TOXICOLOGY ASSESSMENT AND COMPLIANCE ASSURANCE GROUP
3M COMPANY

13-430: ACUTE INHALATION TOXICITY STUDY OF MTDID 37312 IN MALE RATS

FINAL REPORT

ToxDocs Study Number	13-430
Test Material	MTDID 37312
Lot Number(s)	Lot 30107 (per GID 103988)
Strategic Tox Lab Study Number	ST-460
Other Identification Number(s)	FC-10
19F/1H-NMR Analytical Report LIMS Number	LIMS ## M13-1896 (see Appendix 1: Certificate of Analysis)
Study Director	Jill Hart, AAS, LATg Senior Laboratory Technologist
Study Monitor	Sue Chang, Ph.D. Senior Toxicology Specialist
Testing Facility	3M Strategic Toxicology Laboratory 3M Center, Bldg 270, room SB324 Saint Paul, MN 55144
In-Life Start Date	December 9, 2013
In-Life Termination Date	December 30, 2013

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Compliance Statement and Signature Page

This study was conducted for research and development purposes and does not conform to regulatory guidelines.

This final report has been reviewed and approved by:

Jill Hart

Jill Hart, AAS, LATg
Senior Laboratory Technologist
Study Director

19JAN. 2015
Date

Sue Chang, Ph.D.
Senior Toxicology Specialist
Study Monitor

19 Jan, 2015
Date

1 Study Summary

This study was to evaluate the serum uptake and metabolism of MTDID 37312 (white solid, 99.9%pure, *N*-ethyl-heptadecafluoro-*N*-(2-hydroxyethyl)-1-octanesulfonamide, N-EtFOSE) upon inhalation exposure in male Sprague Dawley rats.

Using a flow-through setup, male rats (N=4) were exposed, whole body, to approximately 7 ppb (v/v) of N-EtFOSE for 6 hours. Observations were made continuously throughout the exposure. All animals appeared normal during the entire study period and all animals survived until the scheduled necropsy. There were no significant findings or gross lesions observed during the necropsy.

Serum samples collected before and after exposure were analyzed for N-EtFOSE concentrations as well as the concentrations of its metabolite, perfluorooctane sulfonate (PFOS), by LC-MS/MS.

While three of the four animals had quantifiable N-EtFOSE in the serum immediately after the exposure, only one animal had quantifiable serum PFOS at the same time. Eighteen hours after exposure, while only one animal still had quantifiable serum N-EtFOSE, all of them had PFOS present in the serum. The level of serum PFOS continued to increase up to Days 8 – 14 after exposure before it declined on Day 21.

Within the limit of the study design, data obtained here suggested N-EtFOSE can be absorbed into blood and metabolized via inhalation exposure. Percent of inhaled N-EtFOSE dose converted to PFOS-equivalent dose ranged from 12.21 ± 7.22% to 21.59 ± 9.52% in male Sprague Dawley rats.

2 Study Objective

This study was to evaluate the serum uptake and metabolism of MTDID 37312 (white solid, 99.9%pure, *N*-ethyl-heptadecafluoro-*N*-(2-hydroxyethyl)-1-octanesulfonamide, N-EtFOSE) upon inhalation exposure in male Sprague Dawley rats.

3 Test Material Information

3.1 Test Substance

Test Material ID	MTDID 37312
Lot	Lot 30107 (per GID 103988)
Other Identification	N-EtFOSE, N-EtFOSE Alcohol, FC-10
Purity	99.9%
Physical State of Test Material	Vapor
Chemical Name	*N*-ethyl-heptadecafluoro-*N*-(2-hydroxyethyl)-1-octanesulfonamide
Chemical Structure	$CF_3(CF_2)_x$-SO_2-N(CH_2CH_3)-CH_2CH_2-OH

Molecular Weight	571 g/mol
Density	N/A
Vapor Pressure	~17 ppb @ 23° C (estimated)

3.2 Dose Preparation

Dose Preparation	Due to low vapor pressure at room temperature, the test material was coated onto micro beads and the beads were packaged in a sealed stainless steel generator cartridge by the 3M Environmental Lab. The test atmosphere was generated at room temperature when air flow was introduced through the generator cartridge containing N-EtFOSE at a constant flow rate (2 L/min) and into the 40 L chamber.
Physical State of administered material	Vapor
Route of Administration	Inhalation (whole body exposure)

4.1 Test System Information

Species	Rat
Strain	Sprague-Dawley
Source	Harlan
Age at Initiation of Treatment	6-8 weeks
Weight at Initiation of Treatment	253-275 g
Number and Sex	4 males
Identification	Unique tail mark in indelible ink
IACUC Animal Usage Application Number	2013-0001

4.2 Animal Husbandry

Housing	All rats were group housed in solid bottom cages throughout the study with the exception of the exposure period.
Diet/Water	Harlan Teklad Rat/Mouse 2018 Diet (Harlan Teklad, Madison, WI) and tap water were available *ad libitum* throughout the study except during the exposures.
Housing Environment	Temperature Range 72 ± 3°F Humidity Range 30 – 70% Minimum of 10 exchanges of room air per hour 12 hour light/dark cycle
Test Chamber Environment	Temperature Range 69 – 72°F Humidity Range 37 – 93%

5.1 Study Design

Animals were exposed, whole body, to N-EtFOSE at approximately 7 ppb (v/v) for 6 hours. Control animals were not utilized in this study. The study design is presented in the following table:

Dose Group	N-EtFOSE Concentration (ppb)	Exposure Time	N (males)	Interim tail vein bleeding (for sera)	Euthanasia
1	7 ppb (v/v) *(see Section 9.5 as well as Appendix 2)*	6 hours	4	Pre-exposure; also immediately, 18 h, 24, h, 48 h, 72 h, Day 8, and Day 14 post exposure	21 days post exposure

6 Parameters Evaluated

6.1 Clinical Observations

Each animal was observed throughout the study for clinical signs of toxicity and mortality.

6.2 Body Weight

Body weights were recorded for all animals prior to exposure and on Days 1-4, 7-11, 14, 17-18, and 21 post-exposure.

6.4 Serum Collection

Prior to exposure and throughout study period, interim blood samples (approximately 200 uL) were collected via tail vein to labelled collection tubes without anticoagulant at designated time as outlined in Study Design. On Day 21 post-dose, all animals were euthanized via CO_2 asphyxiation and for each animal, blood was collected (≈ 6 mL) via the abdominal aorta and transferred to labeled collection tubes without anticoagulant.

The blood samples were allowed to clot for 15 to 30 minutes at room temperature and then centrifuged at 2000 x *g* for 15 minutes. The resulting supernatant (serum) was transferred to labelled polypropylene microcentrifuge tubes. Serum samples were stored frozen at -70^{o}C pending LC-MS/MS analyses.

6.5 Gross Necropsy, Organ Weights and Tissue Collection

Gross necropsies were performed on all animals on Day 21 post-exposure. The livers were harvested from each animal, weighed, and stored frozen at -80 degrees C. There were no other tissues collected.

6.6 Analytical

LC-MS/MS was used to determine the test chamber air samples by using Occupational Safety and Health Administration (OSHA) versatile sampler (OVS) tubes to trap air immediately before the inlet of the exposure chamber and also immediately at the outlet of the chamber followed. The tube absorbent materials were then extracted and analyzed for N-EtFOSE by LC-MS/MS (work performed by 3M Environmental Laboratory).

Separately, LC-MS/MS was performed by 3M Medical Department Bioanalytical Lab to determine concentrations of N-EtFOSE and PFOS in the serum samples collected from animals.

7 Statistical Analysis

Microsoft Excel software was used to calculate mean and standard deviation.

8 Raw Data

The raw data for clinical observations and body weights are recorded in 3M Notebook # 163984, pages 107 – 111.

9 Results

9.1 Clinical Observations

Clinical observations were normal throughout the study. All animals survived until the scheduled necropsy.

9.2 Body Weights/Liver Weights

Body weights and liver weights are shown below.

Animal #	Tail Mark	Body Weight (g)														Liver Weight (g)
		Day 0 (pre-exposure)	Day 1	Day 2	Day 3	Day 4	Day 7	Day 8	Day 9	Day 10	Day 11	Day 14	Day 17	Day 18	Day 21	Day 21
3R674	Blue I	267	271	270	272	278	290	294	296	300	304	318	323	321	334	13.20
3R675	Blue II	275	274	275	279	282	296	302	304	310	311	328	338	338	350	13.80
3R676	Blue III	253	253	252	259	259	279	284	291	294	297	314	323	329	335	14.76
3R677	Blue IV	274	277	273	281	282	298	303	310	314	310	335	343	347	354	14.51

9.4 Gross Necropsy

Gross necropsies were performed on all animals on Day 21 post exposure. There were no abnormal findings nor gross lesions noted.

9.5 Analytical Results

The test atmosphere concentrations of N-EtFOSE done with OVS sampling indicated that N-EtFOSE concentrations inside the inhalation chamber varied between 9.43 ± 0.33 ppb v/v (mean concentration at inlet) and 5.31 ± 1.34 ppb v/v (mean concentration at outlet) (see Appendix 2: 3M Environmental Laboratory Final Analytical Report E13-0880). The difference in concentrations between inlet and outlet could be attributed, in part, by the adhesion property of N-EtFOSE onto the furs of the rats as well as inhalation chamber surfaces. Therefore, for the study results reported herein, the approximated overall mean of 7 ppb (7.37 ± 2.35 ppb, rounded to 7 ppb) obtained at both inlet and outlet was used to represent test chamber concentration for N-EtFOSE.

Data for serum concentrations of N-EtFOSE and PFOS are shown in the table below:

Animal #	Serum N-EtFOSE concentrations before and after 6-hour exposure to N-EtFOSE, ng/mL								
	Before	After							
	Pre-exposure	Immediately	18 hrs	24 hrs	48 hrs	72 hrs	Day 8	Day 14	Day 21
3R674	< LLOQ	< LLOQ	< LLOQ	< LLOQ	< LLOQ	< LLOQ	< LLOQ	< LLOQ	< LLOQ
3R675	< LLOQ	3.1	2.2	< LLOQ	< LLOQ	< LLOQ	< LLOQ	< LLOQ	< LLOQ
3R676	< LLOQ	1.3	< LLOQ	< LLOQ	< LLOQ	< LLOQ	< LLOQ	< LLOQ	< LLOQ
3R677	< LLOQ	1.3	< LLOQ	< LLOQ	< LLOQ	< LLOQ	< LLOQ	< LLOQ	< LLOQ

Animal #	Serum PFOS concentrations before and after 6-hour exposure to N-EtFOSE, ng/mL								
	Before	After							
	Pre-exposure	Immediately	18 hrs	24 hrs	48 hrs	72 hrs	Day 8	Day 14	Day 21
3R674	< LLOQ	< LLOQ	6.2	6.7	7.1	7.7	11.6	11.2	7.4
3R675	< LLOQ	3.3	14.3	13.6	16.0	17.7	19.4	22.3	18.9
3R676	< LLOQ	< LLOQ	5.5	5.0	7.0	7.9	10.2	10.9	4.9
3R677	< LLOQ	< LLOQ	5.0	7.1	5.9	7.5	9.4	10.6	5.7

LLOQ = lower limit of quantitation (0.5 ng/mL for N-EtFOSE and PFOS)

9.6 Theoretical N-EtFOSE Dose Inhaled

Theoretical resting ventilation volume for Sprague Dawley Rats = 0.102 L/min Based on experimental determination from a group of 16 Sprague Dawley rats with a mean body weight of 364 grams and mean ventilation volume of 28 mL/min/100g BW; Strohl et al., J Appl Physiol (1985). 1997 Jan;82(1):317-323.
Mean chamber [N-EtFOSE] = 7 ppb v/v = 0.16 ug/L [7 x 10^{-9} x (571 g/mol)] / (24.45 L/mol) = 0.00000016 g/L = 0.16 ug/L

Theoretical amount of N-EtFOSE inhaled in 6 hours (360 minutes) = 5.88 ug

0.102 L/min x 360 min x 0.16 ug/L = 5.88 ug

9.7 Theoretical PFOS-equivalent Dose derived from Serum PFOS Concentration

Animal #	Serum PFOS concentration after N-EtFOSE inhalation exposure, ng/mL								PFOS-equivalent dose, ug/kg Assuming each time point is Cmax Dose = Cmax x Vd; V_d = 300 mL/kg							
	Immediately	18 hrs	24 hrs	48 hrs	72 hrs	Day 8	Day 14	Day 21	Immediately	18 hrs	24 hrs	48 hrs	72 hrs	Day 8	Day 14	Day 21
3R674	< LLOQ	6.2	6.7	7.1	7.7	11.6	11.2	7.4		1.9	2.0	2.1	2.3	3.5	3.4	2.2
3R675	3.3	14.3	13.6	16.0	17.7	19.4	22.3	18.9	1.0	4.3	4.1	4.8	5.3	5.8	6.7	5.7
3R676	< LLOQ	5.5	5.0	7.0	7.9	10.2	10.9	4.9		1.7	1.5	2.1	2.4	3.1	3.3	1.5
3R677	< LLOQ	5.0	7.1	5.9	7.5	9.4	10.6	5.7		1.5	2.1	1.8	2.2	2.8	3.2	1.7

9.8 Percent Dose Converted from Inhaled N-EtFOSE Dose to Serum PFOS Dose

Animal #	BW during exposure (g)	Theoretical inhaled N-EtFOSE Dose (umol/kg)	PFOS-equivalent dose relative to inhaled N-EtFOSE dose, %							
			Immediately	18 hrs	24 hrs	48 hrs	72 hrs	Day 8	Day 14	Day 21
3R674	267	0.0386	--	9.66	10.42	11.01	11.95	18.07	17.44	11.53
3R675	275	0.0374	0.00	22.99	21.86	25.72	28.45	31.19	35.85	30.38
3R676	253	0.0407	--	8.15	7.42	10.27	11.65	15.07	16.10	7.18
3R677	274	0.0376	--	8.04	11.32	9.43	11.91	15.09	16.95	9.03
Mean	267.3	0.0386	0.00	12.21	12.75	14.11	15.99	19.85	21.59	14.53
SD	10.14	0.0015		7.22	6.30	7.77	8.31	7.68	9.52	10.72

10 Conclusions

While three of the four animals had quantifiable N-EtFOSE in the serum immediately after the exposure, only one animal had quantifiable serum PFOS at the same time. Eighteen hours after exposure, while only one animal still had quantifiable serum N-EtFOSE, all of them had PFOS present in the serum. The level of serum PFOS continued to increase up to Days 8 – 14 after exposure before it declined on Day 21.

Within the limit of the study design, data obtained here suggested N-EtFOSE can be absorbed into blood and metabolized via inhalation exposure. Percent of inhaled N-EtFOSE dose converted to PFOS-equivalent dose ranged from 12.21 ± 7.22% to 21.59 ± 9.52% in male Sprague Dawley rats.

Appendix 1:

Certificate of Analysis

3M MATERIALS RESOURCE DIVISION ANALYTICAL LABORATORY

LIMS Request No. **M13-1896**

To: Sue Chang – (733-9073) –Toxicology Assessment and Compliance Assurance – 220-6W-08
Dave Ehresman – (733-5070) - Toxicology Assessment and Compliance Assurance 236-1B-22
Kent Lindstrom - (733-9882) – 3M Environmental Lab- 260-5N-17

From: Tom Kestner - (733-5633) – 3M MRD Analytical Laboratory - 236-2B-11

Subject: **^{1}H/^{19}F-NMR Characterization of TCR-1085: Purified N-Et FOSE Alcohol for Tox Study**

Date: November 24, 2013

SAMPLE DESCRIPTION:

- TCR-1085 is purified N-Et FOSE alcohol.
  The nominal product is C_8F_{17}-$SO_2N(CH_2CH_3)CH_2CH_2OH$ (white powder).

Summary of NMR Spectra Acquired for TCR-1085

NMR Spectra #'s	Experiments Descriptions
H131896.401	400 MHz ^{1}H-NMR spectrum for a portion of the sample dissolved in acetone-d_6 and spiked with small amounts of $CFCl_3$ and p-HFX internal standard.
F131896.401	376.3 MHz ^{19}F-NMR spectrum for a portion of the sample dissolved in acetone-d_6 and spiked with small amounts of $CFCl_3$ and p-HFX internal standard.

OBJECTIVE:

The sample of TCR-1085 was subjected to ^{1}H-NMR and ^{19}F-NMR spectral analyses to determine the purity of the nominal product and to characterize as many impurity components as possible. Joel Miller also performed an LCMS analysis to assist in the characterization of impurity components and his results were reported previously. In addition, you requested that I prepare and issue a certificate of analysis as a separate document in support of an upcoming 3M toxicology study.

EXPERIMENTAL:

A 62 mg portion of the TCR-1085 sample was totally dissolved in ~ 0.7 mL of deuterated acetone (acetone-d_6) and then the solution was spiked with small amounts of $CFCl_3$ and 1,4-bis(trifluoromethyl)benzene (p-HFX) for NMR analyses. A 400 MHz ^{1}H-NMR spectrum and a 376.3 MHz ^{19}F-NMR spectrum were acquired using an Agilent VNMRS 400 FT-NMR spectrometer that was operating with a 5mm inverse-detection gradient probe at an analysis temperature of 22-23 °C.

RESULTS:

The combined ^{19}F-NMR and ^{1}H-NMR spectral data indicate the sample of TCR-1085 consists of ~ **99.9 relative wt.%** of the nominal product, C_nF_{2n+1}-SO_2-$N(CH_2CH_3)$-CH_2CH_2OH, in at least six isomeric forms, where **n** is mainly 8. Trace amounts of two impurities were also assigned. The qualitative and quantitative compositional results that were derived from a single trial ^{19}F/^{1}H-NMR cross integration spectral analysis are summarized in **TABLE-1**. The relative weight percent concentrations shown in TABLE-1 should be very close to their respective absolute wt.% values. Trace amounts of unassigned components are also detected in the NMR spectra but additional work would be needed in an effort to assign or quantify the other impurities.

Small amounts of longer or shorter chain fluorochemical homolog impurities could have easily gone undetected because the ^{19}F-NMR technique is not particularly well suited for characterizing small amounts

of homologs unless the chains are very short (i.e., C_1-C_3). Characterization of fluorochemical **homolog** impurities was performed by Joel Miller using LCMS.

If you have any questions about these NMR results, or if any further work is needed, please let me know. .

Tom Kestner

c: Joel Miller
Scott Schmick

TABLE-1

Sample: TCR-1085, Purified N-Et FOSE alcohol

Compositional Results by $^{19}F/^{1}H$-NMR Cross Integration Spectral Analysis

Structural Assignments [1]	$^{19}F/^{1}H$-NMR Relative Wt.% Concentrations
Sum of at least **6** desired product isomers: C_nF_{2n+1}-SO_2-$N(CH_2CH_3)$-CH_2CH_2-OH where **n** assumed to be 8 for calculation purposes	**Purity = 99.9%**
$CF_3(CF_2)_x$-SO_2-$N(CH_2CH_3)$-CH_2CH_2-OH (**Normal chain**, where x assumed to 7 for calculation purposes)	70.55%
$CF_3(CF_2)_x$-$CF(CF_3)$-$(CF_2)_y$-SO_2-$N(CH_2CH_3)$-CH_2CH_2-OH (**Internal monomethyl branch**, where x+y assumed to be 5, and $x \neq 0$, $y \neq 0$, for calculation purposes)	16.93%
$(CF_3)_2CF$-$(CF_2)_x$-SO_2-$N(CH_2CH_3)$-CH_2CH_2-OH (**Isopropyl branch**, where x assumed to be 5 for calculation purposes)	10.36%
C_xF_{2x+1}-$CF(CF_3)$-SO_2-$N(CH_2CH_3)$-CH_2CH_2-OH (**Alpha branch**, where x assumed to be 6 for calculation purposes)	1.67%
$(CF_3)_3C$-$(CF_2)_x$-SO_2-$N(CH_2CH_3)$-CH_2CH_2-OH (**t-butyl branch**, where x assumed to be 4 for calculation purposes)	0.24%
CF_3-$(CF_2)_x$-$C(CF_3)_2$-$(CF_2)_y$-SO_2-$N(CH_2CH_3)$-CH_2CH_2-OH (**Internal gem-dimethyl branch**, where x+y assumed to be 4, and $x \neq 0$, for calculation purposes)	0.12%
Probable carboxamide C_mF_{2m+1}-CO-NH-CH_2CH_3 where m assumed to be 7 for calculation purposes	0.12%
Probable N-Me FOSE alcohol C_nF_{2n+1}-SO_2-$N(CH_3)$-CH_2CH_2-OH where **n** assumed to be 8 for calculation purposes	0.018%

1. Trace amounts of unassigned impurity components are also detected in the NMR spectra.

Appendix 2:

3M Environmental Laboratory Final Analytical Report E13-0880

Final Analytical Report

Analysis of Gas-Phase EtFOSE-OH in Air Samples Collected from an Exposure Chamber with OVS-Tubes During an Inhalation Toxicology Study with Rats

Laboratory Request Number: E13-0888

Method or Regulatory Requirement: Non-GLP

Testing Laboratory

3M Environmental Health and Safety Operations (EHS Opns)
3M Environmental Laboratory

Analytical Lead

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Project Requester

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1 Introduction / Summary

The objective of this study was to measure the level of gas-phase 2-[*N*- (ethyl)-perfluorooctanesulfonamido]-ethyl alcohol (a.k.a. EtFOSE-OH) in air that was delivered to a polyacrylate exposure chamber during a 6 hour inhalation exposure study with rats conducted by 3M-Strategic Toxicology in collaboration with the 3M EHS Opns Environmental Laboratory. Air flowing from a generator cartridge that contained glass beads coated with solid EtFOSE-OH delivered gas-phase EtFOSE-OH to the exposure chamber at a nominal flow rate of 2 L/min. Air samples were collected immediately before the inlet of the exposure chamber and also immediately at the outlet of the chamber. Samples were collected at the inlet and outlet via a split flow gas line to an OVS sampler tube with a nominal sampling flow rate of 0.1 L/min and with an ~60 minute collection time for each OVS (nominal 6 Liters total collected per OVS tube). Six inlet samples and six outlet samples were collected sequentially during the 6 hour exposure period. Herein are provided the analytical measurement result for those OVS samples provided from the EtFOSE-OH inhalation exposure study conducted in December 2013, as well as all of the associated QC samples prepared and analyzed with those samples.

For analysis of EtFOSE-OH, each OVS tube was disassembled into three fractions following the procedures described in method ETS-8-105.0. Each fraction was extracted with 10 mL acetone containing d_9-EtFOSE-OH as an internal standard (IS). The extracts were then quantitatively analyzed by LC/MS/MS against solvent calibration standards. A lower limit of quantitation (LLOQ) of 0.100 ng/mL was achieved during the analyses. The total mass quantity of EtFOSE-OH trapped on each OVS was determined based on the summed quantity of EtFOSE-OH extracted and measured for each of the three OVS tube fractions. For preparation of the quality control (QC) samples included with each analytical batch, fresh OVS tubes were fortified onto the inlet filter with 10, 100, 1000 or 10000 ng of EtFOSE-OH, without air passed through them. Once spiked, each was disassembled, extracted and analyzed the same as samples in the batch; prior method development work (study E13-0722) showed no loss of EtFOSE-OH from QCs with up to 60 Liters of air passed through them. The QC results demonstrated an overall excellent recovery and data accuracy of 99.2 $\pm$ 5.9% for all QC levels. In general, the amount of EtFOSE-OH captured at the inlet to the exposure chamber was on the order of 1500 ng, and at the outlet was on the order of 1000 ng. Recovery ($\pm$ standard deviation) for the 1000 ng QCs (n = 6) was therefore the best indicator of the data accuracy for the study and showed an accuracy of 101% $\pm$ 3.4%. Blanks prepared with samples were essentially devoid of any significant levels of EtFOSE-OH and were less than the lower limit of quantitation (LLOQ).

As listed in **Table 1** and plotted in **Figure 1**, the determined air concentrations of EtFOSE-OH at the inlet were significantly higher than at the outlet. Throughout the course of the exposure, it was apparent that equilibrium (i.e. inlet/outlet ratio of 1) was not established. The inlet/outlet air concentration ratio at the onset of the study for the 0-1 hr sampling and 1-2 hr sampling were 2.7 and 2.4, respectively. However, an inlet/outlet ratio of approximately 1.50 was achieved after the first 2 hours and was relatively stable after that, as shown in **Figure 2**. The gas-phase concentration at the chamber inlet for the 2-3 hour sampling was 222 ng/L (9.5 ppbV) and the outlet was 148 ng/L (6.3 ppbV), and for the 5-6 hour sampling the inlet/outlet ratio was 1.46 with an inlet concentration of 225 ng/L (9.6 ppbV) and outlet concentration of 155 ng/L (6.6 ppbV).

Additionally, as part of the LC/MS/MS analysis, sufficient chromatographic resolution of linear and branched isomers was achieved to allow estimation of the percent linear isomer and percent as total-branched isomers. While the EtFOSE-OH used to construct the EtFOSE-OH generator cartridge was 70% linear isomer EtFOSE-OH (30% branched isomers) EtFOSE-OH, the EtFOSE-OH collected from gas-phase samples at room temperature in the inlet and outlet of the test

chamber showed enrichment for branched isomers. This observation was consistent with isomer enrichment observed during the previous test chamber equilibration study E13-0722. During this study, at the initiation of delivery of gas phase EtFOSE-OH from the generator tube to the exposure chamber, the EtFOSE-OH isomer composition was ~38% linear isomer at the inlet. However, a significant change in the isomer composition at the inlet occurred over the course of the 6 hour exposure period which was not observed at the outlet, and increased to 62% linear isomer by the end of the exposure. In contrast, the isomer composition appeared relatively stable at the outlet during the entire 6 hour exposure period and composed of ~32% linear isomer at the beginning to and ~34% linear isomer at the end of the exposure period (see **Figure 2)**. These results indicate that deposition of branched EtFOSE-OH on the chamber walls likely occurred during the earlier conducted pre-study chamber equilibration study E13-0722, and during this study sublimation of branched EtFOSE-OH off of the walls, and possibly preferential deposition of linear isomer onto the surface from the incoming gas, contributed to a continuous level of enrichment of branched isomers in exhaust air measured at the outlet.

Based on these analytical results, exposure levels of gas-phase EtFOSE-OH concentrations were between ~6 and 9 ppbV during the exposure based on inlet and outlet concentration. Furthermore, it was shown that the gas-phase EtFOSE-OH was enriched with branched isomers. The inhalation-dose of highly-branched EtFOSE-OH could have a profound impact on the absorption, distribution, metabolism and excretion (ADME) properties of the EtFOSE-OH, and should be considered when comparing these inhalation-dose results to previous toxicological studies.

Table 1. Summarized Results for EtFOSE-OH Concentration and Linear Isomer Composition

Sample ID	Sample Description	EtFOSE-OH				
		Actual Air Volume Captured on OVS (L)	Total Recovered from OVS (ng)	Air Concentration (ng/L)	Air Concentration (ppbV)	Linear Isomer (Percent of Total)
E13-0880-003	Test #1 Inlet, 0.1 L/min	6.77	1397	206	8.79	38.4%
E13-0880-004	Test #1 Outlet, 0.1 L/min	6.86	524	76.4	3.25	31.5%
E13-0880-005	Test #2 Inlet, 0.1 L/min	6.77	1520	225	9.56	45.9%
E13-0880-006	Test #2 Outlet, 0.1 L/min	6.86	652	95.1	4.05	28.2%
E13-0880-007	Test #3 Inlet, 0.1 L/min	6.77	1501	222	9.45	52.4%
E13-0880-008	Test #3 Outlet, 0.1 L/min	6.86	1013	148	6.29	32.3%
E13-0880-009	Test #4 Inlet, 0.1 L/min	6.77	1544	228	9.71	55.8%
E13-0880-010	Test #4 Outlet, 0.1 L/min	6.86	958	140	5.95	32.2%
E13-0880-011	Test #5 Inlet, 0.1 L/min	6.77	1505	222	9.47	59.7%
E13-0880-012	Test #5 Outlet, 0.1 L/min	6.86	919	134	5.71	32.3%
E13-0880-013	Test #6 Inlet, 0.1 L/min	5.64	1271	225	9.59	61.5%
E13-0880-014	Test #6 Outlet, 0.1 L/min	5.71	885	155	6.59	33.6%

The analytical measurement uncertainty for these study results was estimated at ± 12% based on QC results.
[a] Value was estimated based on peak area response of the linear isomer chromatographic peak versus total peak area of linear + branched isomer peaks (see **Figure 3** for LC/MS/MS Chromatogram of EtFOSE-OH).

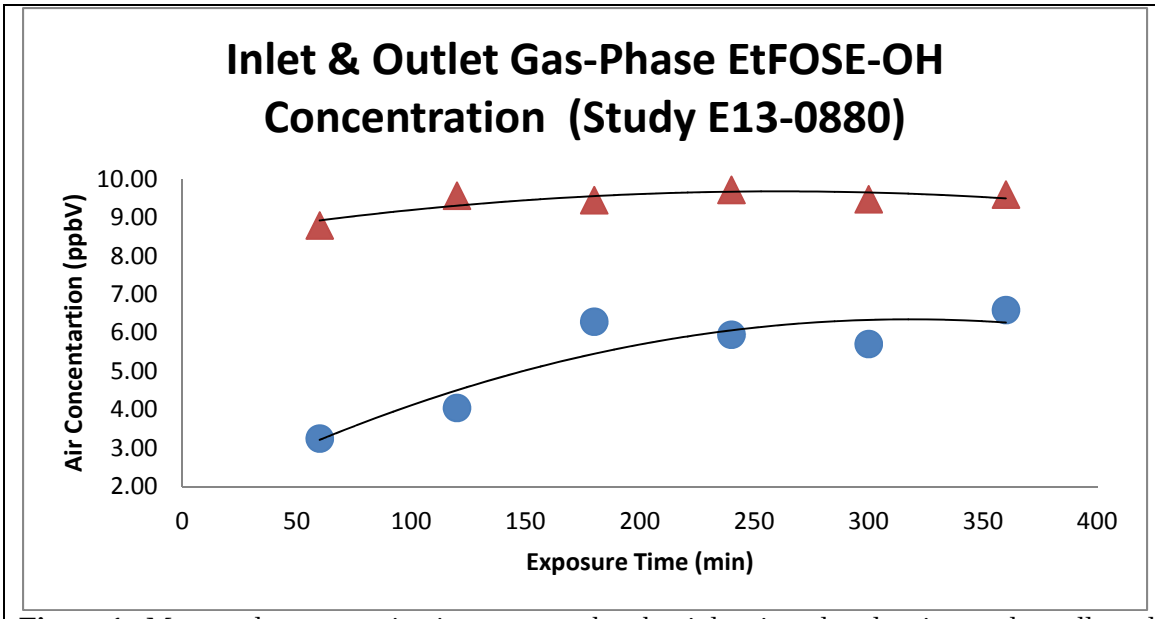

Figure 1. Measured concentration in exposure chamber inlet air and outlet air samples collected and analyzed during a rat inhalation exposure study as study E13-0880. (Inlet ▲, outlet ●)

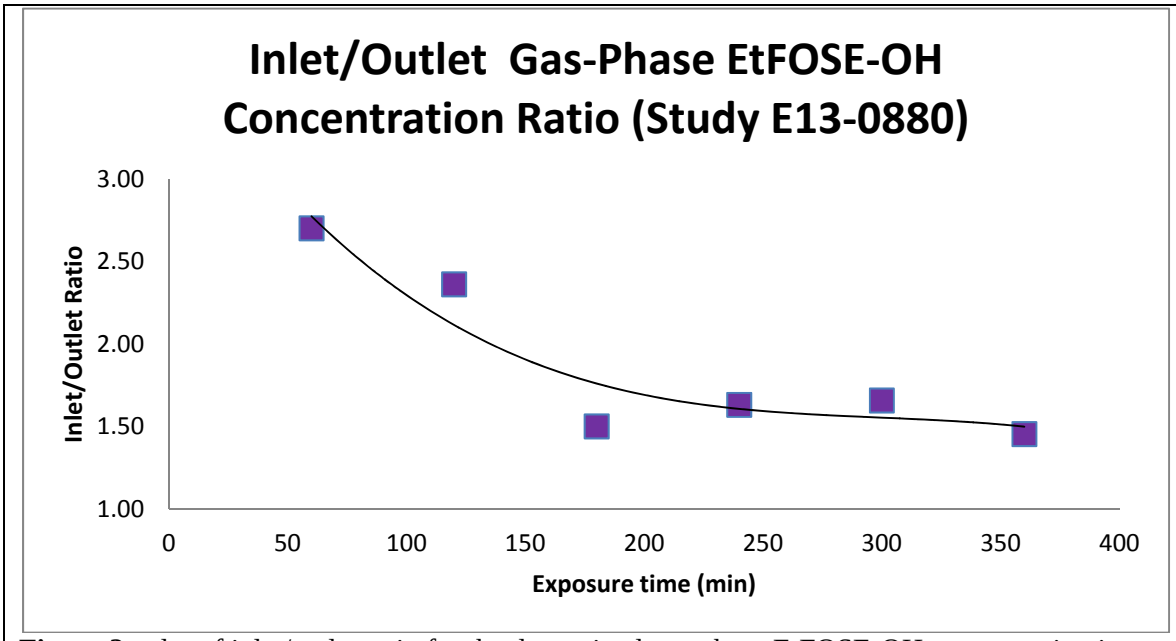

Figure 2. plot of inlet/outlet ratio for the determined gas-phase EtFOSE-OH concentration in exposure chamber inlet-air and outlet-air samples collected on OVS tubes during a rat inhalation exposure study.

2 Analytical and Preparatory

2.1 Reference Substance

Table 2. Reference Substances			
Substance	EtFOSE-OH (linear + branched)	EtFOSE-OH (linear)	d_9-EtFOSE-OH
TCR No.	TCR-1085	TCR09-0061-1/10	TCR09-0053-2/4 TCR09-0053-3/4
Source	3M, Purified by HPLC at Pace Analytical Services	Wellington	Wellington
Use	Generator Cartridge Loading and QC fortifications	Calibration Standard Preparations	Quantitation Internal Standard
Chemical Name	2[(*N*-methyl)-perfluorooctanesulfonamido]-ethyl alcohol	2[(*N*-methyl)-perfluorooctanesulfonamido]-ethyl alcohol	Deuterated 2[(*N*-methyl)-perfluorooctanesulfonamido]-ethyl alcohol
Chemical Formula	$C_{12}H_{10}F_{17}NO_3S$	$C_{12}H_{10}F_{17}NO_3S$	$C_{12}HD_9F_{17}NO_3S$
Formula Wt.	571	571	580
Isomer Composition	Mixed Linear (70%) & Branched (30%) Isomers	Pure Linear Isomer	Pure Linear Isomer
Purity	99.9%	50 µg/mL Solution in MeOH	50 µg/mL Solution in MeOH
Expiration	7/31/2016	2/23/2014	2/18/2014

2.2 Analytical Sample and Sample Batch Preparation

Disassembly and extraction of the OVS tubes was performed following method ETS-8-105.0. Each OVS sampling tube was dismantled into three sets of components, as follows: component 1 was the 1st bed of XAD®-4 resin and 1st PUF plug; component 2 was the XAD®-4 resin from the 2nd bed and the 2nd polyurethane foam (PUF) plug; and component 3 was the glass fiber filter, HDPE retaining ring and glass tube housing. Each of the three components was separately extracted with 10 mL of acetone containing d_9-EtFOSE-OH which served as IS. This resulted in three 10 mL analytical sample extracts per OVS tube (net 10-fold dilution of each solid state component set). The LC/MS/MS analysis of the extracts was conducted using the parameters described in **Tables 3, 4 and 5**. Two analytical batches were analyzed to collect the data for reporting and were batches m131210a and m131211a.

Calibration standards were prepared for each analytical batch ranging from nominal 0.100 ng/mL to 500 ng/mL and were prepared by fortifying pure linear EtFOSE-OH at known levels into acetone containing d_9-EtFOSE-OH, same acetone mix as used to extract samples. Quantitation was by internal standard method. Calibration curve regression was performed with 1/x weighting and coefficient of determination (R^2) for the calibration curve regressions were $\geq$ 0.995. Reinjection of calibration standards during the analysis was performed as continuing calibration verification (CCVs) during each run and all results for CCVs were within 100 $\pm$ 10% for all

analytical runs reported.

Additional new purchased OVS tubes of the same type were used for the exposure chamber experiments (ORBO™65P OVS Fluoride Tube with Glass Fiber Filter, Supelco Item 20029-U) and were used to prepare quality control (QC) samples for each analytical batch. The QC samples were fortified with reference substance TCR-1085 (70% linear, 30% branched isomers) and was the same reference substance used to make the generator cartridge. The QCs were fortified at four levels, each level in triplicate, and each level prepared by spiking 10.0 ng, 100 ng, 1000 ng or 11400 ng of EtFOSE-OH (mixed linear/branched isomer material) onto the filter in the OVS inlet side. QCs did not have air passed through them; however, previous method development work as part of study E13-0722 showed that EtFOSE-OH is retained on OVS tubes with up to 60 liters of air passed through them, a volume of air that was ~10-fold more than the volume of air collected on OVS tubes during this study.

The component-3 extract is where EtFOSE-OH is typically trapped and retained, and for the 11400 ng QC the component-3 extract was diluted 1000-fold (as s dilution QC). However, samples did not require dilution, hence, the dilution QC was determined to be unnecessary. Results of QCs were used to verify the performance of the analytical method. The QC results are summarized in the results section in **Table 8**, and individual QC OVS component results are shown in **Table 9**.

Laboratory media blanks were control OVS tubes without fortification and without air passed through them/ Results of media blanks are provided in the results section as **Table 6**.

The Air Pre-Test and Post-Test air blanks were collected by passing non-dosed tank-air through them. The air used was the same tank air as passed through the generator column and test chamber during the exposure. Results for air blanks are presented in the results section as **Table 7**.

2.3 LC/MS/MS Analysis

Table 3. Instrument Information (Study E13-0880)	
Instrument Name	ETS-MaryAnn (batches m131210a & m131211a)
Analytical Method ID	ETS-8-105.0 for Extraction
Liquid Chromatograph	Agilent 1200
Analytical column	Betasil C18 (100 x 2.1 mm; 5 µm); 30°C
Injection Volume	1.0 µL
Mass Spectrometer	API 5000 Triple Quadrapole
Ion Source	Turbo Spray
Polarity	Negative
Software	Analyst 1.6.1

Table 4. Liquid Chromatography Conditions (Study E13-0880)

Step Number	*Total Time [min]*	*Flow Rate [mL/min]*	*Percent A [2mM Aqueous Ammonium Acetate]*	*Percent B [2 mM Ammonium Acetate in Methanol]*
0	0.00	0.500	20.0	80.0
1	0.50	0.500	20.0	80.0
2	2.50	0.500	99.0	1.0
3	3.10	0.500	99.0	1.0
4	3.11	0.500	20.0	80.0
5	4.50	0.500	20.0	80.0

Table 5. Mass Transitions (Study E13-0880)

Analyte	**Mass Transitions (MRMs) Monitored**
EtFOSE-OH	630>59
C9Analog [a]	680>59
C7 Analog[a]	580>59
d9-EtFOSE-OH (IS)	639>59
[a] Mass transitions for C9 and C7 Analogs of EtFOSE-OH were included, but not used for quantitation during this study.	

2.4 Calculations

The results as part per billion by volume (ppbV) is a gas phase concentration value (nL/L), and was determined as described below:

First the volume of EtFOSE-OH in the air sample is calculated by the ideal gas law, as follows:

PV= nRT

or, [V = nRT/P]

where, $V=V_{EtFOSE\text{-}OH}$ (L) and is the volume occupied by EtFOSE-OH in the air sample from the OVS

n = mole EtFOSE-OH captured on OVS using 571 g/mole conversion value

R is the ideal gas constant at 0.08206 [(atm*mol) /(L*°K)]

P is assumed 1 atm

T is assumed 23 °C (296.15 °K).

Then, ppbV (nL per Liter of Air) was calculated where V_{Air} = volume of air sample through the OVS in liters, and $=V_{EtFOSE\text{-}OH}$ is the volume of EtFOSE-H in that air sample entered in nL

ppbV = $V_{EtFOSE\text{-}OH}$ (nL) / V_{Air} (L)

All other calculations were performed per 3M EHSO Environmental Laboratory standard operating procedures (SOPs).

3 Results

3.1 Media Blanks

OVS Tube media blanks results were below the LLOQ. The results are summarized in **Table 6**. An LLOQ of 0.100 ng/mL translates to an LLOQ of 1.00 ng per OVS component, hence, 3 ng per OVS tube for the three components.

Table 6. Summarized Results for OVS Tube Media Blanks

Sample ID	Sample Description		EtFOSE-OH		
		Nominal Air Volume Captured (L)	Total Recovered from OVS (ng)	Air Concentration (ng/L)	Air Concentration (ppbV)
E13-0880-001	OVS Media Blank 1	0	< 3.00	NA	NA
E13-0880-016	OVS Media Blank 2	0	< 3.00	NA	NA

3.2 Air Blanks

Laboratory blanks were devoid of EtFOSE-OH and all results were below the lower limit of quantitation of 0.100 ng/mL (i.e. <1.00 ng per component, < 3.00 ng per OVS). Results of laboratory blanks are summarized in **Table 7**.

Table 7. Summarized Results for Air Blanks

Sample ID	Sample Description		EtFOSE-OH		
		Nominal Air Volume Captured (L)	Total Recovered from OVS (ng)	Air Concentration (ng/L)	Air Concentration (ppbV)
E13-0880-001	Air Pre-Test Blank, nominal flow 1 L/min	6	< 3.00	< 0.500	< 0.0213
E13-0880-016	Air Post-Test Blank , nominal flow 1 L/min	7	< 3.00	< 0.429	< 0.0182

3.3 QC Results

Four levels of quality control (QC) samples were prepared, each level in triplicate, by spiking OVS tubes with 10.0 ng, 100 ng, 1000 ng and 11400 ng of EtFOSE-OH, and then extracting the same as samples. For the 11400 ng QC, the component-3 10 mL acetone extract was diluted 10-fold prior to analysis to achieve a result within the range of the calibration (total dilution of 100-fold for that OVS solid state component).

As summarized in **Table 8**, the QC results showed excellent data accuracy and precision with an overall average and standard deviation of 99.2% ± 5.9% (RSD 6.0%). EtFOSE-OH was efficiently recovered off of the OVS tubes at all levels with all QC recoveries within 100 ±17%. The majority of EtFOSE-OH was recovered from component 3 (glass fiber filter, HDPE retaining ring and glass tube housing) with some captured from component 2 (the 1st bed of XAD®-4 resin-beads and 1st PUF plug). Component 3 (2nd bed and 2nd polyurethane foam (PUF) plug) typically did not contain much EtFOSE-OH.

The estimated analytical measurement uncertainty for this study was calculated from statistical analysis of the QC results, per 3M EHSO Environmental Laboratory SOP ETS-12-12.2.

Table 8. QC Summary Results (Study E13-0880)

Analytical Batch ID	EtFOSE-OH Recovery from OVS QCs			
	10.0 ng QC	**100 ng QC**	**1000 ng QC**	**11400 ng QC**
m131210	83.3%	96.5%	96.4%	103%
	101%	94.4%	104%	104%
	95.7%	92.3%	98.9%	107%
m131211a	95.2%	87.3%	105%	99.3%
	97.4%	103%	104%	105%
	98.9%	103%	101%	107%
Average Recovery	*95.3%*	*96.1%*	*101%*	*104%*
Std. Dev.	*6.2%*	*6.2%*	*3.4%*	*2.8%*
RSD	*6.5%*	*6.5%*	*3.3%*	*2.7%*
n	*6*	*6*	*6*	*6*
Overall Average	**99.2%**			
Overall Standard Deviation	**5.9%**			
Overall RSD	**6.0%**			
N	**24**			
Estimated Analytical Measurement Uncertainty (95% CI)	**± 12%**			

3.4 Individual Sample Results

Table 9. Individual QC Results (Study E13-0880)

QC ID	Analytical Run ID	Fortification Level (ng)	OVS Tube Component	Determined Amount (ng)	Total EtFOSE-OH (ng) [a]	QC Recovery [a]	Average Recovery
KDM10-Dec2013-017	m131210a	10.0	1	<1.00	8.33	83.3%	93.3% (RSD 9.7%)
			2	<1.00			
			3	8.33			
KDM10-Dec2013-018	m131210a	10.0	1	<1.00	10.1	101%	
			2	<1.00			
			3	10.1			
KDM10-Dec2013-019	m131210a	10.0	1	<1.00	9.57	95.7%	
			2	<1.00			
			3	9.57			
KDM10-Dec2013-020	m131210a	100	1	6.91	96.5	96.5%	94.4% (RSD 2.2%)
			2	<1.00			
			3	89.6			
KDM10-Dec2013-021	m131210a	100	1	4.26	94.4	94.4%	
			2	<1.00			
			3	90.1			
KDM10-Dec2013-022	m131210a	100	1	5.53	92.3	92.3%	
			2	<1.00			
			3	86.8			
KDM10-Dec2013-023	m131210a	1000	1	110	964	96.4%	99.8% (RSD 3.9%)
			2	<1.00			
			3	854			
KDM10-Dec2013-024	m131210a	1000	1	161	1040	104%	
			2	<1.00			
			3	879			
KDM10-Dec2013-025	m131210a	1000	1	94.9	989	98.9%	
			2	<1.00			
			3	894			
KDM10-Dec2013-026	m131210a	11400	1	1580	11800	103%	105% (RSD 1.8%)
			2	2.28			
			3	10200			
KDM10-Dec2013-027	m131210a	11400	1	965	11900	104%	
			2	4.11			
			3	10900			
KDM10-Dec2013-028	m131210a	11400	1	1690	12200	107%	
			2	1.15			
			3	10500			
KDM10-Dec2013-029	m131211a	10.0	1	<1.00	9.52	95.2%	97.2% (RSD
			2	<1.00			
			3	9.52			

Table 9. Individual QC Results (Study E13-0880)

QC ID	Analytical Run ID	Fortification Level (ng)	OVS Tube Component	Determined Amount (ng)	Total EtFOSE-OH (ng) [a]	QC Recovery [a]	Average Recovery
KDM10-Dec2013-030	m131211a	10.0	1	<1.00	9.74	97.4%	1.9%)
			2	<1.00			
			3	9.74			
KDM10-Dec2013-031	m131211a	10.0	1	<1.00	9.89	98.9%	
			2	<1.00			
			3	9.89			
KDM10-Dec2013-032	m131211a	100	1	5.29	87.3	87.3%	
			2	<1.00			
			3	82.0			
KDM10-Dec2013-033	m131211a	100	1	5.92	103	103%	97.8% (RSD 9.3%)
			2	<1.00			
			3	96.7			
KDM10-Dec2013-034	m131211a	100	1	8.59	103	103%	
			2	<1.00			
			3	94.9			
KDM10-Dec2013-035	m131211a	1000	1	59.5	1050	105%	
			2	<1.00			
			3	991			
KDM10-Dec2013-036	m131211a	1000	1	60.4	1040	104%	103% (RSD 2.2%)
			2	<1.00			
			3	976			
KDM10-Dec2013-037	m131211a	1000	1	69.3	1010	101%	
			2	<1.00			
			3	937			
KDM10-Dec2013-038	m131211a	11400	1	1120	11320	99.3%	
			2	<1.00			
			3	10200			
KDM10-Dec2013-038	m131211a	11400	1	1130	11930	105%	104% (RSD 3.7%)
			2	<1.00			
			3	10800			
KDM10-Dec2013-039	m131211a	11400	1	1160	12160	107%	
			2	<1.00			
			3	11000			

All values are rounded to 3 significant figures, but precise data was used in data calculations.

[a] Values of Zero (0) were used for results below the LLOQ (<LLOQ) when calculating total EtFOSE-OH and QC recoveries.

Table 3. Individual Air Sample Results (Study E13-0880)

Sample ID	Component Extracted	EtFOSE-OH Component Amount Measured (ng)	EtFOSE-OH Amount from OVS tube (ng) and [Percent Linear Isomer]	Air Volume Captured (L)	EtFOSE-OH Air Concentration	Inlet/Outlet Ratio
Inlet Test #1	1	2.07	1397 [38.4%]	6.77	8.79	2.70
	2	14.7				
	3	1380				
Outlet Test #1	1	18.7	524 [31.5%]	6.86	3.25	
	2	2.94				
	3	502				
Inlet Test #2	1	3.11	1520 [45.9%]	6.77	9.56	2.36
	2	16.9				
	3	1500				
Outlet Test #2	1	18.8	652 [28.2%]	6.86	4.05	
	2	19.9				
	3	613				
Inlet Test #3	1	169	1501 [52.4%]	6.77	9.45	1.50
	2	22.3				
	3	1310				
Outlet Test #3	1	55.8	1013 [32.3%]	6.86	6.29	
	2	27.9				
	3	929				
Inlet Test #4	1	9.69	1544 [55.8%]	6.77	9.71	1.63
	2	24.2				
	3	1510				
Outlet Test #4	1	122	958 [32.2%]	6.86	5.95	
	2	21.2				
	3	815				
Inlet Test #5	1	413	1505 [59.7%]	6.77	9.47	1.66
	2	32.1				
	3	1060				
Outlet Test #5	1	149	919 [32.3%]	6.86	5.71	
	2	10.3				
	3	760				
Inlet Test #6	1	<1.00	1271 [61.5%]	5.64	9.59	1.46
	2	10.5				
	3	1260				
Outlet Test #6	1	89.6	885 [33.6%]	5.71	6.59	
	2	17.9				
	3	777				

4 Conclusion

A lower limit of quantitation (LLOQ) of 0.100 ng/mL was achieved during the analyses. The total mass quantity of EtFOSE-OH trapped on each OVS was determined based on the summed quantity of EtFOSE-OH measured for each of the three OVS fractions. Quality control (QC) samples were prepared with each analytical batch by fortifying fresh OVS tubes with EtFOSE-OH at nominal 10, 100, 1000 and 10000 ng, each level prepared in triplicate, and then disassembling, extracting and analyzing them the same as samples. QC result demonstrated an overall excellent data accuracy of 99.2 $\pm$ 5.9% for all QC levels. In general, the amount of EtFOSE-OH captured at the inlet was on the order of 1500 ng per OVS, and at the outlet was on the order of 1000 ng per OVS. Recovery results for the 1000 ng QCs (n = 6) was therefore the best indicator of the data accuracy for the study and showed an accuracy of 101% $\pm$ 3.4%. Blanks prepared with samples essentially did not contain any significant levels of EtFOSE-OH and were less than the lower limit of quantitation (LLOQ).

Analysis results for the individual OVS components for samples and QCs showed that typically 90-100% of the EtFOSE-OH was captured in component 3 (glass fiber filter, HDPE retaining ring and glass tube housing), ~0-10% in component 1 (1^{st} XAD bed and PUF, middle stage) and less than 1% was captured on component 2 (2^{nd} XAD bed and 2^{nd} PUF), the final stage of the OVS, indicating no breakthrough.

Based on these analytical results, exposure levels of gas-phase EtFOSE-OH concentrations were between ~6 and 9 ppbV during the exposure based on the measured inlet and outlet concentration. Furthermore, as shown in **Figure 3**, it was demonstrated that the gas-phase EtFOSE-OH in the exposure chamber was enriched with branched isomers.

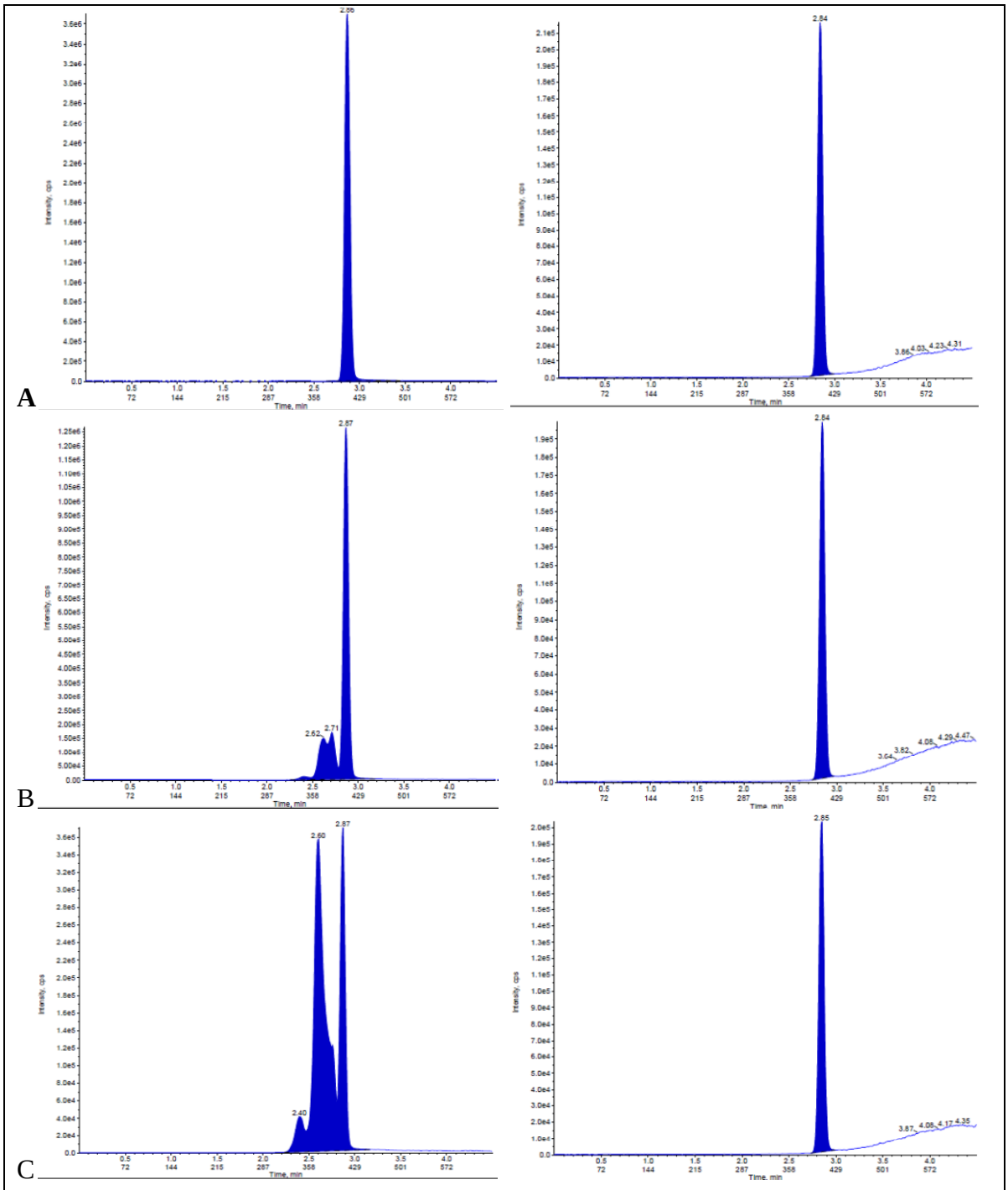

Figure 3. The LC/MS/MS chromatograms of EtFOSE-OH (left) and corresponding linear d_9-EtFOSE-OH internal standard peak (right). Samples from top to bottom were the component-3 extracts of the following samples and analyzed in the same analytical run m131210a: **A**) 200 ng/mL calibration standard prepared with linear EtFOSE-OH obtained commercially from Wellington Laboratories; **B**) 1000 ng QC fortified with substance TCR-1085 (70% linear, 30% branched isomers) and was same substance as used to make the generator cartridge for dosing; and **C**) the isomer profile of component 3 extract of sample E13-0880-006 (1-2 hour sampling point, chamber outlet) showing the enrichment of branched isomers in gas-phase EtFOSE-OH (~28% linear isomer and ~72% branched isomers).

5 Data/Sample Retention

Samples generated during this study E13-0880 will be retained indefinitely, or until requested by the study Requestor to dispose of them, and will only be disposed of with laboratory management approval.

6 Attachments

E13-0880 Final Analytical Report, Appendix-A: "Field Summary: Ethyl-FOSE Rat Exposure Chamber Test"; Lab Request Number E13-0880 (3M EHS Opns. Environmental Laboratory-Field Services Group Report)

7 Signatures

The following 3M Environmental Laboratory personnel have reviewed and approved this report:

Digitally signed by Cleston C. Lange
DN: c=US, st=MN, l=St. Paul, ou=3M Environmental Laboratory - authenticated by LRA, email=clange@mmm.com, o=3M, cn=Cleston C. Lange
Reason: I am approving this document
Date: 2014.02.06 11:02:25 -06'00'

Cleston C. Lange, Ph.D., Analytical Lead Date

Digitally signed by William K. Reagen
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William K. Reagen, Ph.D., Technical Director Date

The results and report were audited by Quality Associates, Inc. (QAI)

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QAI Representative Date

Field Summary

Ethyl-FOSE Rat Exposure Chamber Test

Laboratory Request Number: E13-0880
Client's Department: 108022

Method or Regulatory Requirement: On-Site Modified EPA Method 320

Testing Laboratory

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3M Environmental Laboratory

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3M Environmental Laboratory – On-site FTIR/OVS Tubes
Report Author: Jess Eldridge
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Field Report

Project Number: E13-0880
Date of Report: January 10, 2014

1 Introduction / Summary

The purpose of this testing was to support 3M Strategic Toxicology by performing a study on rats exposed to ethyl-FOSE generated from a generator cartridge. This test was a follow-up to the preliminary work performed under lab request E13-0722. Testing consisted of FTIR and OVS tube LC/MS based measurements of the target compound at the inlet and outlet of the test chamber. If other compounds were present, they would be reported by FTIR if feasible.

On-site Fourier Transform Infrared (FTIR) spectroscopy testing and OSHA Versatile Sampler (OVS) tube sampling (Supelco) were conducted in Room SB 322/324 located in Bulding 270 for the 3M Toxicology and 3M Materials Resources Division groups. A "Breathing Air" quality compressed gas cylinder # P411310802/019928 was used to flow air through the ethyl-FOSE generator tube at a rate of 2.1 lpm into and through the 40 liter exposure chamber. Gas exiting the chamber was flowed through the FTIR cell and exhausted in the adjacent vent hood. The continuous air flow measurement was made using a calibrated rotometer supplied by the 3M Toxicology lab; SN 337973-1. The chamber inlet and outlet locations were configured each with a valved sampling port from which an OVS sample could be drawn via SKC AirChek® 52 pump. The pumps were set to sample at approximately 100 cc/min for each test per location. Pump # 150 was used at the inlet location and Pump # 222 was used at the outlet location for the entire testing event. A beginning and end flow rate was measured for each OVS sample via a Dry-Cal flow meter; 3M Instrument # 158675. A "dummy" OVS tube was used to measure the flows rather than the actual sampling tubes assuming the flow rates would be consistent between all tubes. Since the exposure chamber was under slight pressure, a flow rate at the inlet and outlet sampling locations were performed once while plumbed into the system. A correction factor was then determined to apply to all other flow rates measured throughout this event based upon measurements made during the preliminary test under lab request E13-0722. A detailed spreadsheet of exact flow rates, correction factors, and test times is presented in Section 7. The FTIR results are shown in Section 8. Hand written notes taken during the event including the lot numbers and expiration dates per OVS sample are shown in Section 9. The Chain of Custody Forms are shown in Section 10. The General Project Outline (GPO) is shown in Section 11.

December 9th, 2013 Summary:

Testing began on December 9th 2013 and included continuous FTIR testing and six one hour OVS tube samples collected at the inlet and outlet of the exposure chamber for the entire day.

A breathing air cylinder OVS tube sample was collected from 8:18 to 8:24 at a flow rate of 1 lpm. This test was performed as a blank to confirm the absence of ethyl-FOSE in the cylinder.

The OVS tube tests were numbered 1-6. Test 1 was from 9:12 to 10:12, Test 2 was from 10:15 to 11:15, Test 3 was from 11:18 to 12:18, and Test 4 was from 12:21 to 13:21, Test 5 was from 13:24 to 14:24, and Test 6 was from 14:27 to 15:17 (50 minutes). A blank OVS tube was submitted along with the other samples; designated time 8:22.

The exposure test was complete and the system shut down at 15:19. The system was opened and the rats were removed by Jill Hart, Trina John, and Sue Chang for the continuance of the biological phase of the exposure test.

The breathing air cylinder was connected directly to the FTIR at 15:30 flowing at 1 lpm until 15:37. This test was performed to confirm the presence of carbon monoxide, carbon dioxide, and methane as was observed in the preliminary testing. The same cylinder was used for the rat exposure test as used for the preliminary testing.

At 15:43 the generator tube exhaust was plumbed directly to the FTIR to test whether the ethy-FOSE could be directly measured. The flow rate was 2 lpm into the FTIR. Spectral collection continued until 15:51 at which time the sampling was discontinued.

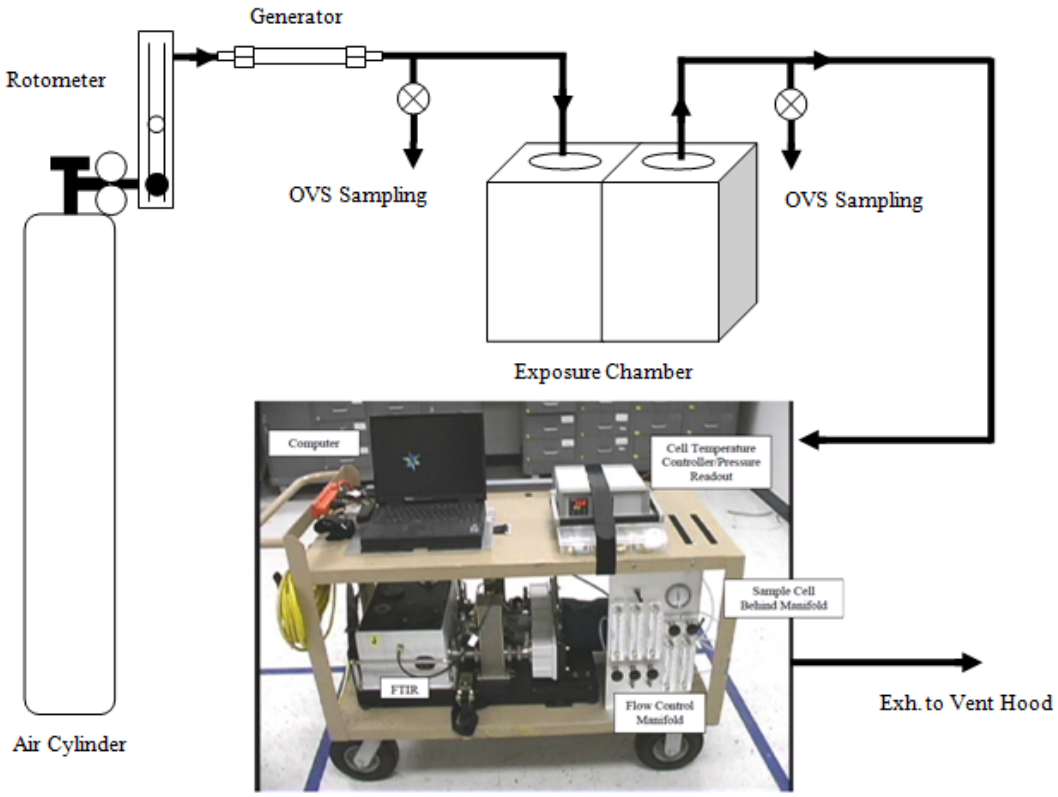
The FTIR data showed the presence of methanol, methane, carbon monoxide, carbon dioxide, and ammonia. The methanol was coming from within the chamber apparently from past cleaning activities. There was a thin white plastic sheet material on the bottom of the chamber that we suspected acted like a sponge slowly emitting the methanol. The ammonia was presumed to be from rat urine. The concentration continued to increased throughout the test.

After all the samples were collected the flow of air through the generator tube and exposure chamber was stopped and everything valved closed and plugged/capped. The test was ended at 14:09 12/9/13.

2 Methods - Analytical and Preparatory

The exposure chamber testing was performed by plumbing an air supply line from the breathing air cylinder to the rotometer then to the ethyl-FOSE generator tube. From the generator tube a T was installed with a valve to provide a sampling port for the OVS tubes. From that point the tube continued to the inlet of the exposure chamber located on one end. Exiting the chamber from the other end is another T with a valve to provide a sampling port for the outlet OVS location. After the T the line continues to the FTIR cart. The line was attached to one of the sampling inlet ports on the control panel. From the panel the line continues to the FTIR sample cell inlet where sample gas traverses the length of the cell out the exhaust line where the gases were vented into the adjacent hood. FTIR measurements were initially collected continuously then after several minutes the frequency was changed to 5 minute intervals. The overall sampling system was leak checked each day prior to testing. Cylinder air was flowed at 2 lpm into the entire system while the final exhaust was plugged. The pressure on the system was monitored by the pressure sensor in the FTIR. When the system was pressurized between 1-2 psia above ambient, the cylinder valve was closed. The system was checked for pressure change over at least a 5 minute time frame. Acceptance criteria is <4% change. All leak checks ranged between 0 and -0.51%. A schematic of the sampling system is shown in Figure 1 below.

Figure 1 – Sample System Schematic



Typical FTIR

The method used for the FTIR analyses was a modified procedure of ETS-8-31.2 "Measurement of Vapor Phase Compounds by Extractive Fourier Transform Infrared (FTIR) Spectroscopy", which is based upon NIOSH 3800 and EPA Method 320. For these tests the exposure chamber air was extracted through a Midac I-series FTIR system. The FTIR system was equipped with a nominal 20.0 meter optical pathlength gas cell operated at ambient temperatures. The FTIR continuously collected data throughout the tests and created average sample spectra approximately every 60 seconds.

FTIR results were generated using Midac AutoQuant™ software and are reported in ppmv (parts per million by volume). The software utilizes a classical least squares (CLS) algorithm to compare a sample spectrum to a set of reference spectra. The least-squares algorithm computes what fraction of each reference spectrum must be added to reproduce the sample spectrum. The equivalent proportion of reference spectra is equal to the concentration in the sample. CLS assumes a linear relationship between absorbance and concentration.

Concentrations of analytes in representative FTIR sample spectrum were verified using manual subtraction of a reference spectrum from the sample spectrum utilizing Galactic software. The relative fraction of the reference spectrum, or subtraction factor, was then used to calculate the concentration of the sample in ppmv using the following equation:

$$\text{ppmv} = \frac{(\text{subtraction factor}) * (\text{reference spectrum concentration at cell temp (ppmv*m)})}{\text{pathlength for sample analysis (m)}}$$

3 FTIR Analysis

Spectral features from representative sample spectra were evaluated and carbon monoxide, carbon dioxide, methane, methanol, and water were detected. Ethyl-FOSE was not detected in any chamber exhausts during this study. There were several other unknown spectral features observed at the startup of the testing. These features dropped below detection several minutes after startup. It is suspected these features were related to the white plastic material at the bottom of the exposure chamber. Methanol was also attributed to residual effects within the chamber due most likely to past cleaning activities.

All quality control requirements including daily pathlength determinations and sampling system leak checks met the requirements of EPA Method 320 and ETS-8-31.2.

4 FTIR Test Results – Data Plots

Figure 1 - All Test Compounds Plotted

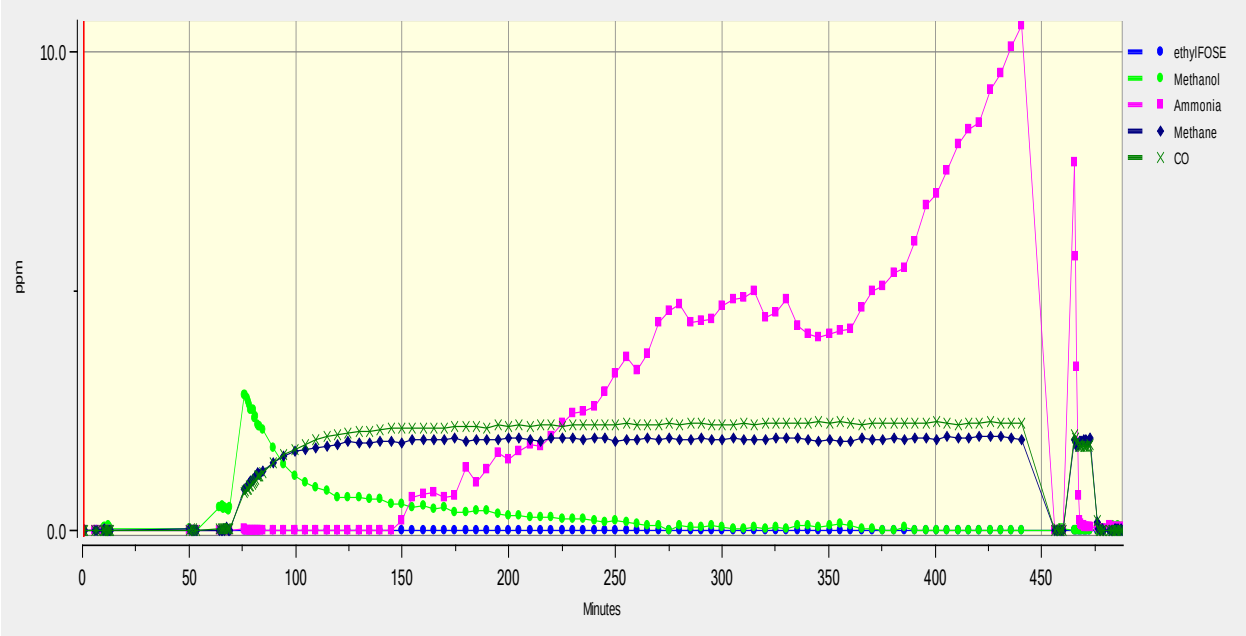


Figure 2 – All Test Compounds Excluding Ammonia

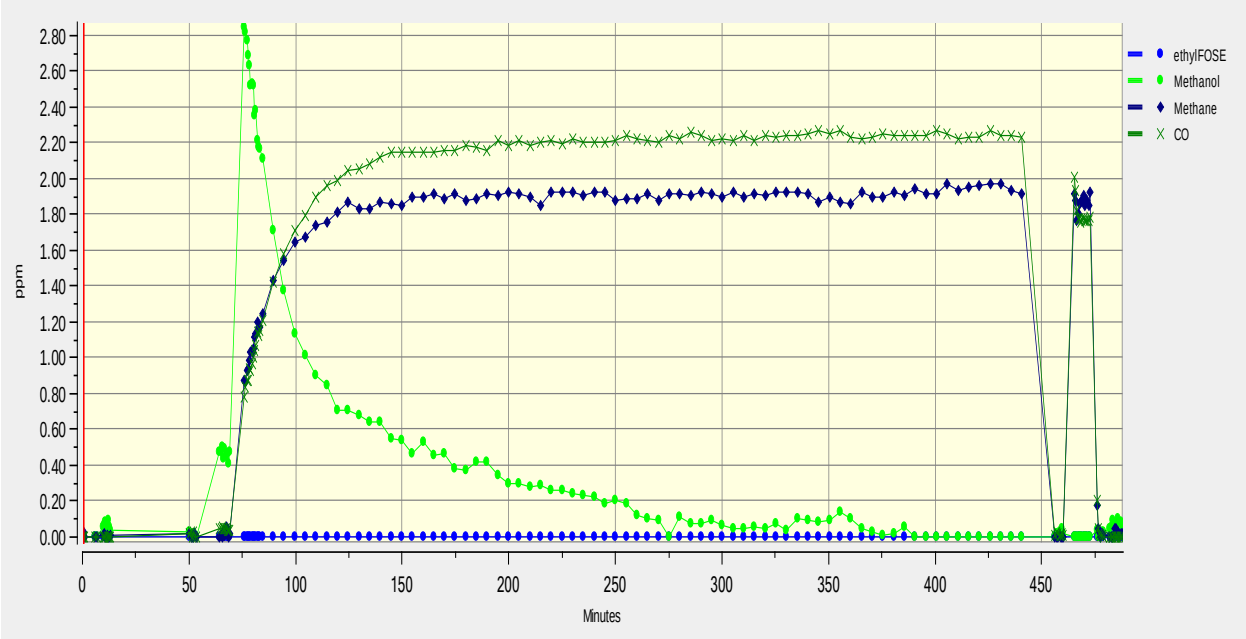
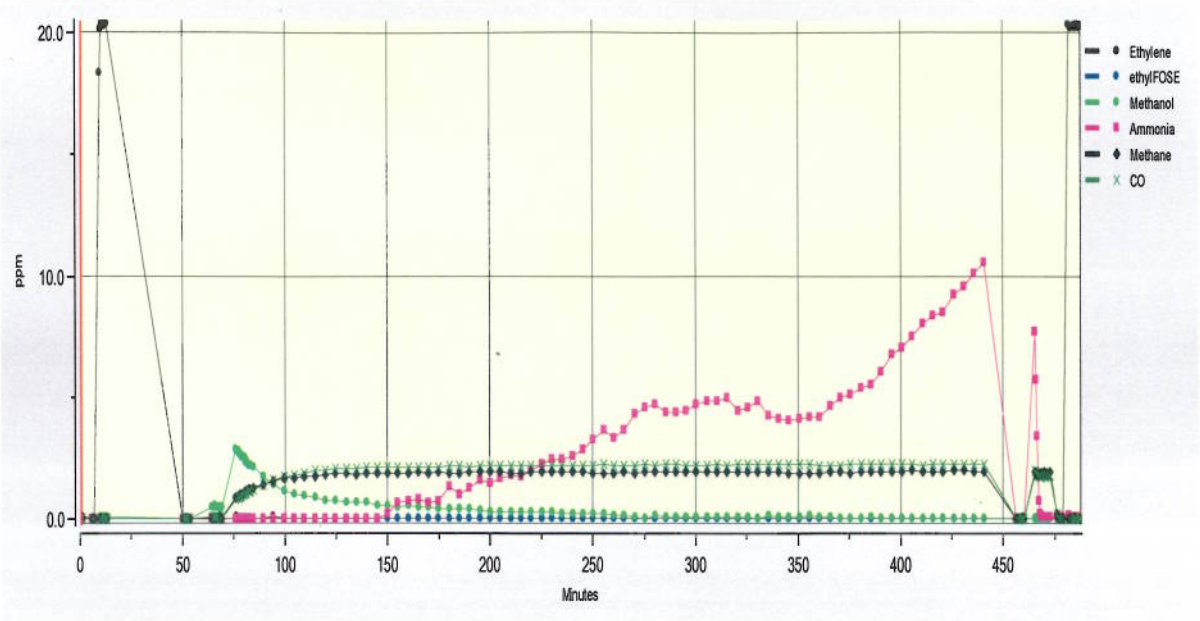


Figure 3 - All Test Compounds plus Ethylene (Pathlength Calc)



5 Data/Sample Retention

Data will be archived in the 3M Environmental Lab archives in accordance with 3M policy for record retention.

6 Signatures

Jess Eldridge, 3M Environmental Lab — Date: 2-6-14

Brian Mader, Technical Manager, 3M Environmental Lab — Date: 2-6-14

7 Flow Rates, Correction Factors, Test Times

E13-0880 Final Analytical Report, Appendix-A

E13-0722 B270 Tox Chamber Ethyl-FOSE Conditioning

By: JSE 11/26/13

Sweep gas pressure setting = 10 psi
Sweep gas flow rate = 2 lpm; calibrated rotometer
Flow rate checked on inlet connected to pressurized system @ 8:55 11/14/13 = 115 cc/min; not connected @ 8:36 = 104.5 cc/min
Flow rate checked on outlet connected to pressurized system @ 10:15 11/20/13 = 116 cc/min; not connected @ 10:09 = 108 cc/min
Inlet = pump #IH0000150
Outlet = pump #IH0000222
Dry-Cal # 3M Instrument # 158675, #E0000003898

Diff, cc/min	10.5
Diff, cc/min	8
Avg, cc/min	9.25

EtFOSE-OH P-Chem Structure	C8F17SO2N(CH2CH3)CH2CH2OH
MW	571
T ©	23
P (atm)	1

Lab Request E13-0722 - Preliminary Chamber Test

Date	Start Time	Stop Time	Elpased (hr)	Gas	Test	Location	Initial flow, cc/min	Final flow, cc/min	Avg flow, cc/min	Cor. Factor, cc/min	Adj flow, cc/min	Run Time, min	Volume, L	Ethyl FOSE (ng/OVS tube)	Air Conc. Ethyl FOSE (ng/L)	Air Conc. Ethyl FOSE (ppbV)
11/14/2013	10:25	11:25	1.00	Air	1	Inlet	104.5	104	104.25	9.25	113.5	60	6.810	1710	251	11
11/14/2013	10:25	11:25	1.00	Air	1	Outlet	103	107	105	9.25	114.25	60	6.855	6.1	0.89	0.04
11/14/2013	12:20	13:20	1.00	Air	2	Inlet	104	103	103.5	9.25	112.75	60	6.765	3120	461	20
11/14/2013	12:20	13:20	1.00	Air	2	Outlet	107	108	107.5	9.25	116.75	60	7.005	30.6	4.4	0.19
11/14/2013	14:20	15:20	1.00	Air	3	Inlet	103	103	103	9.25	112.25	60	6.735	3510	521	22
11/14/2013	14:20	15:20	1.00	Air	3	Outlet	108	109	108.5	9.25	117.75	60	7.065	72.7	10	0.44
11/14/2013	15:22	16:22	1.00	Air	4	Inlet	103	103	103	9.25	112.25	60	6.735	4040	600	25
11/14/2013	15:22	16:22	1.00	Air	4	Outlet	108	109	108.5	9.25	117.75	60	7.065	124.0	18	0.75
11/15/2013	8:42	9:42	1.00	Air	5	Inlet	104	104	104	9.25	113.25	60	6.795	3990	587	25
11/15/2013	8:42	9:42	1.00	Air	5	Outlet	105	105	105	9.25	114.25	60	6.855	124.0	18	0.8
11/15/2013	10:42	11:42	1.00	Air	6	Inlet	104	104	104	9.25	113.25	60	6.795	4640	683	29
11/15/2013	10:42	11:42	1.00	Air	6	Outlet	105	105	105	9.25	114.25	60	6.855	145.0	21	0.9
11/15/2013	12:42	13:42	1.00	Air	7	Inlet	104	103	103.5	9.25	112.75	60	6.765	5080	751	32
11/15/2013	12:42	13:42	1.00	Air	7	Outlet	105	105	105	9.25	114.25	60	6.855	219.0	32	1.4
11/15/2013	13:44	14:44	1.00	Air	8	Inlet	104	103	103.5	9.25	112.75	60	6.765	5480	810	34
11/15/2013	13:44	14:44	1.00	Air	8	Outlet	105	105	105	9.25	114.25	60	6.855	302.0	44	1.9
11/20/2013	9:06	10:06	1.00	Nitrogen	9	Inlet	104	104	104	9.25	113.25	60	6.795	4590	675	29
11/20/2013	9:06	10:06	1.00	Nitrogen	9	Outlet	108	108	108	9.25	117.25	60	7.035	865.0	123	5.2
11/21/2013	9:05	10:05	1.00	Nitrogen	10	Inlet	105	104	104.5	9.25	113.75	60	6.825	3660	536	23
11/21/2013	9:05	10:05	1.00	Nitrogen	10	Outlet	109	108	108.5	9.25	117.75	60	7.065	1170.0	166	7.0
11/22/2013	8:51	9:51	1.00	Nitrogen	11	Inlet	104	104	104	9.25	113.25	60	6.795	4140	609	26
11/22/2013	8:51	9:51	1.00	Nitrogen	11	Outlet	106	106	106	9.25	115.25	60	6.915	1140.0	165	7.0
11/25/2013	9:54	10:55	1.02	Nitrogen	12	Inlet	104	103	103.5	9.25	112.75	61	6.878	2950	429	18
11/25/2013	9:54	10:55	1.02	Nitrogen	12	Outlet	108	108	108	9.25	117.25	61	7.152	1450.0	203	8.6
12/4/2013	9:18	10:18	1.00	Nitrogen	13	Inlet	104	104	104	9.25	113.25	60	6.795	1770	260	11
12/4/2013	9:18	10:18	1.00	Nitrogen	13	Outlet	105	104	104.5	9.25	113.75	60	6.825	748.0	110	4.7
							Lab Request E13-0880 - Exposure Test w Rats								
12/9/2013	9:12	10:12	1.00	Air	1	Inlet	104	103	103.5	9.25	112.75	60	6.765	1397	207	8.8
12/9/2013	9:12	10:12	1.00	Air	1	Outlet	104	106	105	9.25	114.25	60	6.855	524.0	76	3.2
12/9/2013	10:15	11:15	1.00	Air	2	Inlet	104	103	103.5	9.25	112.75	60	6.765	1520	225	9.6
12/9/2013	10:15	11:15	1.00	Air	2	Outlet	104	106	105	9.25	114.25	60	6.855	652.0	95	4.0
12/9/2013	11:18	12:18	1.00	Air	3	Inlet	104	103	103.5	9.25	112.75	60	6.765	1501	222	9.4
12/9/2013	11:18	12:18	1.00	Air	3	Outlet	104	106	105	9.25	114.25	60	6.855	1013.0	148	6.3
12/9/2013	12:21	13:21	1.00	Air	4	Inlet	104	103	103.5	9.25	112.75	60	6.765	1544	228	9.7
12/9/2013	12:21	13:21	1.00	Air	4	Outlet	104	106	105	9.25	114.25	60	6.855	958.0	140	5.9
12/9/2013	13:24	14:24	1.00	Air	5	Inlet	104	103	103.5	9.25	112.75	60	6.765	1505	222	9.5
12/9/2013	13:24	14:24	1.00	Air	5	Outlet	104	106	105	9.25	114.25	60	6.855	919.0	134	5.7
12/9/2013	14:27	15:17	0.83	Air	6	Inlet	104	103	103.5	9.25	112.75	50	5.6375	1271	225	9.6
12/9/2013	14:27	15:17	0.83	Air	6	Outlet	104	106	105	9.25	114.25	50	5.7125	885.0	155	6.6

Inlet
Outlet

Ethyl-FOSE Gas-phase Concentration

Comment	Date/ Time	Generator Outlet ppbV	Chamber Outlet ppbV	Generator Outlet ng/L	Chamber Outlet ng/L
Pre-test	11/14/13 11:25	11	0.04	251	0.89
Pre-test	11/14/13 13:20	20	0.19	461	4.4
Pre-test	11/14/13 15:20	22	0.44	521	10
Pre-test	11/14/13 16:22	25	0.75	600	18
Pre-test	11/15/13 9:42	25	0.77	587	18
Pre-test	11/15/13 11:42	29	0.90	683	21
Pre-test	11/15/13 13:42	32	1.36	751	32
Pre-test	11/15/13 14:44	34	1.87	810	44
Pre-test	11/20/13 10:06	29	5.23	675	123
Pre-test	11/21/13 10:05	23	7.04	536	166
Pre-test	11/22/13 9:51	26	7.01	609	165
Pre-test	11/25/13 10:55	18	8.62	429	203
Pre-test	12/4/13 10:18	11	4.66	260	110

Ethyl-FOSE Gas-phase Concentration

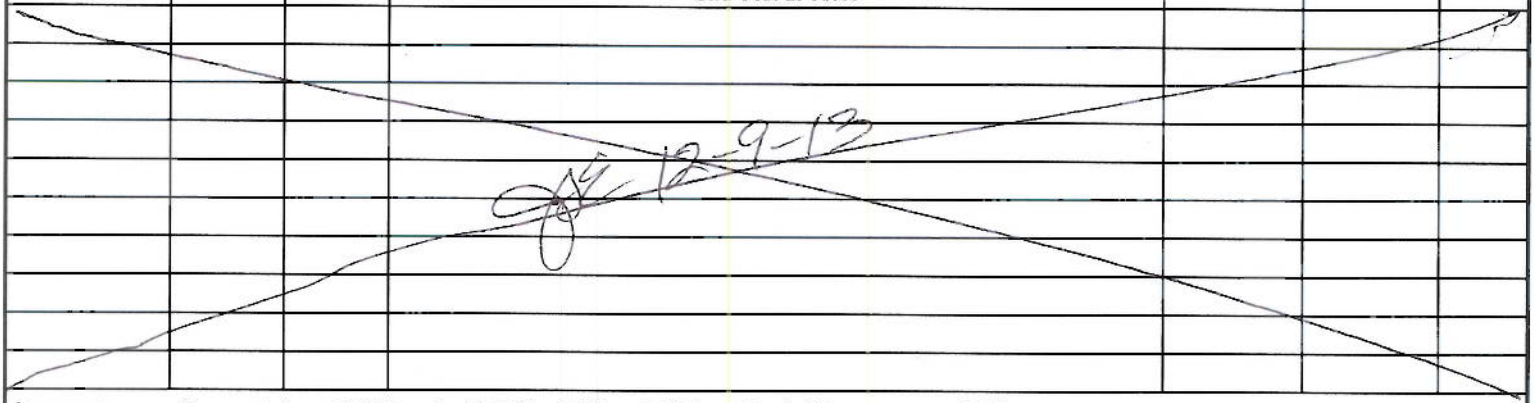
Comment	Date/ Time	Generator Outlet ppbV	Chamber Outlet ppbV	Generator Outlet ng/L	Chamber Outlet ng/L
Exposure Test	12/9/2013 10:12	8.8	3.2	207	76
Exposure Test	12/9/2013 11:15	9.6	4.0	225	95
Exposure Test	12/9/2013 12:18	9.4	6.3	222	148
Exposure Test	12/9/2013 13:21	9.7	5.9	228	140
Exposure Test	12/9/2013 14:24	9.5	5.7	222	134
Exposure Test	12/9/2013 15:27	9.6	6.6	225	155

Start Date Time	Stop Date Time	Elpased (hr)	Elapsed (min)	Flow-rate (LPM)	Volume (L)	
11/14/2013 10:25	11/14/2013 16:24	5.98	359	2	718	E13-0722 Prelim Chamber Test
11/15/2013 8:30	11/15/2013 14:52	12.35	741	2	1482	E13-0722 Prelim Chamber Test
11/19/2013 15:40	11/26/2013 13:00	177.68	10661	2	21322	E13-0722 Prelim Chamber Test
11/26/2013 14:44	12/4/2013 10:44	365.68	21941	2	43882	E13-0722 Prelim Chamber Test
12/9/2013 9:12	12/9/2013 9:19	365.80	21948	2	43896	E13-0880 Exposure test w Rats
12/9/2013 9:19	12/9/2013 15:19	371.80	22308	2.1	46847	shut system down @15:19 12/9/13 sampling done @ 15:17

8 FTIR Data, Method Map, Pathlength, Spectra, Leak Checks, QA/QC

3M EH&S Opns Environmental Laboratory			Extractive FTIR Sample Collection Data Sheet				Page 1 of /		
Lab Req. No:	E13-0880	Baro, inHg:	28.95	14.22 psia	Signal 4K(cn	7300	Signal 2K(cm^{-1}):	42000	17%
Project Name:	B270 ethyl-FOSE Rat Exposure Tox Test				Test Loc:	(1) N2	CTS Cyl S.N.:	SG9104949BAL	
Computer ID:	U	FTIR ID:	U (20 meter)		(2)	Ethylene 20.3 ppmv	(3)	Chamber	
Operator (s):	JSE	Date:	12/9/2013		(4)	Room air	(5)	Air cylinder	
Ref. Method:	ETS 8-31	Quality Level:	(1) Screen		(2) Quantative	(3) Comp	(4) Validation	Quantitative	
Collection Dir:	U9Dec2013				Meth Nam	B270 ethyl-FOSE	Inst. Res(cm^{-1}):	0.5	
# Scans, BG/Samp:	128	64	Time/Sample, min:	2.1	1.1	Sampling Interval: continuous	Pathlength, m:	24.2/24.15	
Cells: PL,Vol	0.5cm, 0.0006	1cm, 0.0113	5cm, 0.0567	10cm, 0.113	4m, 0.209	10m, 2.13	Tape, 5.7	Parr, 0.636	Tube, ID in., length ft
Leak Check:	Initial, atm:	15.37	Time:	9:03	Final, psia:	15.37	Time:	9:08	Diff, psia, min: 0 5
Cell Vol, L:	2.1325	Tubing Vol,	0.193	System Vol, L:	2.3256	Leak Vol/min:	0.0000		Pass, <4%: 0.0000
Leak Check:	Initial, psia:		Time:		Final, psia:		Time:		Diff, psia,min: 0 0
Cell Vol, L:		Tubing Vol,	0.193	System Vol, L:	0.1931	Leak Vol/min:	#DIV/0!		Pass, <4%: #DIV/0!

File Name(s)	Time (24hr)	Test Location	Sample Description	Flow (LPM)	Cell Pressure (psia)	Temp (deg C)
BG1	7:54	1	Background nitrogen	2	14.26	22
BG2	7:56	1	Background nitrogen	2	14.26	22
U1-3	7:58	1	Sample nitrogen	2	14.26	22
BG3	8:00	1	Background nitrogen	2	14.26	22
BG4	8:03	1	Background nitrogen	2	14.26	22
U4-5	8:04	1	Sample nitrogen	2	14.26	22
U6-12	8:08	2	Ethylene 20.3 ppmV	2	14.26	22
U13-18	8:48	1	Sample nitrogen	2	14.27	22
U19-27	9:03	3	Leak check	0	15.37	22
U28-112	9:14	3	Chamber w rats and ethyl-FOSE - switched to 5 min samp @ spect 41	2	14.28	22
U113-119	15:34	1	Sample nitrogen	2	14.28	22
U120-132	15:43	3	Generator tube direct to FTIR flowing cylinder air 2 lpm	2	14.30	22
U133-138	15:54	1	Sample nitrogen	2	14.29	22
U139-148	16:00	2	Ethylene 20.3 ppmV	2	14.29	22
****	****	****	End Test at 16:09	****	****	****



Comments: (Barometer) = 163347; noise @3000 ~0.004 and 1000 cm-1 ~ 0.003 on spectrum U14.

Leak checked entire system 40 liter chamber plus FTIR. Increased flow to 2.1 lpm @ 9:19 per Sue Chang to compensate for 0.104 lpm OVS inlet sample.

Seeing methaonol early, then decreasing; then ammonia - urine.

Connected chamber exhaust directly to generator and ran directly into FTIR at 15:43

Method Name: B270 ethyl-FOSE
Method Path: C:\E13-0880 B270 Ethyl-FOSE Rat Exp. Test\Method\B270 ethyl-FOSE\B270 ethyl-FOSE.aq4
Method Type: AutoQuant 4.0
Non-Linear Analysis Mode
MethodParameters

Wavenumber range:	650.00 - 4500.00 cm-1
Default Pathlength =	24.1800 M
Gain =	0
Apodization =	Triangle
Phase Correction =	Mertz
Resolution =	0.5 cm-1
Baseline Correction:	Single Linear
Exclusion Criterion:	2500

Compound: Ethylene

Description:	Ethylene
Molecular Weight:	0
Alarms:	Disabled
Primary Spectrum:	J2KETY.SPC
Reference Concentration:	206.6000 ppm-m
Reference Pathlength:	0.1000 M
Reference Pressure:	0.9699 atm
Reference Temperature:	20.00 C
Region #1:	850.00 - 1100.00 cm-1

Compound: ethylFOSE

Description:	ethylFOSE
Molecular Weight:	0
Alarms:	Disabled
Primary Spectrum:	Ethyl FOSE 17PPB.SPC
Reference Concentration:	0.1700 ppm-m
Reference Pathlength:	10.0000 M
Reference Pressure:	1.0000 atm
Reference Temperature:	25.00 C
Region #1:	1000.00 - 1056.00 cm-1
Region #2:	1057.00 - 1131.00 cm-1
Region #3:	807.00 - 834.00 cm-1

Compound: Methanol

Description:	Methanol
Molecular Weight:	0
Alarms:	Disabled
Spectrum:	MeOh_25T.spc
Reference Concentration:	1.0000 ppm-m
Reference Pathlength:	1.0000 M
Reference Pressure:	1.0000 atm

	Reference Temperature:	25.00 C
	Region #1:	1028.00 - 1038.00 cm-1
Spectrum:	meoh_z5a.spc	
	Reference Concentration:	224.6000 ppm-m
	Reference Pathlength:	1.0000 M
	Reference Pressure:	1.0000 atm
	Reference Temperature:	25.00 C
	Region #1:	1028.00 - 1038.00 cm-1
Primary Spectrum:	MEOHZ9A.SPC	
	Reference Concentration:	22.5000 ppm-m
	Reference Pathlength:	1.0000 M
	Reference Pressure:	1.0000 atm
	Reference Temperature:	25.00 C
	Region #1:	1028.00 - 1038.00 cm-1

Compound: Temp

Description:	temperature	
Molecular Weight:		0
Alarms:	Disabled	

Compound: Press

Description:	pressure	
Molecular Weight:		0
Alarms:	Disabled	

Compound: Ammonia

Description:	Ammonia	
Molecular Weight:		0
Alarms:	Disabled	
Spectrum:	NH3_25T.spc	
	Reference Concentration:	1.0000 ppm-m
	Reference Pathlength:	1.0000 M
	Reference Pressure:	1.0000 atm
	Reference Temperature:	25.00 C
	Region #1:	800.00 - 1165.00 cm-1
Primary Spectrum:	nh3_12.spc	
	Reference Concentration:	52.6000 ppm-m
	Reference Pathlength:	1.0000 M
	Reference Pressure:	1.0000 atm
	Reference Temperature:	25.00 C
	Region #1:	800.00 - 1165.00 cm-1
Spectrum:	nh3_9.spc	
	Reference Concentration:	99.0000 ppm-m
	Reference Pathlength:	1.0000 M
	Reference Pressure:	1.0000 atm
	Reference Temperature:	25.00 C

	Region #1:	800.00 - 1165.00 cm-1

Compound: Methane

Description:	Methane	
Molecular Weight:	0	
Alarms:	Disabled	
Primary Spectrum:	AIHZME.SPC	
	Reference Concentration:	100.0000 ppm-m
	Reference Pathlength:	1.0000 M
	Reference Pressure:	1.0000 atm
	Reference Temperature:	25.00 C
	Region #1:	2900.00 - 3035.00 cm-1
Spectrum:	CH4_25A.SPC	
	Reference Concentration:	273.0000 ppm-m
	Reference Pathlength:	1.0000 M
	Reference Pressure:	1.0000 atm
	Reference Temperature:	25.00 C
	Region #1:	2900.00 - 3035.00 cm-1
Spectrum:	CH4_25T.spc	
	Reference Concentration:	1.0000 ppm-m
	Reference Pathlength:	1.0000 M
	Reference Pressure:	1.0000 atm
	Reference Temperature:	25.00 C
	Region #1:	2900.00 - 3035.00 cm-1

Compound: CO

Description:	CO	
Molecular Weight:	0	
Alarms:	Disabled	
Spectrum:	7CO.SPC	
	Reference Concentration:	6.6000 ppm-m
	Reference Pathlength:	1.0000 M
	Reference Pressure:	1.0000 atm
	Reference Temperature:	25.00 C
	Region #1:	2100.00 - 2181.00 cm-1
Spectrum:	67CO.SPC	
	Reference Concentration:	66.6900 ppm-m
	Reference Pathlength:	1.0000 M
	Reference Pressure:	1.0000 atm
	Reference Temperature:	25.00 C
	Region #1:	2100.00 - 2181.00 cm-1
Primary Spectrum:	113CO.SPC	
	Reference Concentration:	112.7000 ppm-m
	Reference Pathlength:	1.0000 M
	Reference Pressure:	1.0000 atm
	Reference Temperature:	25.00 C

	Region #1:	2124.00 - 2160.00 cm-1

Compound: Moisture

Description:	Moisture	
Molecular Weight:		0
Alarms:	Disabled	
Primary Spectrum:	U0000030.spc	
	Reference Concentration:	1.0000 ppm-m
	Reference Pathlength:	24.5700 M
	Reference Pressure:	0.9406 atm
	Reference Temperature:	22.10 C
	Region #1:	2900.00 - 3150.00 cm-1
	Region #2:	2200.00 - 2000.00 cm-1
	Region #3:	1345.00 - 1200.00 cm-1

Ethylene Cylinder Number SG9104949BAL
Concentration , ppmV 20.3

Date	Method	Filename	Sample Line	Ethylene (ppm)	SEC (ppm)
12/9/2013 8:08	B270 ethyl-FOSE	U0000006	N/A	21.8714	0.0891
12/9/2013 8:09	B270 ethyl-FOSE	U0000007	N/A	24.0072	0.1004
12/9/2013 8:09	B270 ethyl-FOSE	U0000008	N/A	24.2399	0.1012
12/9/2013 8:10	B270 ethyl-FOSE	U0000009	N/A	24.2151	0.0995
12/9/2013 8:11	B270 ethyl-FOSE	U0000010	N/A	24.1698	0.0996
12/9/2013 8:11	B270 ethyl-FOSE	U0000011	N/A	24.1984	0.0996
12/9/2013 8:12	B270 ethyl-FOSE	U0000012	N/A	24.2151	0.1009
			Average	24.21	
12/9/2013 16:00	B270 ethyl-FOSE	U0000139	N/A	24.1959	0.1039
12/9/2013 16:01	B270 ethyl-FOSE	U0000140	N/A	24.0793	0.1048
12/9/2013 16:02	B270 ethyl-FOSE	U0000141	N/A	24.0897	0.1046
12/9/2013 16:03	B270 ethyl-FOSE	U0000142	N/A	24.1542	0.1028
12/9/2013 16:03	B270 ethyl-FOSE	U0000143	N/A	24.1643	0.1024
12/9/2013 16:04	B270 ethyl-FOSE	U0000144	N/A	24.1092	0.1036
12/9/2013 16:04	B270 ethyl-FOSE	U0000145	N/A	24.1952	0.1034
12/9/2013 16:05	B270 ethyl-FOSE	U0000146	N/A	24.1802	0.1036
12/9/2013 16:06	B270 ethyl-FOSE	U0000147	N/A	24.0867	0.1029
12/9/2013 16:06	B270 ethyl-FOSE	U0000148	N/A	24.132	0.1036
			Average	24.15	
			Overall Average	**24.18**	

E13-0880 Final Analytical Report, Appendix-A

Date	Method	Filename	Sample Line	Ammonia (ppm)	SEC (ppm)	CO (ppm)	SEC (ppm)	Ethylene (ppm)	SEC (ppm)	Methane (ppm)	SEC (ppm)	Methanol (ppm)	SEC (ppm)	Moisture (ppm)	SEC (ppm)	Press (atm)	SEC (atm)	Temp (C)	SEC (C)	ethylFOSE (ppm)	SEC (ppm)
12/9/2013 7:59	B270 ethyl-FOSE	U0000001	N/A	0	0.0082	0	0.0112	0.0787	0.0229	0.0143	0.0154	0	0.0189	0	0	0.9689	0	21.5453	0	0	0.0001
12/9/2013 7:59	B270 ethyl-FOSE	U0000002	N/A	0.0164	0.0089	0	0.0115	0.0815	0.0254	0.0228	0.0152	0	0.0182	0	0	0.9698	0	21.5453	0	0	0.0001
12/9/2013 8:00	B270 ethyl-FOSE	U0000003	N/A	0	0.0088	0	0.0125	0.083	0.025	0	0.015	0	0.0275	0	0	0.9677	0	21.7026	0	0	0.0001
12/9/2013 8:05	B270 ethyl-FOSE	U0000004	N/A	0.0062	0.0066	0.0031	0.0123	0	0.0165	0	0.0162	0	0.0266	0	0	0.9698	0	21.5453	0	0	0.0001
12/9/2013 8:05	B270 ethyl-FOSE	U0000005	N/A	0.008	0.0066	0.0022	0.0121	0	0.016	0	0.0163	0	0.0225	0.0001	0	0.9698	0	21.5453	0	0.0002	0.0001
12/9/2013 8:08	B270 ethyl-FOSE	U0000006	N/A	0.0015	0.0241	0	0.0115	18.353	0.0761	0.0095	0.0523	0.0506	0.0703	0.0069	0.0001	0.9698	0	21.5453	0	0	0.0001
12/9/2013 8:09	B270 ethyl-FOSE	U0000007	N/A	0	0.0271	0	0.0119	20.1471	0.0858	0.0171	0.0414	0.0634	0.0762	0.0025	0.0001	0.9698	0	21.6239	0	0	0.0002
12/9/2013 8:09	B270 ethyl-FOSE	U0000008	N/A	0.0041	0.0272	0	0.012	20.3409	0.0864	0	0.0381	0.0797	0.0827	0.0018	0.0001	0.9698	0	21.5453	0	0	0.0002
12/9/2013 8:10	B270 ethyl-FOSE	U0000009	N/A	0.0048	0.0268	0	0.0122	20.3145	0.0849	0.0117	0.0387	0.0393	0.0838	0.0014	0.0001	0.9698	0	21.5453	0	0	0.0002
12/9/2013 8:11	B270 ethyl-FOSE	U0000010	N/A	0	0.0269	0	0.0114	20.2869	0.0851	0	0.0367	0.0902	0.0808	0.0012	0.0001	0.9698	0	21.5453	0	0.0001	0.0002
12/9/2013 8:11	B270 ethyl-FOSE	U0000011	N/A	0	0.0268	0	0.0122	20.3085	0.0851	0	0.0345	0.0581	0.0817	0.0012	0.0001	0.9698	0	21.4667	0	0	0.0002
12/9/2013 8:12	B270 ethyl-FOSE	U0000012	N/A	0.0145	0.0272	0	0.0128	20.3176	0.0862	0.0095	0.0355	0.0393	0.0799	0.0011	0.0001	0.9698	0	21.5453	0	0	0.0002
12/9/2013 8:49	B270 ethyl-FOSE	U0000013	N/A	0.0078	0.0064	0.0137	0.0118	0	0.0159	0.0185	0.0162	0.0293	0.0287	0	0	0.9698	0	21.4667	0	0	0.0001
12/9/2013 8:49	B270 ethyl-FOSE	U0000014	N/A	0	0.0065	0.023	0.0104	0.0013	0.0161	0	0.0152	0	0.0255	0.0001	0	0.9694	0	21.4667	0	0	0.0001
12/9/2013 8:50	B270 ethyl-FOSE	U0000015	N/A	0.0006	0.0068	0	0.0117	0	0.0159	0	0.0173	0	0.0283	0	0	0.9698	0	21.4667	0	0	0.0001
12/9/2013 8:51	B270 ethyl-FOSE	U0000016	N/A	0.0122	0.0066	0.0278	0.0124	0	0.0171	0	0.0169	0	0.0246	0	0	0.9698	0	21.5453	0	0	0.0001
12/9/2013 8:51	B270 ethyl-FOSE	U0000017	N/A	0	0.0066	0	0.0118	0	0.0166	0.0156	0.0164	0.0163	0.0251	0	0	0.9702	0	21.4667	0	0	0.0001
12/9/2013 8:52	B270 ethyl-FOSE	U0000018	N/A	0.002	0.0062	0	0.0112	0	0.0152	0	0.0161	0	0.0268	0	0	0.9698	0	21.5453	0	0	0.0001
12/9/2013 9:03	B270 ethyl-FOSE	U0000019	N/A	0	0.0064	0.048	0.0129	0	0.026	0	0.0522	0.4717	0.0281	0.0153	0.0002	1.0195	0	21.5453	0	0.0017	0.0001
12/9/2013 9:04	B270 ethyl-FOSE	U0000020	N/A	0.0002	0.0066	0.0447	0.0131	0	0.0256	0.009	0.053	0.4695	0.0325	0.0152	0.0002	1.0195	0	21.4667	0	0.0015	0.0001
12/9/2013 9:04	B270 ethyl-FOSE	U0000021	N/A	0.0144	0.0068	0.0508	0.0122	0	0.0266	0	0.0543	0.5042	0.031	0.015	0.0002	1.0195	0	21.6239	0	0.0016	0.0001
12/9/2013 9:05	B270 ethyl-FOSE	U0000022	N/A	0.0062	0.0066	0.045	0.0119	0	0.0259	0.0295	0.0539	0.4358	0.0331	0.0148	0.0002	1.0195	0	21.7026	0	0.0015	0.0001
12/9/2013 9:05	B270 ethyl-FOSE	U0000023	N/A	0	0.0066	0.0442	0.0129	0	0.0257	0.0122	0.0513	0.488	0.027	0.0147	0.0002	1.0171	0	21.4667	0	0.0016	0.0001
12/9/2013 9:06	B270 ethyl-FOSE	U0000024	N/A	0.0062	0.0071	0.0456	0.0111	0	0.0261	0.0538	0.0528	0.4476	0.0437	0.0145	0.0002	1.0195	0	21.7026	0	0.0016	0.0001
12/9/2013 9:07	B270 ethyl-FOSE	U0000025	N/A	0.0072	0.0064	0.0321	0.0118	0	0.0239	0.0467	0.0522	0.4646	0.0292	0.0144	0.0002	1.0199	0	21.4667	0	0.0016	0.0001
12/9/2013 9:07	B270 ethyl-FOSE	U0000026	N/A	0.0023	0.0068	0.0389	0.0125	0	0.0244	0	0.0528	0.411	0.0371	0.0143	0.0002	1.0195	0	21.7026	0	0.0018	0.0001
12/9/2013 9:08	B270 ethyl-FOSE	U0000027	N/A	0.0143	0.0064	0.0339	0.0117	0	0.024	0.0143	0.0519	0.4749	0.0286	0.0143	0.0002	1.0199	0	21.6239	0	0.0017	0.0001
12/9/2013 9:15	B270 ethyl-FOSE	U0000028	N/A	0.027	0.0338	0.7795	0.0977	0	0.1412	0.8684	0.1331	2.8434	0.0983	0.2939	0.001	0.9698	0	21.7026	0	0	0.0004
12/9/2013 9:15	B270 ethyl-FOSE	U0000029	N/A	0.0053	0.0337	0.8342	0.0971	0.0475	0.072	0.8627	0.1304	2.8142	0.0899	0.2907	0.001	0.9698	0	21.4667	0	0	0.0004
12/9/2013 9:16	B270 ethyl-FOSE	U0000030	N/A	0.0111	0.0331	0.8761	0.0967	0.0003	0.0707	0.9291	0.1299	2.7659	0.0978	0.2882	0.001	0.9685	0	21.4667	0	0.0001	0.0004
12/9/2013 9:16	B270 ethyl-FOSE	U0000031	N/A	0.0044	0.033	0.8752	0.095	0.0301	0.0703	0.9425	0.1277	2.6898	0.0954	0.2854	0.001	0.9706	0	21.4667	0	0	0.0004
12/9/2013 9:17	B270 ethyl-FOSE	U0000032	N/A	0.0019	0.0324	0.9413	0.0955	0	0.1308	0.9871	0.1282	2.6331	0.1013	0.2843	0.001	0.9706	0	21.6239	0	0	0.0004
12/9/2013 9:18	B270 ethyl-FOSE	U0000033	N/A	0.0044	0.0321	0.9307	0.0935	0	0.1271	1.0282	0.126	2.5186	0.0955	0.2824	0.001	0.9702	0	21.6239	0	0	0.0004
12/9/2013 9:18	B270 ethyl-FOSE	U0000034	N/A	0.0022	0.0322	0.9675	0.0937	0.0247	0.0685	1.0327	0.1281	2.5297	0.0942	0.2794	0.001	0.971	0	21.7026	0	0	0.0004
12/9/2013 9:19	B270 ethyl-FOSE	U0000035	N/A	0	0.0315	0.9999	0.0944	0.0078	0.0675	1.0528	0.1273	2.5196	0.0982	0.2782	0.001	0.9706	0	21.7026	0	0	0.0004
12/9/2013 9:19	B270 ethyl-FOSE	U0000036	N/A	0	0.0315	1.0403	0.0934	0.0185	0.0665	1.111	0.1272	2.3565	0.0973	0.2764	0.0011	0.9706	0	21.5453	0	0	0.0004
12/9/2013 9:20	B270 ethyl-FOSE	U0000037	N/A	0.0008	0.0309	1.0697	0.0908	0.0079	0.0659	1.1329	0.1243	2.3762	0.0895	0.2726	0.001	0.9706	0	21.7026	0	0	0.0004
12/9/2013 9:21	B270 ethyl-FOSE	U0000038	N/A	0	0.0308	1.1389	0.0925	0.0342	0.0667	1.2	0.1253	2.2142	0.0868	0.2722	0.001	0.9677	0	21.5453	0	0	0.0004
12/9/2013 9:21	B270 ethyl-FOSE	U0000039	N/A	0.008	0.0303	1.1284	0.0916	0.0112	0.0644	1.174	0.125	2.1761	0.0886	0.2702	0.0011	0.971	0	21.7026	0	0	0.0004
12/9/2013 9:22	B270 ethyl-FOSE	U0000040	N/A	0	0.0308	1.1515	0.0915	0	0.1107	1.1717	0.1245	2.1661	0.0994	0.2715	0.001	0.971	0	21.6239	0	0	0.0004
12/9/2013 9:23	B270 ethyl-FOSE	U0000041	N/A	0.0005	0.0305	1.2115	0.0912	0.0076	0.0654	1.2406	0.1252	2.1124	0.0749	0.2714	0.001	0.971	0	21.7026	0	0	0.0004
12/9/2013 9:28	B270 ethyl-FOSE	U0000042	N/A	0	0.0321	1.4198	0.0958	0	0.0948	1.4314	0.1263	1.7107	0.0827	0.2776	0.0011	0.971	0	21.6239	0	0	0.0004
12/9/2013 9:33	B270 ethyl-FOSE	U0000043	N/A	0	0.0349	1.5841	0.1013	0.0469	0.0735	1.5467	0.1338	1.3751	0.0848	0.2942	0.0011	0.9706	0	21.7812	0	0	0.0004
12/9/2013 9:38	B270 ethyl-FOSE	U0000044	N/A	0	0.0354	1.7063	0.1033	0.0364	0.0733	1.6494	0.1335	1.1296	0.0883	0.2975	0.0011	0.9706	0	21.6239	0	0	0.0004
12/9/2013 9:43	B270 ethyl-FOSE	U0000045	N/A	0	0.0346	1.7969	0.1018	0	0.0806	1.6749	0.1332	1.0162	0.0747	0.2958	0.0011	0.9706	0	21.7812	0	0	0.0004
12/9/2013 9:48	B270 ethyl-FOSE	U0000046	N/A	0	0.0373	1.8919	0.1085	0	0.0807	1.739	0.1388	0.9006	0.0839	0.3116	0.0011	0.971	0	21.5453	0	0	0.0004
12/9/2013 9:53	B270 ethyl-FOSE	U0000047	N/A	0	0.0371	1.9656	0.1066	0	0.0809	1.7575	0.1392	0.8441	0.0863	0.3119	0.001	0.9706	0	21.7026	0	0	0.0004
12/9/2013 9:58	B270 ethyl-FOSE	U0000048	N/A	0	0.0371	1.9919	0.1082	0	0.0793	1.8083	0.1419	0.7047	0.0803	0.3137	0.001	0.971	0	21.7026	0	0	0.0004
12/9/2013 10:03	B270 ethyl-FOSE	U0000049	N/A	0	0.037	2.0431	0.1086	0	0.0787	1.871	0.1413	0.705	0.0817	0.317	0.001	0.971	0	21.7026	0	0	0.0004
12/9/2013 10:08	B270 ethyl-FOSE	U0000050	N/A	0	0.0379	2.0542	0.1089	0	0.0808	1.8327	0.1419	0.6799	0.0806	0.3141	0.0011	0.9706	0	21.6239	0	0	0.0004
12/9/2013 10:13	B270 ethyl-FOSE	U0000051	N/A	0	0.0379	2.0789	0.1111	0	0.0801	1.8277	0.1414	0.6447	0.0875	0.3172	0.0011	0.971	0	21.7026	0	0	0.0004
12/9/2013 10:18	B270 ethyl-FOSE	U0000052	N/A	0	0.038	2.1154	0.1085	0	0.0797	1.8689	0.1416	0.6422	0.0895	0.3175	0.001	0.9706	0	21.6239	0	0	0.0004
12/9/2013 10:23	B270 ethyl-FOSE	U0000053	N/A	0	0.0373	2.1468	0.1072	0	0.0775	1.8606	0.1409	0.5503	0.0739	0.3151	0.001	0.9706	0	21.7026	0	0	0.0004
12/9/2013 10:28	B270 ethyl-FOSE	U0000054	N/A	0.2226	0.0373	2.1485	0.1055	0	0.0795	1.8462	0.1417	0.5349	0.0794	0.3168	0.001	0.971	0	21.7026	0	0	0.0004
12/9/2013 10:33	B270 ethyl-FOSE	U0000055	N/A	0.6911	0.0367	2.1507	0.1058	0	0.0952	1.8956	0.1427	0.4677	0.0825	0.315	0.001	0.9706	0	21.7026	0	0	0.0004
12/9/2013 10:38	B270 ethyl-FOSE	U0000056	N/A	0.7556	0.0369	2.1435	0.104	0	0.0979	1.897	0.1414	0.5289	0.0826	0.3147	0.001	0.9706	0	21.7026	0	0	0.0004
12/9/2013 10:43	B270 ethyl-FOSE	U0000057	N/A	0.8087	0.0372	2.1505	0.1036	0	0.1001	1.9129	0.1414	0.4557	0.0846	0.3163	0.001	0.9706	0	21.8598	0	0	0.0004
12/9/2013 10:48	B270 ethyl-FOSE	U0000058	N/A	0.6755	0.0363	2.1554	0.1037	0	0.0923	1.8878	0.1388	0.4677	0.0744	0.3157	0.001	0.971	0	21.7026	0	0	0.0004
12/9/2013 10:53	B270 ethyl-FOSE	U0000059	N/A	0.7345	0.0362	2.1571	0.1037	0	0.095	1.9178	0.1424	0.3788	0.0757	0.3176	0.0009	0.9706	0	21.7026	0	0	0.0004
12/9/2013 10:58	B270 ethyl-FOSE	U0000060	N/A	1.3016	0.0376	2.1804	0.1041	0	0.0751	1.8802	0.1426	0.3753	0.0751	0.317	0.001	0.9706	0	21.9385	0	0	0.0004
12/9/2013 11:03	B270 ethyl-FOSE	U0000061	N/A	0.9866	0.0368	2.1723	0.1042	0	0.0736	1.8842	0.1426	0.4213	0.0691	0.3174	0.0009	0.971	0	21.7026	0	0	0.0004
12/9/2013 11:08	B270 ethyl-FOSE	U0000062	N/A	1.2612	0.0374	2.156	0.1041	0	0.0743	1.9146	0.1414	0.4216	0.0759	0.3129	0.001	0.971	0	21.7026	0	0	0.0004
12/9/2013 11:13	B270 ethyl-FOSE	U0000063	N/A	1.6276	0.0376	2.2097	0.1029	0	0.074	1.9023	0.1378	0.3472	0.0866	0.3132	0.001	0.971	0	21.8598	0	0	0.0004
12/9/2013 11:18	B270 ethyl-FOSE	U0000064	N/A	1.4892	0.0379	2.1819	0.1049	0	0.0756	1.9248	0.1401	0.2957	0.0788	0.3156	0.001	0.971	0	21.8598	0	0	0.0004
12/9/2013 11:23	B270 ethyl-FOSE	U0000065	N/A	1.6732	0.0384	2.2114	0.105	0	0.0773	1.9178	0.1394	0.2953	0.0786	0.3142	0.001	0.971	0	21.7026	0	0	0.0004
12/9/2013 11:29	B270 ethyl-FOSE	U0000066	N/A	1.791	0.0385	2.1814	0.1058	0	0.0761	1.8936	0.1401	0.2741	0.0878	0.3154	0.001	0.9706	0	21.9385	0	0	0.0004
12/9/2013 11:34	B270 ethyl-FOSE	U0000067	N/A	1.7606	0.0379	2.2071	0.1052	0	0.0753	1.8499	0.141	0.2831	0.0802	0.3134	0.001	0.9706	0	21.7026	0	0	0.0004
12/9/2013 11:39	B270 ethyl-FOSE	U0000068	N/A	1.9827	0.038	2.2111	0.1034	0	0.0756	1.9199	0.1405	0.261	0.0778	0.3139	0.001	0.9706	0	21.8598	0	0	0.0004
12/9/2013 11:44	B270 ethyl-FOSE	U0000069	N/A	2.2443	0.0383	2.1894	0.1035	0	0.0764	1.9275	0.1394	0.2585	0.0889	0.3108	0.001	0.9706	0	21.9385	0	0	0.0004
12/9/2013 11:49	B270 ethyl-FOSE	U0000070	N/A	2.4505	0.0393	2.221	0.1024	0	0.0774	1.9278	0.1408	0.2382	0.0861	0.3088	0.001	0.9706	0	21.8598	0	0	0.0004
12/9/2013 11:54	B270 ethyl-FOSE	U0000071	N/A	2.4921	0.0392	2.1992	0.1053	0	0.079	1.9092	0.1404	0.2277	0.0976	0.3113	0.001	0.9706	0	21.8598	0	0	0.0004
12/9/2013 11:59	B270 ethyl-FOSE	U0000072	N/A	2.588	0.0397	2.2063	0.1037	0	0.0792	1.9242	0.1394	0.2226	0.0901	0.3117	0.001	0.9706	0	21.7812	0	0	0.0005
12/9/2013 12:04	B270 ethyl-FOSE	U0000073	N/A	2.8893	0.0405	2.2057	0.1059	0	0.0795	1.9277	0.1403	0.1856	0.1006	0.3142	0.001	0.971	0	21.8598	0	0	0.0005
12/9/2013 12:09	B270 ethyl-FOSE	U0000074	N/A	3.2634	0.041	2.2117	0.1049	0	0.0809	1.8733	0.1433	0.2076	0.1038	0.3142	0.001	0.9706	0	21.7812	0	0	0.0005
12/9/2013 12:14	B270 ethyl-FOSE	U0000075	N/A	3.6378	0.0424	2.2359	0.1064	0	0.0826	1.89	0.1429	0.183	0.1174	0.3161	0.001	0.9706	0	21.9385	0	0	0.0005
12/9/2013 12:19	B270 ethyl-FOSE	U0000076	N/A	3.3373	0.0414	2.2181	0.1048	0	0.0807	1.8878	0.1409	0.1221	0.0935	0.3146	0.001	0.9706	0	21.8598	0	0	0.0005
12/9/2013 12:24	B270 ethyl-FOSE	U0000077	N/A	3.6776	0.0425	2.216	0.1072	0	0.0826	1.9162	0.1423	0.1049	0.0999	0.3156	0.001	0.9706	0	21.9385	0	0	0.0005
12/9/2013 12:29	B270 ethyl-FOSE	U0000078	N/A	4.3525	0.0446	2.2067	0.1067	0	0.0862	1.8812	0.1429	0.0891	0.1068	0.3153	0.001	0.9706	0	21.8598	0	0	0.0005
12/9/2013 12:34	B270 ethyl-FOSE	U0000079	N/A	4.5781	0.0448	2.2357	0.1045	0	0.0867	1.9158	0.1438	0.0005	0.1701	0.3154	0.001	0.9706	0	21.9385	0	0	0.0005

12/9/2013 12:39	B270 ethyl-FOSE	U0000080	N/A	4.7143	0.0451	2.2215	0.106	0	0.0871	1.9128	0.1426	0.1106	0.1181	0.3144	0.001	0.9706	0	21.8598	0	0	0.0005
12/9/2013 12:44	B270 ethyl-FOSE	U0000081	N/A	4.3564	0.0444	2.2544	0.106	0	0.0856	1.9093	0.1429	0.073	0.1163	0.3149	0.001	0.9706	0	21.9385	0	0	0.0005
12/9/2013 12:49	B270 ethyl-FOSE	U0000082	N/A	4.3951	0.0441	2.2371	0.1041	0	0.0852	1.9217	0.1425	0.0738	0.116	0.316	0.001	0.9706	0	21.9385	0	0	0.0005
12/9/2013 12:54	B270 ethyl-FOSE	U0000083	N/A	4.4325	0.0447	2.2133	0.1058	0	0.0846	1.912	0.1428	0.0877	0.1014	0.3147	0.001	0.9706	0	21.8598	0	0	0.0005
12/9/2013 12:59	B270 ethyl-FOSE	U0000084	N/A	4.704	0.0445	2.2236	0.1041	0	0.0859	1.8999	0.1428	0.0654	0.1171	0.314	0.001	0.971	0	21.8598	0	0	0.0005
12/9/2013 13:04	B270 ethyl-FOSE	U0000085	N/A	4.8292	0.0453	2.2161	0.1034	0	0.0859	1.9198	0.1413	0.0481	0.1189	0.3162	0.001	0.9706	0	21.8598	0	0	0.0005
12/9/2013 13:09	B270 ethyl-FOSE	U0000086	N/A	4.8793	0.0459	2.2358	0.1047	0	0.0872	1.8984	0.143	0.0462	0.1214	0.3158	0.001	0.9706	0	21.8598	0	0	0.0005
12/9/2013 13:14	B270 ethyl-FOSE	U0000087	N/A	5.0059	0.0461	2.2086	0.106	0	0.0874	1.9145	0.145	0.0527	0.1275	0.3153	0.001	0.9706	0	21.8598	0	0	0.0005
12/9/2013 13:19	B270 ethyl-FOSE	U0000088	N/A	4.4362	0.0445	2.2406	0.1064	0	0.0855	1.9072	0.141	0.0425	0.1069	0.3159	0.001	0.9706	0	21.8598	0	0	0.0005
12/9/2013 13:24	B270 ethyl-FOSE	U0000089	N/A	4.5703	0.0455	2.2315	0.1072	0	0.0884	1.9282	0.1432	0.0732	0.1183	0.3161	0.001	0.971	0	21.9385	0	0	0.0005
12/9/2013 13:29	B270 ethyl-FOSE	U0000090	N/A	4.8279	0.047	2.2414	0.1098	0	0.0902	1.9211	0.1434	0.0359	0.1208	0.3168	0.001	0.9706	0	21.8598	0	0	0.0005
12/9/2013 13:34	B270 ethyl-FOSE	U0000091	N/A	4.273	0.0449	2.2436	0.11	0	0.0879	1.9268	0.1444	0.104	0.1118	0.3164	0.001	0.971	0	21.8598	0	0	0.0005
12/9/2013 13:39	B270 ethyl-FOSE	U0000092	N/A	4.1152	0.0448	2.249	0.1079	0	0.0876	1.9104	0.143	0.0905	0.1074	0.316	0.001	0.9685	0	21.9385	0	0	0.0005
12/9/2013 13:44	B270 ethyl-FOSE	U0000093	N/A	4.0323	0.0442	2.2645	0.1069	0	0.0862	1.8679	0.1428	0.0795	0.1112	0.315	0.001	0.971	0	21.8598	0	0	0.0005
12/9/2013 13:49	B270 ethyl-FOSE	U0000094	N/A	4.1195	0.0442	2.2496	0.1088	0	0.086	1.8936	0.144	0.0919	0.107	0.316	0.001	0.9706	0	21.9385	0	0	0.0005
12/9/2013 13:54	B270 ethyl-FOSE	U0000095	N/A	4.184	0.0447	2.2656	0.1074	0	0.0862	1.87	0.1435	0.1399	0.1143	0.3143	0.001	0.971	0	21.9385	0	0	0.0005
12/9/2013 13:59	B270 ethyl-FOSE	U0000096	N/A	4.1938	0.0443	2.2277	0.1064	0	0.0855	1.8574	0.1414	0.0966	0.1128	0.3134	0.001	0.971	0	21.7026	0	0	0.0005
12/9/2013 14:04	B270 ethyl-FOSE	U0000097	N/A	4.6446	0.0454	2.2188	0.1056	0	0.0871	1.9247	0.1413	0.0425	0.1121	0.3161	0.001	0.9706	0	21.8598	0	0	0.0005
12/9/2013 14:09	B270 ethyl-FOSE	U0000098	N/A	4.9885	0.0462	2.2294	0.1056	0	0.0882	1.8988	0.1434	0.0273	0.1171	0.3134	0.001	0.9706	0	21.8598	0	0	0.0005
12/9/2013 14:14	B270 ethyl-FOSE	U0000099	N/A	5.1158	0.0464	2.2494	0.1061	0	0.0889	1.8917	0.1433	0.0117	0.1835	0.316	0.001	0.971	0	21.8598	0	0	0.0005
12/9/2013 14:19	B270 ethyl-FOSE	U0000100	N/A	5.3908	0.0474	2.2397	0.1056	0	0.0893	1.9278	0.1436	0.0146	0.1987	0.3163	0.001	0.971	0	21.8598	0	0	0.0005
12/9/2013 14:24	B270 ethyl-FOSE	U0000101	N/A	5.4873	0.0478	2.2373	0.1052	0	0.0905	1.9094	0.1447	0.0572	0.1263	0.3167	0.001	0.9706	0	21.8598	0	0	0.0005
12/9/2013 14:29	B270 ethyl-FOSE	U0000102	N/A	6.0468	0.0494	2.2423	0.1064	0	0.092	1.9452	0.1429	0	0.1334	0.3176	0.0009	0.971	0	21.8598	0	0	0.0005
12/9/2013 14:34	B270 ethyl-FOSE	U0000103	N/A	6.7935	0.0522	2.2364	0.1064	0	0.0972	1.9174	0.1435	0	0.1407	0.3179	0.001	0.9706	0	21.7026	0	0	0.0005
12/9/2013 14:39	B270 ethyl-FOSE	U0000104	N/A	7.0278	0.0532	2.2683	0.1063	0	0.0996	1.9146	0.1438	0	0.1432	0.3185	0.001	0.9706	0	21.8598	0	0	0.0005
12/9/2013 14:44	B270 ethyl-FOSE	U0000105	N/A	7.5309	0.0545	2.2512	0.1037	0	0.1012	1.9729	0.1411	0	0.1536	0.3158	0.001	0.9706	0	21.8598	0	0	0.0006
12/9/2013 14:49	B270 ethyl-FOSE	U0000106	N/A	8.0732	0.056	2.2209	0.1053	0	0.1038	1.9332	0.1423	0	0.155	0.3163	0.001	0.9706	0	21.8598	0	0	0.0006
12/9/2013 14:54	B270 ethyl-FOSE	U0000107	N/A	8.3954	0.0569	2.2307	0.1056	0	0.1055	1.9488	0.1438	0	0.1629	0.3154	0.001	0.9706	0	21.8598	0	0	0.0006
12/9/2013 14:59	B270 ethyl-FOSE	U0000108	N/A	8.5224	0.0572	2.2297	0.1043	0	0.1062	1.9613	0.1439	0	0.1685	0.3146	0.001	0.971	0	21.9385	0	0	0.0006
12/9/2013 15:04	B270 ethyl-FOSE	U0000109	N/A	9.2226	0.0603	2.2718	0.1053	0	0.1115	1.9707	0.1435	0	0.1743	0.3183	0.001	0.9685	0	21.8598	0	0	0.0006
12/9/2013 15:09	B270 ethyl-FOSE	U0000110	N/A	9.5705	0.0617	2.2446	0.1056	0	0.115	1.9694	0.1423	0	0.1887	0.3164	0.001	0.9706	0	21.8598	0	0	0.0006
12/9/2013 15:14	B270 ethyl-FOSE	U0000111	N/A	10.1112	0.0639	2.2396	0.1055	0	0.1187	1.9289	0.1444	0	0.1902	0.3152	0.001	0.9706	0	21.8598	0	0	0.0006
12/9/2013 15:19	B270 ethyl-FOSE	U0000112	N/A	10.5619	0.0654	2.2299	0.1048	0	0.8278	1.9123	0.1434	0	0.2068	0.3168	0.001	0.9698	0	21.9385	0	0	0.0006
12/9/2013 15:35	B270 ethyl-FOSE	U0000113	N/A	0	0.0067	0.0052	0.0118	0	0.0165	0	0.0184	0	0.0285	0.0006	0	0.9706	0	22.0957	0	0	0.0001
12/9/2013 15:36	B270 ethyl-FOSE	U0000114	N/A	0.0007	0.0064	0.0299	0.0109	0	0.0165	0	0.019	0.0136	0.0328	0.0008	0	0.971	0	22.0171	0	0	0.0001
12/9/2013 15:36	B270 ethyl-FOSE	U0000115	N/A	0	0.007	0.0139	0.0119	0	0.017	0	0.0177	0	0.0216	0.0007	0	0.971	0	22.0171	0	0	0.0001
12/9/2013 15:37	B270 ethyl-FOSE	U0000116	N/A	0.0092	0.0067	0.0106	0.0124	0	0.0171	0.0054	0.018	0.0296	0.0268	0.0007	0	0.9706	0	22.0957	0	0	0.0001
12/9/2013 15:37	B270 ethyl-FOSE	U0000117	N/A	0.0033	0.0065	0.0115	0.0115	0	0.0163	0.0003	0.0192	0	0.041	0.0007	0	0.9706	0	22.0957	0	0	0.0001
12/9/2013 15:38	B270 ethyl-FOSE	U0000118	N/A	0.0008	0.0066	0.0217	0.0125	0	0.0166	0	0.0181	0.042	0.0262	0.0007	0	0.9714	0	21.9385	0	0	0.0001
12/9/2013 15:39	B270 ethyl-FOSE	U0000119	N/A	0.0152	0.0065	0.0077	0.0115	0	0.0162	0	0.0192	0.017	0.028	0.0006	0	0.9689	0	22.0171	0	0	0.0001
12/9/2013 15:44	B270 ethyl-FOSE	U0000120	N/A	7.7074	0.0481	2.0068	0.0735	0	0.0861	1.9121	0.1177	0	0.1537	0.2445	0.0008	0.9706	0	22.0957	0	0	0.0004
12/9/2013 15:45	B270 ethyl-FOSE	U0000121	N/A	5.7211	0.0363	1.9319	0.051	0	0.0648	1.8797	0.0988	0	0.1053	0.1514	0.0009	0.9718	0	21.8598	0	0	0.0003
12/9/2013 15:45	B270 ethyl-FOSE	U0000122	N/A	3.4022	0.0247	1.8213	0.0325	0	0.0447	1.7688	0.0824	0	0.0733	0.0686	0.0006	0.9706	0	22.0171	0	0	0.0002
12/9/2013 15:46	B270 ethyl-FOSE	U0000123	N/A	0.7415	0.0086	1.7723	0.0262	0	0.0631	1.8058	0.0625	0	0.0365	0.0138	0.0002	0.9677	0	21.9385	0	0	0.0001
12/9/2013 15:46	B270 ethyl-FOSE	U0000124	N/A	0.2044	0.007	1.7792	0.0259	0.0017	0.0235	1.8549	0.0437	0	0.0279	0.0019	0.0001	0.9722	0	22.0171	0	0.0002	0.0001
12/9/2013 15:47	B270 ethyl-FOSE	U0000125	N/A	0.1227	0.0065	1.7548	0.0266	0.0126	0.0191	1.8702	0.0398	0	0.0256	0.0007	0.0001	0.971	0	21.9385	0	0.0001	0.0001
12/9/2013 15:48	B270 ethyl-FOSE	U0000126	N/A	0.1005	0.0068	1.7768	0.0265	0	0.0181	1.8807	0.0393	0	0.0254	0.0005	0.0001	0.971	0	22.0171	0	0	0.0001
12/9/2013 15:48	B270 ethyl-FOSE	U0000127	N/A	0.099	0.0069	1.7745	0.0266	0.0182	0.0181	1.9062	0.0377	0	0.0262	0.0004	0.0001	0.971	0	22.0171	0	0.0001	0.0001
12/9/2013 15:49	B270 ethyl-FOSE	U0000128	N/A	0.0757	0.0069	1.7631	0.0264	0.0378	0.0178	1.852	0.0365	0	0.0265	0.0003	0.0001	0.971	0	22.0171	0	0	0.0001
12/9/2013 15:49	B270 ethyl-FOSE	U0000129	N/A	0.0839	0.0065	1.7674	0.0263	0.0198	0.0173	1.8821	0.0362	0	0.0272	0.0003	0.0002	0.9706	0	22.0171	0	0	0.0001
12/9/2013 15:50	B270 ethyl-FOSE	U0000130	N/A	0.069	0.0068	1.768	0.0271	0	0.0174	1.8733	0.0368	0	0.0304	0.0003	0.0002	0.971	0	21.8598	0	0	0.0001
12/9/2013 15:51	B270 ethyl-FOSE	U0000131	N/A	0.0715	0.0068	1.7646	0.0275	0	0.0181	1.8509	0.038	0	0.0283	0.0004	0.0002	0.9706	0	21.8598	0	0.0001	0.0001
12/9/2013 15:51	B270 ethyl-FOSE	U0000132	N/A	0.0635	0.0069	1.7872	0.0263	0	0.0169	1.9265	0.0363	0	0.0301	0.0003	0.0002	0.9706	0	21.9385	0	0.0003	0.0001
12/9/2013 15:55	B270 ethyl-FOSE	U0000133	N/A	0.0734	0.0064	0.1995	0.0115	0	0.0168	0.1794	0.0198	0.038	0.024	0.0006	0.0001	0.9706	0	21.7812	0	0.0003	0.0001
12/9/2013 15:55	B270 ethyl-FOSE	U0000134	N/A	0.061	0.0066	0.0459	0.0122	0	0.0176	0.0452	0.0177	0	0.0238	0.0005	0	0.9706	0	21.8598	0	0.0003	0.0001
12/9/2013 15:56	B270 ethyl-FOSE	U0000135	N/A	0.0426	0.0067	0.0156	0.0117	0	0.0172	0.0287	0.0179	0	0.0259	0.0005	0	0.9685	0	21.8598	0	0.0002	0.0001
12/9/2013 15:56	B270 ethyl-FOSE	U0000136	N/A	0.0431	0.0068	0.0059	0.0117	0	0.0175	0.0002	0.0173	0.0135	0.0318	0.0005	0	0.971	0	21.7026	0	0	0.0001
12/9/2013 15:57	B270 ethyl-FOSE	U0000137	N/A	0.0433	0.0068	0.0059	0.0121	0	0.0168	0.021	0.0186	0.0296	0.0288	0.0005	0	0.9706	0	21.7812	0	0.0001	0.0001
12/9/2013 15:58	B270 ethyl-FOSE	U0000138	N/A	0.0362	0.0068	0	0.0114	0	0.0172	0.005	0.0177	0.0222	0.0258	0.0004	0	0.9706	0	21.8598	0	0	0.0001
12/9/2013 16:00	B270 ethyl-FOSE	U0000139	N/A	0.1204	0.0278	0	0.0108	20.3142	0.0888	0.0021	0.0423	0.0449	0.0855	0.0023	0.0001	0.9706	0	21.8598	0	0.0003	0.0002
12/9/2013 16:01	B270 ethyl-FOSE	U0000140	N/A	0.0852	0.0281	0	0.0124	20.1975	0.0893	0	0.0388	0.0499	0.0788	0.0015	0.0001	0.9706	0	21.9385	0	0	0.0002
12/9/2013 16:02	B270 ethyl-FOSE	U0000141	N/A	0.0633	0.0281	0	0.0113	20.2208	0.0894	0	0.038	0.0893	0.0833	0.0014	0.0001	0.971	0	21.8598	0	0.0001	0.0002
12/9/2013 16:03	B270 ethyl-FOSE	U0000142	N/A	0.051	0.0276	0	0.0117	20.2746	0.0878	0.0426	0.0375	0.0698	0.0782	0.0014	0.0001	0.9706	0	21.8598	0	0.0002	0.0002
12/9/2013 16:03	B270 ethyl-FOSE	U0000143	N/A	0.0686	0.0276	0	0.0124	20.2774	0.0875	0.0409	0.0363	0.0603	0.0842	0.0013	0.0001	0.9706	0	21.8598	0	0.0001	0.0002
12/9/2013 16:04	B270 ethyl-FOSE	U0000144	N/A	0.0535	0.0279	0	0.0118	20.2353	0.0885	0.0169	0.0371	0.0647	0.082	0.0012	0.0001	0.971	0	21.8598	0	0.0002	0.0002
12/9/2013 16:04	B270 ethyl-FOSE	U0000145	N/A	0.0465	0.0278	0	0.012	20.3048	0.0884	0.0263	0.0373	0.0998	0.0803	0.0012	0.0001	0.9706	0	21.9385	0	0.0001	0.0002
12/9/2013 16:05	B270 ethyl-FOSE	U0000146	N/A	0.0511	0.0279	0	0.0122	20.2923	0.0883	0.0067	0.0378	0.0122	0.09	0.0011	0.0001	0.9706	0	21.8598	0	0.0001	0.0002
12/9/2013 16:06	B270 ethyl-FOSE	U0000147	N/A	0.0555	0.0277	0	0.0123	20.213	0.0879	0.0185	0.0376	0.0842	0.0819	0.0011	0.0001	0.971	0	21.2308	0	0	0.0002
12/9/2013 16:06	B270 ethyl-FOSE	U0000148	N/A	0.0567	0.0279	0	0.0121	20.2487	0.0884	0.0159	0.0371	0.0643	0.0817	0.0011	0.0001	0.9698	0	21.7026	0	0	0.0002

E13-0880 Final Analytical Report, Appendix-A

Time	Filename	Ammonia (ppm)	SEC (ppm)	FMU, %	CO (ppm)	SEC (ppm)	FMU, %	Ethylene (ppm)	SEC (ppm)	FMU, %	Methane (ppm)	SEC (ppm)	FMU, %	Methanol (ppm)	SEC (ppm)	FMU, %	ethylFOSE (ppm)	SEC (ppm)	FMU, %	Moisture (ppm)	SEC (ppm)	Press (atm)	Temp (C)
7:59:05	U0000001	0	0.0082	#DIV/0!	0	0.0112	#DIV/0!	0.0787	0.0229	58.2%	0.0143	0.0154	215.4%	0	0.0189	#DIV/0!	0	0.0001		0	0	0.9689	21.5453
7:59:40	U0000002	0.0164	0.0089	108.5%	0	0.0115	#DIV/0!	0.0815	0.0254	62.3%	0.0228	0.0152	133.3%	0	0.0182	#DIV/0!	0	0.0001		0	0	0.9698	21.5453
8:00:16	U0000003	0	0.0088	#DIV/0!	0	0.0125	#DIV/0!	0.083	0.025	60.2%	0	0.015	#DIV/0!	0	0.0275	#DIV/0!	0	0.0001		0	0	0.9677	21.7026
8:05:03	U0000004	0.0062	0.0066	212.9%	0.0031	0.0123	793.5%	0	0.0165	#DIV/0!	0	0.0162	#DIV/0!	0	0.0266	#DIV/0!	0	0.0001		0	0	0.9698	21.5453
8:05:39	U0000005	0.008	0.0066	165.0%	0.0022	0.0121	1100.0%	0	0.016	#DIV/0!	0	0.0163	#DIV/0!	0	0.0225	#DIV/0!	0.0002	0.0001		0.0001	0	0.9698	21.5453
8:08:44	U0000006	0.0015	0.0241	3213.3%	0	0.0115	#DIV/0!	18.353	0.0761	0.8%	0.0095	0.0523	1101.1%	0.0506	0.0703	277.9%	0	0.0001		0.0069	0.0001	0.9698	21.5453
8:09:20	U0000007	0	0.0271	#DIV/0!	0	0.0119	#DIV/0!	20.1471	0.0858	0.9%	0.0171	0.0414	484.2%	0.0634	0.0762	240.4%	0	0.0002		0.0025	0.0001	0.9698	21.6239
8:09:56	U0000008	0.0041	0.0272	1326.8%	0	0.012	#DIV/0!	20.3409	0.0864	0.8%	0	0.0381	#DIV/0!	0.0797	0.0827	207.5%	0	0.0002		0.0018	0.0001	0.9698	21.5453
8:10:32	U0000009	0.0048	0.0268	1116.7%	0	0.0122	#DIV/0!	20.3145	0.0849	0.8%	0.0117	0.0387	661.5%	0.0393	0.0838	426.5%	0	0.0002		0.0014	0.0001	0.9698	21.5453
8:11:08	U0000010	0	0.0269	#DIV/0!	0	0.0114	#DIV/0!	20.2869	0.0851	0.8%	0	0.0367	#DIV/0!	0.0902	0.0808	179.2%	0.0001	0.0002		0.0012	0.0001	0.9698	21.5453
8:11:44	U0000011	0	0.0268	#DIV/0!	0	0.0122	#DIV/0!	20.3085	0.0851	0.8%	0	0.0345	#DIV/0!	0.0581	0.0817	281.2%	0	0.0002		0.0012	0.0001	0.9698	21.4667
8:12:20	U0000012	0.0145	0.0272	375.2%	0	0.0128	#DIV/0!	20.3176	0.0862	0.8%	0.0095	0.0355	747.4%	0.0393	0.0799	406.6%	0	0.0002		0.0011	0.0001	0.9698	21.5453
8:49:23	U0000013	0.0078	0.0064	164.1%	0.0137	0.0118	172.3%	0	0.0159	#DIV/0!	0.0185	0.0162	175.1%	0.0293	0.0287	195.9%	0	0.0001		0	0	0.9698	21.4667
8:49:59	U0000014	0	0.0065	#DIV/0!	0.023	0.0104	90.4%	0.0013	0.0161	2476.9%	0	0.0152	#DIV/0!	0	0.0255	#DIV/0!	0	0.0001		0.0001	0	0.9694	21.4667
8:50:35	U0000015	0.0006	0.0068	2266.7%	0	0.0117	#DIV/0!	0	0.0159	#DIV/0!	0	0.0173	#DIV/0!	0	0.0283	#DIV/0!	0	0.0001		0	0	0.9698	21.4667
8:51:11	U0000016	0.0122	0.0066	108.2%	0.0278	0.0124	89.2%	0	0.0171	#DIV/0!	0	0.0169	#DIV/0!	0	0.0246	#DIV/0!	0	0.0001		0	0	0.9698	21.5453
8:51:47	U0000017	0	0.0066	#DIV/0!	0	0.0118	#DIV/0!	0	0.0166	#DIV/0!	0.0156	0.0164	210.3%	0.0163	0.0251	308.0%	0	0.0001		0	0	0.9702	21.4667
8:52:23	U0000018	0.002	0.0062	620.0%	0	0.0112	#DIV/0!	0	0.0152	#DIV/0!	0	0.0161	#DIV/0!	0	0.0268	#DIV/0!	0	0.0001		0	0	0.9698	21.5453
9:03:27	U0000019	0	0.0064	#DIV/0!	0.048	0.0129	53.8%	0	0.026	#DIV/0!	0	0.0522	#DIV/0!	0.4717	0.0281	11.9%	0.0017	0.0001		0.0153	0.0002	1.0195	21.5453
9:04:03	U0000020	0.0002	0.0066	6600.0%	0.0447	0.0131	58.6%	0	0.0256	#DIV/0!	0.009	0.053	1177.8%	0.4695	0.0325	13.8%	0.0015	0.0001		0.0152	0.0002	1.0195	21.4667
9:04:39	U0000021	0.0144	0.0068	94.4%	0.0508	0.0122	48.0%	0	0.0266	#DIV/0!	0	0.0543	#DIV/0!	0.5042	0.031	12.3%	0.0016	0.0001		0.015	0.0002	1.0195	21.6239
9:05:15	U0000022	0.0062	0.0066	212.9%	0.045	0.0119	52.9%	0	0.0259	#DIV/0!	0.0295	0.0539	365.4%	0.4358	0.0331	15.2%	0.0015	0.0001		0.0148	0.0002	1.0195	21.7026
9:05:51	U0000023	0	0.0066	#DIV/0!	0.0442	0.0129	58.4%	0	0.0257	#DIV/0!	0.0122	0.0513	841.0%	0.488	0.027	11.1%	0.0016	0.0001		0.0147	0.0002	1.0171	21.4667
9:06:27	U0000024	0.0062	0.0071	229.0%	0.0456	0.0111	48.7%	0	0.0261	#DIV/0!	0.0538	0.0528	196.3%	0.4476	0.0437	19.5%	0.0016	0.0001		0.0145	0.0002	1.0195	21.7026
9:07:03	U0000025	0.0072	0.0064	177.8%	0.0321	0.0118	73.5%	0	0.0239	#DIV/0!	0.0467	0.0522	223.6%	0.4646	0.0292	12.6%	0.0016	0.0001		0.0144	0.0002	1.0199	21.4667
9:07:39	U0000026	0.0023	0.0068	591.3%	0.0389	0.0125	64.3%	0	0.0244	#DIV/0!	0	0.0528	#DIV/0!	0.411	0.0371	18.1%	0.0018	0.0001		0.0143	0.0002	1.0195	21.7026
9:08:15	U0000027	0.0143	0.0064	89.5%	0.0339	0.0117	69.0%	0	0.024	#DIV/0!	0.0143	0.0519	725.9%	0.4749	0.0286	12.0%	0.0017	0.0001		0.0143	0.0002	1.0199	21.6239
9:15:02	U0000028	0.027	0.0338	250.4%	0.7795	0.0977	25.1%	0	0.1412	#DIV/0!	0.8684	0.1331	30.7%	2.8434	0.0983	6.9%	0	0.0004		0.2939	0.001	0.9698	21.7026
9:15:38	U0000029	0.0053	0.0337	1271.7%	0.8342	0.0971	23.3%	0.0475	0.072	303.2%	0.8627	0.1304	30.2%	2.8142	0.0899	6.4%	0	0.0004		0.2907	0.001	0.9698	21.4667
9:16:14	U0000030	0.0111	0.0331	596.4%	0.8761	0.0967	22.1%	0.0003	0.0707	47133.3%	0.9291	0.1299	28.0%	2.7659	0.0978	7.1%	0.0001	0.0004		0.2882	0.001	0.9685	21.4667
9:16:50	U0000031	0.0044	0.033	1500.0%	0.8752	0.095	21.7%	0.0301	0.0703	467.1%	0.9425	0.1277	27.1%	2.6898	0.0954	7.1%	0	0.0004		0.2854	0.001	0.9706	21.4667
9:17:26	U0000032	0.0019	0.0324	3410.5%	0.9413	0.0955	20.3%	0	0.1308	#DIV/0!	0.9871	0.1282	26.0%	2.6331	0.1013	7.7%	0	0.0004		0.2843	0.001	0.9706	21.6239
9:18:02	U0000033	0.0044	0.0321	1459.1%	0.9307	0.0935	20.1%	0	0.1271	#DIV/0!	1.0282	0.126	24.5%	2.5186	0.0955	7.6%	0	0.0004		0.2824	0.001	0.9702	21.6239
9:18:38	U0000034	0.0022	0.0322	2927.3%	0.9675	0.0937	19.4%	0.0247	0.0685	554.7%	1.0327	0.1281	24.8%	2.5297	0.0942	7.4%	0	0.0004		0.2794	0.001	0.971	21.7026
9:19:14	U0000035	0	0.0315	#DIV/0!	0.9999	0.0944	18.9%	0.0078	0.0675	1730.8%	1.0528	0.1273	24.2%	2.5196	0.0982	7.8%	0	0.0004		0.2782	0.001	0.9706	21.7026
9:19:50	U0000036	0	0.0315	#DIV/0!	1.0403	0.0934	18.0%	0.0185	0.0665	718.9%	1.111	0.1272	22.9%	2.3565	0.0973	8.3%	0	0.0004		0.2764	0.0011	0.9706	21.5453
9:20:26	U0000037	0.0008	0.0309	7725.0%	1.0697	0.0908	17.0%	0.0079	0.0659	1668.4%	1.1329	0.1243	21.9%	2.3762	0.0895	7.5%	0	0.0004		0.2726	0.001	0.9706	21.7026
9:21:02	U0000038	0	0.0308	#DIV/0!	1.1389	0.0925	16.2%	0.0342	0.0667	390.1%	1.2	0.1253	20.9%	2.2142	0.0868	7.8%	0	0.0004		0.2722	0.001	0.9677	21.5453
9:21:38	U0000039	0.008	0.0303	757.5%	1.1284	0.0916	16.2%	0.0112	0.0644	1150.0%	1.174	0.125	21.3%	2.1761	0.0886	8.1%	0	0.0004		0.2702	0.0011	0.971	21.7026
9:22:14	U0000040	0	0.0308	#DIV/0!	1.1515	0.0915	15.9%	0	0.1107	#DIV/0!	1.1717	0.1245	21.3%	2.1661	0.0994	9.2%	0	0.0004		0.2715	0.001	0.971	21.6239
9:23:34	U0000041	0.0005	0.0305	12200.0%	1.2115	0.0912	15.1%	0.0076	0.0654	1721.1%	1.2406	0.1252	20.2%	2.1124	0.0749	7.1%	0	0.0004		0.2714	0.001	0.971	21.7026
9:28:35	U0000042	0	0.0321	#DIV/0!	1.4198	0.0958	13.5%	0	0.0948	#DIV/0!	1.4314	0.1263	17.6%	1.7107	0.0827	9.7%	0	0.0004		0.2776	0.0011	0.971	21.6239
9:33:36	U0000043	0	0.0349	#DIV/0!	1.5841	0.1013	12.8%	0.0469	0.0735	313.4%	1.5467	0.1338	17.3%	1.3751	0.0848	12.3%	0	0.0004		0.2942	0.0011	0.9706	21.7812
9:38:37	U0000044	0	0.0354	#DIV/0!	1.7063	0.1033	12.1%	0.0364	0.0733	402.7%	1.6494	0.1335	16.2%	1.1296	0.0883	15.6%	0	0.0004		0.2975	0.0011	0.9706	21.6239
9:43:38	U0000045	0	0.0346	#DIV/0!	1.7969	0.1018	11.3%	0	0.0806	#DIV/0!	1.6749	0.1332	15.9%	1.0162	0.0747	14.7%	0	0.0004		0.2958	0.0011	0.9706	21.7812
9:48:39	U0000046	0	0.0373	#DIV/0!	1.8919	0.1085	11.5%	0	0.0807	#DIV/0!	1.739	0.1388	16.0%	0.9006	0.0839	18.6%	0	0.0004		0.3116	0.0011	0.971	21.5453
9:53:40	U0000047	0	0.0371	#DIV/0!	1.9656	0.1066	10.8%	0	0.0809	#DIV/0!	1.7575	0.1392	15.8%	0.8441	0.0863	20.4%	0	0.0004		0.3119	0.001	0.9706	21.7026
9:58:41	U0000048	0	0.0371	#DIV/0!	1.9919	0.1082	10.9%	0	0.0793	#DIV/0!	1.8083	0.1419	15.7%	0.7047	0.0803	22.8%	0	0.0004		0.3137	0.001	0.971	21.7026
10:03:42	U0000049	0	0.037	#DIV/0!	2.0431	0.1086	10.6%	0	0.0787	#DIV/0!	1.871	0.1413	15.1%	0.705	0.0817	23.2%	0	0.0004		0.317	0.001	0.971	21.7026
10:08:43	U0000050	0	0.0379	#DIV/0!	2.0542	0.1089	10.6%	0	0.0808	#DIV/0!	1.8327	0.1419	15.5%	0.6799	0.0806	23.7%	0	0.0004		0.3141	0.0011	0.9706	21.6239
10:13:44	U0000051	0	0.0379	#DIV/0!	2.0789	0.1111	10.7%	0	0.0801	#DIV/0!	1.8277	0.1414	15.5%	0.6447	0.0875	27.1%	0	0.0004		0.3172	0.0011	0.971	21.7026
10:18:45	U0000052	0	0.038	#DIV/0!	2.1154	0.1085	10.3%	0	0.0797	#DIV/0!	1.8689	0.1416	15.2%	0.6422	0.0895	27.9%	0	0.0004		0.3175	0.001	0.9706	21.6239
10:23:46	U0000053	0	0.0373	#DIV/0!	2.1468	0.1072	10.0%	0	0.0775	#DIV/0!	1.8606	0.1409	15.1%	0.5503	0.0739	26.9%	0	0.0004		0.3151	0.001	0.9706	21.7026
10:28:47	U0000054	0.2226	0.0373	33.5%	2.1485	0.1055	9.8%	0	0.0795	#DIV/0!	1.8462	0.1417	15.4%	0.5349	0.0794	29.7%	0	0.0004		0.3168	0.001	0.971	21.7026
10:33:48	U0000055	0.6911	0.0367	10.6%	2.1507	0.1058	9.8%	0	0.0952	#DIV/0!	1.8956	0.1427	15.1%	0.4677	0.0825	35.3%	0	0.0004		0.315	0.001	0.9706	21.7026
10:38:49	U0000056	0.7556	0.0369	9.8%	2.1435	0.104	9.7%	0	0.0979	#DIV/0!	1.897	0.1414	14.9%	0.5289	0.0826	31.2%	0	0.0004		0.3147	0.001	0.9706	21.7026
10:43:50	U0000057	0.8087	0.0372	9.2%	2.1505	0.1036	9.6%	0	0.1001	#DIV/0!	1.9129	0.1414	14.8%	0.4557	0.0846	37.1%	0	0.0004		0.3163	0.001	0.9706	21.8598
10:48:51	U0000058	0.6755	0.0363	10.7%	2.1554	0.1037	9.6%	0	0.0923	#DIV/0!	1.8878	0.1388	14.7%	0.4677	0.0744	31.8%	0	0.0004		0.3157	0.001	0.971	21.7026
10:53:53	U0000059	0.7345	0.0362	9.9%	2.1571	0.1037	9.6%	0	0.095	#DIV/0!	1.9178	0.1424	14.9%	0.3788	0.0757	40.0%	0	0.0004		0.3176	0.0009	0.9706	21.7026
10:58:54	U0000060	1.3016	0.0376	5.8%	2.1804	0.1041	9.5%	0	0.0751	#DIV/0!	1.8802	0.1426	15.2%	0.3753	0.0751	40.0%	0	0.0004		0.317	0.001	0.9706	21.9385
11:03:55	U0000061	0.9866	0.0368	7.5%	2.1723	0.1042	9.6%	0	0.0736	#DIV/0!	1.8842	0.1426	15.1%	0.4213	0.0691	32.8%	0	0.0004		0.3174	0.0009	0.971	21.7026
11:08:56	U0000062	1.2612	0.0374	5.9%	2.156	0.1041	9.7%	0	0.0743	#DIV/0!	1.9146	0.1414	14.8%	0.4216	0.0759	36.0%	0	0.0004		0.3129	0.001	0.971	21.7026
11:13:57	U0000063	1.6276	0.0376	4.6%	2.2097	0.1029	9.3%	0	0.074	#DIV/0!	1.9023	0.1378	14.5%	0.3472	0.0866	49.9%	0	0.0004		0.3132	0.001	0.971	21.8598
11:18:58	U0000064	1.4892	0.0379	5.1%	2.1819	0.1049	9.6%	0	0.0756	#DIV/0!	1.9248	0.1401	14.6%	0.2957	0.0788	53.3%	0	0.0004		0.3156	0.001	0.971	21.8598
11:23:59	U0000065	1.6732	0.0384	4.6%	2.2114	0.105	9.5%	0	0.0773	#DIV/0!	1.9178	0.1394	14.5%	0.2953	0.0786	53.2%	0	0.0004		0.3142	0.001	0.971	21.7026
11:29:00	U0000066	1.791	0.0385	4.3%	2.1814	0.1058	9.7%	0	0.0761	#DIV/0!	1.8936	0.1401	14.8%	0.2741	0.0878	64.1%	0	0.0004		0.3154	0.001	0.9706	21.9385
11:34:01	U0000067	1.7606	0.0379	4.3%	2.2071	0.1052	9.5%	0	0.0753	#DIV/0!	1.8499	0.141	15.2%	0.2831	0.0802	56.7%	0	0.0004		0.3134	0.001	0.9706	21.7026
11:39:02	U0000068	1.9827	0.038	3.8%	2.2111	0.1034	9.4%	0	0.0756	#DIV/0!	1.9199	0.1405	14.6%	0.261	0.0778	59.6%	0	0.0004		0.3139	0.001	0.9706	21.8598
11:44:03	U0000069	2.2443	0.0383	3.4%	2.1894	0.1035	9.5%	0	0.0764	#DIV/0!	1.9275	0.1394	14.5%	0.2585	0.0889	68.8%	0	0.0004		0.3108	0.001	0.9706	21.9385
11:49:04	U0000070	2.4505	0.0393	3.2%	2.221	0.1024	9.2%	0	0.0774	#DIV/0!	1.9278	0.1408	14.6%	0.2382	0.0861	72.3%	0	0.0004		0.3088	0.001	0.9706	21.8598
11:54:05	U0000071	2.4921	0.0392	3.1%	2.1992	0.1053	9.6%	0	0.079	#DIV/0!	1.9092	0.1404	14.7%	0.2277	0.0976	85.7%	0	0.0004		0.3113	0.001	0.9706	21.8598
11:59:06	U0000072	2.588	0.0397	3.1%	2.2063	0.1037	9.4%	0	0.0792	#DIV/0!	1.9242	0.1394	14.5%	0.2226	0.0901	81.0%	0	0.0005		0.3117	0.001	0.9706	21.7812
12:04:07	U0000073	2.8893	0.0405	2.8%	2.2057	0.1059	9.6%	0	0.0795	#DIV/0!	1.9277	0.1403	14.6%	0.1856	0.1006	108.4%	0	0.0005		0.3142	0.001	0.971	21.8598
12:09:08	U0000074	3.2634	0.041	2.5%	2.2117	0.1049	9.5%	0	0.0809	#DIV/0!	1.8733	0.1433	15.3%	0.2076	0.1038	100.0%	0	0.0005		0.3142	0.001	0.9706	21.7812
12:14:09	U0000075	3.6378	0.0424	2.3%	2.2359	0.1064	9.5%	0	0.0826	#DIV/0!	1.89	0.1429	15.1%	0.183	0.1174	128.3%	0	0.0005		0.3161	0.001	0.9706	21.9385
12:19:11	U0000076	3.3373	0.0414	2.5%	2.2181	0.1048	9.4%	0	0.0807	#DIV/0!	1.8878	0.1409	14.9%	0.1221	0.0935	153.2%	0	0.0005		0.3146	0.001	0.9706	21.8598
12:24:12	U0000077	3.6776	0.0425	2.3%	2.216	0.1072	9.7%	0	0.0826	#DIV/0!	1.9162	0.1423	14.9%	0.1049	0.0999	190.5%	0	0.0005		0.3156	0.001	0.9706	21.9385
12:29:13	U0000078	4.3525	0.0446	2.0%	2.2067	0.1067	9.7%	0	0.0862	#DIV/0!	1.8812	0.1429	15.2%	0.0891	0.1068	239.7%	0	0.0005		0.3153	0.001	0.9706	21.8598
12:34:14	U0000079	4.5781	0.0448	2.0%	2.2357	0.1045	9.3%	0	0.0867	#DIV/0!	1.9158	0.1438	15.0%	0.0005	0.1701	68040.0%	0	0.0005		0.3154	0.001	0.9706	21.9385
12:39:15	U0000080	4.7143	0.0451	1.9%	2.2215	0.106	9.5%	0	0.0871	#DIV/0!	1.9128	0.1426	14.9%	0.1106	0.1181	213.6%	0	0.0005		0.3144	0.001	0.9706	21.8598
12:44:16	U0000081	4.3564	0.0444	2.0%	2.2544	0.106	9.4%	0	0.0856	#DIV/0!	1.9093	0.1429	15.0%	0.073	0.1163	318.6%	0	0.0005		0.3149	0.001	0.9706	21.9385
12:49:17	U0000082	4.3951	0.0441	2.0%	2.2371	0.1041	9.3%	0	0.0852	#DIV/0!	1.9217	0.1425	14.8%	0.0738	0.116	314.4%	0	0.0005		0.316	0.001	0.9706	21.9385
12:54:18	U0000083	4.4325	0.0447	2.0%	2.2133	0.1058	9.6%	0	0.0846	#DIV/0!	1.912	0.1428	14.9%	0.0877	0.1014	231.2%	0	0.0005		0.3147	0.001	0.9706	21.8598
12:59:19	U0000084	4.704	0.0445	1.9%	2.2236	0.1041	9.4%	0	0.0859	#DIV/0!	1.8999	0.1428	15.0%	0.0654	0.1171	358.1%	0	0.0005		0.314	0.001	0.971	21.8598
13:04:20	U0000085	4.8292	0.0453	1.9%	2.2161	0.1034	9.3%	0	0.0859	#DIV/0!	1.9198	0.1413	14.7%	0.0481	0.1189	494.4%	0	0.0005		0.3162	0.001	0.9706	21.8598
13:09:21	U0000086	4.8793	0.0459	1.9%	2.2358	0.1047	9.4%	0	0.0872	#DIV/0!	1.8984	0.143	15.1%	0.0462	0.1214	525.5%	0	0.0005		0.3158	0.001	0.9706	21.8598
13:14:22	U0000087	5.0059	0.0461	1.8%	2.2086	0.106	9.6%	0	0.0874	#DIV/0!	1.9145	0.145	15.1%	0.0527	0.1275	483.9%	0	0.0005		0.3153	0.001	0.9706	21.8598
13:19:23	U0000088	4.4362	0.0445	2.0%	2.2406	0.1064	9.5%	0	0.0855	#DIV/0!	1.9072	0.141	14.8%	0.0425	0.1069	503.1%	0	0.0005		0.3159	0.001	0.9706	21.8598
13:24:24	U0000089	4.5703	0.0455	2.0%	2.2315	0.1072	9.6%	0	0.0884	#DIV/0!	1.9282	0.1432	14.9%	0.0732	0.1183	323.2%	0	0.0005		0.3161	0.001	0.971	21.9385
13:29:26	U0000090	4.8279	0.047	1.9%	2.2414	0.1098	9.8%	0	0.0902	#DIV/0!	1.9211	0.1434	14.9%	0.0359	0.1208	673.0%	0	0.0005		0.3168	0.001	0.9706	21.8598
13:34:27	U0000091	4.273	0.0449	2.1%	2.2436	0.11	9.8%	0	0.0879	#DIV/0!	1.9268	0.1444	15.0%	0.104	0.1118	215.0%	0	0.0005		0.3164	0.001	0.971	21.8598
13:39:28	U0000092	4.1152	0.0448	2.2%	2.249	0.1079	9.6%	0	0.0876	#DIV/0!	1.9104	0.143	15.0%	0.0905	0.1074	237.3%	0	0.0005		0.316	0.001	0.9685	21.9385

E13-0880 Final Analytical Report, Appendix-A

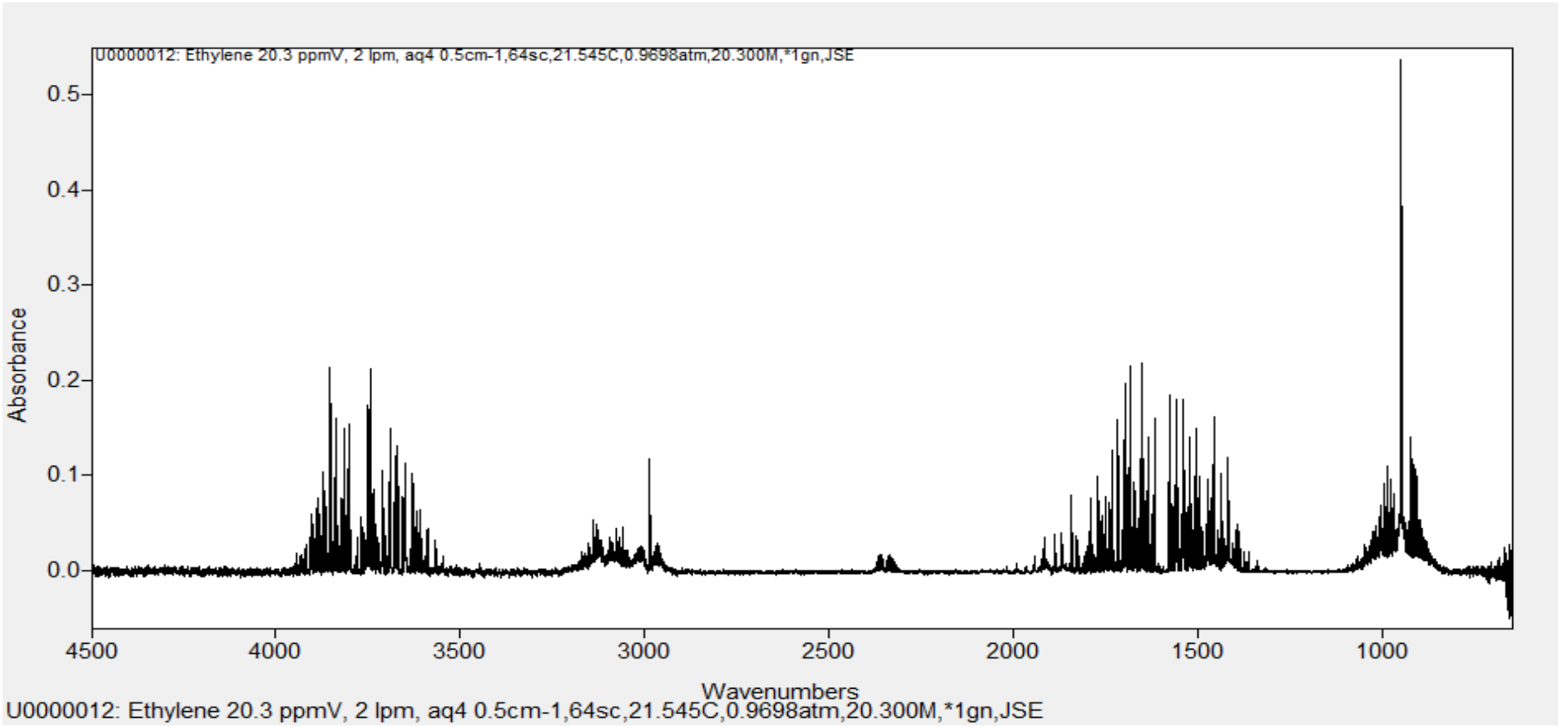
13:44:29	U0000093	4.0323	0.0442	2.2%	2.2645	0.1069	9.4%	0	0.0862	#DIV/0!	1.8679	0.1428	15.3%	0.0795	0.1112	279.7%	0	0.0005	0.315	0.001	0.971	21.8598
13:49:30	U0000094	4.1195	0.0442	2.1%	2.2496	0.1088	9.7%	0	0.086	#DIV/0!	1.8936	0.144	15.2%	0.0919	0.107	232.9%	0	0.0005	0.316	0.001	0.9706	21.9385
13:54:31	U0000095	4.184	0.0447	2.1%	2.2656	0.1074	9.5%	0	0.0862	#DIV/0!	1.87	0.1435	15.3%	0.1399	0.1143	163.4%	0	0.0005	0.3143	0.001	0.971	21.9385
13:59:32	U0000096	4.1938	0.0443	2.1%	2.2277	0.1064	9.6%	0	0.0855	#DIV/0!	1.8574	0.1414	15.2%	0.0966	0.1128	233.5%	0	0.0005	0.3134	0.001	0.971	21.7026
14:04:36	U0000097	4.6446	0.0454	2.0%	2.2188	0.1056	9.5%	0	0.0871	#DIV/0!	1.9247	0.1413	14.7%	0.0425	0.1121	527.5%	0	0.0005	0.3161	0.001	0.9706	21.8598
14:09:37	U0000098	4.9885	0.0462	1.9%	2.2294	0.1056	9.5%	0	0.0882	#DIV/0!	1.8988	0.1434	15.1%	0.0273	0.1171	857.9%	0	0.0005	0.3134	0.001	0.9706	21.8598
14:14:38	U0000099	5.1158	0.0464	1.8%	2.2494	0.1061	9.4%	0	0.0889	#DIV/0!	1.8917	0.1433	15.2%	0.0117	0.1835	3136.8%	0	0.0005	0.316	0.001	0.971	21.8598
14:19:39	U0000100	5.3908	0.0474	1.8%	2.2397	0.1056	9.4%	0	0.0893	#DIV/0!	1.9278	0.1436	14.9%	0.0146	0.1987	2721.9%	0	0.0005	0.3163	0.001	0.971	21.8598
14:24:40	U0000101	5.4873	0.0478	1.7%	2.2373	0.1052	9.4%	0	0.0905	#DIV/0!	1.9094	0.1447	15.2%	0.0572	0.1263	441.6%	0	0.0005	0.3167	0.001	0.9706	21.8598
14:29:41	U0000102	6.0468	0.0494	1.6%	2.2423	0.1064	9.5%	0	0.092	#DIV/0!	1.9452	0.1429	14.7%	0	0.1334	#DIV/0!	0	0.0005	0.3176	0.0009	0.971	21.8598
14:34:42	U0000103	6.7935	0.0522	1.5%	2.2364	0.1064	9.5%	0	0.0972	#DIV/0!	1.9174	0.1435	15.0%	0	0.1407	#DIV/0!	0	0.0005	0.3179	0.001	0.9706	21.7026
14:39:43	U0000104	7.0278	0.0532	1.5%	2.2683	0.1063	9.4%	0	0.0996	#DIV/0!	1.9146	0.1438	15.0%	0	0.1432	#DIV/0!	0	0.0005	0.3185	0.001	0.9706	21.8598
14:44:44	U0000105	7.5309	0.0545	1.4%	2.2512	0.1037	9.2%	0	0.1012	#DIV/0!	1.9729	0.1411	14.3%	0	0.1536	#DIV/0!	0	0.0006	0.3158	0.001	0.9706	21.8598
14:49:45	U0000106	8.0732	0.056	1.4%	2.2209	0.1053	9.5%	0	0.1038	#DIV/0!	1.9332	0.1423	14.7%	0	0.155	#DIV/0!	0	0.0006	0.3163	0.001	0.9706	21.8598
14:54:46	U0000107	8.3954	0.0569	1.4%	2.2307	0.1056	9.5%	0	0.1055	#DIV/0!	1.9488	0.1438	14.8%	0	0.1629	#DIV/0!	0	0.0006	0.3154	0.001	0.9706	21.8598
14:59:47	U0000108	8.5224	0.0572	1.3%	2.2297	0.1043	9.4%	0	0.1062	#DIV/0!	1.9613	0.1439	14.7%	0	0.1685	#DIV/0!	0	0.0006	0.3146	0.001	0.971	21.9385
15:04:48	U0000109	9.2226	0.0603	1.3%	2.2718	0.1053	9.3%	0	0.1115	#DIV/0!	1.9707	0.1435	14.6%	0	0.1743	#DIV/0!	0	0.0006	0.3183	0.001	0.9685	21.8598
15:09:49	U0000110	9.5705	0.0617	1.3%	2.2446	0.1056	9.4%	0	0.115	#DIV/0!	1.9694	0.1423	14.5%	0	0.1887	#DIV/0!	0	0.0006	0.3164	0.001	0.9706	21.8598
15:14:50	U0000111	10.1112	0.0639	1.3%	2.2396	0.1055	9.4%	0	0.1187	#DIV/0!	1.9289	0.1444	15.0%	0	0.1902	#DIV/0!	0	0.0006	0.3152	0.001	0.9706	21.8598
15:19:51	U0000112	10.5619	0.0654	1.2%	2.2299	0.1048	9.4%	0	0.8278	#DIV/0!	1.9123	0.1434	15.0%	0	0.2068	#DIV/0!	0	0.0006	0.3168	0.001	0.9698	21.9385
15:35:16	U0000113	0	0.0067	#DIV/0!	0.0052	0.0118	453.8%	0	0.0165	#DIV/0!	0	0.0184	#DIV/0!	0	0.0285	#DIV/0!	0	0.0001	0.0006	0	0.9706	22.0957
15:36:11	U0000114	0.0007	0.0064	1828.6%	0.0299	0.0109	72.9%	0	0.0165	#DIV/0!	0	0.019	#DIV/0!	0.0136	0.0328	482.4%	0	0.0001	0.0008	0	0.971	22.0171
15:36:47	U0000115	0	0.007	#DIV/0!	0.0139	0.0119	171.2%	0	0.017	#DIV/0!	0	0.0177	#DIV/0!	0	0.0216	#DIV/0!	0	0.0001	0.0007	0	0.971	22.0171
15:37:22	U0000116	0.0092	0.0067	145.7%	0.0106	0.0124	234.0%	0	0.0171	#DIV/0!	0.0054	0.018	666.7%	0.0296	0.0268	181.1%	0	0.0001	0.0007	0	0.9706	22.0957
15:37:58	U0000117	0.0033	0.0065	393.9%	0.0115	0.0115	200.0%	0	0.0163	#DIV/0!	0.0003	0.0192	12800.0%	0	0.041	#DIV/0!	0	0.0001	0.0007	0	0.9706	22.0957
15:38:34	U0000118	0.0008	0.0066	1650.0%	0.0217	0.0125	115.2%	0	0.0166	#DIV/0!	0	0.0181	#DIV/0!	0.042	0.0262	124.8%	0	0.0001	0.0007	0	0.9714	21.9385
15:39:10	U0000119	0.0152	0.0065	85.5%	0.0077	0.0115	298.7%	0	0.0162	#DIV/0!	0	0.0192	#DIV/0!	0.017	0.028	329.4%	0	0.0001	0.0006	0	0.9689	22.0171
15:44:24	U0000120	7.7074	0.0481	1.2%	2.0068	0.0735	7.3%	0	0.0861	#DIV/0!	1.9121	0.1177	12.3%	0	0.1537	#DIV/0!	0	0.0004	0.2445	0.0008	0.9706	22.0957
15:45:00	U0000121	5.7211	0.0363	1.3%	1.9319	0.051	5.3%	0	0.0648	#DIV/0!	1.8797	0.0988	10.5%	0	0.1053	#DIV/0!	0	0.0003	0.1514	0.0009	0.9718	21.8598
15:45:36	U0000122	3.4022	0.0247	1.5%	1.8213	0.0325	3.6%	0	0.0447	#DIV/0!	1.7688	0.0824	9.3%	0	0.0733	#DIV/0!	0	0.0002	0.0686	0.0006	0.9706	22.0171
15:46:12	U0000123	0.7415	0.0086	2.3%	1.7723	0.0262	3.0%	0	0.0631	#DIV/0!	1.8058	0.0625	6.9%	0	0.0365	#DIV/0!	0	0.0001	0.0138	0.0002	0.9677	21.9385
15:46:48	U0000124	0.2044	0.007	6.8%	1.7792	0.0259	2.9%	0.0017	0.0235	2764.7%	1.8549	0.0437	4.7%	0	0.0279	#DIV/0!	0.0002	0.0001	0.0019	0.0001	0.9722	22.0171
15:47:24	U0000125	0.1227	0.0065	10.6%	1.7548	0.0266	3.0%	0.0126	0.0191	303.2%	1.8702	0.0398	4.3%	0	0.0256	#DIV/0!	0.0001	0.0001	0.0007	0.0001	0.971	21.9385
15:48:00	U0000126	0.1005	0.0068	13.5%	1.7768	0.0265	3.0%	0	0.0181	#DIV/0!	1.8807	0.0393	4.2%	0	0.0254	#DIV/0!	0	0.0001	0.0005	0.0001	0.971	22.0171
15:48:36	U0000127	0.099	0.0069	13.9%	1.7745	0.0266	3.0%	0.0182	0.0181	198.9%	1.9062	0.0377	4.0%	0	0.0262	#DIV/0!	0.0001	0.0001	0.0004	0.0001	0.971	22.0171
15:49:12	U0000128	0.0757	0.0069	18.2%	1.7631	0.0264	3.0%	0.0378	0.0178	94.2%	1.852	0.0365	3.9%	0	0.0265	#DIV/0!	0	0.0001	0.0003	0.0001	0.971	22.0171
15:49:48	U0000129	0.0839	0.0065	15.5%	1.7674	0.0263	3.0%	0.0198	0.0173	174.7%	1.8821	0.0362	3.8%	0	0.0272	#DIV/0!	0	0.0001	0.0003	0.0002	0.9706	22.0171
15:50:24	U0000130	0.069	0.0068	19.7%	1.768	0.0271	3.1%	0	0.0174	#DIV/0!	1.8733	0.0368	3.9%	0	0.0304	#DIV/0!	0	0.0001	0.0003	0.0002	0.971	21.8598
15:51:00	U0000131	0.0715	0.0068	19.0%	1.7646	0.0275	3.1%	0	0.0181	#DIV/0!	1.8509	0.038	4.1%	0	0.0283	#DIV/0!	0.0001	0.0001	0.0004	0.0002	0.9706	21.8598
15:51:36	U0000132	0.0635	0.0069	21.7%	1.7872	0.0263	2.9%	0	0.0169	#DIV/0!	1.9265	0.0363	3.8%	0	0.0301	#DIV/0!	0.0003	0.0001	0.0003	0.0002	0.9706	21.9385
15:55:00	U0000133	0.0734	0.0064	17.4%	0.1995	0.0115	11.5%	0	0.0168	#DIV/0!	0.1794	0.0198	22.1%	0.038	0.024	126.3%	0.0003	0.0001	0.0006	0.0001	0.9706	21.7812
15:55:36	U0000134	0.061	0.0066	21.6%	0.0459	0.0122	53.2%	0	0.0176	#DIV/0!	0.0452	0.0177	78.3%	0	0.0238	#DIV/0!	0.0003	0.0001	0.0005	0	0.9706	21.8598
15:56:12	U0000135	0.0426	0.0067	31.5%	0.0156	0.0117	150.0%	0	0.0172	#DIV/0!	0.0287	0.0179	124.7%	0	0.0259	#DIV/0!	0.0002	0.0001	0.0005	0	0.9685	21.8598
15:56:48	U0000136	0.0431	0.0068	31.6%	0.0059	0.0117	396.6%	0	0.0175	#DIV/0!	0.0002	0.0173	17300.0%	0.0135	0.0318	471.1%	0	0.0001	0.0005	0	0.971	21.7026
15:57:24	U0000137	0.0433	0.0068	31.4%	0.0059	0.0121	410.2%	0	0.0168	#DIV/0!	0.021	0.0186	177.1%	0.0296	0.0288	194.6%	0.0001	0.0001	0.0005	0	0.9706	21.7812
15:58:00	U0000138	0.0362	0.0068	37.6%	0	0.0114	#DIV/0!	0	0.0172	#DIV/0!	0.005	0.0177	708.0%	0.0222	0.0258	232.4%	0	0.0001	0.0004	0	0.9706	21.8598
16:00:50	U0000139	0.1204	0.0278	46.2%	0	0.0108	#DIV/0!	20.3142	0.0888	0.9%	0.0021	0.0423	4028.6%	0.0449	0.0855	380.8%	0.0003	0.0002	0.0023	0.0001	0.9706	21.8598
16:01:59	U0000140	0.0852	0.0281	66.0%	0	0.0124	#DIV/0!	20.1975	0.0893	0.9%	0	0.0388	#DIV/0!	0.0499	0.0788	315.8%	0	0.0002	0.0015	0.0001	0.9706	21.9385
16:02:35	U0000141	0.0633	0.0281	88.8%	0	0.0113	#DIV/0!	20.2208	0.0894	0.9%	0	0.038	#DIV/0!	0.0893	0.0833	186.6%	0.0001	0.0002	0.0014	0.0001	0.971	21.8598
16:03:11	U0000142	0.051	0.0276	108.2%	0	0.0117	#DIV/0!	20.2746	0.0878	0.9%	0.0426	0.0375	176.1%	0.0698	0.0782	224.1%	0.0002	0.0002	0.0014	0.0001	0.9706	21.8598
16:03:47	U0000143	0.0686	0.0276	80.5%	0	0.0124	#DIV/0!	20.2774	0.0875	0.9%	0.0409	0.0363	177.5%	0.0603	0.0842	279.3%	0.0001	0.0002	0.0013	0.0001	0.9706	21.8598
16:04:23	U0000144	0.0535	0.0279	104.3%	0	0.0118	#DIV/0!	20.2353	0.0885	0.9%	0.0169	0.0371	439.1%	0.0647	0.082	253.5%	0.0002	0.0002	0.0012	0.0001	0.971	21.8598
16:04:59	U0000145	0.0465	0.0278	119.6%	0	0.012	#DIV/0!	20.3048	0.0884	0.9%	0.0263	0.0373	283.7%	0.0998	0.0803	160.9%	0.0001	0.0002	0.0012	0.0001	0.9706	21.9385
16:05:35	U0000146	0.0511	0.0279	109.2%	0	0.0122	#DIV/0!	20.2923	0.0883	0.9%	0.0067	0.0378	1128.4%	0.0122	0.09	1475.4%	0.0001	0.0002	0.0011	0.0001	0.9706	21.8598
16:06:11	U0000147	0.0555	0.0277	99.8%	0	0.0123	#DIV/0!	20.213	0.0879	0.9%	0.0185	0.0376	406.5%	0.0842	0.0819	194.5%	0	0.0002	0.0011	0.0001	0.971	21.2308
16:06:47	U0000148	0.0567	0.0279	98.4%	0	0.0121	#DIV/0!	20.2487	0.0884	0.9%	0.0159	0.0371	466.7%	0.0643	0.0817	254.1%	0	0.0002	0.0011	0.0001	0.9698	21.7026

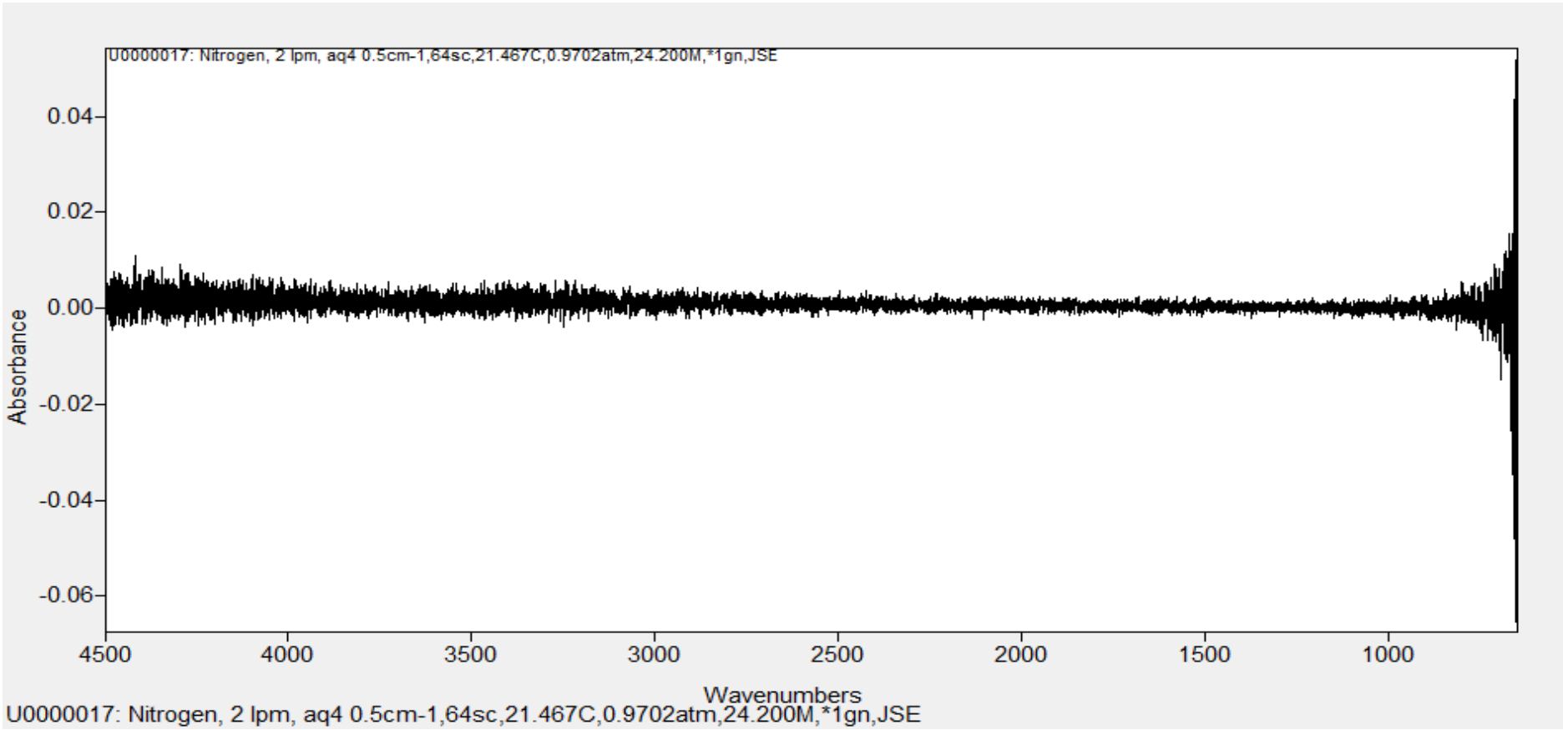
Manual Validation 2/4/2014 By: JSE

Trial	Compound	Ref Spectrum	Conc, ppm-m	Region	Samp Spectrum	SF	PL, m	AQ value, ppmV	Grams value, ppmV	% recovery
1	Ammonia	NH3_12	52.6	800-980	U80	2.52	24.18	4.71	5.48	116.4%
2	Ammonia	NH3_12	52.6	800-980	U80	2.48	24.18	4.71	5.39	114.5%
1	CO	113CO	112.7	2124-2160	U80	0.44	24.18	2.22	2.05	92.4%
2	CO	113CO	112.7	2124-2160	U80	0.47	24.18	2.22	2.19	98.7%
3	CO	113CO	112.7	2124-2160	U30	0.13	24.18	0.9	0.60	66.7%
1	Methane	AIHZME	100	2900-3035	U80	0.46	24.18	1.91	1.90	99.6%
2	Methane	AIHZME	100	2900-3035	U80	0.46	24.18	1.91	1.90	99.6%
3	Methane	AIHZME	100	2900-3035	U30	0.2	24.18	0.93	0.83	88.9%
1	Methanol	MEOHZ9A	22.5	960-1085	U40	2.05	24.18	1.96	1.91	97.3%
2	Methanol	MEOHZ9A	22.5	960-1085	U40	2.08	24.18	1.96	1.94	98.7%
3	Methanol	MEOHZ9A	22.5	960-1085	U47	0.85	24.18	0.84	0.79	94.2%

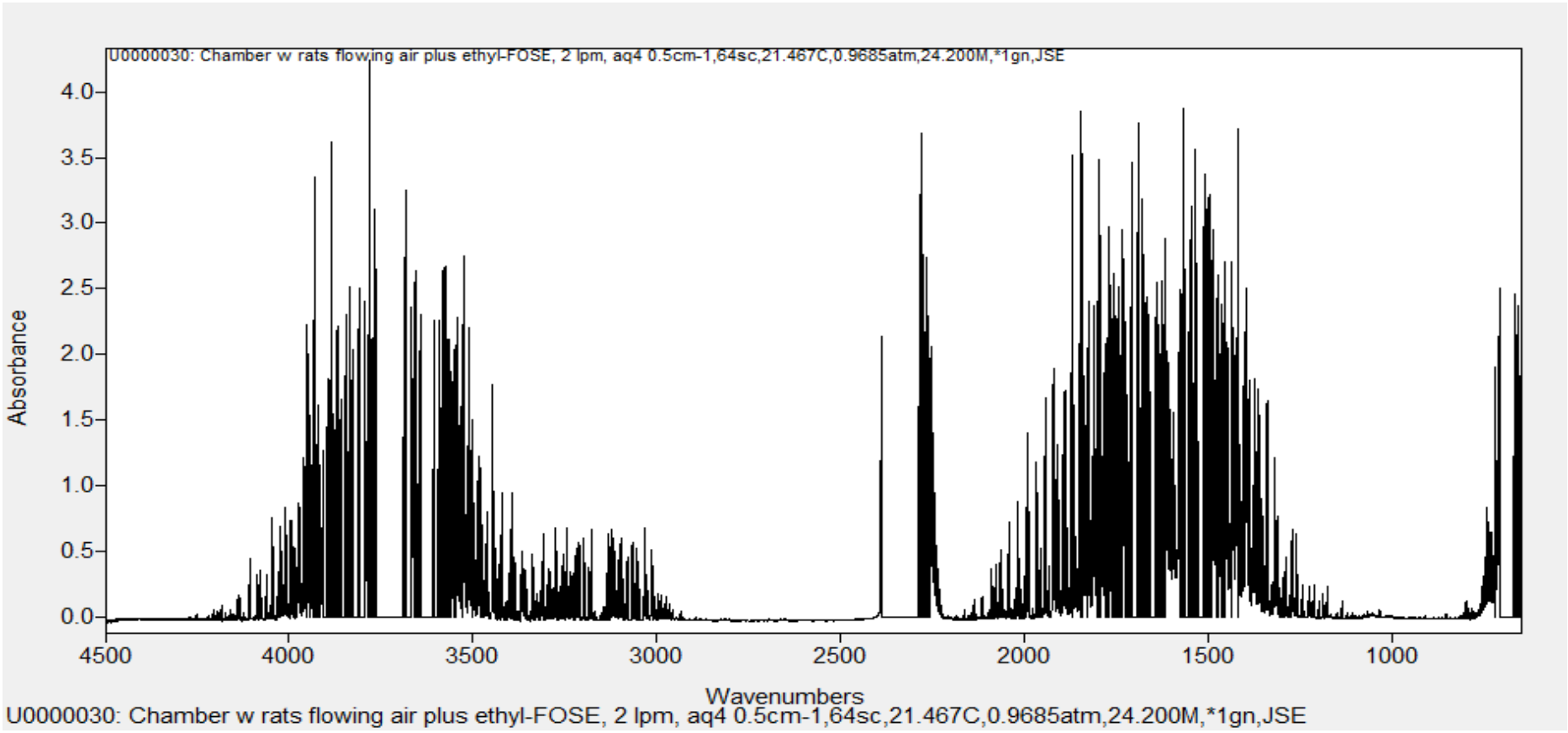
Ammonia LOQ = 0.30 ppmV based upon the FMU of 30% and a manual review of spectrum 54.
CO LOQ = 0.90 ppmV based upon FMU of 17 % on spectrum 30 and manual subtraction: matrix interference
Methane LOQ = 0.9 ppmV based upon FMU of 28% on spectrum 30 and manual subtraction
Methanol LOQ = 0.5 ppmV based upon FMU of 30% on spectrum 54 and manual subtraction

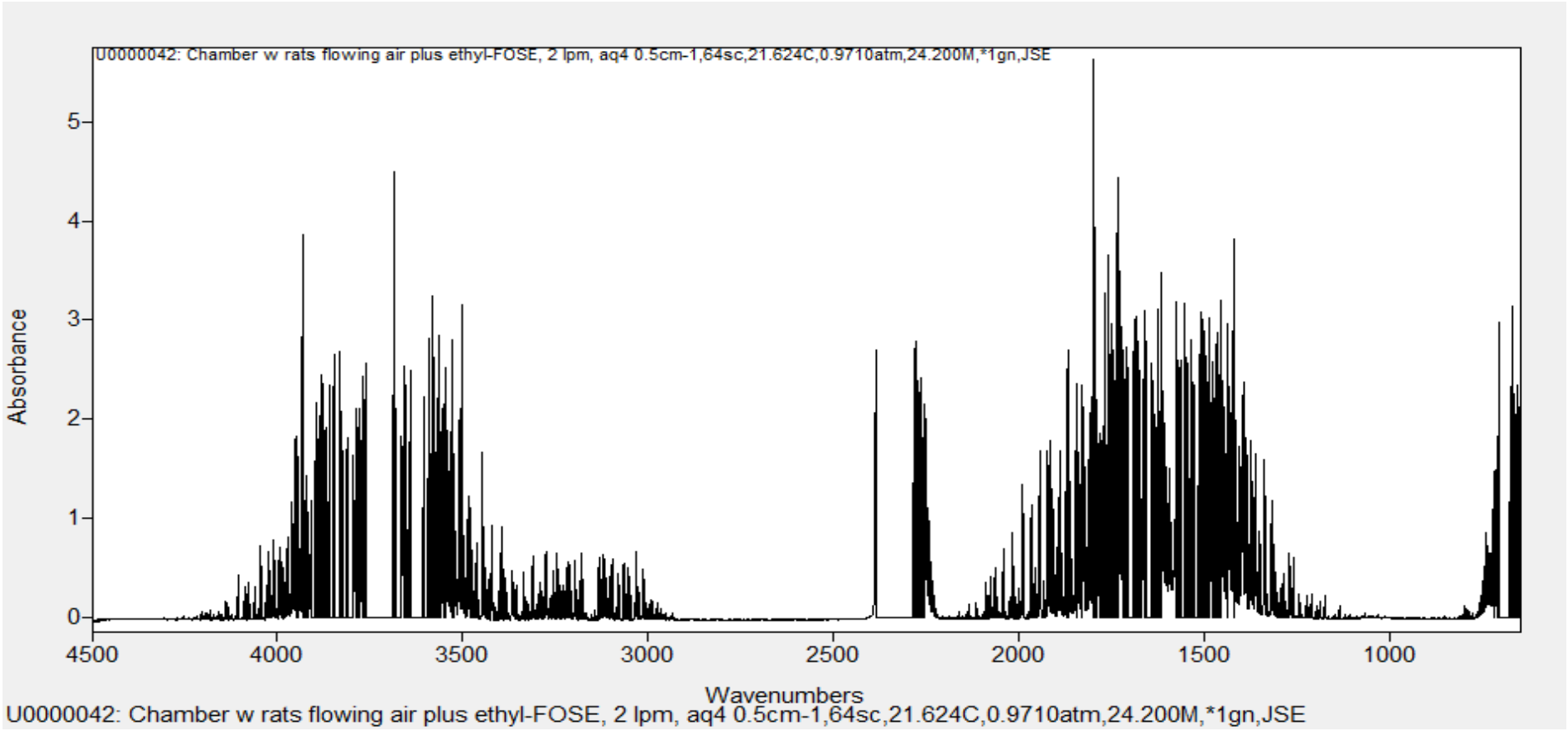
SEC = Sample Error Concentration calculated by AutoQuant software
FMU = Fractional Model Uncertainty
FMU = (2x SEC)/predicted value
The lower the SEC thus FMU the better the predictive model is performing
LOQ is based upon manual spectral interpretation and factoring in the FMU values
The FMU calculation evaluates the predictive model performance on a real sample matrix per compound
Primary model performance factors are FTIR instrument condition, quality of reference spectra, matrix interference, and spectral regions chosen in method


U0000012: Ethylene 20.3 ppmV, 2 lpm, aq4 0.5cm-1,64sc,21.545C,0.9698atm,20.300M,*1gn,JSE
Absorbance
0.5
0.4
0.3
0.2
0.1
0.0
4500
4000
3500
3000
2500
2000
1500
1000
Wavenumbers
U0000012: Ethylene 20.3 ppmV, 2 lpm, aq4 0.5cm-1,64sc,21.545C,0.9698atm,20.300M,*1gn,JSE

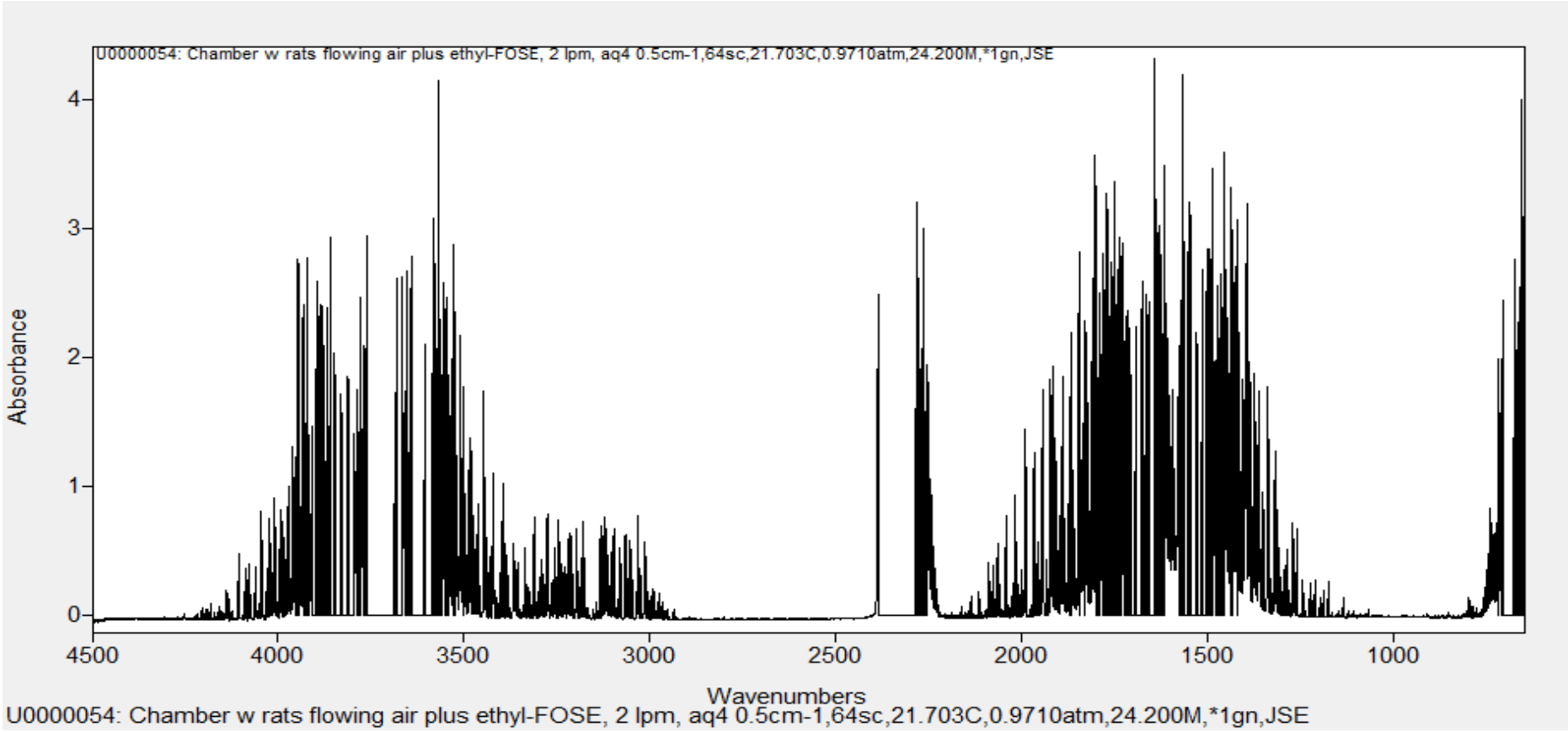


U0000017: Nitrogen, 2 lpm, aq4 0.5cm-1,64sc,21.467C,0.9702atm,24.200M,*1gn,JSE

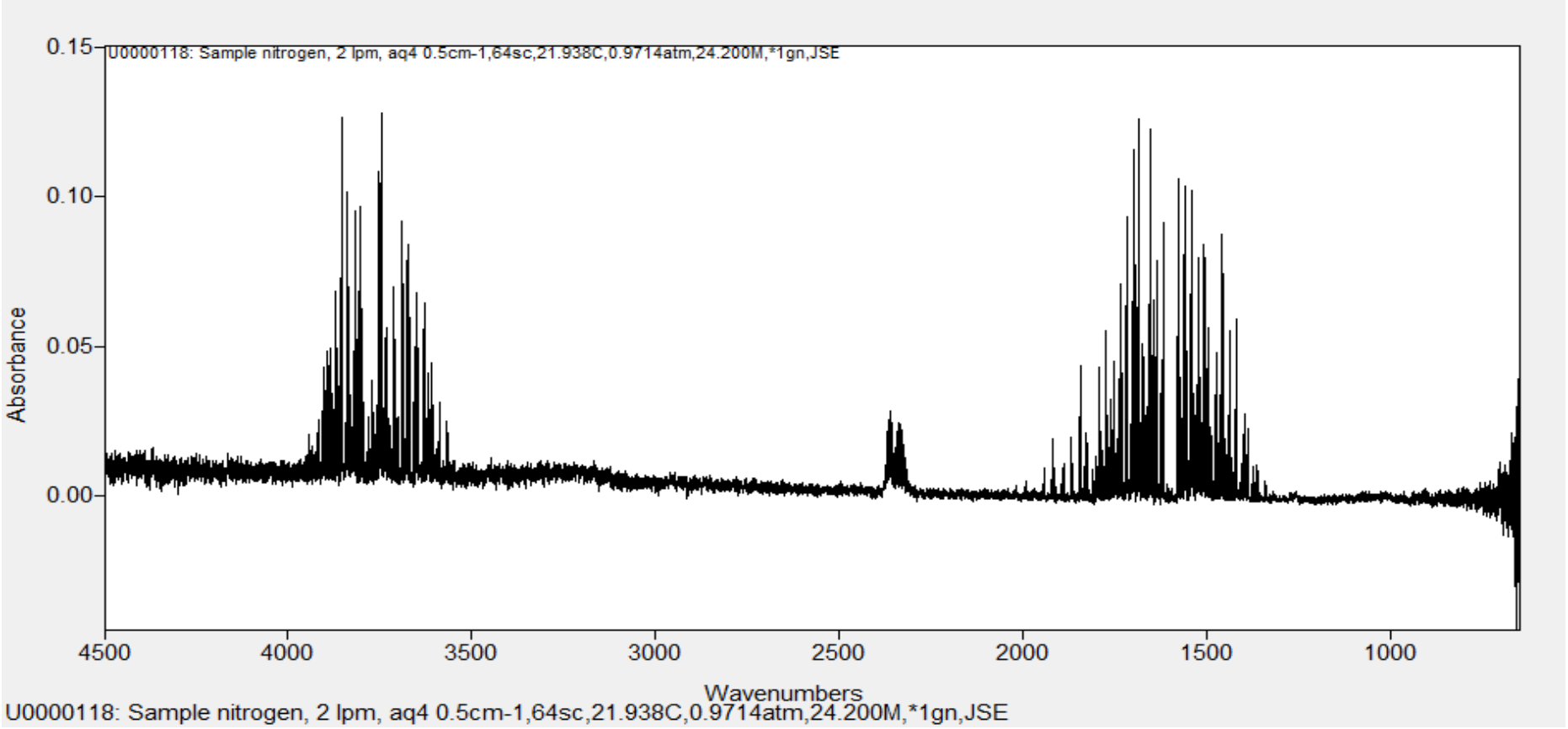

U0000030: Chamber w rats flowing air plus ethyl-FOSE, 2 lpm, aq4 0.5cm-1,64sc,21.467C,0.9685atm,24.200M,*1gn,JSE
Absorbance
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
4500
4000
3500
3000
2500
2000
1500
1000
Wavenumbers
U0000030: Chamber w rats flowing air plus ethyl-FOSE, 2 lpm, aq4 0.5cm-1,64sc,21.467C,0.9685atm,24.200M,*1gn,JSE

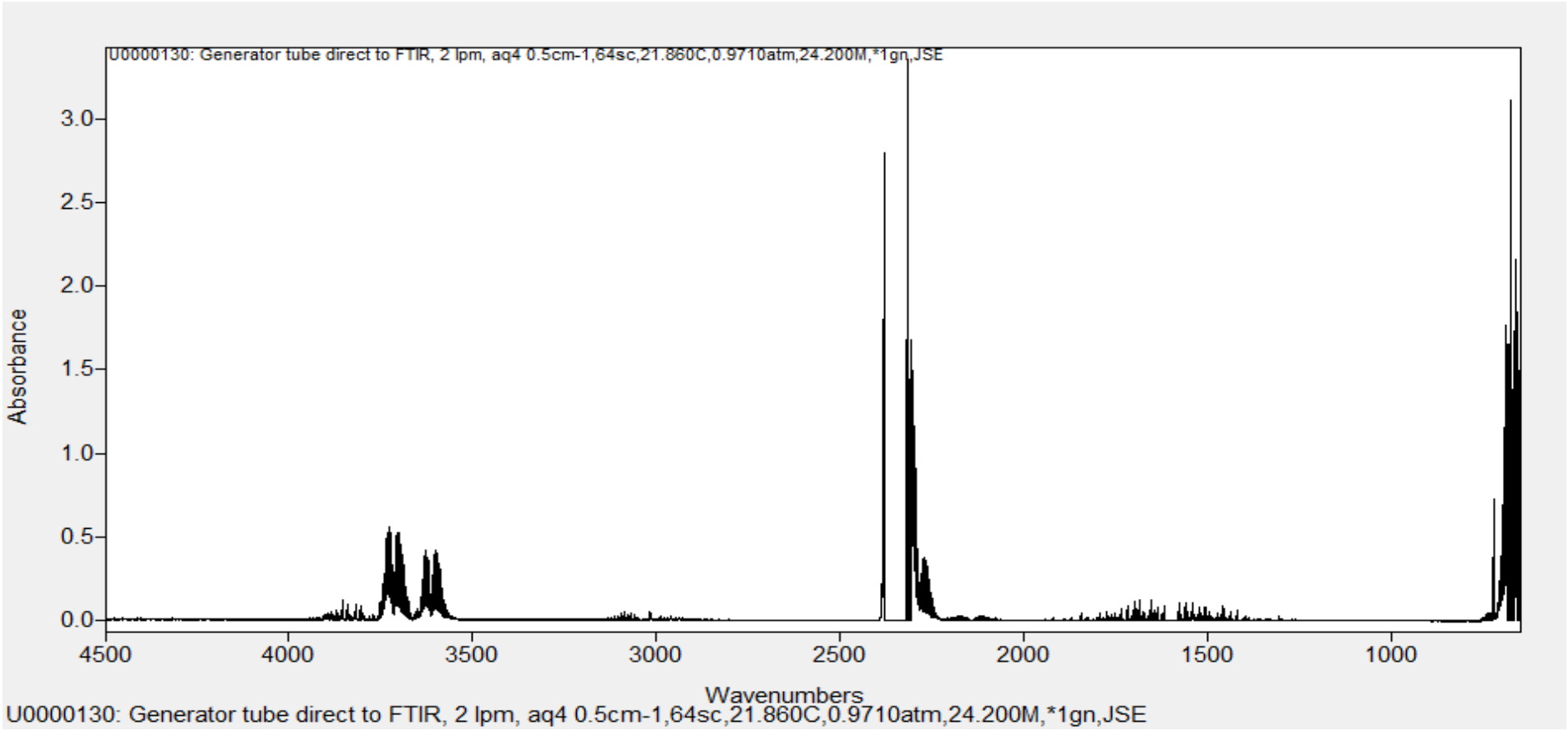


U0000042: Chamber w rats flowing air plus ethyl-FOSE, 2 lpm, aq4 0.5cm-1,64sc,21.624C,0.9710atm,24.200M,*1gn,JSE

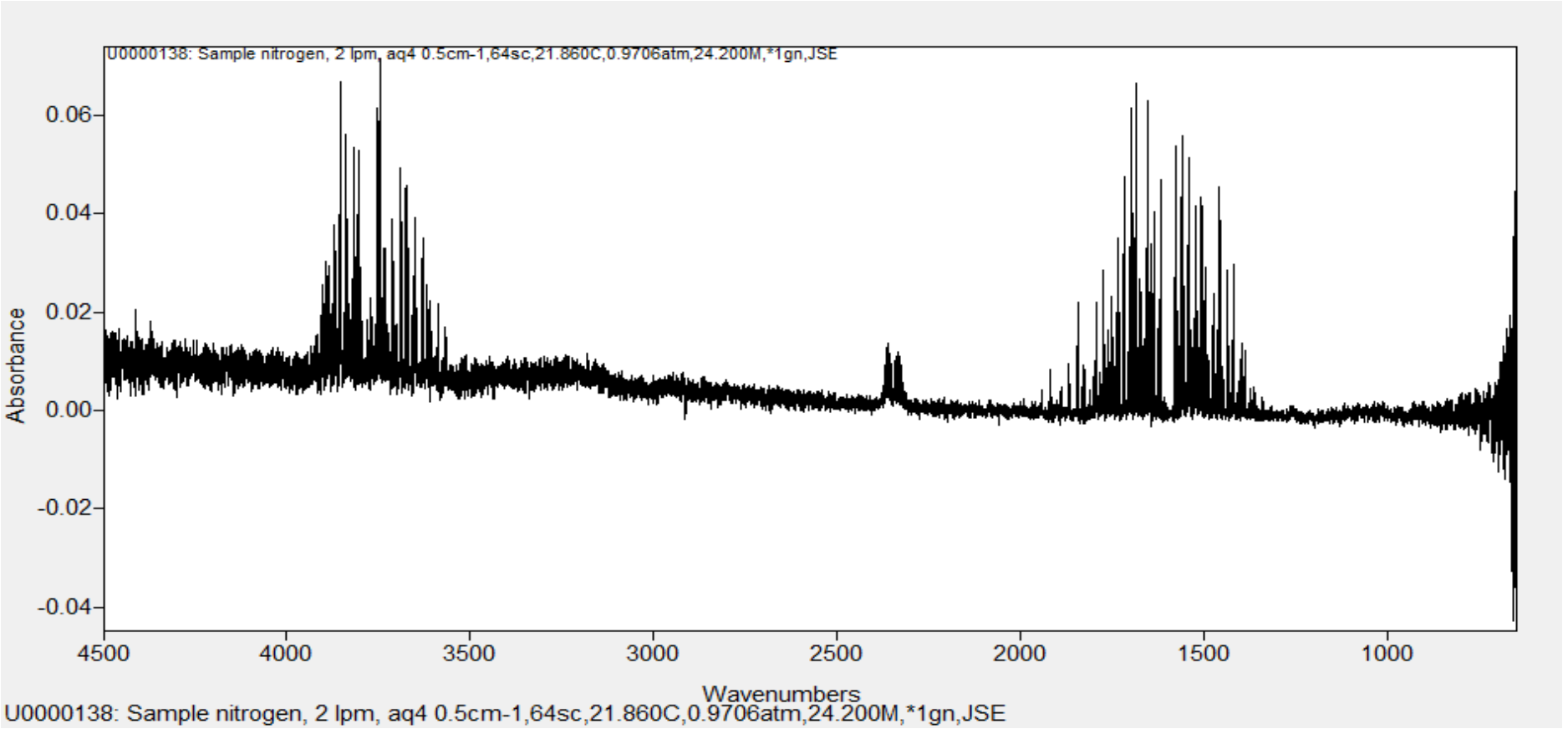


U0000054: Chamber w rats flowing air plus ethyl-FOSE, 2 lpm, aq4 0.5cm-1,64sc,21.703C,0.9710atm,24.200M,*1gn,JSE

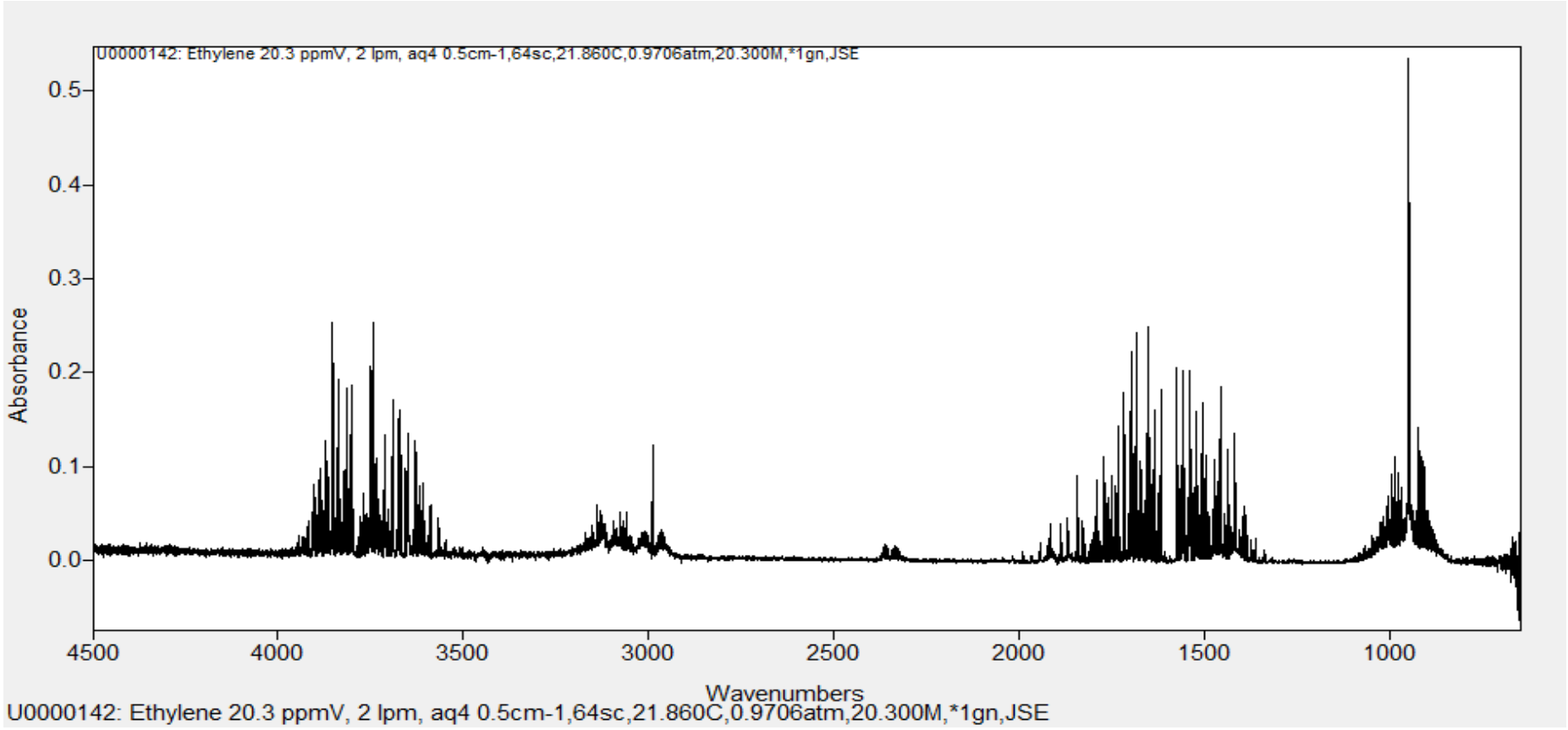

U0000118: Sample nitrogen, 2 lpm, aq4 0.5cm-1,64sc,21.938C,0.9714atm,24.200M,*1gn,JSE
0.15
0.10
0.05
0.00
Absorbance
4500
4000
3500
3000
2500
2000
1500
1000
Wavenumbers
U0000118: Sample nitrogen, 2 lpm, aq4 0.5cm-1,64sc,21.938C,0.9714atm,24.200M,*1gn,JSE



U0000130: Generator tube direct to FTIR, 2 lpm, aq4 0.5cm-1,64sc,21.860C,0.9710atm,24.200M,*1gn,JSE



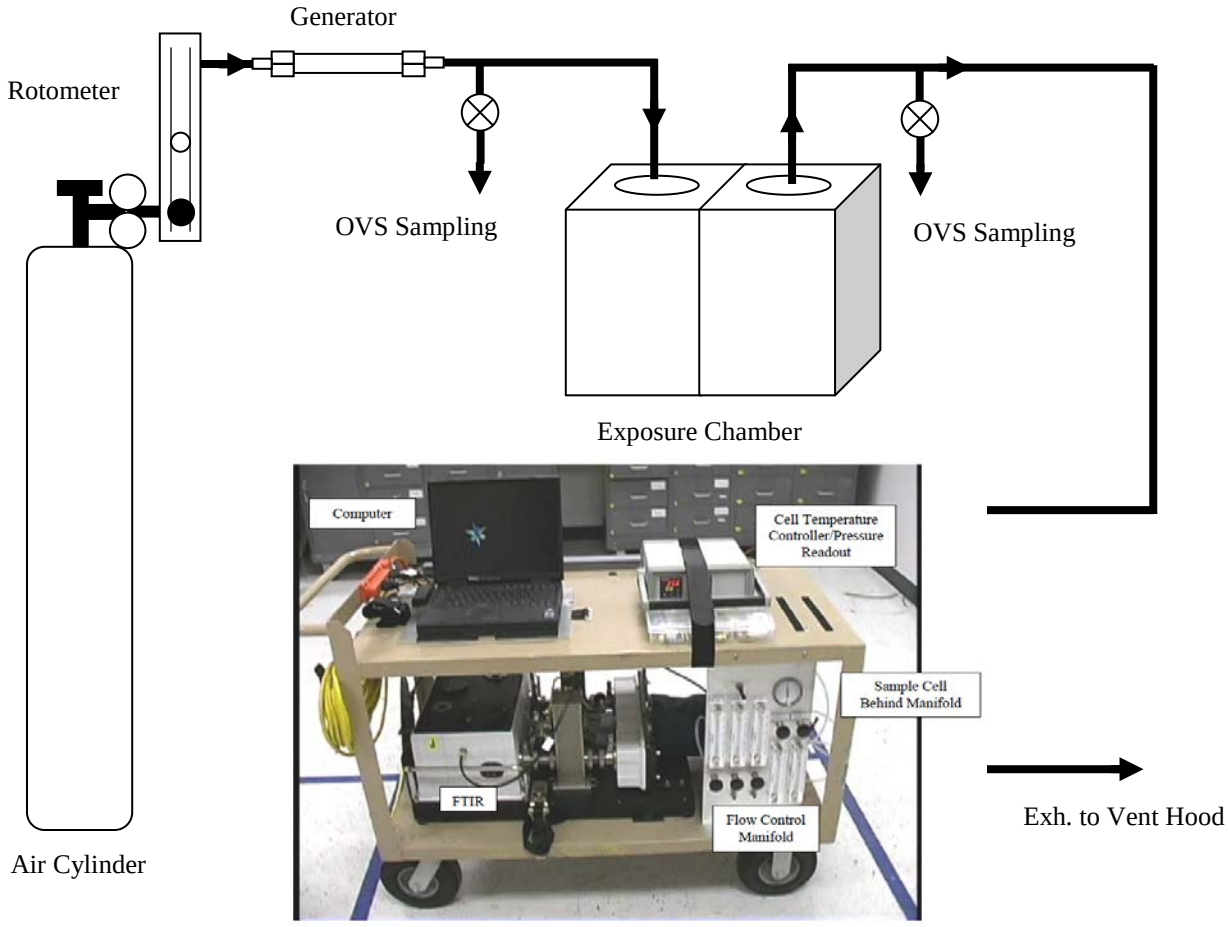
U0000138: Sample nitrogen, 2 lpm, aq4 0.5cm-1,64sc,21.860C,0.9706atm,24.200M,*1gn,JSE



U0000142: Ethylene 20.3 ppmV, 2 lpm, aq4 0.5cm-1,64sc,21.860C,0.9706atm,20.300M,*1gn,JSE

Figure __

Sample System Schematic



Typical FTIR

9 Hand Written Notes

JE 12-9-13 ethy-FOSE vat exposure pg 1 of 3
E13-0880

7:30 8:15 Arrive - add liq nitrogen to DeWar - collect background, & ethylene path length.

Start pre-test air blank @ 8:18:20 flowing @ 1 lpm. Collect for 6 min Stop @ 8:24:20. Cylinder # 9938 Breathing air quality
Media Blank 8:22 Lot 44440, 2009-4
Exp = May 2015

- Pump #150 @ inlet
Pump #222 @ outlet

8:35 - Inlet flow rate = 104 cc/min avg of 10
Outlet flow rate = 104 cc/min avg of 10
- Leak check ⇒ 15 psi for 5 min.
Inlet Test #1 start @ 9:12 Lot # 44440, 2009-4
Outlet Flow rate = 2 lpm into system

- Bumped inlet flow to 2.1 lpm per
9:19 Sue Chang to get 2 lpm thru chamber.
Inlet sample port draws 0.104 lpm for OVS tube sample
- Test #2 Stop @ 10:12

JE 12-9-13 ethyl-FOE Rat Exposure pg 2 of 3
E13-0880

Test #2 Lot #44440, entry error JE 12-9-13 ~~Lot~~ 20029-U

Start test #2 @ 10:15 - Inlet + Outlet
Stop test #2 @ 11:15

Start test #3 @ 11:18 - Inlet + Outlet
Stop test #3 @ 12:18

Start test #4 @ 12:21 - Inlet + Outlet
Stop test #4 @ 13:21

All samples from the same lot.

Start test #5 @ 13:24 - Inlet + Outlet
Stop test #5 @ 14:24

Start test #6 @ ~~14:~~27 entry error JE 12-9-13 - Inlet + Outlet
Stop test #6 @ 15:17 50 mins

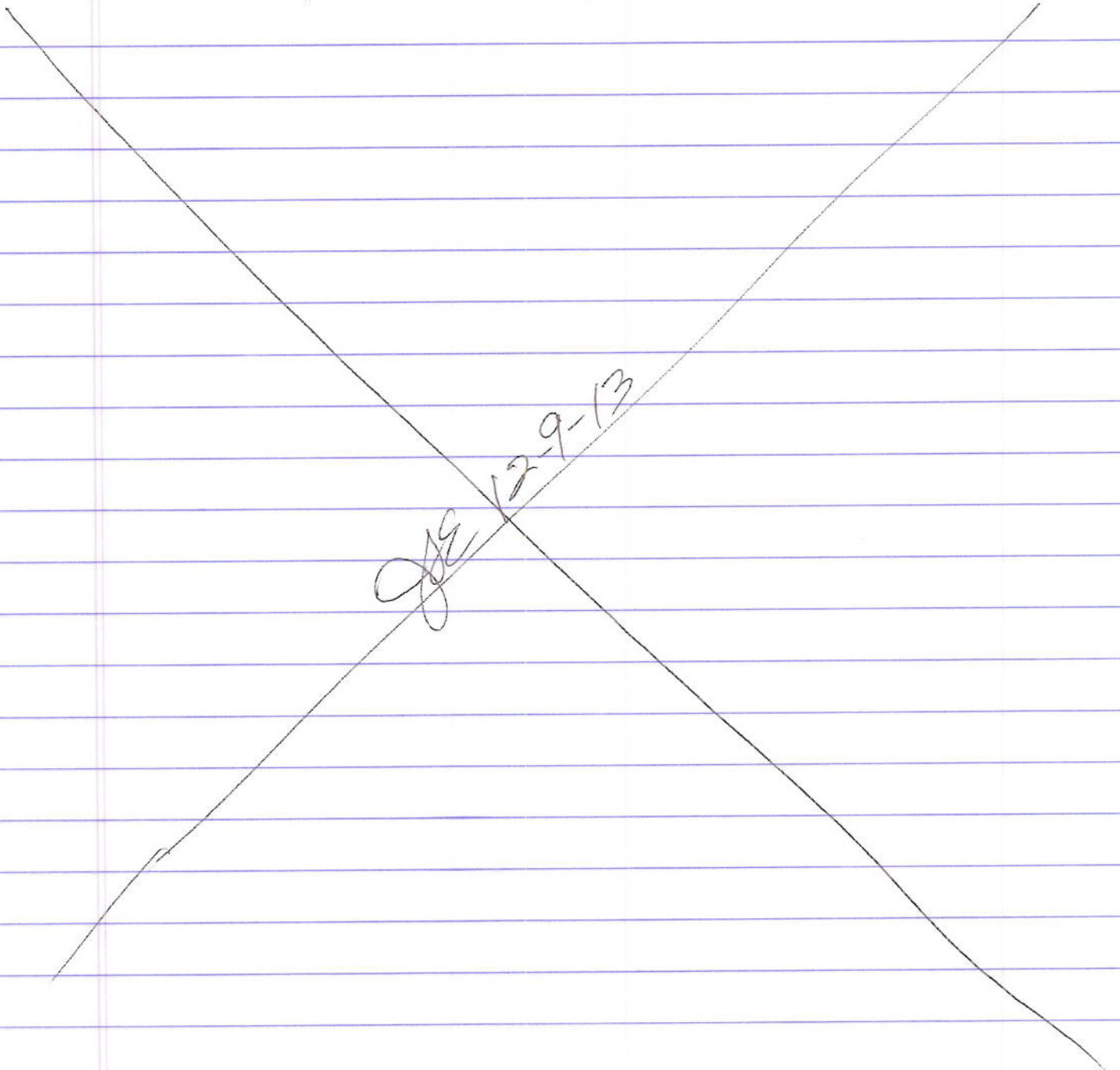
Shut system down @ 15:19

Start Post-Test air Cylinder Blank @ 15:30
flow rate = 1 lpm Stop @ ~~15:36~~ entry error JE 12-9-13 15:37
15:43 - Connected generator tube directly to FTIR

12-9-13 ethyl-FOSE Rat Exp. pg 3 of 3
E13-0880

15:57 - Inlet flow rate = 103 cc/min avg of 10
Outlet flow rate = 106 cc/min avg of 10

- Performed final ethylene check on FTIR
End Test ≈ 14:09



10 Chain of Custody Forms

3M Environmental Laboratory

Form 38778 - A - PWO

Shipping Address:
3M Center
Bldg. 260-5N-17
St. Paul, MN 55144

Telephone:
Sample Receiving: (651) 736-6559
Alternate: (651) 733-9873
FAX: (651) 733-5982

Chain of Custody /Request for Laboratory Analytical 15513

Project ID/Project Name	
Template #	Final Report Due Date
Project Lead	Internal Due Date
Dept. # (main)	Class/Job/Project #

3M Env. Lab Project #
For Internal Use Only
E13-0880

Report Results to:

Contact Name	
Company	
Mailing Address	
City, State, Zip	
Telephone #	FAX #

Date Available	
Date Due	
Contract Lab	

Special Instructions and/or Specific Regulatory Requirements:
(method, limit of detection, reporting units, etc.)

Preservatives:
Enter the number of containers of each

Item #	Client Sample Identification	3M LIMS#	Date Sampled	Time Sampled	Matrix/ Media	HNO_3	H_2SO_4	VOCs	None	Other	Total Number of Containers	Analysis Requested: Complete below. Attach any associated information. (Enter an 'X' in the box below to indicate request)
1.	Air Pre-Test Blank	001	12/3	9:00-9:30	air				1			X
2.	Blank media	002		9:30	n/a				1			X
3.	Test #1 Inlet	003		9:45-10:15	air				1			X
4.	Test #1 Outlet	004		9:45-10:15					1			X
5.	Test #2 Inlet	005		10:15-10:45					1			X
6.	Test #2 Outlet	006		10:15-10:45					1			X
7.	Test #3 Inlet	007		10:45-11:15					1			X
8.	Test #3 Outlet	008		10:45-11:15					1			X
9.	Test #4 Inlet	009		11:30-12:00					1			X
10.	Test #4 Outlet	010		11:30-12:00					1			X

Chain of Custody

Collected by (print): Jess Eldridge

Collector's signature: Jess Eldridge

Item #	Relinquished by/Affiliation	Time	Date	Shipped Via:	Received by/Affiliation	Time	Date
1-10	Jess Eldridge / 3M		12/3/13	FedEx	[illegible]	7:20	12/4/13

Sample Condition Upon Receipt: O Acceptable O Other:

Temperature: 'C O Received on Ice

Other Associated CoCs:

Copies to:

Comments:

E13-0880 Final Analytical Report, Appendix A

3M Environmental Laboratory

Form 38778 - A - PWO

Shipping Address:
3M Center
Bldg. 260-5N-17
St. Paul, MN 55144

Telephone:
Sample Receiving: (651) 736-6559
Alternate: (651) 733-9873
FAX: (651) 733-5982

Chain of Custody /Request for Laboratory Analytical 15512

Project ID/Project Name	Tox Work - Rat Exposure
Template #	Final Report Due Date
Project Lead	Internal Due Date
Dept. # (main)	Class/Job/Project #

3M Env. Lab Project #
For Internal Use Only
E13-0880

Report Results to:

Contact Name	
Company	
Mailing Address	
City, State, Zip	
Telephone #	FAX #

Date Available	
Date Due	
Contract Lab	

Special Instructions and/or Specific Regulatory Requirements:
(method, limit of detection, reporting units, etc.)

Preservatives:

HNO_3	H_2SO_4	VOCs	None	Other	Total Number of Containers
Enter the number of containers of each					

Analysis Requested:
Complete below. Attach any associated information.

(Enter an 'X' in the box below to indicate request)

Item #	Client Sample Identification	3M LIMS#	Date Sampled	Time Sampled	Matrix/ Media	None	Analysis Requested
1.	Test #5 Inlet	011	2/13	[illegible]	Air	1	X
2.	Test #5 Outlet	012				1	X
3.	Test #6 Inlet	013				1	X
4.	Test #6 Outlet	014				1	X
5.	Media Blank	015		1430		1	X
6.	Rat-Test Chamber Blank	016	↓	[illegible]	↓	1	X
7.							
8.							
9.							
10.							

Chain of Custody

Collected by (print): Jess Eldridge

Collector's signature: [signature]

Item #	Relinquished by/Affiliation	Time	Date	Shipped Via:	Received by/Affiliation	Time	Date
1-6	[signature]		2/13	FedEx	[signature]	9:10 AM	2/14/13

Sample Condition Upon Receipt: O Acceptable O Other:

Temperature: 'C O Received on Ice

Other Associated CoCs:

Copies to:

Comments: Sample #6 sampled only 50 min per Sue Chang - they wanted to get going on next week or so.

Page ____ Of ____

Original - Accompanying Samples

Last Page - Originator

See Reverse Side for Instructions

E13-0880 Final Analytical Report, Appendix-A

11 General Project Outline (GPO)

3M Field Analytical Services & Technologies / General Project Outline

To: Sue Chang – 3M Toxicology

cc: Paul Lieder – 3M Toxicology
Jill Hart – 3M Toxicology
Kris Murphy – Pace Analytical Services
Cleston Lange – 3M EHS Operations, Environmental Laboratory 260-5N-17
Jess Eldridge – 3M EHS Operations, Environmental Laboratory 260-5N-17

From: Brian Mader – 3M EHS Operations, Environmental Laboratory 260-5N-17

Date: Dec 6, 2013

Subject: **3M B270 ethyl-FOSE Rat Exposure Chamber Test**

- **Department No.** 108022
- **Lab Request No.** E13-0880
- **Test Date(s)** Dec 9, 2013
- **Monitoring Requested by:**
  Sue Chang
  3M Toxicology
  3M Center, Building 220-6W-08
  St. Paul, MN 55144
  Email: s.chang@mmm.com
  Phone No: 651-737-9073

- **Monitoring Coordinated by:**
  Brian Mader, Ph.D.
  3M EHS Opns Environmental Laboratory
  3M Center, Building 260-5N-17
  St. Paul, MN 55144
  E-mail:bmader@mmm.com
  Phone No.: (651) 733-9866
  Fax: (651) 778-6176

All verbal and written correspondence will be directed to the Monitoring Coordinator.

- **Plant Location / Contact(s)**

3M Center
Building 270 Room SB322/324
St. Paul, MN 55144
3M Company B270-2A-8
Plant Contact: Jill Hart
Phone Number: 651-733-8586

- **Project Objective**

The purpose of this testing is to support 3M Strategic Toxicology exposure study and perform FTIR and OVS-based measurements of the concentration of the target compound ethyl-FOSE generated from a generator cartridge and in the exhaust of an exposure chamber during a rat exposure chamber test. The goal of the test is to measure the gas-phase concentration of ethyl-FOSE. The test will be done at the 3M Strategic toxicology lab at SB322/324 located on the third floor of B270. The initial target concentration for the ethyl-FOSE is approximately 5-10 ppbV for a 6 hour rat exposure. The material will be introduced into the chamber via a generator tube containing ~ 65 gm of glass beads coated with ~ 700 mg of ethyl-FOSE and flowing 2 lpm air through the tube. In addition to FTIR, samples will be collected on OVS adsorbant sample tubes for analysis in the 3M Env Lab via HPLC/MS. If other compounds are present as detected by the FTIR, they will be analyzed and reported.

- **Project Schedule**

December 6th, 2013	*Equipment Preparation, Set-up*
December 9th, 2013	*Begin Monitoring*
December 10th, 2013	*Replicate tests(if needed), demobilization*
December 11-13th, 2013	*Analysis of Samples*
December 20th, 2013	*Preliminary Data needed.*
January 6th, 2014	*Final Report Due*

- **Process(es) Requiring Testing**

Exposure chamber air sampled inline on the new “flow through” system.

- **Test Conditions and Locations**

Condition 1: Quality control – no test chemicals nor animals

(1) Breathing Air Background - cylinder
   a. Prior to and after the toxicity test take a 5 minute OVS tube sample of the cylinder breathing air; flow set at 1 lpm for each sample. The pressure of the cylinder will drive the sampling – no pump will be used.

Condition 2: Steady-State Chamber Testing

(1) Chamber Test
   a. Collect samples continuously with the FTIR during the testing with target chemical present.

b. Two locations will be sampled with OVS tubes ; immediately downstream of the generator tube and immediately downstream of the test chamber(s).
c. During the 6 hour run time, six 60 min samples will be collected contiguously at both locations. There will be several minutes between removing one set of samples and re-setting new tubes in place for the next one hour period.
d. Sample rates through the OVS tubes will be set to approximately 0.1 lpm; measured and set on each pump. The actual flow rates and samples volume will be documented.

➢ Gas Stream Characteristics

Experiments will be conducted with ethyl-FOSE as the target compound. Other compounds may be present as well and will be analyzed and identified on-site. Based on the preliminary generator cartridge monitoring performed under lab request E13-0722 the expected concentration will be in the range of 5-10 ppbV.

Table 1. ethyl-FOSE Standard Information

1. INGREDIENT	C.A.S. NO.	PERCENT
PERFLUOROOCTANESULFONAMIDO ALCOHOL.....	1691-99-2	80.0 - 90.0
RESIDUAL ORGANIC FLUOROCHEMICALS.....	TradeSecret	< 12
PERFLUOROHEXANESULFONAMIDO ALCOHOL.....	34455-03-3	3.0 - 7.0
PERFLUOROHEPTANESULFONAMIDO ALCOHOL.....	68555-73-7	2.0 - 6.0
PERFLUOROBUTANESULFONAMIDO ALCOHOL.....	34449-89-3	2.0 - 6.0
PERFLUOROPENTANESULFONAMIDO ALCOHOL.....	68555-72-6	1.0 - 3.0

➢ Test Methods

+ OVS Analysis by LC/MS ETS-8-105.0

Analysis of the Ethyl FOSE concentration will be conducted at the 3M Environmental Lab using the appropriate 3M Env. Lab SOP. The analysis will include analysis of blanks as well as the use of multipoint calibrations curves and QA/QC procedures that may include LCS and LMS spikes. The target compound is ethyl-FOSE but the presence of other compounds will be reported as will the relative distribution of branched versus liner materials present in the OVS samples. The MS/MS ion masses monitored are for EtFOSE-OH acetate adduct, and is 630 > 59 (acetate adduct)

+EPA Method 320 modified for speciated FTIR analysis

PQL 2 Quantitative Monitoring

Project Quality Level 2 (PQL 2) is appropriate for emission factor estimates and non-compliance test measurements. PQL 2 is appropriate when the project objectives specify the data will not be incorporated in compliance tests of manufacturing emissions, but can be used for use in certain environmental permitting and regulatory activities such as emission factor estimation.

As per SOP ETS-8-31 the project quality level (PQL) for this project has been identified as **PQL 2** with the following project specific goals to be met:

+ Selection and preparation of the relevant equipment, supplies and spectral libraries.
  – Midac Fourier Transform Infrared Spectrometer (FTIR), heated sample cell, non-Intrinsically Safe (non-IS) heated sample lines, and rotary vane or diaphragm pumps for sample ports.
  – EPA, MIDAC and 3M library standards. etc
+ Use of quantitative FTIR spectral libraries and methods provided by the 3M Environmental Lab with a documented concentration. For each compound the series of reference spectra should span the range of ppmV-m values expected to be observed during the testing.
+ Pre-test calculations and documentation:
  – Estimated absorption path-length.
  – Determination of the detector linearity as per SOP ETS-8-031.
  – FTIR maintenance as per SOP ETS-9-58
+ Testing procedures and documentation:
+ As per SOP ETS-8-031 including but not limited to:
    + Direct and system calibration with calibration transfer standard (CTS).
    + Desired Analytical Uncertainty (AU) value = ±50%
    + Direct and system calibration with calibration transfer standard (CTS).
    + Potential Interferents:
      – Water
      – Carbon Dioxide
+ Data Analysis:
  – The concentration determinations using AutoQuant 4.0 CLS analytical program and/or MD Grams.
+ Reporting:
  – Comprehensive report (See Reporting Requirements section)

➢ Estimated Project Cost

All managed outsourced testing expense for this project will be charged to the department number identified on page one of the GPO.

Estimated Total Project Cost ~ $3,000 - $5,000

Actual project costs are determined on a time and materials basis in accordance with the existing 3M Environmental Laboratory contract.

➢ Reporting Requirements

Type of report(s) required:

+ On-site results will be reported to the Project Requestor as requested during the project
+ Final Reports
  – The “Comprehensive Final” report due to the 3M Project Requestor 4 weeks from the test date.

➢ Supplemental Information

+ 3M facility personnel must provide:
  – One dedicated 20-amp, 110-120 VAC electrical power circuit (reachable with extension cords) at the test location.
  – Designated representatives
  – Daily work permits as necessary.
+ 3M facility must identify proper PPE and if necessary the type of full face respirator that is to be worn.
+ 3M facility must verify non-intrinsically safe equipment is acceptable at the test locations.
+ 3M facility must ensure that the test conditions are maintained during the test and properly documented.
+ 3M facility must provide OSHA approved safe access to test locations.
+ 3M facility must install all test ports that will be needed prior to the test.
+ Perform all process operations and attempt to maintain consistent operating parameters throughout the testing time frame including pressures, temperature, etc.

Contract Lab Requirements:

+ Contract technicians must follow all applicable safety protocols while on-site at the 3M facility (see plant safety officer for appropriate safety procedures).

+ Invoicing must be sent to monitoring coordinator including;

- Invoice Date
- Project Description (Must be similar to the description found on the 3M Lab Request)
- Test Date(s)
- 3M 6 Digit Department No.
- 3M Site Source No. (If a site source has been assigned it will be found on the 3M Lab Request)
- 3M Project No. (If a project number has been assigned it will be found on the 3M Lab Request)
- 3M Lab Request No.
- Cost Itemization