2500	2500	mg/kg	12.27.13 12.01	D1	50
Fluorene	86-73-7	<2500	2500	mg/kg	12.27.13 12.01	D1	50
Hexachlorobenzene	118-74-1	<2500	2500	mg/kg	12.27.13 12.01	D1	50
Hexachlorobutadiene	87-68-3	<2500	2500	mg/kg	12.27.13 12.01	D1	50
Hexachlorocyclopentadiene	77-47-4	<2500	2500	mg/kg	12.27.13 12.01	D1	50
Hexachloroethane	67-72-1	<2500	2500	mg/kg	12.27.13 12.01	D1	50
Indeno(1,2,3-c,d)Pyrene	193-39-5	<2500	2500	mg/kg	12.27.13 12.01	D1	50
Isophorone	78-59-1	<2500	2500	mg/kg	12.27.13 12.01	D1	50
Naphthalene	91-20-3	<2500	2500	mg/kg	12.27.13 12.01	D1	50
Nitrobenzene	98-95-3	<2500	2500	mg/kg	12.27.13 12.01	D1	50
N-Nitrosodi-n-Propylamine	621-64-7	<2500	2500	mg/kg	12.27.13 12.01	D1	50
N-Nitrosodiphenylamine	86-30-6	<2500	2500	mg/kg	12.27.13 12.01	D1	50
Pentachlorophenol	87-86-5	<5000	5000	mg/kg	12.27.13 12.01	D1	50
Phenanthrene	85-01-8	<2500	2500	mg/kg	12.27.13 12.01	D1	50
Phenol	108-95-2	<5000	5000	mg/kg	12.27.13 12.01	D1	50
Pyrene	129-00-0	<2500	2500	mg/kg	12.27.13 12.01	D1	50
Pyridine	110-86-1	<5000	5000	mg/kg	12.27.13 12.01	D1	50
Benzene, 1,2,3-trimethyl- (TIC)	TIC	**17300**		mg/kg	12.27.13 12.01	D2T4	50
Benzene, 1,2,4,5-tetramethyl- (TIC)	TIC	**9640**		mg/kg	12.27.13 12.01	D2T4	50
Benzene, 1-ethyl-2,4-dimethyl- (TIC)	TIC	**13200**		mg/kg	12.27.13 12.01	D2T4	50
Benzene, 1-ethyl-3-methyl- (TIC)	TIC	**47400**		mg/kg	12.27.13 12.01	D2T4	50
Benzene, 2-propenyl- (TIC)	TIC	**18200**		mg/kg	12.27.13 12.01	D2T4	50
Cycloheptane, 1,3,5-tris(methylene)- (TIC)	TIC	**22300**		mg/kg	12.27.13 12.01	D2T4	50
Cyclohexane, 1,1,3-trimethyl- (TIC)	TIC	**12100**		mg/kg	12.27.13 12.01	D2T4	50
Cyclohexane, 1,4-dimethyl- (TIC)	TIC	**11700**		mg/kg	12.27.13 12.01	D2T4	50
Cyclohexanol, 2-(1,1-dimethylethyl)- (TIC)	TIC	**8230**		mg/kg	12.27.13 12.01	D2T4	50
Decane, 2,5,6-trimethyl- (TIC)	TIC	**10700**		mg/kg	12.27.13 12.01	D2T4	50
Decane, 2-methyl- (TIC)	TIC	**12100**		mg/kg	12.27.13 12.01	D2T4	50
Dodecane (TIC)	TIC	**20600**		mg/kg	12.27.13 12.01	D2T4	50

Certificate of Analytical Results 476075

Southwest Research Institute, San Antonio, TX

Jet Fuel

Sample Id:	**CL13-5265**	Matrix:	Product	Date Received:	12.18.13 10.00
Lab Sample Id:	476075-001	Date Collected:	12.17.13 00.00		
Analytical Method:	SVOCs by SW-846 8270C			Prep Method:	SW3580A
Tech:	RIM			% Moisture:	
Analyst:	PKH	Date Prep:	12.24.13 12.09	Basis:	Wet Weight
Seq Number:	930871			SUB:	TX104704215

Parameter	Cas Number	Result	RL	Units	Analysis Date	Flag	Dil
Ethylbenzene (TIC)	TIC	**9610**		mg/kg	12.27.13 12.01	D2T4	50
Heptane, 3-ethyl-2-methyl- (TIC)	TIC	**13800**		mg/kg	12.27.13 12.01	D2T4	50
Nonane (TIC)	TIC	**41500**		mg/kg	12.27.13 12.01	D2T4	50
Octane (TIC)	TIC	**8210**		mg/kg	12.27.13 12.01	D2T4	50
Octane, 2,6-dimethyl- (TIC)	TIC	**24900**		mg/kg	12.27.13 12.01	D2T4	50
Tetradecane (TIC)	TIC	**11800**		mg/kg	12.27.13 12.01	D2T4	50
Undecane (TIC)	TIC	**48100**		mg/kg	12.27.13 12.01	D2T4	50
p-Xylene (TIC)	TIC	**17800**		mg/kg	12.27.13 12.01	D2T4	50

Surrogate	Cas Number	% Recovery	Units	Limits	Analysis Date	Flag
2-Fluorophenol	367-12-4	123	%	25-121	12.27.13 12.01	S1
Phenol-d6	13127-88-3	108	%	24-113	12.27.13 12.01	
Nitrobenzene-d5	4165-60-0	116	%	23-120	12.27.13 12.01	
2-Fluorobiphenyl	321-60-8	114	%	30-115	12.27.13 12.01	
2,4,6-Tribromophenol	118-79-6	94	%	19-122	12.27.13 12.01	
Terphenyl-D14	1718-51-0	115	%	18-137	12.27.13 12.01	

XENCO Laboratories

Certificate of Analytical Results 476075

Southwest Research Institute, San Antonio, TX

Jet Fuel

Sample Id: **CL13-5265** Matrix: Product Date Received: 12.18.13 10.00
Lab Sample Id: 476075-001 Date Collected: 12.17.13 00.00

Analytical Method: VOAs by SW-846 8260B Prep Method: SW5030B
Tech: MCH % Moisture:
Analyst: MCH Date Prep: 12.20.13 12.20 Basis: Wet Weight
Seq Number: 930572 SUB: TX104704215

Parameter	Cas Number	Result	RL	Units	Analysis Date	Flag	Dil
1,1,1,2-Tetrachloroethane	630-20-6	<25.1	25.1	mg/kg	12.20.13 20.26	D1	5000
1,1,1-Trichloroethane	71-55-6	<25.1	25.1	mg/kg	12.20.13 20.26	D1	5000
1,1,2,2-Tetrachloroethane	79-34-5	<25.1	25.1	mg/kg	12.20.13 20.26	D1	5000
1,1,2-Trichloroethane	79-00-5	<25.1	25.1	mg/kg	12.20.13 20.26	D1	5000
1,1-Dichloroethane	75-34-3	<25.1	25.1	mg/kg	12.20.13 20.26	D1	5000
1,1-Dichloroethene	75-35-4	<25.1	25.1	mg/kg	12.20.13 20.26	D1	5000
1,1-Dichloropropene	563-58-6	<25.1	25.1	mg/kg	12.20.13 20.26	D1	5000
1,2,3-Trichlorobenzene	87-61-6	<25.1	25.1	mg/kg	12.20.13 20.26	D1	5000
1,2,3-Trichloropropane	96-18-4	<25.1	25.1	mg/kg	12.20.13 20.26	D1	5000
1,2,4-Trichlorobenzene	120-82-1	<25.1	25.1	mg/kg	12.20.13 20.26	D1	5000
1,2,4-Trimethylbenzene	95-63-6	**3800**	501	mg/kg	12.24.13 19.31	D2	100000
1,2-Dibromo-3-Chloropropane	96-12-8	<25.1	25.1	mg/kg	12.20.13 20.26	D1	5000
1,2-Dibromoethane	106-93-4	<25.1	25.1	mg/kg	12.20.13 20.26	D1	5000
1,2-Dichlorobenzene	95-50-1	<25.1	25.1	mg/kg	12.20.13 20.26	D1	5000
1,2-Dichloroethane	107-06-2	<25.1	25.1	mg/kg	12.20.13 20.26	D1	5000
1,2-Dichloropropane	78-87-5	<25.1	25.1	mg/kg	12.20.13 20.26	D1	5000
1,3,5-Trimethylbenzene	108-67-8	**2920**	251	mg/kg	12.24.13 02.12	D2	50000
1,3-Dichlorobenzene	541-73-1	<25.1	25.1	mg/kg	12.20.13 20.26	D1	5000
1,3-Dichloropropane	142-28-9	<25.1	25.1	mg/kg	12.20.13 20.26	D1	5000
1,4-Dichlorobenzene	106-46-7	<25.1	25.1	mg/kg	12.20.13 20.26	D1	5000
2,2-Dichloropropane	594-20-7	<25.1	25.1	mg/kg	12.20.13 20.26	D1	5000
2-Butanone	78-93-3	<251	251	mg/kg	12.20.13 20.26	D1	5000
2-Chlorotoluene	95-49-8	<25.1	25.1	mg/kg	12.20.13 20.26	D1	5000
2-Hexanone	591-78-6	<251	251	mg/kg	12.20.13 20.26	D1	5000
4-Chlorotoluene	106-43-4	<25.1	25.1	mg/kg	12.20.13 20.26	D1	5000
Acetone	67-64-1	<501	501	mg/kg	12.20.13 20.26	D1	5000
Benzene	71-43-2	<25.1	25.1	mg/kg	12.20.13 20.26	D1	5000
Bromobenzene	108-86-1	<25.1	25.1	mg/kg	12.20.13 20.26	D1	5000
Bromochloromethane	74-97-5	<25.1	25.1	mg/kg	12.20.13 20.26	D1	5000
Bromodichloromethane	75-27-4	<25.1	25.1	mg/kg	12.20.13 20.26	D1	5000
Bromoform	75-25-2	<25.1	25.1	mg/kg	12.20.13 20.26	D1	5000
Bromomethane	74-83-9	<25.1	25.1	mg/kg	12.20.13 20.26	D1	5000
Carbon Disulfide	75-15-0	<251	251	mg/kg	12.20.13 20.26	D1	5000
Carbon Tetrachloride	56-23-5	<25.1	25.1	mg/kg	12.20.13 20.26	D1	5000
Chlorobenzene	108-90-7	<25.1	25.1	mg/kg	12.20.13 20.26	D1	5000
Chloroethane	75-00-3	<50.1	50.1	mg/kg	12.20.13 20.26	D1	5000
Chloroform	67-66-3	<25.1	25.1	mg/kg	12.20.13 20.26	D1	5000
Chloromethane	74-87-3	<50.1	50.1	mg/kg	12.20.13 20.26	D1	5000
cis-1,2-Dichloroethene	156-59-2	<25.1	25.1	mg/kg	12.20.13 20.26	D1	5000

XENCO Laboratories

Certificate of Analytical Results 476075

Southwest Research Institute, San Antonio, TX

Jet Fuel

Sample Id: **CL13-5265**	Matrix: Product	Date Received: 12.18.13 10.00	
Lab Sample Id: 476075-001	Date Collected: 12.17.13 00.00		
Analytical Method: VOAs by SW-846 8260B		Prep Method: SW5030B	
Tech: MCH		% Moisture:	
Analyst: MCH	Date Prep: 12.20.13 12.20	Basis: Wet Weight	
Seq Number: 930572		SUB: TX104704215	

Parameter	Cas Number	Result	RL	Units	Analysis Date	Flag	Dil
cis-1,3-Dichloropropene	10061-01-5	<25.1	25.1	mg/kg	12.20.13 20.26	D1	5000
Dibromochloromethane	124-48-1	<25.1	25.1	mg/kg	12.20.13 20.26	D1	5000
Dibromomethane	74-95-3	<25.1	25.1	mg/kg	12.20.13 20.26	D1	5000
Dichlorodifluoromethane	75-71-8	<25.1	25.1	mg/kg	12.20.13 20.26	D1	5000
Ethylbenzene	100-41-4	**652**	25.1	mg/kg	12.20.13 20.26	D2	5000
Hexachlorobutadiene	87-68-3	<25.1	25.1	mg/kg	12.20.13 20.26	D1	5000
Iodomethane (Methyl Iodide)	74-88-4	<100	100	mg/kg	12.20.13 20.26	D1	5000
isopropylbenzene	98-82-8	**273**	25.1	mg/kg	12.20.13 20.26	D2	5000
m,p-Xylenes	179601-23-1	**3210**	501	mg/kg	12.24.13 02.12	D2	50000
Methylene Chloride	75-09-2	<100	100	mg/kg	12.20.13 20.26	D1	5000
MTBE	1634-04-4	<25.1	25.1	mg/kg	12.20.13 20.26	D1	5000
Naphthalene	91-20-3	**674**	50.1	mg/kg	12.20.13 20.26	D2	5000
n-Butylbenzene	104-51-8	**498**	25.1	mg/kg	12.20.13 20.26	D2	5000
n-Propylbenzene	103-65-1	**727**	25.1	mg/kg	12.20.13 20.26	D2	5000
o-Xylene	95-47-6	**2230**	251	mg/kg	12.24.13 02.12	D2	50000
p-Cymene (p-Isopropyltoluene)	99-87-6	**295**	25.1	mg/kg	12.20.13 20.26	D2	5000
Sec-Butylbenzene	135-98-8	**316**	25.1	mg/kg	12.20.13 20.26	D2	5000
Styrene	100-42-5	<25.1	25.1	mg/kg	12.20.13 20.26	D1	5000
tert-Butylbenzene	98-06-6	<25.1	25.1	mg/kg	12.20.13 20.26	D1	5000
Tetrachloroethylene	127-18-4	<25.1	25.1	mg/kg	12.20.13 20.26	D1	5000
Toluene	108-88-3	**286**	25.1	mg/kg	12.20.13 20.26	D2	5000
Total Xylenes	1330-20-7	**5440**	251	mg/kg	12.24.13 02.12	D2	50000
trans-1,2-dichloroethene	156-60-5	<25.1	25.1	mg/kg	12.20.13 20.26	D1	5000
trans-1,3-dichloropropene	10061-02-6	<25.1	25.1	mg/kg	12.20.13 20.26	D1	5000
Trichloroethene	79-01-6	<25.1	25.1	mg/kg	12.20.13 20.26	D1	5000
Trichlorofluoromethane	75-69-4	<25.1	25.1	mg/kg	12.20.13 20.26	D1	5000
Vinyl Acetate	108-05-4	<251	251	mg/kg	12.20.13 20.26	D1	5000
Vinyl Chloride	75-01-4	<10.0	10.0	mg/kg	12.20.13 20.26	D1	5000
Benzene, 1-ethyl-2-methyl- (TIC)	TIC	**551**		mg/kg	12.20.13 20.26	D2T4	5000
Benzene, 1-ethyl-3-methyl- (TIC)	TIC	**218**		mg/kg	12.20.13 20.26	D2T4	5000
Cyclohexane, 1,2-dimethyl- (TIC)	TIC	**280**		mg/kg	12.20.13 20.26	D2T4	5000
Decane, 4-methyl- (TIC)	TIC	**228**		mg/kg	12.20.13 20.26	D2T4	5000
Heptane, 2-methyl- (TIC)	TIC	**277**		mg/kg	12.20.13 20.26	D2T4	5000
Heptane, 3-methyl- (TIC)	TIC	**240**		mg/kg	12.20.13 20.26	D2T4	5000
Hexadecane (TIC)	TIC	**351**		mg/kg	12.20.13 20.26	D2T4	5000
Octane, 3,5-dimethyl- (TIC)	TIC	**258**		mg/kg	12.20.13 20.26	D2T4	5000
Tridecane (TIC)	TIC	**182**		mg/kg	12.20.13 20.26	D2T4	5000
Undecane (TIC)	TIC	**498**		mg/kg	12.20.13 20.26	D2T4	5000

Certificate of Analytical Results 476075

Southwest Research Institute, San Antonio, TX

Jet Fuel

Sample Id:	**CL13-5265**	Matrix:	Product	Date Received:	12.18.13 10.00
Lab Sample Id:	476075-001	Date Collected:	12.17.13 00.00		
Analytical Method:	VOAs by SW-846 8260B			Prep Method:	SW5030B
Tech:	MCH			% Moisture:	
Analyst:	MCH	Date Prep:	12.20.13 12.20	Basis:	Wet Weight
Seq Number:	930572			SUB:	TX104704215

Surrogate	Cas Number	% Recovery	Units	Limits	Analysis Date	Flag
Dibromofluoromethane	1868-53-7	108	%	53-142	12.20.13 20.26	
1,2-Dichloroethane-D4	17060-07-0	107	%	56-150	12.20.13 20.26	
Toluene-D8	2037-26-5	115	%	70-130	12.20.13 20.26	
4-Bromofluorobenzene	460-00-4	132	%	68-152	12.20.13 20.26	

XENCO Laboratories

QC Summary 476075

Southwest Research Institute

Jet Fuel

Analytical Method: SVOCs by SW-846 8270C — Prep Method: SW3580A
Seq Number: 930871 — Matrix: Solid — Date Prep: 12.26.13
MB Sample Id: 648898-1-BLK — LCS Sample Id: 648898-1-BKS — LCSD Sample Id: 648898-1-BSD

Parameter	MB Result	Spike Amount	LCS Result	LCS %Rec	LCSD Result	LCSD %Rec	Limits	%RPD	RPD Limit	Units	Analysis Date	Flag
1,2,4-Trichlorobenzene	<45.7	500	372	74	383	77	35-129	3	30	mg/kg	12.26.13 15:19	
1,2-Dichlorobenzene	<54.3	500	377	75	387	77	38-122	3	30	mg/kg	12.26.13 15:19	
1,3-Dichlorobenzene	<45.8	500	376	75	388	78	38-120	3	30	mg/kg	12.26.13 15:19	
1,4-Dichlorobenzene	<49.3	500	376	75	394	79	37-121	5	30	mg/kg	12.26.13 15:19	
2,4,5-Trichlorophenol	<58.7	500	374	75	408	82	40-135	9	30	mg/kg	12.26.13 15:19	
2,4,6-Trichlorophenol	<40.2	500	375	75	390	78	39-139	4	30	mg/kg	12.26.13 15:19	
2,4-Dichlorophenol	<47.1	500	369	74	378	76	36-135	2	30	mg/kg	12.26.13 15:19	
2,4-Dimethylphenol	<118	500	378	76	396	79	38-133	5	30	mg/kg	12.26.13 15:19	
2,4-Dinitrophenol	<104	500	529	106	547	109	19-131	3	40	mg/kg	12.26.13 15:19	
2,4-Dinitrotoluene	<47.7	500	362	72	373	75	48-131	3	30	mg/kg	12.26.13 15:19	
2,6-Dinitrotoluene	<47.9	500	352	70	377	75	42-136	7	30	mg/kg	12.26.13 15:19	
2-Chloronaphthalene	<39.6	500	327	65	341	68	32-138	4	30	mg/kg	12.26.13 15:19	
2-Chlorophenol	<48.5	500	388	78	392	78	38-125	1	30	mg/kg	12.26.13 15:19	
2-Methylnaphthalene	<51.3	500	379	76	390	78	36-126	3	30	mg/kg	12.26.13 15:19	
2-methylphenol	<65.0	500	394	79	401	80	37-128	2	30	mg/kg	12.26.13 15:19	
2-Nitroaniline	<44.1	500	351	70	363	73	30-133	3	40	mg/kg	12.26.13 15:19	
2-Nitrophenol	<34.2	500	360	72	367	73	33-142	2	30	mg/kg	12.26.13 15:19	
3&4-Methylphenol	<114	500	388	78	397	79	38-126	2	30	mg/kg	12.26.13 15:19	
3,3-Dichlorobenzidine	<68.6	500	339	68	353	71	35-134	4	40	mg/kg	12.26.13 15:19	
3-Nitroaniline	<52.0	500	337	67	363	73	41-135	7	40	mg/kg	12.26.13 15:19	
4,6-dinitro-2-methyl phenol	<40.7	500	321	64	334	67	30-146	4	40	mg/kg	12.26.13 15:19	
4-Bromophenyl-phenylether	<50.9	500	353	71	379	76	37-140	7	30	mg/kg	12.26.13 15:19	
4-chloro-3-methylphenol	<52.6	500	375	75	381	76	40-134	2	30	mg/kg	12.26.13 15:19	
4-Chloroaniline	<100	500	337	67	351	70	34-124	4	40	mg/kg	12.26.13 15:19	
4-Chlorophenyl-phenyl ether	<50.3	500	376	75	396	79	41-131	5	30	mg/kg	12.26.13 15:19	
4-Nitroaniline	<45.1	500	359	72	373	75	46-132	4	40	mg/kg	12.26.13 15:19	
4-Nitrophenol	<46.7	500	321	64	309	62	21-152	4	40	mg/kg	12.26.13 15:19	
Acenaphthene	<53.7	500	375	75	389	78	37-131	4	30	mg/kg	12.26.13 15:19	
Acenaphthylene	<50.7	500	372	74	385	77	39-129	3	30	mg/kg	12.26.13 15:19	
Aniline (Phenylamine, Aminobenzene)	<167	500	332	66	336	67	33-117	1	40	mg/kg	12.26.13 15:19	
Anthracene	<38.5	500	372	74	388	78	39-139	4	30	mg/kg	12.26.13 15:19	
Benzo(a)anthracene	<42.1	500	379	76	389	78	44-135	3	30	mg/kg	12.26.13 15:19	
Benzo(a)pyrene	<43.6	500	373	75	386	77	43-153	3	30	mg/kg	12.26.13 15:19	
Benzo(b)fluoranthene	<40.5	500	337	67	399	80	40-153	17	30	mg/kg	12.26.13 15:19	
Benzo(g,h,i)perylene	<44.1	500	379	76	395	79	40-153	4	30	mg/kg	12.26.13 15:19	
Benzo(k)fluoranthene	<58.5	500	415	83	368	74	33-156	12	30	mg/kg	12.26.13 15:19	
Benzoic Acid	<72.4	1500	249	17	252	17	31-135	1	50	mg/kg	12.26.13 15:19	L2
Benzyl Butyl Phthalate	<38.9	500	368	74	384	77	43-145	4	30	mg/kg	12.26.13 15:19	
bis(2-chloroethoxy) methane	<55.9	500	353	71	377	75	30-129	7	30	mg/kg	12.26.13 15:19	
bis(2-chloroethyl) ether	<53.7	500	380	76	392	78	33-127	3	30	mg/kg	12.26.13 15:19	
bis(2-chloroisopropyl) ether	<50.1	500	369	74	369	74	25-124	0	30	mg/kg	12.26.13 15:19	
bis(2-ethylhexyl) phthalate	<39.9	500	373	75	386	77	46-145	3	30	mg/kg	12.26.13 15:19	
Chrysene	<45.4	500	369	74	386	77	42-135	5	30	mg/kg	12.26.13 15:19	
Dibenz(a,h)Anthracene	<52.6	500	370	74	384	77	41-155	4	30	mg/kg	12.26.13 15:19	
Dibenzofuran	<49.3	500	364	73	387	77	39-132	6	30	mg/kg	12.26.13 15:19	
Diethyl Phthalate	<51.8	500	372	74	390	78	45-131	5	30	mg/kg	12.26.13 15:19	
Dimethyl Phthalate	<51.6	500	372	74	387	77	43-132	4	30	mg/kg	12.26.13 15:19	
di-n-Butyl Phthalate	<43.0	500	366	73	384	77	43-142	5	30	mg/kg	12.26.13 15:19	
di-n-Octyl Phthalate	<47.5	500	374	75	384	77	34-166	3	30	mg/kg	12.26.13 15:19	
Fluoranthene	<47.3	500	371	74	387	77	41-138	4	30	mg/kg	12.26.13 15:19	
Fluorene	<53.4	500	373	75	387	77	41-131	4	30	mg/kg	12.26.13 15:19	
Hexachlorobenzene	<43.8	500	368	74	388	78	36-142	5	30	mg/kg	12.26.13 15:19	

QC Summary 476075

Southwest Research Institute

Jet Fuel

Analytical Method: SVOCs by SW-846 8270C — Prep Method: SW3580A

Seq Number: 930871 — Matrix: Solid — Date Prep: 12.26.13

MB Sample Id: 648898-1-BLK — LCS Sample Id: 648898-1-BKS — LCSD Sample Id: 648898-1-BSD

Parameter	MB Result	Spike Amount	LCS Result	LCS %Rec	LCSD Result	LCSD %Rec	Limits	%RPD	RPD Limit	Units	Analysis Date	Flag
Hexachlorobutadiene	<47.0	500	363	73	384	77	35-129	6	30	mg/kg	12.26.13 15:19	
Hexachlorocyclopentadiene	<22.0	500	404	81	412	82	16-106	2	30	mg/kg	12.26.13 15:19	
Hexachloroethane	<56.0	500	370	74	384	77	36-121	4	30	mg/kg	12.26.13 15:19	
Indeno(1,2,3-c,d)Pyrene	<46.4	500	370	74	388	78	39-154	5	30	mg/kg	12.26.13 15:19	
Isophorone	<44.8	500	369	74	381	76	36-128	3	30	mg/kg	12.26.13 15:19	
Naphthalene	<51.6	500	370	74	384	77	35-128	4	30	mg/kg	12.26.13 15:19	
Nitrobenzene	<43.7	500	366	73	382	76	32-129	4	30	mg/kg	12.26.13 15:19	
N-Nitrosodi-n-Propylamine	<59.8	500	380	76	396	79	34-129	4	30	mg/kg	12.26.13 15:19	
N-Nitrosodiphenylamine	<37.4	500	373	75	388	78	27-155	4	30	mg/kg	12.26.13 15:19	
Pentachlorophenol	<33.1	500	280	56	284	57	14-148	1	40	mg/kg	12.26.13 15:19	
Phenanthrene	<49.8	500	372	74	387	77	37-139	4	30	mg/kg	12.26.13 15:19	
Phenol	<53.7	500	377	75	384	77	34-127	2	40	mg/kg	12.26.13 15:19	
Pyrene	<50.0	500	373	75	391	78	42-138	5	30	mg/kg	12.26.13 15:19	
Pyridine	<64.0	500	441	88	440	88	30-113	0	40	mg/kg	12.26.13 15:19	

Surrogate	MB %Rec	MB Flag	LCS %Rec	LCS Flag	LCSD %Rec	LCSD Flag	Limits	Units	Analysis Date
2-Fluorophenol	85		76		77		25-121	%	12.26.13 15:19
Phenol-d6	75		79		78		24-113	%	12.26.13 15:19
Nitrobenzene-d5	80		73		74		23-120	%	12.26.13 15:19
2-Fluorobiphenyl	86		73		75		30-115	%	12.26.13 15:19
2,4,6-Tribromophenol	68		78		77		19-122	%	12.26.13 15:19
Terphenyl-D14	85		75		74		18-137	%	12.26.13 15:19

XENCO Laboratories

QC Summary 476075

Southwest Research Institute

Jet Fuel

Analytical Method: VOAs by SW-846 8260B — Prep Method: SW5035A

Seq Number: 930572 — Matrix: Solid — Date Prep: 12.20.13

MB Sample Id: 648873-1-BLK — LCS Sample Id: 648873-1-BKS — LCSD Sample Id: 648873-1-BSD

Parameter	MB Result	Spike Amount	LCS Result	LCS %Rec	LCSD Result	LCSD %Rec	Limits	%RPD	RPD Limit	Units	Analysis Date	Flag
1,1,1,2-Tetrachloroethane	<0.000148	0.0500	0.0480	96	0.0491	98	81-127	2	25	mg/kg	12.20.13 09:58	
1,1,1-Trichloroethane	<0.000602	0.0500	0.0493	99	0.0455	91	71-124	8	25	mg/kg	12.20.13 09:58	
1,1,2,2-Tetrachloroethane	<0.000194	0.0500	0.0472	94	0.0475	95	75-133	1	25	mg/kg	12.20.13 09:58	
1,1,2-Trichloroethane	<0.000225	0.0500	0.0463	93	0.0462	92	75-131	0	25	mg/kg	12.20.13 09:58	
1,1-Dichloroethane	<0.000125	0.0500	0.0471	94	0.0447	89	73-124	5	25	mg/kg	12.20.13 09:58	
1,1-Dichloroethene	<0.000192	0.0500	0.0454	91	0.0419	84	68-119	8	25	mg/kg	12.20.13 09:58	
1,1-Dichloropropene	<0.000198	0.0500	0.0452	90	0.0457	91	72-118	1	25	mg/kg	12.20.13 09:58	
1,2,3-Trichlorobenzene	<0.000106	0.0500	0.0477	95	0.0495	99	75-131	4	25	mg/kg	12.20.13 09:58	
1,2,3-Trichloropropane	<0.000359	0.0500	0.0504	101	0.0518	104	75-131	3	25	mg/kg	12.20.13 09:58	
1,2,4-Trichlorobenzene	<0.000191	0.0500	0.0472	94	0.0480	96	79-128	2	25	mg/kg	12.20.13 09:58	
1,2-Dibromo-3-Chloropropane	<0.00107	0.0500	0.0469	94	0.0485	97	58-133	3	25	mg/kg	12.20.13 09:58	
1,2-Dibromoethane	<0.000193	0.0500	0.0488	98	0.0486	97	80-127	0	25	mg/kg	12.20.13 09:58	
1,2-Dichlorobenzene	<0.000129	0.0500	0.0473	95	0.0475	95	84-121	0	25	mg/kg	12.20.13 09:58	
1,2-Dichloroethane	<0.000177	0.0500	0.0495	99	0.0473	95	70-123	5	25	mg/kg	12.20.13 09:58	
1,2-Dichloropropane	<0.000162	0.0500	0.0475	95	0.0440	88	75-122	8	25	mg/kg	12.20.13 09:58	
1,3-Dichlorobenzene	<0.000159	0.0500	0.0478	96	0.0489	98	84-124	2	25	mg/kg	12.20.13 09:58	
1,3-Dichloropropane	<0.000227	0.0500	0.0483	97	0.0479	96	82-131	1	25	mg/kg	12.20.13 09:58	
1,4-Dichlorobenzene	<0.0000970	0.0500	0.0457	91	0.0467	93	82-120	2	25	mg/kg	12.20.13 09:58	
2,2-Dichloropropane	<0.000127	0.0500	0.0493	99	0.0456	91	67-137	8	25	mg/kg	12.20.13 09:58	
2-Butanone	<0.00173	0.600	0.511	85	0.508	85	46-137	1	25	mg/kg	12.20.13 09:58	
2-Chlorotoluene	<0.000217	0.0500	0.0499	100	0.0501	100	83-129	0	25	mg/kg	12.20.13 09:58	
2-Hexanone	<0.00112	0.600	0.544	91	0.547	91	52-137	1	25	mg/kg	12.20.13 09:58	
4-Chlorotoluene	<0.000118	0.0500	0.0510	102	0.0514	103	83-125	1	25	mg/kg	12.20.13 09:58	
Acetone	0.00283	0.600	0.491	82	0.481	80	33-148	2	25	mg/kg	12.20.13 09:58	
Benzene	<0.000300	0.0500	0.0474	95	0.0459	92	71-119	3	25	mg/kg	12.20.13 09:58	
Bromobenzene	<0.000198	0.0500	0.0455	91	0.0453	91	84-123	0	25	mg/kg	12.20.13 09:58	
Bromochloromethane	<0.000215	0.0500	0.0452	90	0.0422	84	71-120	7	25	mg/kg	12.20.13 09:58	
Bromodichloromethane	<0.000186	0.0500	0.0498	100	0.0471	94	78-126	6	25	mg/kg	12.20.13 09:58	
Bromoform	<0.000393	0.0500	0.0486	97	0.0501	100	63-136	3	25	mg/kg	12.20.13 09:58	
Bromomethane	<0.000274	0.0500	0.0468	94	0.0425	85	57-118	10	25	mg/kg	12.20.13 09:58	
Carbon Disulfide	<0.0000880	0.550	0.433	79	0.410	75	55-136	5	25	mg/kg	12.20.13 09:58	
Carbon Tetrachloride	<0.000132	0.0500	0.0477	95	0.0470	94	63-135	1	25	mg/kg	12.20.13 09:58	
Chlorobenzene	<0.000104	0.0500	0.0473	95	0.0477	95	83-121	1	25	mg/kg	12.20.13 09:58	
Chloroethane	<0.000254	0.0500	0.0446	89	0.0402	80	57-122	10	25	mg/kg	12.20.13 09:58	
Chloroform	<0.000139	0.0500	0.0465	93	0.0443	89	74-118	5	25	mg/kg	12.20.13 09:58	
Chloromethane	<0.000322	0.0500	0.0421	84	0.0390	78	58-110	8	25	mg/kg	12.20.13 09:58	
cis-1,2-Dichloroethene	<0.000165	0.0500	0.0467	93	0.0441	88	72-131	6	25	mg/kg	12.20.13 09:58	
cis-1,3-Dichloropropene	<0.000128	0.0500	0.0502	100	0.0491	98	74-135	2	25	mg/kg	12.20.13 09:58	
Dibromochloromethane	<0.000422	0.0500	0.0489	98	0.0518	104	77-130	6	25	mg/kg	12.20.13 09:58	
Dibromomethane	<0.000260	0.0500	0.0479	96	0.0462	92	73-126	4	25	mg/kg	12.20.13 09:58	
Dichlorodifluoromethane	<0.000484	0.0500	0.0438	88	0.0388	78	54-122	12	25	mg/kg	12.20.13 09:58	
Ethylbenzene	<0.000104	0.0500	0.0496	99	0.0492	98	80-123	1	25	mg/kg	12.20.13 09:58	
Hexachlorobutadiene	<0.000346	0.0500	0.0483	97	0.0475	95	77-130	2	25	mg/kg	12.20.13 09:58	
Iodomethane (Methyl Iodide)	<0.000200	0.0500	0.0437	87	0.0413	83	63-116	6	25	mg/kg	12.20.13 09:58	
isopropylbenzene	<0.000112	0.0500	0.0534	107	0.0532	106	55-155	0	25	mg/kg	12.20.13 09:58	
Methylene Chloride	0.000820	0.0500	0.0448	90	0.0414	83	57-134	8	25	mg/kg	12.20.13 09:58	
MTBE	<0.000142	0.100	0.0997	100	0.0966	97	64-148	3	25	mg/kg	12.20.13 09:58	
Naphthalene	<0.000148	0.0500	0.0481	96	0.0506	101	53-162	5	25	mg/kg	12.20.13 09:58	
n-Butylbenzene	<0.0000990	0.0500	0.0530	106	0.0531	106	82-127	0	25	mg/kg	12.20.13 09:58	
n-Propylbenzene	<0.000137	0.0500	0.0507	101	0.0512	102	84-131	1	25	mg/kg	12.20.13 09:58	
p-Cymene (p-Isopropyltoluene)	<0.0000800	0.0500	0.0546	109	0.0545	109	84-130	0	25	mg/kg	12.20.13 09:58	
Sec-Butylbenzene	<0.000121	0.0500	0.0516	103	0.0541	108	84-131	5	25	mg/kg	12.20.13 09:58	

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Jet Fuel

Analytical Method: VOAs by SW-846 8260B — Prep Method: SW5035A
Seq Number: 930572 — Matrix: Solid — Date Prep: 12.20.13
MB Sample Id: 648873-1-BLK — LCS Sample Id: 648873-1-BKS — LCSD Sample Id: 648873-1-BSD

Parameter	MB Result	Spike Amount	LCS Result	LCS %Rec	LCSD Result	LCSD %Rec	Limits	%RPD	RPD Limit	Units	Analysis Date	Flag
Styrene	<0.000158	0.0500	0.0524	105	0.0532	106	80-126	2	25	mg/kg	12.20.13 09:58	
tert-Butylbenzene	<0.0000900	0.0500	0.0517	103	0.0536	107	83-132	4	25	mg/kg	12.20.13 09:58	
Tetrachloroethylene	<0.000173	0.0500	0.0445	89	0.0438	88	79-124	2	25	mg/kg	12.20.13 09:58	
Toluene	0.000140	0.0500	0.0464	93	0.0460	92	74-122	1	25	mg/kg	12.20.13 09:58	
trans-1,2-dichloroethene	<0.000123	0.0500	0.0442	88	0.0431	86	63-110	3	25	mg/kg	12.20.13 09:58	
trans-1,3-dichloropropene	<0.000361	0.0500	0.0523	105	0.0510	102	73-125	3	25	mg/kg	12.20.13 09:58	
Trichloroethene	<0.000147	0.0500	0.0453	91	0.0441	88	78-119	3	25	mg/kg	12.20.13 09:58	
Trichlorofluoromethane	<0.000186	0.0500	0.0475	95	0.0444	89	71-148	7	25	mg/kg	12.20.13 09:58	
Vinyl Acetate	<0.000213	0.500	0.566	113	0.546	109	40-154	4	25	mg/kg	12.20.13 09:58	
Vinyl Chloride	<0.000193	0.0500	0.0435	87	0.0394	79	60-123	10	25	mg/kg	12.20.13 09:58	

Surrogate	MB %Rec	MB Flag	LCS %Rec	LCS Flag	LCSD %Rec	LCSD Flag	Limits	Units	Analysis Date
Dibromofluoromethane	116		102		95		53-142	%	12.20.13 09:58
1,2-Dichloroethane-D4	113		102		91		56-150	%	12.20.13 09:58
Toluene-D8	98		100		100		70-130	%	12.20.13 09:58
4-Bromofluorobenzene	94		102		105		68-152	%	12.20.13 09:58

Analytical Method: VOAs by SW-846 8260B — Prep Method: SW5030B
Seq Number: 930651 — Matrix: Solid — Date Prep: 12.23.13
MB Sample Id: 648928-1-BLK — LCS Sample Id: 648928-1-BKS — LCSD Sample Id: 648928-1-BSD

Parameter	MB Result	Spike Amount	LCS Result	LCS %Rec	LCSD Result	LCSD %Rec	Limits	%RPD	RPD Limit	Units	Analysis Date	Flag
1,2,4-Trimethylbenzene	<0.000103	0.0500	0.0587	117	0.0580	116	60-159	1	25	mg/kg	12.23.13 16:13	
1,3,5-Trimethylbenzene	<0.000166	0.0500	0.0590	118	0.0571	114	61-160	3	25	mg/kg	12.23.13 16:13	
m,p-Xylenes	<0.000185	0.100	0.110	110	0.105	105	78-127	5	25	mg/kg	12.23.13 16:13	
o-Xylene	<0.000149	0.0500	0.0580	116	0.0555	111	79-125	4	25	mg/kg	12.23.13 16:13	

Surrogate	MB %Rec	MB Flag	LCS %Rec	LCS Flag	LCSD %Rec	LCSD Flag	Limits	Units	Analysis Date
Dibromofluoromethane	100		97		98		53-142	%	12.23.13 16:13
1,2-Dichloroethane-D4	97		98		106		56-150	%	12.23.13 16:13
Toluene-D8	94		99		97		70-130	%	12.23.13 16:13
4-Bromofluorobenzene	95		96		95		68-152	%	12.23.13 16:13

QC Summary 476075

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Jet Fuel

Analytical Method: VOAs by SW-846 8260B — Prep Method: SW5035A
Seq Number: 930791 — Matrix: Solid — Date Prep: 12.24.13
MB Sample Id: 649007-1-BLK — LCS Sample Id: 649007-1-BKS — LCSD Sample Id: 649007-1-BSD

Parameter	MB Result	Spike Amount	LCS Result	LCS %Rec	LCSD Result	LCSD %Rec	Limits	%RPD	RPD Limit	Units	Analysis Date	Flag
1,2,4-Trimethylbenzene	<0.000103	0.0500	0.0553	111	0.0548	110	60-159	1	25	mg/kg	12.24.13 09:21	
1,3,5-Trimethylbenzene	<0.000166	0.0500	0.0559	112	0.0553	111	61-160	1	25	mg/kg	12.24.13 09:21	
m,p-Xylenes	<0.000185	0.100	0.105	105	0.106	106	78-127	1	25	mg/kg	12.24.13 09:21	
o-Xylene	<0.000149	0.0500	0.0529	106	0.0536	107	79-125	1	25	mg/kg	12.24.13 09:21	

Surrogate	MB %Rec	MB Flag	LCS %Rec	LCS Flag	LCSD %Rec	LCSD Flag	Limits	Units	Analysis Date
Dibromofluoromethane	108		95		95		53-142	%	12.24.13 09:21
1,2-Dichloroethane-D4	104		97		98		56-150	%	12.24.13 09:21
Toluene-D8	98		98		101		70-130	%	12.24.13 09:21
4-Bromofluorobenzene	97		100		97		68-152	%	12.24.13 09:21

QC Summary 476075

Southwest Research Institute

Jet Fuel

Analytical Method: VOAs by SW-846 8260B — Prep Method: SW5035A

Seq Number: 930572 — Matrix: Soil — Date Prep: 12.20.13

Parent Sample Id: 476047-001 — MS Sample Id: 476047-001 S — MSD Sample Id: 476047-001 SD

Parameter	Parent Result	Spike Amount	MS Result	MS %Rec	MSD Result	MSD %Rec	Limits	%RPD	RPD Limit	Units	Analysis Date	Flag
1,1,1,2-Tetrachloroethane	<0.00554	1.87	1.77	95	1.68	90	72-125	5	25	mg/kg	12.20.13 14:48	
1,1,1-Trichloroethane	<0.0225	1.87	1.55	83	1.42	76	75-125	9	25	mg/kg	12.20.13 14:48	
1,1,2,2-Tetrachloroethane	<0.00726	1.87	1.66	89	1.74	93	74-125	5	25	mg/kg	12.20.13 14:48	
1,1,2-Trichloroethane	<0.00842	1.87	1.64	88	1.71	91	75-127	4	25	mg/kg	12.20.13 14:48	
1,1-Dichloroethane	<0.00468	1.87	1.58	84	1.46	78	72-125	8	25	mg/kg	12.20.13 14:48	
1,1-Dichloroethene	<0.00719	1.87	1.59	85	1.43	76	59-172	11	25	mg/kg	12.20.13 14:48	
1,1-Dichloropropene	<0.00741	1.87	1.63	87	1.57	84	75-125	4	25	mg/kg	12.20.13 14:48	
1,2,3-Trichlorobenzene	<0.00397	1.87	1.74	93	1.66	89	75-137	5	25	mg/kg	12.20.13 14:48	
1,2,3-Trichloropropane	<0.0134	1.87	1.72	92	1.88	101	75-125	9	25	mg/kg	12.20.13 14:48	
1,2,4-Trichlorobenzene	<0.00715	1.87	1.66	89	1.63	87	75-135	2	25	mg/kg	12.20.13 14:48	
1,2-Dibromo-3-Chloropropane	<0.0399	1.87	1.71	91	1.64	88	59-125	4	25	mg/kg	12.20.13 14:48	
1,2-Dibromoethane	<0.00722	1.87	1.65	88	1.71	91	73-125	4	25	mg/kg	12.20.13 14:48	
1,2-Dichlorobenzene	<0.00483	1.87	1.74	93	1.74	93	75-125	0	25	mg/kg	12.20.13 14:48	
1,2-Dichloroethane	<0.00662	1.87	1.71	91	1.64	88	68-127	4	25	mg/kg	12.20.13 14:48	
1,2-Dichloropropane	<0.00606	1.87	1.61	86	1.56	83	74-125	3	25	mg/kg	12.20.13 14:48	
1,3-Dichlorobenzene	<0.00595	1.87	1.71	91	1.82	97	75-125	6	25	mg/kg	12.20.13 14:48	
1,3-Dichloropropane	<0.00850	1.87	1.71	91	1.80	96	75-125	5	25	mg/kg	12.20.13 14:48	
1,4-Dichlorobenzene	<0.00363	1.87	1.63	87	1.67	89	75-125	2	25	mg/kg	12.20.13 14:48	
2,2-Dichloropropane	<0.00475	1.87	1.48	79	1.36	73	75-125	8	25	mg/kg	12.20.13 14:48	M2
2-Butanone	<0.0646	22.5	17.0	76	17.4	77	75-125	2	25	mg/kg	12.20.13 14:48	
2-Chlorotoluene	<0.00812	1.87	1.79	96	1.80	96	73-125	1	25	mg/kg	12.20.13 14:48	
2-Hexanone	<0.0419	22.5	18.3	81	20.7	92	75-125	12	25	mg/kg	12.20.13 14:48	
4-Chlorotoluene	<0.00442	1.87	1.79	96	1.87	100	74-125	4	25	mg/kg	12.20.13 14:48	
Acetone	0.146	22.5	16.2	71	15.4	68	50-150	5	25	mg/kg	12.20.13 14:48	
Benzene	<0.0112	1.87	1.65	88	1.57	84	66-142	5	25	mg/kg	12.20.13 14:48	
Bromobenzene	<0.00741	1.87	1.70	91	1.77	95	75-125	4	25	mg/kg	12.20.13 14:48	
Bromochloromethane	<0.00805	1.87	1.60	86	1.48	79	60-140	8	25	mg/kg	12.20.13 14:48	
Bromodichloromethane	<0.00696	1.87	1.67	89	1.63	87	75-125	2	25	mg/kg	12.20.13 14:48	
Bromoform	<0.0147	1.87	1.71	91	1.80	96	75-125	5	25	mg/kg	12.20.13 14:48	
Bromomethane	<0.0103	1.87	1.18	63	1.03	55	60-140	14	25	mg/kg	12.20.13 14:48	M2
Carbon Disulfide	<0.00329	20.6	13.9	67	12.6	61	60-140	10	25	mg/kg	12.20.13 14:48	
Carbon Tetrachloride	<0.00494	1.87	1.61	86	1.52	81	62-125	6	25	mg/kg	12.20.13 14:48	
Chlorobenzene	<0.00389	1.87	1.74	93	1.71	91	60-133	2	25	mg/kg	12.20.13 14:48	
Chloroethane	<0.00951	1.87	1.18	63	1.03	55	60-140	14	25	mg/kg	12.20.13 14:48	M2
Chloroform	<0.00520	1.87	1.54	82	1.42	76	74-125	8	25	mg/kg	12.20.13 14:48	
Chloromethane	<0.0121	1.87	1.42	76	1.28	68	60-140	10	25	mg/kg	12.20.13 14:48	
cis-1,2-Dichloroethene	<0.00618	1.87	1.59	85	1.45	78	75-125	9	25	mg/kg	12.20.13 14:48	
cis-1,3-Dichloropropene	<0.00479	1.87	1.75	94	1.83	98	74-125	4	25	mg/kg	12.20.13 14:48	
Dibromochloromethane	<0.0158	1.87	1.81	97	1.80	96	73-125	1	25	mg/kg	12.20.13 14:48	
Dibromomethane	<0.00973	1.87	1.62	87	1.59	85	69-127	2	25	mg/kg	12.20.13 14:48	
Dichlorodifluoromethane	<0.0181	1.87	1.34	72	1.18	63	65-135	13	25	mg/kg	12.20.13 14:48	M2
Ethylbenzene	<0.00389	1.87	1.74	93	1.75	94	75-125	1	25	mg/kg	12.20.13 14:48	
Hexachlorobutadiene	<0.0129	1.87	1.62	87	1.63	87	75-125	1	25	mg/kg	12.20.13 14:48	
Iodomethane (Methyl Iodide)	<0.00749	1.87	1.53	82	1.40	75	75-125	9	25	mg/kg	12.20.13 14:48	
isopropylbenzene	<0.00419	1.87	1.88	101	1.93	103	75-125	3	25	mg/kg	12.20.13 14:48	
Methylene Chloride	<0.0160	1.87	1.49	80	1.36	73	75-125	9	25	mg/kg	12.20.13 14:48	M2
MTBE	<0.00531	3.74	3.50	94	3.24	87	60-140	8	25	mg/kg	12.20.13 14:48	
Naphthalene	<0.00554	1.87	1.75	94	1.75	94	70-130	0	25	mg/kg	12.20.13 14:48	
n-Butylbenzene	<0.00371	1.87	1.82	97	1.85	99	75-125	2	25	mg/kg	12.20.13 14:48	
n-Propylbenzene	<0.00513	1.87	1.80	96	1.89	101	75-125	5	25	mg/kg	12.20.13 14:48	
p-Cymene (p-Isopropyltoluene)	<0.00299	1.87	1.94	104	1.93	103	75-125	1	25	mg/kg	12.20.13 14:48	
Sec-Butylbenzene	<0.00453	1.87	1.84	98	1.86	99	75-125	1	25	mg/kg	12.20.13 14:48	

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Jet Fuel

Analytical Method: VOAs by SW-846 8260B — Prep Method: SW5035A
Seq Number: 930572 — Matrix: Soil — Date Prep: 12.20.13
Parent Sample Id: 476047-001 — MS Sample Id: 476047-001 S — MSD Sample Id: 476047-001 SD

Parameter	Parent Result	Spike Amount	MS Result	MS %Rec	MSD Result	MSD %Rec	Limits	%RPD	RPD Limit	Units	Analysis Date	Flag
Styrene	<0.00591	1.87	1.91	102	1.93	103	75-125	1	25	mg/kg	12.20.13 14:48	
tert-Butylbenzene	<0.00337	1.87	1.89	101	1.93	103	75-125	2	25	mg/kg	12.20.13 14:48	
Tetrachloroethylene	<0.00647	1.87	1.60	86	1.55	83	71-125	3	25	mg/kg	12.20.13 14:48	
Toluene	0.00785	1.87	1.66	88	1.67	89	59-139	1	25	mg/kg	12.20.13 14:48	
trans-1,2-dichloroethene	<0.00460	1.87	1.46	78	1.31	70	75-125	11	25	mg/kg	12.20.13 14:48	M2
trans-1,3-dichloropropene	<0.0135	1.87	1.84	98	1.87	100	66-125	2	25	mg/kg	12.20.13 14:48	
Trichloroethene	<0.00550	1.87	1.64	88	1.59	85	62-137	3	25	mg/kg	12.20.13 14:48	
Trichlorofluoromethane	<0.00696	1.87	1.49	80	1.35	72	67-125	10	25	mg/kg	12.20.13 14:48	
Vinyl Acetate	<0.00797	18.7	16.4	88	17.5	94	60-140	6	25	mg/kg	12.20.13 14:48	
Vinyl Chloride	<0.00722	1.87	1.39	74	1.24	66	60-140	11	25	mg/kg	12.20.13 14:48	

Surrogate	MS %Rec	MS Flag	MSD %Rec	MSD Flag	Limits	Units	Analysis Date
Dibromofluoromethane	93		87		53-142	%	12.20.13 14:48
1,2-Dichloroethane-D4	89		85		56-150	%	12.20.13 14:48
Toluene-D8	99		99		70-130	%	12.20.13 14:48
4-Bromofluorobenzene	101		103		68-152	%	12.20.13 14:48

Analytical Method: VOAs by SW-846 8260B — Prep Method: SW5030B
Seq Number: 930651 — Matrix: Sludge — Date Prep: 12.23.13
Parent Sample Id: 476349-001 — MS Sample Id: 476349-001 S — MSD Sample Id: 476349-001 SD

Parameter	Parent Result	Spike Amount	MS Result	MS %Rec	MSD Result	MSD %Rec	Limits	%RPD	RPD Limit	Units	Analysis Date	Flag
1,2,4-Trimethylbenzene	0.217	2.50	2.85	105	2.84	105	75-125	0	25	mg/kg	12.23.13 20:29	
1,3,5-Trimethylbenzene	0.0891	2.50	2.66	103	2.67	103	70-130	0	25	mg/kg	12.23.13 20:29	
m,p-Xylenes	0.0180	5.01	4.68	93	4.81	96	75-125	3	25	mg/kg	12.23.13 20:29	
o-Xylene	0.0160	2.50	2.50	99	2.57	102	75-125	3	25	mg/kg	12.23.13 20:29	

Surrogate	MS %Rec	MS Flag	MSD %Rec	MSD Flag	Limits	Units	Analysis Date
Dibromofluoromethane	90		87		53-142	%	12.23.13 20:29
1,2-Dichloroethane-D4	99		93		56-150	%	12.23.13 20:29
Toluene-D8	98		95		70-130	%	12.23.13 20:29
4-Bromofluorobenzene	98		100		68-152	%	12.23.13 20:29

QC Summary 476075

Southwest Research Institute

Jet Fuel

Analytical Method: VOAs by SW-846 8260B — Prep Method: SW5035A
Seq Number: 930791 — Matrix: Soil — Date Prep: 12.24.13
Parent Sample Id: 476189-002 — MS Sample Id: 476189-002 S — MSD Sample Id: 476189-002 SD

Parameter	Parent Result	Spike Amount	MS Result	MS %Rec	MSD Result	MSD %Rec	Limits	%RPD	RPD Limit	Units	Analysis Date	Flag
1,2,4-Trimethylbenzene	<0.00423	2.05	2.26	110	2.66	109	75-125	16	25	mg/kg	12.24.13 14:04	
1,3,5-Trimethylbenzene	<0.00681	2.05	2.25	110	2.51	102	70-130	11	25	mg/kg	12.24.13 14:04	
m,p-Xylenes	<0.00759	4.11	4.22	103	4.80	98	75-125	13	25	mg/kg	12.24.13 14:04	
o-Xylene	<0.00612	2.05	2.25	110	2.48	101	75-125	10	25	mg/kg	12.24.13 14:04	

Surrogate	MS %Rec	MS Flag	MSD %Rec	MSD Flag	Limits	Units	Analysis Date
Dibromofluoromethane	88		89		53-142	%	12.24.13 14:04
1,2-Dichloroethane-D4	93		94		56-150	%	12.24.13 14:04
Toluene-D8	97		95		70-130	%	12.24.13 14:04
4-Bromofluorobenzene	100		100		68-152	%	12.24.13 14:04

476075-H

Army Lab (Chem Lab)
Work Instruction Form (SHIPPING)

WI No.	**13-296**
Requestor:	**Scott Hutzler**
Issue Date:	**12/17/2013**
Required Arrival Date:	**12/20/2013**

Requests for overnight shipments must be received by 9 AM

Charge Number: **1.08.07.13.17149.36.001**

Assigned To:

Authorized by (Initiator): **Scott Hutzler**

Completed By: _____

Completion Date _____

Completion Approved By: _____

Shipping Instructions

Sample #	Container Volume	Sample Type	Notes
CL13-5265	100mL	Aviation	

MSDS must be attached for all sample types

Point of Contact	Attn: Jose Londono
Address:	Xenco Laboratories
	4143 Greenbriar Dr.
	Stafford, TX 77477
Telephone Number:	281-240-4280

Lab Notes

Please run EPA 8260B and EPA 8270C

SOUTHWEST RESEARCH INSTITUTE

9503 W. COMMERCE - SAN ANTONIO, TX 78227-1301
(210) 684-5111

SHIPPING TICKET NO. 73536
(THIS IS NOT A P.O. NO.)
DATE: 12/17/13

PRIOR TO REPAIR OF ANY ITEM MENTIONED BELOW, PLEASE CONTACT 210/522-3074 WITH ESTIMATE AND FOR P.O. NO.

SHIP TO:
Xenco Laboratories
4143 Greenbriar Dr.
Stafford, TX 77477
Ph.# 281-240-4290
ATTN: Jose Londono
VENDOR PHONE NO.
R.M.A. NO.

Please check box for method of shipment to and from Vendor
Circle specific method of shipment by Air Freight or UPS

SHIP VIA	TO VENDOR	RETURN TO SWRI
MOTOR FREIGHT	☐	☐
AIR FREIGHT (PRIORITY AIR GENERAL CARGO)	☐	☐
UPS (1 day, 2days or 7-10 days)	☐	☐
FEDERAL EXPRESS (1 day, 2 days)	☒	☐
OTHER	☐	☐

PPD. ☒ COLL ☐	INSURE FOR $	DECLARED VALUE $	GOVT. PROJ. ☐	DEPT NO.	PURCHASE ORDER NO.
	0.00	0.00		08	

AIR BILL OR W/B NO.	ACCT. OR PROJECT NO.	SWRI REQ. NO.	RETURN INITIATED BY	EXT.
	17149.36.001		Hutzler/mwc	

QUANTITY	DESCRIPTION & SERIAL NO.	ORIGINAL P.O., S.O., R.O., C.O.D./REQ. NO./B/O
	EOT Date	
	1 - 100mL Aviation Fuel Sample Coded: CL13-5265	
		0.10 L
	UNISS, Kerosene, 3, PG III	

S.W.R.I. BUYER		BUYER NOTIFIED ☐	Please indicate if items are HAZARDOUS MATERIAL. ☒ YES ☐ NO
NO. OF PACKAGES 1	☒ BOX ☐ CTN ☐ DRUM ☐	WEIGHT	DIMENSIONS

REASON FOR SHIPMENT AND/OR REMARKS

☐ REPAIR (INDICATE PROBLEM IN REMARKS AREA) ☐ WARRANTY ☐ CREDIT ☐ CREDIT LESS RESTOCKING CHG. ☐ EXCHANGE ☐ OTHER (EXPLAIN IN REMARKS AREA)

REMARKS

DATE SHIPPED | VENDOR RECEIPT BY:

THIS FORM TO BE USED FOR ANYTHING SHIPPED FROM S.W.R.I.

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PACKING LIST (PINK COPY) SHOULD BE ATTACHED TO THE OUTSIDE OF THE CONTAINER. REMAINDER OF SHIPPING TICKET SHOULD BE RETURNED TO SHIPPING & RECEIVING. PT.5 (GOLDENROD COPY) WILL BE RETURNED TO YOU FOR DEPARTMENT RECORDS.

SHIPPING COPY

Page 21 of 21 Final 1.000

Appendix BP
Certificates of Analysis (CoA) by POSF Number

SOUTHWEST RESEARCH INSTITUTE®

6220 CULEBRA ROAD 78238-5166 • P.O. DRAWER 28510 78228-0510 • SAN ANTONIO, TEXAS, USA • (210) 684-5111 • WWW.SWRI.ORG
FUELS AND LUBRICANTS RESEARCH DIVISION ISO 9001 CERTIFIED
ISO 14001 CERTIFIED

AFFET LABORATORY REPORT
AFPA/PTPLA
2430 C Street
Building 70, Area B
Wright-Patterson AFB, OH 45433-7632

Lab Report No:2012LA36413001 Date Received:02/29/12 1330 hrs* Date Sampled: 02/29/2012**
Cust Sample No:POSF 7708 Date Reported:03/02/12 1536 hrs* Protocol:FU-AVI-0019
JON: GENERAL FUND

Sample Submitter:
Rhonda Cook
AFRL/RZPF
1790 Loop Road N
Bldg 490
Wright-Patterson AFB, OH 45433

Reason for Submission: AFRL Research
Product: Aviation Turbine Fuel, Kerosene
Specification: MIL-DTL-83133H Grade:JP-8

Source: AMYRIS Biotechnologies Qty Submitted: 2 gal
Batch/Lot/Origin: BIOFUEL

Method	Test	Min	Max	Result	Fail
ASTM D 2622 - 10	Sulfur (ug/g)			432	
MIL-STD-3004C	Appearance			Pass	
MIL-DTL-83133H	Workmanship			Pass	
ASTM D 6045 - 09	Color, Saybolt	Report Only		+28	
ASTM D 3242 - 11	Total Acid Number (mg KOH/g)		0.015	0.004	
ASTM D 1319 - 10	Aromatics (% vol)		25.0	14.4	
ASTM D 3227 - 04a	Mercaptan Sulfur (% mass)		0.002	0.000	
ASTM D 86 - 11b	Distillation				
	Initial Boiling Point (°C)			164	
	10% Recovered (°C)		205	177	
	20% Recovered (°C)			182	
	50% Recovered (°C)			200	
	90% Recovered (°C)			248	
	End Point (°C)		300	268	
	Residue (% vol)		1.5	1.2	
	Loss (% vol)		1.5	0.7	
ASTM D 93 - 11	Flash Point (°C)	38		52	
ASTM D 4052 - 11	API Gravity @ 60°F	37.0	51.0	44.8	
ASTM D 4052 - 11	Density @ 15°C (kg/L)	0.775	0.840	0.802	
ASTM D 5972 - 05e1	Freezing Point (°C)		-47	-54	
ASTM D 976 - 06 (2011)	Cetane Index, Calculated	Report Only		44	
ASTM D 3343 - 05	Hydrogen Content (% mass)	13.4		14.4	
ASTM D 1322 - 08	Smoke Point (mm)	25.0		27.0	
ASTM D 130 - 10	Copper Strip Corrosion (2 h @ 100°C)	1 (Max)		1a	
ASTM D 3241 - 11a	Thermal Stability @ 260°C				
	Tube Deposit Rating, Visual	<3 (Max)		1	
	Change in Pressure (mmHg)		25	0	
ASTM D 381 - 04	Existent Gum (mg/100 mL)		7.0	2.6	
ASTM D 5452 - 08	Particulate Matter (mg/L)		1.0	0.4	
MIL-DTL-83133H	Filtration Time (min)		15	4	
ASTM D 1094 - 07	Water Reaction Interface Rating	1b (Max)		1	
ASTM D 7224 - 08	WSIM	70		81	
ASTM D 2624 - 09	Conductivity (pS/m)	150	600	0	X
ASTM D 5001 - 10	Lubricity Test (BOCLE) Wear Scar (mm)	Report Only		0.57	
ASTM D 3338 - 08	Net Heat of Combustion (MJ/kg)	42.8		43.6	
ASTM D 4809 - 09a	Net Heat of Combustion (MJ/kg)	42.8		43.2	
ASTM D 1319 - 10	Olefins (% vol)	Report Only		1.5	
ASTM D 445 - 11a	Viscosity @ -20°C (mm²/s)		8.0	5.0	

* Date reflects Eastern Standard Time(EST) | Report Generated: 03/2/12 15:37*
** Date as provided by customer

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AFPET LABORATORY REPORT
AFPA/PTPLA
2430 C Street
Building 70, Area B
Wright-Patterson AFB, OH 45433-7632

Lab Report No:2012LA36413001 Date Received:02/29/12 1330 hrs* Date Sampled: 02/29/2012**
Cust Sample No:POSF 7708 Date Reported:03/02/12 1536 hrs* Protocol:FU-AVI-0019
JON: GENERAL FUND

Sample Submitter:
Rhonda Cook
AFRL/RZPF
1790 Loop Road N
Bldg 490
Wright-Patterson AFB, OH 45433

Reason for Submission: AFRL Research
Product: Aviation Turbine Fuel, Kerosene
Specification: MIL-DTL-83133H Grade:JP-8

Source: AMYRIS Biotechnologies Qty Submitted: 2 gal
Batch/Lot/Origin: BIOFUEL

Method	Test	Min	Max	Result	Fail
ASTM D 445 - 11a	Viscosity @ 40°C (mm^2/s)	Report Only		1.4	

Dispositions:
For information purposes only.

Approved By **Date**
Michael Cole 03/02/2012*
\\SIGNED\\

This report was electronically delivered to:
david.vowell@wpafb.af.mil, donald.minus@wpafb.af.mil, janet.stewart2@wpafb.af.mil, jennifer.engelman@wpafb.af.mil, linda.shafer@wpafb.af.mil, michael.cole@wpafb.af.mil, michael.thiede@wpafb.af.mil, raymond.bunch@wpafb.af.mil, rhonda.cook.ctr@wpafb.af.mil

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AFFBT LABORATORY REPORT

AFPA/PTPLA
2430 C Street
Building 70, Area B
Wright-Patterson AFB, OH 45433-7632

Lab Report No:2012LA36126001 Date Received:02/10/12 1036 hrs* Date Sampled: **
Cust Sample No:7708 Date Reported:02/10/12 1525 hrs* Protocol:FU-AVI-0019
JON: GENERAL FUND

Sample Submitter:
AFRL/RZPF
1790 Loop Road N
Bldg 490
WPAFB, OH 45433

Reason for Submission: AFRL Research
Product: Aviation Turbine Fuel, Kerosene
Specification: MIL-DTL-83133H Grade:JP-8

Qty Submitted: 200 mL
Batch/Lot/Origin: BIOFUEL / JET A BLEND

Method	Test	Min	Max	Result
ASTM D 381 - 04	Existent Gum (mg/100 mL)		7.0	2.4

Dispositions:
For information purposes only.

Approved By **Date**
Michael Cole 02/10/2012*
\\SIGNED\\

This report was electronically delivered to:
afpa.lab@wpafb.af.mil, donald.minus@wpafb.af.mil, jennifer.engelman@wpafb.af.mil, linda.shafer@wpafb.af.mil, michael.cole@wpafb.af.mil, rhonda.cook.ctr@wpafb.af.mil

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AFPET LABORATORY REPORT
AFPA/PTPLA
2430 C Street
Building 70, Area B
Wright-Patterson AFB, OH 45433-7632

Lab Report No:2012LA37315001 Date Received:04/13/12 1214 hrs* Date Sampled: **
Cust Sample No:8123 Date Reported:04/19/12 1403 hrs* Protocol:FU-AVI-0019
JON: GENERAL FUND

Sample Submitter:
AFRL/RZPF
1790 Loop Road N
Bldg 490
Wright-Patterson AFB, OH 45433

Reason for Submission: AFRL Research
Product: Aviation Turbine Fuel, Kerosene
Specification: MIL-DTL-83133H Grade:JP-8

Qty Submitted: 1 L
Batch/Lot/Origin: BIOFUEL / JET A

Method	Test	Min	Max	Result	Fail
ASTM D 3241 - 11a	Thermal Stability @ 300°C				
	Tube Deposit Rating, Visual			2	
	Change in Pressure (mmHg)			0	
ASTM D 1319 - 10	Aromatics (% vol)		25.0	26.5	X

Dispositions:
For information purposes only.

Approved By **Date**
David Craycroft, 04/19/2012*
Lead Chemist
\\SIGNED\\

This report was electronically delivered to:
david.craycroft@wpafb.af.mil, donald.minus@wpafb.af.mil, jennifer.engelman@wpafb.af.mil, linda.shafer@wpafb.af.mil, michael.thiede@wpafb.af.mil, rhonda.cook.ctr@wpafb.af.mil, richard.wilkes@wpafb.af.mil

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** Date as provided by customer

Appendix C

Effect of FAME Contamination on Permittivity and Density

December 5, 2013

Energy Institute
Attn: Mr. Martin Hunnybun
61 New Cavendish Street
London W1G 7AR, UK

Via e-mail: MHunnybun@energyinst.org.uk

Subject: Letter Report for Southwest Research Institute® Project No. 08.17149.36.001, entitled, *"Effect of FAME Contamination on Permittivity and Density"*

Dear Mr. Hunnybun:

Please find attached the results for the permittivity study of FAME-contaminated jet fuel.

C.1.0 Introduction

A test plan was provided by Airbus which defined the requirements to determine the effect of Fatty Acid Methyl Ester (FAME) contamination within western commercial aviation turbine fuels, on the properties of relative permittivity and density across the useful fuel temperature range.

The evidence provided herein is necessary to satisfy the process of fuel additive / contamination level clearance, as stipulated by ASTM D4054 [1]. The evidence must be judged to be acceptable by airframe, engine and fuel system equipment manufacturers. The properties of permittivity and density are of particular importance in the measurement of fuel quantity using aircraft gauging systems. Their relationships against fuel temperature across the aircraft operating range, as well as their relationship to each other, are critically important to suppliers of fuel gauging system equipment to aircraft OEMs.

[1] "Qualification and Approval of New Aviation Turbine Fuels and Fuel Additives"

C.2.0 Background

The Energy Institute (EI) is coordinating the clearance activity for western commercial aviation fuels with FAME contamination at a maximum concentration of 100 ppm. Clearance of this level requires the acquisition of test evidence at four times the desired cleared concentration. Consequently, testing at 400 ppm FAME contamination is required. There are four main types (sources) of FAME. The principle adopted for the ASTM D4054 process has been to use a cocktail of equal parts of these four types as the contaminant, added to the base fuel to give a FAME concentration of 400 ppm.

The EI had previously commissioned the testing of permittivity against temperature for fuel contaminated with FAME at 400 ppm. This particular testing did not include the testing of density. The results of the testing were presented in the EI report dated 10th October 2011 [2]. Review of these results identified significant anomalies, and Airbus concluded that the results were fallacious.

Consequently, the robustness of the ASTM D4054 process, for qualifying FAME to 100 ppm, has been undermined since the test plan for establishing the permittivity characteristics against temperature and density has not provided usable results, as required by ASTM D4054 Section 8.2. The previous EI report also contained test data for both density and permittivity against temperature for a military fuel grade (JP-8), with and without a singular type of FAME. This evidence is considered to be supplemental only, due to its limited scope, and the fact that it was not commissioned or performed specifically as part of this EI FAME approval initiative. The evidence is not the robust, primary data required by the ASTM D4054 process; this is a validation issue for the clearance activity. Furthermore, this evidence was evaluated by a fuel gauging system supplier who judged it to be insufficient to clear its equipment for FAME at 100 ppm. It should be noted that the ASTM D4054 principle of testing at a concentration of four times the desired clearance level presents a dilemma when considering fuel gauging system performance. The performance (e.g. accuracy of contents, propensity for out-of-range alerts), might be intrinsically related to the level of contamination. Consequently, the effect on system performance at 400 ppm could possibly be four times greater than that seen at 100 ppm. In other words, the consequences of accounting for 400 ppm (due to the approval process) may be onerous, compared to those for 100 ppm. An example of such an onerous consequence might be a requirement to increase the aircraft fuel reserves significantly to account for gauging inaccuracies, which would be an unwarranted penalty. Testing at concentrations of 0 ppm, 100 ppm, and 400 ppm would resolve this dilemma.

The majority of the testing of density reported in the previous EI report (with and without FAME contamination), was performed independently, and without any permittivity testing, by several fuel test houses (as part of a comprehensive analysis of fuel properties). Consequently, this testing of density was carried out on different base fuels and FAME contaminants. Furthermore, density was measured by these fuel test houses at single temperatures only. Characteristics of density against either temperature or permittivity cannot be determined from such results. The

[2] "Seeking Original Equipment Manufacturer (OEM) Approvals for 100 mg/kg Fatty Acid Methyl Ester (FAME) In Aviation Turbine Fuel," EI Research Report, 10 October 2011

issues presented above explain why it was considered necessary to re-commission robust testing for both permittivity and density against temperature. The results of such testing will allow the determination of valid characteristics both for these relationships, and for the density versus permittivity relationship. Additional testing at 100 ppm FAME concentration would contribute to a more insightful judgment on the acceptability of FAME in aviation fuel with respect to the performance for aircraft fuel gauging systems. The evidence obtained from such testing will contribute to the library of public domain knowledge, and the importance of its validity cannot be over-stressed.

C.3.0 Test Materials

C.3.1 Fuel

The following test fuel was provided by the Air Force Research Lab (AFRL)

- Jet A (POSF 9326, SwRI CL13-4804)

The provided fuel type was marked as “Jet A” but has a measured freeze point of -54°C. Therefore, this fuel should be suitable as a Jet A-1. A copy of the Certificate of Analysis (CoA) is provided in Appendix C-1.

C.3.2 FAME Contaminant

The FAME cocktail used to contaminate the Jet A consisted of an equal part by weight mixture of the following individual FAME components:

- Palm Oil Methyl Ester (POME)
- Rapeseed Methyl Ester (RME)
- Soy(bean) Methyl Ester (SME)
- Tallow Methyl Ester (TME)

The FAME cocktail was also provided by AFRL (SwRI CL13-4806).

C.3.3 FAME Contaminated Jet A

Using the Jet A and FAME cocktail provided by AFRL, three samples were prepared in sufficient quantity to perform the full scope of work:

- Neat Jet A with 0 ppmw FAME cocktail (SwRI CL13-4804)
- Jet A with 100 ppmw FAME cocktail (SwRI CL13-4908)
- Fuel with 400 ppmw FAME cocktail (SwRI CL13-4909)

The samples were stored at ambient temperature (nominally 15-20°C) when not in use.

C.4.0 Test equipment

The following equipment was used to perform this study:

Capacitance Cell
- Provided by Goodrich Sensors and Integrated Systems, Inc.
- k-Cell (2-wire)

- Capacitance Bridge
  - Andeen Hagerling AH 2700A Ultra-Precision Capacitance Bridge
  - Operated at 10 kHz
- Benchtop Densitometer
  - Anton Paar D4500 M
  - Operable Range: 0 to 95°C
  - Stated Accuracy: 0.05 kg/m^3
- Thermocouple Reader
  - Fluke 54 II
  - Type K Thermocouple

C.5.0 Technical Approach

C.5.1 Test Temperatures

The nominal test temperatures requested for this study were as follows:

- -40°C
- -25°C
- -10°C
- +20°C
- +35°C
- +50°C

Although it was requested that density and permittivity be performed simultaneously, this was not practical given the nature of the equipment used. However, the measurements were conducted in the same facility, on the same fuels, within a short timeframe. Further supporting evidence as to the stability of the individual measurements can be found in section below.

C.5.2 Temperature Sequence Order

The following nominal test point sequence order was requested. The rationale for the specific order was to exercise the fuel and test apparatus across the dynamic range for temperature. This approach provides more independent measurements upon which the repeatability of each test point can be evaluated.

The specific objectives behind this rationale were:

- To obtain at least 2 results per nominal temperature point (for repeatability assessment)
- To acquire data to provide any evidence of any hysteresis characteristic
- To minimize the number of large temperature changes between test points for a particular fuel sample under test (for test cell practicalities)
- To minimize the number of test points to achieve all other objectives

The following twelve test point sequence was utilized:

- -40°C
- -25°C
- -10°C
- +20°C
- +35°C
- +50°C
- +35°C
- +20°C
- -10°C
- -25°C
- -40°C
- +50°C

Given the unlikely possibility that all test points could be completed in a single session for a given fuel, any deviations to the test point sequence were to be noted. The actual test point sequence recorded for each fuel is shown in Table C-1.

Table C-1. Test Point Sequence

Neat Jet A	Jet A w/ 100 ppm FAME	Jet A w/ 400 ppm FAME
15.0*	**16.0***	**16.3***
-39.9	-40.0	-40.1
-24.9	-25.1	-25.0
-10.1	-10.1	-10.0
20.0	19.9	20.0
35.0	35.0	35.1
49.9	50.0	50.1
15.7*	**16.9***	**20.9***
35.1	35.1	34.9
19.9	19.9	20.0
-10.0	-9.9	-10.0
-25.0	-25.0	-25.1
-40.0	-40.0	-40.0
50.0	50.1	50.1

* Beginning temperature at the start of each measurement session before continuing to the next test point in the prescribed sequence. No data from this temperature is reported.

C.5.3 Test Method

The test procedure utilized in this study is documented in Appendix C-2.

C.6.0 Results and Discussions

C.6.1 Measured Density Data

For each of the three fuels, the density values were measured according to ASTM D4052 as a curve over the range of 5-85°C in 5°C increments. The measured values are tabulated in Table C-2. The slope and intercept of the linear best-fit line for each sample is also shown and was used to extrapolate values from the curve for the actual test points measured during the permittivity runs.

Table C-2. Density Data

Temperature (°C)	NEAT Jet A	100 ppm	400 ppm
	Density (kg/m^3)	Density (kg/m^3)	Density (kg/m^3)
5	813.0	813.0	813.1
15	805.6	805.6	805.6
25	798.1	798.1	798.1
35	790.6	790.6	790.6
45	783.0	783.1	783.0
55	775.4	775.4	775.5
65	767.8	767.8	767.9
75	760.2	760.2	760.2
85	752.5	752.5	752.4
m	-0.756667	-0.756667	-0.757500
b	816.961111	816.972222	817.020833

C.6.2 Measured Permittivity Values and Corresponding Density Values

The measured permittivity values and the density values calculated from the corresponding density curves are shown below as follows:

- Neat Jet A Table C-3
- 100 ppm FAME Table C-4
- 400 ppm FAME Table C-5

Table C-3. Measured Permittivity and Extrapolated Density Values NEAT Jet A

Temperature (°C)	Permittivity	Density (kg/m^3)
-39.9	2.212	847.2
-24.9	2.189	835.8
-10.1	2.167	824.6
20.0	2.125	801.8
35.0	2.107	790.5
49.9	2.086	779.2
35.1	2.105	790.4
19.9	2.125	801.9
-10.0	2.171	824.5
-25.0	2.193	835.9
-40.0	2.217	847.2
50.0	2.087	779.1

Table C-4. Measured Permittivity and Extrapolated Density Values 100 ppm FAME in Jet A

Temperature (°C)	Permittivity	Density (kg/m^3)
-40.0	2.216	847.2
-25.1	2.193	836.0
-10.1	2.171	824.6
19.9	2.127	801.9
35.0	2.107	790.5
50.0	2.088	779.1
35.1	2.108	790.4
19.9	2.128	801.9
-9.9	2.171	824.5
-25.0	2.192	835.9
-40.0	2.216	847.2
50.1	2.088	779.1

Table C-5. Measured Permittivity and Extrapolated Density Values 400 ppm FAME in Jet A

Temperature (°C)	Permittivity	Density (kg/m^3)
-40.1	2.215	847.4
-25.0	2.192	836.0
-10.0	2.171	824.6
20.0	2.128	801.9
35.1	2.107	790.4
50.1	2.088	779.1
34.9	2.107	790.6
20.0	2.128	801.9
-10.0	2.170	824.6
-25.1	2.192	836.0
-40.0	2.216	847.3
50.1	2.087	779.1

C.6.3 Permittivity vs. Temperature

The Permittivity vs. Temperature plots for each of the fuels are shown below in Figure C-1, Figure C-2, and Figure C-3 for Neat Jet A, 100 ppm FAME, and 400 ppm FAME, respectively. The upper and lower uncertainty range limits are shown on each plot in red.

Note on error analysis: For these and subsequent plots below, the uncertainty analysis was performed by first determining the linear best-fit line through the data (using MS Excel). Then, two data points, one above and one below, with the largest difference in the y-variable from the best fit line were selected. For each point, error bars were applied to both dimensions (permittivity = 0.005 and density = 0.1 kg/m^3). For each point, the outermost vertex of the rectangular area formed by the errors bars was determined (upper right vertex for upper uncertainty and lower left vertex for lower uncertainty). A line having the same slope and passing through each of these respective vertices was determined and plotted as the upper and lower uncertainty range bars.

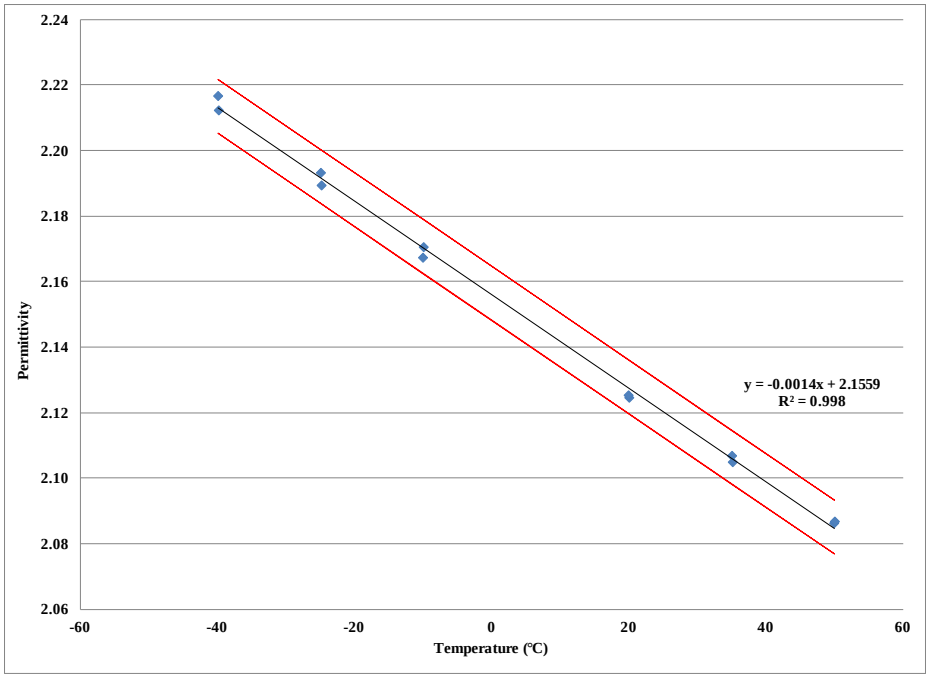


Figure C-1. Permittivity vs. Temperature – Neat Jet A

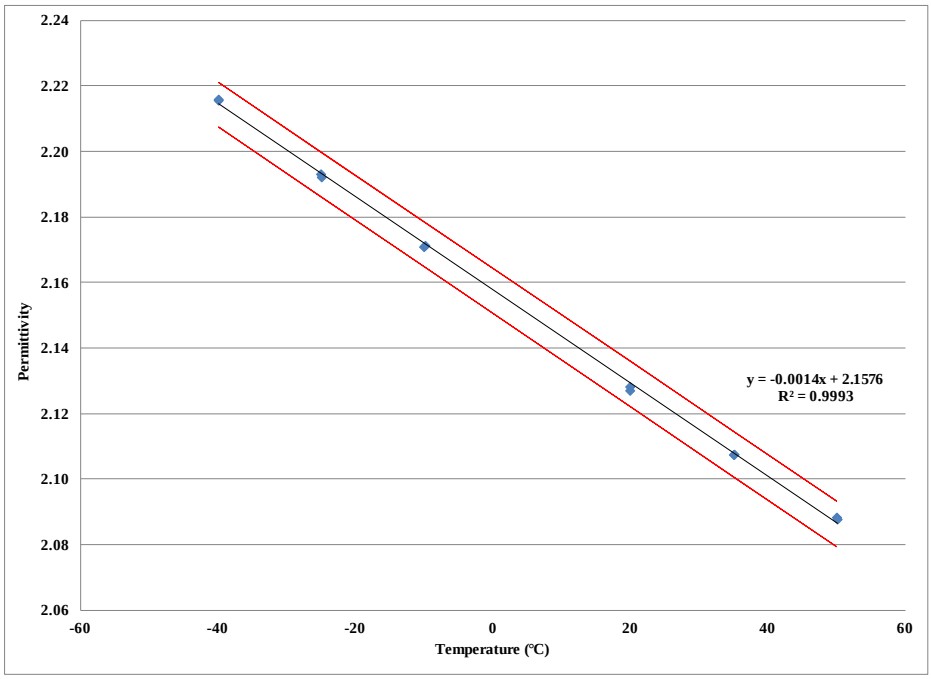


Figure C-2. Permittivity vs. Temperature - 100 ppmw FAME

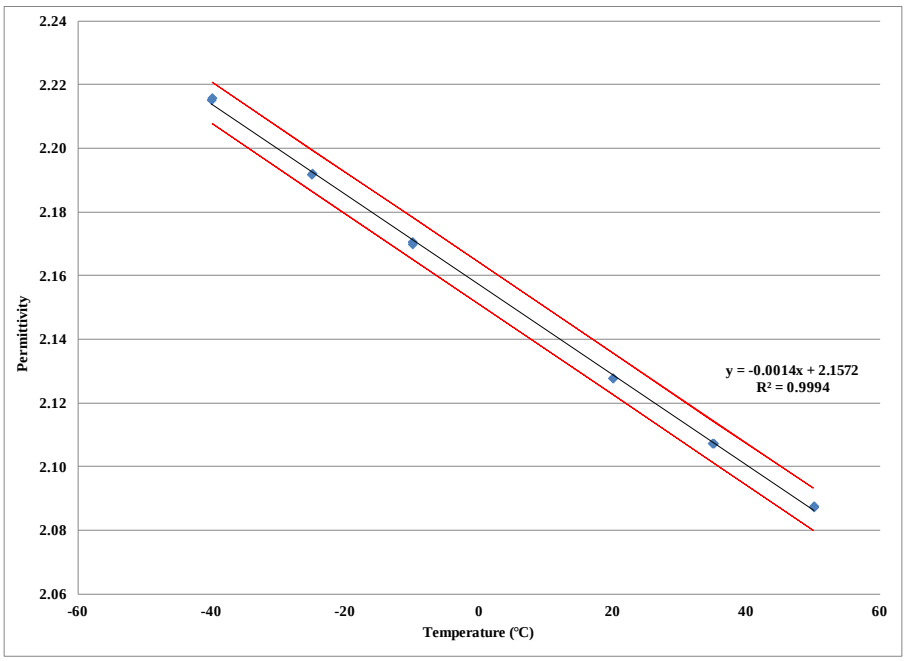


Figure C-3. Permittivity vs. Temperature - 400 ppmw FAME

C.6.4 Density vs. Temperature

The Density vs. Temperature plots for each of the fuels are shown below in Figure C-4, Figure C-5, and Figure C-6 for Neat Jet A, 100 ppm FAME, and 400 ppm FAME, respectively. The linearity of the data provided a true, perfect fit line. No further error analysis was performed on this data.

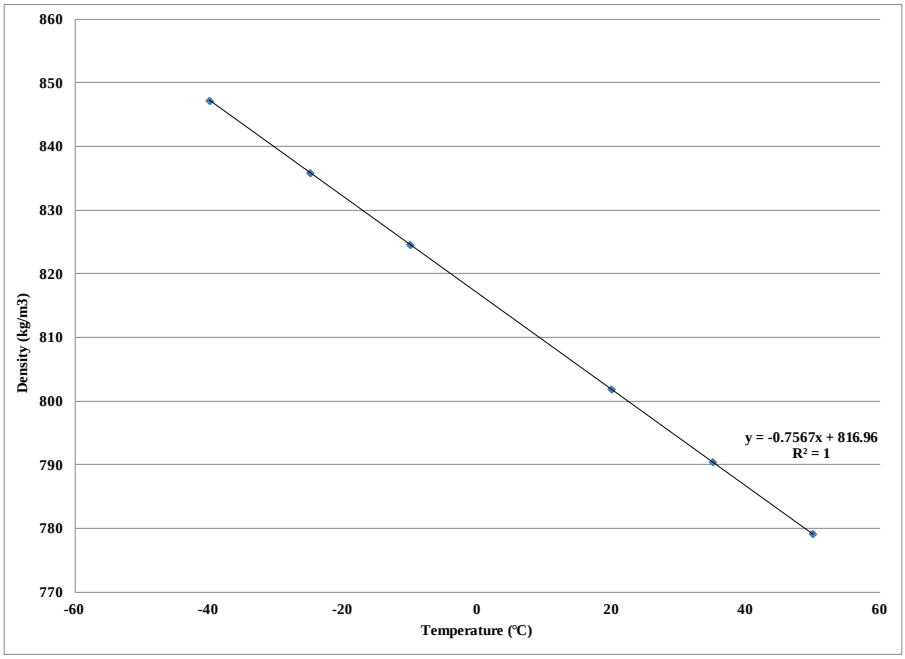


Figure C-4. Density vs. Temperature – Neat Jet A

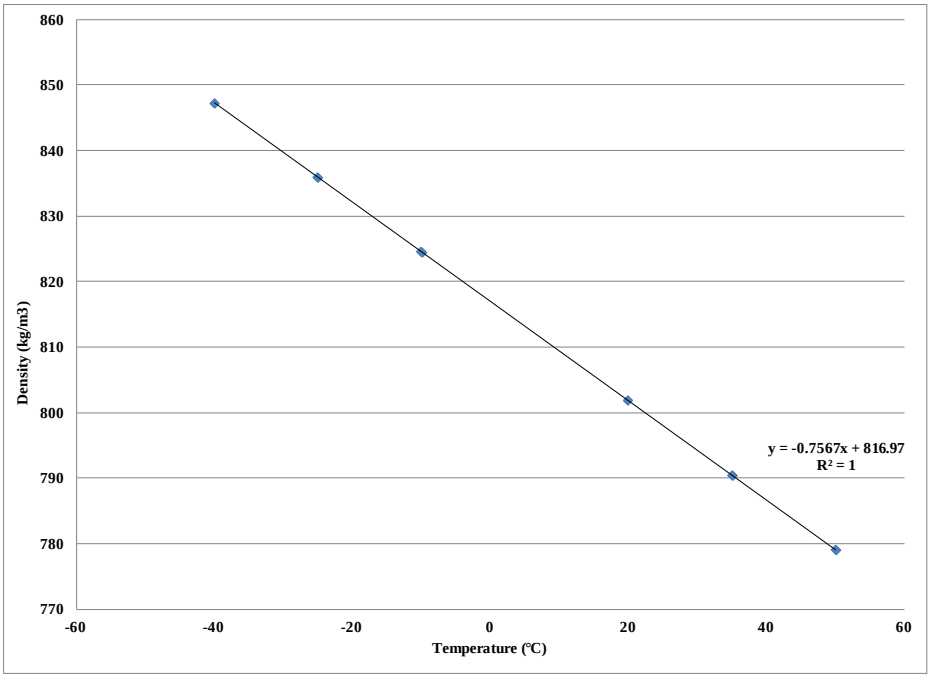


Figure C-5. Density vs. Temperature 100 ppmw FAME

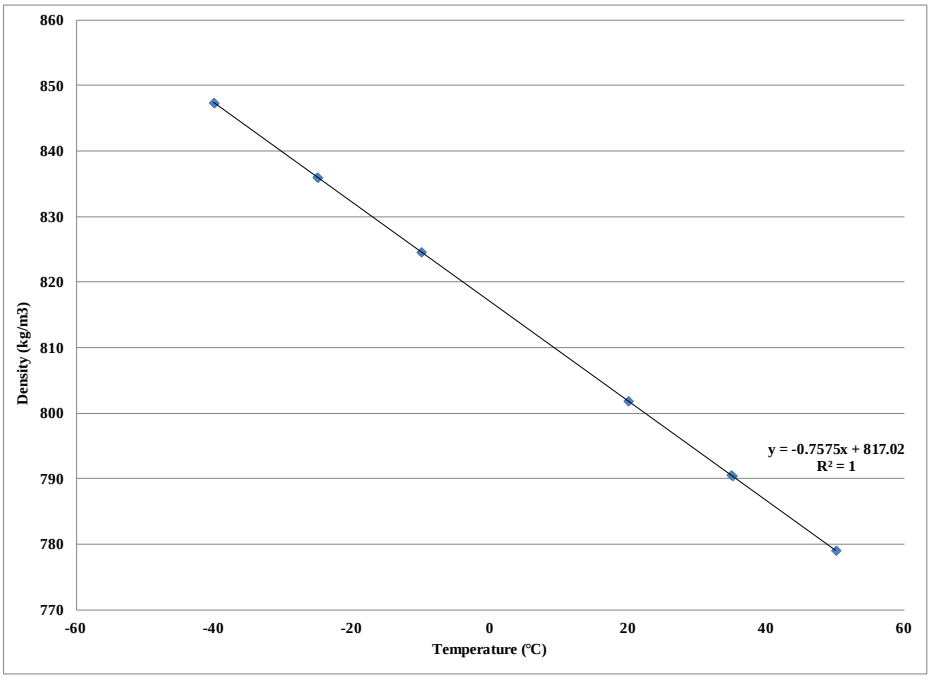


Figure C-6. Density vs. Temperature - 400 ppmw FAME

C.6.5 Density vs. Permittivity

The Density vs. Permittivity plots for each of the fuels are shown below in Figure C-7, Figure C-8, and Figure C-9 for Neat Jet A, 100 ppm FAME, and 400 ppm FAME, respectively. The upper and lower uncertainty error bars were determined in the same manner as before.

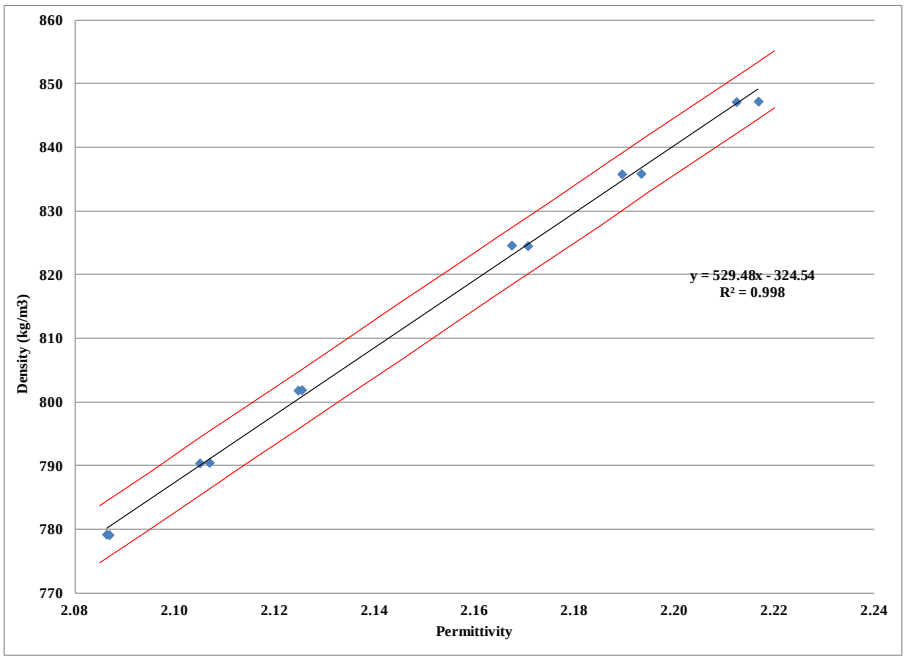


Figure C-7. Density vs. Permittivity – Neat Jet A

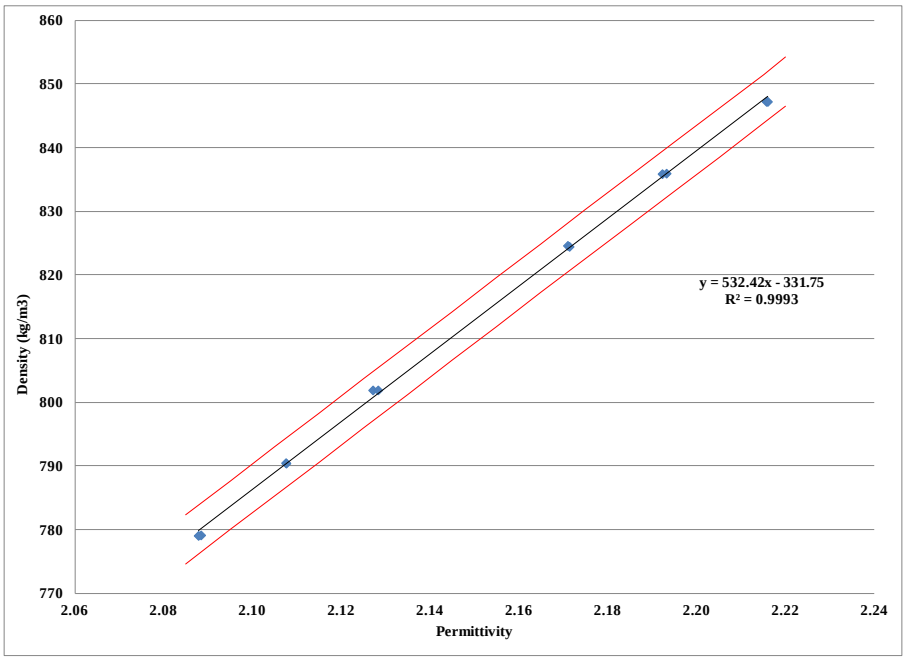


Figure C-8. Density vs. Permittivity - 100 ppmw FAME

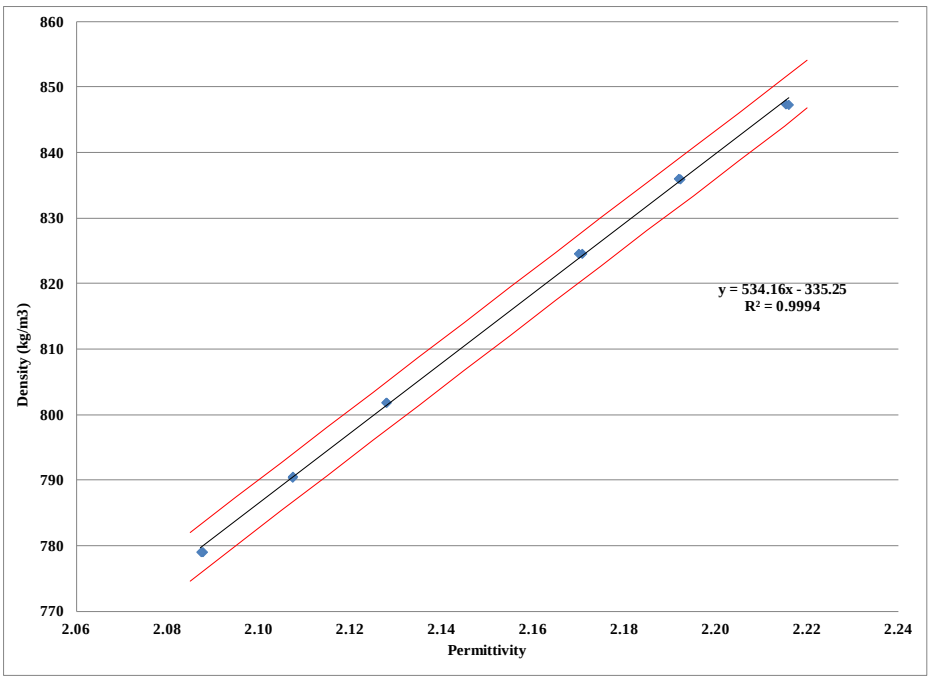


Figure C-9. Density vs. Permittivity - 400 ppmw FAME

C.6.6 Permittivity vs. Temperature vs. FAME Concentration

A family of constant temperature curves for Permittivity vs. FAME is shown in Figure C-10.

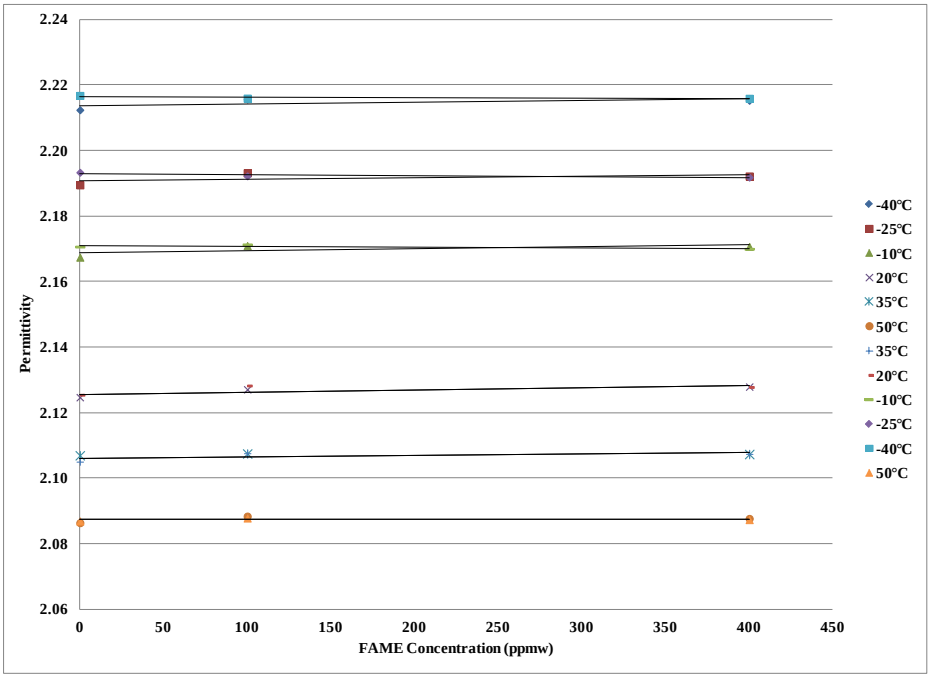


Figure C-10. Permittivity vs. Temperature vs. FAME Concentration

C.6.7 Density vs. Temperature vs. FAME Concentration

A family of constant temperature curves for Density vs. FAME is shown in Figure C-11.

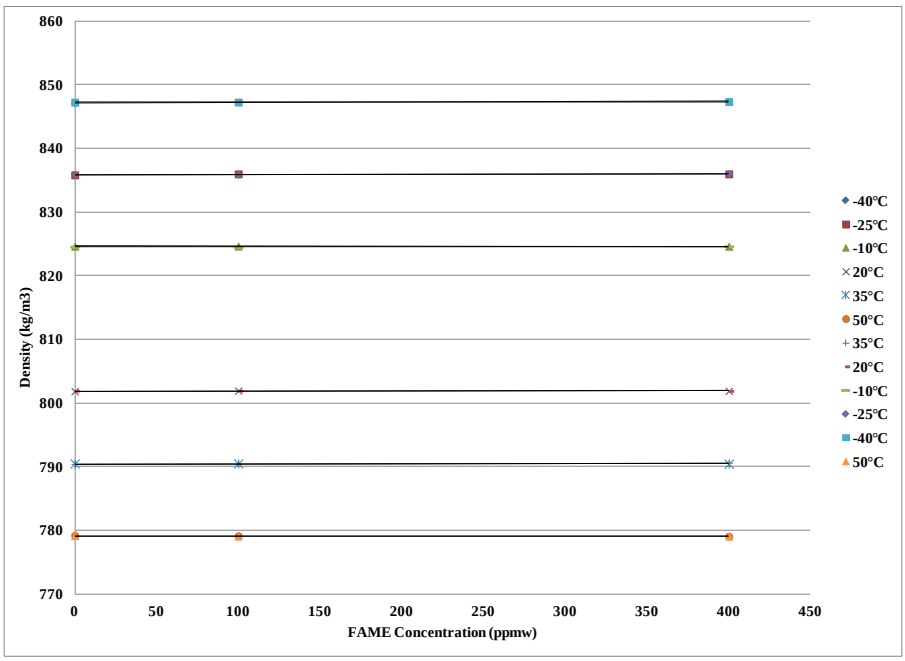


Figure C-11. Density vs. Temperature vs. FAME Concentration

C.6.8 Density vs. Permittivity vs. FAME Concentration

A family of constant permittivity curves for Density vs. FAME is shown in Figure C-12.

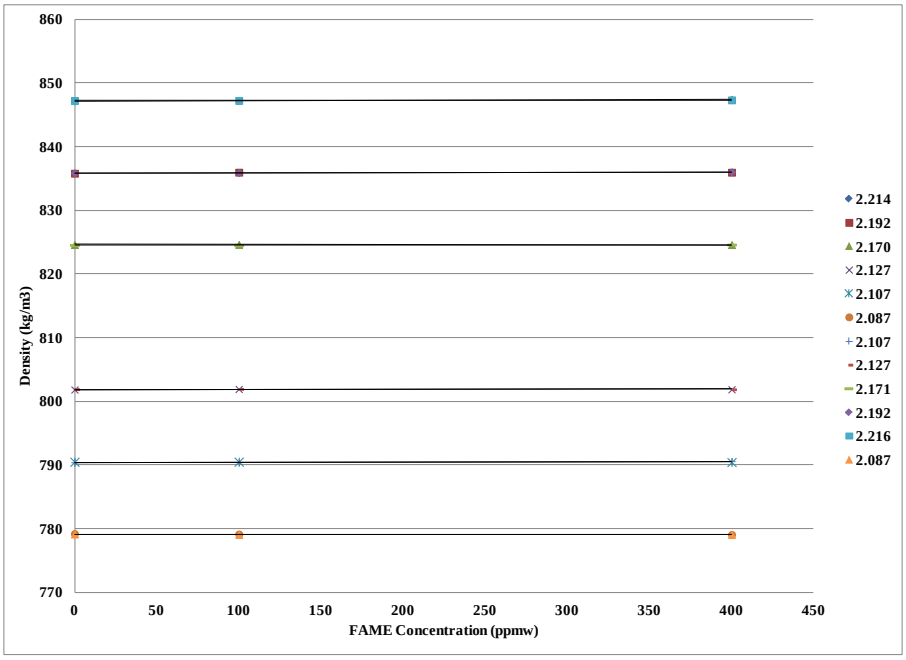


Figure C-12. Density vs. Permittivity vs. FAME Concentration

C.6.9 Permittivity vs. FAME Concentration

A family of constant density curves for Permittivity vs. FAME is shown in Figure C-13.

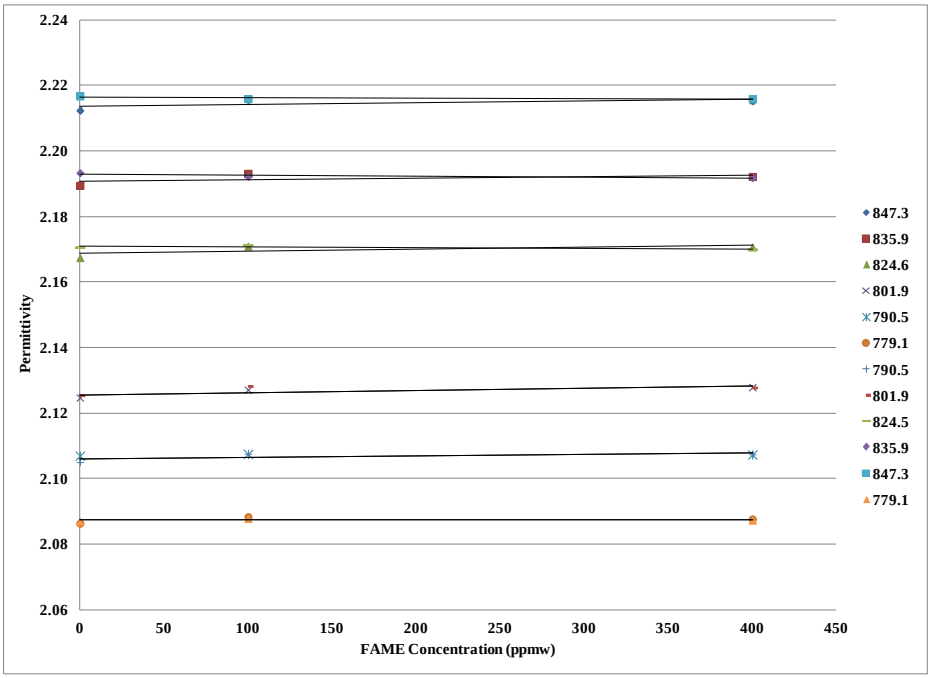


Figure C-13. Permittivity vs. Density vs. FAME Concentration

C.6.10 Comparison of all the Results to CRC Data

Comparative plots of permittivity, density, and temperature are shown below with CRC minimum and maximum limits overlaid for reference. CRC limits were extracted from CRC report No. 647 (World Fuel Sampling Program). To the extent possible (as indicated in the CRC report), synthetic or partially synthetic fuels were avoided when establishing CRC limits. The synthetic fuels often lie at the extremes of the density and permittivity curves which would skew the true limits of the average global aviation fuel.

C.6.10.1 Permittivity vs. Temperature

Permittivity vs. Temperature plots with CRC limits are shown below in Figure C-14, Figure C-15, and Figure C-16 for Neat Jet A, 100 ppm FAME, and 400 ppm FAME, respectively.

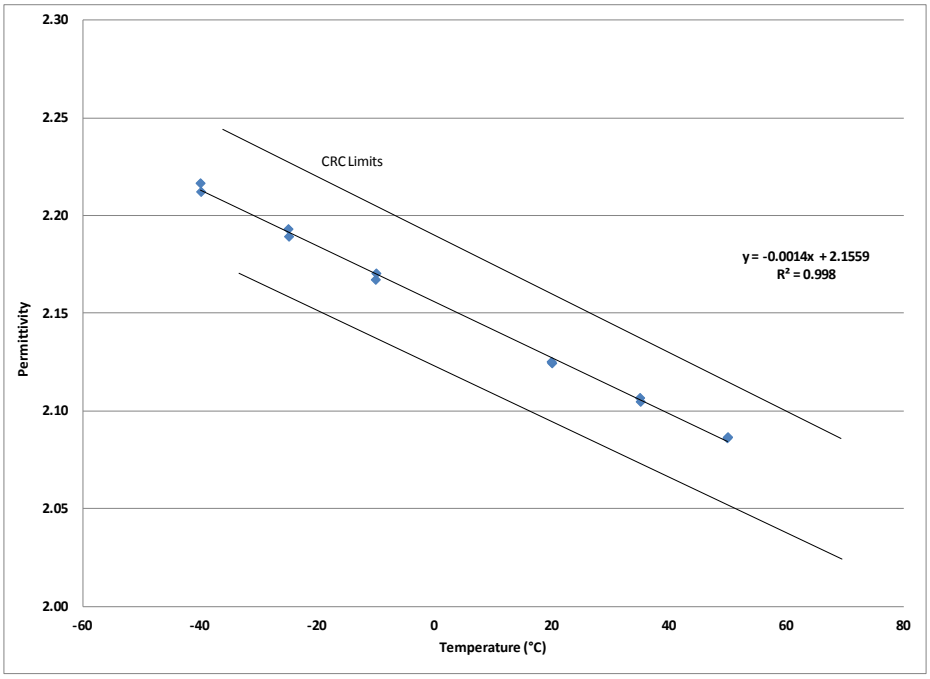


Figure C-14. Permittivity vs. Temperature – Neat Jet A (w/ CRC Limits)

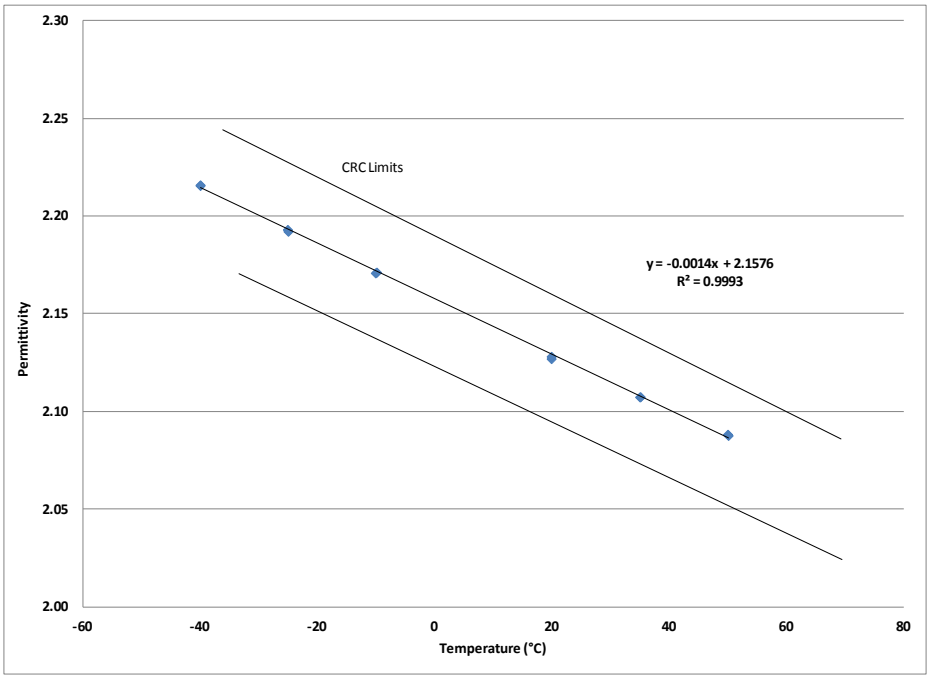


Figure C-15. Permittivity vs. Temperature – 100 ppm FAME (w/ CRC Limits)

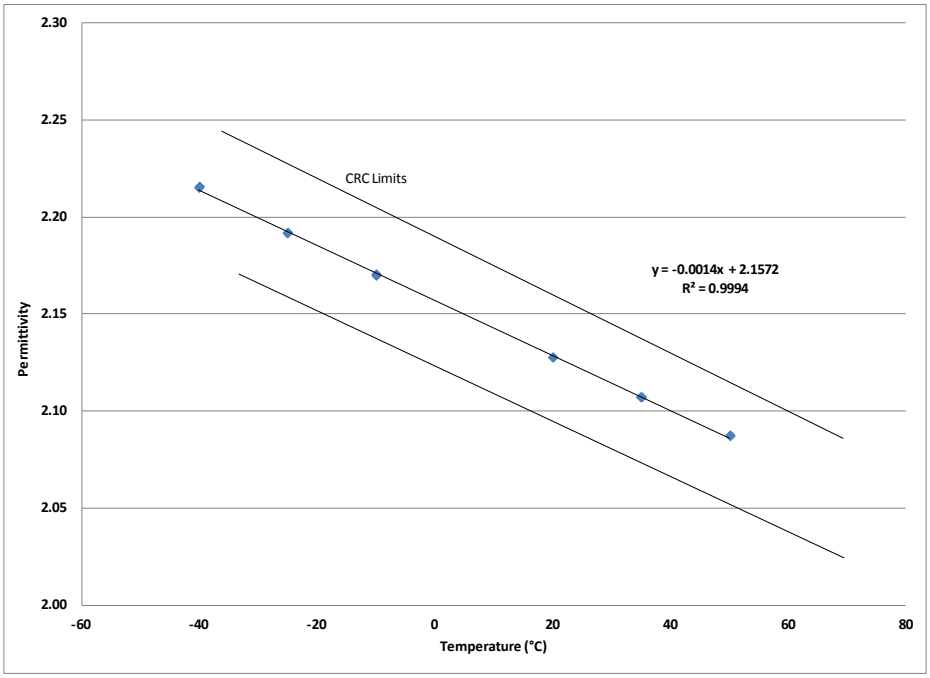


Figure C-16. Permittivity vs. Temperature – 400 ppm FAME (w/ CRC Limits)

C.6.10.2 Density vs. Temperature

Density vs. Temperature plots with CRC limits are shown below in Figure C-17, Figure C-18, and Figure C-19 for Neat Jet A, 100 ppm FAME, and 400 ppm FAME, respectively. The specification range limits (775-840 kg/m^3 @ 15°C), common to both military and commercial fuel specifications, is indicated in the figures below.

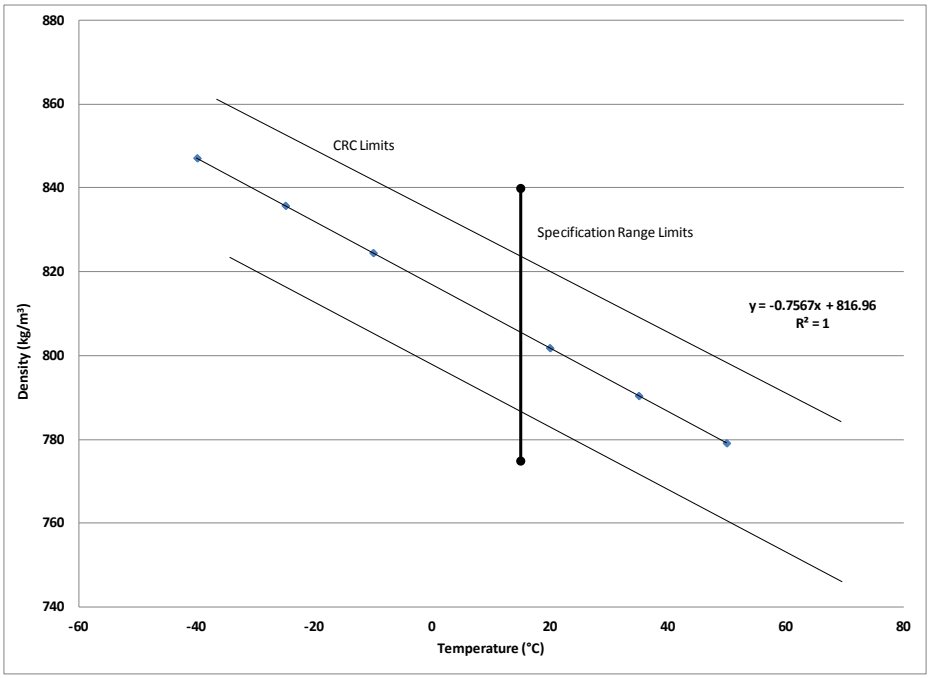


Figure C-17. Density vs. Temperature – Neat Jet A (w/ CRC Limits)

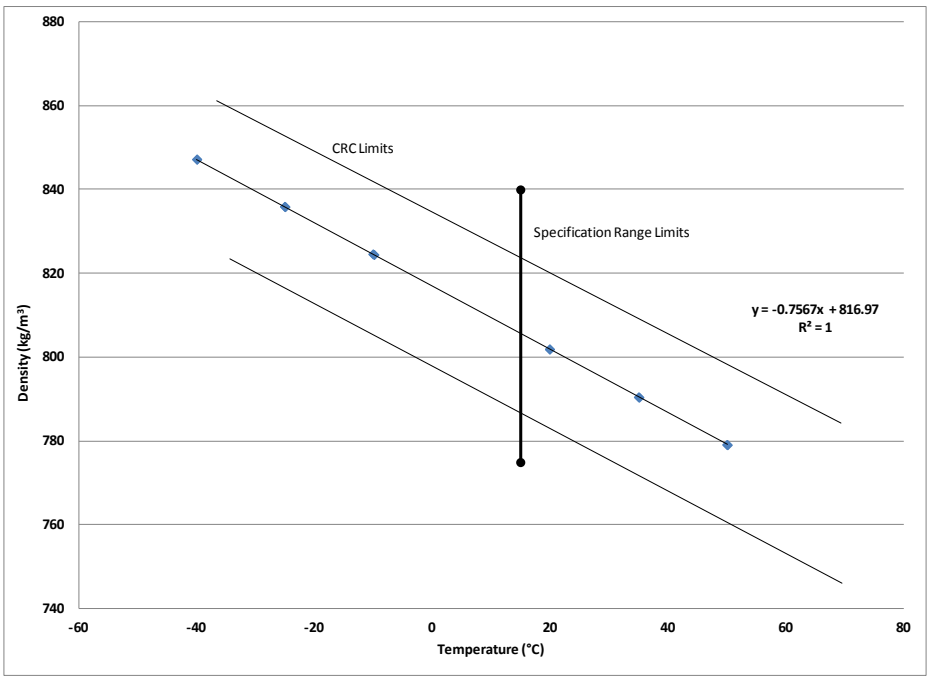


Figure C-18. Density vs. Temperature – 100 ppm FAME (w/ CRC Limits)

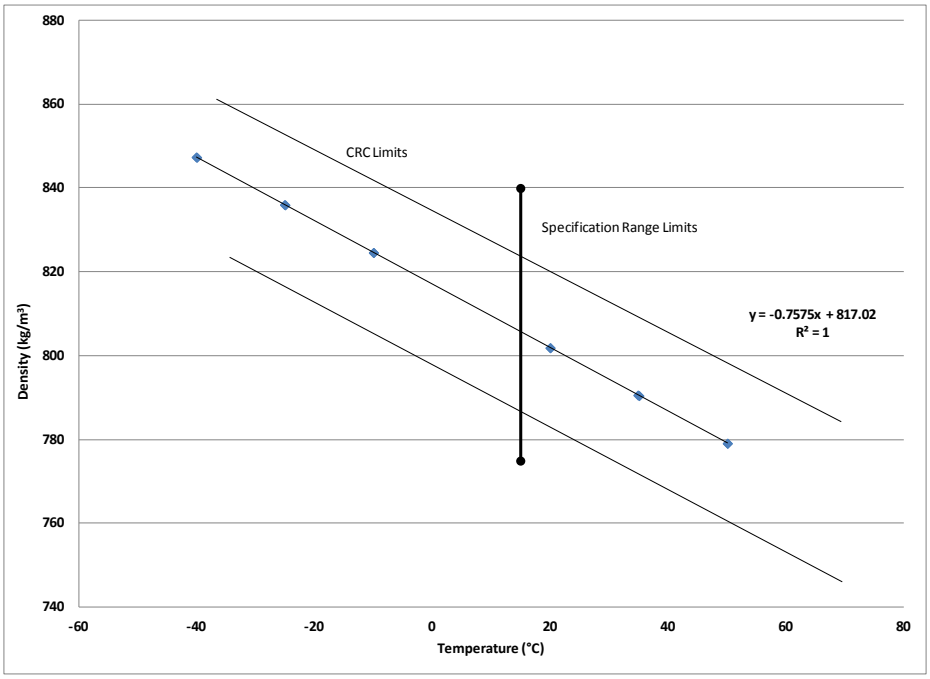


Figure C-19. Density vs. Temperature – 400 ppm FAME (w/ CRC Limits)

C.6.10.3 Density vs. Permittivity

Density vs. Permittivity plots with CRC limits are shown below in Figure C-20, Figure C-21, and Figure C-22 for Neat Jet A, 100 ppm FAME, and 400 ppm FAME, respectively.

Note that these limits were determined by plotting the Density vs. Permittivity for a given temperature for all fuels in the CRC report and then selecting the two fuels that appeared to lie at the extremes of that data set.

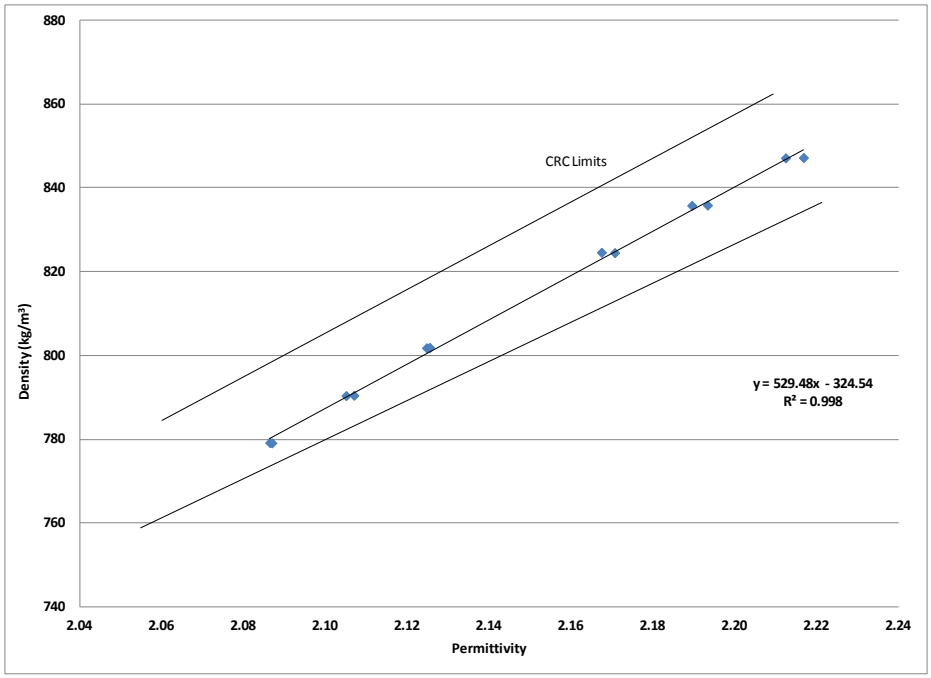


Figure C-20. Density vs. Permittivity – Neat Jet A (w/ CRC Limits)

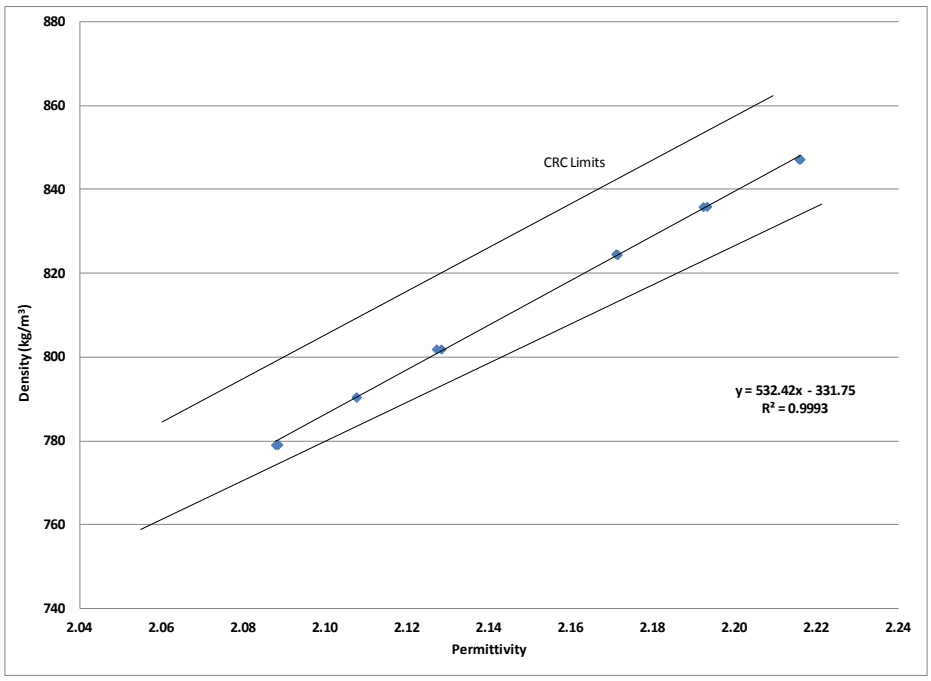


Figure C-21. Density vs. Permittivity – 100 ppm FAME (w/ CRC Limits)

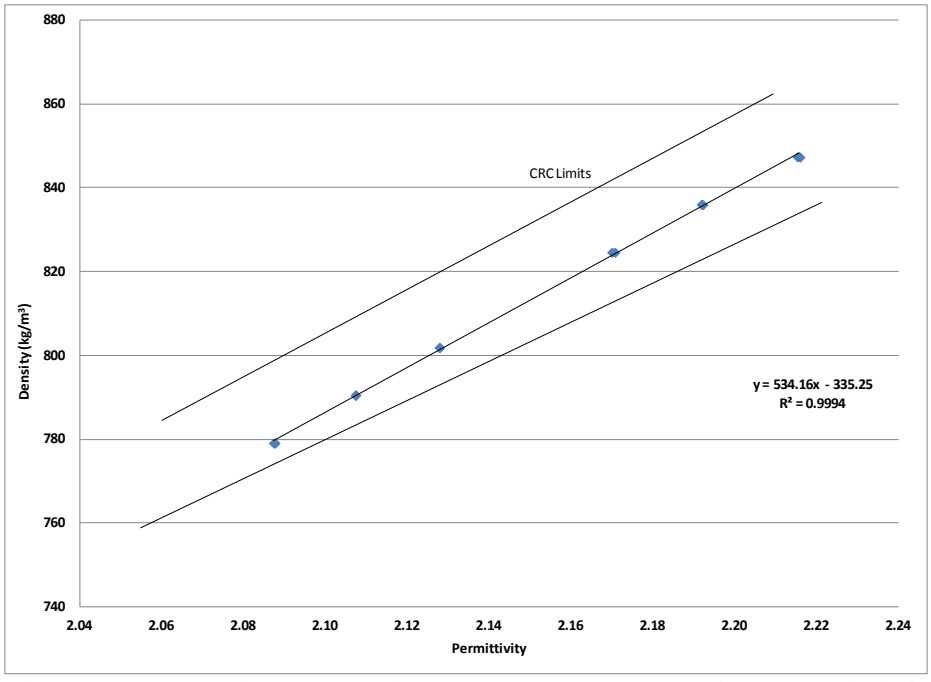


Figure C-22. Density vs. Permittivity – 400 ppm FAME (w/ CRC Limits)

C.6.11 Miscellaneous Supporting Data

Many of the concerns surrounding the dielectric values are related to the accuracy of the permittivity and density measurements themselves in addition to the extrapolation of density values to extreme temperatures. To address those concerns, the following sections provide data generated on hydrocarbon standards for those respective measurements.

C.6.11.1 Density of n-hexane

A sample of n-hexane was measured on the benchtop densitometer at the highlighted temperatures shown in Table C-6. From those measurements, a linear curve fit was applied and then extrapolated to a range of -50°C to 70°C. Those values were then compared to literature values for n-hexane and found to have an average error of approximately 0.08%.

Table C-6. Density Values for n-hexane

Temperature (°C)	Literature Values kg/m^3	Measured/Extrapolated kg/m^3	Absolute Difference	% Error
-50	722.7	723.4	0.6	0.09
-45	718.2	718.8	0.6	0.09
-40	713.7	714.3	0.6	0.09
-35	709.1	709.7	0.6	0.09
-30	704.6	705.2	0.6	0.09
-25	700.0	700.6	0.6	0.09
-20	695.5	696.1	0.6	0.09
-15	690.9	691.5	0.6	0.09
-10	686.4	687.0	0.6	0.09
-5	681.9	682.4	0.6	0.09
0	677.3	677.9	0.6	0.08
5	672.8	673.3	0.6	0.08
10	668.2	668.8	0.6	0.08
15	663.7	664.2	0.5	0.08
20	659.1	659.7	0.5	0.08
25	654.6	655.1	0.5	0.08
30	650.1	650.6	0.5	0.08
35	645.5	646.0	0.5	0.08
40	641.0	641.5	0.5	0.08
45	636.4	636.9	0.5	0.08
50	631.9	632.4	0.5	0.08
55	627.4	627.8	0.5	0.08
60	622.8	623.3	0.5	0.08
65	618.3	618.7	0.5	0.08
70	613.7	614.2	0.5	0.08

C.6.11.2 Permittivity of Cyclohexane

The permittivities for a sample of cyclohexane were measured at the temperatures shown in Table C-7. Those values were then compared to literature values, shown in Table C-8, and found to have an average error of approximately 0.04%. The permittivities of cyclohexane and the corresponding linear curve fit are shown in Figure C-23.

Table C-7. Permittivity of Cyclohexane

Temperature (°C)	Permittivity	Literature Value	% Error
15.0	2.031	2.032	0.05%
19.9	2.024	2.024	0.01%
25.1	2.015	2.016	0.04%
30.0	2.009	2.008	0.06%
35.2	2.000	1.999	0.05%
39.9	1.993	1.992	0.06%

Table C-8. Literature Values for Permittivity of Cyclohexane

Temperature (°C)	Permittivity
10	2.040
20	2.024
30	2.008
40	1.992
50	1.975
m	b
-0.00162	2.0564

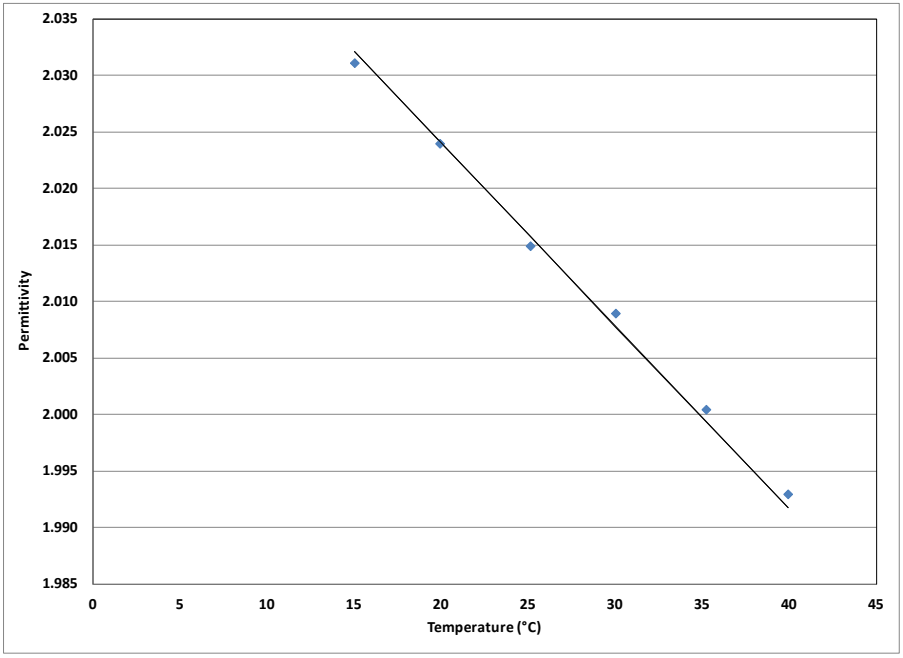


Figure C-23. Permittivity vs. Temperature – Cyclohexane

C.7.0 Conclusions

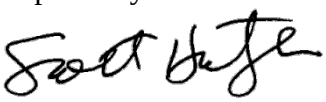
Based on an initial assessment of the raw data, both the permittivity and density values appeared to be essentially identical for the neat jet fuel and FAME-additized fuels. The subsequent analysis, provided herein, shows strong linear relationships among permittivity, density, and temperature. There appears to be little hysteresis in the permittivity measurement technique across the full range of test points. The results also appear to fall well within the experience-base provided by the CRC World Fuel Sampling Program. Based on these results, it is a reasonable conclusion that FAME contamination up to 400 ppmw does not significantly affect the measurement of permittivity or density over a relatively wide-temperature range beyond the normal expected variation in the test methods themselves.

Based on the computed uncertainty range limits, approximate accuracy statements are as follows:

- Permittivity vs. Temperature: ±0.006
- Density vs. Temperature: ±0.1 kg/m^3
- Density vs. Permittivity: ±3.9 kg/m^3

We appreciate the opportunity to perform this testing for you. If you have any questions regarding this data, please do not hesitate to contact me at (210) 522-6978 or by e-mail at scott.hutzler@swri.org.

Prepared by:



Scott A. Hutzler, Manager
Fluids Filtration and Handling Research
Fuels & Lubricants Technology Department

Approved by:

Gary Bessee, Director
Fuels & Lubricants Technology Department

SH/kp/rs

r:\working\Report_EnergyInstitute_1714936001_120513

cc: J. Edwards, AFRL (via e-mail)
G. Wilson III, SwRI (via e-mail)
D. Barrera, SwRI (via e-mail)
rrecordcopyb, SwRI (via e-mail)

Appendix CA
Jet A Certificate of Analysis

AFPET LABORATORY REPORT
AFPA/PTPLA
2480 C Street
Building 70, Area B
Wright-Patterson AFB, OH 45433-7632

Lab Report No:2012LA40064001 Date Received:09/24/12 1028 hrs* Date Sampled: **
Cust Sample No:9326 Date Reported:10/01/12 1331 hrs* Protocol:FU-AVI-0036
JON: GENERAL FUND

Sample Submitter:
AFRL/RZPF
1790 Loop Road N
Bldg 490
Wright-Patterson AFB, OH 45433

Reason for Submission: AFRL Research
Product: Aviation Turbine Fuel, Kerosene
Specification: ASTM D 1655 - 12 Grade:Jet A

Qty Submitted: 2 gal
Batch/Lot/Origin: JET A

Method	Test	Min	Max	Result	Fail
ASTM D 3241 - 11a	Thermal Stability @ 290°C				
	Tube Deposit Rating, Visual			1A	X
	Change in Pressure (mmHg)			0	
ASTM D 3241 - 11a	Thermal Stability @ 280°C				
	Tube Deposit Rating, Visual			1	
	Change in Pressure (mmHg)			0	
ASTM D 3241 - 11a	Thermal Stability Breakpoint				
	Tube Deposit Rating, Visual			1	
	Change in Pressure (mmHg)			0	
	Breakpoint (°C)			285	
MIL-STD-3004C	Appearance			Pass	
ASTM D 3242 - 11	Total Acid Number (mg KOH/g)		0.10	0.00	
ASTM D 1319 - 10	Aromatics (% vol)		25	21	
ASTM D 3227 - 04a	Mercaptan Sulfur (% mass)		0.003	0.002	
ASTM D 4294 - 10	Total Sulfur (% mass)		0.30	0.06	
ASTM D 86 - 11b	Distillation				
	10% Recovered (°C)		205	164	
	20% Recovered (°C)	Report Only		171	
	50% Recovered (°C)	Report Only		194	
	90% Recovered (°C)	Report Only		246	
	End Point (°C)		300	269	
	Residue (% vol)		1.5	1.3	
	Loss (% vol)		1.5	0.5	
ASTM D 56 - 05	Flash Point (°C)	38		43	
ASTM D 4052 - 11	Density @ 15°C (kg/m³)	775	840	805	
ASTM D 5972 - 05e1	Freezing Point (°C)		-40	-54	
ASTM D 445 - 12	Viscosity @ -20°C (mm²/s)		8.0	3.8	
ASTM D 1322 - 08	Smoke Point				
	Smoke Point (w/allowable Naphthalenes) (mm)	18		20	
ASTM D 1840 - 07	Naphthalenes (% vol)		3.0	1.2	
ASTM D 130 - 10	Copper Strip Corrosion (2 h @ 100°C)		1 (Max)	1a	
ASTM D 3241 - 11a	Thermal Stability @ 260°C				
	Change in Pressure (mmHg)		25	0	
	Tube Deposit Rating, Visual		<3 (Max)	1	
ASTM D 381 - 12	Existent Gum (mg/100 mL)		7	<1	
ASTM D 1094 - 07	Water Reaction Interface Rating		1b (Max)	1	
ASTM D 3948 - 11	WSIM	70		99	
ASTM D 2624 - 09	Conductivity (pS/m)	50	600	0	X
ASTM D 5001 - 10	Lubricity Test (BOCLE) Wear Scar (mm)		Report Only	0.66	
MIL-DTL-83133H	Filtration Time (min)			3	

* Date reflects Eastern Standard Time(EST) | Report Generated: 10/1/12 13:31*
** Date as provided by customer

Appendix CB
SwRI Permittivity Procedure

Apparatus

- k-cell
- k-cell holder
- Andeen-Hagerling Ultra-Precision Capacitance Bridge (2700A), 50Hz-20kHz
- Thermocouple
- Thermocouple reader

The “system” shall refer to the combination of the capacitance bridge and k-cell.

Materials

- 1000mL Beaker
- Isopropanol (Grade - Certified ACS Plus or better)
- Cyclohexane, HPLC Grade or better
- Solvent bottle

Cleaning the k-cell

To clean the k-cell, use the following procedure:

- Disconnect the k-cell from the capacitance bridge
- Allow the k-cell to drain thoroughly
- Perform an initial flush of the k-cell using isopropanol from a solvent bottle
- Allow the k-cell to drain thoroughly
- Submerge the k-cell into a beaker filled with isopropanol. Do not submerge the BNC connectors of the k-cell.
- Remove the k-cell from the isopropanol.
- Repeat steps 5-6 two more times
- Allow the k-cell to drain thoroughly.
- Submerge the k-cell into a second beaker filled with isopropanol. Do not submerge the BNC connectors of the k-cell.
- Remove the k-cell from the isopropanol.
- Repeat steps 9-10 two more times
- Allow the k-cell to drain thoroughly.
- Dry the k-cell using a stream of dry, oil-free air. The k-cell should be kept vertical so that fluid can drain.

System Verification

When verification of the system is required, the following procedure shall be followed.

- Determine the dielectric constant of cyclohexane at ambient temperature (18-25°C) according to the procedure below.
- The dielectric constant of cyclohexane shall not deviate by more than ±0.01 units from those established by the following curve:

$$\varepsilon_r = -0.00162T + 2.0564$$

where,
ε_r = dielectric constant
T = temperature (°C)

Instrument Calibration

Calibration of the capacitance bridge shall only be performed by the manufacturer.

Sample Preparation

Other than equilibrating the sample to the appropriate test temperature, no sample preparation is required in the normal execution of this procedure.

Test Procedure

The following procedures are used to measure the capacitance of an air or a liquid sample. Refer to the operating manual for instructions on using the capacitance bridge. For all procedures, allow the capacitance bridge at least 30 minutes of warm-up time prior to performing a measurement.

Dielectric Constant of Air

- Ensure that the k-cell has been cleaned as described above.
- Connect the k-cell to the capacitance bridge (the cables are labeled to match the inputs on the rear of the bridge)
- Set the desired frequency of the capacitance bridge (e.g. 10 kHz)
- Air measurements should be performed at room temperature (18-23°C). Allow the k-cell and its holder to equilibrate to the room temperature for at least 30 minutes prior to running.
- Place the k-cell in its holder.
- Collect and record three separate capacitance and temperature readings within two minutes. The temperature should not deviate by more than 0.1°C.
- Calculate the average air capacitance.

Dielectric Constant of a Liquid Sample

- Ensure that the k-cell has been cleaned as described above.
- Connect the k-cell to the capacitance bridge (the cables are labeled to match the inputs on the rear of the bridge).
- Set the desired frequency of the capacitance bridge (e.g. 10 kHz).
- Assemble the k-cell, k-cell holder, and sample under ambient conditions in a low humidity environment (50% non-condensing).
- Equilibrate the k-cell, k-cell holder, and sample together to the desired temperature. Under cold conditions, this prevents humid air from condensing out on the k-cell and k-cell holder which will affect the results.
- Collect and record three separate capacitance and temperature readings within two minutes. The temperature should not deviate by more than 0.1°C.
- Calculate the dielectric constant from each of the three capacitance readings using the average of the air capacitance as described below.

Calculations

The dielectric constant, ε_r, is calculated as the ratio of the capacitance of the fuel-wetted k-cell to the capacitance of air (dry k-cell):

$$\varepsilon_r = C_{sample} / C_{air}$$

where,
ε_r = dielectric constant
C_{sample} = capacitance of the sample (pF)
C_{air} = capacitance of air (dry cell) (pF)

The capacitance of air, C_{air}, is measured once per day, in triplicate, prior to samples being run. The final value is computed as an average of the three runs and used in all subsequent calculations for samples run that day.

Data to Be Recorded

- Capacitance of air (in triplicate) at ambient temperature (pF)
- Air temperature (°C)
- Capacitance of the sample (in triplicate) (pF)
- Sample temperature (°C)
- k-cell holder ID#
- Thermocouple S/N
- Thermocouple reader S/N

Capacitance values shall include all digits displayed by the capacitance bridge.