Technical Report Documentation Page

1. Report No.	2. Government Accession No.	3. Recipient's Catalog No.
DOT/FAA/AM-24/10		

4. Title and Subtitle	5. Report Date
Chemical Analysis of Resulting Bleed Air Samples Collected from Simulated Engine Fluid Contamination Events	6. Performing Organization Code AAM-631

7. Author(s)	8. Performing Organization Report No.
Krisiam Ortiz-Martinez, Ph.D.	ARITR-24-001

9. Performing Organization Name and Address	10. Work Unit No. (TRAIS)
Naval Air Warfare Center Aircraft Division Human Systems Engineering Department Patuxent River, MD 20670	11. Contract or Grant No.

12. Sponsoring Agency Name and Address	13. Type of Report and Period Covered
Office of Aerospace Medicine Federal Aviation Administration 800 Independence Ave., S.W. Washington, DC 20591	Technical Report 14. Sponsoring Agency Code AAM-600

15. Supplementary Notes

Author's ORCID: https://orcid.org/0000-0001-9360-8186

DOI: https://doi.org/10.21949/1529639

16. Abstract

Naval Air Warfare Center Aircraft Division (NAWCAD) supported a series of engine stand tests led by the Federal Aviation Administration's Civil Aerospace Medical Institute (FAA/CAMI) as part of a congressionally mandated aircraft air quality study. Experiments were conducted at the Kansas National Gas Machinery Laboratory (NGML) from May 16th to 19th, 2022. Engine tests simulated bleed air-contaminated events by injecting aircraft fluids into an engine system. NAWCAD collected 56 air samples using tri-bed sorbent tubes to detect Volatile Organic Compounds (VOCs) resulting from these events. Samples were processed and analyzed by Gas Chromatography-Mass Spectrometry (GCMS) per an adapted EPA TO-17 method at the Naval Air Station (NAS) Patuxent River. To the extent of the data, chemical analysis of the samples demonstrated that VOCs are present in the bleed air stream when aircraft fluids enter the engine system. Overall, each fluid category showed a distinctive VOC emission profile. However, significant residual fluid was observed between injections that negatively affected the chemical analysis of these emissions.

17. Key Word	18. Distribution Statement
	Document is available to the public through the National Transportation Library: https://ntl.bts.gov/ntl

19. Security Classification (of this report)	20. Security Classification (of this page)	21. No. of Pages
Unclassified	Unclassified	195

Naval Air Warfare Center Aircraft Division
Human Systems Engineering Department
Patuxent River, MD 20670

Technical Report

Chemical Analysis of Resulting Bleed Air Samples Collected from Simulated Engine Fluid Contamination Events

Federal Aviation Administration Civil Aerospace Medical Institute (FAA/CAMI)

by

Krisiam Ortiz-Martinez, Ph.D.
Chemical Engineer

February 23, 2024

NAVAIR Public Release 2024-0079.

This report version (ARITR-24-001) has been released through NAVAIR Public Affairs as Distribution A. There are no content differences between the report that follows this cover letter and the original report (ARITR-23-001) delivered to the Civil Aerospace Medical Institute (CAMI) of the Federal Aviation Administration (FAA).

Naval Air Warfare Center Aircraft Division
Human Systems Engineering Department
Patuxent River, MD 20670

Date: February 23, 2024
ARITR-24-001

CHEMICAL ANALYSIS OF RESULTING BLEED AIR SAMPLES COLLECTED FROM SIMULATED ENGINE FLUID CONTAMINATION EVENTS

Prepared By

Krisiam Ortiz-Martinez, Ph.D.
Chemical Engineer
Aeromedical Research & Integration Branch

Reviewed By

Leah R. Eller, Ph.D.
Senior Organic Chemist
Aeromedical Research & Integration Branch

Sam Trepp
Branch Head
Aeromedical Research & Integration Branch

Contents

List of Tables:

List of Figures:

Human Systems Engineering Department
Aeromedical Research & Integration Technical Report

Chemical Analysis of Resulting Bleed Air Samples Collected from Simulated Engine Fluid Contamination Events

Executive Summary

Naval Air Warfare Center Aircraft Division (NAWCAD) supported a series of engine stand tests led by the Federal Aviation Administration's Civil Aerospace Medical Institute (FAA/CAMI) as part of a congressionally mandated aircraft air quality study. Experiments were conducted at the Kansas National Gas Machinery Laboratory (NGML) from May 16th to 19th, 2022. Engine tests simulated bleed air-contaminated events by injecting aircraft fluids into an engine system. NAWCAD collected 56 air samples using tri-bed sorbent tubes to detect Volatile Organic Compounds (VOCs) resulting from these events. Samples were processed and analyzed by Gas Chromatography-Mass Spectrometry (GCMS) per an adapted EPA TO-17 method at the Naval Air Station (NAS) Patuxent River. To the extent of the data, chemical analysis of the samples demonstrated that VOCs are present in the bleed air stream when aircraft fluids enter the engine system. Overall, each fluid category showed a distinctive VOC emission profile. However, significant residual fluid was observed between injections that negatively affected the chemical analysis of these emissions.

Background

The FAA/CAMI initiated a multi-phase aircraft air quality study to address the potential impact of contaminated air events onboard commercial aircrafts in collaboration with industry, academia, and the NAWCAD. In May 2022, the FAA/CAMI, and Kansas State University (KSU) conducted the first set of experiments to assess bleed air quality from an engine test stand at the NGML. Experiments consisted of simulating engine fluid contamination events to characterize the resulting fume composition profile, identify chemical markers, and evaluate potential health effects.

For these engine tests, controlled amounts of aircraft fluids (i.e., 5ppmW) were injected into the engine compressor inlet to mimic fluid leaks and ingestions in the bleed system. The resulting bleed air was extracted, cooled by a heat exchanger, and sampled. **Figure 1** shows the engine test stand with the sampling locations. Six different fluids commonly used in commercial and military aircraft were injected into the system. **Table 1** details the selected fluids.

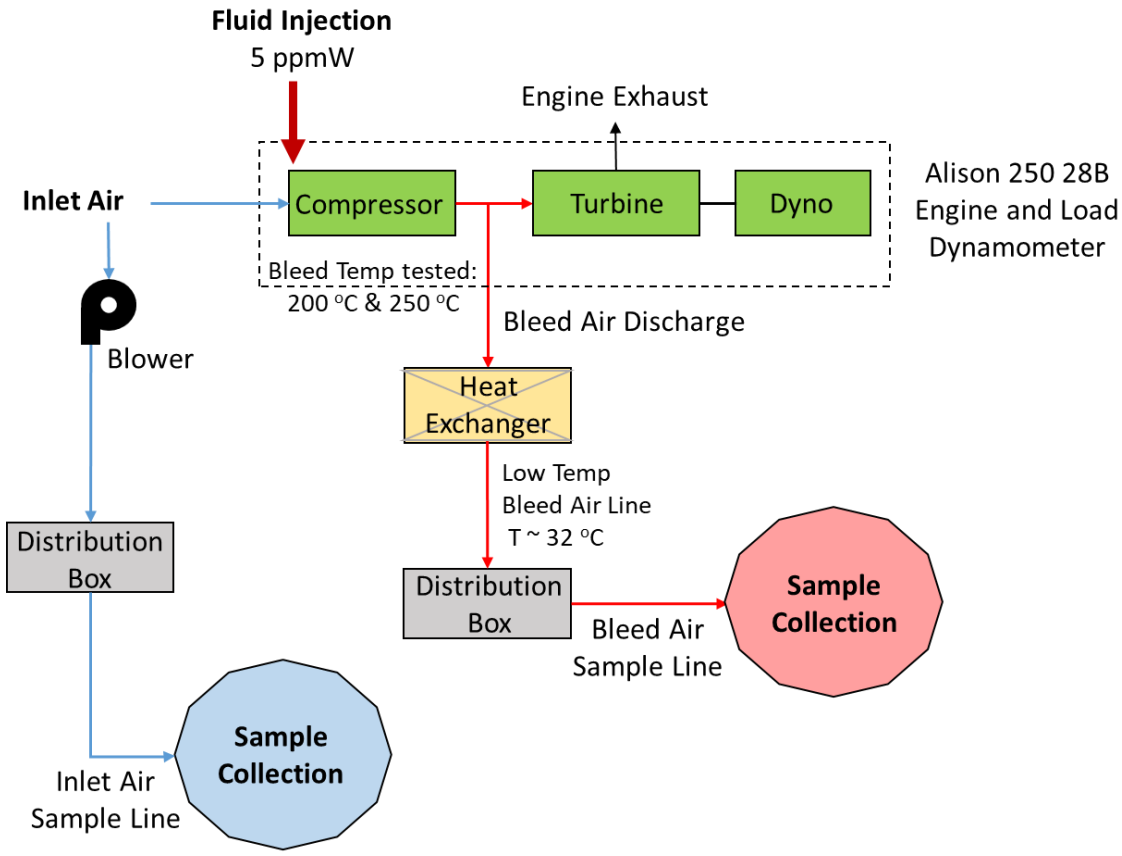


Figure 1: Engine test stand and sampling locations

Table 1: Tested Aircraft Fluids

Classification	Fluid Name	Additional Description/Properties[1]
Engine Oils	Eastman Turbo Oil 2389 (**ETO2389**)	Standard oil; μ=3cSt at 100°C
	Mobil Jet Oil II (**MJOII**)	Standard oil; μ=5cST at 100°C
	Mobil Jet Oil 387 (**MJO387**)	High Thermal Stability oil; μ=5cST at 100°C
Hydraulic Fluids	Skydrol PE-5 (**PE-5**)	5000 PSI fluid
	HyJet IV-A Plus (**HyJetIV**)	3000 PSI fluid
Deicing Fluid	Safewing MP/LFD 88 Dilute (**Deicing**)	Type 1 deicing fluid

μ = viscosity

[1]More information on the selected fluids are in the **Appendix E**

NAWCAD's efforts were to provide analytical and technical expertise, assist with the test planning, collect air samples, and conduct chemical analysis of the collected samples for VOCs per an adapted EPA TO-17 method.

From May 16th to 19th, NAWCAD collected 56 air samples from the engine tests. On May 19th, samples were shipped to NAS Patuxent River for processing and analysis at the Gas & Fluid Flow Integration Laboratory.

Procedure

Sample collection

Air Samples were collected using tri-bed sorbent tubes attached to GilAir pumps to draw in air from multiple locations in the engine test stand. **Figure 2** shows the sampling configuration. Sampling was conducted at a mass flow rate of 50mL/min for 60mins. Pumps were calibrated, and the sample flow rate was verified using a flow meter before and after a day of sampling.

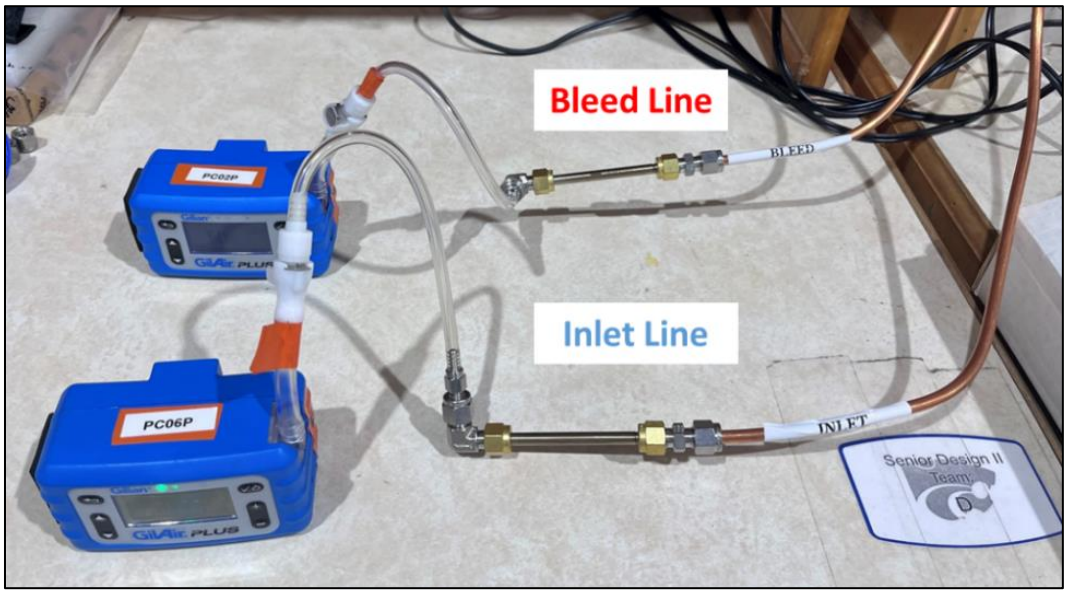


Figure 2: Air sampling configuration

Each sample tube was pre-conditioned and pre-evaluated before shipping them to NGML for sample collection. Additionally, sample tubes were kept sealed and refrigerated when not in use.

Sample collection was divided into seven batches; each batch corresponded to a different fluid injection event. It should be noted that selected fluids were injected once into the engine system. Only the *MJOII* fluid was injected twice as a replicate run, as it is a standard class oil most commonly used in commercial aviation.

For each fluid injection event, the engine test stand was sampled before (i.e., Baseline samples) and while injecting the fluid (i.e., Fluid samples) at two locations (i.e., Inlet line and Bleed line). Likewise, each fluid injected into the engine was evaluated at two bleed air temperatures (i.e., 200°C and 250°C).

Table 2 summarizes a general sequence of a fluid injection event. First, the engine was purged for about 30mins to clean out the system by heating the lines downstream of the heat exchanger (i.e., from 32°C to 60°C). After purging the engine, the system was brought to the first test conditions (i.e., bleed temperature of 200°C). After an additional 30mins of system stabilization, baseline sample collection started for 60mins. No fluid was injected under these baseline conditions. Once baseline sampling was finished, fluid injection started. After 40mins under these conditions, the first experimental fluid sample collection began for 60mins. Once fluid sampling at 200°C was completed, the bleed temperature was increased to 250°C, and the fluid injection continued. After 40mins of system stabilization, the second round of experimental fluid sample collection at 250°C started for 60mins. Once sampling at 250°C was finished, the fluid injection was stopped, and the system was purged for an additional 60mins. **It should be noted that the particulate sensors on site determined the system stabilization and purge times. No pre-tests were conducted to measure the actual system's delay time for the VOCs.**

Table 2: Sequence of a fluid injection event

Test Condition	Time (min)[1]	Sample Collection
1. Engine Purge	30	No
2. Setting Engine Conditions & System Stabilization	30	No
3. Baseline at T_{Bleed}= 200°C	60	Yes - Baseline samples at 200°C
4. *Fluid* Injection: a. System stabilization	30-40	No
b. T_{Bleed}= 200°C	60	Yes - *Fluid* samples at 200°C
c. T_{Bleed} Increase & System Stabilization	30	No
d. T_{Bleed}= 250°C	60	Yes - *Fluid* samples at 250°C
5. Engine Purge	30	No

T_{Bleed}=Bleed air temperature

[1] It should be noted that the particulate sensors on site determined the system stabilization and purge times. No pre-tests were conducted to measure the actual system's delay time for the VOCs.

In addition to the collected Baseline and Fluid samples, extra control samples were also taken. These controls account for interferences or artifacts from the engine test stand surroundings and shipping process. **Table 3** summarizes the control samples collected during fluid injections.

Table 3: Control samples taken during a fluid injection event

Control Name		Sample Description
Control Samples	Field blank	Tube that was briefly exposed to the ambient NGML air, but no air was drawn in through the tube.
	Field sample	Ambient NGML air that was drawn in through the tube during fluid injections.[1]
	Shipping blank	Tube that accompanied the samples throughout the sampling and shipping process. But no air was drawn in through the tube.

NGML= National Gas Machinery Laboratory

[1] Field Samples were only collected once per day

Table 4 shows all the samples collected for this effort. More details for each sample are available in the Chain of Custody Record in **Appendix D.**

Table 4: Samples collected from the engine tests

		Day 1 : 16MAY	Day 2 : 17MAY	Day 3 : 18MAY	Day 4 : 19MAY
Morning	**Injection Event**		***MJOII***	***PE-5***	***Deicing***[2]
			Baseline Inlet 200°C	Baseline Inlet 200°C	Baseline Inlet 200°C
			Baseline Bleed 200°C	Baseline Bleed 200°C	Baseline Bleed 200°C
			Field Blank	Field Blank	Field Blank
			Shipping Blank	Shipping Blank	Shipping Blank
			MJOII Inlet 200°C	*PE-5* Inlet 200°C	*Deicing* Inlet 200°C
			MJOII Bleed 200°C	*PE-5* Bleed 200°C	*Deicing* Bleed 200°C
			MJOII Inlet 250°C	*PE-5* Inlet 250°C	
			MJOII Bleed 250°C	*PE-5* Bleed 250°C	
Afternoon/Evening	**Injection Event**	***ETO2389***	***MJO387***	***HyJetIV***	***MJOII (Replicate)***[2]
		Baseline Inlet 200°C	Baseline Inlet 200°C	Baseline Inlet 200°C	Baseline Inlet 200°C
		Baseline Bleed 200°C	Baseline Bleed 200°C	Baseline Bleed 200°C	Baseline Bleed 200°C
		Field Blank	Field Blank	Field Blank	Field Blank
		Field Sample	Field Sample	Field Sample	Field Sample
		Shipping Blank	Shipping Blank	Shipping Blank	Shipping Blank
		ETO2389 Inlet 200°C	*MJO387* Inlet 200°C	*HyJetIV* Inlet 200°C	*MJOIIRep* Inlet 200°C
		ETO2389 Bleed 200°C	*MJO387* Bleed 200°C	*HyJetIV* Bleed 200°C	*MJOIIRep* Bleed 200°C
		ETO2389 Inlet 263°C[1]	*MJO387* Inlet 250°C	*HyJetIV* Inlet 250°C	
		ETO2389 Bleed 263°C[1]	*MJO387* Bleed 250°C	*HyJetIV* Bleed 250°C	

[1]Only day where bleed temperature reached 263°C

[2] Runs where the only bleed temperature evaluated was 200°C

Fluid Inlet 200°C & *Fluid* Inlet 250°C: Intake air during a Fluid injection at bleed temperatures of 200°C and 250°C, respectively.

Fluid Bleed 200°C & Fluid Bleed 250°C: Bleed air during a Fluid injection at bleed temperatures of 200°C and 250°C, respectively.

Sample Processing

Air samples were run by the GCMS unit in the Gas & Fluid Flow Integration Lab at NAS Patuxent River. The GCMS run was performed using an Agilent 7890B GC System equipped with an Agilent 5977B MSD series quadrupole mass spectrometer. The method used is an adapted version of the TO-17 EPA Compendium Method. The processing run used an electron impact ionization at an ionization energy of 70eV. A mass range of 30 to 400 amu was scanned. The source was maintained at 325^{o}C, and the quadrupole was fixed at 150^{o}C. The oven temperature was ramped from 35^{o}C to 325^{o}C. A final hold of 3mins was applied for a total run time of 42mins. A Restek Rtx-1 60m x 320µm x 1µm column was used, with helium carrier gas at a constant flow of 2mL/min. Samples were introduced into a splitless inlet maintained at 200^{o}C using a Markes TD100-xr Automated Thermal Desorber. Each tube was desorbed at 300^{o}C for 10mins.

Each fluid injection batch was processed with GCMS blanks, Laboratory blanks, and Certified Reference Standards (CRS). These additional controls were run to track carryover from sample to sample and to account for any interferences from the laboratory instrumentation, laboratory environment, and technician. Similarly, CRS tubes loaded with calibration gases were run at the start and end of each batch sequence to ensure proper GCMS response and to semi-quantify the air samples.

VOC Identification

Compound identification was based on mass spectrum deconvolution and mass spectrum matches against the NIST library. In general, the identified compounds are within a computed match factor greater than 80%. **It should be noted that these identifications are considered tentative since each compound was not compared against its corresponding standard.** Additionally, per this method, only compounds up to a retention time of 36.5mins were identified.

VOC Semi-quantification

Since not all compounds are commercially available and generating a calibration curve for each detected compound would be impractical, concentrations of identified compounds were based on a single point-toluene calibration line (i.e., toluene equivalents). In general, this technique relates the area of each compound peak in the chromatograms to the area of toluene response from the CRS by a scaling factor. It should be noted that this method introduces a level of uncertainty since each compound ionizes differently in the mass spectrometer. Therefore, these calculated concentrations should be considered an estimate.

Data and Analysis

This section focuses on the chemical analysis of the samples collected in the bleed air as a result of the fluid injections (i.e., *Fluid* Bleed 200°C and *Fluid* Bleed 250°C). Please note that the data shown has been corrected. However, the results for all the samples taken without corrections are in **Appendix A**.

The correction process was needed due to the high VOC levels detected in the controls (i.e., baseline bleed, inlet air, and field air samples). For instance, **Table 5** summarizes the most prominent VOCs identified in the control samples on the first day of testing for the ETO2389 injection event. In this case, the baseline bleed and the inlet air emission profiles were more intense than the bleed emission profile during the actual injection event (see also the total ion chromatograms in **Appendix B**).

Table 5: Major VOCs identified in main control samples for the ETO2389 injection sequence run on Day 1

Control Samples	RT (min)	Compound Name	CAS #	Concentration[1]	
				µg/m³	ppbV
Baseline Bleed 200°C	22.14	Naphthalene	91-20-3	592.9	113.2
	24.28	2-methylnaphthalene	91-57-6	131.3	22.6
	25.64	Byphenyl	92-52-4	123.8	19.6
***ETO2389* Inlet 200°C**	20.35	Undecane	1120-21-4	70.9	11.1
	22.14	Naphthalene	91-20-3	113.0	21.6
	25.64	Byphenyl	92-52-4	116.9	18.5
***ETO2389* Inlet 263°C**	15.86	Nonane	111-84-2	64.2	12.2
	18.00	1,2,3-trimethylbenzene	526-73-8	76.8	15.6
	18.21	Decane	124-18-5	80.8	13.9
Field Sample	4.52	Acetone	67-64-1	69.2	29.2
	4.71	Isopropyl alcohol	67-63-0	52.1	21.2
	8.83	1-butanol	71-36-3	56.1	18.5

RT=Retention time; CAS#=Chemical Abstract Service registry number
[1]Toluene-equivalent concentration

Figure 3 also gathers the identified compounds by chemical class for the aforementioned control samples. In general, the most identified compounds for the Baseline and Inlet samples were within the aromatic and alkanes classification. In contrast, for the Field sample, most identified VOCs were within the alcohol and ketone class.

These results show that the bleed line contained a significant accumulation of contaminants, probably from previous testing done in the system. It is also possible that certain instruments as well as human activities surrounding the system negatively impacted the air during testing. For example, alcohols like butanol probably came from solvents used in the particulate sensors. Similarly, ketones such as acetone likely came from human emissions. In contrast, alkane and aromatic compounds like naphthalene and biphenyl probably came from engine exhaust or emissions from filling the fuel tank.

Therefore, corrections were intended to remove such interferences and facilitate the identification of compounds that were a direct result of the actual fluid events.

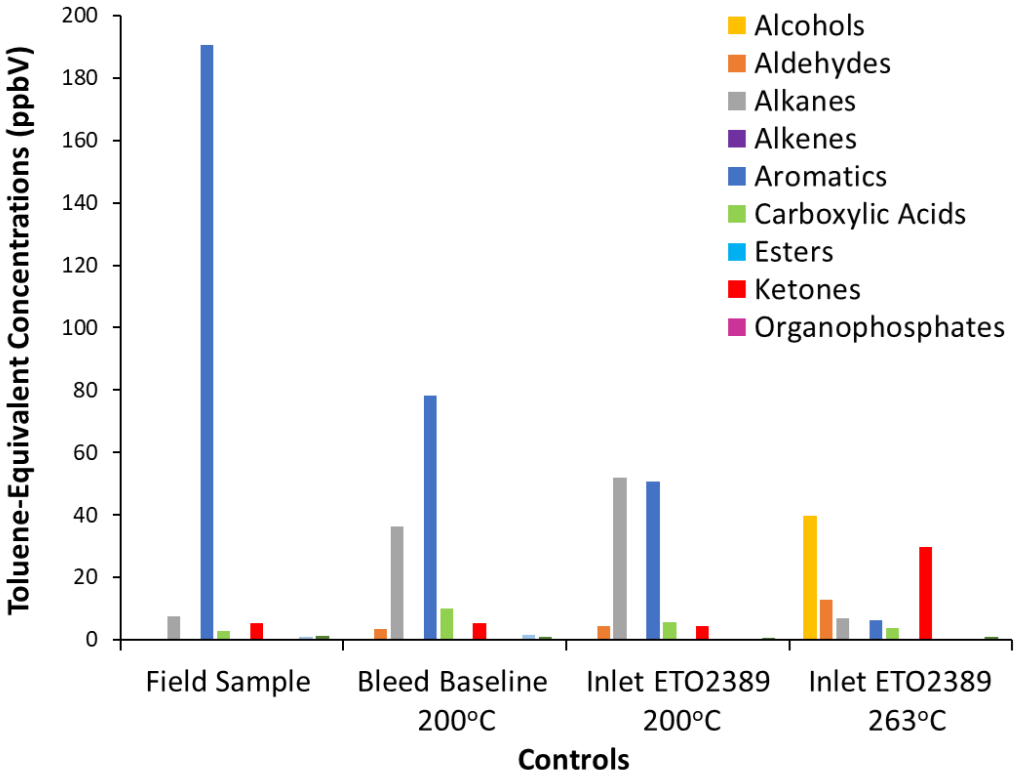


Figure 3: Major classes of VOCs identified in the main control samples for the ETO2389 injection sequence run on Day 1

Corrections applied to the *Fluid* bleed samples varied depending on the compounds identified and conditions tested. The controls were used to subtract background signal responses from the actual fluid bleed signal responses. For instance, Baseline bleed and Inlet samples were mainly used to correct the Fluid bleed samples. However, the Field controls were used to correct for low molecular weight compounds. At the same time, the Shipping controls were used to correct for phthalate and plasticizer compounds. It is important to note that these subtractions were performed using the GCMS signal responses and not the estimated concentrations. This process was chosen to facilitate the corrections between some controls since no airflow was actively drawn through the tube media of the Shipping and Field blanks.

Turbo Engine Oils

Engine oils were the first fluids evaluated in the system. On the first day of testing, only ETO2389 was injected. On the second day, the remaining two oils were tested. MJOII was injected in the morning, followed by MJO387 in the afternoon. A replicate injection for the MJOII oil was also evaluated, on day four, after testing the hydraulic and deicing fluids.

Tables 6-9 show the identified VOCs at both evaluated bleed temperatures after data corrections. Concentrations are also listed in units of part per billion by volume (ppbV) and micrograms per cubic meter ($\mu g/m^3$). More details on the full emission profiles and the total ion chromatograms for these injection events are found in **Appendix A** and **B**, respectively.

These results indicate that VOCs are present in the bleed when oils enter the engine system. In general, it can be seen that as the bleed temperature increased, VOC emissions also increased downstream of the system.

This trend may have been influenced by two factors: the volatilization of VOCs and the thermal-oxidative decomposition of the fluids. As the temperature increased, the compounds that had previously accumulated in the system gained additional kinetic energy, increasing their vaporization and mobilization. Additionally, the temperature rise could have promoted the breakdown of the base stock and additives of these fluids under the exposed pressure, moisture, and oxygen conditions. However, since Baseline Bleed samples were only collected at 200°C and not 250°C before the injections, it is challenging to determine which specific factor played a significant role in this behavior.

Table 6: VOC tentatively identified in the bleed samples as a result of the *ETO2389* injection into the system. Data are corrected results.

RT (min)	Compound Name	CAS #	Concentration[1]			
			$\mu g/m^3$		ppbV	
			ETO2389 **200°C**	***ETO2389*** **263°C**	***ETO2389*** **200°C**	***ETO2389*** **263°C**
8.90	2-ethylacrolein	922-63-4	--	80.6	--	23.45
8.94	Benzene	71-43-2	--	7.4	--	2.30
9.63	Pentanal	110-62-3	--	20.4	--	5.79
12.64	Hexanal	66-25-1	8.6	26.1	2.10	6.37
14.88	Pentanoic acid	109-52-4	--	40.8	--	9.76
14.90	p-xylene	106-42-3	--	11.0	--	2.53
15.39	Heptanal	111-71-7	1.7	45.1	0.37	9.67
15.86	Nonane	111-84-2	1.8	31.9	0.35	6.08
16.75	2,6-dimethyloctane	2051-30-1	--	24.5	--	4.21
17.22	1-ethyl-2-methyl-benzene	611-14-3	1.1	12.0	0.23	2.44
17.85	Octanal	124-13-0	--	29.5	--	5.62
18.00	1,2,3-trimethylbenzene	526-73-8	6.0	80.7	1.23	16.42
18.21	Decane	124-18-5	--	72.5	--	12.46
18.77	2,6-dimethylnonane	17302-28-2	--	16.7	--	2.61
19.30	p-cresol	106-44-5	--	52.1	--	11.79
19.42	Heptanoic acid	111-14-8	--	151.3	--	28.43

RT (min)	Compound Name	CAS #	Concentration[1]			
			µg/m³		ppbV	
			ETO2389 200°C	*ETO2389* 263°C	*ETO2389* 200°C	*ETO2389* 263°C
20.08	Nonanal	124-19-6	--	32.4	--	5.57
20.35	Undecane	1120-21-4	21.5	65.5	3.37	10.25
21.26	Octanoic acid	124-07-2	--	149.9	--	25.43
21.47	p-cymene	99-87-6	6.61	27.41	1.20	5.00
21.66	4,7-dimethylundecane	17301-32-5	5.89	7.49	0.78	0.99
22.33	Dodecane	112-40-3	102.67	30.59	14.75	4.39
22.65	2,6-dimethylundecane	17301-23-4	28.97	10.85	3.84	1.44
23.29	(1,3-dimethylbutyl)cyclohexane	61142-19-6	4.39	3.91	0.64	0.57
24.18	Tridecane	629-50-5	10.36	35.92	1.38	4.77
25.90	Tetradecane	629-59-4	--	9.17	--	1.13
27.54	Pentadecane	629-62-9	--	5.75	--	0.66
29.00	Hexadecane	544-76-3	--	7.22	--	0.78
29.29	Tributyl phosphate	126-73-8	--	26.80	--	2.46
32.60	Dibutyl phenyl phosphate	2528-36-1	--	8.52	--	0.73
33.25	o-terphenyl	84-15-1	--	31.19	--	3.31
34.77	p-dicyclohexylbenzene	1087-02-1	--	40.97	--	4.14
35.01	(1,1'-Bicyclohexyl)-4-ylbenzene	20273-27-2	--	35.09	--	3.54
35.17	Heptanoic acid, anhydride	626-27-7	--	29.99	--	3.03
35.70	1-cyclohexyl-4-phenylbenzene	1000401-12-4	--	8.16	--	0.85

RT=Retention time; CAS#=Chemical Abstract Service registry number; -- =below the detection limits of the method used.

[1]Toluene-equivalent concentration

Table 7: VOC tentatively identified in the bleed samples as a result of the *MJOII* injection into the system. Data are corrected results.

RT (min)	Compound Name	CAS #	Concentration[1]			
			µg/m^3		ppbV	
			MJOII 200°C	*MJOII* 250°C	*MJOII* 200°C	*MJOII* 250°C
8.94	Benzene	71-43-2	6.2	9.9	1.95	3.11
9.63	Pentanal	110-62-3	11.3	10.8	3.21	3.08
12.09	Toluene	108-88-3	4.2	5.4	1.10	1.44
12.65	Hexanal	66-25-1	13.0	10.9	3.16	2.65
14.15	2-methylbutanoic acid	116-53-0	9.8	20.8	2.35	4.99
14.88	Pentanoic acid	109-52-4	68.9	69.9	16.50	16.74
15.39	Heptanal	111-71-7	4.6	21.1	0.98	4.52
15.86	Nonane	111-84-2	--	40.1	--	7.64
16.75	2,6-dimethyloctane	2051-30-1	--	22.2	--	3.82
18.00	1,2,3-trimethylbenzene	526-73-8	3.9	54.1	0.79	11.02
18.21	Decane	124-18-5	--	36.9	--	6.35
19.30	p-cresol	106-44-5	--	46.4	--	10.50
19.42	Heptanoic acid	111-14-8	44.3	156.7	8.32	29.45
20.35	Undecane	1120-21-4	12.7	30.9	1.99	4.84
21.30	Octanoic acid	124-07-2	50.8	81.0	8.63	13.74
21.47	p-cymene	99-87-6	10.0	12.6	1.82	2.30
21.66	4,7-dimethylundecane	17301-32-5	10.7	15.7	1.42	2.08
22.33	Dodecane	112-40-3	69.3	81.2	9.96	11.66
22.65	2,6-dimethylundecane	17301-23-4	29.7	26.8	3.94	3.56
23.29	(1,3-dimethylbutyl)cyclohexane	61142-19-6	23.9	10.0	3.47	1.45
23.76	2,6-dimethyloctane	2051-30-1	37.5	35.3	6.45	6.08
24.18	Tridecane	629-50-5	62.5	112.0	8.30	14.86
24.56	3,5-dimethyldodecane	107770-99-0	--	18.4	--	2.27
24.87	n-decanoic acid	334-48-5	23.8	43.9	3.39	6.24
25.15	Oxalic acid, 6-ethyloct-3-yl isohexyl ester	1000309-34-3	--	32.1	--	2.50
25.60	2,6,10-trimethyldodecane	3891-98-3	10.7	23.2	1.23	2.67
25.90	Tetradecane	629-59-4	23.3	63.0	2.88	7.77
26.99	2,6,10,14-tetramethylheptadecane	18344-37-1	--	18.1	--	1.49
27.54	Pentadecane	629-62-9	0.9	23.6	0.10	2.71
29.05	Nonadecane	629-92-5	1.5	1.6	0.14	0.15
29.29	Tributyl phosphate	126-73-8	13.1	3.6	1.20	0.33
32.60	Dibutyl phenyl phosphate	2528-36-1	17.6	21.7	1.50	1.86
34.02	Allyl stearate	6289-31-2	--	19.9	--	1.50
34.77	p-dicyclohexylbenzene	1087-02-1	--	1.2	--	0.12
35.01	(1,1'-Bicyclohexyl)-4-ylbenzene	20273-27-2	1.9	3.2	0.19	0.32
35.17	Heptanoic acid, anhydride	626-27-7	21.0	113.0	2.12	11.41
35.70	1-cyclohexyl-4-phenylbenzene	1000401-12-4	10.4	11.9	1.08	1.23
36.30	2,7-dimethyl-3,5-Octanedione	7307-07-5	--	78.9	--	11.33

RT=Retention time; CAS#=Chemical Abstract Service registry number; -- =below the detection limits of the method used.
[1]Toluene-equivalent concentration

Table 8: VOC tentatively identified in the bleed samples as a result of the *MJO387* injection into the system. Data are corrected results.

RT (min)	Compound Name	CAS #	Concentration[1]			
			µg/m³		ppbV	
			***MJO387* 200°C**	***MJO387* 250°C**	***MJO387* 200°C**	***MJO387* 250°C**
8.94	Benzene	71-43-2	0.4	4.3	0.13	1.34
9.63	Pentanal	110-62-3	--	3.7	--	1.05
12.65	Hexanal	66-25-1	2.9	5.6	0.71	1.37
14.88	Pentanoic acid	109-52-4	32.9	69.0	7.89	16.52
15.39	Heptanal	111-71-7	--	7.3	--	1.57
19.42	Heptanoic acid	111-14-8	41.9	55.1	7.88	10.36
21.30	Octanoic acid	124-07-2	21.6	28.7	3.66	4.87
22.33	Dodecane	112-40-3	--	2.0	--	0.29
24.87	n-decanoic acid	334-48-5	27.0	25.0	3.84	3.55
29.29	Tributyl phosphate	126-73-8	2.1	3.2	0.19	0.29
35.17	Heptanoic acid, anhydride	626-27-7	35.6	--	3.59	--
35.80	Butyl diphenyl phosphate	2752-95-6	11.1	13.0	0.89	1.04
36.30	2,7-dimethyl-3,5-Octanedione	7307-07-5	86.6	46.9	12.44	6.74

RT=Retention time; CAS#=Chemical Abstract Service registry number; -- =below the detection limits of the method used.
[1]Toluene-equivalent concentration

Table 9: VOC tentatively identified in the bleed samples as a result of the *MJOIIRep* injection into the system. Data are corrected results.

RT (min)	Compound Name	CAS #	Concentration[1]	
			µg/m³	ppbV
			***MJOIIRep* 200°C**	***MJOIIRep* 200°C**
9.63	Pentanal	110-62-3	4.1	1.16
12.65	Hexanal	66-25-1	5.7	1.39
14.15	2-methylbutanoic acid	116-53-0	7.2	1.73
14.99	Pentanoic acid	109-52-4	36.5	8.75
15.39	Heptanal	111-71-7	5.5	1.18
19.42	Heptanoic acid	111-14-8	83.7	15.74
21.30	Octanoic acid	124-07-2	36.4	6.18
24.87	n-decanoic acid	334-48-5	21.8	3.09
26.99	2,6,10,14-tetramethylheptadecane	18344-37-1	3.9	0.32
27.54	Pentadecane	629-62-9	6.0	0.69
32.60	Dibutyl phenyl phosphate	2528-36-1	5.3	0.45
33.69	n-hexadecanoic acid	57-10-3	9.3	0.88
34.02	Allyl stearate	6289-31-2	7.8	0.59
35.01	(1,1'-Bicyclohexyl)-4-ylbenzene	20273-27-2	6.1	0.61
35.17	Heptanoic acid, anhydride	626-27-7	43.0	4.34
36.30	2,7-dimethyl-3,5-Octanedione	7307-07-5	64.1	9.22

RT=Retention time; CAS#=Chemical Abstract Service registry number
[1]Toluene-equivalent concentration

Figure 4 summarizes the identified VOCs by chemical class for these oil events. In general, carboxylic acids were the most detected compounds, followed by alkanes. *MJOII* replicate injection also followed this trend. These results compare well with the chemical composition of engine oils and expected byproducts from the oil degradation. Typically, these fluids comprise a blend of polyol ester base oils, which break down into long aliphatic chains (such as alkanes) and oxygenated compounds (such as aldehydes and ketones). The oxygenated compounds can then react further, primarily forming carboxylic acids.

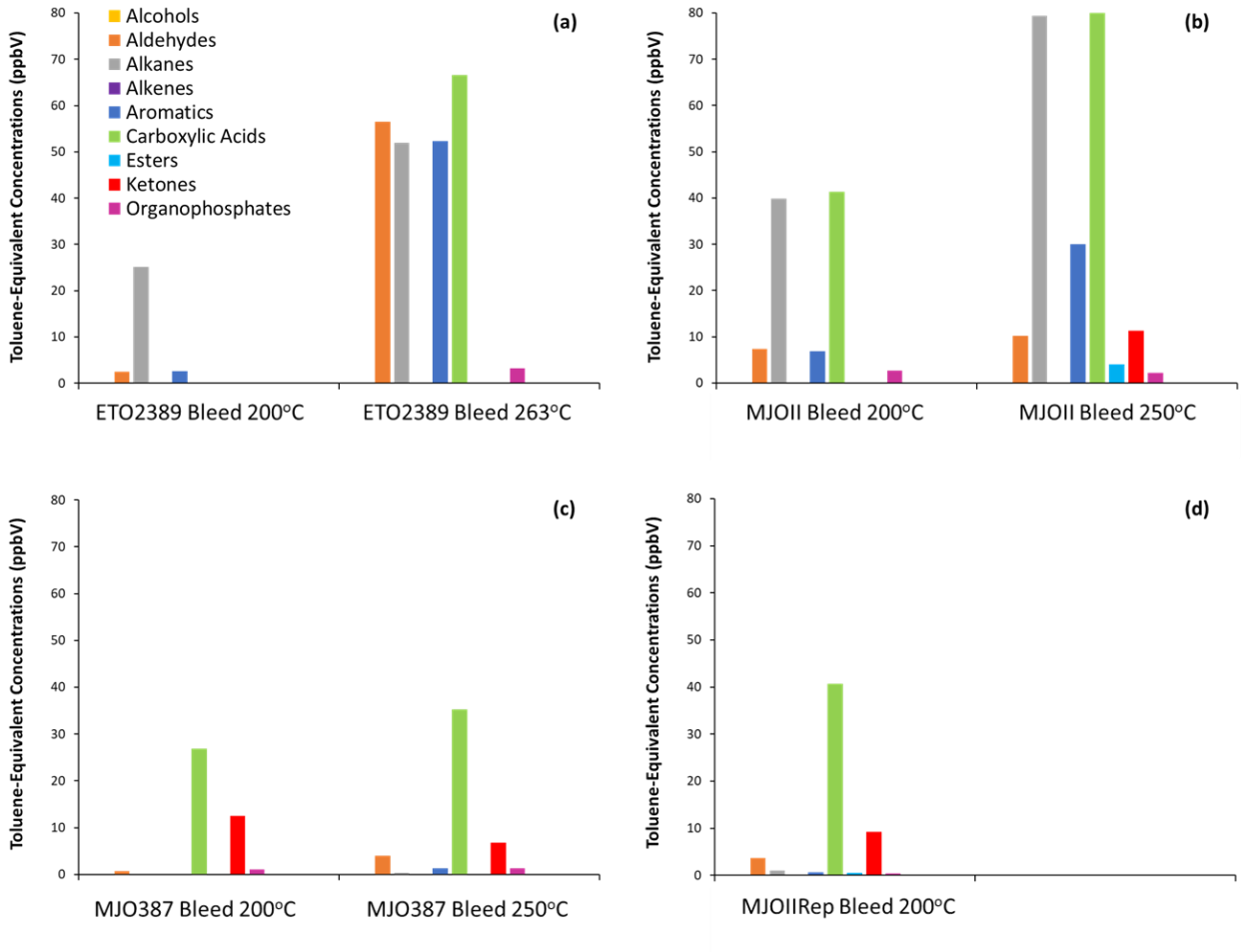


Figure 4: Major classes of VOCs identified in the Bleed line for the (a) ETO2389, (b) MJOII, (c) MJO387, and (d) MJOIIRep injection sequence runs. Data are corrected results.

As seen in **Tables 6-9** above, ETO2389 and MJOII oils resulted in the highest VOC emissions, followed by MJO387. However, since these two oils (ETO2389 and MJOII) were the first ones to be tested in the system and significant residual fluid levels were found before starting these tests (see Baseline Bleed in **Figure 3**), this trend could be related more to this carryover effect than to the oil properties themselves.

Additional evidence of this fluid carryover effect can be seen in the remaining baseline bleed samples for these oil events shown in **Figure 5**. Both **Figure 5** and the chromatograms in **Appendix B** show that with each injection, the emission profiles of the baseline samples resemble the previous injected fluid event, even after purging the engine between injections. This behavior shows that the purge time was insufficient to return the system to the "clean" pre-injection conditions. However, this behavior may also be caused by a lack of sufficient delay between the start of fluid injections and the sampling time, indicating that the system requires more time to reach a steady state.

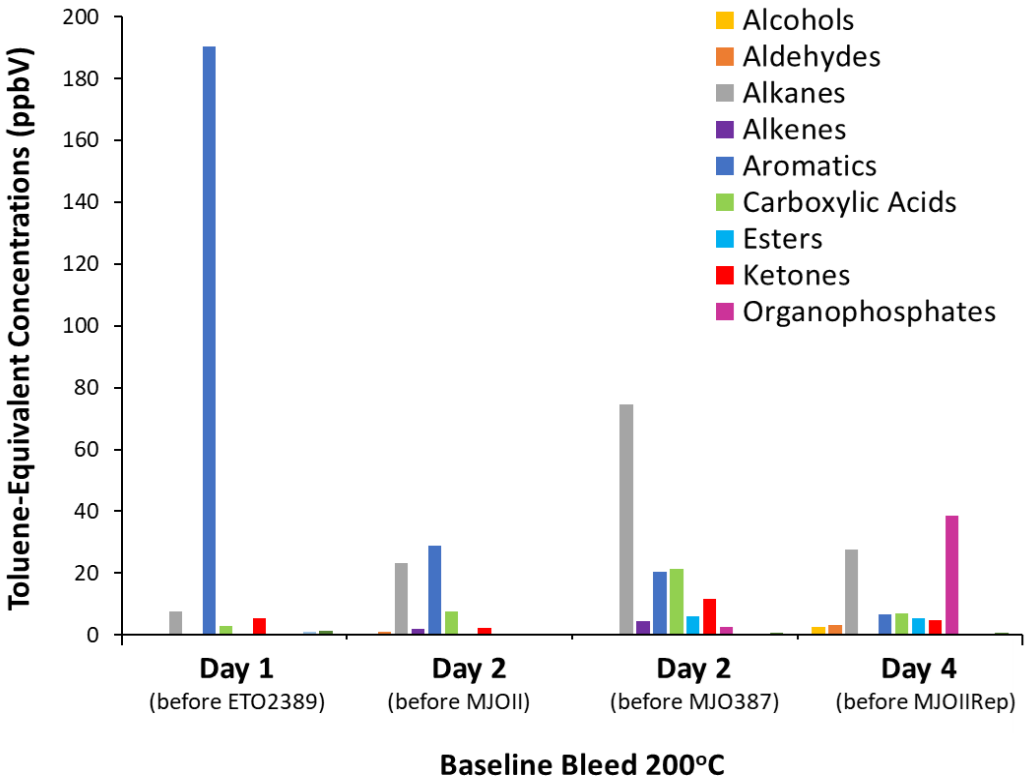


Figure 5: Major classes of VOCs identified in the Baseline Bleed samples for the oil events.

Hydraulic Fluids

Hydraulic fluids were the second class of fluids evaluated in the system. On the third day, *PE-5* was tested in the morning, followed by *HyJetIV* in the afternoon. **Tables 10** and **11** show the identified VOCs at both evaluated bleed temperatures after data corrections. In the same way that it was observed with the oils, the increase in bleed temperature also increased the emissions.

Table 10: VOC tentatively identified in the bleed samples as a result of the *PE-5* injection into the system. Data are corrected results.

RT (min)	Compound Name	CAS #	Concentration[1]			
			µg/m³		ppbV	
			PE-5 200°C	*PE-5* 250°C	*PE-5* 200°C	*PE-5* 250°C
17.34	n-butyl methacrylate	97-88-1	--	23.6	--	4.07
27.31	Triisobutyl phosphate	126-71-6	38.0	220.4	3.49	20.24
27.71	Butylated hydroxytoluene	128-37-0	--	2.6	--	0.29
29.29	Tributyl phosphate	126-73-8	24.0	455.4	2.21	41.83
32.48	3-cyclopentylpropionic acid, 2-ethylhexyl ester[2]	1000293-47-0	--	15.6	--	1.50
32.60	Dibutyl phenyl phosphate	2528-36-1	--	5.1	--	0.44
35.17	Heptanoic acid, anhydride	626-27-7	2.6	14.7	0.26	1.49
36.28	2-Tetradecanol octanoate	55193-79-8	2.3	17.1	0.17	1.23

RT=Retention time; CAS#=Chemical Abstract Service registry number, -- =below the detection limits of the method used.
[1]Toluene-equivalent concentration
[2] Closely related 7-Oxabicyclo(4.1.0)heptane-3-carboxylic acid, 2-ethylhexyl ester compound

Table 11: VOC tentatively identified in the bleed samples as a result of the *HyJetIV* injection into the system. Data are corrected results.

RT (min)	Compound Name	CAS #	Concentration[1]			
			µg/m³		ppbV	
			HyJetIV 200°C	*HyJetIV* 250°C	*HyJetIV* 200°C	*HyJetIV* 250°C
3.64	2-butene	624-64-6	--	20.3	--	8.87
14.64	1-hexanol	111-27-3	--	41.2	--	9.86
15.86	Nonane	111-84-2	--	17.4	--	3.33
16.75	2,6-dimethyloctane	2051-30-1	--	12.6	--	2.17
17.34	n-butyl methacrylate	97-88-1	5.7	84.9	0.99	14.62
18.00	1,2,3-trimethylbenzene	526-73-8	1.6	19.9	0.32	4.05
18.21	Decane	124-18-5	0.9	23.7	0.16	4.07
20.35	Undecane	1120-21-4	1.5	24.5	0.23	3.83
22.33	Dodecane	112-40-3	1.9	17.9	0.27	2.57
24.18	Tridecane	629-50-5	--	27.2	--	3.61
25.90	Tetradecane	629-59-4	--	17.1	--	2.11
26.99	2,6,10,14-tetramethylheptadecane	18344-37-1	17.4	5.2	1.43	0.43
27.31	Triisobutyl phosphate	126-71-6	--	5.0	--	0.46
27.54	Pentadecane	629-62-9	2.8	3.8	0.33	0.43
27.71	Butylated hydroxytoluene	128-37-0	10.9	33.5	1.21	3.72
29.29	Tributyl phosphate	126-73-8	--	1276.1	--	117.23
34.02	Allyl stearate	6289-31-2	12.9	12.1	0.97	0.91
35.17	Heptanoic acid, anhydride	626-27-7	22.4	70.8	2.26	7.15
36.30	2,7-dimethyl-3,5-Octanedione	7307-07-5	14.6	40.2	1.05	2.89

RT=Retention time; CAS#=Chemical Abstract Service registry number, -- =below the detection limits of the method used.
[1]Toluene-equivalent concentration

Results in the above tables and the chromatograms found in **Appendix B** show distinctive emission profiles compared to the oil events. Unlike the oil events, these hydraulic fluids presented lower VOC emissions but higher Semi-Volatile Organic Compound (SVOC) emissions.

Figure 6 summarizes the compounds by chemical class for these hydraulic fluids. It is observed that organophosphate compounds stand out the most for these events. These results align with the chemical composition of the injected fluids, which consists mainly of a mixture of organophosphate compounds (**Appendix E**). In this instance, the main constituents of the formulation were volatilized under the high bleed temperature and did not necessarily break down (as seen with the previous oils). This observation was attributed to the fact that most of the identified compounds were pure constituents.

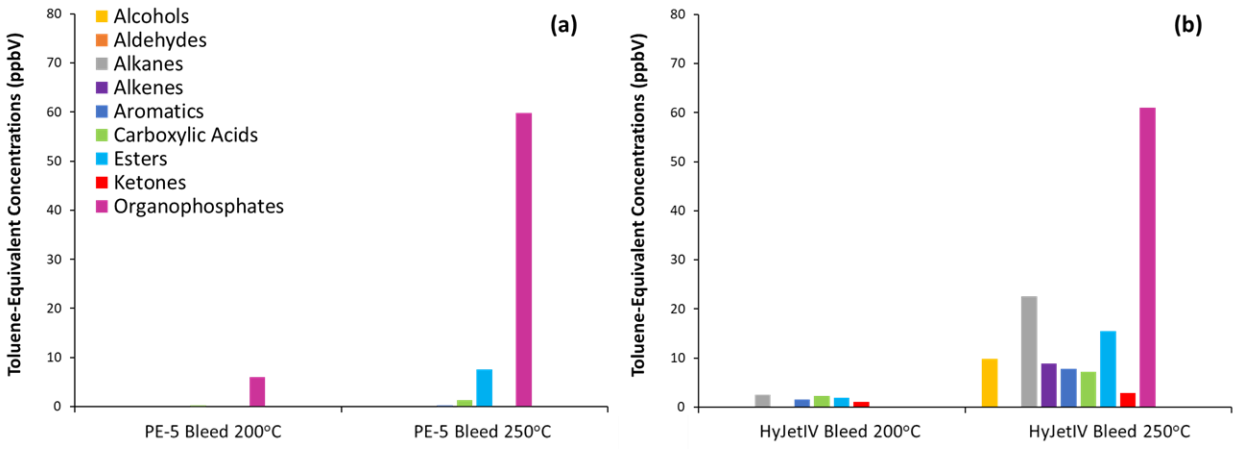


Figure 6: Major classes of VOCs identified in the Bleed line for the (a) PE-5, and (b) HyJetIV injection sequence runs. Data are corrected results.

Tables 10 -11 and **Figure 6** also appear to exhibit lower compound emissions for the *PE-5* fluid compared to *HyJetIV*, which could be confused for a higher performance grade of *PE-5*. However, as seen previously, this behavior is more likely attributed to a combination of time delay and carryover effects.

Evidence of these effects can be seen in **Figure 7**. This graph compares the last *PE-5* injection to the baseline sample for the next *HyJetIV* injection event. It is evident that organophosphates from the *PE-5* injection are still present in the system, even after the *PE-5* injection was stopped and the lines were purged for 30-40min. It can also be seen that the post-injection baseline sample contained higher organophosphate emissions than the actual *PE-5* injection event. This behavior could also indicate that when the system was sampled, it was still in a transient and not steady state. Therefore, these findings suggest that these fluid injection captures were only the initial undeveloped concentration fronts of the actual VOC emissions, which means the reported concentrations for these emissions are underestimated.

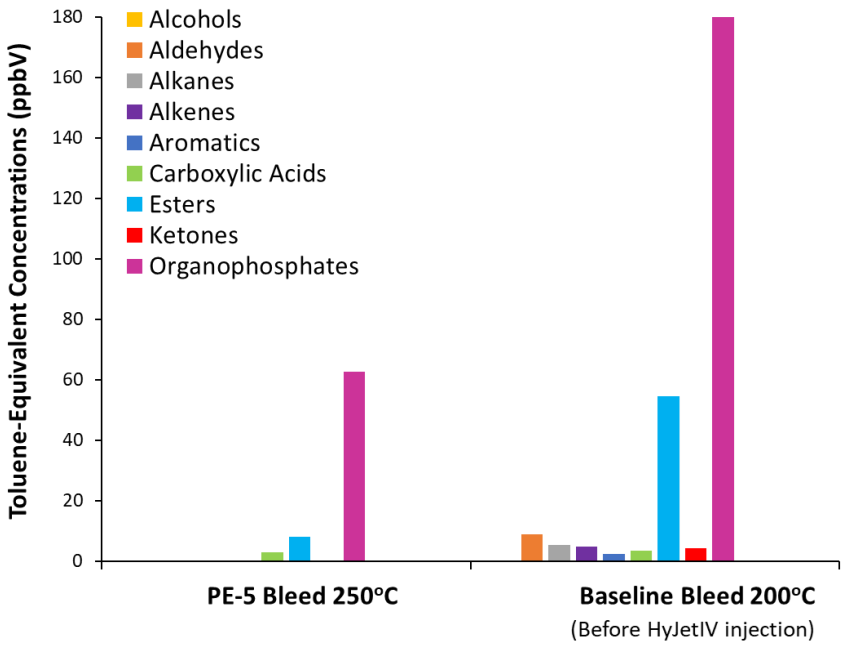


Figure 7: Comparison of VOC emissions in the Bleed line between the PE-5 injection and the subsequent Baseline sample after purge.

It should also be noted that the hydraulic fluid showed the highest carryover effect compared to the other fluids. Even after the *Deicing* fluid and the *MJOII* oil replicate events, organophosphates persisted in the bleed stream. This behavior could be attributed to the physical and chemical properties of these compounds. Organophosphates are heavy molecules with high boiling points, and they contain functional groups that interact strongly with metal surfaces. More details on this emission behavior are also found in **Appendix C**.

Deicing Fluid

The deicing fluid was tested on day four in the morning. **Table 12** shows the VOCs identified only at a bleed temperature of 200°C. Injections at 250°C were not considered.

Table 12: VOC tentatively identified in the bleed samples due to *Deicing* injection into the system. Data are corrected results.

RT (min)	Compound Name	CAS #	Concentration	
			µg/m³	ppbV
			***Deicing* 200°C**	**Deicing 200°C**
14.06	3-hydroxy-2-butanone	513-86-0	118.2	32.82
14.30	Propylene glycol[2]	57-55-6	399.2	128.4
19.64	Propylene glycol[2]	57-55-6	127.5	40.99
35.17	Heptanoic acid, anhydride	626-27-7	5.8	0.59

RT=Retention time; CAS#=Chemical Abstract Service registry number
[1]Toluene-equivalent concentration
[2] Closely related propylene glycol compounds

This deicing fluid event showed the lowest VOC identification of all the fluids studied. This lower VOC content was expected since the composition of this Type I deicing fluid is mainly propylene glycol and water.

As seen in **Table 12**, only four compounds were detected after the data corrections were made. Among these, two were identified as propylene glycol, suggesting the presence of closely related compounds in the fluid's formulation. The remaining two compounds could have been additional residual VOCs purged by the event. **Figure 8** also shows this emission by chemical class.

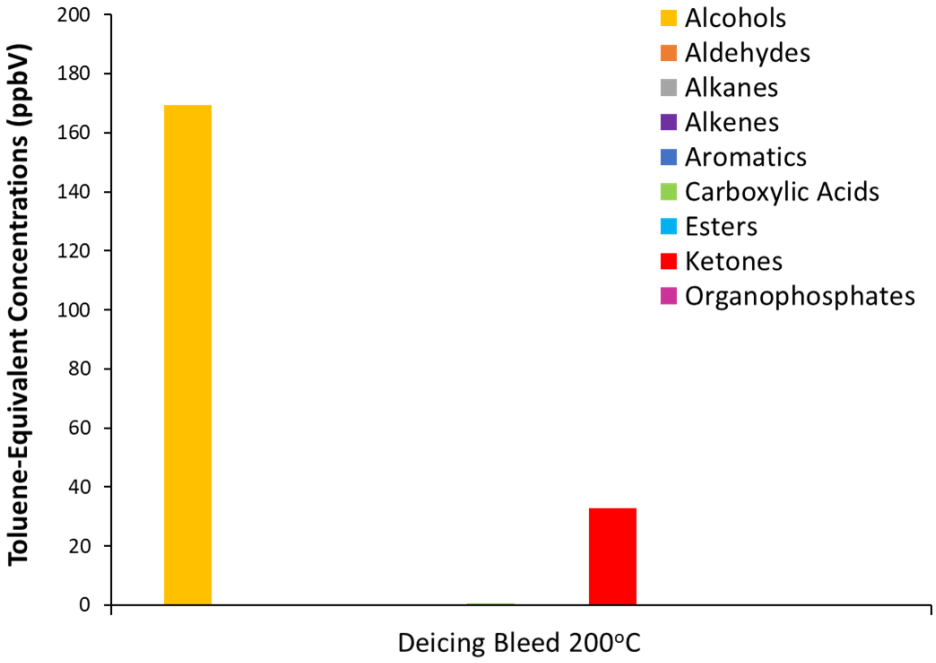


Figure 8: Major classes of VOCs identified in the Bleed line for the Deicing injection run. Data are corrected results.

Conclusion

These findings showed that the system was affected by significant fluid carryovers between injections, which negatively impacted the chemical analysis. It was also found that the engine system responded slowly to the fluid injections. Therefore, as more fluids were introduced into the system, it became difficult to differentiate the emissions and trace them back to a particular fluid event of interest. Additionally, due to this system lag, these results point to samples being collected too early, suggesting that the quantification of these emissions is underestimated.

However, to the extent of the data, this chemical analysis (after corrections) demonstrated that:

- VOCs were present in the bleed air stream when aircraft fluids entered the engine system.
- VOC emissions increased as the bleed air temperature increased.
- Each fluid category showed a distinctive VOC emission profile.
- Deicing fluid had the least VOC emissions, followed by hydraulic fluids and engine oil events.
- Carboxylic acid and alkane emissions increased during the engine oil events.
- Organophosphate emissions increased during the hydraulic fluid events.
- Hydraulic fluid events exhibited the highest carryover effect.

Recommendations

Based on the findings of this study, the following recommendations are suggested:

Testing Recommendations

- Conduct pre-tests to determine the time it takes for VOCs to travel through the system and the time it takes for the system to produce steady VOC emissions.
- Establish a baseline for all conditions under which the system will be tested.
- Collect more control samples for each baseline to minimize experimental variables other than the ones being tested.
- Change the order of fluid injections to minimize fluid carryover effects.
- Increase purge temperature and time to clean system lines and reduce fluid carryover.
- Conduct fluid injection replicates multiple times to increase confidence in the integrity of the VOC emissions generated by the engine system. A standard minimum of two replicates is recommended.

Chemical Analysis Recommendations:

- Improve identification accuracy and quantification for compounds of interest by running specific standards.

Acronyms and Abbreviations

Acronyms/Abbreviations	Definition
μ	Viscosity
$\mu g/m^3$	Micrograms per cubic meter
CAS#	Chemical Abstract Service registry number
CRS	Certified Reference Standards
cST	Centistoke
Deicing	Type I Deicing Safewing MP/LFD 88 Dilute
EPA	Environmental Protection Agency
TO-17	Toxic Organic Compendium of Methods - 17 Determination of Volatile Organic Compounds in Ambient Air using Active Sampling onto Sorbent Tubes
ETO2389	Eastman Turbo Oil 2389
FAA/CAMI	Federal Aviation Administration's Civil Aerospace Medical Institute
GCMS	Gas Chromatography-Mass Spectrometry
HyJetIV	Hydraulic fluid - HyJet IV-A Plus
KSU	Kansas State University
MJO387	Turbine engine oil - Mobil Jet Oil 387
MJOII	Turbine engine oil - Mobil Jet Oil II
NAS	Naval Air Station
NAWCAD	Naval Air Warfare Center Aircraft Division
NGML	National Gas Machinery Laboratory
PE-5	Hydraulic fluid - Skydrol PE-5
ppbV	Part per billion by volume
PSI	Pounds per square inch
ppmW	Part per million by weight
RT	Retention time
SVOC	Semi-Volatile Organic Compound
T_{Bleed}	Bleed air temperature
TIC	Total Ion Chromatograms
VOC	Volatile Organic Compound

Appendix A

Volatile Organic Compound Concentration Results before Corrections

Day 1- Afternoon: *ETO 2389* Injection Event (Concentration results in units of parts per billion volume, ppbV)

RT (min)	Compound Name	CAS#	Compound Concentration (ppbV)[1]								
			Controls			Baseline 200		ETO2389 200		ETO2389 263	
			Shipping Blank[2]	Field Blank[2]	Field Sample	Inlet	Bleed	Inlet	Bleed	Inlet	Bleed
3.50	Isobutane	75-28-5	--	--	1.76	--	--	--	--	--	--
4.52	Acetone	67-64-1	6.04	8.55	29.16	--	5.36	3.62	--	2.60	4.73
4.71	Isopropyl alcohol	67-63-0	--	--	21.19	--	--	--	--	--	--
5.65	Carbon disulfide	75-15-0	--	--		--	4.38	--	--	--	--
6.63	Butanal	123-72-8	--	--	11.25	--	--	--	--	--	--
6.72	Acetic acid	64-19-7	6.03	2.18		--	--	--	--	--	--
8.83	1-butanol	71-36-3	--	--	18.52	--	--	--	--	--	--
8.90	2-ethylacrolein	922-63-4	--	--	--	--	--	--	--	--	23.45
8.94	Benzene	71-43-2	6.74	7.35	1.69	1.75	2.51	2.80	2.44	3.19	5.14
9.63	Pentanal	110-62-3	--	--	--	--	--	--	--	--	5.79
12.09	Toluene	108-88-3	--	1.52	1.68	--	--	1.90	1.98	1.45	1.85
12.64	Hexanal	66-25-1	--	--	--	--	--	--	2.10	--	7.42
12.67	1,3-oxathiolane	2094-97-5	--	--	--	--	16.13	--	--	--	--
13.77	Hexamethylcyclotrisiloxane	541-05-9	3.05	2.96	0.68	0.64	1.26	1.05	0.91	0.72	1.06
14.88	Pentanoic acid	109-52-4	--	--	--	--	--	2.23	--	--	9.76
14.90	p-xylene	106-42-3	--	--	1.03	4.77	4.25	4.27	3.19	9.09	8.93
15.39	Heptanal	111-71-7	--	--	--	--	--	1.21	1.58	--	--
15.86	Nonane	111-84-2	--	--	--	7.35	3.33	5.95	4.99	12.25	14.29
16.75	2,6-dimethyloctane	2051-30-1	--	--	--	4.45	2.65	3.32	2.65	7.95	9.51
16.83	Benzaldehyde	100-52-7	2.90	4.31	0.99	--	--	2.07	--	--	--
17.22	1-ethyl-2-methyl-benzene	611-14-3	--	--	--	3.57	3.01	3.03	3.25	6.17	7.08
17.34	n-butyl methacrylate	97-88-1	--	--	--	2.98	--	--	--	--	--
17.85	Octanal	124-13-0	--	--	--	--	--	--	--	2.82	8.45
18.00	1,2,3-trimethylbenzene	526-73-8	--	--	1.05	5.62	4.68	4.87	6.00	15.64	26.91
18.21	Decane	124-18-5	--	--	0.63	1.10	--	5.98	5.46	13.89	20.77
18.77	2,6-dimethylnonane	17302-28-2	--	--	--	--	1.60	2.06	1.77	4.18	5.54
19.25	Acetophenone	98-86-2	--	--	0.65	--	--	1.74	--	--	--
19.30	p-cresol	106-44-5	--	--	--	--	--	--	--	--	11.79

RT (min)	Compound Name	CAS#	Compound Concentration (ppbV)[1]								
			Controls			Baseline 200		ETO2389 200		ETO2389 263	
			Shipping Blank[2]	Field Blank[2]	Field Sample	Inlet	Bleed	Inlet	Bleed	Inlet	Bleed
19.42	Heptanoic acid	111-14-8	--	--	--	--	--	1.68	--	2.66	31.09
20.08	Nonanal	124-19-6	--	--	0.69	--	--	--	--	1.59	7.16
20.35	Undecane	1120-21-4	--	--	1.27	--	--	11.10	14.47	3.89	15.81
21.04	Benzoic acid	65-85-0	1.28	1.14	3.29	--	--	2.61	--	2.12	--
21.26	Octanoic acid	124-07-2	--	--	--	--	--	1.36	--	--	25.43
21.42	DecamethylCyclopentasiloxane	541-02-6	--	0.37	0.24	2.42	--	--	--	--	--
21.47	p-cymene	99-87-6	--	--	--	--	--	6.32	7.53	--	8.76
21.66	4,7-dimethylundecane	17301-32-5	--	--	--	--	--	1.07	1.85	--	1.92
22.14	Naphthalene	91-20-3	1.00	1.01	0.76	71.82	113.20	21.58	21.06	6.65	12.26
22.33	Dodecane	112-40-3	--	--	1.06	--	--	4.23	18.98	7.26	12.77
22.65	2,6-dimethylundecane	17301-23-4	--	--	--	--	--	--	3.84	1.74	3.27
23.29	(1,3-dimethylbutyl)cyclohexane	61142-19-6	--	--	0.23	--	--	1.39	2.03	0.86	1.51
23.76	2,6-dimethyloctane	2051-30-1	--	--	0.25	--	--	--	--	--	--
24.18	Tridecane	629-50-5	--	--	0.66	--	--	--	2.37	--	5.95
24.28	2-methylnaphthalene	91-57-6	--	--	--	43.73	34.53	3.72	4.80	0.67	2.04
25.64	Byphenyl	92-52-4	--	--	--	52.36	19.65	18.55	9.07	4.78	4.29
25.90	Tetradecane	629-59-4	--	--	0.39	--	--	--	--	--	1.72
27.04	Biphenylene	259-79-0	--	--	--	41.06	8.67	10.05	6.87	2.70	2.17
27.54	Pentadecane	629-62-9	--	--	0.25	--	--	--	--	--	1.04
27.60	Acenaphthene	83-32-9	--	--	--	3.81	--	--	--	--	--
28.59	Diethyl phthalate	84-66-2	5.94	--	0.29	--	27.70	1.06	0.34	--	--
29.00	Hexadecane	544-76-3	--	--	0.24	--	--	1.20	--	--	1.14
29.10	Diphenyl sulfide	139-66-2	1.46	1.35	--	--	--	--	--	--	--
29.18	Fluorene	86-73-7	--	--	--	2.22	--	--	--	--	--
29.29	Tributyl phosphate	126-73-8	--	--	--	--	--	--	--	--	2.46
31.36	n-butylbenzenesulfonamide	3622-84-2	3.19	1.09	0.15	--	0.98	1.58	--	0.31	--
32.12	Phenanthrene	85-01-8	--	--	--	2.59	--	1.12	--	0.42	--
32.51	Diisobutyl phthalate	84-69-5	0.49	--	--		1.56	--	--	--	--
32.60	Dibutyl phenyl phosphate	2528-36-1	--	--	--	--	--	--	--	--	0.73

RT (min)	Compound Name	CAS#	Compound Concentration (ppbV)[1]								
			Controls			Baseline 200		ETO2389 200		ETO2389 263	
			Shipping Blank[2]	Field Blank[2]	Field Sample	Inlet	Bleed	Inlet	Bleed	Inlet	Bleed
33.25	o-Terphenyl	84-15-1	--	--	--	--	--	--	--	--	3.31
33.69	n-hexadecanoic acid	57-10-3	0.88	10.84	0.37	1.50	2.77	2.12	1.89	0.81	1.00
34.77	p-dicyclohexylbenzene	1087-02-1	--	--	--	--	--	--	--	--	4.14
35.01	(1,1'-Bicyclohexyl)-4-ylbenzene	20273-27-2	--	--	--	--	--	--	--	--	3.54
35.17	Heptanoic acid, anhydride	626-27-7	--	--	--	--	--	--	--	--	3.03
35.70	1-cyclohexyl-4-phenylbenzene	1000401-12-4	--	--	--	--	--	--	--	--	0.85

-- =below the detection limits of the method used.

[1]Toluene-equivalent concentrations.

[2]A volume of 1L was used for blanks to facilitate the VOC quantification.

Day 1- Afternoon: *ETO 2389* Injection Event (Concentration results in units of µg/m^3)

RT (min)	Compound Name	CAS#	Compound Concentrations (µg/m^3)[1]								
			Controls			Baseline 200°C		ETO2389 200°C		ETO2389 263°C	
			Shipping Blank[2]	Field Blank[2]	Field Sample	Inlet	Bleed	Inlet	Bleed	Inlet	Bleed
3.50	Isobutane	75-28-5	--	--	4.2	--	--	--	--	--	--
4.52	Acetone	67-64-1	14.3	20.3	69.2	--	12.7	8.6	--	6.2	11.2
4.71	Isopropyl alcohol	67-63-0	--	--	52.1	--	--	--	--	--	--
5.65	Carbon disulfide	75-15-0	--	--		--	13.6	--	--	--	--
6.63	Butanal	123-72-8	--	--	33.1	--	--	--	--	--	--
6.72	Acetic acid	64-19-7	14.8	5.4	--	--	--	--	--	--	--
8.83	1-butanol	71-36-3	--	--	56.1	--	--	--	--	--	--
8.90	2-ethylacrolein	922-63-4	--	--	--	--	--	--	--	--	80.6
8.94	Benzene	71-43-2	21.5	23.5	5.4	5.6	8.0	8.9	7.8	10.2	16.4
9.63	Pentanal	110-62-3	--	--	--	--	--	--	--	--	20.4
12.09	Toluene	108-88-3	--	5.7	6.3	--	--	7.2	7.4	5.5	7.0
12.64	Hexanal	66-25-1	--	--	--	--	--	--	8.6	--	30.4
12.67	1,3-oxathiolane	2094-97-5	--	--	--	--	59.4	--	--	--	--
13.77	Hexamethylcyclotrisiloxane	541-05-9	27.7	26.8	6.2	5.8	11.4	9.6	8.3	6.6	9.6
14.88	Pentanoic acid	109-52-4	--	--	--	--	--	9.3	--	--	40.8
14.90	p-xylene	106-42-3	--	--	4.5	20.7	18.5	18.5	13.8	39.4	38.7
15.39	Heptanal	111-71-7	--	--	--	--	--	5.7	7.4	--	48.8
15.86	Nonane	111-84-2	--	--	--	38.5	17.4	31.2	26.1	64.2	74.9
16.75	2,6-dimethyloctane	2051-30-1	--	--	--	25.9	15.4	19.3	15.4	46.2	55.3
16.83	Benzaldehyde	100-52-7	12.6	18.7	4.3	--	--	9.0	--	--	--
17.22	1-ethyl-2-methyl-benzene	611-14-3	--	--	--	17.5	14.8	14.9	15.9	30.3	34.8
17.34	n-butyl methacrylate	97-88-1	--	--	--	17.3	--	--	--	--	--
17.85	Octanal	124-13-0	--	--	--	--	--	--	--	14.8	44.3
18.00	1,2,3-trimethylbenzene	526-73-8	--	--	5.1	27.6	23.0	23.9	29.5	76.8	132.2
18.21	Decane	124-18-5	--	--	3.6	6.4	--	34.8	31.7	80.8	120.8
18.77	2,6-dimethylnonane	17302-28-2	--	--	--	--	10.2	13.1	11.3	26.7	35.4
19.25	Acetophenone	98-86-2	--	--	3.2	--	--	8.5	--	--	--
19.30	p-cresol	106-44-5	--	--	--	--	--	--	--	--	52.1

RT (min)	Compound Name	CAS#	Compound Concentrations (µg/m³)[1]								
			Controls			Baseline 200°C		ETO2389 200°C		ETO2389 263°C	
			Shipping Blank[2]	Field Blank[2]	Field Sample	Inlet	Bleed	Inlet	Bleed	Inlet	Bleed
19.42	Heptanoic acid	111-14-8	--	--	--	--	--	8.9	--	14.2	165.5
20.08	Nonanal	124-19-6	--	--	4.0	--	--	--	--	9.3	41.6
20.35	Undecane	1120-21-4	--	--	8.1	--	--	70.9	92.4	24.8	101.0
21.04	Benzoic acid	65-85-0	6.4	5.7	16.4	--	--	13.0	--	10.6	--
21.26	Octanoic acid	124-07-2	--	--	--	--	--	8.0	--	--	149.9
21.42	DecamethylCyclopentasiloxane	541-02-6	--	5.6	3.7	36.6	--	--	--	--	--
21.47	p-cymene	99-87-6	--	--	--	--	--	34.7	41.3	--	48.1
21.66	4,7-dimethylundecane	17301-32-5	--	--	--	--	--	8.0	13.9	--	14.4
22.14	Naphthalene	91-20-3	5.2	5.3	4.0	376.2	592.9	113.0	110.3	34.8	64.2
22.33	Dodecane	112-40-3	--	--	7.4	--	--	29.4	132.1	50.5	88.9
22.65	2,6-dimethylundecane	17301-23-4	--	--	--	--	--	--	29.0	13.1	24.7
23.29	(1,3-dimethylbutyl)cyclohexane	61142-19-6	--	--	1.6	--	--	9.6	14.0	5.9	10.4
23.76	2,6-dimethyloctane	2051-30-1	--	--	1.5	--	--	--	--	--	--
24.18	Tridecane	629-50-5	--	--	5.0	--	--	--	17.9		44.8
24.28	2-methylnaphthalene	91-57-6	--	--	--	170.8	131.3	21.6	27.9	3.9	11.9
24.60	2-methylnaphthalene	91-57-6	--	--	--	83.3	69.3	--	--	--	--
25.64	Byphenyl	92-52-4	--	--	--	330.0	123.8	116.9	57.2	30.1	27.0
25.90	Tetradecane	629-59-4	--	--	3.2	--	--	--	--	--	14.0
27.04	Biphenylene	259-79-0	--	--	--	255.4	53.9	62.5	42.7	16.8	13.5
27.54	Pentadecane	629-62-9	--	--	2.2	--	--	--	--	--	9.0
27.60	Acenaphthene	83-32-9	--	--	--	24.0	--	--	--	--	--
28.59	Diethyl phthalate	84-66-2	54.0	--	2.6	--	251.6	9.7	3.1	--	--
29.00	Hexadecane	544-76-3	--	--	2.2	--	--	11.1	--	--	10.6
29.10	Diphenyl sulfide	139-66-2	11.1	10.3	--	--	--	--	--	--	--
29.18	Fluorene	86-73-7	--	--	--	15.1	--	--	--	--	--
29.29	Tributyl phosphate	126-73-8	--	--	--	--	--	--	--	--	26.8
31.36	n-butylbenzenesulfonamide	3622-84-2	27.8	9.5	1.3	--	8.5	13.8	--	2.7	--
32.12	Phenanthrene	85-01-8	--	--	--	18.8	--	8.2	--	3.0	--
32.51	Diisobutyl phthalate	84-69-5	5.6	--	--	--	17.7	--	--	--	--
32.60	Dibutyl phenyl phosphate	2528-36-1	--	--	--	--	--	--	--	--	8.5

RT (min)	Compound Name	CAS#	Compound Concentrations (µg/m^3)[1]								
			Controls			Baseline 200°C		ETO2389 200°C		ETO2389 263°C	
			Shipping Blank[2]	Field Blank[2]	Field Sample	Inlet	Bleed	Inlet	Bleed	Inlet	Bleed
33.25	o-Terphenyl	84-15-1	--	--	--	--	--	--	--	--	31.2
33.69	n-hexadecanoic acid	57-10-3	9.2	113.6	3.9	15.7	29.0	22.3	19.9	8.5	10.5
34.77	p-dicyclohexylbenzene	1087-02-1	--	--	--	--	--	--	--	--	41.0
35.01	(1,1'-Bicyclohexyl)-4-ylbenzene	20273-27-2	--	--	--	--	--	--	--	--	35.1
35.17	Heptanoic acid, anhydride	626-27-7	--	--	--	--	--	--	--	--	30.0
35.70	1-cyclohexyl-4-phenylbenzene	1000401-12-4	--	--	--	--	--	--	--	--	8.16

-- =below the detection limits of the method used.

[1]Toluene-equivalent concentrations.

[2]A volume of 1L was used for blanks to facilitate the VOC quantification.

Day 2- Morning: *MJOII* Injection Event (Concentration results in units of parts per billion volume, ppbV)

RT (min)	Compound Name	CAS#	Compound Concentration (ppbV)[1]								
			Controls			Baseline 200		MJOII 200		MJOII 250	
			Shipping Blank[2]	Field Blank[2]	Field Sample	Inlet	Bleed	Inlet	Bleed	Inlet	Bleed
3.50	Isobutane	75-28-5	--	--	3.08	--	--	3.08	--	1.97	--
4.52	Acetone	67-64-1	2.60	3.03	30.20	12.18	2.21	20.92	1.52	15.42	--
4.71	Isopropyl alcohol	67-63-0	--	--	13.14	3.75	--	17.09	--	6.95	--
6.63	Butanal	123-72-8	--	--	9.04	3.62	--	3.83	--	3.49	--
6.72	Acetic acid	64-19-7	2.32	3.04	--	--	1.44	1.49	0.96	--	1.14
8.83	1-butanol	71-36-3	--	--	13.93	6.39	--	8.25	--	9.59	--
8.94	Benzene	71-43-2	2.09	2.75	1.53	2.36	3.45	2.63	4.99	1.04	5.74
9.63	Pentanal	110-62-3	--	--	0.61	--	--	--	3.81	--	4.98
12.09	Toluene	108-88-3	--	--	2.17	1.67	3.62	1.48	3.65	1.46	3.99
12.65	Hexanal	66-25-1	--	--	--	--	0.42	--	3.59	--	4.66
13.77	Hexamethylcyclotrisiloxane	541-05-9	0.52	1.26	0.78	0.28	0.40	0.42	0.74	0.42	0.74
14.15	2-methylbutanoic acid	116-53-0	--	--	--	--	--	--	2.35	--	6.17
14.88	Pentanoic acid	109-52-4	--	--	--	--	1.18	--	17.69	--	26.17
14.99	p-xylene	106-42-3	--	--	1.35	1.07	--	0.87	--	0.98	--
15.39	Heptanal	111-71-7	0.27	--		0.73	--	--	1.08	--	5.06
15.86	Nonane	111-84-2	--	--	0.38	0.42	2.28	--	1.55	0.83	9.02
16.75	2,6-dimethyloctane	2051-30-1	--	--	--	--	1.05	--	0.77	0.48	4.51
16.83	Benzaldehyde	100-52-7	1.19	1.34	1.02	0.68	--	1.01	--	--	1.01
17.22	1-ethyl-2-methyl-benzene	611-14-3	--	--	--	0.52	--	0.49	--	0.67	--
17.85	Octanal	124-13-0	--	--	--	--	--	0.44	--	0.48	--
18.00	1,2,3-trimethylbenzene	526-73-8	--	--	1.43	1.24	2.39	0.94	2.45	1.02	12.75
18.21	Decane	124-18-5	--	--	1.03	1.17	3.01	0.55	1.57	0.82	7.90
19.25	Acetophenone	98-86-2	0.31	--	--	--	--	--	--	--	--
19.30	p-cresol	106-44-5	--	--	--	--	1.36	--	--	--	11.18
19.42	Heptanoic acid	111-14-8	--	--	--	0.45	2.78	--	11.10	--	36.40
20.08	Nonanal	124-19-6	--	--	1.68	0.39	0.68	1.16	1.25	0.77	1.60
20.35	Undecane	1120-21-4	--	--	2.22	1.97	4.02	2.15	5.08	1.95	8.09
21.04	Benzoic acid	65-85-0	--	--	5.30	--	1.09	--	1.68	1.04	2.63

RT (min)	Compound Name	CAS#	Compound Concentration (ppbV)[1]								
			Controls			Baseline 200		MJOII 200		MJOII 250	
			Shipping Blank[2]	Field Blank[2]	Field Sample	Inlet	Bleed	Inlet	Bleed	Inlet	Bleed
21.30	Octanoic acid	124-07-2	--	--	--	--	0.92	--	9.54	--	18.97
21.42	DecamethylCyclopentasiloxane	541-02-6	--	--	0.36	--	--	--	--	--	0.29
21.47	p-cymene	99-87-6	--	--	0.65	0.65	--	0.73	2.56	0.93	3.40
21.66	4,7-dimethylundecane	17301-32-5	--	--	--	--	--	--	1.42	--	2.79
22.14	Naphthalene	91-20-3	--	--	1.26	10.20	9.53	8.20	5.06	6.47	5.46
22.33	Dodecane	112-40-3	--	--	2.62	1.24	5.56	1.56	13.52	2.14	17.50
22.65	2,6-dimethylundecane	17301-23-4	--	--	0.54	0.35	2.16	0.46	5.25	0.69	5.75
23.29	(1,3-dimethylbutyl)cyclohexane	61142-19-6	--	--	0.68	--	--	0.43	4.15	0.58	2.78
23.76	2,6-dimethyloctane	2051-30-1	--	--	0.79	--	0.84	--	7.30	--	10.15
24.18	Tridecane	629-50-5	--	--	2.94	--	2.25	--	11.22	0.41	18.43
24.28	2-methylnaphthalene	91-57-6	--	--	--	0.78	1.51	0.64	--	1.15	--
24.56	3,5-dimethyldodecane	107770-99-0	--	--	--	--	--	--	--	--	2.27
24.87	n-decanoic acid	334-48-5	--	--	--	--	--	--	3.39	--	7.93
25.15	Oxalic acid, 6-ethyloct-3-yl isohexyl ester	1000309-34-3	--	--	--	--	--	--	--	--	2.50
25.60	2,6,10-trimethyldodecane	3891-98-3	--	--	--	--	--	--	1.23	--	3.29
25.64	Byphenyl	92-52-4	--	--	--	2.46	2.50	2.81	1.42	3.27	1.97
25.90	Tetradecane	629-59-4	--	--	1.19	--	1.38	--	4.26	--	10.59
26.99	2,6,10,14-tetramethylheptadecane	18344-37-1	--	--	--	--	--	--	--	--	1.49
27.04	Biphenylene	259-79-0	--	--	--	1.39	1.49	1.50	--	1.69	--
27.54	Pentadecane	629-62-9	--	--	0.56	--	0.42	--	0.65	--	3.27
28.59	Diethyl phthalate	84-66-2	1.61	0.26	--	--	--	11.83	0.32	0.51	--
29.05	Nonadecane	629-92-5	--	--	0.29	--	0.20	--	0.42	--	0.46
29.10	Diphenyl sulfide	139-66-2	0.99	0.48	--	--	--	--	--	--	--
29.29	Tributyl phosphate	126-73-8	--	--	--	--	0.34	--	1.54	--	1.26
31.36	n-butylbenzenesulfonamide	3622-84-2	1.06	0.59	--	--	--	--	--	--	--
32.51	Diisobutyl phthalate	84-69-5	0.14	--	--	--	--	0.58	--	--	--
32.60	Dibutyl phenyl phosphate	2528-36-1	--	--	--	--	--	--	1.50	--	2.61
33.25	o-Terphenyl	84-15-1	--	--	--	--	0.82	--	0.79	--	0.60
33.69	n-Hexadecanoic acid	57-10-3	0.90	5.07	1.43	0.46	--	2.74	0.75	0.77	1.34

RT (min)	Compound Name	CAS#	Compound Concentration (ppbV)[1]								
			Controls			Baseline 200		MJOII 200		MJOII 250	
			Shipping Blank[2]	Field Blank[2]	Field Sample	Inlet	Bleed	Inlet	Bleed	Inlet	Bleed
34.02	Allyl stearate	6289-31-2	--	--	--	--	--	--	--	--	1.50
34.77	p-dicyclohexylbenzene	1087-02-1	--	--	--	--	1.12	--	0.98	--	1.17
35.01	(1,1'-Bicyclohexyl)-4-ylbenzene	20273-27-2	--	--	--	--	1.06	--	1.25	--	1.48
35.17	Heptanoic acid, anhydride	626-27-7	--	--	--	--	0.43	--	2.56	--	12.91
35.70	1-cyclohexyl-4-phenylbenzene	1000401-12-4	--	--	--	--	--	--	1.08	--	1.77
36.30	2,7-dimethyl-3,5-Octanedione	7307-07-5	--	--	--	--	--	--	--	--	11.33

-- =below the detection limits of the method used.

[1]Toluene-equivalent concentrations.

[2]A volume of 1L was used for blanks to facilitate the VOC quantification.

Day 2- Morning: *MJOII* Injection Event (Concentration results in units of µg/m^3)

RT (min)	Compound Name	CAS#	Compound Concentration (µg/m^3)[1]								
			Controls			Baseline 200		MJOII 200		MJOII 250	
			Shipping Blank[2]	Field Blank[2]	Field Sample	Inlet	Bleed	Inlet	Bleed	Inlet	Bleed
3.50	Isobutane	75-28-5	--	--	7.3	--	--	7.3	--	4.7	--
4.52	Acetone	67-64-1	6.2	7.2	71.7	28.9	5.2	49.7	3.6	36.6	--
4.71	Isopropyl alcohol	67-63-0	--	--	32.3	9.2	--	42.0	--	17.1	--
6.63	Butanal	123-72-8	--	--	26.6	10.7	--	11.3	--	10.3	--
6.72	Acetic acid	64-19-7	5.7	7.5	--	--	3.5	3.7	2.4	--	2.8
8.83	1-butanol	71-36-3	--	--	42.2	19.4	--	25.0	--	29.0	--
8.94	Benzene	71-43-2	6.7	8.8	4.9	7.5	11.0	8.4	15.9	3.3	18.3
9.63	Pentanal	110-62-3	--	--	2.1	--	--	--	13.4	--	17.5
12.09	Toluene	108-88-3	--	--	8.2	6.3	13.6	5.6	13.8	5.5	15.0
12.65	Hexanal	66-25-1	--	--	--	--	1.7	--	14.7	--	19.1
13.77	Hexamethylcyclotrisiloxane	541-05-9	4.7	11.4	7.1	2.6	3.6	3.8	6.7	3.8	6.7
14.15	2-methylbutanoic acid	116-53-0	--	--	--	--	--	--	9.8	--	25.8
14.88	Pentanoic acid	109-52-4	--	--	--	--	4.9	--	73.8	--	109.3
14.99	p-xylene	106-42-3	--	--	5.8	4.6	--	3.8	--	4.3	--
15.39	Heptanal	111-71-7	1.2	--	--	3.4	--	--	5.0	--	23.6
15.86	Nonane	111-84-2	--	--	2.0	2.2	12.0	--	8.1	4.4	47.3
16.75	2,6-dimethyloctane	2051-30-1	--	--	--	--	6.1	--	4.5	2.8	26.2
16.83	Benzaldehyde	100-52-7	5.2	5.8	4.4	3.0	--	4.4	--	--	4.4
17.22	1-ethyl-2-methyl-benzene	611-14-3	--	--	--	2.6	--	2.4	--	3.3	--
17.85	Octanal	124-13-0	--	--	--	--	--	2.3	--	2.5	--
18.00	1,2,3-trimethylbenzene	526-73-8	--	--	7.0	6.1	11.8	4.6	12.1	5.0	62.6
18.21	Decane	124-18-5	--	--	6.0	6.8	17.5	3.2	9.1	4.7	45.9
19.25	Acetophenone	98-86-2	1.5	--	--	--	--	--	--	--	--
19.30	p-cresol	106-44-5	--	--	--	--	6.0	--	--	--	49.4
19.42	Heptanoic acid	111-14-8	--	--	--	2.4	14.8	--	59.1	--	193.7
20.08	Nonanal	124-19-6	--	--	9.7	2.3	3.9	6.7	7.3	4.5	9.3
20.35	Undecane	1120-21-4	--	--	14.2	12.6	25.7	13.7	32.4	12.5	51.7
21.04	Benzoic acid	65-85-0	--	--	26.4	--	5.4	--	8.4	5.2	13.1

RT (min)	Compound Name	CAS#	Compound Concentration (µg/m³)[1]								
			Controls			Baseline 200		MJOII 200		MJOII 250	
			Shipping Blank[2]	Field Blank[2]	Field Sample	Inlet	Bleed	Inlet	Bleed	Inlet	Bleed
21.30	Octanoic acid	124-07-2	--	--	--	--	5.4	--	56.3	--	111.8
21.42	DecamethylCyclopentasiloxane	541-02-6	--	--	5.4	--	--	--	--	--	4.4
21.47	p-cymene	99-87-6	--	--	3.6	3.6	--	4.0	14.0	5.1	18.7
21.66	4,7-dimethylundecane	17301-32-5	--	--	--	--	--	--	10.7	--	21.0
22.14	Naphthalene	91-20-3	--	--	6.6	53.4	49.9	42.9	26.5	33.9	28.6
22.33	Dodecane	112-40-3	--	--	18.2	8.6	38.7	10.8	94.1	14.9	121.8
22.65	2,6-dimethylundecane	17301-23-4	--	--	4.1	2.6	16.3	3.5	39.6	5.2	43.3
23.29	(1,3-dimethylbutyl)cyclohexane	61142-19-6	--	--	4.7	--	--	2.9	28.5	4.0	19.1
23.76	2,6-dimethyloctane	2051-30-1	--	--	4.6	--	4.9	--	42.4	--	59.0
24.18	Tridecane	629-50-5	--	--	22.2	--	16.9	--	84.5	3.1	138.9
24.28	2-methylnaphthalene	91-57-6	--	--	--	4.5	8.8	3.7	--	6.7	--
24.56	3,5-dimethyldodecane	107770-99-0	--	--	--	--	--	--	--	--	18.4
24.87	n-decanoic acid	334-48-5	--	--	--	--	--	--	23.8	--	55.8
25.15	Oxalic acid, 6-ethyloct-3-yl isohexyl ester	1000309-34-3	--	--	--	--	--	--	--	--	32.1
25.60	2,6,10-trimethyldodecane	3891-98-3	--	--	--	--	--	--	10.7	--	28.5
25.64	Byphenyl	92-52-4	--	--	--	15.5	15.8	17.7	8.9	20.6	12.4
25.90	Tetradecane	629-59-4	--	--	9.6	--	11.2	--	34.5	--	85.8
26.99	2,6,10,14-tetramethylheptadecane	18344-37-1	--	--	--	--	--	--	--	--	18.1
27.04	Biphenylene	259-79-0	--	--	--	8.6	9.3	9.3	--	10.5	--
27.54	Pentadecane	629-62-9	--	--	4.8	--	3.6	--	5.7	--	28.4
28.59	Diethyl phthalate	84-66-2	14.7	2.4		--	--	107.5	2.9	4.6	--
29.05	Nonadecane	629-92-5	--	--	3.2	--	2.2	--	4.6	--	5.1
29.10	Diphenyl sulfide	139-66-2	7.5	3.7	--	--	--	--	--	--	--
29.29	Tributyl phosphate	126-73-8	--	--	--	--	3.7	--	16.7	--	13.8
31.36	n-butylbenzenesulfonamide	3622-84-2	9.3	5.1	--	--	--	--	--	--	--
32.51	Diisobutyl phthalate	84-69-5	1.6	--	--	--	--	6.6	--	--	--
32.60	Dibutyl phenyl phosphate	2528-36-1	--	--	--	--	--	--	17.6	--	30.5
33.25	o-Terphenyl	84-15-1	--	--	--	--	7.7	--	7.5	--	5.6
33.69	n-hexadecanoic acid	57-10-3	9.4	53.2	15.0	4.8	--	28.8	7.9	8.1	14.0

RT (min)	Compound Name	CAS#	Compound Concentration (µg/m³)[1]								
			Controls			Baseline 200		MJOII 200		MJOII 250	
			Shipping Blank[2]	Field Blank[2]	Field Sample	Inlet	Bleed	Inlet	Bleed	Inlet	Bleed
34.02	Allyl stearate	6289-31-2	--	--	--	--	--	--	--	--	19.9
34.77	p-dicyclohexylbenzene	1087-02-1	--	--	--	--	11.1	--	9.7	--	11.6
35.01	(1,1'-Bicyclohexyl)-4-ylbenzene	20273-27-2	--	--	--	--	10.5	--	12.4	--	14.6
35.17	Heptanoic acid, anhydride	626-27-7	--	--	--	--	4.3	--	25.3	--	127.8
35.70	1-cyclohexyl-4-phenylbenzene	1000401-12-4	--	--	--	--	--	--	10.4	--	17.1
36.30	2,7-dimethyl-3,5-Octanedione	7307-07-5	--	--	--	--	--	--	--	--	78.9

-- =below the detection limits of the method used.

[1]Toluene-equivalent concentrations.

[2]A volume of 1L was used for blanks to facilitate the VOC quantification.

Day 2- Afternoon: *MJO387* Injection Event (Concentration results in units of parts per billion volume, ppbV)

RT (min)	Compound Name	CAS#	Compound Concentration (ppbV)[1]								
			Controls			Baseline 200		MJO387 200		MJO387 250	
			Shipping Blank[2]	Field Blank[2]	Field Sample	Inlet	Bleed	Inlet	Bleed	Inlet	Bleed
3.50	Isobutane	75-28-5	--	--	2.9	--	--	--	--	--	2.7
3.64	2-butene	624-64-6	1.1	--	--	3.5	4.4	2.8	2.1	2.1	2.5
4.52	Acetone	67-64-1	3.1	3.3	28.3	2.9	3.6	2.7	1.4	1.5	2.2
4.71	Isopropyl alcohol	67-63-0	--	--	12.3	--	--	--	--	--	--
6.63	Butanal	123-72-8	--	--	8.5	--	--	--	--	--	1.9
6.72	Acetic acid	64-19-7	2.6	4.1	--	--	--	2.3	1.0	--	0.9
8.83	1-butanol	71-36-3	--	--	13.1	--	--	--	--	--	--
8.94	Benzene	71-43-2	2.3	3.5	1.4	1.7	2.5	2.5	2.6	2.8	4.0
9.63	Pentanal	110-62-3	--	--	0.6	--	--	--	--	--	1.7
12.09	Toluene	108-88-3	--	--	2.0	1.1	1.6	1.2	1.4	0.8	1.1
12.65	Hexanal	66-25-1	--	--	--	--	--	--	0.7	--	1.7
13.77	Hexamethylcyclotrisiloxane	541-05-9	0.9	1.3	0.7	0.3	0.7	0.7	--	0.2	0.8
14.88	Pentanoic acid	109-52-4	--	--	--	2.5	--	--	7.9	--	20.5
14.99	o-xylene	95-47-6	0.4	--	1.3	3.3	--	1.7	--	0.8	--
15.39	Heptanal	111-71-7	--	--	--	--	--	0.7	--	--	1.6
15.86	Nonane	111-84-2	--	--	0.4	7.1	5.5	3.6	2.6	1.4	1.8
16.75	2,6-dimethyloctane	2051-30-1	--	--	--	4.3	3.4	1.6	1.8	1.0	1.3
16.83	Benzaldehyde	100-52-7	1.2	1.3	1.0	--	--	--	--	--	--
17.22	1-ethyl-2-methyl-benzene	611-14-3	0.5	--	--	3.4	3.4	2.3	1.3	1.1	--
17.34	n-butyl methacrylate	97-88-1	--	--	--	--	2.1	1.4	1.0	0.7	--
17.85	Octanal	124-13-0	0.3	--	--	1.0	--	--	--	--	--
18.00	1,2,3-trimethylbenzene	526-73-8	--	--	1.3	5.8	5.5	3.3	3.1	1.8	3.0
18.21	Decane	124-18-5	--	--	1.0	6.1	5.6	3.7	3.6	2.0	2.9
19.42	Heptanoic acid	111-14-8	--	--	--	1.5	6.7	1.0	11.7	0.6	15.3
20.08	Nonanal	124-19-6	--	--	1.6	--	--	--	--	--	--
20.35	Undecane	1120-21-4	--	--	2.1	4.7	5.1	3.4	3.9	2.2	3.3
21.04	Benzoic acid	65-85-0	--	--	5.0	--	--	--	--	--	--
21.30	Octanoic acid	124-07-2	--	--	--	0.9	2.3	0.7	5.2	--	8.6

RT (min)	Compound Name	CAS#	Compound Concentration (ppbV)[1]								
			Controls			Baseline 200		MJO387 200		MJO387 250	
			Shipping Blank[2]	Field Blank[2]	Field Sample	Inlet	Bleed	Inlet	Bleed	Inlet	Bleed
21.42	DecamethylCyclopentasiloxane	541-02-6	--	--	0.3	--	--	--	--	--	--
21.47	p-cymene	99-87-6	--	--	--	1.1	--	1.6	--	--	--
22.14	Naphthalene	91-20-3	--	--	1.2	5.7	3.7	5.8	3.8	4.1	3.2
22.33	Dodecane	112-40-3	--	--	2.5	7.7	10.3	7.4	8.1	4.8	7.3
22.65	2,6-dimethylundecane	17301-23-4	--	--	0.5	2.7	3.4	2.4	2.7	1.7	2.3
23.29	(1,3-dimethylbutyl)cyclohexane	61142-19-6	--	--	0.6	1.6	2.1	1.4	1.4	1.0	1.4
23.55	2,10-dimethylundecane	17301-27-8	--	--	--	--	1.3	--	--	0.7	--
23.69	3-methyldodecane	17312-57-1	--	--	--	1.1	1.9	1.2	1.5	0.9	1.1
23.76	2,6-dimethyloctane	2051-30-1	--	--	0.7	3.7	4.5	3.4	3.4	2.4	2.9
24.18	Tridecane	629-50-5	--	--	2.2	10.0	11.3	8.5	9.1	6.8	8.5
24.28	2-methylnaphthalene	91-57-6	--	--	--	--	0.8	--	--	--	--
24.56	3,5-dimethyldodecane	107770-99-0	--	--	--	1.1	1.2	1.0	0.8	0.6	0.8
24.87	n-decanoic acid	334-48-5	--	--	--	--	--	--	3.8	--	5.5
25.15	Oxalic acid, 6-ethyloct-3-yl isohexyl ester	1000309-34-3	--	--	--	1.7	1.6	1.3	1.4	0.9	1.2
25.60	2,6,10-trimethyldodecane	3891-98-3	--	--	--	2.7	2.7	1.6	2.0	1.1	1.6
25.64	Byphenyl	92-52-4	--	--	--	1.5	--	1.5	--	1.1	--
25.9	Tetradecane	629-59-4	--	--	1.1	7.5	8.2	5.4	5.9	3.0	4.8
26.99	2,6,10,14-tetramethylheptadecane	18344-37-1	--	--	--	2.0	2.0	1.6	1.2	0.8	0.9
27.03	Biphenylene	259-79-0	--	--	--	1.0	1.1	--	--	--	--
27.54	Pentadecane	629-62-9	--	--	0.5	5.0	4.6	3.9	3.4	2.3	2.5
27.71	Butylated hydroxytoluene	128-37-0	--	--	--	0.5	--	--	--	--	--
28.59	Diethyl phthalate	84-66-2	1.2	--	--	--	--	1.1	--	--	--
29.05	Nonadecane	629-92-5	0.8	--	0.3	--	1.3	0.7	1.0	--	0.8
29.29	Tributyl phosphate	126-73-8	--	--	--	--	0.6	--	0.8	--	1.0
31.36	n-butylbenzenesulfonamide	3622-84-2	0.9	0.8	--	--	--	2.0	--	--	--
32.10	2-tridecenal	7069-41-2	--	--	--	--	--	0.6	--	--	--
32.51	Diisobutyl phthalate	84-69-5	--	--	--	--	--	0.4	--	--	--
32.60	Dibutyl phenyl phosphate	2528-36-1	--	--	--	--	1.9	--	1.9	--	1.2
33.25	o-terphenyl	84-15-1	--	--	--	--	0.4	--	0.4	--	0.4

RT (min)	Compound Name	CAS#	Compound Concentration (ppbV)[1]								
			Controls			Baseline 200		MJO387 200		MJO387 250	
			Shipping Blank[2]	Field Blank[2]	Field Sample	Inlet	Bleed	Inlet	Bleed	Inlet	Bleed
33.69	n-hexadecanoic acid	57-10-3	0.8	2.5	1.3	0.3	0.5	1.9	0.5	1.2	1.1
34.02	Allyl stearate	6289-31-2	--	--	--	--	2.0	--	1.6	--	0.8
35.17	Heptanoic acid, anhydride	626-27-7	--	--	--	--	11.9	--	15.5	--	12.6
35.70	1-cyclohexyl-4-phenylbenzene	1000401-12-4	--	--	--	--	1.9	--	1.3	--	--
35.80	Butyl diphenyl phosphate	2752-95-6	--	--	--	--	--	--	0.9	--	1.5
36.30	2,7-dimethyl-3,5-Octanedione	7307-07-5	--	--	--	--	8.0	0.2	16.5	--	19.0

-- =below the detection limits of the method used.

[1]Toluene-equivalent concentrations.

[2]A volume of 1L was used for blanks to facilitate the VOC quantification.

Day 2- Afternoon: *MJO387* Injection Event (Concentration results in units of µg/m^3)

RT (min)	Compound Name	CAS#	Compound Concentration (µg/m^3)[1]								
			Controls			Baseline 200		MJO387 200		MJO387 250	
			Shipping Blank[2]	Field Blank[2]	Field Sample	Inlet	Bleed	Inlet	Bleed	Inlet	Bleed
3.50	Isobutane	75-28-5	--	--	6.9	--	--	--	--	--	6.4
3.64	2-butene	624-64-6	2.5	--	--	8.1	10.0	6.4	4.9	4.8	5.7
4.52	Acetone	67-64-1	7.4	7.9	67.2	6.9	8.7	6.4	3.4	3.7	5.1
4.71	Isopropyl alcohol	67-63-0	--	--	30.3	--	--	--	--	--	--
6.63	Butanal	123-72-8	--	--	25.0	--	--	--	--	--	5.5
6.72	Acetic acid	64-19-7	6.4	10.2	--	--	--	5.6	2.5	--	2.1
8.83	1-butanol	71-36-3	--	--	39.6	--	--	--	--	--	--
8.94	Benzene	71-43-2	7.4	11.3	4.6	5.6	7.9	7.9	8.3	8.8	12.7
9.63	Pentanal	110-62-3	--	--	2.0	--	--	--	--	--	5.9
12.09	Toluene	108-88-3	--	--	7.7	4.2	6.1	4.5	5.4	3.1	4.1
12.65	Hexanal	66-25-1	--	--	--	--	--	--	2.9		7.1
13.77	Hexamethylcyclotrisiloxane	541-05-9	7.7	11.9	6.7	2.4	6.2	6.6	--	1.8	7.0
14.88	Pentanoic acid	109-52-4	--	--	--	10.5	--	--	32.9		85.4
14.99	o-xylene	106-42-3	1.8	--	5.5	14.3	--	7.2	--	3.6	--
15.39	Heptanal	111-71-7	--	--	--	--	--	3.4	--	--	7.3
15.86	Nonane	111-84-2	--	--	1.9	37.4	28.6	18.7	13.6	7.4	9.5
16.75	2,6-dimethyloctane	2051-30-1	--	--	--	24.7	20.0	9.1	10.4	5.7	7.8
16.83	Benzaldehyde	100-52-7	5.1	5.7	4.2	--	--	--	--	--	--
17.22	1-ethyl-2-methyl-benzene	611-14-3	2.4	--	--	16.5	16.6	11.5	6.5	5.6	--
17.34	n-butyl methacrylate	97-88-1	--	--	--	--	12.1	7.9	6.0	4.2	--
17.85	Octanal	124-13-0	1.5	--	--	5.5	--	--	--	--	--
18.00	1,2,3-trimethylbenzene	526-73-8	--	--	6.6	28.5	27.1	16.2	15.2	9.0	14.7
18.21	Decane	124-18-5	--	--	5.6	35.5	32.8	21.6	21.0	11.9	16.7
19.42	Heptanoic acid	111-14-8	--	--	--	8.1	35.4	5.2	62.2	3.4	81.2
20.08	Nonanal	124-19-6	--	--	9.1	--	--	--	--	--	--
20.35	Undecane	1120-21-4	--	--	13.3	29.7	32.5	21.9	25.2	13.9	21.1
21.04	Benzoic acid	65-85-0	--	--	24.8	--	--	--	--	--	--
21.30	Octanoic acid	124-07-2	--	--	--	5.4	13.7	3.9	30.4	--	50.7

RT (min)	Compound Name	CAS#	Compound Concentration (µg/m³)[1]								
			Controls			Baseline 200		MJO387 200		MJO387 250	
			Shipping Blank[2]	Field Blank[2]	Field Sample	Inlet	Bleed	Inlet	Bleed	Inlet	Bleed
21.42	DecamethylCyclopentasiloxane	541-02-6	--	--	5.1	--	--	--	--	--	--
21.47	p-cymene	99-87-6	--	--	--	12.2	--	8.9	--	--	--
22.14	Naphthalene	91-20-3	--	--	6.2	29.8	19.6	30.2	19.7	21.2	16.8
22.33	Dodecane	112-40-3	--	--	17.1	53.3	72.0	51.8	56.4	33.4	50.8
22.65	2,6-dimethylundecane	17301-23-4	--	--	3.8	20.5	25.2	18.4	20.1	12.7	17.5
23.29	(1,3-dimethylbutyl)cyclohexane	61142-19-6	--	--	4.4	10.8	14.6	9.3	10.0	6.9	9.4
23.55	2,10-dimethylundecane	17301-27-8	--	--	--	--	10.0	--	--	5.4	--
23.69	3-methyldodecane	17312-57-1	--	--	--	8.1	14.6	9.4	11.7	6.5	8.2
23.76	2,6-dimethyloctane	2051-30-1	--	--	4.3	21.6	26.1	19.5	19.7	14.1	16.9
24.18	Tridecane	629-50-5	--	--	16.5	75.6	84.9	64.0	68.7	51.4	64.1
24.28	2-methylnaphthalene	91-57-6	--	--	--	--	4.7	--	--	--	--
24.56	3,5-dimethyldodecane	107770-99-0	--	--	--	8.8	9.8	8.0	6.9	5.1	6.6
24.87	n-decanoic acid	334-48-5	--	--	--	--	--	--	27.0	--	38.5
25.15	Oxalic acid, 6-ethyloct-3-yl isohexyl ester	1000309-34-3	--	--	--	21.7	19.9	16.4	17.9	11.5	15.2
25.60	2,6,10-trimethyldodecane	3891-98-3	--	--	--	23.2	23.2	13.7	17.5	9.2	13.6
25.64	Byphenyl	92-52-4	--	--	--	9.7	--	9.3	--	6.8	--
25.9	Tetradecane	629-59-4	--	--	9.0	61.1	66.4	44.0	47.8	24.6	38.6
26.99	2,6,10,14-tetramethylheptadecane	18344-37-1	--	--	--	24.6	24.1	19.8	15.0	9.6	10.9
27.03	Biphenylene	259-79-0	--	--	--	6.2	7.1	--	--	--	--
27.54	Pentadecane	629-62-9	--	--	4.5	43.0	39.9	33.8	29.2	19.7	21.7
27.71	Butylated hydroxytoluene	128-37-0	--	--	--	4.5	--	--	--	--	--
28.59	Diethyl phthalate	84-66-2	10.7	--	--	--	--	10.2	--	--	--
29.05	Nonadecane	629-92-5	9.1	--	3.0	--	14.6	7.3	10.6	--	8.8
29.29	Tributyl phosphate	126-73-8	--	--	--	--	6.4	--	8.5	--	10.6
31.36	n-butylbenzenesulfonamide	3622-84-2	8.1	7.3	--	--	--	17.9	--	--	--
32.10	2-tridecenal	7069-41-2	--	--	--	--	--	4.6	--	--	--
32.51	Diisobutyl phthalate	84-69-5	--	--	--	--	--	4.2	--	--	--
32.60	Dibutyl phenyl phosphate	2528-36-1	--	--	--	--	22.8	--	22.4	--	13.8
33.25	o-terphenyl	84-15-1	--	--	--	--	4.7	--	4.6	--	4.6

RT (min)	Compound Name	CAS#	Compound Concentration (µg/m³)[1]								
			Controls			Baseline 200		MJO387 200		MJO387 250	
			Shipping Blank[2]	Field Blank[2]	Field Sample	Inlet	Bleed	Inlet	Bleed	Inlet	Bleed
33.69	n-hexadecanoic acid	57-10-3	8.4	26.2	14.0	3.1	5.5	19.4	5.0	12.7	11.2
34.02	Allyl stearate	6289-31-2	--	--	--	--	26.7	--	21.3	--	11.1
35.17	Heptanoic acid, anhydride	626-27-7	--	--	--	--	118.2	--	153.8	--	124.9
35.70	1-cyclohexyl-4-phenylbenzene	1000401-12-4	--	--	--	--	18.0	--	12.8	--	--
35.80	Butyl diphenyl phosphate	2752-95-6	--	--	--	--	--	--	11.1	--	18.5
36.30	2,7-dimethyl-3,5-Octanedione	7307-07-5	--	--	--	--	55.6	1.2	115.0	--	132.2

-- =below the detection limits of the method used.

[1]Toluene-equivalent concentrations.

[2]A volume of 1L was used for blanks to facilitate the VOC quantification.

Day 3- Morning: *PE-5* Injection Event (Concentration results in units of ppbV)

RT (min)	Compound Name	CAS#	Compound Concentration (ppbV)[1]								
			Controls			Baseline 200		PE-5 200		PE-5 250	
			Shipping Blank[2]	Field Blank[2]	Field Sample	Inlet	Bleed	Inlet	Bleed	Inlet	Bleed
3.50	Isobutane	75-28-5	--	--	1.93	--	--	--	--	--	--
4.52	Acetone	67-64-1	2.31	4.21	19.70	--	--	--	--	--	--
4.71	Isopropyl alcohol	67-63-0	--	--	8.38	--	--	--	--	--	--
6.63	Butanal	123-72-8	--	--	8.74	--	--	--	--	--	--
6.72	Acetic acid	64-19-7	2.30	3.41	--	--	--	--	--	--	--
8.83	1-butanol	71-36-3	--	--	12.33	--	--	--	--	--	--
8.94	Benzene	71-43-2	3.01	3.61	--	--	--	--	--	--	--
9.63	Pentanal	110-62-3	--	--	--	--	--	--	--	0.85	--
12.09	Toluene	108-88-3	--	--	1.54	--	--	--	--	--	--
13.77	Hexamethylcyclotrisiloxane	541-05-9	1.63	1.94	0.75	--	--	--	--	--	--
15.86	Nonane	111-84-2	--	--	--	0.21	--	--	--	--	--
16.75	2,6-dimethyloctane	2051-30-1	--	--	--	0.17	--	--	--	--	--
16.83	Benzaldehyde	100-52-7	0.91	1.96	1.10	--	--	--	--	--	--
17.34	n-butyl methacrylate	97-88-1	--	--	--	--	--	--	--	--	4.07
18.00	1,2,3-trimethylbenzene	526-73-8	--	--	1.23	0.23	0.17	--	--	--	--
18.21	Decane	124-18-5	--	--	0.59	0.23	--	--	--	--	--
19.25	Acetophenone	98-86-2	--	--	0.80	--	--	--	--	--	--
20.08	Nonanal	124-19-6	0.52	0.64	1.06	--	--	--	--	--	--
20.35	Undecane	1120-21-4		--	1.20	0.20	0.13	--	--	--	--
21.04	Benzoic acid	65-85-0	0.73	--	4.17	--	--	--	--	--	--
21.42	DecamethylCyclopentasiloxane	541-02-6	--	--	0.51	--	--	--	--	--	--
22.14	Naphthalene	91-20-3	--	--	1.04	0.44	0.24	0.14	0.19	0.28	--
22.33	Dodecane	112-40-3	--	--	1.13	0.31	0.17	--	--	--	--
23.76	2,6-dimethyloctane	2051-30-1	--	--	--	0.24	--	--	--	--	--
24.18	Tridecane	629-50-5	--	--	0.67	0.63	0.19	0.10	--	--	--
25.64	Byphenyl	92-52-4	--	--		0.21	--	--	--	--	--
25.90	Tetradecane	629-59-4	--	--	0.30	0.28	--	--	--	--	--
27.31	Triisobutyl phosphate	126-71-6	--	--	--	--	--	--	3.49	--	20.24

RT (min)	Compound Name	CAS#	Compound Concentration (ppbV)[1]								
			Controls			Baseline 200		PE-5 200		PE-5 250	
			Shipping Blank[2]	Field Blank[2]	Field Sample	Inlet	Bleed	Inlet	Bleed	Inlet	Bleed
27.54	Pentadecane	629-62-9	--	--	--	0.21	--	0.10	--	--	--
27.71	Butylated hydroxytoluene	128-37-0	--	--	--	--	--	--	--	--	0.29
28.59	Diethyl phthalate	84-66-2	--	--	--	--	--	--	1.71	0.18	--
29.10	Diphenyl sulfide	139-66-2	0.20	0.77	--	--	--	--	--	--	--
29.29	Tributyl phosphate	126-73-8	--	--	--	--	--	--	2.47	--	42.09
31.36	n-butylbenzenesulfonamide	3622-84-2	0.31	0.88	--	--	--	--	--	--	--
32.48	3-cyclopentylpropionic acid, 2-ethylhexyl ester[3]	1000293-47-0	--	--	--	--	--	--	--	--	2.4
32.60	Dibutyl phenyl phosphate	2528-36-1	--	--	--	--	--	--	--	--	0.44
33.69	n-hexadecanoic acid	57-10-3	0.26	9.84	0.37	0.26	2.32	0.72	0.70	0.80	0.71
35.17	Heptanoic acid, anhydride	626-27-7	--	--	--	--	0.84	--	1.10	--	2.33
36.28	2-tetradecanol octanoate	55193-79-8	--	--	--	--	0.51	--	0.68	--	1.74

[1]Toluene-equivalent concentrations.

[2]A volume of 1L was used for blanks to facilitate the VOC quantification.

[3]Closely related 7-Oxabicyclo(4.1.0)heptane-3-carboxylic acid, 2-ethylhexyl ester compound.

Day 3- Morning: *PE-5* Injection Event (Concentration results in units of parts per billion volume, µg/m^3)

RT (min)	Compound Name	CAS#	Compound Concentration (µg/m^3)[1]								
			Controls			Baseline 200		PE-5 200		PE-5 250	
			Shipping Blank[2]	Field Blank[2]	Field Sample	Inlet	Bleed	Inlet	Bleed	Inlet	Bleed
3.50	Isobutane	75-28-5	--	--	4.6	--	--	--	--	--	--
4.52	Acetone	67-64-1	5.5	10.0	46.8	--	--	--	--	--	--
4.71	Isopropyl alcohol	67-63-0	--	--	20.6	--	--	--	--	--	--
6.63	Butanal	123-72-8	--	--	25.8	--	--	--	--	--	--
6.72	Acetic acid	64-19-7	5.6	8.4	--	--	--	--	--	--	--
8.83	1-butanol	71-36-3	--	--	37.4	--	--	--	--	--	--
8.94	Benzene	71-43-2	9.6	11.5	--	--	--	--	--	--	--
9.63	Pentanal	110-62-3	--	--	--	--	--	--	--	3.0	--
12.09	Toluene	108-88-3	--	--	5.8	--	--	--	--	--	--
13.77	Hexamethylcyclotrisiloxane	541-05-9	14.8	17.6	6.8	--	--	--	--	--	--
15.86	Nonane	111-84-2	--	--	--	1.1	--	--	--	--	--
16.75	2,6-dimethyloctane	2051-30-1	--	--	--	1.0	--	--	--	--	--
16.83	Benzaldehyde	100-52-7	3.9	8.5	4.8	--	--	--	--	--	--
17.34	n-butyl methacrylate	97-88-1	--	--	--	--	--	--	--	--	23.6
18.00	1,2,3-trimethylbenzene	526-73-8	--	--	6.0	1.1	0.9	--	--	--	--
18.21	Decane	124-18-5	--	--	3.4	1.4	--	--	--	--	--
19.25	Acetophenone	98-86-2	--	--	3.9	--	--	--	--	--	--
20.08	Nonanal	124-19-6	3.0	3.7	6.2	--	--	--	--	--	--
20.35	Undecane	1120-21-4	--	--	7.7	1.3	0.8	--	--	--	--
21.04	Benzoic acid	65-85-0	3.6	--	20.8	--	--	--	--	--	--
21.42	DecamethylCyclopentasiloxane	541-02-6	--	--	7.7	--	--	--	--	--	--
22.14	Naphthalene	91-20-3	--	--	5.5	2.3	1.3	0.7	1.0	1.5	--
22.33	Dodecane	112-40-3	--	--	7.9	2.1	1.2	--	--	--	--
23.76	2,6-dimethyloctane	2051-30-1	--	--	--	1.4	--	--	--	--	--
24.18	Tridecane	629-50-5	--	--	5.0	4.8	1.4	0.7	--	--	--
25.64	Byphenyl	92-52-4	--	--	--	1.3	--	--	--	--	--
25.90	Tetradecane	629-59-4	--	--	2.4	2.3	--	--	--	--	--
27.31	Triisobutyl phosphate	126-71-6	--	--	--	--	--	--	38.0	--	220.4

RT (min)	Compound Name	CAS#	Compound Concentration (µg/m³)[1]								
			Controls			Baseline 200		PE-5 200		PE-5 250	
			Shipping Blank[2]	Field Blank[2]	Field Sample	Inlet	Bleed	Inlet	Bleed	Inlet	Bleed
27.54	Pentadecane	629-62-9	--	--	--	1.8	--	0.8	--	--	--
27.71	Butylated hydroxytoluene	128-37-0	--	--	--	--	--	--	--	--	2.6
28.59	Diethyl phthalate	84-66-2	--	--	--	--	--	--	15.5	1.6	--
29.10	Diphenyl sulfide	139-66-2	1.5	5.9	--	--	--	--	--	--	--
29.29	Tributyl phosphate	126-73-8	--	--	--	--	--	--	26.9	--	458.2
31.36	n-butylbenzenesulfonamide	3622-84-2	2.7	7.6	--	--	--	--	--	--	--
32.48	3-cyclopentylpropionic acid, 2-ethylhexyl ester[3]	1000293-47-0	--	--	--	--	--	--	--	--	24.72
32.60	Dibutyl phenyl phosphate	2528-36-1	--	--	--	--	--	--	--	--	5.1
33.69	n-hexadecanoic acid	57-10-3	2.7	103.1	3.9	2.7	24.3	7.6	7.4	8.4	7.4
35.17	Heptanoic acid, anhydride	626-27-7	--	--	--	--	8.3	--	10.9	--	23.1
36.28	2-tetradecanol octanoate	55193-79-8	--	--	--	--	7.2	--	9.5	--	24.2

-- =below the detection limits of the method used.

[1] Toluene-equivalent concentrations.

[2] A volume of 1L was used for blanks to facilitate the VOC quantification.

[3] Closely related 7-Oxabicyclo(4.1.0)heptane-3-carboxylic acid, 2-ethylhexyl ester compound.

Day 3- Afternoon: *HyJetIV* Injection Event (Concentration results in units of ppbV)

RT (min)	Compound Name	CAS#	Compound Concentration (ppbV)[1]								
			Controls			Baseline 200		HyJetIV 200		HyJetIV 250	
			Shipping Blank[2]	Field Blank[2]	Field Sample	Inlet	Bleed	Inlet	Bleed	Inlet	Bleed
3.50	Isobutane	75-28-5	--	--	1.93	--	--	--	--	--	--
3.64	2-butene	624-64-6	--	--	--	--	4.97	--	1.89	--	12.30
4.52	Acetone	67-64-1	3.98	1.65	19.70	2.36	--	3.12	--	1.16	--
4.71	Isopropyl alcohol	67-63-0	--	--	8.38	--	--	--	--	--	--
6.63	Butanal	123-72-8	--	--	8.74	--	--	--	--	--	7.17
6.72	Acetic acid	64-19-7	4.33	1.80	--	1.05	--	--	--	2.87	--
8.83	1-butanol	71-36-3	--	--	12.33	--	--	--	--	--	8.89
8.94	Benzene	71-43-2	3.48	3.07	--	2.01	--	1.86	--	2.16	--
9.63	Pentanal	110-62-3	--	--	--	--	--	--	--	0.69	--
10.38	Heptane	142-82-5	--	--	--	--	--	--	--	0.50	--
12.09	Toluene	108-88-3	--	--	1.54	0.51	--	0.74	--	1.31	--
13.77	Hexamethylcyclotrisiloxane	541-05-9	2.23	1.61	0.75	0.23	--	0.68	--	0.72	--
14.64	1-hexanol	111-27-3	--	--	--	--	--	--	--	--	9.86
14.92	p-xylene	106-42-3	--	--	--	--	--	1.24	--	1.08	--
15.86	Nonane	111-84-2	--	--	--	0.65	--	1.85	1.75	2.24	4.89
16.75	2,6-dimethyloctane	2051-30-1	--	--	--	0.35	--	1.31	--	1.34	3.51
16.83	Benzaldehyde	100-52-7	1.75	1.11	1.10	0.61	--	--	--	--	--
17.22	1-ethyl-2-methyl-benzene	611-14-3	--	--	--	0.58	--	1.52	--	1.26	--
17.34	n-butyl methacrylate	97-88-1	--	--	--	--	--	0.95	1.94	--	15.59
18.00	1,2,3-trimethylbenzene	526-73-8	--	--	1.23	0.74	--	2.26	2.58	2.45	5.92
18.21	Decane	124-18-5	--	--	0.59	0.93	--	2.85	3.01	2.67	6.16
19.25	Acetophenone	98-86-2	--	--	0.80	--	--	--	--	--	--
19.42	Heptanoic acid	111-14-8	--	--	--	--	--	0.66	--	0.76	--
20.08	Nonanal	124-19-6	--	0.50	1.06	0.54	--	0.72	--	0.75	--
20.35	Undecane	1120-21-4	--	--	1.20	0.96	--	2.41	2.64	1.76	5.38
21.04	Benzoic acid	65-85-0	--	0.48	4.17	0.68	--	0.79	--	0.89	--
21.42	DecamethylCyclopentasiloxane	541-02-6	--	0.17	0.51	--	--	--	--	--	--
22.14	Naphthalene	91-20-3	--	--	1.04	2.76	2.33	3.12	2.10	3.08	--

RT (min)	Compound Name	CAS#	Compound Concentration (ppbV)[1]								
			Controls			Baseline 200		HyJetIV 200		HyJetIV 250	
			Shipping Blank[2]	Field Blank[2]	Field Sample	Inlet	Bleed	Inlet	Bleed	Inlet	Bleed
22.33	Dodecane	112-40-3	--	--	1.13	1.76	1.59	1.98	2.05	0.98	3.97
22.65	2,6-dimethylundecane	17301-23-4	--	--	--	0.61	--	0.46	--	--	--
23.69	3-methyldodecane	17312-57-1	--	--	--	0.31	--	--	--	--	--
23.76	2,6-dimethyloctane	2051-30-1	--	--	--	0.68	--	0.97	--	--	--
24.18	Tridecane	629-50-5	--	--	0.67	1.82	2.22	3.38	2.89	0.32	5.05
25.15	Oxalic acid, 6-ethyloct-3-yl isohexyl ester	1000309-34-3	--	--	--	--	--	0.41	--	--	--
25.60	2,6,10-trimethyldodecane	3891-98-3	--	--	--	--	--	0.61	--	--	--
25.90	Tetradecane	629-59-4	--	--	0.30	1.14	1.71	2.14	2.14	0.70	3.42
26.99	2,6,10,14-tetramethylheptadecane	18344-37-1	--	--	--	0.38	--	0.38	1.82	--	1.34
27.31	Triisobutyl phosphate	126-71-6	--	--	--	--	14.94	--	8.85	--	12.35
27.54	Pentadecane	629-62-9	--	--	--	1.13	--	0.83	1.16	0.60	1.02
27.71	Butylated hydroxytoluene	128-37-0	--	--	--	--	--	--	1.21	--	4.32
28.59	Diethyl phthalate	84-66-2	34.22	--	--	--	--	--	--	--	5.77
29.05	Nonadecane	629-92-5	--	--	--	0.43	--	0.45	--	0.28	--
29.10	Diphenyl sulfide	139-66-2	--	0.20	--	--	--	--	--	--	--
29.29	Tributyl phosphate	126-73-8	--	--	--	--	159.3	--	69.13	--	174.7
31.36	N-butylbenzenesulfonamide	3622-84-2	1.02	--	--	0.41	--	--	--	--	--
32.10	2-Tridecenal	7069-41-2	--	--	--	--	8.91	--	1.46	--	--
32.48	3-cyclopentylpropionic acid, 2-ethylhexyl ester[3]	1000293-47-0	--	--	--	--	33.57	--	7.59	--	13.17
32.51	Diisobutyl phthalate	84-69-5	2.18	--	--	--	--	--	--	--	--
32.60	Dibutyl phenyl phosphate	2528-36-1	--	--	--	--	8.91	--	8.57	--	8.39
32.72	3-cyclopentylpropionic acid, 2-ethylhexyl ester[3]	1000293-47-0	--	--	--	--	21.10	--	6.20	--	10.45
33.69	n-hexadecanoic acid	57-10-3	1.25	9.48	0.37	1.54	--	1.62	1.12	2.28	2.42
34.02	Allyl stearate	6289-31-2	--	--	--	--	--	--	0.97	--	1.40
35.17	Heptanoic acid, anhydride	626-27-7	--	--	--	--	3.41	--	5.67	--	11.69
36.30	2,7-dimethyl-3,5-Octanedione	7307-07-5	--	--	--	--	4.23	--	6.34	--	11.06

-- =below the detection limits of the method used.

[1]Toluene-equivalent concentrations.

[2]A volume of 1L was used for blanks to facilitate the VOC quantification.

[3] Closely related 7-Oxabicyclo(4.1.0)heptane-3-carboxylic acid, 2-ethylhexyl ester compound.

Day 3- Afternoon: HyJetIV Injection Event (Concentration results in units of parts per billion volume, µg/m^3)

RT (min)	Compound Name	CAS#	Compound Concentration (µg/m^3)[1]								
			Controls			Baseline 200		HyJetIV 200		HyJetIV 250	
			Shipping Blank[2]	Field Blank[2]	Field Sample	Inlet	Bleed	Inlet	Bleed	Inlet	Bleed
3.50	Isobutane	75-28-5	--	--	4.6	--	--	--	--	--	--
3.64	2-butene	624-64-6	--	--	--	--	11.4	--	4.3	--	28.2
4.52	Acetone	67-64-1	9.4	3.9	46.8	5.6	--	7.4	--	2.8	--
4.71	Isopropyl alcohol	67-63-0	--	--	20.6	--	--	--	--	--	--
6.63	Butanal	123-72-8	--	--	25.8	--	--	--	--	--	21.1
6.72	Acetic acid	64-19-7	10.6	4.4	--	2.6	--	--	--	7.0	--
8.83	1-butanol	71-36-3	--	--	37.4	--	--	--	--	--	26.9
8.94	Benzene	71-43-2	11.1	9.8	--	6.4	--	6.0	--	6.9	--
9.63	Pentanal	110-62-3	--	--	--	--	--	--	--	2.4	--
10.38	Heptane	142-82-5	--	--	--	--	--	--	--	2.0	--
12.09	Toluene	108-88-3	--	--	5.8	1.9	--	2.8	--	4.9	--
13.77	Hexamethylcyclotrisiloxane	541-05-9	20.2	14.6	6.8	2.1	--	6.2	--	6.5	--
14.64	1-hexanol	111-27-3	--	--	--	--	--	--	--	--	41.2
14.93	p-xylene	106-42-3	--	--	--	--	--	5.4	--	4.7	--
15.86	Nonane	111-84-2	--	--	--	3.4	--	9.7	9.2	11.7	25.6
16.75	2,6-dimethyloctane	2051-30-1	--	--	--	2.0	--	7.6	--	7.8	20.4
16.83	Benzaldehyde	100-52-7	7.6	4.8	4.8	2.6	--	--	--	--	--
17.22	1-ethyl-2-methyl-benzene	611-14-3	--	--	--	2.8	--	7.5	--	6.2	--
17.34	n-butyl methacrylate	97-88-1	--	--	--	--	--	5.5	11.3	--	90.6
18.00	1,2,3-trimethylbenzene	526-73-8	--	--	6.0	3.6	--	11.1	12.7	12.0	29.1
18.21	Decane	124-18-5	--	--	3.4	5.4	--	16.5	17.5	15.5	35.8
19.25	Acetophenone	98-86-2	--	--	3.9	--	--	--	--	--	--
19.42	Heptanoic acid	111-14-8	--	--	--	--	--	3.5	--	4.0	--
20.08	Nonanal	124-19-6	--	2.9	6.2	3.2	--	4.2	--	4.3	--
20.35	Undecane	1120-21-4	--	--	7.7	6.1	--	15.4	16.9	11.3	34.3
21.04	Benzoic acid	65-85-0	--	2.4	20.8	3.4	--	3.9	--	4.5	--
21.42	DecamethylCyclopentasiloxane	541-02-6	--	2.6	7.7	--	--	--	--	--	--
22.14	Naphthalene	91-20-3	--	--	5.5	14.5	12.2	16.4	11.0	16.1	--

RT (min)	Compound Name	CAS#	Compound Concentration (µg/m³)[1]								
			Controls			Baseline 200		HyJetIV 200		HyJetIV 250	
			Shipping Blank[2]	Field Blank[2]	Field Sample	Inlet	Bleed	Inlet	Bleed	Inlet	Bleed
22.33	Dodecane	112-40-3	--	--	7.9	12.2	11.1	13.8	14.3	6.8	27.7
22.65	2,6-dimethylundecane	17301-23-4	--	--	--	4.6	--	3.5	--	--	--
23.69	3-methyldodecane	17312-57-1	--	--	--	2.3	--	--	--	--	--
23.76	2,6-dimethyloctane	2051-30-1	--	--	--	4.0	--	5.7	--	--	--
24.18	Tridecane	629-50-5	--	--	5.0	13.7	16.7	25.4	21.7	2.4	38.0
25.15	Oxalic acid, 6-ethyloct-3-yl isohexyl ester	1000309-34-3	--	--	--	--	--	5.3	--	--	--
25.60	2,6,10-trimethyldodecane	3891-98-3	--	--	--	--	--	5.3	--	--	--
25.90	Tetradecane	629-59-4	--	--	2.4	9.2	13.8	17.3	17.4	5.7	27.8
26.99	2,6,10,14-tetramethylheptadecane	18344-37-1	--	--	--	4.6	--	4.7	22.0	--	16.2
27.31	Triisobutyl phosphate	126-71-6	--	--	--	--	162.6		96.3	--	134.4
27.54	Pentadecane	629-62-9	--	--	--	9.8	--	7.2	10.0	5.2	8.9
27.71	Butylated hydroxytoluene	128-37-0	--	--	--	--	--	--	10.9	--	38.9
28.59	Diethyl phthalate	84-66-2	310.8	--	--	--	--	--	--	--	52.4
29.05	Nonadecane	629-92-5	--	--	--	4.7	--	5.0	--	3.0	--
29.10	Diphenyl sulfide	139-66-2	--	1.5	--	--	--	--	--	--	--
29.29	Tributyl phosphate	126-73-8	--	--	--	--	1734.4	--	752.6	--	1902.4
31.36	N-butylbenzenesulfonamide	3622-84-2	8.9	--	--	3.6	--	--	--	--	--
32.10	2-Tridecenal	7069-41-2	--	--	--	--	71.5	--	11.7	--	--
32.48	3-cyclopentylpropionic acid, 2-ethylhexyl ester[3]	1000293-47-0	--	--	--	--	349.1	--	78.9	--	136.9
32.51	Diisobutyl phthalate	84-69-5	24.8	--	--	--	--	--	--	--	--
32.60	Dibutyl phenyl phosphate	2528-36-1	--	--	--	--	104.3	--	100.3	--	98.2
32.72	3-cyclopentylpropionic acid, 2-ethylhexyl ester[3]	1000293-47-0	--	--	--	--	219.3	--	64.5	--	108.7
33.69	n-hexadecanoic acid	57-10-3	13.1	99.3	3.9	16.1	--	17.0	11.7	23.9	25.3
34.02	Allyl stearate	6289-31-2	--	--	--	--	--	--	12.9	--	18.5
35.17	Heptanoic acid, anhydride	626-27-7	--	--	--	--	33.8	--	56.2	--	115.8
36.30	2,7-dimethyl-3,5-Octanedione	7307-07-5	--	--	--	--	29.4	--	44.1	--	76.9

-- =below the detection limits of the method used.

[1]Toluene-equivalent concentrations.

[2]A volume of 1L was used for blanks to facilitate the VOC quantification.

[3] Closely related 7-Oxabicyclo(4.1.0)heptane-3-carboxylic acid, 2-ethylhexyl ester compound.

Day 4- Morning: *Deicing* Injection Event (Concentration results in units of parts per billion volume, ppbV)

RT (min)	Compound Name	CAS#	Compound Concentration (ppbV)[1]						
			Controls			Baseline 200		Deicing 200	
			Shipping Blank[2]	Field Blank[2]	Field Sample	Inlet	Bleed	Inlet	Bleed
3.50	Isobutane	75-28-5	--	--	3.27	--	--	--	--
3.64	2-butene	624-64-6	--	1.98	1.63	--	--	--	--
4.52	Acetone	67-64-1	3.43	3.15	21.20	--	--	--	--
4.71	Isopropyl alcohol	67-63-0	--	--	4.62	--	--	--	--
6.63	Butanal	123-72-8	--	--	9.29	--	--	--	--
6.72	Acetic acid	64-19-7	6.65	1.12	2.57	--	--	--	--
8.83	1-butanol	71-36-3	--	--	13.80	--	--	--	--
8.94	Benzene	71-43-2	2.43	9.39	2.16	--	--	--	1.99
12.09	Toluene	108-88-3	--	1.12	2.36	--	--	--	--
13.77	Hexamethylcyclotrisiloxane	541-05-9	2.00	1.78	0.66	--	--	--	--
14.06	3-hydroxy-2-butanone	513-86-0	--	--	--	--	--	--	32.82
14.30	Propylene glycol[3]	57-55-6	--	--	--	--	--	--	128.35
14.93	p-xylene	106-42-3	--	--	1.21	--	--	--	--
16.75	2,6-dimethyloctane	2051-30-1	--	--	--	--	--	--	--
16.83	Benzaldehyde	100-52-7	1.44	1.95	1.49	--	--	--	--
18.00	1,2,3-trimethylbenzene	526-73-8	0.73	0.84	1.09	--	--	0.12	--
18.21	Decane	124-18-5	--	--	0.81	--	--	--	--
19.25	Acetophenone	98-86-2	--	--	1.07	--	--	--	--
19.64	Propylene glycol[3]	57-55-6	--	--	--	--	--	--	40.99
20.08	Nonanal	124-19-6	0.46	0.56	1.01	--	--	--	--
20.35	Undecane	1120-21-4	--	--	1.49	--	--	0.17	--
21.04	Benzoic acid	65-85-0	1.35	--	5.28	--	--	--	--
21.42	DecamethylCyclopentasiloxane	541-02-6	--	--	0.51	--	--	--	--
21.69	Diethylene glycol monobutyl ether	112-34-5	--	--	7.57	--	--	--	--
22.14	Naphthalene	91-20-3	0.29	1.29	1.22	0.23	--	0.13	--
22.33	Dodecane	112-40-3	--	--	1.57	--	--	--	--
22.65	2,6-dimethylundecane	17301-23-4	--	--	--	--	--	--	--
24.18	Tridecane	629-50-5	--	--	0.98	--	--	--	--

RT (min)	Compound Name	CAS#	Compound Concentration (ppbV)[1]						
			Controls			Baseline 200		Deicing 200	
			Shipping Blank[2]	Field Blank[2]	Field Sample	Inlet	Bleed	Inlet	Bleed
25.90	Tetradecane	629-59-4	--	--	0.75	--	--	--	--
26.99	2,6,10,14-tetramethylheptadecane	18344-37-1	--	1.33	--	--	--	--	--
27.31	Triisobutyl phosphate	126-71-6	--	--	--	--	0.79	--	0.63
28.59	Diethyl phthalate	84-66-2	0.26	--	--	--	9.84	0.21	--
29.05	Nonadecane	629-92-5	0.44	--	--	--	--	--	--
29.10	Diphenyl sulfide	139-66-2	0.34	--	--	--	--	--	--
29.29	Tributyl phosphate	126-73-8	--	--	--	--	38.42	--	18.77
31.36	n-butylbenzenesulfonamide	3622-84-2	1.12	0.69	0.43	0.12	--	--	0.51
32.10	2-Tridecenal	7069-41-2	--	--	--	--	1.75	--	0.53
32.48	3-Cyclopentylpropionic acid, 2-ethylhexyl ester[4]	1000293-47-0	--	--	--	--	11.75	--	1.01
32.51	Diisobutyl phthalate	84-69-5	0.22	--	--	--	--	--	--
32.60	Dibutyl phenyl phosphate	2528-36-1	--	--	--	--	1.43	--	1.42
32.72	3-Cyclopentylpropionic acid, 2-ethylhexyl ester[4]	1000293-47-0	--	--	--	--	11.30	--	1.79
33.69	n-hexadecanoic acid	57-10-3	1.42	16.88	2.52	0.15	1.46	0.51	0.93
35.17	Heptanoic acid, anhydride	626-27-7	--	--	--	--	1.14	--	1.73
36.28	2-tetradecanol octanoate	55193-79-8	--	--	--	--	0.70	--	0.68

-- =below the detection limits of the method used.

[1]Toluene-equivalent concentrations.

[2]A volume of 1L was used for blanks to facilitate the VOC quantification.

[3] Closely related propylene glycol compounds.

[4] Closely related 7-Oxabicyclo(4.1.0)heptane-3-carboxylic acid, 2-ethylhexyl ester compound.

Day 4- Morning: *Deicing* Injection Event (Concentration results in units of µg/m^3)

RT (min)	Compound Name	CAS#	Compound Concentration (µg/m^3)[1]						
			Controls			Baseline 200		Deicing 200	
			Shipping Blank[2]	Field Blank[2]	Field Sample	Inlet	Bleed	Inlet	Bleed
3.50	Isobutane	75-28-5	--	--	7.8	--	--	--	--
3.64	2-butene	624-64-6	--	4.5	3.7	--	--	--	--
4.52	Acetone	67-64-1	8.1	7.5	50.3	--	--	--	--
4.71	Isopropyl alcohol	67-63-0	--	--	11.3	--	--	--	--
6.63	Butanal	123-72-8	--	--	27.4	--	--	--	--
6.72	Acetic acid	64-19-7	16.3	2.7	6.3	--	--	--	--
8.83	1-butanol	71-36-3	--	--	41.8	--	--	--	--
8.94	Benzene	71-43-2	7.7	30.0	6.9	--	--	--	6.4
12.09	Toluene	108-88-3	--	4.2	8.9	--	--	--	--
13.77	Hexamethylcyclotrisiloxane	541-05-9	18.2	16.1	6.0	--	--	--	--
14.06	3-hydroxy-2-butanone	513-86-0	--	--	--	--	--	--	118.2
14.30	Propylene glycol[3]	57-55-6	--	--	--	--	--	--	399.2
14.93	p-xylene	106-42-3	--	--	5.3	--	--	--	--
16.75	2,6-dimethyloctane	2051-30-1	--	--	--	--	--	--	--
16.83	Benzaldehyde	100-52-7	6.3	8.5	6.5	--	--	--	--
18.00	1,2,3-trimethylbenzene	526-73-8	3.6	4.1	5.4	--	--	0.6	--
18.21	Decane	124-18-5	--	--	4.7	--	--	--	--
19.25	Acetophenone	98-86-2	--	--	5.3	--	--	--	--
19.64	Propylene glycol[3]	57-55-6	--	--	--	--	--	--	127.5
20.08	Nonanal	124-19-6	2.7	3.2	5.9	--	--	--	--
20.35	Undecane	1120-21-4	--	--	9.5	--	--	1.1	--
21.04	Benzoic acid	65-85-0	6.8	--	26.4	--	--	--	--
21.42	DecamethylCyclopentasiloxane	541-02-6	--	--	7.8	--	--	--	--
21.69	Diethylene glycol monobutyl ether	112-34-5	--	--	50.2	--	--	--	--
22.14	Naphthalene	91-20-3	1.5	6.8	6.4	1.2	--	0.7	--
22.33	Dodecane	112-40-3	--	--	10.9	--	--	--	--
22.65	2,6-dimethylundecane	17301-23-4	--	--	--	--	--	--	--
24.18	Tridecane	629-50-5	--	--	7.3	--	--	--	--

RT (min)	Compound Name	CAS#	Compound Concentration (µg/m^3)[1]						
			Controls			Baseline 200		Deicing 200	
			Shipping Blank[2]	Field Blank[2]	Field Sample	Inlet	Bleed	Inlet	Bleed
25.90	Tetradecane	629-59-4	--	--	6.1	--	--	--	--
26.99	2,6,10,14-tetramethylheptadecane	18344-37-1	--	16.1	--	--	--	--	--
27.31	Triisobutyl phosphate	126-71-6	--	--	--	--	8.6	--	6.9
28.59	Diethyl phthalate	84-66-2	2.4	--	--	--	89.4	1.9	--
29.05	Nonadecane	629-92-5	4.8	--	--	--	--	--	--
29.10	Diphenyl sulfide	139-66-2	2.6	--	--	--	--	--	--
29.29	Tributyl phosphate	126-73-8	--	--	--	--	418.3	--	204.3
31.36	n-butylbenzenesulfonamide	3622-84-2	9.8	6.0	3.7	1.0	--	--	4.5
32.10	2-Tridecenal	7069-41-2	--	--	--	--	14.1	--	4.3
32.48	3-Cyclopentylpropionic acid, 2-ethylhexyl ester[4]	1000293-47-0	--	--	--	--	122.2	--	10.6
32.51	Diisobutyl phthalate	84-69-5	2.5	--	--	--	--	--	--
32.60	Dibutyl phenyl phosphate	2528-36-1	--	--	--	--	16.7	--	16.6
32.72	3-Cyclopentylpropionic acid, 2-ethylhexyl ester[4]	1000293-47-0	--	--	--	--	117.5	--	18.6
33.69	n-hexadecanoic acid	57-10-3	14.9	176.9	26.4	1.6	15.3	5.3	9.7
35.17	Heptanoic acid, anhydride	626-27-7	--	--	--	--	11.3	--	17.1
36.28	2-tetradecanol octanoate	55193-79-8	--	--	--	--	9.8	--	9.5

-- =below the detection limits of the method used.

[1]Toluene-equivalent concentrations.

[2]A volume of 1L was used for blanks to facilitate the VOC quantification.

[3] Closely related propylene glycol compounds.

[4] Closely related 7-Oxabicyclo(4.1.0)heptane-3-carboxylic acid, 2-ethylhexyl ester compound.

Day 4- Afternoon: *MJOIIRep* Injection Event (Concentration results in units of parts per billion volume, ppbV)

RT (min)	Compound Name	CAS#	Compound Concentration (ppbV)[1]						
			Controls			Baseline 200		*MJOIIRep* 200	
			Shipping Blank[2]	Field Blank[2]	Field Sample	Inlet	Bleed	Inlet	Bleed
3.50	Isobutane	75-28-5	--	--	3.27	--	--	--	--
3.64	2-butene	624-64-6	1.22	--	1.63	3.32	--	3.03	--
4.52	Acetone	67-64-1	3.50	1.82	21.20	1.30	--	3.47	1.96
4.71	Isopropyl alcohol	67-63-0	--	--	4.62	--	--	--	--
6.63	Butanal	123-72-8	--	--	9.29	--	--	--	--
6.72	Acetic acid	64-19-7	2.71	1.82	2.57	--	--	--	2.39
8.83	1-butanol	71-36-3	--	--	13.80	--	--	--	--
8.94	Benzene	71-43-2	5.62	2.73	2.16	1.69	2.02	1.62	2.15
9.63	Pentanal	110-62-3	--	--	--	--	--	--	1.16
12.09	Toluene	108-88-3	0.74	--	2.36	1.18	1.21	0.90	1.21
12.65	Hexanal	66-25-1	--	--	--	--	--	--	1.39
13.77	Hexamethylcyclotrisiloxane	541-05-9	0.54	0.56	0.66	0.52	0.61	0.75	0.66
14.15	2-methylbutanoic acid	116-53-0	--	--	--	--	--	--	1.73
14.93	p-xylene	106-42-3	--	--	1.21	--	--	--	--
14.88	Pentanoic acid	109-52-4	--	--	--	--	--	--	8.75
15.39	Heptanal	111-71-7	--	--	--	--	--	--	1.18
15.86	Nonane	111-84-2	--	--	--	1.75	1.25	1.87	1.27
16.75	2,6-dimethyloctane	2051-30-1	--	--	--	1.08	--	1.14	0.94
16.83	Benzaldehyde	100-52-7	1.97	0.95	1.49	--	--	--	--
17.34	n-butyl methacrylate	97-88-1	--	--	--	--	--	0.97	--
18.00	1,2,3-trimethylbenzene	526-73-8	--	--	1.09	2.45	2.00	2.46	1.92
18.21	Decane	124-18-5	--	--	0.81	2.81	2.35	3.04	2.40
19.25	Acetophenone	98-86-2	--	--	1.07	--	--	--	--
19.42	Heptanoic acid	111-14-8	--	--	--	--	--	--	15.74
20.08	Nonanal	124-19-6	0.78	0.27	1.01	--	--	--	1.01
20.35	Undecane	1120-21-4	--	--	1.49	2.87	2.91	2.78	2.83
21.04	Benzoic acid	65-85-0	--	--	5.28	--	--	1.21	1.38
21.30	Octanoic acid	124-07-2	--	--	--	--	--	--	6.18

RT (min)	Compound Name	CAS#	Compound Concentration (ppbV)[1]						
			Controls			Baseline 200		*MJOIIRep* 200	
			Shipping Blank[2]	Field Blank[2]	Field Sample	Inlet	Bleed	Inlet	Bleed
21.42	DecamethylCyclopentasiloxane	541-02-6	--	--	0.51	0.51	--	--	--
21.68	Diethylene glycol monobutyl ether	112-34-5	--	--	7.57	--	--	--	--
22.14	Naphthalene	91-20-3	--	--	1.22	2.34	1.31	2.48	1.82
22.33	Dodecane	112-40-3	--	--	1.57	3.96	3.92	2.98	2.90
22.65	2,6-dimethylundecane	17301-23-4	--	--	--	1.01	1.28	0.67	0.81
23.76	2,6-dimethyloctane	2051-30-1	--	--	--	1.48	1.88	1.31	1.51
24.18	Tridecane	629-50-5	--	--	0.98	4.80	5.94	4.16	4.22
24.87	n-decanoic acid	334-48-5	--	--	--	--	--	--	3.09
25.15	Oxalic acid, 6-ethyloct-3-yl isohexyl ester	1000309-34-3	--	--	--	0.46	--	0.39	--
25.60	2,6,10-trimethyldodecane	3891-98-3	--	--	--	1.07	1.42	1.10	1.13
25.90	Tetradecane	629-59-4	--	--	0.75	3.93	4.31	3.89	3.83
26.99	2,6,10,14-tetramethylheptadecane	18344-37-1	--	--	--	0.93	0.52	0.78	0.97
27.03	Biphenylene	259-79-0	--	0.46	--	--	--	--	--
27.31	Triisobutyl phosphate	126-71-6	--	--	--	--	0.95	--	0.88
27.54	Pentadecane	629-62-9	--	--	--	2.71	1.99	2.37	2.87
28.59	Diethyl phthalate	84-66-2	--	--	--	19.59	--	--	--
29.05	Nonadecane	629-92-5	--	--	--	0.50	--	0.81	0.70
29.29	Tributyl phosphate	126-73-8	--	--	--	--	34.71	--	17.80
31.36	n-butylbenzenesulfonamide	3622-84-2	--	0.30	0.43	--	--	--	--
32.10	2-tridecenal	7069-41-2	--	--	--	--	1.84	--	0.73
32.48	3-Cyclopentylpropionic acid, 2-ethylhexyl ester[3]	1000293-47-0	--	--	--	--	2.34	--	0.75
32.51	Diisobutyl phthalate	84-69-5	--	--	--	0.62	--	--	--
32.60	Dibutyl phenyl phosphate	2528-36-1	--	--	--	--	2.86	--	3.31
32.72	3-Cyclopentylpropionic acid, 2-ethylhexyl ester[3]	1000293-47-0	--	--	--	--	2.99	--	0.86
33.69	n-hexadecanoic acid	57-10-3	1.44	3.40	2.52	1.39	1.45	0.54	3.41
34.02	Allyl stearate	6289-31-2	--	--	--	--	--	--	0.59
35.01	(1,1'-Bicyclohexyl)-4-ylbenzene	20273-27-2	--	--	--	--	--	--	0.61
35.17	Heptanoic acid, anhydride	626-27-7	--	--	--	--	5.49	--	9.84
36.30	2,7-dimethyl-3,5-Octanedione	7307-07-5	--	--	--	--	4.71	--	13.92

RT (min)	Compound Name	CAS#	Compound Concentration (ppbV)[1]						
			Controls			Baseline 200		*MJOIIRep* 200	
			Shipping Blank[2]	Field Blank[2]	Field Sample	Inlet	Bleed	Inlet	Bleed

-- =below the detection limits of the method used.

[1] Toluene-equivalent concentrations.

[2] A volume of 1L was used for blanks to facilitate the VOC quantification.

[3] Closely related 7-Oxabicyclo(4.1.0)heptane-3-carboxylic acid, 2-ethylhexyl ester compound.

Day 4- Afternoon: *MJOIIRep* Injection Run (Concentration results in units of µg/m^3)

RT (min)	Compound Name	CAS#	Compound Concentration (µg/m^3)[1]						
			Controls			Baseline 200		*MJOIIRep* 200	
			Shipping Blank[2]	Field Blank[2]	Field Sample	Inlet	Bleed	Inlet	Bleed
3.50	Isobutane	75-28-5	--	--	7.8	--	--	--	--
3.64	2-butene	624-64-6	2.8	--	3.7	7.6	--	7.0	--
4.52	Acetone	67-64-1	8.3	4.3	50.3	3.1	--	8.2	4.7
4.71	Isopropyl alcohol	67-63-0	--	--	11.3	--	--	--	--
6.63	Butanal	123-72-8	--	--	27.4	--	--	--	--
6.72	Acetic acid	64-19-7	6.6	4.5	6.3	--	--	--	5.9
8.83	1-butanol	71-36-3	--	--	41.8	--	--	--	--
8.94	Benzene	71-43-2	17.9	8.7	6.9	5.4	6.5	5.2	6.8
9.63	Pentanal	110-62-3	--	--	--	--	--	--	4.1
12.09	Toluene	108-88-3	2.8	--	8.9	4.4	4.6	3.4	4.6
12.65	Hexanal	66-25-1	--	--	--	--	--	--	5.7
13.77	Hexamethylcyclotrisiloxane	541-05-9	4.9	5.1	6.0	4.8	5.6	6.8	6.0
14.15	2-methylbutanoic acid	116-53-0	--	--	--	--	--	--	7.2
14.93	p-xylene	106-42-3	--	--	5.3	--	--	--	--
14.88	Pentanoic acid	109-52-4	--	--	--	--	--	--	36.5
15.39	Heptanal	111-71-7	--	--	--	--	--	--	5.5
15.86	Nonane	111-84-2	--	--	--	9.2	6.5	9.8	6.7
16.75	2,6-dimethyloctane	2051-30-1	--	--	--	6.3	--	6.6	5.5
16.83	Benzaldehyde	100-52-7	8.5	4.1	6.5	--	--	--	--
17.34	n-butyl methacrylate	97-88-1	--	--	--	--	--	5.7	--
18.00	1,2,3-trimethylbenzene	526-73-8	--	--	5.4	12.0	9.8	12.1	9.5
18.21	Decane	124-18-5	--	--	4.7	16.3	13.6	17.7	14.0
19.25	Acetophenone	98-86-2	--	--	5.3	--	--	--	--
19.42	Heptanoic acid	111-14-8	--	--	--	--	--	--	83.7
20.08	Nonanal	124-19-6	4.6	1.6	5.9	--	--	--	5.8
20.35	Undecane	1120-21-4	--	--	9.5	18.3	18.6	17.7	18.1
21.04	Benzoic acid	65-85-0	--	--	26.4	--	--	6.0	6.9
21.30	Octanoic acid	124-07-2	--	--	--	--	--	--	36.4

RT (min)	Compound Name	CAS#	Compound Concentration (µg/m³)[1]						
			Controls			Baseline 200		*MJOIIRep* 200	
			Shipping Blank[2]	Field Blank[2]	Field Sample	Inlet	Bleed	Inlet	Bleed
21.42	DecamethylCyclopentasiloxane	541-02-6	--	--	7.8	7.7	--	--	--
21.68	Diethylene glycol monobutyl ether	112-34-5	--	--	50.2	--	--	--	--
22.14	Naphthalene	91-20-3	--	--	6.4	12.3	6.9	13.0	9.5
22.33	Dodecane	112-40-3	--	--	10.9	27.5	27.3	20.7	20.2
22.65	2,6-dimethylundecane	17301-23-4	--	--	--	7.6	9.6	5.0	6.1
23.76	2,6-dimethyloctane	2051-30-1	--	--	--	8.6	10.9	7.6	8.8
24.18	Tridecane	629-50-5	--	--	7.3	36.1	44.8	31.3	31.8
24.87	n-decanoic acid	334-48-5	--	--	--	--	--	--	21.8
25.15	Oxalic acid, 6-ethyloct-3-yl isohexyl ester	1000309-34-3	--	--	--	5.9	--	5.0	--
25.60	2,6,10-trimethyldodecane	3891-98-3	--	--	--	9.3	12.3	9.6	9.8
25.90	Tetradecane	629-59-4	--	--	6.1	31.9	35.0	31.6	31.1
26.99	2,6,10,14-tetramethylheptadecane	18344-37-1	--	--	--	11.3	6.3	9.5	11.7
27.03	Biphenylene	259-79-0	--	2.8	--	--	--	--	--
27.31	Triisobutyl phosphate	126-71-6	--	--	--	--	10.3	--	9.6
27.54	Pentadecane	629-62-9	--	--	--	23.5	17.2	20.6	25.0
28.59	Diethyl phthalate	84-66-2	--	--	--	178.0	--	--	--
29.05	Nonadecane	629-92-5	--	--	--	5.5	--	8.9	7.7
29.29	Tributyl phosphate	126-73-8	--	--	--	--	377.9	--	193.8
31.36	n-butylbenzenesulfonamide	3622-84-2	--	2.6	3.7	--	--	--	--
32.10	2-tridecenal	7069-41-2	--	--	--	--	14.8	--	5.8
32.48	3-Cyclopentylpropionic acid, 2-ethylhexyl ester[3]	1000293-47-0	--	--	--	--	24.4	--	7.8
32.51	Diisobutyl phthalate	84-69-5	--	--	--	7.0	--	--	--
32.60	Dibutyl phenyl phosphate	2528-36-1	--	--	--	--	33.4	--	38.7
32.72	3-Cyclopentylpropionic acid, 2-ethylhexyl ester[3]	1000293-47-0	--	--	--	--	31.1	--	9.0
33.69	n-hexadecanoic acid	57-10-3	15.1	35.7	26.4	14.6	15.2	5.6	35.7
34.02	Allyl stearate	6289-31-2	--	--	--	--	--	--	7.8
35.01	(1,1'-Bicyclohexyl)-4-ylbenzene	20273-27-2	--	--	--	--	--	--	6.1
35.17	Heptanoic acid, anhydride	626-27-7	--	--	--	--	54.4	--	97.4
36.30	2,7-dimethyl-3,5-Octanedione	7307-07-5	--	--	--	--	32.7	--	96.9

RT (min)	Compound Name	CAS#	Compound Concentration (µg/m^3)[1]						
			Controls			Baseline 200		*MJOIIRep* 200	
			Shipping Blank[2]	Field Blank[2]	Field Sample	Inlet	Bleed	Inlet	Bleed

-- =below the detection limits of the method used.

[1] Toluene-equivalent concentrations.

[2] A volume of 1L was used for blanks to facilitate the VOC quantification.

[3] Closely related 7-Oxabicyclo(4.1.0)heptane-3-carboxylic acid, 2-ethylhexyl ester compound.

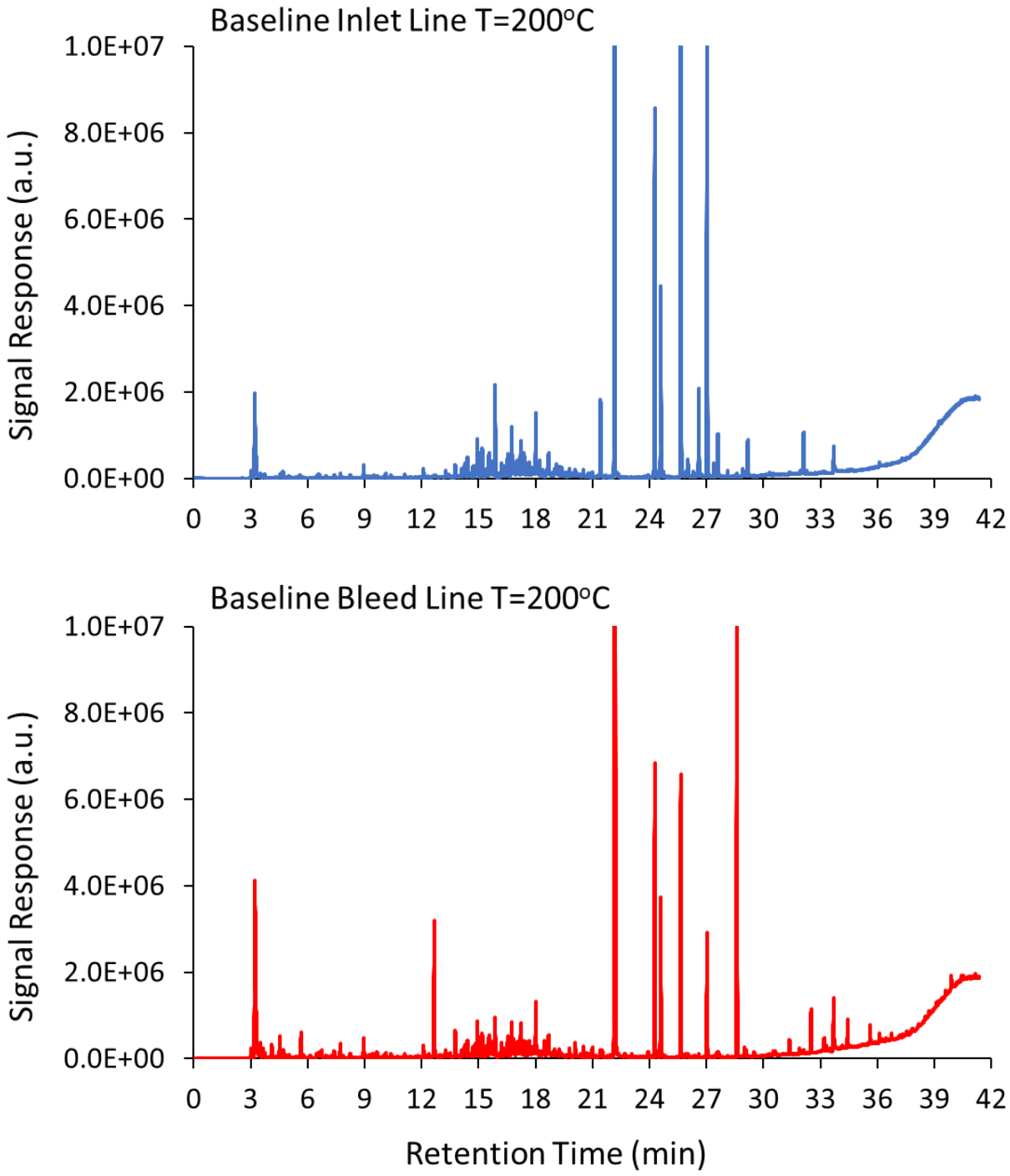
Appendix B

GCMS Total Ion Chromatograms (TICs)

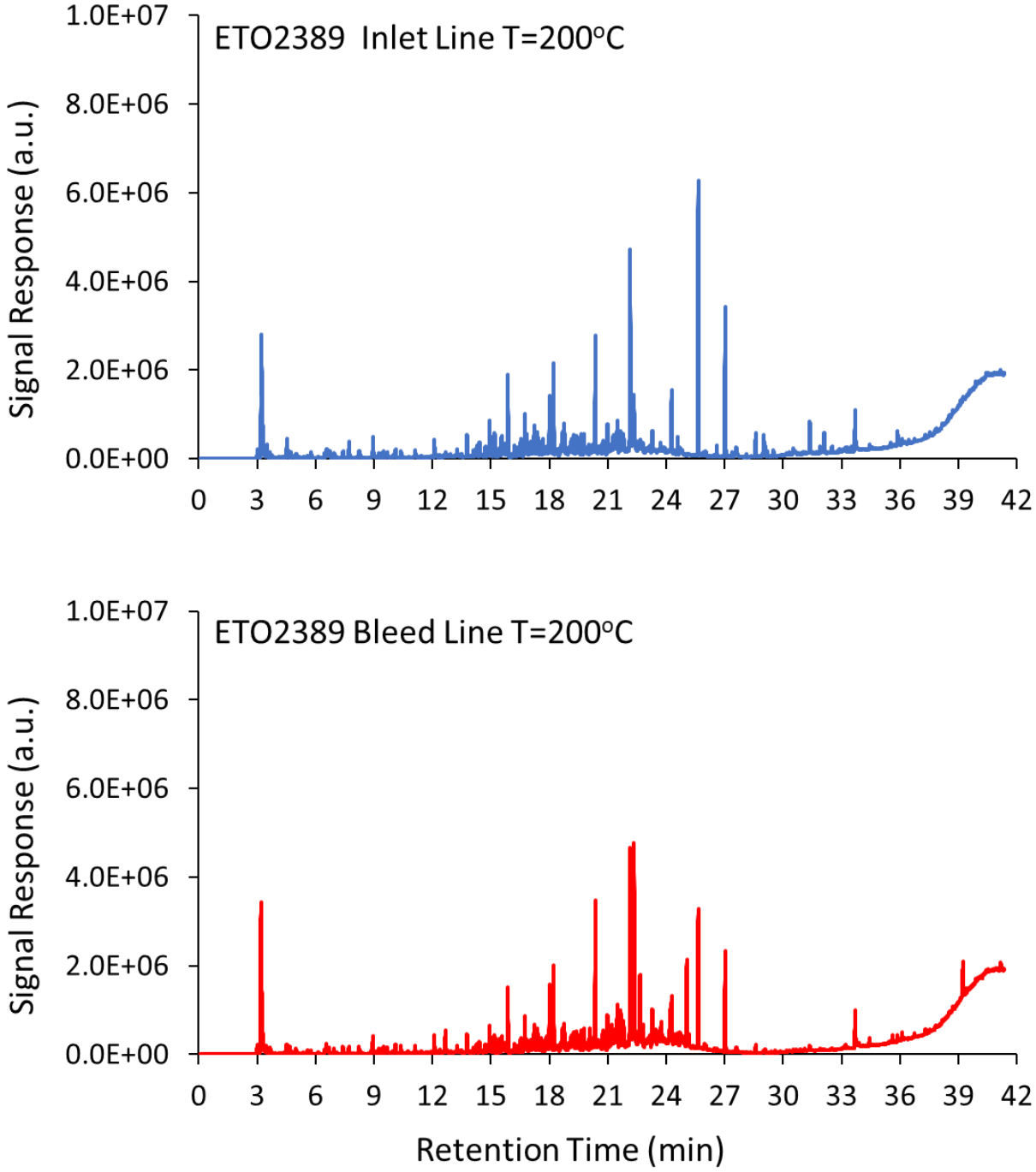
Note: *The distinctive peak observed at 3.2 minutes is an artifact of the method used.*

Day 1- Afternoon: ETO 2389 Injection Event

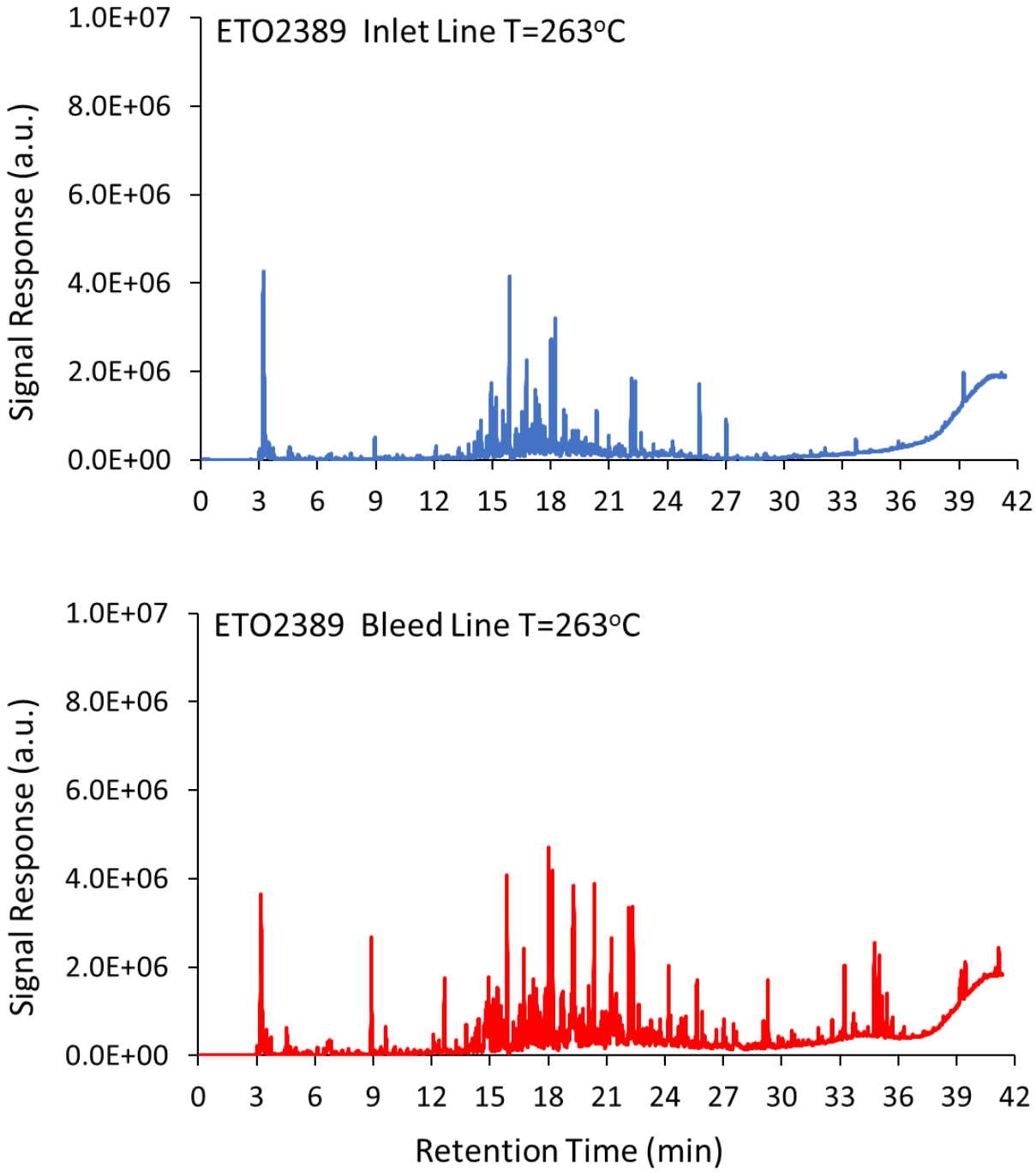
Baseline Samples



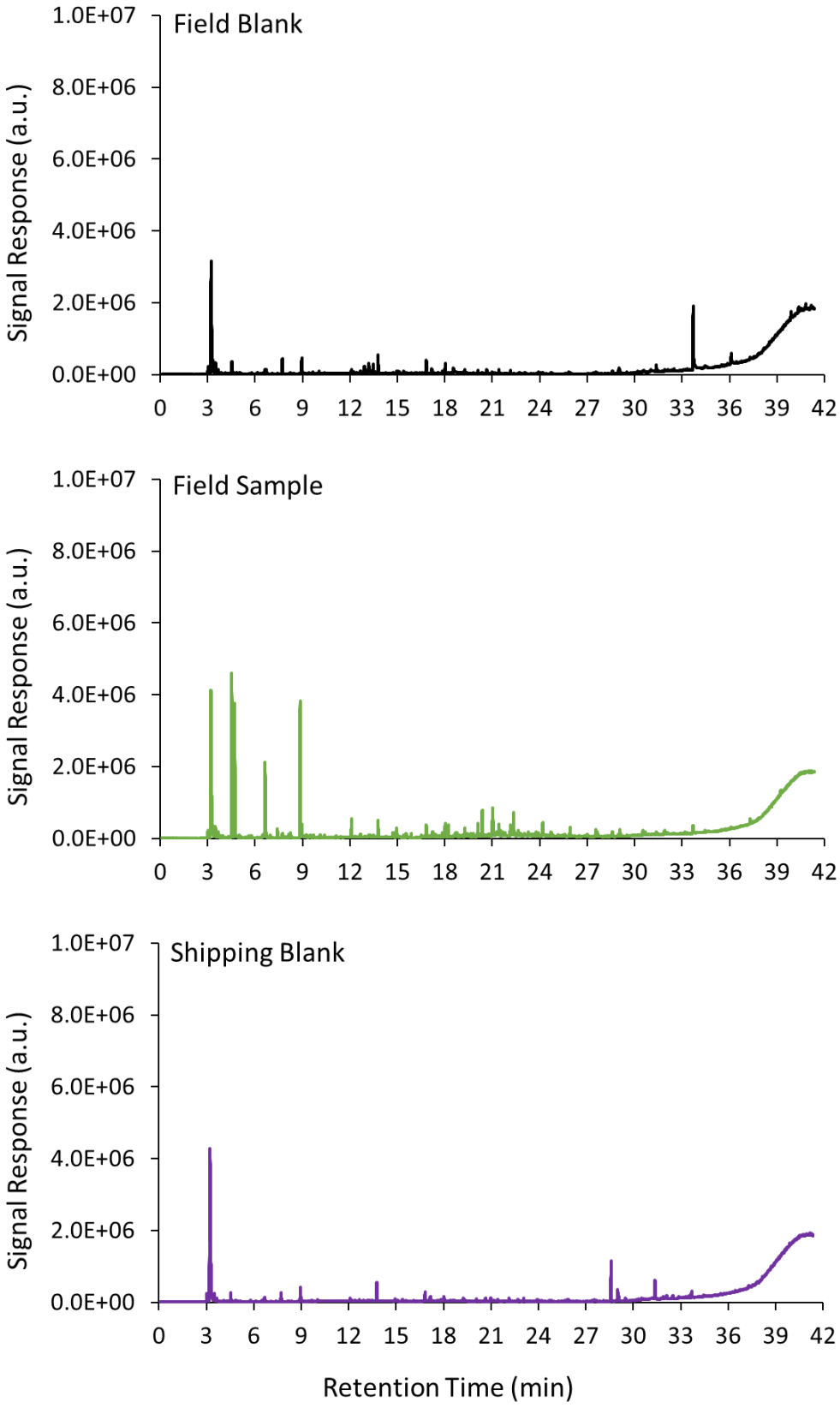
Samples during ETO2389 injection at T=200°C



Samples during ETO2389 injection at T=263°C

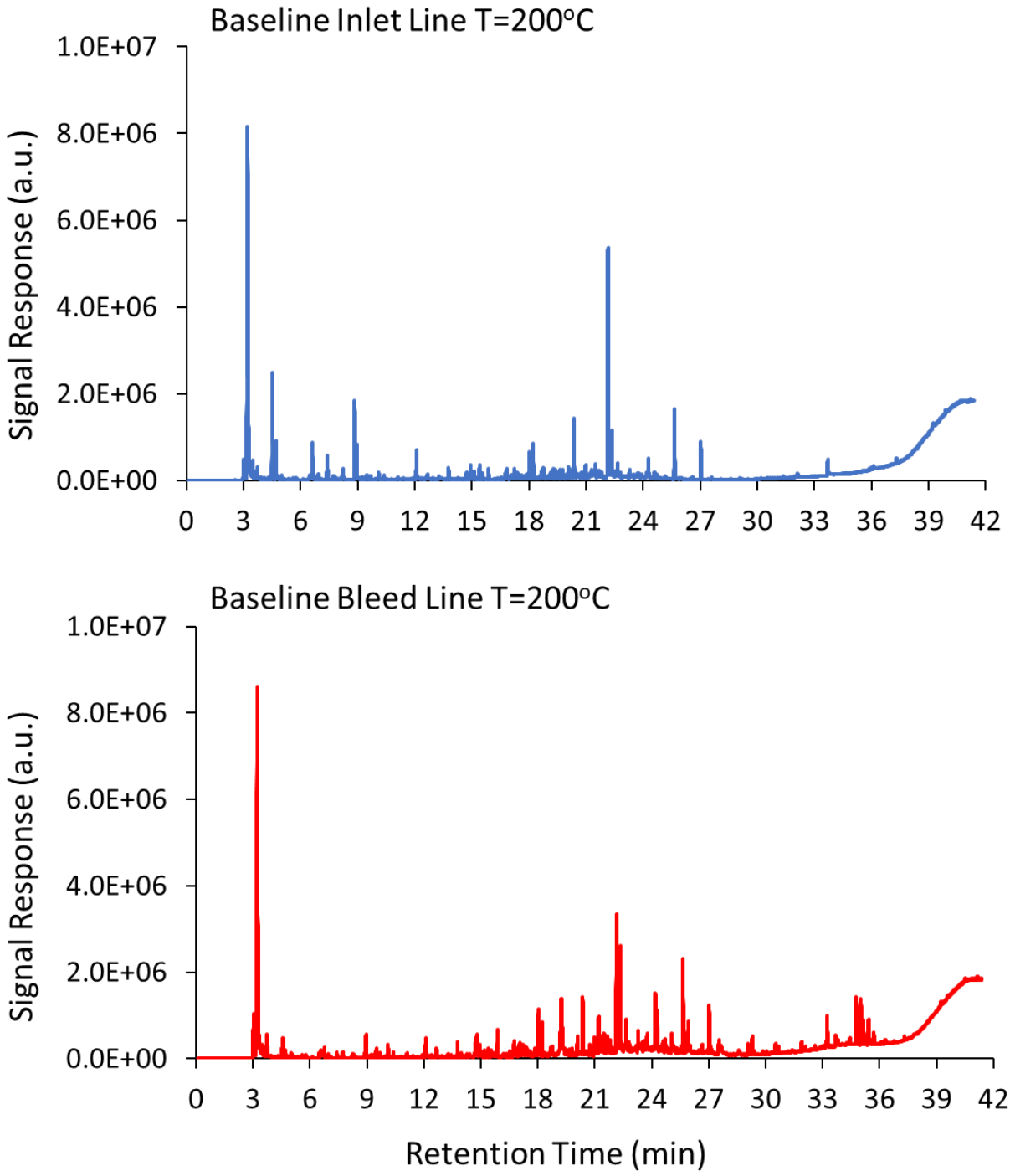


Control samples

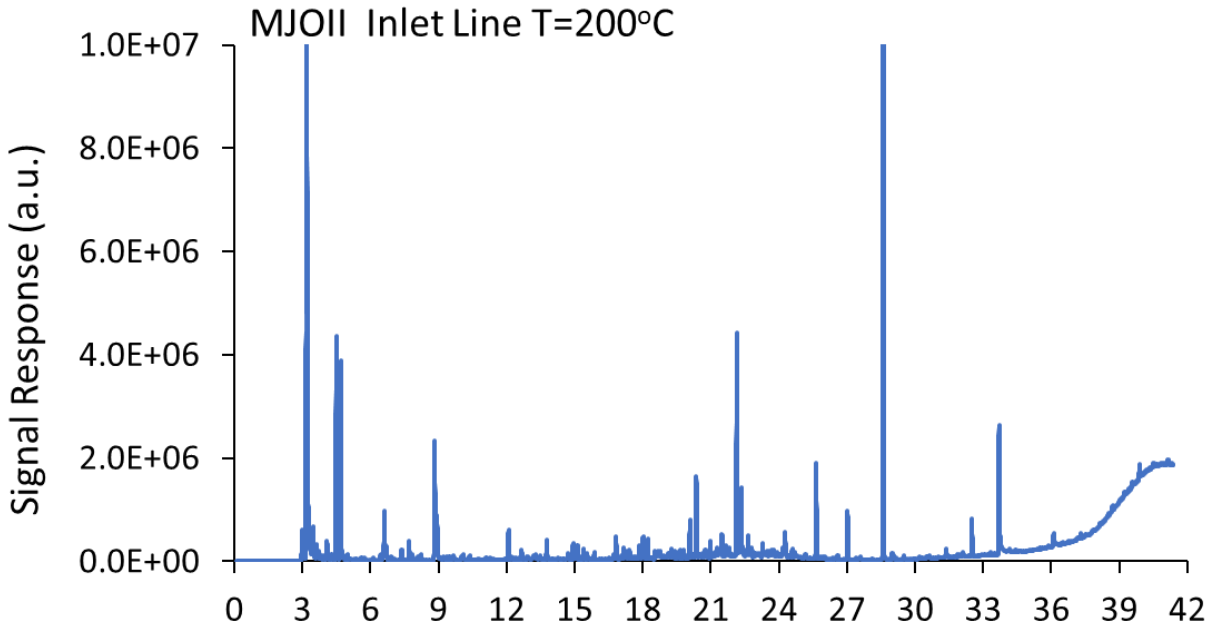


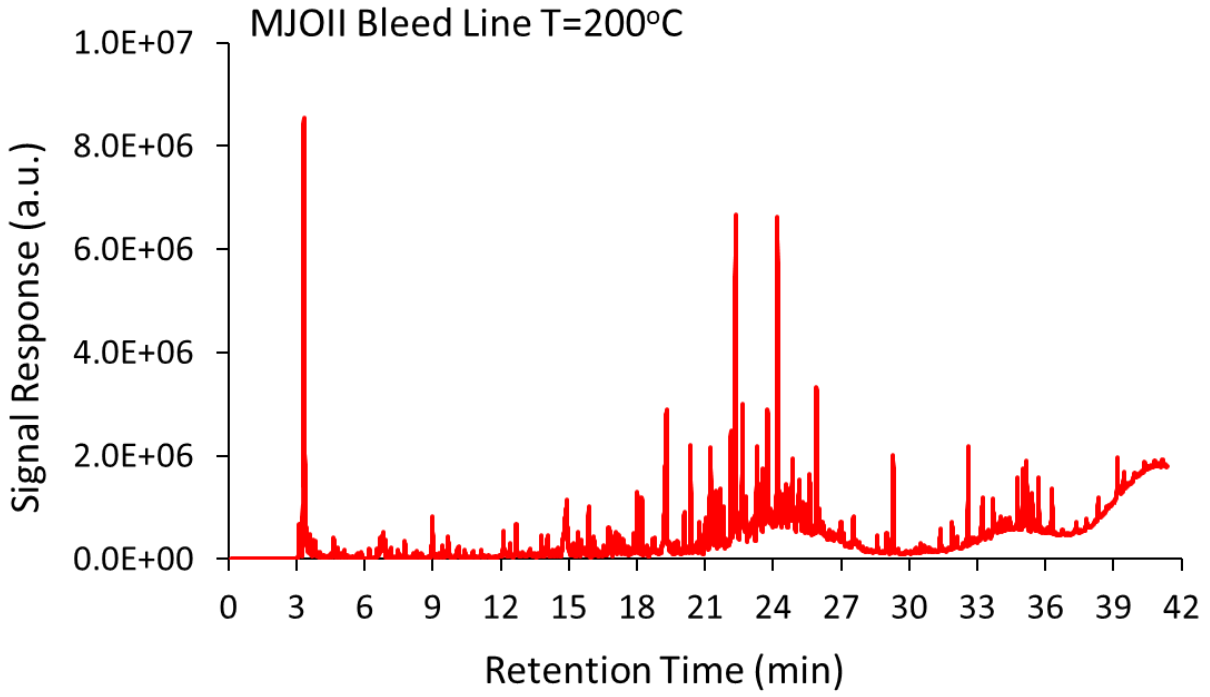
Day 2 - Morning: MJOII Injection Event

Baseline Samples

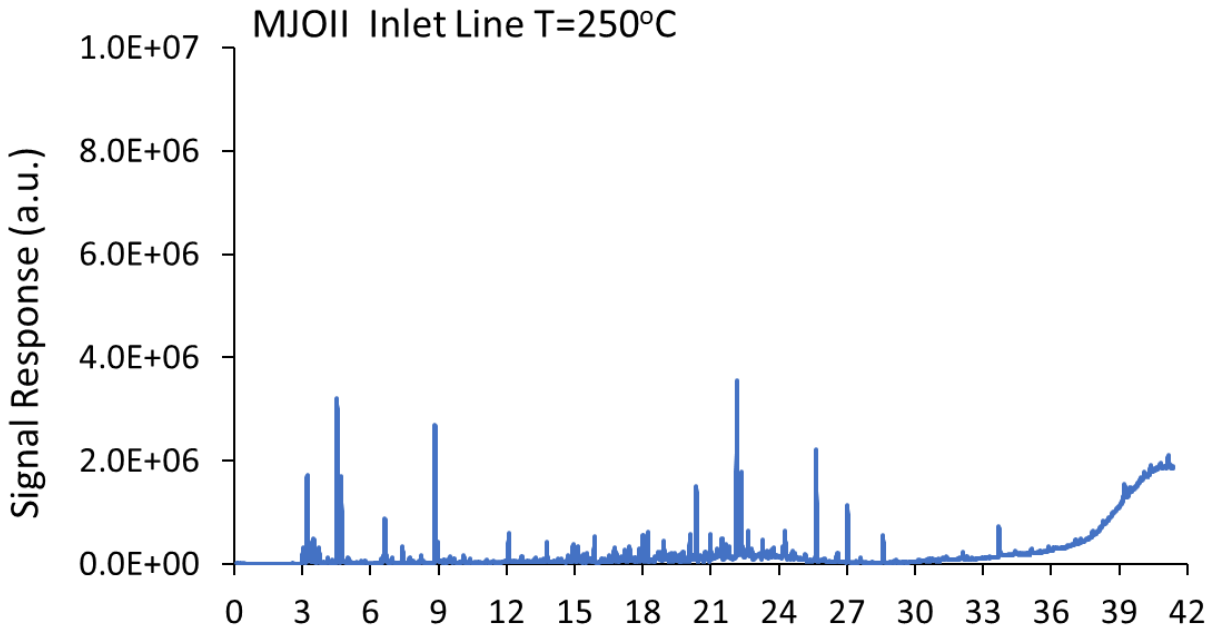


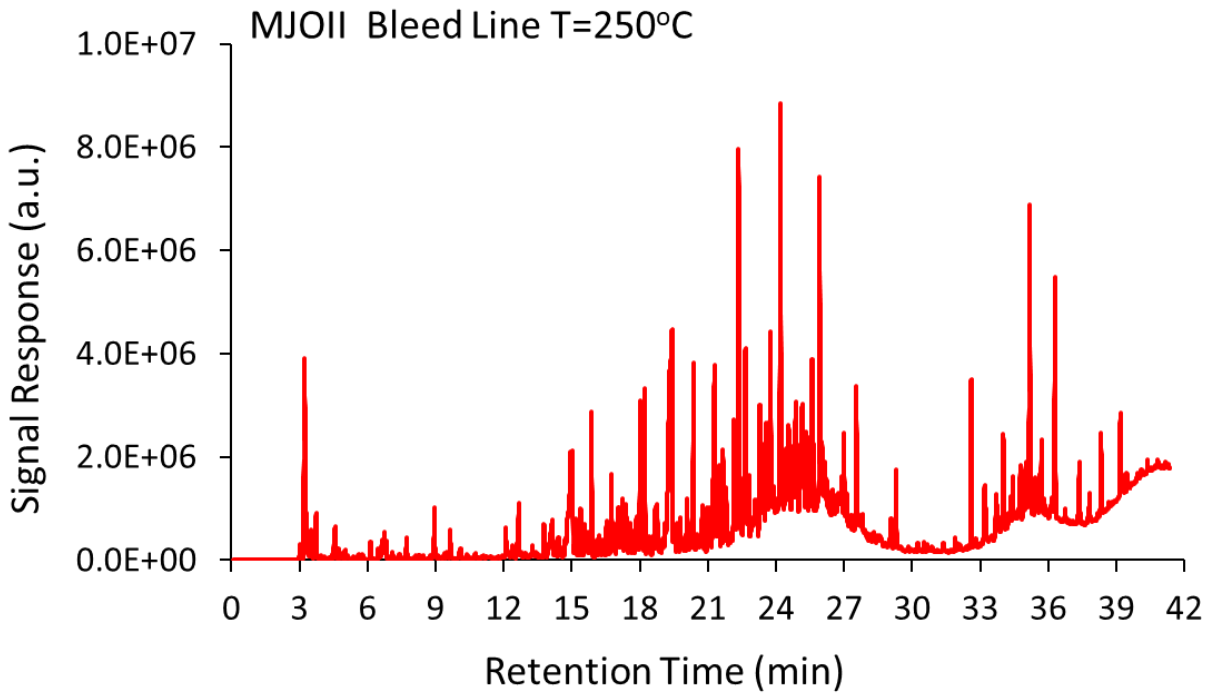
Samples during MJOII injection at T=200°C



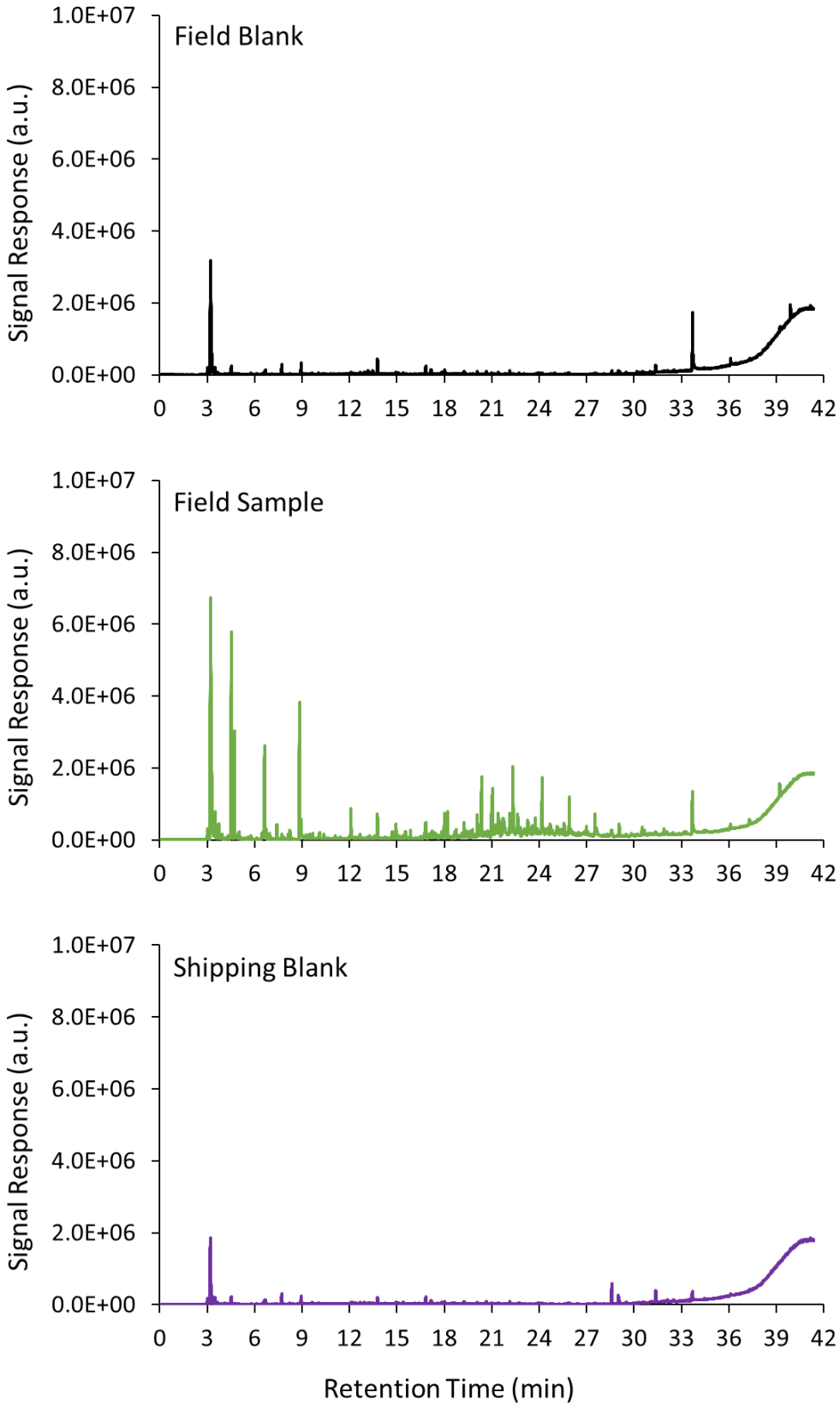


Samples during MJOII injection at T=250°C



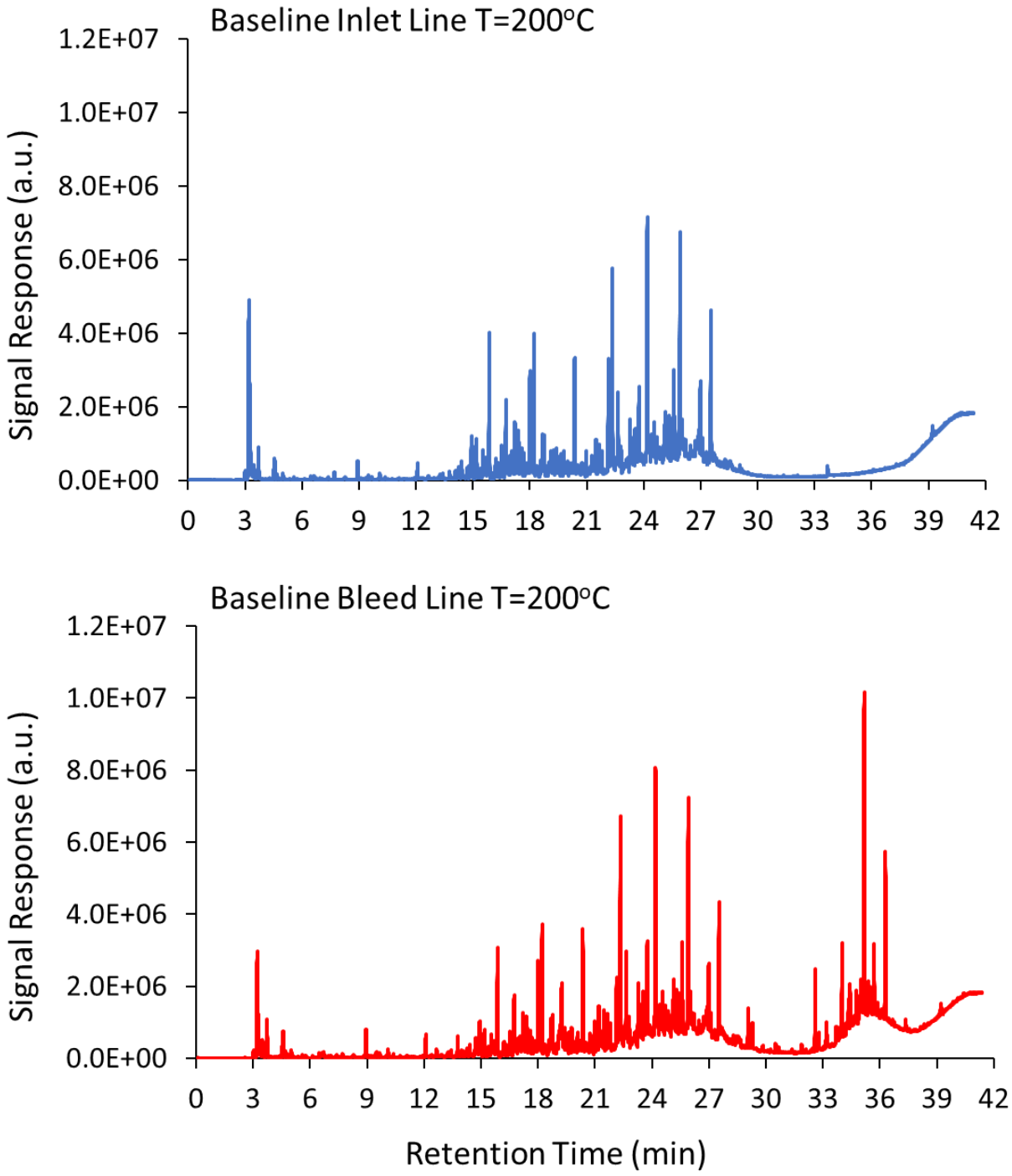


Controls samples

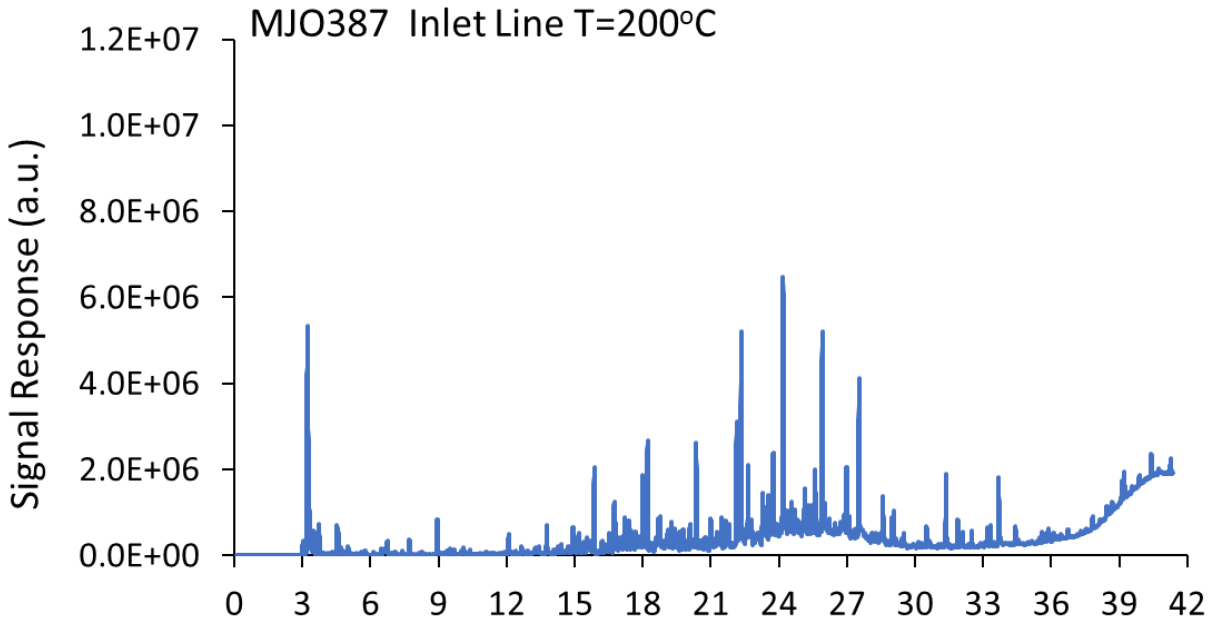


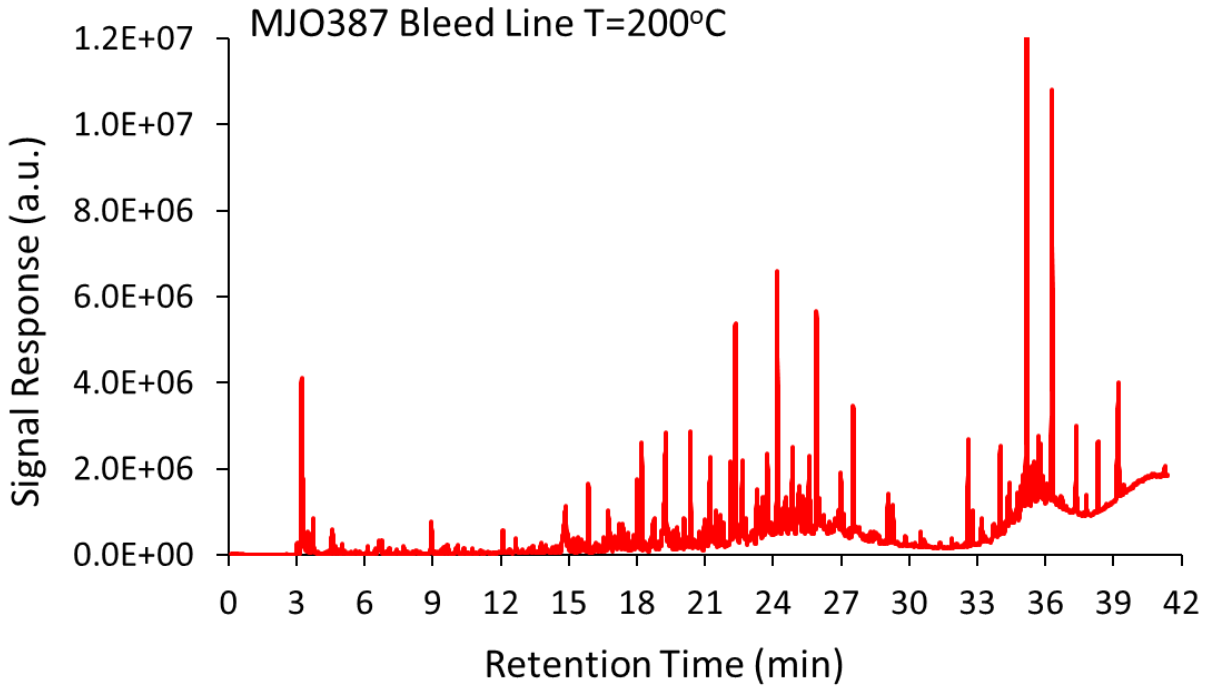
Day 2 - Afternoon: MJO387 Injection Event

Baseline Samples

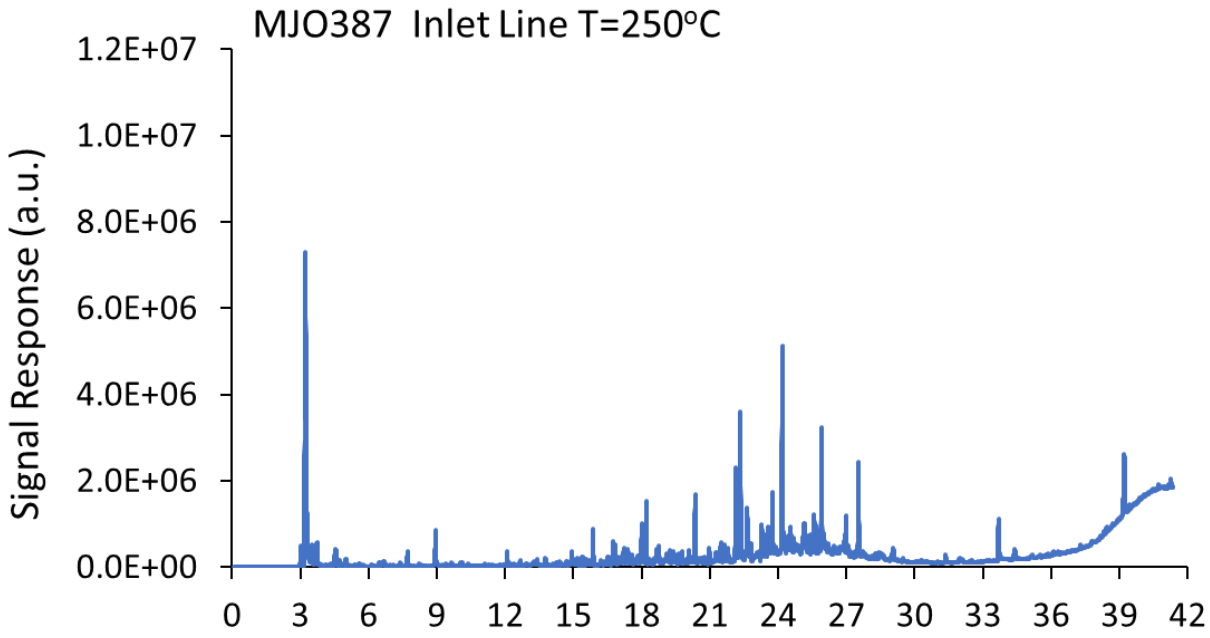


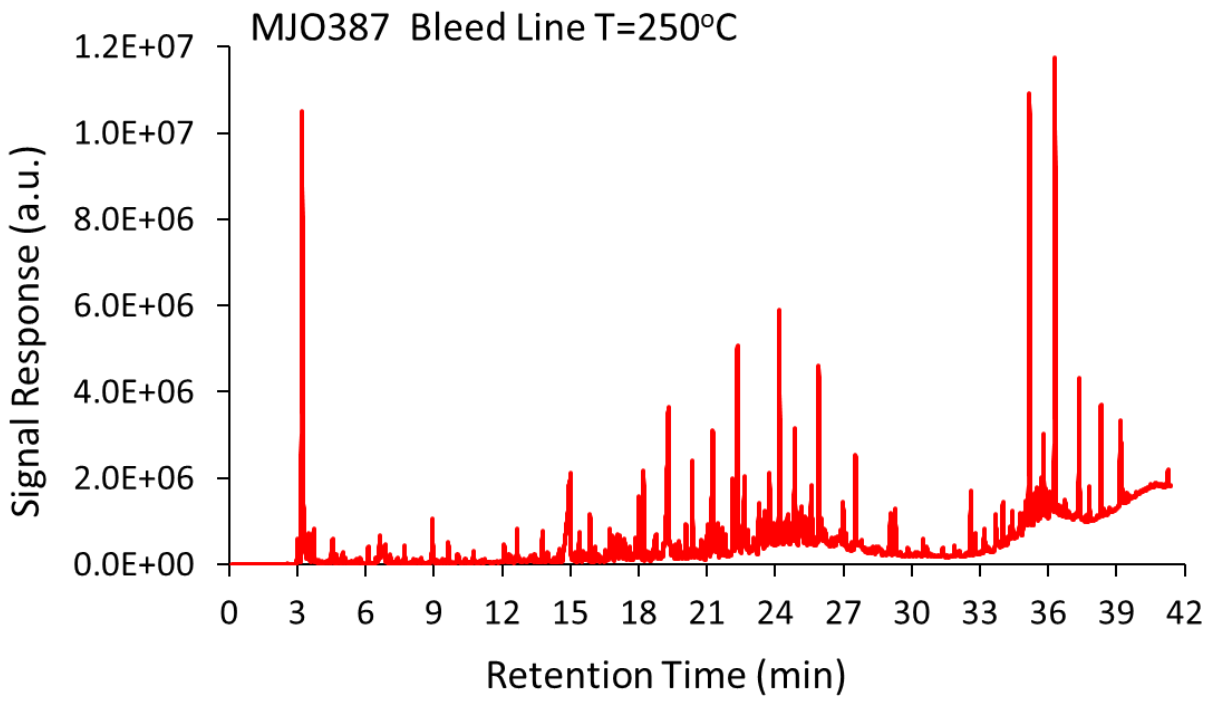
Samples during MJO387 injection at T=200°C



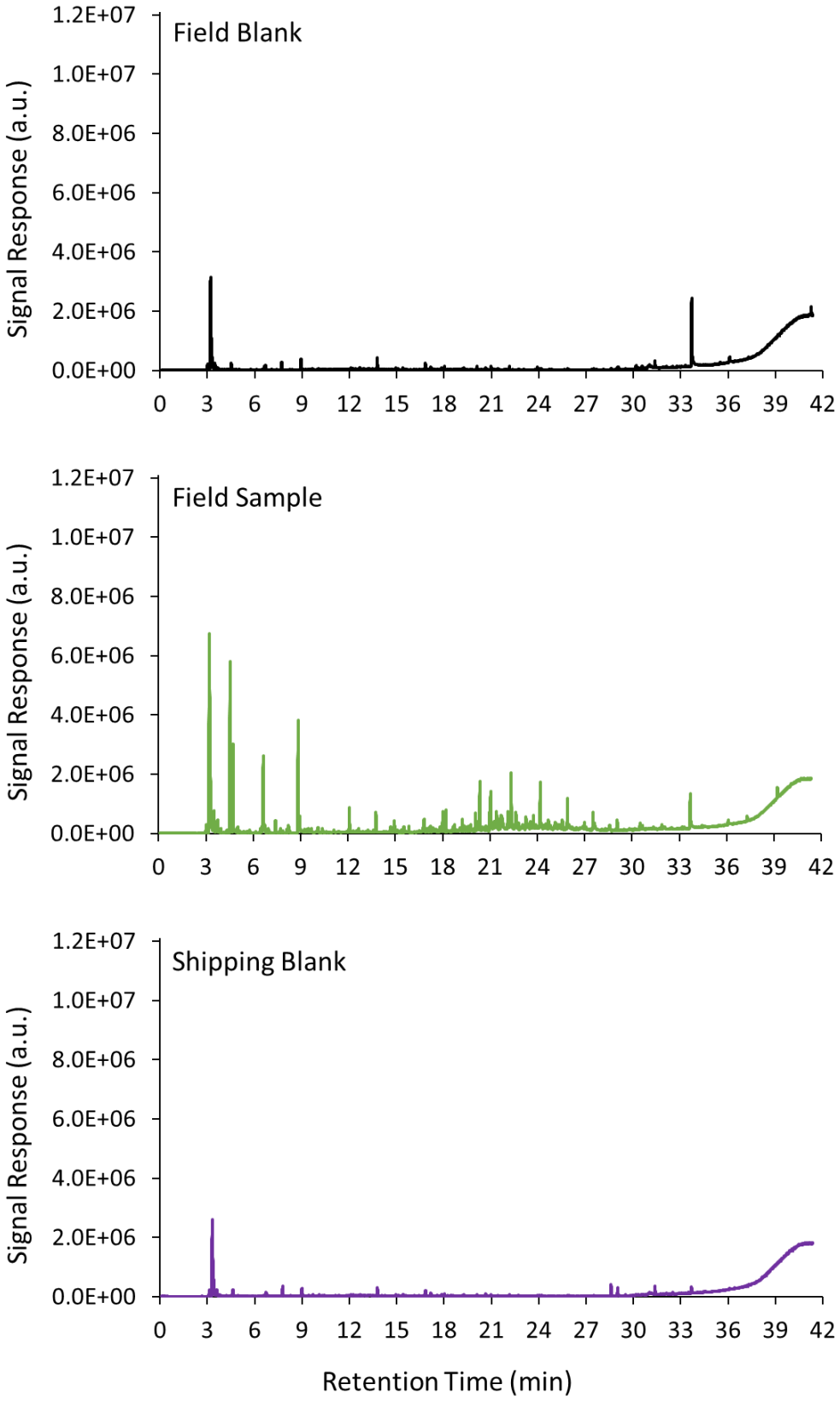


Samples during MJO387 injection at T=250°C



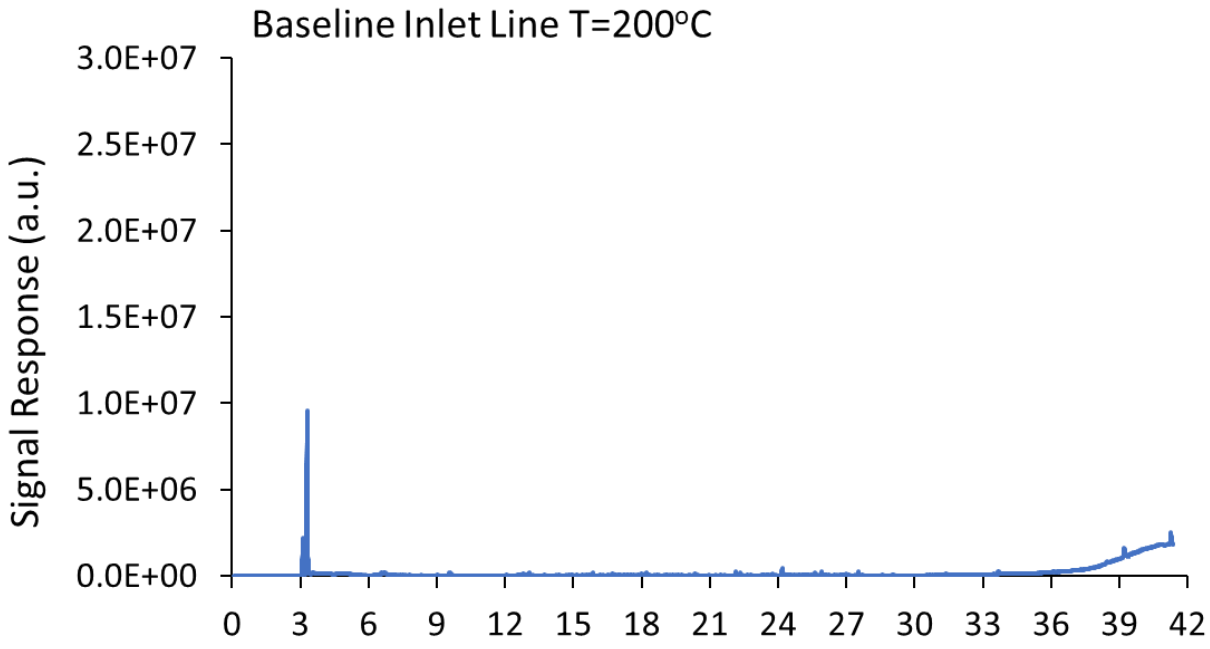


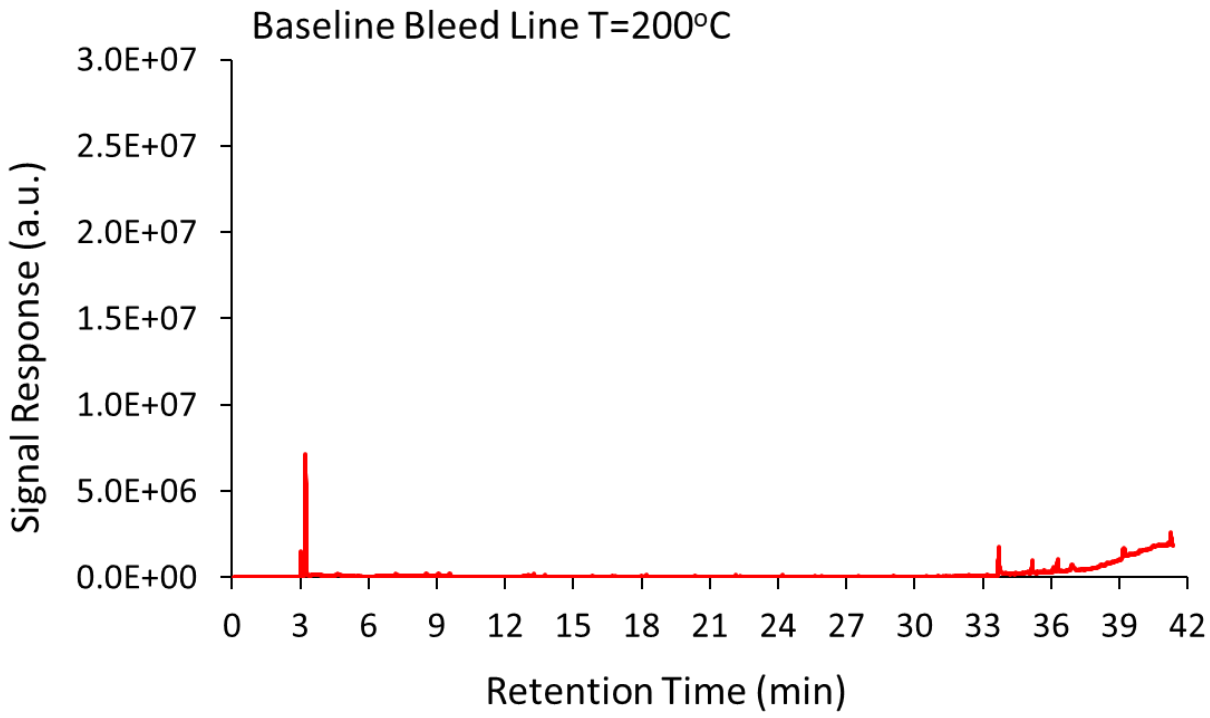
Controls samples



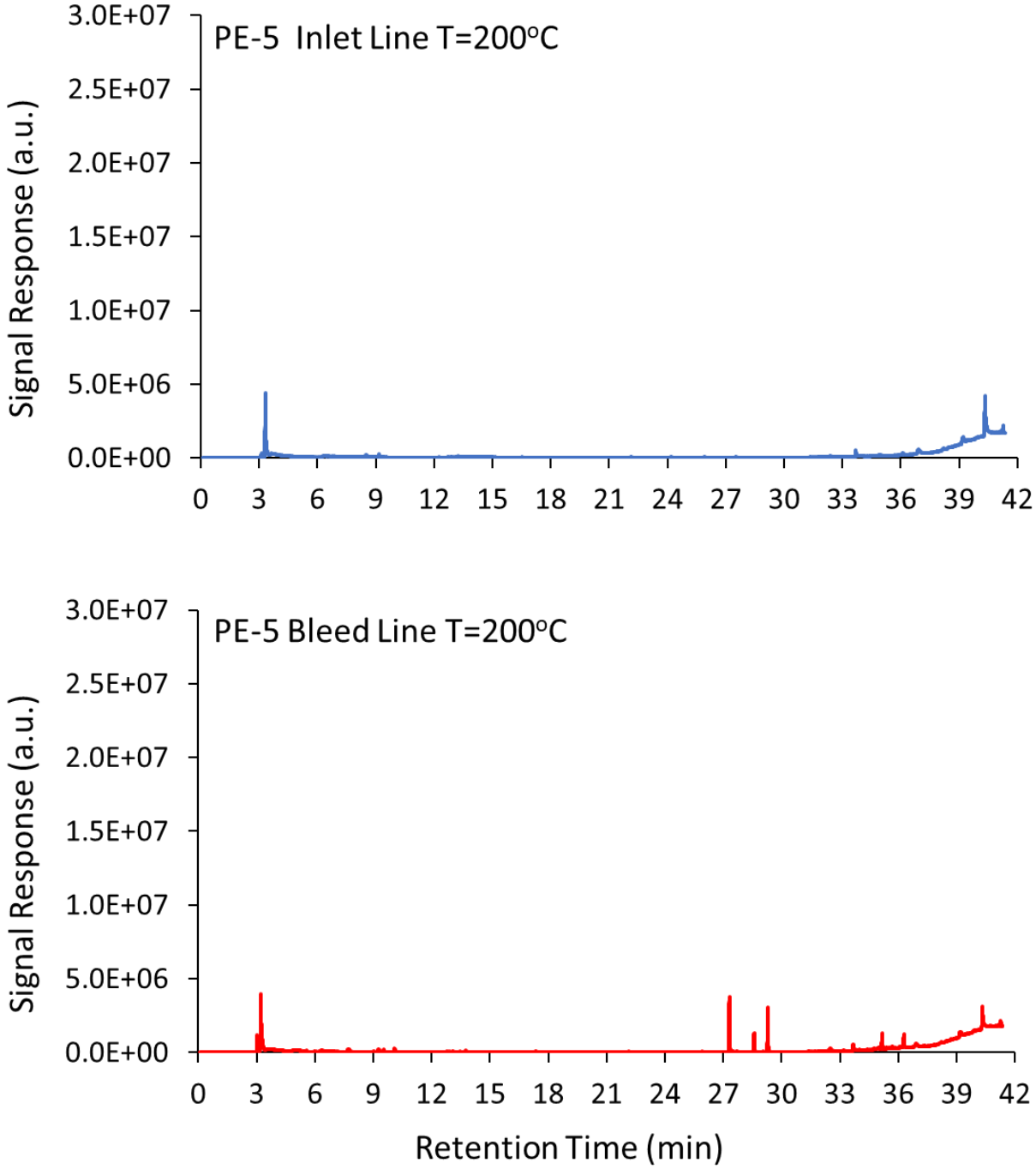
Day 3 - Morning: PE-5 Injection Event

Baseline Samples

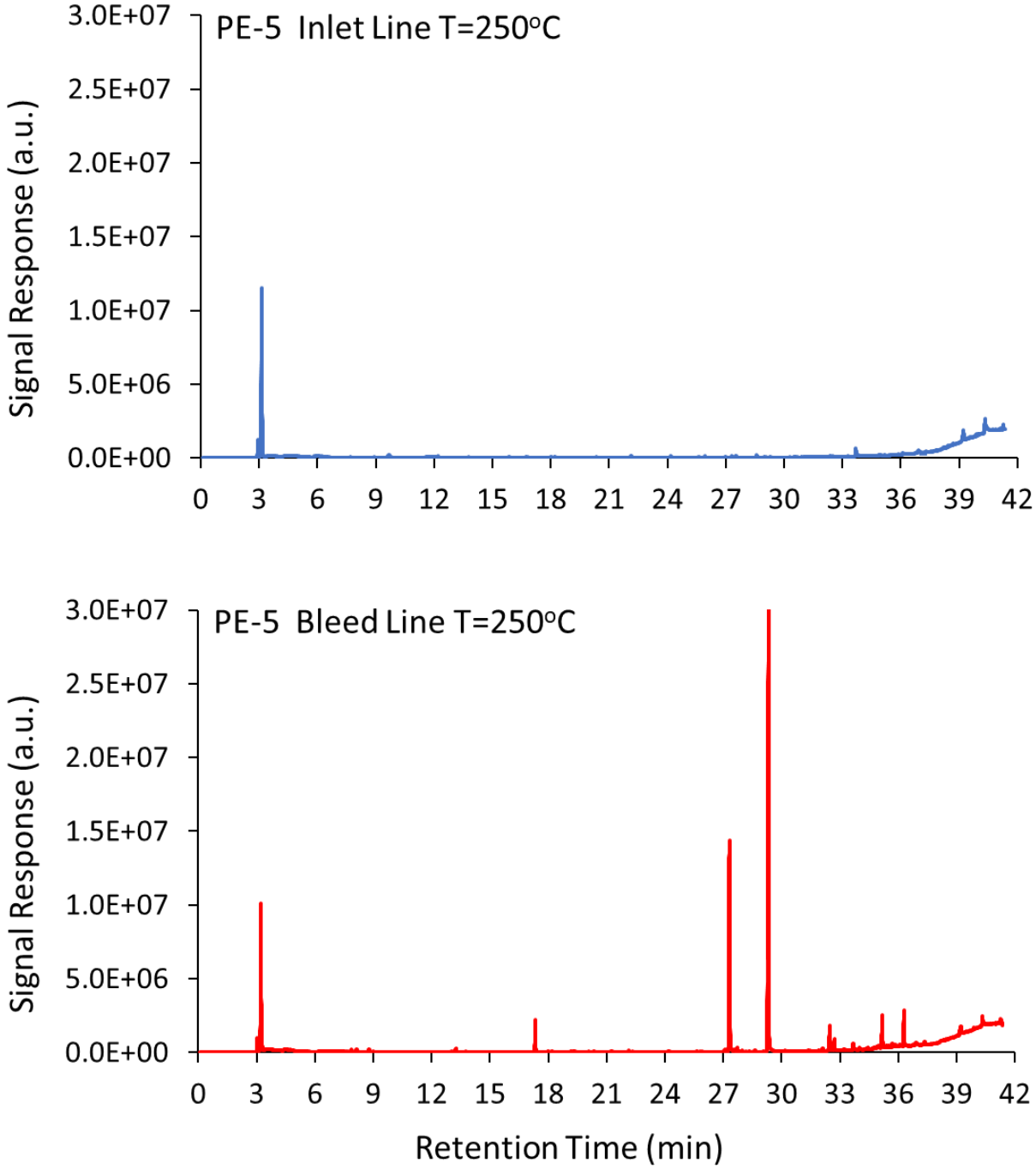




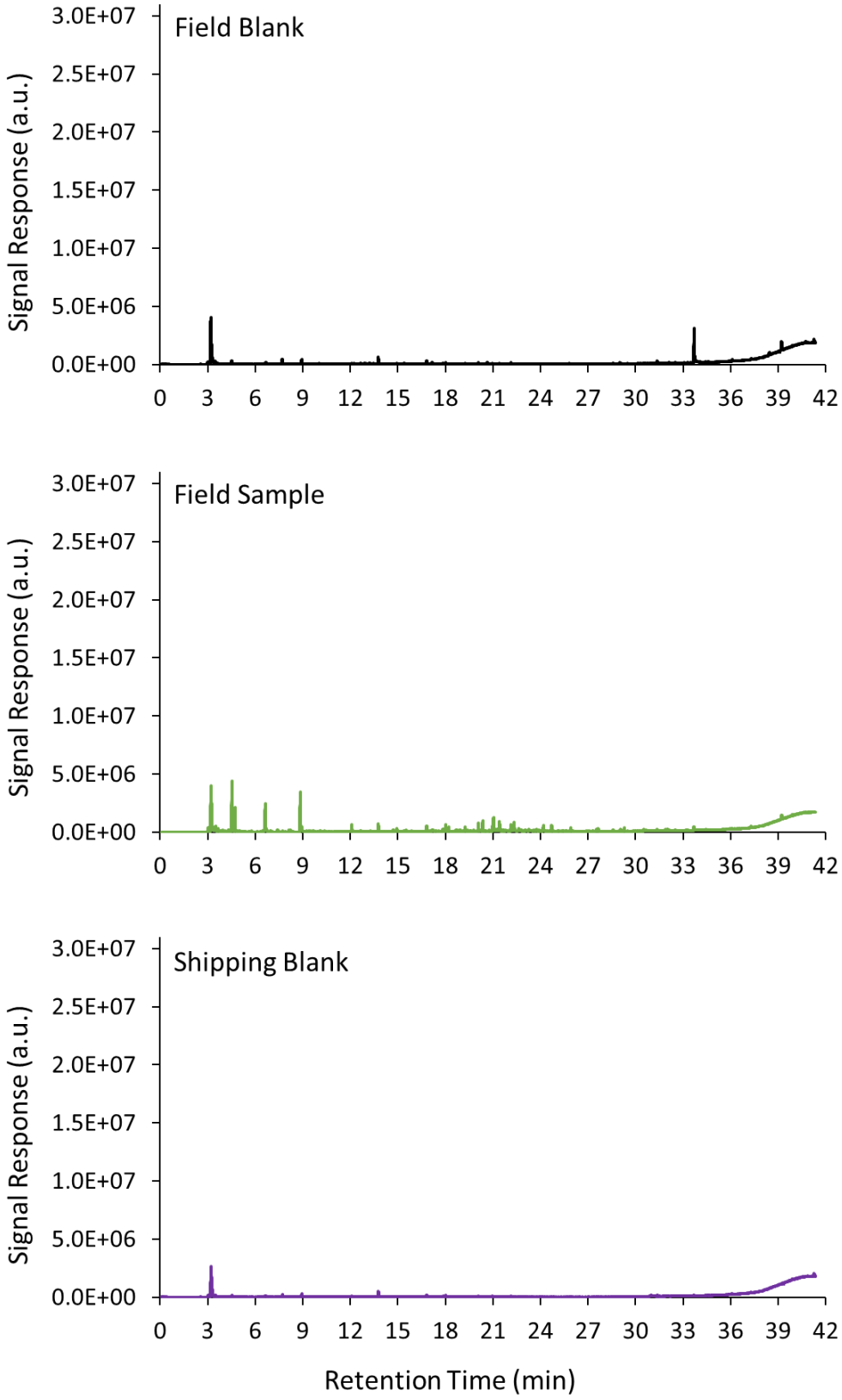
Samples during PE-5 injection at T=200°C



Samples during PE-5 injection at T=250°C

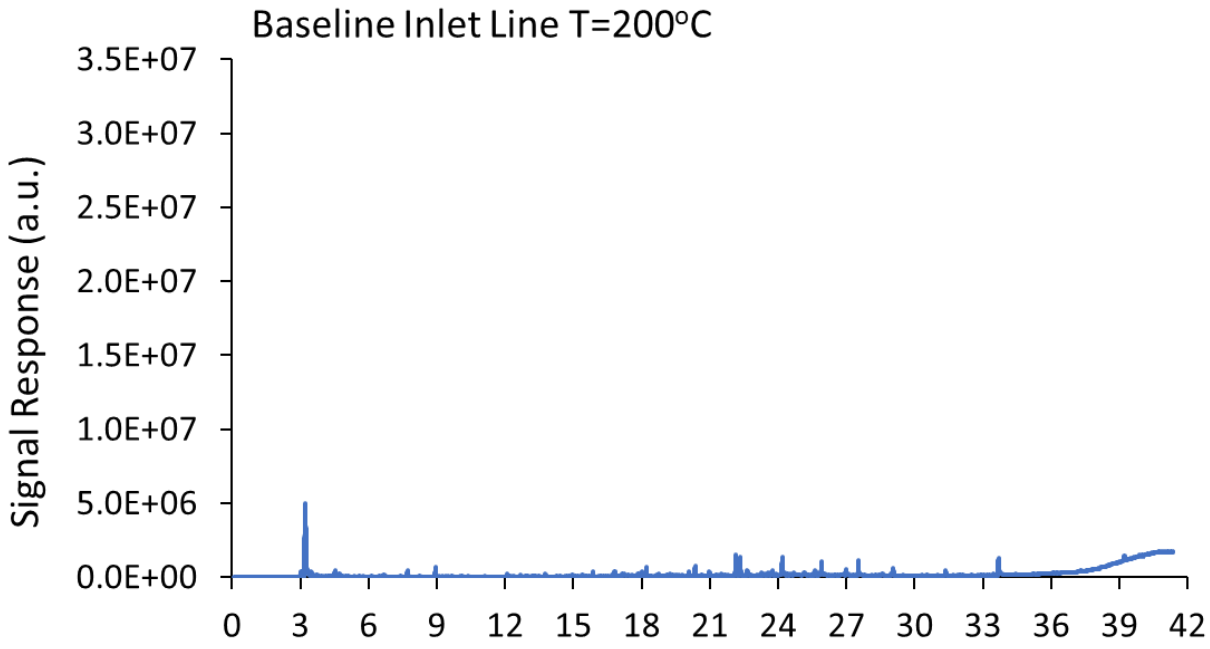


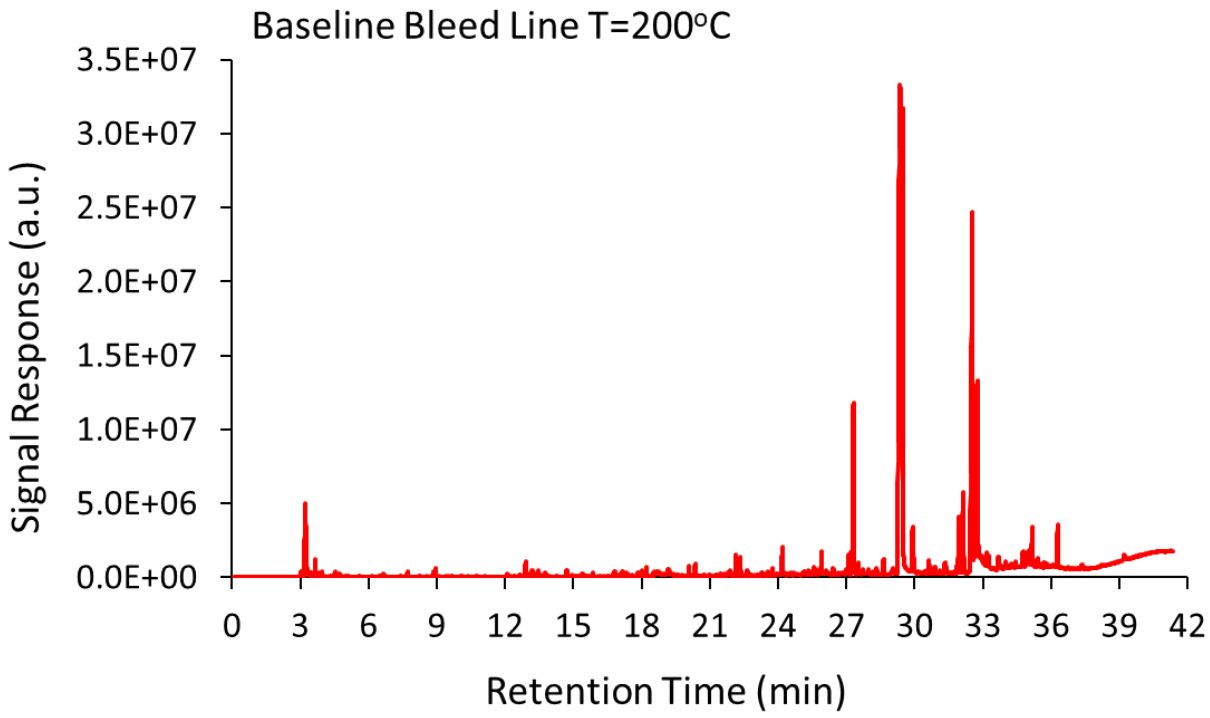
Controls samples



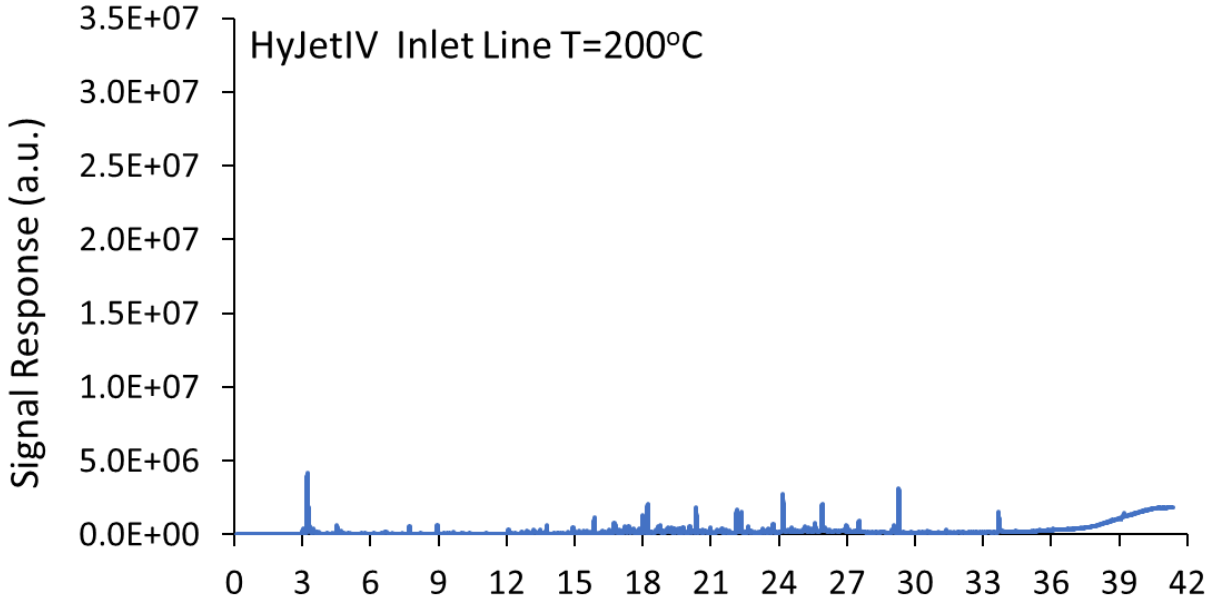
Day 3 - Afternoon: HyJetIV Injection Event

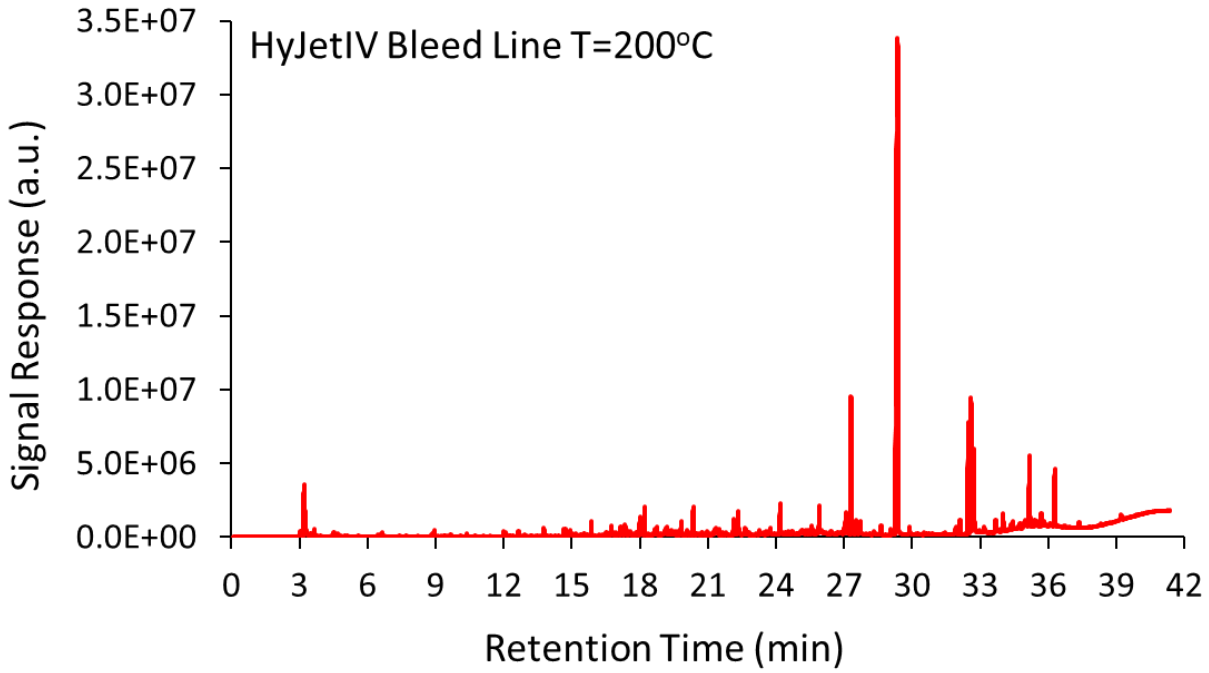
Baseline Samples



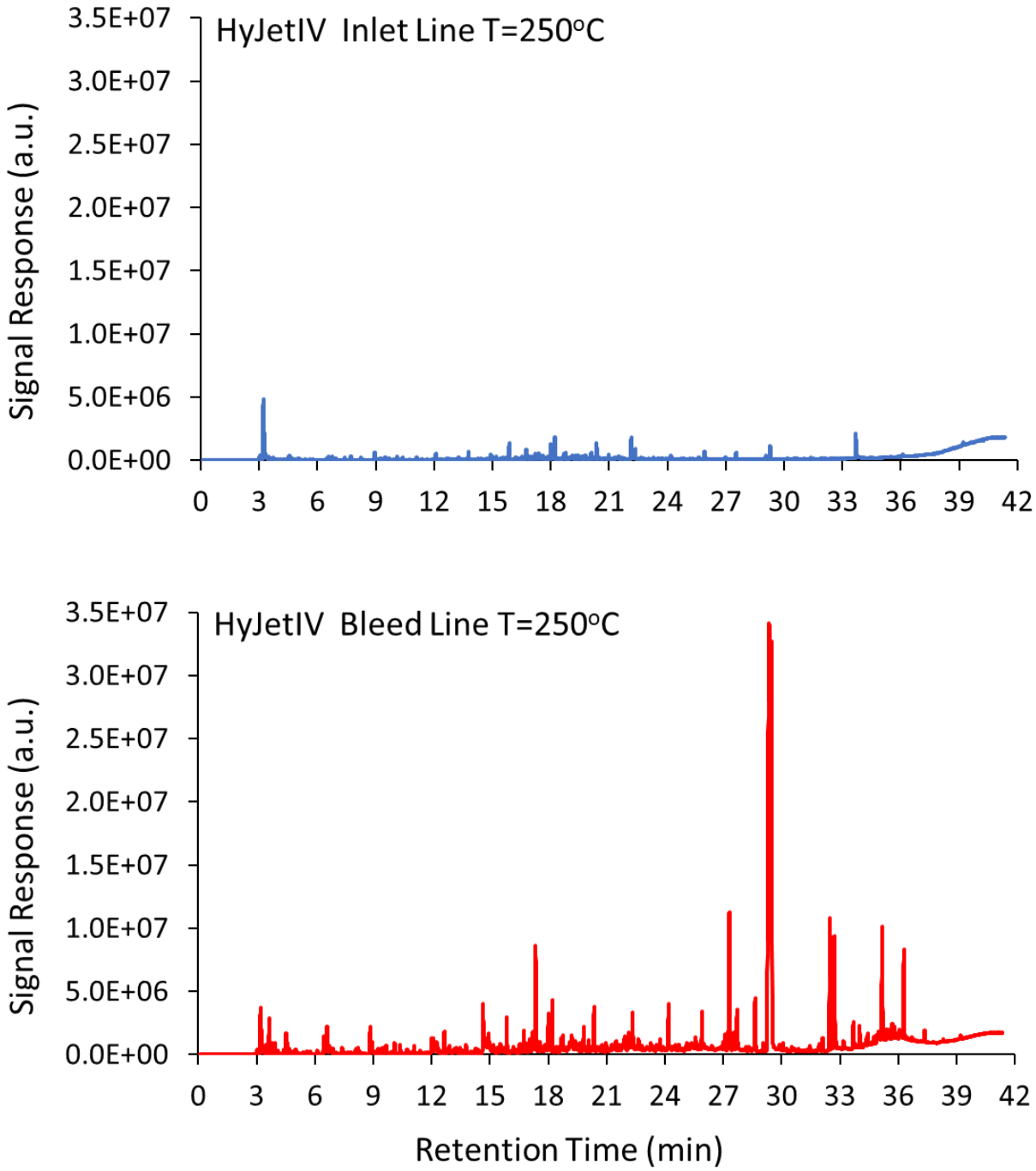


Samples during HyJetIV injection at T=200°C

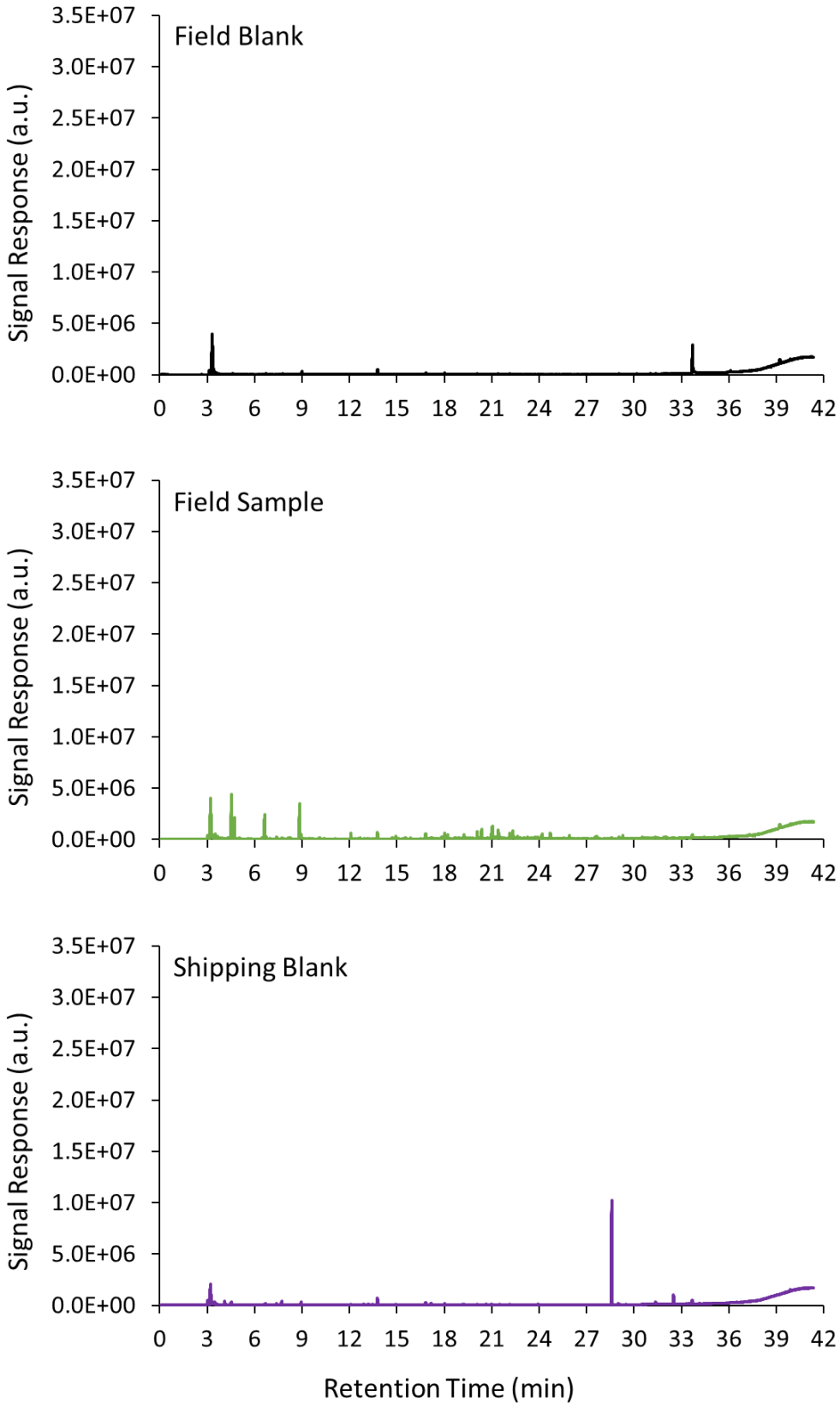




Samples during HyJetIV injection at T=250°C

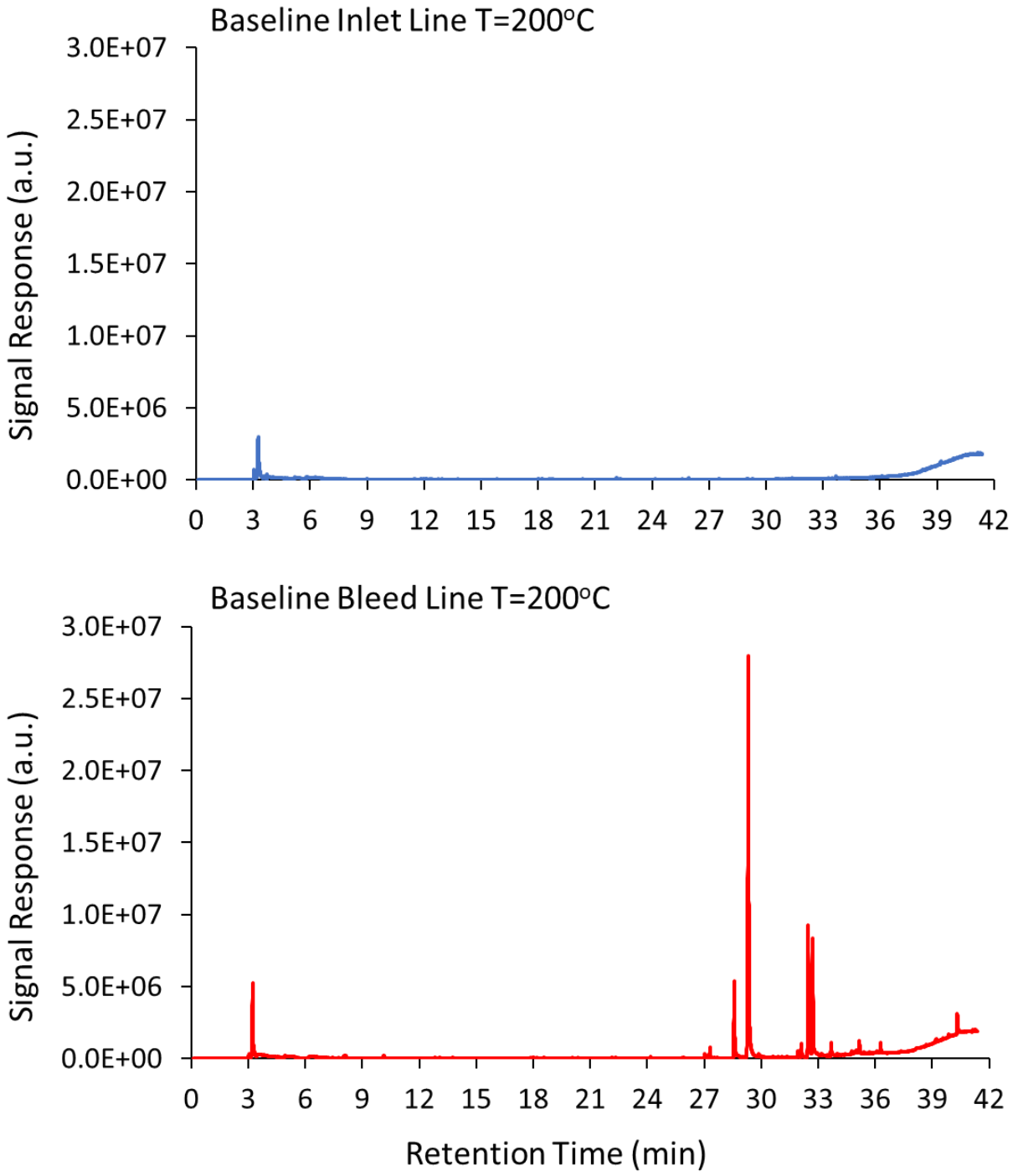


Controls samples

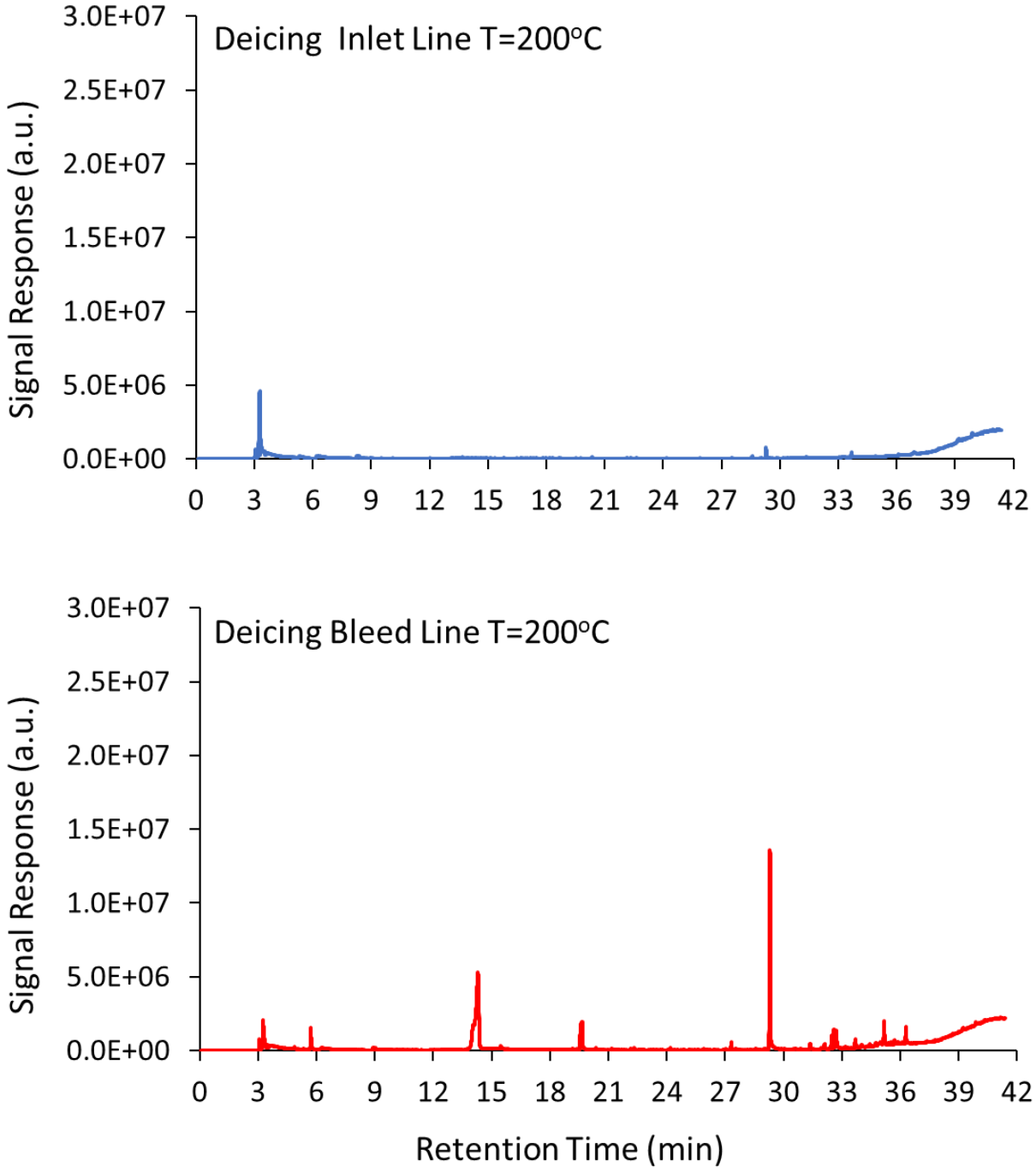


Day 4 - Morning: Deicing Injection Event

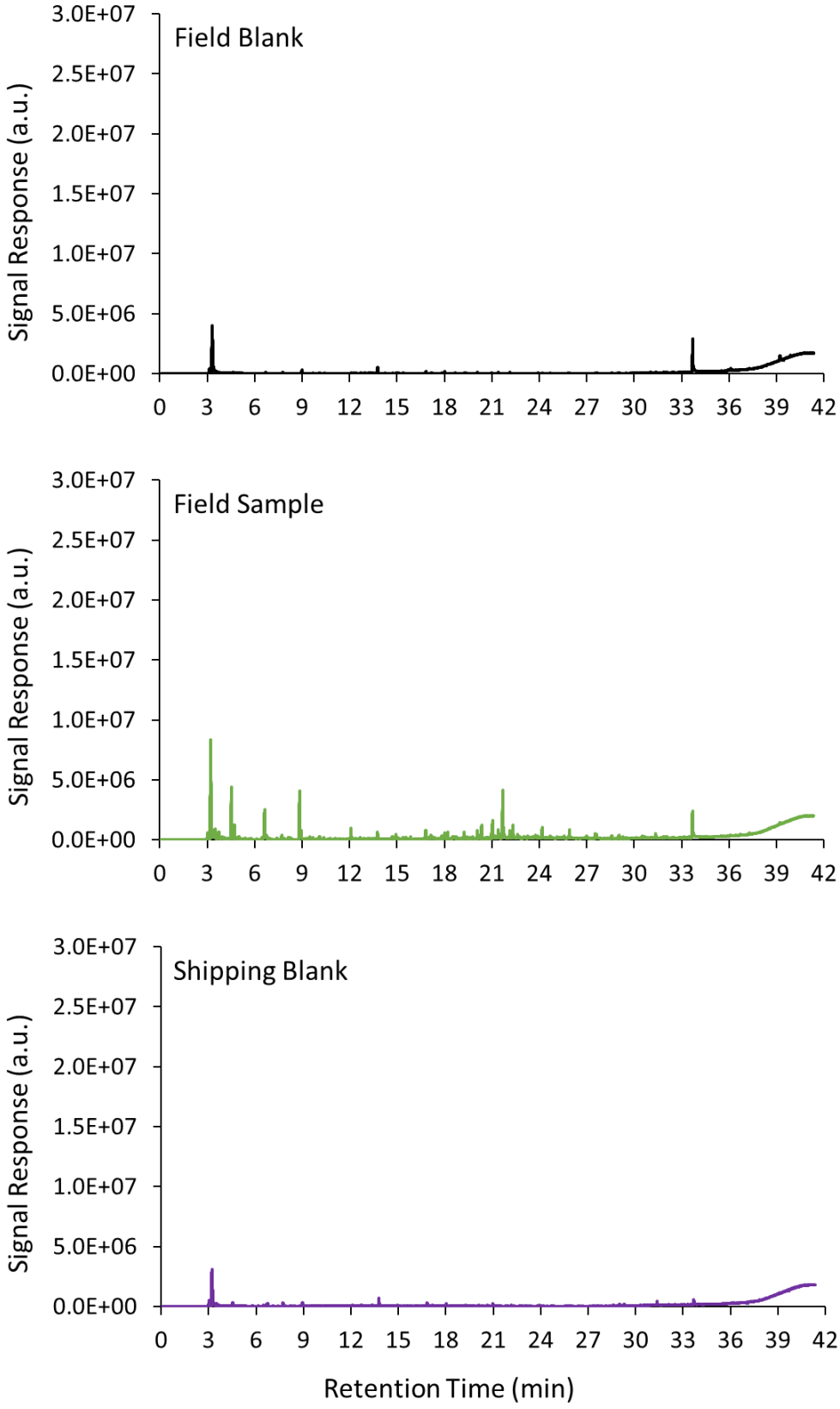
Baseline Samples



Samples during Deicing injection at T=200°C

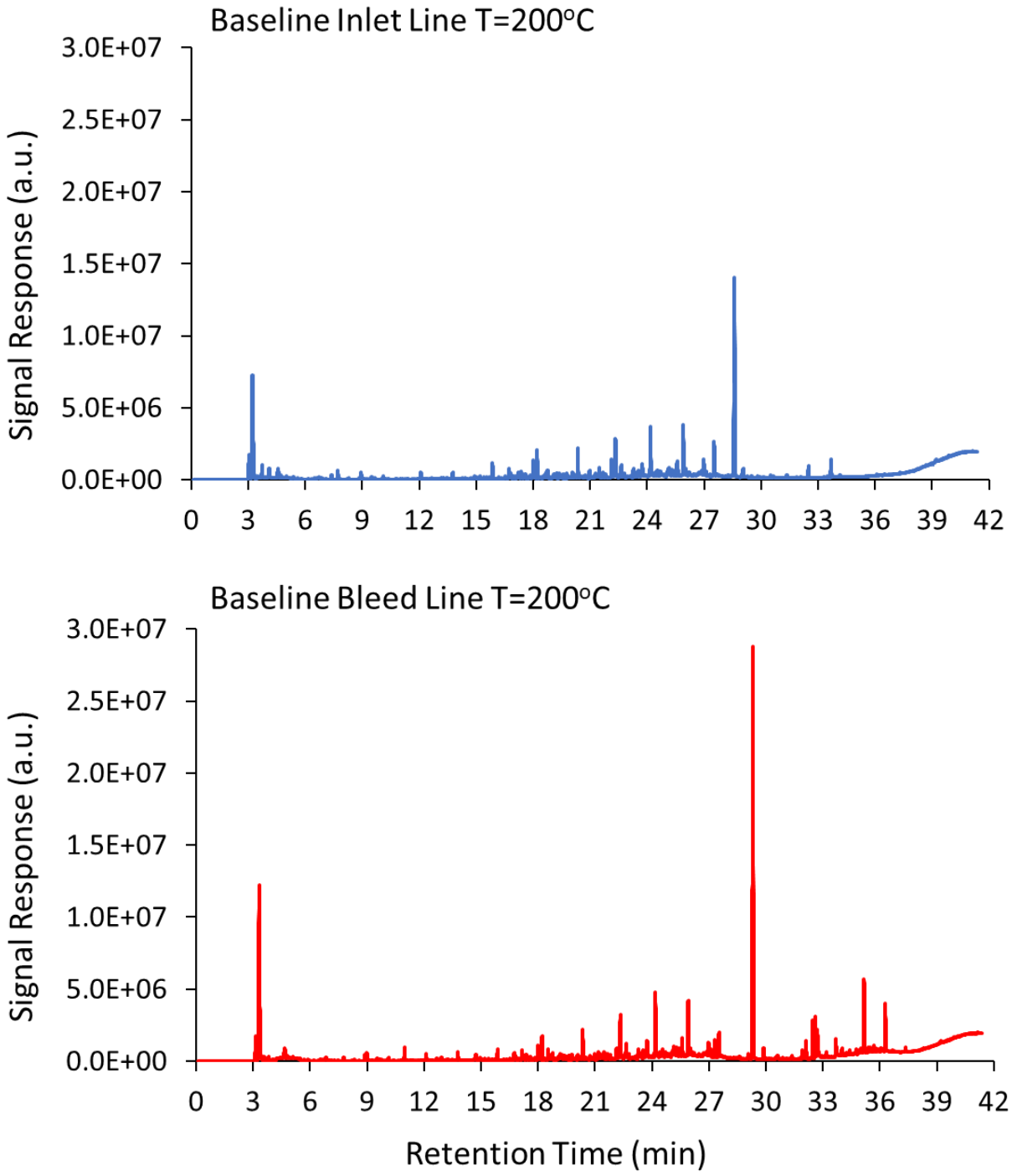


Controls samples

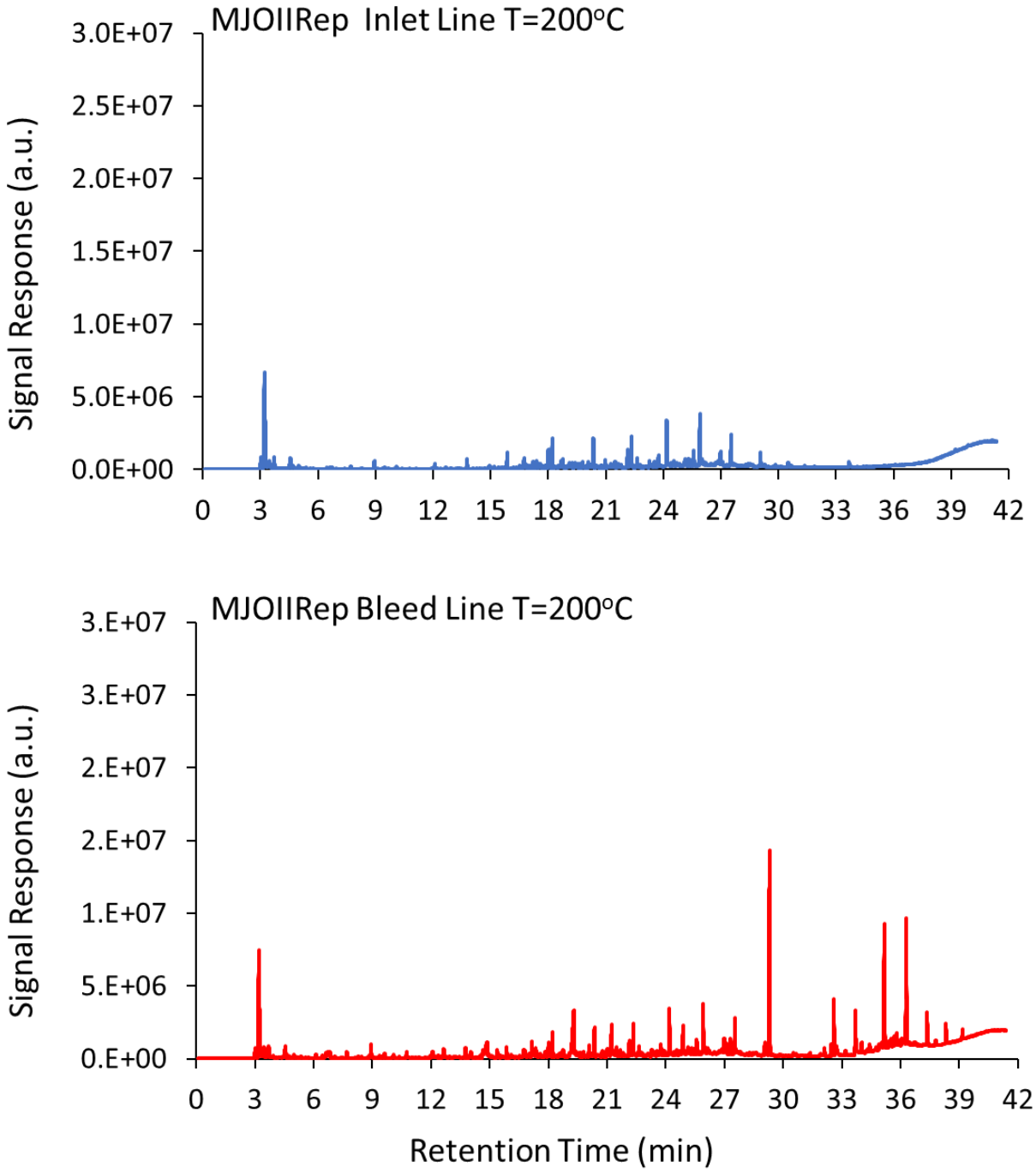


Day 4 - Afternoon: MJOIIRep Injection Event

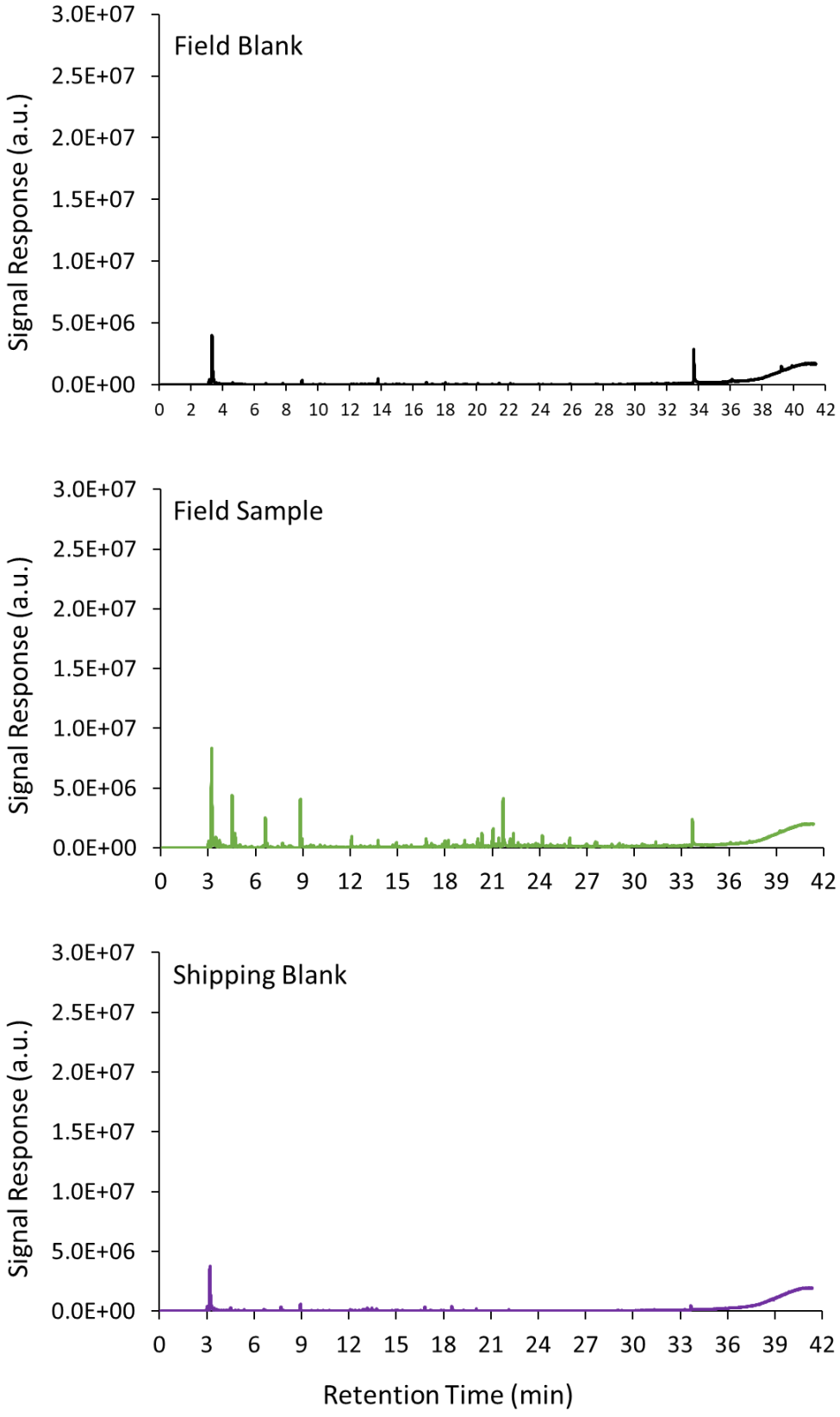
Baseline Samples



Samples during MJOIIRep injection at T=200°C



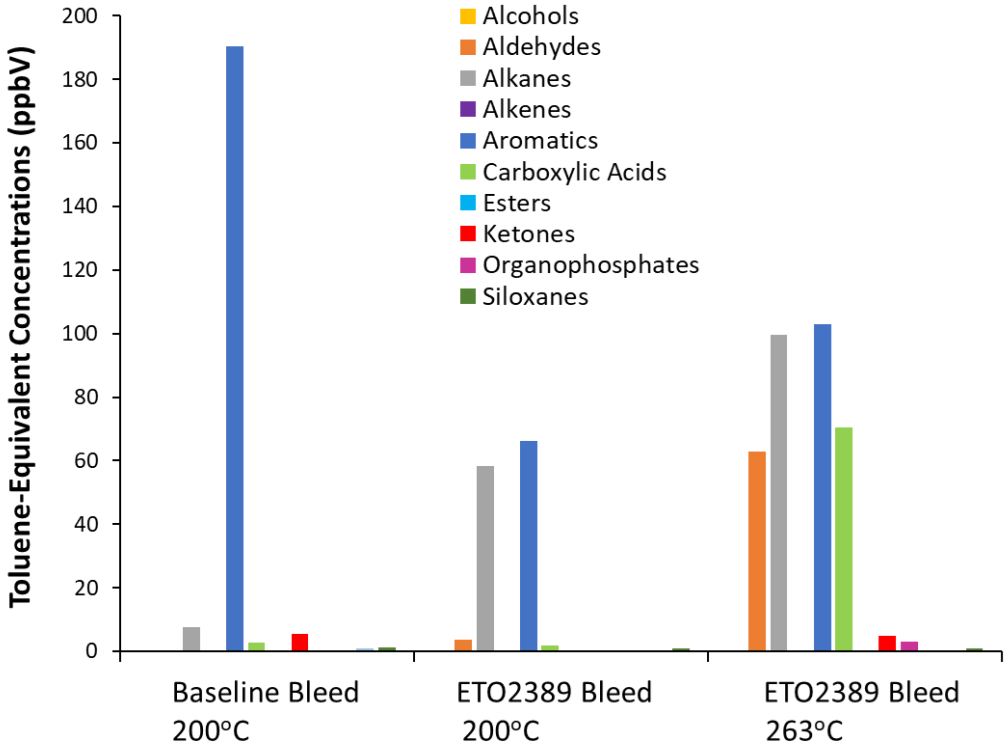
Controls samples



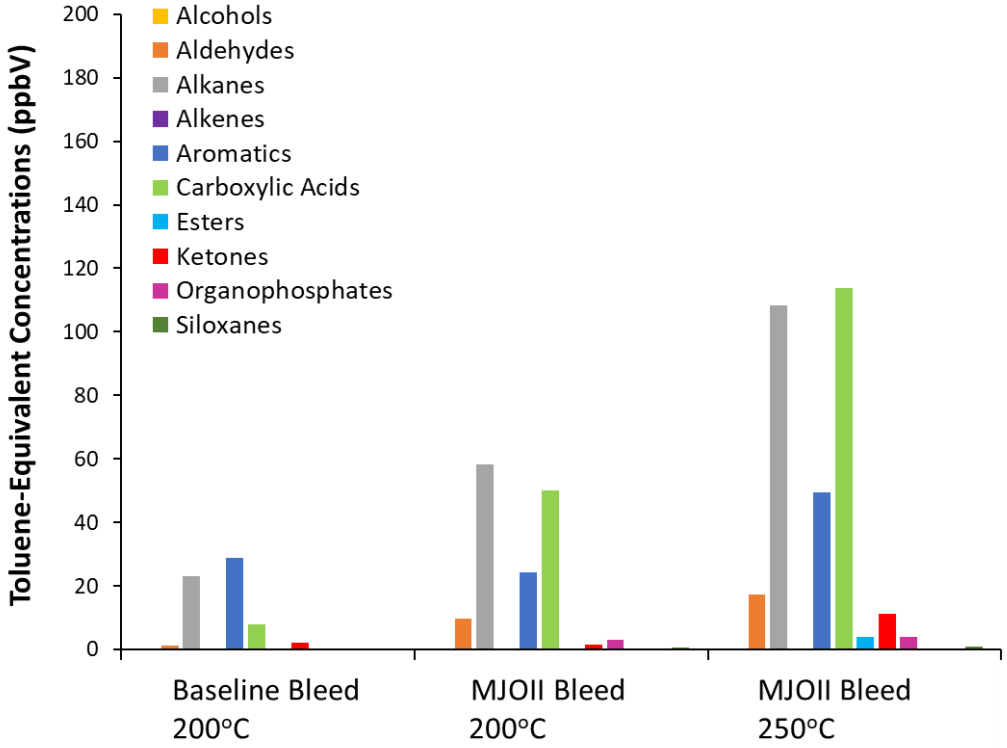
Appendix C

Major Classes of VOCs Identified in the Bleed line before corrections

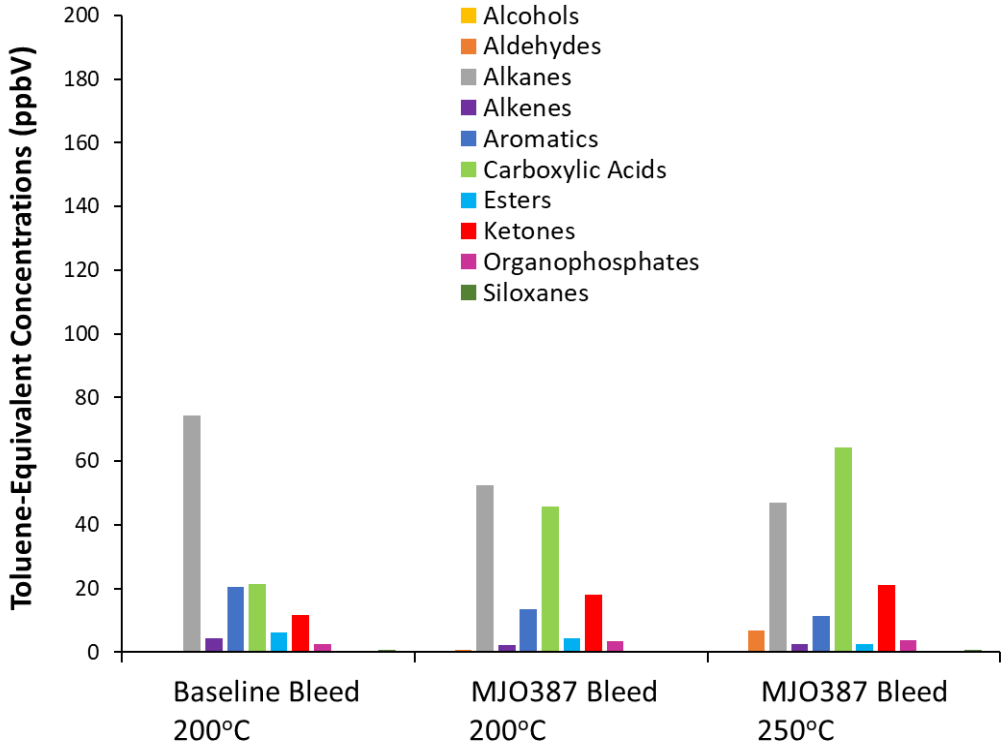
Day 1 – Afternoon: ETO2389 Injection Event



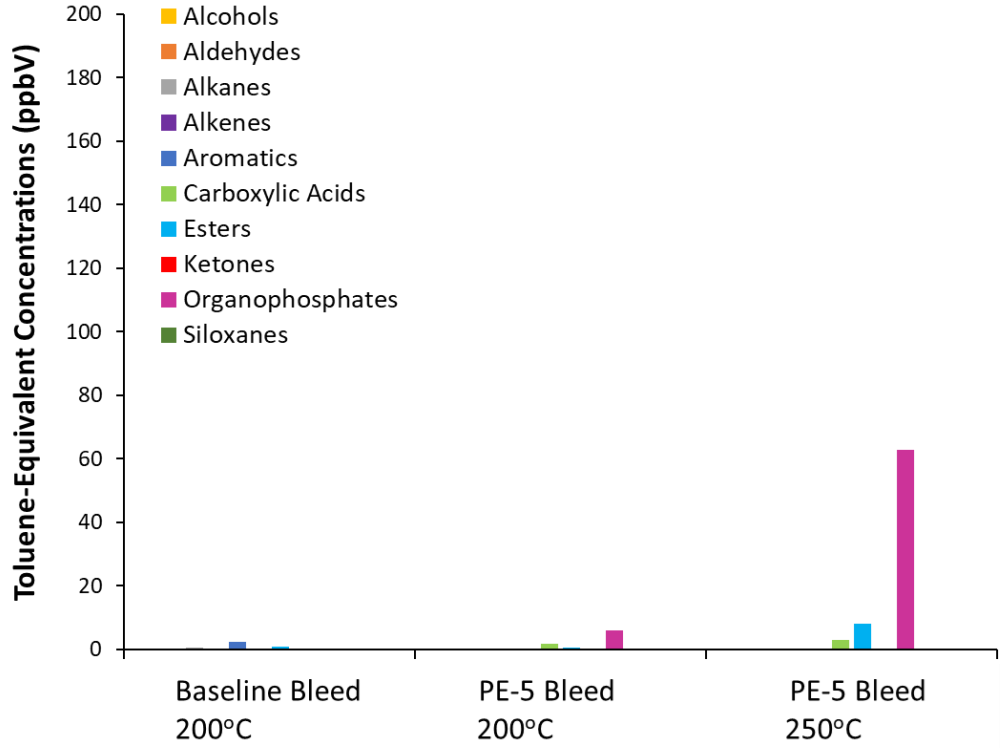
Day 2 – Morning: MJOII Injection Event



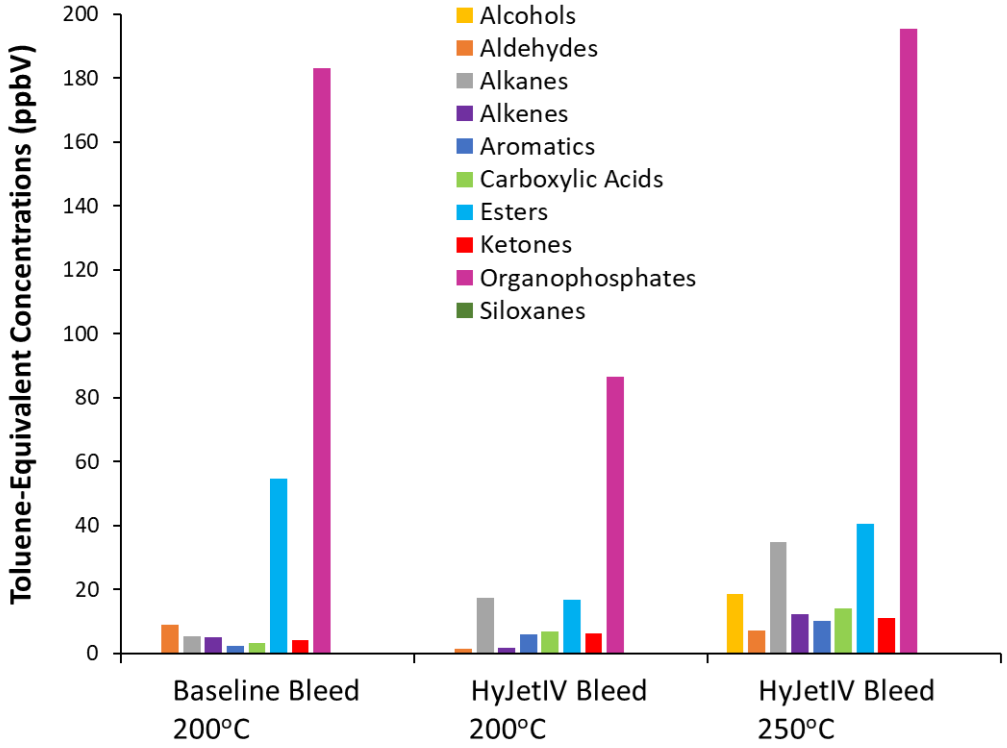
Day 2 – Afternoon: MJO387 Injection Event



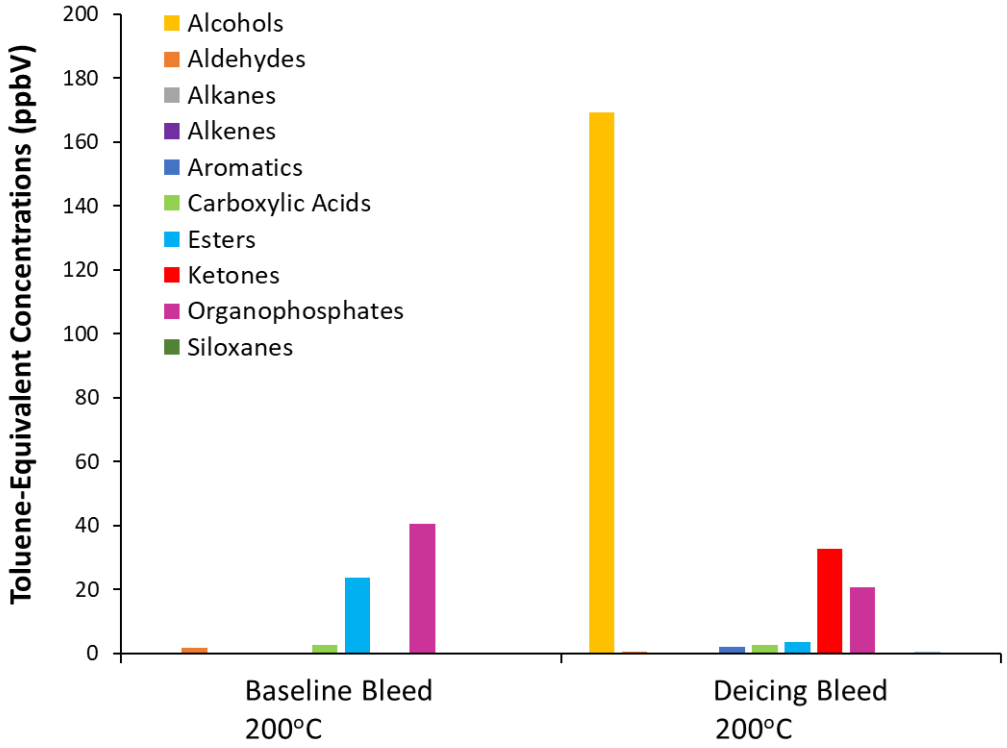
Day 3 – Morning: PE-5 Injection Event



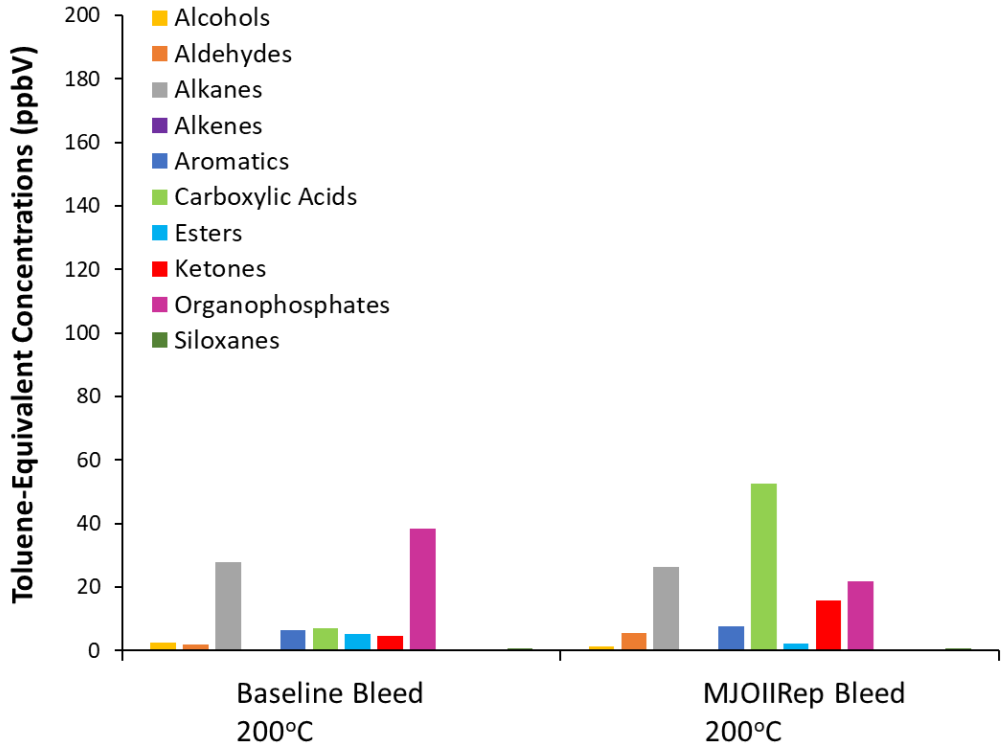
Day 3 – Afternoon: HyJetIV Injection Event



Day 4 – Morning: Deicing Injection Event



Day 4 – Afternoon: MJOIIRep Injection Event



Compound Name	Major Classes of VOCs											
	Alcohols	Aldehydes	Alkanes	Alkenes	Aromatics	Carboxylic acids	Esters	Ketones	Organophosphates	Siloxanes	Phthalates	Organosulfur
Isobutane			x									
2-butene				x								
Acetone								x				
Isopropyl alcohol	x											
Carbon disulfide												x
Butanal		x										
Acetic acid						x						
1-butanol	x											
2-ethylacrolein		x										
Benzene					x							
Pentanal		x										
Heptane			x									
Propylene glycol	x											
Toluene					x							
Hexanal		x										
1,3-oxathiolane												x
Hexamethylcyclotrisiloxane										x		
3-hydroxy-2-butanone								x				
2-methylbutanoic acid						x						
1-hexanol	x											
m,p,o-xylene					x							
Pentanoic acid						x						
Heptanal		x										
Nonane			x									
2,6-dimethyloctane			x									
Benzaldehyde		x										
1-ethyl-2-methyl-benzene					x							
n-butyl methacrylate							x					
Octanal		x										
1,2,3-trimethylbenzene					x							
Decane			x									
Acetophenone								x				
p-cresol					x							
Heptanoic acid						x						
Nonanal		x										
Undecane			x									
Benzoic acid						x						
Octanoic acid						x						
Decamethylcyclopentasiloxane										x		

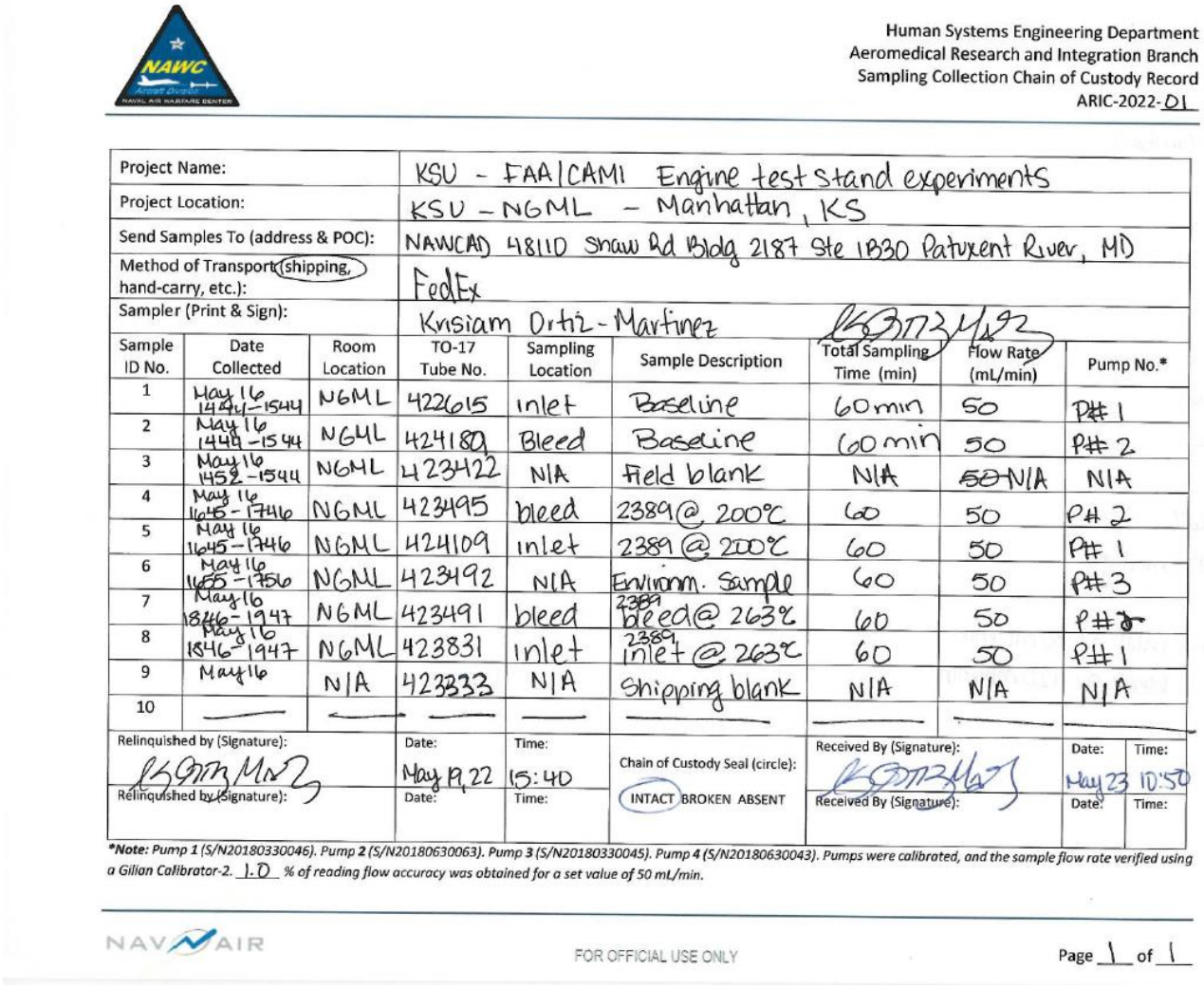
Compound Name	Major Classes of VOCs											
	Alcohols	Aldehydes	Alkanes	Alkenes	Aromatics	Carboxylic acids	Esters	Ketones	Organophosphates	Siloxanes	Phthalates	Organosulfur
p-cymene					x							
Diethylene glycol monobutyl ether	x											
4,7-dimethylundecane			x									
Naphthalene					x							
Dodecane			x									
2,6-dimethylundecane			x									
(1,3-dimethylbutyl)cyclohexane			x									
2,10-dimethylundecane			x									
3-methyldodecane			x									
2,6-dimethyloctane			x									
Tridecane			x									
2-methylnaphthalene					x							
3,5-dimethyldodecane			x									
n-decanoic acid						x						
Oxalic acid, 6-ethyloct-3-yl isohexyl ester							x					
2,6,10-trimethyldodecane			x									
Byphenyl					x							
Tetradecane			x									
2,6,10,14-tetramethylheptadecane			x									
Biphenylene					x							
Triisobutyl phosphate									x			
Pentadecane			x									
Acenaphthene					x							
Butylated hydroxytoluene					x							
Diethyl phthalate											x	
Hexadecane			x									
Nonadecane			x									
Diphenyl sulfide												x
Fluorene					x							
Tributyl phosphate									x			
n-butylbenzenesulfonamide												x
2-tridecenal		x										
Phenanthrene					x							
3-Cyclopentylpropionic acid, 2-ethylhexyl ester							x					
Diisobutyl phthalate												x
Dibutyl phenyl phosphate									x		x	
o-terphenyl					x							
n-hexadecanoic acid						x						
Allyl stearate							x					

Compound Name	Major Classes of VOCs											
	Alcohols	Aldehydes	Alkanes	Alkenes	Aromatics	Carboxylic acids	Esters	Ketones	Organophosphates	Siloxanes	Phthalates	Organosulfur
p-dicyclohexylbenzene					x							
(1,1'-Bicyclohexyl)-4-ylbenzene					x							
n-heptanoic acid, anhydride						x						
1-cyclohexyl-4-phenylbenzene					x							
Butyl diphenyl phosphate									x			
2,7-dimethyl-3,5-Octanedione								x				
2-Tetradecanol octanoate							x					

Appendix D

Chain of Custody Record

Day 1 - Afternoon: ETO2389 Injection Event



Human Systems Engineering Department
Aeromedical Research and Integration Branch
Sampling Collection Chain of Custody Record
ARIC-2022-01

Project Name:	KSU - FAA/CAMI Engine test stand experiments
Project Location:	KSU - NGML - Manhattan, KS
Send Samples To (address & POC):	NAWCAD 48110 Shaw Rd Bldg 2187 Ste 1B30 Patuxent River, MD
Method of Transport (shipping, hand-carry, etc.):	FedEx
Sampler (Print & Sign):	Krisiam Ortiz-Martinez

Sample ID No.	Date Collected	Room Location	TO-17 Tube No.	Sampling Location	Sample Description	Total Sampling Time (min)	Flow Rate (mL/min)	Pump No.*
1	May 16 1444-1544	NGML	422615	inlet	Baseline	60 min	50	P# 1
2	May 16 1449-1544	NGML	424189	Bleed	Baseline	60 min	50	P# 2
3	May 16 1458-1544	NGML	423422	N/A	field blank	N/A	~~50~~ N/A	N/A
4	May 16 1645-1746	NGML	423495	bleed	2389 @ 200°C	60	50	P# 2
5	May 16 1645-1746	NGML	424109	inlet	2389 @ 200°C	60	50	P# 1
6	May 16 1655-1756	NGML	423492	N/A	Environm. Sample	60	50	P# 3
7	May 16 1846-1947	NGML	423491	bleed	2389 bleed @ 263°C	60	50	P# ~~3~~
8	May 16 1846-1947	NGML	423831	inlet	2389 inlet @ 263°C	60	50	P# 1
9	May 16	N/A	423333	N/A	Shipping blank	N/A	N/A	N/A
10	—	—	—	—	—	—	—	—

Relinquished by (Signature):	Date: May 19, 22	Time: 15:40	Chain of Custody Seal (circle):	Received By (Signature):	Date: May 23	Time: 10:50
Relinquished by (Signature):	Date:	Time:	INTACT BROKEN ABSENT	Received By (Signature):	Date:	Time:

*Note: Pump 1 (S/N20180330046). Pump 2 (S/N20180630063). Pump 3 (S/N20180330045). Pump 4 (S/N20180630043). Pumps were calibrated, and the sample flow rate verified using a Gilian Calibrator-2. 1.0 % of reading flow accuracy was obtained for a set value of 50 mL/min.

NAVAIR FOR OFFICIAL USE ONLY Page 1 of 1

Day2 - Morning: MJOII Injection Event

Human Systems Engineering Department
Aeromedical Research and Integration Branch
Sampling Collection Chain of Custody Record
ARIC-2022-02

Project Name:	KSU - FAA/CAMI Engine test stand experiments
Project Location:	KSU - NGML - Manhattan, KS
Send Samples To (address & POC):	NAWCAD 48110 Shaw Rd Bldg 2187 Ste 1B30 Patuxent River, MD
Method of Transport (shipping, hand-carry, etc.):	FedEx
Sampler (Print & Sign):	Krsiam Ortz-Martinez

Sample ID No.	Date Collected	Room Location	TO-17 Tube No.	Sampling Location	Sample Description	Total Sampling Time (min)	Flow Rate (mL/min)	Pump No.*
1	May 17 0841-0942	NGML	422693	inlet	Baseline 200C	60	50	P# 1
2	May 17 0841-0942	NGML	422613	bleed	Baseline 200C	60	50	P# 2
3	May 17 0858-	NGML	423429	N/A	Field blank	N/A	N/A	N/A
4	May 17 1011-1112	NGML	423823	inlet	MJOII @ 200C	60	50	P# 1
5	May 17 1011-1112	NGML	423830	bleed	MJOII @ 200C	60	50	P#2
6	May 17 1152-1253	NGML	377668	inlet	MJOII @ 250°C	60	50	P#1
7	May 17 1152-1253	NGML	424046	bleed	MJOII @ 250°C	60	50	P#2
8	May 17 1320	N/A	415092	N/A	Shipping blank	N/A	N/A	N/A
9	—	—	—	—	—	—	—	—
10	—	—	—	—	—	—	—	—

Relinquished by (Signature):	Date: May 19, 22	Time: 15:40	Chain of Custody Seal (circle):	Received By (Signature):	Date: May 23	Time: 10:50
Relinquished by (Signature):	Date:	Time:	INTACT BROKEN ABSENT	Received By (Signature):	Date:	Time:

*Note: Pump 1 (S/N20180330046). Pump 2 (S/N20180630063). Pump 3 (S/N20180330045). Pump 4 (S/N20180630043). Pumps were calibrated, and the sample flow rate verified using a Gilian Calibrator-2. 1.0 % of reading flow accuracy was obtained for a set value of 50 mL/min.

NAVAIR FOR OFFICIAL USE ONLY Page 1 of 2

Day 2 - Afternoon: MJO387 Injection Event

Human Systems Engineering Department
Aeromedical Research and Integration Branch
Sampling Collection Chain of Custody Record
ARIC-2022-02

Project Name:	KSU- FAA/CAMI Engine test stand experiments.
Project Location:	KSU - NGML - Manhattan, KS
Send Samples To (address & POC):	NAWCAD 48110 Shaw Rd Bldg 2187 Ste 1B30 Patuxent River, MD
Method of Transport (shipping, hand-carry, etc.):	FedEx
Sampler (Print & Sign):	Krisiam Ortiz-Martinez

Sample ID No.	Date Collected	Room Location	TO-17 Tube No.	Sampling Location	Sample Description	Total Sampling Time (min)	Flow Rate (mL/min)	Pump No.*
1	May 17 1514-1415	NGML	422096	inlet	Baseline @ 200°C	60 min	50	P#1
2	May 17 1514-1415	NGML	424057	bleed	Baseline@200°C	60min	50	P#2
3	May 1519	NGML	423435	N/A	Field blank	N/A	N/A	N/A
4	May 17 1442-1742	NGML	423445	inlet	MJO 387@200°C	60	50	P#1
5	May 17 1442-1742	NGML	422632	bleed	MJO 387@ 200°C	60	50	P#2
6	May 17 1647-1747	NGML	423819	N/A	Field/Environ. Sample	60	50	P#3
7	May 17 1817-1919	NGML	423805	inlet	MJO 387@ 250°C	60	50	P#1
8	May 17 1818-1919	NGML	423812	bleed	MJO 387@ 250C	60	50	P#2
9	May 17	N/A	423494	N/A	Shipping blank	N/A	N/A	N/A
10	—	—	—	—	—	—	—	—

Relinquished by (Signature):	Date: May 19, 22	Time: 15:40	Chain of Custody Seal (circle):	Received By (Signature):	Date: May 23	Time: 10:50
Relinquished by (Signature):	Date:	Time:	INTACT BROKEN ABSENT	Received By (Signature):	Date:	Time:

*Note: Pump 1 (S/N20180330046). Pump 2 (S/N20180630063). Pump 3 (S/N20180330045). Pump 4 (S/N20180630043). Pumps were calibrated, and the sample flow rate verified using a Gilian Calibrator-2. 1.0 % of reading flow accuracy was obtained for a set value of 50 mL/min.

NAVAIR FOR OFFICIAL USE ONLY Page 2 of 2

Day 3 - Morning: PE-5 Injection Event

Human Systems Engineering Department
Aeromedical Research and Integration Branch
Sampling Collection Chain of Custody Record
ARIC-2022- 03

Project Name:	KSU- FAA|CAMI Engine test stand experiments
Project Location:	KSU – NGML - Manhattan, KS
Send Samples To (address & POC):	NAWCAD 48110 Shaw Rd Bldg 2187 Ste 1B30 Patuxent River, MD
Method of Transport (shipping, hand-carry, etc.):	FedEx
Sampler (Print & Sign):	Krisiam Ortiz-Martinez

Sample ID No.	Date Collected	Room Location	TO-17 Tube No.	Sampling Location	Sample Description	Total Sampling Time (min)	Flow Rate (mL/min)	Pump No.*
1	May 18 0814-0914	NGML	423497	inlet	baseline @ 200C	60	50.0	P#1
2	May 18 0814-0914	NGML	423414	bleed	baseline @ 200C	60	50.0	P#2
3	May 18 0950-1050	NGML	424048	inlet	Skydrol PE-5 @200C	60	50.0	P#1
4	May 18 0950-1050	NGML	424071	bleed	Skydrol PE-5 @200C	60	50.0	P#2
5	May 18 10:43 ~~1138~~	NGML	423360	N/A	Field/Environ. blank	N/A	N/A	N/A
6	May 18 1138-1238	NGML	413489	inlet	Skydrol PE-5 @250C	60	50	P#1
7	May 18 1138-1238	NGML	422616	bleed	Skydrol PE-5 @250C	60	50	P#2
8	May 18 1242	NGML	408350	N/A	Shipping blank	N/A	N/A	N/A
9	—	—	—	—	—	—	—	—
10	—	—	—	—	—	—	—	—

Relinquished by (Signature):	Date: May 19, 22	Time: 15:40	Chain of Custody Seal (circle):	Received By (Signature):	Date: May 23	Time: 10:50
Relinquished by (Signature):	Date:	Time:	INTACT BROKEN ABSENT	Received By (Signature):	Date:	Time:

***Note:** Pump 1 (S/N20180330046). Pump 2 (S/N20180630063). Pump 3 (S/N20180330045). Pump 4 (S/N20180630043). Pumps were calibrated, and the sample flow rate verified using a Gilian Calibrator-2. 1.6 % of reading flow accuracy was obtained for a set value of 50 mL/min.*

NAVAIR FOR OFFICIAL USE ONLY Page 1 of 2

Day 3 - Afternoon: HyJetIV Injection Event

Human Systems Engineering Department
Aeromedical Research and Integration Branch
Sampling Collection Chain of Custody Record
ARIC-2022-03

Project Name:	KSU-FAA/CAMI Engine test stand experiments
Project Location:	KSU - NGML - Manhattan, KS
Send Samples To (address & POC):	NAWCAD 48110 Shaw Rd Bldg 2187 ste 1B30 Patuxent River, MD
Method of Transport (shipping, hand-carry, etc.):	FedEx
Sampler (Print & Sign):	Kristian Ortiz-Martinez

Sample ID No.	Date Collected	Room Location	TO-17 Tube No.	Sampling Location	Sample Description	Total Sampling Time (min)	Flow Rate (mL/min)	Pump No.*
1	May 18 1423-1523	NGML	422677	Inlet	Baseline @ 200°C	60	50	P#1
2	May 18 1423-1523	NGML	422682	bleed	Baseline @ 200C	60	50	P#2
3	May 18 1533	NGML	422759	N/A	Field/Environ. blank	N/A	N/A	N/A
4	May 18 1619-1519	NGML	422718	Inlet	Hy Jet IV @ 200C	60	50	P#1
5	May 18 1619-1519	NGML	423459	bleed	HyJet IV @ 200°C	60	50	P#2
6	May 18 1722-1824	NGML	423384	N/A	Field/Environ Sample	60	50	P#3
7	May 18 1753-1854	NGML	423358	Inlet	HyJet IV @ 250°C	60	50	P#1
8	May 18 1753-1854	NGML	413441	bleed	HyJet IV @ 250°C	60	50	P#2
9	May 18 1858	N/A	408002	N/A	Shipping blank	N/A	N/A	N/A
10	—	—	—	—	—	—	—	—

Relinquished by (Signature):	Date: May 19, 22	Time: 15:40	Chain of Custody Seal (circle):	Received By (Signature):	Date: May 20	Time: 10:50
Relinquished by (Signature):	Date:	Time:	INTACT BROKEN ABSENT	Received By (Signature):	Date:	Time:

*Note: Pump 1 (S/N20180330046). Pump 2 (S/N20180630063). Pump 3 (S/N20180330045). Pump 4 (S/N20180630043). Pumps were calibrated, and the sample flow rate verified using a Gilian Calibrator-2. 1.8 % of reading flow accuracy was obtained for a set value of 50 mL/min.

NAVAIR FOR OFFICIAL USE ONLY Page 2 of 2

Day 4 - Morning: Deicing Injection Event

Human Systems Engineering Department
Aeromedical Research and Integration Branch
Sampling Collection Chain of Custody Record
ARIC-2022-_4

Project Name:	KSU-FAA/CAMI Engine test stand experiments
Project Location:	KSU-NGML – Manhattan, KS
Send Samples To (address & POC):	NAWCAD 48110 Shaw Rd Bldg 2187 ste 1B30 Patuxent River, MD
Method of Transport (shipping, hand-carry, etc.):	FedEx
Sampler (Print & Sign):	Kristian Ortiz-Martinez

Sample ID No.	Date Collected	Room Location	TO-17 Tube No.	Sampling Location	Sample Description	Total Sampling Time (min)	Flow Rate (mL/min)	Pump No.*
1	May19 0753-0853	NGML	422620	inlet	Baseline @200°	60	50	P#1
2	May19 0753-0853	NGML	423813	bleed	Baseline@200°	60	50	P#2
3	May19 0901	NGML	424058	N/A	Field/Environ blank	N/A	N/A	N/A
4	May19 0928-1028	NGML	423338	inlet	Deice Type I @200°	60	50	P#1
5	May19 0928-1028	NGML	424196	bleed	Deice Type I @200°	60	50	P#2
6	May19 @ 1035	NGML	423332	N/A	Shipping blank	N/A	N/A	
7								
8								
9								
10								

Relinquished by (Signature):	Date: May19,22	Time: 15:40	Chain of Custody Seal (circle): INTACT BROKEN ABSENT	Received By (Signature):	Date: May23 Time: 10:50
Relinquished by (Signature):	Date:	Time:		Received By (Signature):	Date: Time:

*Note: Pump 1 (S/N20180330046). Pump 2 (S/N20180630063). Pump 3 (S/N20180330045). Pump 4 (S/N20180630043). Pumps were calibrated, and the sample flow rate verified using a Gilian Calibrator-2. 1.0 % of reading flow accuracy was obtained for a set value of 50 mL/min.

NAVAIR FOR OFFICIAL USE ONLY Page 1 of 2

Day 4 - Afternoon: MJOIIRep Injection Event

Human Systems Engineering Department
Aeromedical Research and Integration Branch
Sampling Collection Chain of Custody Record
ARIC-2022-04

Project Name:	KSU-FAA/CAMI Engine test stand experiments
Project Location:	KSU - NGML - Manhattan, KS
Send Samples To (address & POC):	NAWCAD 48110 Shaw Rd Bldg 2187 ste1B30 Patuxent River, MD
Method of Transport (shipping, hand-carry, etc.):	FedEx
Sampler (Print & Sign):	Krisiam Ortiz-Martinez

Sample ID No.	Date Collected	Room Location	TO-17 Tube No.	Sampling Location	Sample Description	Total Sampling Time (min)	Flow Rate (mL/min)	Pump No.*
1	May 19 12:13-13:13	NGML	423498	inlet	Baseline @ 200°C	60	50	P#1
2	May 19 12:13-13:13	NGML	423453	bleed	Baseline @ 200°C	60	50	P#2
3	May 19 12:14	N6ML	~~N/A~~ 422645	N/A	Field/Environ blank	N/A	~~50~~ N/A	N/A
4	May 19 13:52-14:53	N6ML	423460	inlet	MJOII @ 200°C	60	50	P#1
5	May 19 13:52-14:53	NGML	423457	bleed	MJOII @ 200°C	60	50	P#2
6	May 19 13:53-14:55	N6ML	423455	N/A	Field/Environ Sample	60	50	P#3
7	May 19 14:57	N/A	423017	N/A	Shipping blank	N/A	N/A	N/A
8								
9								
10								

Relinquished by (Signature):	Date: May 19, 22	Time: 15:40	Chain of Custody Seal (circle): INTACT BROKEN ABSENT	Received By (Signature):	Date: May 23 Time: 10:50
Relinquished by (Signature):	Date:	Time:		Received By (Signature):	Date: Time:

*Note: Pump 1 (S/N20180330046). Pump 2 (S/N20180630063). Pump 3 (S/N20180330045). Pump 4 (S/N20180630043). Pumps were calibrated, and the sample flow rate verified using a Gilian Calibrator-2. 1.1 % of reading flow accuracy was obtained for a set value of 50 mL/min.

NAVAIR FOR OFFICIAL USE ONLY Page 2 of 2

Appendix E

Fluid Safety Data Sheets (SDS)

SDS Eatman ETO2389

Eastman(TM) Turbo Oil 2389

Version	Revision Date:	SDS Number:	Date of last issue: 12/11/2019
1.3	07/02/2021	150000097796	Date of first issue: 09/06/2016
PRD		SDSUS / Z8 / 0001	

SECTION 1. IDENTIFICATION

Product name : Eastman(TM) Turbo Oil 2389

Product code : 34360-00, E3436001, P3436000, P3436001, P3436002

Manufacturer or supplier's details

Company name of supplier : Eastman Chemical Company

Address : 200 South Wilcox Drive
Kingsport TN 37660-5280

Telephone : (423) 229-2000

Emergency telephone : CHEMTREC: +1-800-424-9300, +1-703-527-3887 CCN7321
For emergency transportation information, in the United States: call CHEMTREC at 800-424-9300 or call 423-229-2000.

Recommended use of the chemical and restrictions on use

Recommended use : Lubricant

Restrictions on use : None known.

SECTION 2. HAZARDS IDENTIFICATION

GHS classification in accordance with the OSHA Hazard Communication Standard (29 CFR 1910.1200)

Not a hazardous substance or mixture.

GHS label elements

Not a hazardous substance or mixture.

Other hazards

None known.

SECTION 3. COMPOSITION/INFORMATION ON INGREDIENTS

Components

Chemical name	CAS-No.	Concentration (% w/w)
Tricresyl phosphate	1330-78-5	>= 1 - < 5
N-phenyl-1-naphthylenamine	90-30-2	>= 0.1 - < 1

Actual concentration is withheld as a trade secret

SECTION 4. FIRST AID MEASURES

If inhaled : Move to fresh air.

If breathing is difficult, give oxygen.
Consult a physician if necessary.

In case of skin contact : Wash off immediately with soap and plenty of water while removing all contaminated clothes and shoes.
Wash contaminated clothing before reuse.
If symptoms persist, call a physician.

In case of eye contact : In case of contact, immediately flush eyes with plenty of water for at least 15 minutes.
Get medical attention if symptoms occur.

If swallowed : Rinse mouth.
Call a physician or poison control center immediately.
Do NOT induce vomiting.
Never give anything by mouth to an unconscious person.

Most important symptoms and effects, both acute and delayed : Prolonged skin contact may defat the skin and produce dermatitis.
Contact with hot product will cause thermal burns.
Inhalation of thermal decomposition products may lead to adverse effects including pulmonary edema.

Notes to physician : Treat symptomatically.

SECTION 5. FIRE-FIGHTING MEASURES

Suitable extinguishing media : Water spray
Foam
Dry powder
Carbon dioxide (CO2)

Unsuitable extinguishing media : Do not use a solid water stream as it may scatter and spread fire.

Hazardous combustion products : Carbon monoxide
Carbon dioxide (CO2)
Oxides of phosphorus

Further information : In case of fire and/or explosion do not breathe fumes.
Use water spray to cool unopened containers.
Prevent fire extinguishing water from contaminating surface water or the ground water system.

Special protective equipment for fire-fighters : Wear an approved positive pressure self-contained breathing apparatus in addition to standard fire fighting gear.

SECTION 6. ACCIDENTAL RELEASE MEASURES

Personal precautions, protective equipment and emergency procedures : Ventilate the area.
Material can create slippery conditions.
Use personal protective equipment.
Local authorities should be advised if significant spillages

cannot be contained.

Environmental precautions : Avoid release to the environment.

Methods and materials for containment and cleaning up : Contain spillage, soak up with non-combustible absorbent material, (e.g. sand, earth, diatomaceous earth, vermiculite) and transfer to a container for disposal according to local / national regulations (see section 13).

SECTION 7. HANDLING AND STORAGE

Advice on safe handling : Handle in accordance with good industrial hygiene and safety practice.
Do not get in eyes.
Do not get on skin or clothing.
Wash thoroughly after handling.
Do not breathe vapors or spray mist.
Use only in area provided with appropriate exhaust ventilation.
Drain or remove substance from equipment prior to break-in or maintenance.
Wear appropriate personal protective equipment.

Conditions for safe storage : Keep containers tightly closed in a cool, well-ventilated place.

SECTION 8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Ingredients with workplace control parameters

Contains no substances with occupational exposure limit values.

Engineering measures : Good general ventilation (typically 10 air changes per hour) should be used. Ventilation rates should be matched to conditions. If applicable, use process enclosures, local exhaust ventilation, or other engineering controls to maintain airborne levels below recommended exposure limits. If exposure limits have not been established, maintain airborne levels to an acceptable level.

Personal protective equipment

Respiratory protection : Use respiratory protection unless adequate local exhaust ventilation is provided or exposure assessment demonstrates that exposures are within recommended exposure guidelines.

Hand protection

Material : Recommended gloves:

Material : Nitrile rubber

Remarks : Wear suitable gloves. Contact the glove manufacturer for specific advice on glove selection and breakthrough times for your use conditions.

Eye protection	:	Wear safety glasses with side shields (or goggles).
Protective measures	:	Ensure that eye flushing systems and safety showers are located close to the working place.

SECTION 9. PHYSICAL AND CHEMICAL PROPERTIES

Appearance	:	liquid
Color	:	amber
Odor	:	No data available
Odor Threshold	:	not determined
pH	:	not determined
Melting point/freezing point	:	-65 °F / -54 °C
Boiling point/boiling range	:	not determined
Flash point	:	410 °F / 210 °C Method: Cleveland open cup
Evaporation rate	:	not determined
Flammability (solid, gas)	:	Not applicable
Upper explosion limit / Upper flammability limit	:	not determined
Lower explosion limit / Lower flammability limit	:	not determined
Vapor pressure	:	not determined
Relative vapor density	:	not determined
Relative density	:	0.95 (60.1 °F / 15.6 °C)
Density	:	950 kg/m3 (60.1 °F / 15.6 °C)
Solubility(ies) Water solubility	:	insoluble
Partition coefficient: n-octanol/water	:	Not applicable
Autoignition temperature	:	not determined

Decomposition temperature	:	not determined
Viscosity		
Viscosity, dynamic	:	not determined
Viscosity, kinematic	:	11.5 mm2/s (104 °F / 40 °C)
		3 mm2/s (212 °F / 100 °C)
Explosive properties	:	Not classified
Oxidizing properties	:	Not classified

SECTION 10. STABILITY AND REACTIVITY

Reactivity	:	None reasonably foreseeable.
Chemical stability	:	Stable under normal conditions.
Conditions to avoid	:	Keep away from sources of ignition - No smoking.
Incompatible materials	:	Strong oxidizing agents
Hazardous decomposition products	:	Emits acrid smoke and fumes when heated to decomposition.

SECTION 11. TOXICOLOGICAL INFORMATION

Acute toxicity

Not classified based on available information.

Product:

Acute oral toxicity	:	LD50 (Rat): > 10,000 mg/kg Assessment: Not classified
Acute inhalation toxicity	:	Acute toxicity estimate: Exposure time: 4 h Assessment: The substance or mixture has no acute inhalation toxicity Remarks: Read-across from a similar material
Acute dermal toxicity	:	LD50 Dermal (Rabbit): > 3,160 mg/kg Assessment: The substance or mixture has no acute dermal toxicity

Components:

Tricresyl phosphate:

Acute oral toxicity	:	LD50 Oral (Rat): > 5,000 mg/kg
Acute inhalation toxicity	:	LC50 (Rat): > 5.2 mg/l Exposure time: 4 h

Acute dermal toxicity : LD50 Dermal (Rabbit): > 10,000 mg/kg

N-phenyl-1-naphthylenamine:

Acute oral toxicity : LD50 Oral (Rat): 1,250 mg/kg

Acute dermal toxicity : LD50 Dermal (Rabbit): > 2,000 mg/kg

Skin corrosion/irritation

Not classified based on available information.

Product:

Species : Rabbit
Exposure time : 24 h
Assessment : Not classified
Result : slight
Remarks : Based on available data, the classification criteria are not met.

Components:

Tricresyl phosphate:

Species : Rabbit
Exposure time : 24 h
Assessment : Not classified as hazardous.
Result : Non-irritating to the skin.

N-phenyl-1-naphthylenamine:

Species : Rabbit
Assessment : Not classified
Result : none

Serious eye damage/eye irritation

Not classified based on available information.

Product:

Species : Rabbit
Result : slight
Assessment : No eye irritation

Components:

Tricresyl phosphate:

Species : Rabbit
Assessment : Not classified

N-phenyl-1-naphthylenamine:

Species : Rabbit
Result : slight
Assessment : Not classified

Respiratory or skin sensitization

Skin sensitization

Not classified based on available information.

Respiratory sensitization

Not classified based on available information.

Product:

Test Type	:	Skin sensitization
Species	:	Humans
Assessment	:	Not classified
Method	:	Human Repeat Insult Patch Test
Result	:	Does not cause skin sensitization.
Remarks	:	Read-across from a similar material

Components:

Tricresyl phosphate:

Test Type	:	Skin Sensitization
Assessment	:	Not classified

N-phenyl-1-naphthylenamine:

Assessment	:	Skin sensitization
Result	:	sensitizing

Germ cell mutagenicity

Not classified based on available information.

Product:

Genotoxicity in vitro	:	Test Type: Mutagenicity Metabolic activation: Read-across from a similar material Result: Based on available data, the classification criteria are not met.
Genotoxicity in vivo	:	Test Type: Mutagenicity Result: Based on available data, the classification criteria are not met. Remarks: Read-across from a similar material

Components:

Tricresyl phosphate:

Genotoxicity in vitro	:	Test Type: various Result: Based on available data, the classification criteria are not met. Remarks: Not classified
Genotoxicity in vivo	:	Test Type: various Result: Based on available data, the classification criteria are not met.

Carcinogenicity

Not classified based on available information.

IARC No ingredient of this product present at levels greater than or equal to 0.1% is identified as probable, possible or confirmed human carcinogen by IARC.

OSHA No component of this product present at levels greater than or equal to 0.1% is on OSHA's list of regulated carcinogens.

NTP No ingredient of this product present at levels greater than or equal to 0.1% is identified as a known or anticipated carcinogen by NTP.

Reproductive toxicity

Not classified based on available information.

Product:

Reproductive toxicity - Assessment	:	No toxicity to reproduction

Components:

Tricresyl phosphate:

Reproductive toxicity - Assessment	:	May damage the unborn child. Suspected of damaging fertility.

STOT-single exposure

Not classified based on available information.

Product:

Routes of exposure	:	inhalation (dust/mist/fume)
Assessment	:	The substance or mixture is not classified as specific target organ toxicant, single exposure.

Components:

Tricresyl phosphate:

Assessment	:	Based on available data, the classification criteria are not met.

STOT-repeated exposure

Not classified based on available information.

Product:

Assessment	:	The substance or mixture is not classified as specific target organ toxicant, repeated exposure.

Components:

Tricresyl phosphate:

Assessment	:	Based on available data, the classification criteria are not met.

N-phenyl-1-naphthylenamine:

Assessment : Not classified

Repeated dose toxicity

Product:

Remarks : No known significant effects or critical hazards.

Components:

Tricresyl phosphate:

Species : Rat
: 300 mg/l

Aspiration toxicity

Not classified based on available information.

Product:

No aspiration toxicity classification

Components:

Tricresyl phosphate:

Not classified

Routes of exposure

Product:

Inhalation : Remarks: None known.

Skin contact : Remarks: Prolonged skin contact may defat the skin and produce dermatitis.

Eye contact : Remarks: Contact with the eyes may be very painful but does not cause damage.

Ingestion : Remarks: None known.

SECTION 12. ECOLOGICAL INFORMATION

Ecotoxicity

Product:

Toxicity to fish : LC50 (Fish):
Exposure time: 96 h
Remarks: Not classified as hazardous.
(limit of solubility in fresh water)
Read-across from a similar material

Toxicity to daphnia and other : EC50 (Daphnia magna (Water flea)):

aquatic invertebrates		Exposure time: 48 h Remarks: Not classified as hazardous. (limit of solubility in fresh water) Read-across from a similar material
Toxicity to algae/aquatic plants	:	NOEC (Pseudokirchneriella subcapitata (algae)): Exposure time: 72 h Remarks: Not classified as hazardous. (limit of solubility in fresh water) Read-across from a similar material
Toxicity to fish (Chronic toxicity)	:	NOEC (Fish): Remarks: Not classified as hazardous. (limit of solubility in fresh water) Read-across from a similar material
Toxicity to daphnia and other aquatic invertebrates (Chronic toxicity)	:	NOEC: Remarks: Not classified as hazardous. (limit of solubility in fresh water) Read-across from a similar material

Components:

Tricresyl phosphate:

Toxicity to fish	:	LC50 (Oncorhynchus mykiss (rainbow trout)): 0.6 mg/l Exposure time: 96 h
Toxicity to daphnia and other aquatic invertebrates	:	EC50 (Daphnia magna (Water flea)): 0.146 mg/l Exposure time: 48 h
M-Factor (Acute aquatic toxicity)	:	1

N-phenyl-1-naphthylenamine:

Toxicity to fish	:	LC50 (Oncorhynchus mykiss (rainbow trout)): 0.44 mg/l Exposure time: 96 h
Toxicity to daphnia and other aquatic invertebrates	:	EC50 (Daphnia magna (Water flea)): 0.30 - 0.68 mg/l Exposure time: 48 h
Toxicity to microorganisms	:	EC50 (Bacteria): Exposure time: 3 h

Persistence and degradability

Product:

Biochemical Oxygen Demand (BOD)	:	Remarks: No data available
Chemical Oxygen Demand (COD)	:	Remarks: No data available

Bioaccumulative potential

Product:

Bioaccumulation : Remarks: Not applicable
Mixture

Components:

Tricresyl phosphate:

Bioaccumulation : Bioconcentration factor (BCF): 2,000

Partition coefficient: n-octanol/water : Pow: 860,000
log Pow: 5.93

Mobility in soil

Components:

Tricresyl phosphate:

Distribution among environmental compartments : log Koc: 4.31

Other adverse effects

No data available

SECTION 13. DISPOSAL CONSIDERATIONS

Disposal methods

Waste from residues : Dispose of in accordance with local regulations.

SECTION 14. TRANSPORT INFORMATION

International Regulations

IATA-DGR
Not regulated as a dangerous good

IMDG-Code
Not regulated as a dangerous good

Transport in bulk according to Annex II of MARPOL 73/78 and the IBC Code
Not applicable for product as supplied.

Domestic regulation

49 CFR
Not regulated as a dangerous good

SECTION 15. REGULATORY INFORMATION

CERCLA Reportable Quantity

This material does not contain any components with a CERCLA RQ.

SARA 304 Extremely Hazardous Substances Reportable Quantity

This material does not contain any components with a section 304 EHS RQ.

SARA 302 Extremely Hazardous Substances Threshold Planning Quantity

This material does not contain any components with a section 302 EHS TPQ.

SARA 311/312 Hazards : No SARA Hazards

SARA 313 : This material does not contain any chemical components with known CAS numbers that exceed the threshold (De Minimis) reporting levels established by SARA Title III, Section 313.

California Prop. 65

This product does not contain any chemicals known to the State of California to cause cancer, birth, or any other reproductive defects.

The ingredients of this product are reported in the following inventories:

TCSI	:	On the inventory, or in compliance with the inventory
TSCA	:	All substances listed as active on the TSCA inventory
AIIC	:	On the inventory, or in compliance with the inventory
DSL	:	All components of this product are on the Canadian DSL
KECI	:	On the inventory, or in compliance with the inventory
IECSC	:	On the inventory, or in compliance with the inventory
NZIoC	:	On the inventory, or in compliance with the inventory

TSCA list

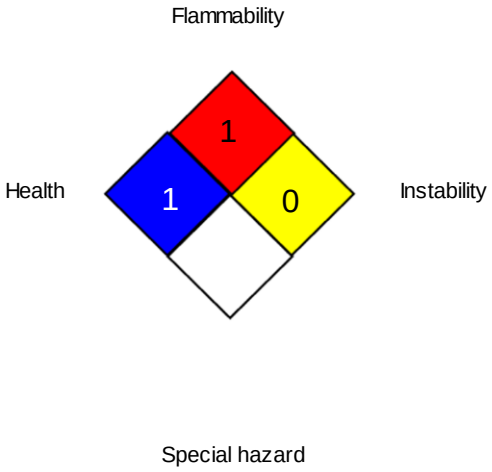
No substances are subject to a Significant New Use Rule.

No substances are subject to TSCA 12(b) export notification requirements.

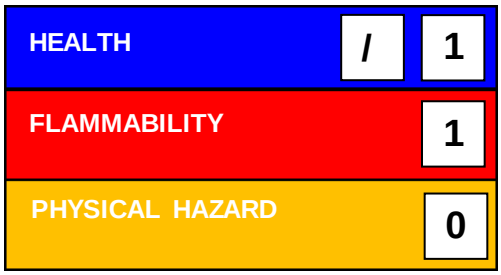
SECTION 16. OTHER INFORMATION

Further information

NFPA 704:



HMIS® IV:



HMIS® ratings are based on a 0-4 rating scale, with 0 representing minimal hazards or risks, and 4 representing significant hazards or risks. The "*" represents a chronic hazard, while the "/" represents the absence of a chronic hazard.

Full text of other abbreviations

AIIC - Australian Inventory of Industrial Chemicals; ASTM - American Society for the Testing of Materials; bw - Body weight; CERCLA - Comprehensive Environmental Response, Compensation, and Liability Act; CMR - Carcinogen, Mutagen or Reproductive Toxicant; DIN - Standard of the German Institute for Standardisation; DOT - Department of Transportation; DSL - Domestic Substances List (Canada); ECx - Concentration associated with x% response; EHS - Extremely Hazardous Substance; ELx - Loading rate associated with x% response; EmS - Emergency Schedule; ENCS - Existing and New Chemical Substances (Japan); ErCx - Concentration associated with x% growth rate response; ERG - Emergency Response Guide; GHS - Globally Harmonized System; GLP - Good Laboratory Practice; HMIS - Hazardous Materials Identification System; IARC - International Agency for Research on Cancer; IATA - International Air Transport Association; IBC - International Code for the Construction and Equipment of Ships carrying Dangerous Chemicals in Bulk; IC50 - Half maximal inhibitory concentration; ICAO - International Civil Aviation Organization; IECSC - Inventory of Existing Chemical Substances in China; IMDG - International Maritime Dangerous Goods; IMO - International Maritime Organization; ISHL - Industrial Safety and Health Law (Japan); ISO - International Organisation for Standardization; KECI - Korea Existing Chemicals Inventory; LC50 - Lethal Concentration to 50 % of a test population; LD50 - Lethal Dose to 50% of a test population (Median Lethal Dose); MARPOL - International Convention for the Prevention of Pollution from Ships; MSHA - Mine Safety and Health Administration; n.o.s. - Not Otherwise Specified; NFPA - National Fire Protection Association; NO(A)EC - No Observed (Adverse) Effect Concentration; NO(A)EL - No Observed (Adverse) Effect Level; NOELR - No Observable Effect Loading Rate; NTP - National Toxicology Program; NZIoC - New Zealand Inventory of Chemicals; OECD - Organization for Economic Co-operation and Development; OPPTS - Office of Chemical Safety and Pollution Prevention; PBT - Persistent, Bioaccumulative and Toxic substance; PICCS - Philippines Inventory of Chemicals and Chemical Substances; (Q)SAR - (Quantitative) Structure Activity Relationship; RCRA - Resource Conservation and Recovery Act; REACH - Regulation (EC) No 1907/2006 of the European Parliament and of the Council concerning the Registration, Evaluation, Authorisation and Restriction of Chemicals; RQ - Reportable Quantity; SADT - Self-Accelerating Decomposition Temperature; SARA - Superfund Amendments and Reauthorization Act; SDS - Safety Data Sheet; TCSI - Taiwan Chemical Substance Inventory; TSCA - Toxic Substances Control Act (United States); UN - United Nations; UNRTDG -

United Nations Recommendations on the Transport of Dangerous Goods; vPvB - Very Persistent and Very Bioaccumulative

Sources of key data used to compile the Material Safety Data Sheet	:	www.EastmanAviationSolutions.com
Revision Date	:	07/02/2021

The information provided in this Safety Data Sheet is correct to the best of our knowledge, information and belief at the date of its publication. The information given is designed only as a guidance for safe handling, use, processing, storage, transportation, disposal and release and is not to be considered a warranty or quality specification. The information relates only to the specific material designated and may not be valid for such material used in combination with any other materials or in any process, unless specified in the text.

US / Z8

SDS Exxon Mobile MJOII

SAFETY DATA SHEET

SECTION 1 PRODUCT AND COMPANY IDENTIFICATION

PRODUCT

Product Name: **MOBIL JET OIL II**
Product Description: Synthetic Esters and Additives
Product Code: 201550101020, 430207-85
Intended Use: Aviation lubricating oil, Turbine oil

COMPANY IDENTIFICATION

Supplier: **Aviall Australia Pty. Limited**
20-22 Lindaway Place
Tullamarine
Victoria 3043 Australia

Product Technical Information	(8:00am to 4:30pm Mon to Fri)	1300 919 904
Supplier General Contact	(03) 9339 3000	

Supplier: **AMPOL AUSTRALIA PTY LTD**
ABN 17 000 032 128
2 Market Street
Sydney
New South Wales 2000 Australia

24 Hour Emergency Telephone	1800 033 111
Product Technical Information	
Supplier General Contact	1300364169 +612 9250-5000

SECTION 2 HAZARDS IDENTIFICATION

This material is not hazardous according to regulatory guidelines (see (M)SDS Section 15).

Contains: N-PHENYL-1-NAPHTHYLAMINE May produce an allergic reaction.

Other hazard information:

Physical / Chemical Hazards:
No significant hazards.

Health Hazards:
High-pressure injection under skin may cause serious damage. This product is not expected to produce adverse health effects under normal conditions of use and with appropriate personal hygiene practices.

Product may decompose at elevated temperatures or under fire conditions and give off irritating and/or harmful (carbon monoxide) gases/vapours/fumes. Symptoms from acute exposure to these decomposition products in confined spaces may include headache, nausea, eye, nose, and throat irritation.

Environmental Hazards:
No significant hazards.

NOTE: This material should not be used for any other purpose than the intended use in Section 1 without expert advice. Health studies have shown that chemical exposure may cause potential human health risks which may vary from person to person.

SECTION 3 COMPOSITION / INFORMATION ON INGREDIENTS

This material is defined as a mixture.

Hazardous Substance(s) or Complex Substance(s) required for disclosure

Name	CAS#	Concentration*	GHS Hazard Codes
N-PHENYL-1-NAPHTHYLAMINE	90-30-2	1%	H302, H317, H373, H400(M factor 1), H410(M factor 1)
9,10-ANTHRACENEDIONE, 1,4-DIHYDROXY-	81-64-1	< 0.1%	H400(M factor 10), H410(M factor 10)
TRICRESYL PHOSPHATE	1330-78-5	1 - < 3%	H361(F), H400(M factor 1), H410(M factor 1)

* All concentrations are percent by weight unless ingredient is a gas. Gas concentrations are in percent by volume. Other ingredients determined not to be hazardous up to 100%.

SECTION 4 FIRST AID MEASURES

INHALATION
Immediately remove from further exposure. Get immediate medical assistance. For those providing assistance, avoid exposure to yourself or others. Use adequate respiratory protection. Give supplemental oxygen, if available. If breathing has stopped, assist ventilation with a mechanical device.

SKIN CONTACT
Wash contact areas with soap and water. Remove contaminated clothing. Launder contaminated clothing before reuse. If product is injected into or under the skin, or into any part of the body, regardless of the appearance of the wound or its size, the individual should be evaluated immediately by a physician as a surgical emergency. Even though initial symptoms from high pressure injection may be minimal or absent, early surgical treatment within the first few hours may significantly reduce the ultimate extent of injury.

EYE CONTACT
Flush thoroughly with water. If irritation occurs, get medical assistance.

INGESTION
Seek immediate medical attention. If medical attention will be delayed, contact a Regional Poison Centre or emergency medical professional regarding the induction of vomiting or use of activated charcoal/syrup of ipecac. Do not induce vomiting or give anything by mouth to a groggy or unconscious person.

NOTE TO PHYSICIAN

None

SECTION 5 FIRE FIGHTING MEASURES

EXTINGUISHING MEDIA

Appropriate Extinguishing Media: Use water fog, foam, dry chemical or carbon dioxide (CO2) to extinguish flames.

Inappropriate Extinguishing Media: Straight streams of water

FIRE FIGHTING

Fire Fighting Instructions: Evacuate area. Prevent run-off from fire control or dilution from entering streams, sewers or drinking water supply. Fire-fighters should use standard protective equipment and in enclosed spaces, self-contained breathing apparatus (SCBA). Use water spray to cool fire exposed surfaces and to protect personnel.

Unusual Fire Hazards: May generate irritating and harmful gases/vapours/fumes when burning.

Hazardous Combustion Products: Aldehydes, Incomplete combustion products, Oxides of carbon, Phosphorus oxides, Smoke, Fume

FLAMMABILITY PROPERTIES

Flash Point [Method]: >246°C (475°F) [ASTM D-92]
Flammable Limits (Approximate volume % in air): LEL: N/D UEL: N/D
Autoignition Temperature: N/D

SECTION 6 ACCIDENTAL RELEASE MEASURES

NOTIFICATION PROCEDURES

In the event of a spill or accidental release, notify relevant authorities in accordance with all applicable regulations.

PROTECTIVE MEASURES

Avoid contact with spilled material. See Section 5 for fire fighting information. See the Hazard Identification Section for Significant Hazards. See Section 4 for First Aid Advice. See Section 8 for advice on the minimum requirements for personal protective equipment. Additional protective measures may be necessary, depending on the specific circumstances and/or the expert judgment of the emergency responders.

SPILL MANAGEMENT

Land Spill: Stop leak if you can do so without risk. Recover by pumping or with suitable absorbent.

Water Spill: Stop leak if you can do so without risk. Confine the spill immediately with booms. Warn other shipping. Remove from the surface by skimming or with suitable absorbents. Seek the advice of a specialist before using dispersants.

Water spill and land spill recommendations are based on the most likely spill scenario for this material; however, geographic conditions, wind, temperature, (and in the case of a water spill) wave and current direction and speed may greatly influence the appropriate action to be taken. For this reason, local experts should be

consulted. Note: Local regulations may prescribe or limit action to be taken.

ENVIRONMENTAL PRECAUTIONS

Large Spills: Dyke far ahead of liquid spill for later recovery and disposal. Prevent entry into waterways, sewers, basements or confined areas.

SECTION 7 HANDLING AND STORAGE

HANDLING

Avoid all personal contact. Prevent small spills and leakage to avoid slip hazard. Material can accumulate static charges which may cause an electrical spark (ignition source). When the material is handled in bulk, an electrical spark could ignite any flammable vapors from liquids or residues that may be present (e.g., during switch-loading operations). Use proper bonding and/or earthing procedures. However, bonding and earthing may not eliminate the hazard from static accumulation. Consult local applicable standards for guidance. Additional references include American Petroleum Institute 2003 (Protection Against Ignitions Arising out of Static, Lightning and Stray Currents) or National Fire Protection Agency 77 (Recommended Practice on Static Electricity) or CENELEC CLC/TR 50404 (Electrostatics - Code of practice for the avoidance of hazards due to static electricity).

Static Accumulator: This material is a static accumulator.

STORAGE

The type of container used to store the material may affect static accumulation and dissipation. Store in a cool, dry place with adequate ventilation. Keep away from incompatible materials, open flames and high temperatures. Do not store in open or unlabelled containers.

Material is defined under the National Standard [NOHSC:1015] Storage and Handling of Workplace Dangerous Goods.

SECTION 8 EXPOSURE CONTROLS / PERSONAL PROTECTION

NOTE: Limits/standards shown for guidance only. Follow applicable regulations.

Biological limits

No biological limits allocated.

ENGINEERING CONTROLS

The level of protection and types of controls necessary will vary depending upon potential exposure conditions. Control measures to consider:

No special requirements under ordinary conditions of use and with adequate ventilation.

PERSONAL PROTECTION

Personal protective equipment selections vary based on potential exposure conditions such as applications, handling practices, concentration and ventilation. Information on the selection of protective equipment for use with this material, as provided below, is based upon intended, normal usage.

Respiratory Protection: If engineering controls do not maintain airborne contaminant concentrations at a level which is adequate to protect worker health, an approved respirator may be appropriate. Respirator

selection, use, and maintenance must be in accordance with regulatory requirements, if applicable. Types of respirators to be considered for this material include:

Particulate

No protection is ordinarily required under normal conditions of use and with adequate ventilation.

For high airborne concentrations, use an approved supplied-air respirator, operated in positive pressure mode. Supplied air respirators with an escape bottle may be appropriate when oxygen levels are inadequate, gas/vapour warning properties are poor, or if air purifying filter capacity/rating may be exceeded.

Hand Protection: Any specific glove information provided is based on published literature and glove manufacturer data. Glove suitability and breakthrough time will differ depending on the specific use conditions. Contact the glove manufacturer for specific advice on glove selection and breakthrough times for your use conditions. Inspect and replace worn or damaged gloves. The types of gloves to be considered for this material include:

Nitrile

Chemical resistant gloves are recommended. If contact with forearms is likely wear gauntlet style gloves.

Eye Protection: If contact is likely, safety glasses with side shields are recommended.

Skin and Body Protection: Any specific clothing information provided is based on published literature or manufacturer data. The types of clothing to be considered for this material include:

Chemical/oil resistant clothing is recommended.

Specific Hygiene Measures: Always observe good personal hygiene measures, such as washing after handling the material and before eating, drinking, and/or smoking. Routinely wash work clothing and protective equipment to remove contaminants. Discard contaminated clothing and footwear that cannot be cleaned. Practise good housekeeping.

ENVIRONMENTAL CONTROLS

Comply with applicable environmental regulations limiting discharge to air, water and soil. Protect the environment by applying appropriate control measures to prevent or limit emissions.

SECTION 9 PHYSICAL AND CHEMICAL PROPERTIES

Note: Physical and chemical properties are provided for safety, health and environmental considerations only and may not fully represent product specifications. Contact the Supplier for additional information.

GENERAL INFORMATION

Physical State: Liquid
Colour: Amber
Odour: Characteristic
Odour Threshold: N/D

IMPORTANT HEALTH, SAFETY, AND ENVIRONMENTAL INFORMATION

Relative Density (at 15 °C): 1
Flammability (Solid, Gas): N/A
Flash Point [Method]: >246°C (475°F) [ASTM D-92]
Flammable Limits (Approximate volume % in air): LEL: N/D UEL: N/D
Autoignition Temperature: N/D

Boiling Point / Range: N/D
Decomposition Temperature: N/D
Vapour Density (Air = 1): N/D
Vapour Pressure: [N/D at 20ºC]
Evaporation Rate (n-butyl acetate = 1): N/D
pH: N/A
Log Pow (n-Octanol/Water Partition Coefficient): N/D
Solubility in Water: Negligible
Viscosity: 27.6 cSt (27.6 mm2/sec) at 40 ºC | 5.1 cSt (5.1 mm2/sec) at 100°C
Oxidizing Properties: See Hazards Identification Section.

OTHER INFORMATION

Freezing Point: N/D
Melting Point: N/A
Pour Point: -59°C (-74°F)

SECTION 10 STABILITY AND REACTIVITY

STABILITY: Material is stable under normal conditions.

CONDITIONS TO AVOID: Excessive heat.

INCOMPATIBLE MATERIALS: Strong oxidisers

HAZARDOUS DECOMPOSITION PRODUCTS: Material does not decompose at ambient temperatures.

POSSIBILITY OF HAZARDOUS REACTIONS: Hazardous polymerization will not occur.

SECTION 11 TOXICOLOGICAL INFORMATION

INFORMATION ON TOXICOLOGICAL EFFECTS

Hazard Class	Conclusion / Remarks
Inhalation	
Acute Toxicity: No end point data for material.	Minimally Toxic. Based on assessment of the components.
Irritation: No end point data for material.	Negligible hazard at ambient/normal handling temperatures.
Ingestion	
Acute Toxicity: No end point data for material.	Minimally Toxic. Based on assessment of the components.
Skin	
Acute Toxicity: No end point data for material.	Minimally Toxic. Based on assessment of the components.
Skin Corrosion/Irritation: No end point data for material.	Negligible irritation to skin at ambient temperatures. Based on assessment of the components.
Eye	
Serious Eye Damage/Irritation: No end point data for material.	May cause mild, short-lasting discomfort to eyes. Based on assessment of the components.
Sensitisation	
Respiratory Sensitization: No end point data for material.	Not expected to be a respiratory sensitizer.

Skin Sensitization: No end point data for material.	Not expected to be a skin sensitizer. Based on assessment of the components.
Aspiration: Data available.	Not expected to be an aspiration hazard. Based on physico-chemical properties of the material.
Germ Cell Mutagenicity: No end point data for material.	Not expected to be a germ cell mutagen. Based on assessment of the components.
Carcinogenicity: No end point data for material.	Not expected to cause cancer. Based on assessment of the components.
Reproductive Toxicity: No end point data for material.	Contains a substance that may be a reproductive toxicant. Based on assessment of the components.
Lactation: No end point data for material.	Not expected to cause harm to breast-fed children.
Specific Target Organ Toxicity (STOT)	
Single Exposure: No end point data for material.	Not expected to cause organ damage from a single exposure.
Repeated Exposure: No end point data for material.	Contains a substance that may cause damage to organs from prolonged or repeated exposure. Based on assessment of the components.

TOXICITY FOR SUBSTANCES

NAME	ACUTE TOXICITY
N-PHENYL-1-NAPHTHYLAMINE	Oral Lethality: LD 50 1625 mg/kg (Rat)

OTHER INFORMATION

For the product itself:

Target Organs Repeated Exposure: Blood, Kidney

Component concentrations in this formulation would not be expected to cause skin sensitization, based on tests of the components, this formulation, or similar formulations.
A literature report of a generic jet engine oil containing tri-cresyl phosphate (TCP) with concentrations of ortho-phenol isomers well in excess of those found in this ExxonMobil product noted delayed peripheral nerve system damage in test animals. A current study of an ExxonMobil Jet Oil formulated with a relatively low ortho-phenol isomer content produced no peripheral nerve system damage in test animals. Oral exposure of male rats to a generic jet engine oil containing 3% of a commercial aryl phosphate product had no effect on male reproductive end points (organ weights, histology, sperm morphology or motility).

Contains:

N-phenyl-1-naphthylamine (PAN): A single oral overexposure may result in clinical signs/symptoms of cyanosis, headache, shallow respiration, dizziness, confusion, low blood pressure, convulsions, coma, or jaundice. Hematuria may occur due to bladder and kidney irritation, and anemia may develop later. Repeated exposure in laboratory animals caused liver and kidney damage and depressed bone marrow activity. Undiluted PAN is a skin sensitiser. Human testing of lubricants containing 1.0% PAN resulted in no reactions indicative of sensitisation. Tricresyl phosphate (TCP): TCP (<9% ortho isomer) administered to rats by oral gavage in a one-generation reproduction/developmental toxicology study adversely affected both males and females. TCP-treated male rats had decreased sperm concentration and motility, abnormal sperm morphology and adverse histologic changes in the testes and epididymides. Adverse histologic changes were also observed in the ovaries of TCP-treated female rats. The percent of sperm-positive females littering was significantly reduced in the TCP-treatment groups with only one of twenty females in the high dose group delivering young . Developmental parameters were unaffected by TCP exposure. Impaired fertility and decreased sperm motility following TCP treatment have also been reported in a reproduction toxicity study in mice.

IARC Classification:

The following ingredients are cited on the lists below: None.

--REGULATORY LISTS SEARCHED--

1 = IARC 1 2 = IARC 2A 3 = IARC 2B

SECTION 12 ECOLOGICAL INFORMATION

The information given is based on data for the material, components of the material, or for similar materials, through the application of bridging principals.

ECOTOXICITY

Material -- Not expected to be harmful to aquatic organisms.
Material -- Not expected to demonstrate chronic toxicity to aquatic organisms.

ECOLOGICAL DATA

Ecotoxicity

Test	Duration	Organism Type	Test Results
Aquatic - Chronic Toxicity	21 day(s)	Daphnia magna	NOELR 1 mg/l

SECTION 13 DISPOSAL CONSIDERATIONS

Disposal recommendations based on material as supplied. Disposal must be in accordance with current applicable laws and regulations, and material characteristics at time of disposal.

DISPOSAL RECOMMENDATIONS

Dispose of waste at an appropriate treatment and disposal facility in accordance with applicable laws and regulations, and product characteristics at time of disposal. Protect the environment. Dispose of used oil at designated sites. Minimize skin contact. Do not mix used oils with solvents, brake fluids or coolants. Product is suitable for burning in an enclosed, controlled burner for fuel value or disposal by supervised incineration.

Empty Container Warning Empty Container Warning (where applicable): Empty containers may contain residue and can be dangerous. Do not attempt to refill or clean containers without proper instructions. Empty drums should be completely drained and safely stored until appropriately reconditioned or disposed. Empty containers should be taken for recycling, recovery, or disposal through suitably qualified or licensed contractor and in accordance with governmental regulations. DO NOT PRESSURISE, CUT, WELD, BRAZE, SOLDER, DRILL, GRIND, OR EXPOSE SUCH CONTAINERS TO HEAT, FLAME, SPARKS, STATIC ELECTRICITY, OR OTHER SOURCES OF IGNITION. THEY MAY EXPLODE AND CAUSE INJURY OR DEATH.

SECTION 14 TRANSPORT INFORMATION

LAND (ADG) : Not Regulated for Land Transport

SEA (IMDG): Not Regulated for Sea Transport according to IMDG-Code

Marine Pollutant: No

AIR (IATA): Not Regulated for Air Transport

SECTION 15 REGULATORY INFORMATION

This material is not considered hazardous according to Australia Model Work Health and Safety Regulations.

Product is not regulated according to Australian Dangerous Goods Code.

No Poison Schedule number allocated by the Standard for the Uniform Scheduling of Medicines and Poisons (SUSMP) established under the Therapeutic Goods Act.

AS1940 COMBUSTIBLE CLASS: C2

REGULATORY STATUS AND APPLICABLE LAWS AND REGULATIONS

Listed or exempt from listing/notification on the following chemical inventories : AIIC, DSL, IECSC, KECI, TCSI, TSCA

Special Cases:

Inventory	Status
PICCS	Restrictions Apply

SECTION 16 OTHER INFORMATION

KEY TO ABBREVIATIONS AND ACRONYMS:

N/D = Not determined, N/A = Not applicable, STEL = Short-Term Exposure Limit, TWA = Time-Weighted Average

KEY TO THE H-CODES CONTAINED IN SECTION 3 OF THIS DOCUMENT (for information only):
H302: Harmful if swallowed; Acute Tox Oral, Cat 4
H317: May cause allergic skin reaction; Skin Sensitisation, Cat 1
H361(F): Suspected of damaging fertility; Repro Tox, Cat 2 (Fertility)
H373: May cause damage to organs through prolonged or repeated exposure; Target Organ, Repeated, Cat 2
H400: Very toxic to aquatic life; Acute Env Tox, Cat 1
H410: Very toxic to aquatic life with long lasting effects; Chronic Env Tox, Cat 1

THIS SAFETY DATA SHEET CONTAINS THE FOLLOWING REVISIONS:
AMPOL AUSTRALIA PTY LTD: Section 01: Supplier Mailing Address information was added.
Perkal Pty Ltd Trading as Statewide Oil (South Australia): Section 01: Supplier Mailing Address information was deleted.
Perkal Pty Ltd Trading as Statewide Oil (Western Australia): Section 01: Supplier Mailing Address information was deleted.
Section 01: Company Contact Methods information was modified.
Section 01: Company Mailing Address information was deleted.
Section 01: Company Mailing Address information was modified.
Section 04: First Aid Inhalation information was modified.
Section 16: HCode Key information was modified.
Southern Cross Lubes (Victoria and Tasmania, New South Wales and Australian Capital Territory): Section 01:

Supplier Mailing Address information was deleted.

DGN: 2003056DAU (552669)

Prepared by: Exxon Mobil Corporation
EMBSI, Clinton NJ USA
Contact Point: See Section 1 for Local Contact number

End of (M)SDS

SDS Exxon Mobile MJO387

SAFETY DATA SHEET

SECTION 1 PRODUCT AND COMPANY IDENTIFICATION

PRODUCT

Product Name: **MOBIL JET OIL 387**
Product Description: Synthetic Esters and Additives
Product Code: 201550101025, 430280-00, 97AD64
Intended Use: Aviation lubricating oil, Turbine oil

COMPANY IDENTIFICATION

Supplier: **EXXON MOBIL CORPORATION**
22777 Springwoods Village Parkway
Spring, TX 77389 USA

24 Hour Health Emergency	609-737-4411
Transportation Emergency Phone	800-424-9300 or 703-527-3887 CHEMTREC
Product Technical Information	800-662-4525
MSDS Internet Address	www.exxon.com, www.mobil.com

SECTION 2 HAZARDS IDENTIFICATION

This material is hazardous according to regulatory guidelines (see (M)SDS Section 15).

CLASSIFICATION:

Reproductive toxicant (fertility): Category 2.

LABEL:
Pictogram:

Signal Word: Warning

Hazard Statements:
H361: Suspected of damaging fertility.

Precautionary Statements:
P201: Obtain special instructions before use. P202: Do not handle until all safety precautions have been read and understood. P280: Wear protective gloves and clothing.P308 + P313: IF exposed or concerned: Get medical advice/ attention.P405: Store locked up.P501: Dispose of contents and container in accordance with local regulations.

Contains: TRICRESYL PHOSPHATE

Other hazard information:

HAZARD NOT OTHERWISE CLASSIFIED (HNOC): None as defined under 29 CFR 1910.1200.

PHYSICAL / CHEMICAL HAZARDS

No significant hazards.

HEALTH HAZARDS

High-pressure injection under skin may cause serious damage. Excessive exposure may result in eye, skin, or respiratory irritation. This product is not expected to produce adverse health effects under normal conditions of use and with appropriate personal hygiene practices. Product may decompose at elevated temperatures or under fire conditions and give off irritating and/or harmful (carbon monoxide) gases/vapors/fumes. Symptoms from acute exposure to these decomposition products in confined spaces may include headache, nausea, eye, nose, and throat irritation.

ENVIRONMENTAL HAZARDS

No significant hazards.

NFPA Hazard ID:	Health:	1	Flammability:	1	Reactivity:	0
HMIS Hazard ID:	Health:	1*	Flammability:	1	Reactivity:	0

NOTE: This material should not be used for any other purpose than the intended use in Section 1 without expert advice. Health studies have shown that chemical exposure may cause potential human health risks which may vary from person to person.

SECTION 3 COMPOSITION / INFORMATION ON INGREDIENTS

This material is defined as a mixture.

Hazardous Substance(s) or Complex Substance(s) required for disclosure

Name	CAS#	Concentration*	GHS Hazard Codes
9,10-ANTHRACENEDIONE, 1,4-DIHYDROXY-	81-64-1	< 0.1%	H400(M factor 10), H410(M factor 10)
TRICRESYL PHOSPHATE	1330-78-5	1 - 2.5%	H361(F), H400(M factor 1), H410(M factor 1)

* All concentrations are percent by weight unless material is a gas. Gas concentrations are in percent by volume.

As per paragraph (i) of 29 CFR 1910.1200, formulation is considered a trade secret and specific chemical identity and exact percentage (concentration) of composition may have been withheld. Specific chemical identity and exact percentage composition will be provided to health professionals, employees, or designated representatives in accordance with applicable provisions of paragraph (i).

SECTION 4 FIRST AID MEASURES

INHALATION

Remove from further exposure. For those providing assistance, avoid exposure to yourself or others. Use adequate respiratory protection. If respiratory irritation, dizziness, nausea, or unconsciousness occurs, seek

immediate medical assistance. If breathing has stopped, assist ventilation with a mechanical device or use mouth-to-mouth resuscitation.

SKIN CONTACT

Wash contact areas with soap and water. Remove contaminated clothing. Launder contaminated clothing before reuse. If product is injected into or under the skin, or into any part of the body, regardless of the appearance of the wound or its size, the individual should be evaluated immediately by a physician as a surgical emergency. Even though initial symptoms from high pressure injection may be minimal or absent, early surgical treatment within the first few hours may significantly reduce the ultimate extent of injury.

EYE CONTACT

Flush thoroughly with water. If irritation occurs, get medical assistance.

INGESTION

Seek immediate medical attention. If medical attention will be delayed, contact a Regional Poison Center or emergency medical professional regarding the induction of vomiting or use of activated charcoal/syrup of ipecac. Do not induce vomiting or give anything by mouth to a groggy or unconscious person.

SECTION 5 FIRE FIGHTING MEASURES

EXTINGUISHING MEDIA

Appropriate Extinguishing Media: Use water fog, foam, dry chemical or carbon dioxide (CO2) to extinguish flames.

Inappropriate Extinguishing Media: Straight Streams of Water

FIRE FIGHTING

Fire Fighting Instructions: Evacuate area. Prevent runoff from fire control or dilution from entering streams, sewers, or drinking water supply. Firefighters should use standard protective equipment and in enclosed spaces, self-contained breathing apparatus (SCBA). Use water spray to cool fire exposed surfaces and to protect personnel.

Unusual Fire Hazards: May generate irritating and harmful gases/vapors/fumes when burning.

Hazardous Combustion Products: Aldehydes, Incomplete combustion products, Oxides of carbon, Phosphorus oxides, Smoke, Fume

FLAMMABILITY PROPERTIES

Flash Point [Method]: 270°C (518°F) [ASTM D-93]
Flammable Limits (Approximate volume % in air): LEL: N/D UEL: N/D
Autoignition Temperature: N/D

SECTION 6 ACCIDENTAL RELEASE MEASURES

NOTIFICATION PROCEDURES

In the event of a spill or accidental release, notify relevant authorities in accordance with all applicable regulations. US regulations require reporting releases of this material to the environment which exceed the applicable reportable quantity or oil spills which could reach any waterway including intermittent dry creeks. The National Response Center can be reached at (800)424-8802.

PROTECTIVE MEASURES

Avoid contact with spilled material. See Section 5 for fire fighting information. See the Hazard Identification Section for Significant Hazards. See Section 4 for First Aid Advice. See Section 8 for advice on the minimum requirements for personal protective equipment. Additional protective measures may be necessary, depending on the specific circumstances and/or the expert judgment of the emergency responders.

SPILL MANAGEMENT

Land Spill: Stop leak if you can do it without risk. Recover by pumping or with suitable absorbent.

Water Spill: Stop leak if you can do it without risk. Confine the spill immediately with booms. Warn other shipping. Remove from the surface by skimming or with suitable absorbents. Seek the advice of a specialist before using dispersants.

Water spill and land spill recommendations are based on the most likely spill scenario for this material; however, geographic conditions, wind, temperature, (and in the case of a water spill) wave and current direction and speed may greatly influence the appropriate action to be taken. For this reason, local experts should be consulted. Note: Local regulations may prescribe or limit action to be taken.

ENVIRONMENTAL PRECAUTIONS

Large Spills: Dike far ahead of liquid spill for later recovery and disposal. Prevent entry into waterways, sewers, basements or confined areas.

SECTION 7 HANDLING AND STORAGE

HANDLING

Prevent small spills and leakage to avoid slip hazard. Material can accumulate static charges which may cause an electrical spark (ignition source). When the material is handled in bulk, an electrical spark could ignite any flammable vapors from liquids or residues that may be present (e.g., during switch-loading operations). Use proper bonding and/or ground procedures. However, bonding and grounds may not eliminate the hazard from static accumulation. Consult local applicable standards for guidance. Additional references include American Petroleum Institute 2003 (Protection Against Ignitions Arising out of Static, Lightning and Stray Currents) or National Fire Protection Agency 77 (Recommended Practice on Static Electricity) or CENELEC CLC/TR 50404 (Electrostatics - Code of practice for the avoidance of hazards due to static electricity).

Static Accumulator: This material is a static accumulator.

STORAGE

The type of container used to store the material may affect static accumulation and dissipation. Store in a cool, dry place with adequate ventilation. Keep away from incompatible materials, open flames, and high temperatures. Do not store in open or unlabelled containers.

SECTION 8 EXPOSURE CONTROLS / PERSONAL PROTECTION

NOTE: Limits/standards shown for guidance only. Follow applicable regulations.

No biological limits allocated.

ENGINEERING CONTROLS

The level of protection and types of controls necessary will vary depending upon potential exposure conditions. Control measures to consider:

Adequate ventilation should be provided whenever the material is heated or mists are generated.

PERSONAL PROTECTION

Personal protective equipment selections vary based on potential exposure conditions such as applications, handling practices, concentration and ventilation. Information on the selection of protective equipment for use with this material, as provided below, is based upon intended, normal usage.

Respiratory Protection: If engineering controls do not maintain airborne contaminant concentrations at a level which is adequate to protect worker health, an approved respirator may be appropriate. Respirator selection, use, and maintenance must be in accordance with regulatory requirements, if applicable. Types of respirators to be considered for this material include:

No protection is ordinarily required under normal conditions of use and with adequate ventilation.

For high airborne concentrations, use an approved supplied-air respirator, operated in positive pressure mode. Supplied air respirators with an escape bottle may be appropriate when oxygen levels are inadequate, gas/vapor warning properties are poor, or if air purifying filter capacity/rating may be exceeded.

Hand Protection: Any specific glove information provided is based on published literature and glove manufacturer data. Glove suitability and breakthrough time will differ depending on the specific use conditions. Contact the glove manufacturer for specific advice on glove selection and breakthrough times for your use conditions. Inspect and replace worn or damaged gloves. The types of gloves to be considered for this material include:

Chemical resistant gloves are recommended. If contact with forearms is likely wear gauntlet style gloves.

Eye Protection: If contact is likely, safety glasses with side shields are recommended.

Skin and Body Protection: Any specific clothing information provided is based on published literature or manufacturer data. The types of clothing to be considered for this material include:

Chemical/oil resistant clothing is recommended.

Specific Hygiene Measures: Always observe good personal hygiene measures, such as washing after handling the material and before eating, drinking, and/or smoking. Routinely wash work clothing and protective equipment to remove contaminants. Discard contaminated clothing and footwear that cannot be cleaned. Practice good housekeeping.

ENVIRONMENTAL CONTROLS

Comply with applicable environmental regulations limiting discharge to air, water and soil. Protect the environment by applying appropriate control measures to prevent or limit emissions.

SECTION 9 PHYSICAL AND CHEMICAL PROPERTIES

Note: Physical and chemical properties are provided for safety, health and environmental considerations only and may not fully represent product specifications. Contact the Supplier for additional information.

GENERAL INFORMATION

Physical State: Liquid
Color: Orange
Odor: Characteristic
Odor Threshold: N/D

IMPORTANT HEALTH, SAFETY, AND ENVIRONMENTAL INFORMATION

Relative Density (at 15 °C): 0.99
Flammability (Solid, Gas): N/A
Flash Point [Method]: 270°C (518°F) [ASTM D-93]
Flammable Limits (Approximate volume % in air): LEL: N/D UEL: N/D
Autoignition Temperature: N/D
Boiling Point / Range: N/D
Decomposition Temperature: N/D
Vapor Density (Air = 1): N/D
Vapor Pressure: [N/D at 20 °C]
Evaporation Rate (n-butyl acetate = 1): N/D
pH: N/A
Log Pow (n-Octanol/Water Partition Coefficient): N/D
Solubility in Water: Negligible
Viscosity: 25 cSt (25 mm2/sec) at 40 °C | 5.1 cSt (5.1 mm2/sec) at 100°C
Oxidizing Properties: See Hazards Identification Section.

OTHER INFORMATION

Freezing Point: N/D
Melting Point: N/A
Pour Point: -54°C (-65°F)

SECTION 10 STABILITY AND REACTIVITY

REACTIVITY: See sub-sections below.

STABILITY: Material is stable under normal conditions.

CONDITIONS TO AVOID: Excessive heat. High energy sources of ignition.

MATERIALS TO AVOID: Strong oxidizers

HAZARDOUS DECOMPOSITION PRODUCTS: Material does not decompose at ambient temperatures.

POSSIBILITY OF HAZARDOUS REACTIONS: Hazardous polymerization will not occur.

SECTION 11 TOXICOLOGICAL INFORMATION

INFORMATION ON TOXICOLOGICAL EFFECTS

Hazard Class	Conclusion / Remarks
Inhalation	
Acute Toxicity: No end point data for material.	Minimally Toxic. Based on assessment of the components.
Irritation: No end point data for material.	Negligible hazard at ambient/normal handling temperatures.

Ingestion	
Acute Toxicity: No end point data for material.	Minimally Toxic. Based on assessment of the components.
Skin	
Acute Toxicity: No end point data for material.	Minimally Toxic. Based on assessment of the components.
Skin Corrosion/Irritation: No end point data for material.	Negligible irritation to skin at ambient temperatures. Based on assessment of the components.
Eye	
Serious Eye Damage/Irritation: No end point data for material.	May cause mild, short-lasting discomfort to eyes. Based on assessment of the components.
Sensitization	
Respiratory Sensitization: No end point data for material.	Not expected to be a respiratory sensitizer.
Skin Sensitization: No end point data for material.	Not expected to be a skin sensitizer. Based on assessment of the components.
Aspiration: Data available.	Not expected to be an aspiration hazard. Based on physico-chemical properties of the material.
Germ Cell Mutagenicity: No end point data for material.	Not expected to be a germ cell mutagen. Based on assessment of the components.
Carcinogenicity: No end point data for material.	Not expected to cause cancer. Based on assessment of the components.
Reproductive Toxicity: No end point data for material.	Contains a substance that may be a reproductive toxicant. Based on assessment of the components.
Lactation: No end point data for material.	Not expected to cause harm to breast-fed children.
Specific Target Organ Toxicity (STOT)	
Single Exposure: No end point data for material.	Not expected to cause organ damage from a single exposure.
Repeated Exposure: No end point data for material.	Not expected to cause organ damage from prolonged or repeated exposure. Based on assessment of the components.

OTHER INFORMATION

For the product itself:

A literature report of a generic jet engine oil containing tri-cresyl phosphate (TCP) with concentrations of ortho-phenol isomers well in excess of those found in this ExxonMobil product noted delayed peripheral nerve system damage in test animals. A current study of an ExxonMobil Jet Oil formulated with a relatively low ortho-phenol isomer content produced no peripheral nerve system damage in test animals. Oral exposure of male rats to a generic jet engine oil containing 3% of a commercial aryl phosphate product had no effect on male reproductive end points (organ weights, histology, sperm morphology or motility).

Contains:

Tricresyl phosphate (TCP): TCP (<9% ortho isomer) administered to rats by oral gavage in a one-generation reproduction/developmental toxicology study adversely affected both males and females. TCP-treated male rats had decreased sperm concentration and motility, abnormal sperm morphology and adverse histologic changes in the testes and epididymides. Adverse histologic changes were also observed in the ovaries of TCP-treated female rats. The percent of sperm-positive females littering was significantly reduced in the TCP-treatment groups with only one of twenty females in the high dose group delivering young . Developmental parameters were unaffected by TCP exposure. Impaired fertility and decreased sperm motility following TCP treatment have also been reported in a reproduction toxicity study in mice.

The following ingredients are cited on the lists below: None.

--REGULATORY LISTS SEARCHED--

1 = NTP CARC	3 = IARC 1	5 = IARC 2B
2 = NTP SUS	4 = IARC 2A	6 = OSHA CARC

SECTION 12 ECOLOGICAL INFORMATION

The information given is based on data for the material, components of the material, or for similar materials, through the application of bridging principals.

ECOTOXICITY

Material -- Not expected to be harmful to aquatic organisms.

PERSISTENCE AND DEGRADABILITY

Biodegradation:

Material -- Expected to be inherently biodegradable

ECOLOGICAL DATA

Ecotoxicity

Test	Duration	Organism Type	Test Results
Aquatic - Chronic Toxicity	21 day(s)	Daphnia magna	NOELR 1 mg/l

SECTION 13 DISPOSAL CONSIDERATIONS

Disposal recommendations based on material as supplied. Disposal must be in accordance with current applicable laws and regulations, and material characteristics at time of disposal.

DISPOSAL RECOMMENDATIONS

Dispose of waste at an appropriate treatment & disposal facility in accordance with applicable laws and regulations, and product characteristics at time of disposal. Protect the environment. Dispose of used oil at designated sites. Minimize skin contact. Do not mix used oils with solvents, brake fluids or coolants. Product is suitable for burning in an enclosed, controlled burner for fuel value or disposal by supervised incineration.

REGULATORY DISPOSAL INFORMATION

RCRA Information: The unused product, in our opinion, is not specifically listed by the EPA as a hazardous waste (40 CFR, Part 261D), nor is it formulated to contain materials which are listed as hazardous wastes. It does not exhibit the hazardous characteristics of ignitability, corrosivity or reactivity and is not formulated with contaminants as determined by the Toxicity Characteristic Leaching Procedure (TCLP). However, used product may be regulated.

Empty Container Warning Empty Container Warning (where applicable): Empty containers may contain residue and can be dangerous. Do not attempt to refill or clean containers without proper instructions. Empty drums should be completely drained and safely stored until appropriately reconditioned or disposed. Empty containers should be taken for recycling, recovery, or disposal through suitably qualified or licensed contractor and in accordance with governmental regulations. DO NOT PRESSURISE, CUT, WELD, BRAZE, SOLDER, DRILL, GRIND, OR EXPOSE SUCH CONTAINERS TO HEAT, FLAME, SPARKS, STATIC ELECTRICITY, OR OTHER SOURCES OF IGNITION.

THEY MAY EXPLODE AND CAUSE INJURY OR DEATH.

SECTION 14 TRANSPORT INFORMATION

LAND (DOT): Not Regulated for Land Transport

LAND (TDG): Not Regulated for Land Transport

SEA (IMDG): Not Regulated for Sea Transport according to IMDG-Code

Marine Pollutant: No

AIR (IATA): Not Regulated for Air Transport

SECTION 15 REGULATORY INFORMATION

OSHA HAZARD COMMUNICATION STANDARD: This material is considered hazardous in accordance with OSHA HazCom 2012, 29 CFR 1910.1200.

Listed or exempt from listing/notification on the following chemical inventories: AIIC, DSL, ISHL, KECI, TCSI, TSCA

Special Cases:

Inventory	Status
IECSC	Restrictions Apply
PICCS	Restrictions Apply

SARA 302: No chemicals in this material are subject to the reporting requirements of SARA Title III, Section 302

SARA (311/312) REPORTABLE GHS HAZARD CLASSES: Reproductive toxicity

SARA (313) TOXIC RELEASE INVENTORY: This material contains no chemicals subject to the supplier notification requirements of the SARA 313 Toxic Release Program.

The following ingredients are cited on the lists below:

Chemical Name	CAS Number	List Citations
TRICRESYL PHOSPHATE	1330-78-5	17

--REGULATORY LISTS SEARCHED--

1 = ACGIH ALL	6 = TSCA 5a2	11 = CA P65 REPRO	16 = MN RTK
2 = ACGIH A1	7 = TSCA 5e	12 = CA RTK	17 = NJ RTK
3 = ACGIH A2	8 = TSCA 6	13 = IL RTK	18 = PA RTK
4 = OSHA Z	9 = TSCA 12b	14 = LA RTK	19 = RI RTK

5 = TSCA 4 10 = CA P65 CARC 15 = MI 293

Code key: CARC=Carcinogen; REPRO=Reproductive

SECTION 16 OTHER INFORMATION

N/D = Not determined, N/A = Not applicable

KEY TO THE H-CODES CONTAINED IN SECTION 3 OF THIS DOCUMENT (for information only):
H361(F): Suspected of damaging fertility; Repro Tox, Cat 2 (Fertility)
H400: Very toxic to aquatic life; Acute Env Tox, Cat 1
H410: Very toxic to aquatic life with long lasting effects; Chronic Env Tox, Cat 1

THIS SAFETY DATA SHEET CONTAINS THE FOLLOWING REVISIONS:
GHS Health Symbol information was modified.
Section 15: National Chemical Inventory Listing information was modified.
Section 15: Special Cases Table information was modified.

The information and recommendations contained herein are, to the best of ExxonMobil's knowledge and belief, accurate and reliable as of the date issued. You can contact ExxonMobil to insure that this document is the most current available from ExxonMobil. The information and recommendations are offered for the user's consideration and examination. It is the user's responsibility to satisfy itself that the product is suitable for the intended use. If buyer repackages this product, it is the user's responsibility to insure proper health, safety and other necessary information is included with and/or on the container. Appropriate warnings and safe-handling procedures should be provided to handlers and users. Alteration of this document is strictly prohibited. Except to the extent required by law, re-publication or retransmission of this document, in whole or in part, is not permitted. The term, "ExxonMobil" is used for convenience, and may include any one or more of ExxonMobil Chemical Company, Exxon Mobil Corporation, or any affiliates in which they directly or indirectly hold any interest.

Internal Use Only
MHC: 0, 0, 0, 0, 0, 0 PPEC: C

DGN: 7080274XUS (1012700)

SDS Skydrol PE-5

Skydrol® PE-5

Version	Revision Date:	SDS Number:	Date of last issue: 08/03/2020
3.0	07/02/2021	150000093410	Date of first issue: 09/06/2016
PRD		SDSUS / Z8 / 0001	

SECTION 1. IDENTIFICATION

Product name : Skydrol® PE-5

Product code : 34103-00, P3410305, P3410304, P3410302, P3410301, P3410306, P3410313, P3410312, P3410303, P3410311, P3410309, E3410301

Manufacturer or supplier's details

Company name of supplier : Eastman Chemical Company

Address : 200 South Wilcox Drive
Kingsport TN 37660-5280

Telephone : (423) 229-2000

Emergency telephone : CHEMTREC: +1-800-424-9300, +1-703-527-3887 CCN7321

Recommended use of the chemical and restrictions on use

Recommended use : Hydraulic fluids

Restrictions on use : The Environmental Protection Agency prohibits processing and distribution of this chemical/product for any use other than: (1) In hydraulic fluids either for the aviation industry or to meet military specifications for safety and performance where no alternative chemical is available that meets U.S. Department of Defense specification requirements, (2) lubricants and greases, (3) new or replacement parts for motor and aerospace vehicles, (4) as an intermediate in the manufacture of cyanoacrylate glue, (5) in specialised engine air filters for locomotive and marine applications, and (6) in adhesives and sealants before January 6, 2025, after which use in adhesives and sealants is prohibited. In addition, all persons are prohibited from releasing PIP (3:1) to water during manufacturing, processing and distribution in commerce, and must follow all existing regulations and best practices to prevent the release of PIP (3:1) to water during the commercial use of PIP (3:1).

SECTION 2. HAZARDS IDENTIFICATION

GHS classification in accordance with the OSHA Hazard Communication Standard (29 CFR 1910.1200)

Acute toxicity (Oral) : Category 4

Skin irritation : Category 2

Carcinogenicity : Category 2

Reproductive toxicity (Oral)	:	Category 2
Specific target organ toxicity - repeated exposure	:	Category 2 (Adrenal gland)

GHS label elements

Hazard pictograms :

Signal Word : Warning

Hazard Statements :

H302 Harmful if swallowed.
H315 Causes skin irritation.
H351 Suspected of causing cancer.
H361 Suspected of damaging fertility or the unborn child if swallowed.
H373 May cause damage to organs (Adrenal gland) through prolonged or repeated exposure.

Precautionary Statements :

Prevention:

P201 Obtain special instructions before use.
P202 Do not handle until all safety precautions have been read and understood.
P260 Do not breathe dust/ fume/ gas/ mist/ vapors/ spray.
P264 Wash skin thoroughly after handling.
P270 Do not eat, drink or smoke when using this product.
P280 Wear protective gloves/ protective clothing/ eye protection/ face protection.

Response:

P301 + P312 + P330 IF SWALLOWED: Call a POISON CENTER/ doctor if you feel unwell. Rinse mouth.
P302 + P352 IF ON SKIN: Wash with plenty of soap and water.
P308 + P313 IF exposed or concerned: Get medical advice/ attention.
P332 + P313 If skin irritation occurs: Get medical advice/ attention.
P362 Take off contaminated clothing and wash before reuse.

Storage:

P405 Store locked up.

Disposal:

P501 Dispose of contents/ container to an approved waste disposal plant.

Other hazards

None known.

SECTION 3. COMPOSITION/INFORMATION ON INGREDIENTS

Components

Chemical name	CAS-No.	Concentration (% w/w)
Tributyl phosphate	126-73-8	58 - 68
Triisobutyl phosphate	126-71-6	8 - 10
Phenol, isopropylated, phosphate (3:1)	68937-41-7	5 - < 10
triphenylphosphate	115-86-6	1.3 - 1.9
7-Oxabicyclo[4.1.0]heptane-3-carboxylic acid, 2-ethylhexyl ester	62256-00-2	5.5 - 6.5
butylated hydroxytoluene	128-37-0	0.1 - 1

SECTION 4. FIRST AID MEASURES

If inhaled : Move to fresh air.
Call a physician or poison control center immediately.

In case of skin contact : Wash off with soap and plenty of water.
Wash contaminated clothing before re-use.
Get medical attention.
Thoroughly clean shoes before reuse.

In case of eye contact : In the case of contact with eyes, rinse immediately with plenty of water and seek medical advice.

If swallowed : Seek medical advice.

Most important symptoms and effects, both acute and delayed : Harmful if swallowed.
Causes skin irritation.
Suspected of causing cancer.
Suspected of damaging fertility or the unborn child if swallowed.
May cause damage to organs through prolonged or repeated exposure.

Notes to physician : Treat symptomatically.

SECTION 5. FIRE-FIGHTING MEASURES

Suitable extinguishing media : Carbon dioxide (CO2)
Dry chemical
Water spray

Unsuitable extinguishing media : Do not use a solid water stream as it may scatter and spread fire.

Hazardous combustion products : Carbon monoxide
Carbon dioxide (CO2)
oxides of phosphorus

Further information : None known.

Special protective equipment for fire-fighters : Wear an approved positive pressure self-contained breathing apparatus in addition to standard fire fighting gear.

SECTION 6. ACCIDENTAL RELEASE MEASURES

Personal precautions, protective equipment and emergency procedures : Wear appropriate personal protective equipment.
Avoid breathing mist or vapors.
Local authorities should be advised if significant spillages cannot be contained.

Environmental precautions : Prevent further leakage or spillage if safe to do so.
Clear up spills immediately and dispose of waste safely.
Avoid release to the environment.

Methods and materials for containment and cleaning up : Prevent runoff from entering drains, sewers, or streams.
Contain spillage, soak up with non-combustible absorbent material, (e.g. sand, earth, diatomaceous earth, vermiculite) and transfer to a container for disposal according to local / national regulations (see section 13).

SECTION 7. HANDLING AND STORAGE

Advice on protection against fire and explosion : None known.

Advice on safe handling : Avoid inhalation of vapor or mist.
Do not get on skin or clothing.
Avoid contact with skin, eyes and clothing.
Do not swallow.
Ensure adequate ventilation.
Wash thoroughly after handling.

Conditions for safe storage : Keep tightly closed.

SECTION 8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Ingredients with workplace control parameters

Components	CAS-No.	Value type (Form of exposure)	Control parameters / Permissible concentration	Basis
Tributyl phosphate	126-73-8	TWA (Inhalable fraction and vapor)	5 mg/m3	ACGIH
		TWA	0.2 ppm 2.5 mg/m3	NIOSH REL
		TWA	5 mg/m3	OSHA Z-1
		TWA	0.2 ppm 2.5 mg/m3	OSHA P0
triphenylphosphate	115-86-6	TWA	3 mg/m3	ACGIH

		TWA	3 mg/m3	NIOSH REL
		TWA	3 mg/m3	OSHA Z-1
		TWA	3 mg/m3	OSHA P0

Engineering measures : Good general ventilation (typically 10 air changes per hour) should be used. Ventilation rates should be matched to conditions. If applicable, use process enclosures, local exhaust ventilation, or other engineering controls to maintain airborne levels below recommended exposure limits. If exposure limits have not been established, maintain airborne levels to an acceptable level.

Personal protective equipment

Respiratory protection : Use respiratory protection unless adequate local exhaust ventilation is provided or exposure assessment demonstrates that exposures are within recommended exposure guidelines.

Use a properly fitted, particulate filter respirator complying with an approved standard if a risk assessment indicates this is necessary.
Respirator selection, use, and maintenance must be in accordance with regulatory requirements, if applicable.
If engineering controls do not maintain airborne concentrations below recommended exposure limits (where applicable) or to an acceptable level (in countries where exposure limits have not been established), an approved respirator must be worn.

Hand protection

Remarks : Contact the glove manufacturer for specific advice on glove selection and breakthrough times for your use conditions. After contamination with product change the gloves immediately and dispose of them according to relevant national and local regulations.

Eye protection : Wear safety glasses with side shields (or goggles).

Skin and body protection : Wear suitable protective clothing.

Protective measures : Remove respiratory and skin/eye protection only after vapors have been cleared from the area.
Ensure that eye flushing systems and safety showers are located close to the working place.
Use personal protective equipment as required.

Hygiene measures : Handle in accordance with good industrial hygiene and safety practice.

SECTION 9. PHYSICAL AND CHEMICAL PROPERTIES

Appearance : oily

Color	:	purple
Odor	:	odorless
Odor Threshold	:	not determined
pH	:	not determined
Melting point/range	:	< -80 °F / -62 °C
Boiling point/boiling range	:	not determined
Flash point	:	340 °F / 171 °C Method: Cleveland open cup
Evaporation rate	:	not determined
Flammability (solid, gas)	:	Not applicable
Upper explosion limit / Upper flammability limit	:	not determined
Lower explosion limit / Lower flammability limit	:	not determined
Vapor pressure	:	0.4 hPa (77 °F / 25 °C)
Relative vapor density	:	not determined
Relative density	:	0.9956 (77 °F / 25 °C)
Density	:	995 kg/m3 (77 °F / 25 °C)
Autoignition temperature	:	795 °F / 424 °C Method: ASTM D2155
Decomposition temperature	:	not determined
Viscosity		
Viscosity, dynamic	:	not determined
Viscosity, kinematic	:	9.02 - 10.02 mm2/s (100 °F / 38 °C)
Explosive properties	:	Not classified
Oxidizing properties	:	Not classified

SECTION 10. STABILITY AND REACTIVITY

Reactivity	:	None reasonably foreseeable.
Chemical stability	:	Stable under normal conditions.
Possibility of hazardous reactions	:	Stable
Conditions to avoid	:	None known.
Incompatible materials	:	Strong oxidizing agents
Hazardous decomposition products	:	Carbon dioxide (CO2) Carbon monoxide

SECTION 11. TOXICOLOGICAL INFORMATION

Acute toxicity

Harmful if swallowed.

Product:

Acute oral toxicity	:	Remarks: Harmful if swallowed.
Acute inhalation toxicity	:	Remarks: No significant adverse effects were reported
Acute dermal toxicity	:	Remarks: No significant adverse effects were reported

Components:

Tributyl phosphate:

Acute oral toxicity	:	LD50 Oral (Rat, male and female): 1,553 mg/kg Assessment: Harmful if swallowed. LD50 Oral (Rat, male and female): 1,400 mg/kg
Acute inhalation toxicity	:	LC50 (Rat, male and female): > 4.242 mg/l Exposure time: 4 h Test atmosphere: dust/mist Assessment: The substance or mixture has no acute inhalation toxicity
Acute dermal toxicity	:	LD50 Dermal (Rabbit, male and female): > 3,100 mg/kg Assessment: The substance or mixture has no acute dermal toxicity

Triisobutyl phosphate:

Acute inhalation toxicity	:	LC50 (Rat): > 5.14 mg/l Exposure time: 4 h Test atmosphere: dust/mist Assessment: The substance or mixture has no acute inhalation toxicity
Acute dermal toxicity	:	LD50 Dermal (Rabbit): > 5,000 mg/kg

Assessment: The substance or mixture has no acute dermal toxicity

Phenol, isopropylated, phosphate (3:1):

Acute oral toxicity	:	LD50 Oral (Rat): > 5,000 mg/kg Assessment: The substance or mixture has no acute oral toxicity
Acute inhalation toxicity	:	LC50 (Rat): > 200 mg/m3 Exposure time: 1 h Assessment: The substance or mixture has no acute inhalation toxicity
Acute dermal toxicity	:	LD50 Dermal (Rabbit): > 10,000 mg/kg Assessment: The substance or mixture has no acute dermal toxicity

triphenylphosphate:

Acute oral toxicity	:	LD50 Oral (Rat, male): > 6,400 mg/kg
Acute dermal toxicity	:	LD50 Dermal (Guinea pig, male): > 5,000 mg/kg

7-Oxabicyclo[4.1.0]heptane-3-carboxylic acid, 2-ethylhexyl ester:

Acute oral toxicity	:	LD50 Oral (Rat, male and female): 4,470 mg/kg
Acute dermal toxicity	:	LD50 Dermal (Rabbit, male and female): > 7,940 mg/kg

butylated hydroxytoluene:

Acute oral toxicity	:	LD50 Oral (Rat): > 6,000 mg/kg
Acute dermal toxicity	:	LD50 Dermal (Guinea pig): > 20,000 mg/kg

Skin corrosion/irritation

Causes skin irritation.

Product:

Remarks	:	Causes skin irritation.

Components:

Tributyl phosphate:

Species	:	Rabbit
Exposure time	:	4 h
Assessment	:	Causes skin irritation.
Result	:	irritating

Triisobutyl phosphate:

Species	:	Rabbit
Exposure time	:	4 h

Result : Mild skin irritation

Phenol, isopropylated, phosphate (3:1):

Species : Rabbit
Assessment : Not classified

triphenylphosphate:

Species : Guinea pig
Remarks : Non-irritating to the skin.

7-Oxabicyclo[4.1.0]heptane-3-carboxylic acid, 2-ethylhexyl ester:

Species : Rabbit
Exposure time : 24 h
Assessment : Not classified as hazardous.
Result : slight to moderate irritation

butylated hydroxytoluene:

Species : Rabbit
Exposure time : 24 h
Result : very slight

Serious eye damage/eye irritation

Not classified based on available information.

Components:

Tributyl phosphate:

Species : Rabbit
Result : slight irritation
Exposure time : 24 h
Assessment : Not classified

Triisobutyl phosphate:

Species : Rabbit
Result : slight
Assessment : Not classified

Phenol, isopropylated, phosphate (3:1):

Species : Rabbit
Result : none
Assessment : Not classified

triphenylphosphate:

Species : Rabbit
Result : slight

7-Oxabicyclo[4.1.0]heptane-3-carboxylic acid, 2-ethylhexyl ester:

Species : Rabbit

Result	:	slight irritation
Exposure time	:	24 h
Assessment	:	Not classified

butylated hydroxytoluene:

Species	:	Rabbit
Result	:	none

Respiratory or skin sensitization

Skin sensitization

Not classified based on available information.

Respiratory sensitization

Not classified based on available information.

Product:

Test Type	:	OECD 429: LLNA
Species	:	Mouse
Result	:	Not a skin sensitizer.

Components:

Tributyl phosphate:

Test Type	:	Skin Sensitization
Species	:	Guinea pig
Assessment	:	Not classified
Result	:	Does not cause skin sensitization.

Test Type	:	Skin Sensitization
Species	:	Humans
Assessment	:	Not classified
Result	:	Does not cause skin sensitization.

Triisobutyl phosphate:

Test Type	:	OECD 406: Guinea pig sensitization
Species	:	Guinea pig
Method	:	OECD 406: Guinea pig sensitization
Result	:	May cause sensitization by skin contact.

7-Oxabicyclo[4.1.0]heptane-3-carboxylic acid, 2-ethylhexyl ester:

Test Type	:	Skin Sensitization
Species	:	Guinea pig
Result	:	May cause sensitization by skin contact.

butylated hydroxytoluene:

Test Type	:	Skin sensitization
Species	:	Guinea pig
Result	:	non-sensitizing

Germ cell mutagenicity

Not classified based on available information.

Components:

Tributyl phosphate:

Genotoxicity in vitro : Test Type: Mutagenicity - Bacterial
Metabolic activation: +/- activation
Method: Bacterial Reverse Mutation Assay
Result: negative

Test Type: Mutagenicity - Mammalian
Metabolic activation: +/- activation
Method: In vitro Mammalian Chromosome Aberration Test
Result: equivocal

Genotoxicity in vivo : Species: Rat (male and female)
Application Route: oral: gavage
Method: Mammalian Bone Marrow Chromosome Aberration Test
Result: negative

Triisobutyl phosphate:

Genotoxicity in vitro : Test Type: Salmonella typhimurium assay (Ames test)
Metabolic activation: +/- activation
Method: Bacterial Reverse Mutation Assay
Result: negative

Genotoxicity in vivo : Result: negative

7-Oxabicyclo[4.1.0]heptane-3-carboxylic acid, 2-ethylhexyl ester:

Genotoxicity in vitro : Test Type: Salmonella typhimurium assay (Ames test)
Metabolic activation: +/- activation
Method: Bacterial Reverse Mutation Assay
Result: negative

Test Type: Mutagenicity - Mammalian
Metabolic activation: +/- activation
Method: In vitro Mammalian Chromosome Aberration Test
Result: equivocal

Test Type: Mutagenicity - Mammalian
Metabolic activation: +/- activation
Method: In vitro Mammalian Cell Gene Mutation Test
Result: negative

Genotoxicity in vivo : Species: Rat (male and female)
Application Route: intraperitoneal injection
Method: Mammalian Bone Marrow Chromosome Aberration Test
Result: equivocal

Carcinogenicity

Suspected of causing cancer.

Components:

Tributyl phosphate:

Species	:	Rat, male and female
Application Route	:	Ingestion
Method	:	EPA OTS 798.3300
Remarks	:	Limited evidence of a carcinogenic effect. May cause cancer.

IARC No ingredient of this product present at levels greater than or equal to 0.1% is identified as probable, possible or confirmed human carcinogen by IARC.

OSHA No component of this product present at levels greater than or equal to 0.1% is on OSHA's list of regulated carcinogens.

NTP No ingredient of this product present at levels greater than or equal to 0.1% is identified as a known or anticipated carcinogen by NTP.

Reproductive toxicity

Suspected of damaging fertility or the unborn child if swallowed.

Components:

Phenol, isopropylated, phosphate (3:1):

Effects on fertility	:	Species: Rat, male and female Application Route: Oral General Toxicity Parent: NOAEL: 25 milligram per kilogram Remarks: Suspected of damaging fertility or the unborn child.

triphenylphosphate:

Reproductive toxicity - Assessment	:	Based on available data, the classification criteria are not met.

STOT-single exposure

Not classified based on available information.

Components:

Tributyl phosphate:

Assessment	:	Based on available data, the classification criteria are not met.

Triisobutyl phosphate:

Assessment	:	Not classified

Phenol, isopropylated, phosphate (3:1):

Remarks	:	Not classified due to data which are conclusive although insufficient for classification.

STOT-repeated exposure

May cause damage to organs (Adrenal gland) through prolonged or repeated exposure.

Components:

Tributyl phosphate:

Assessment : Based on available data, the classification criteria are not met.

Triisobutyl phosphate:

Assessment : Not classified

Phenol, isopropylated, phosphate (3:1):

Assessment : May cause damage to organs through prolonged or repeated exposure.

Repeated dose toxicity

Components:

Tributyl phosphate:

Species : Mouse, male and female
: 75 mg/kg
Application Route : in feed
Exposure time : 90 days

Triisobutyl phosphate:

Species : Rat, male
: 68.4 mg/kg
Application Route : Oral Study
Exposure time : 90 days

Aspiration toxicity

Not classified based on available information.

Product:

No aspiration toxicity classification

Components:

Triisobutyl phosphate:

Not classified

7-Oxabicyclo[4.1.0]heptane-3-carboxylic acid, 2-ethylhexyl ester:

Not applicable

Routes of exposure

Product:

Inhalation : Remarks: May cause damage to organs through prolonged or

repeated exposure.

Skin contact : Remarks: Causes skin irritation.

Eye contact : Remarks: None known.

Ingestion : Remarks: Harmful if swallowed.

Further information

Product:

Remarks : None known.

SECTION 12. ECOLOGICAL INFORMATION

Ecotoxicity

Components:

Tributyl phosphate:

Toxicity to fish	:	LC50 (Oncorhynchus mykiss (rainbow trout)): 4.2 mg/l Exposure time: 96 h
Toxicity to daphnia and other aquatic invertebrates	:	EC50 (Daphnia magna (Water flea)): 1.8 mg/l Exposure time: 48 h
Toxicity to algae/aquatic plants	:	EC50 (Desmodesmus subspicatus (green algae)): 1.1 mg/l Exposure time: 72 h
Toxicity to fish (Chronic toxicity)	:	NOEC (Oncorhynchus mykiss (rainbow trout)): 0.82 mg/l Exposure time: 95 d
		1.7 mg/l
Toxicity to daphnia and other aquatic invertebrates (Chronic toxicity)	:	NOEC (Daphnia magna (Water flea)): 1.3 mg/l Exposure time: 21 d

Triisobutyl phosphate:

Toxicity to fish	:	EC50 (Danio rerio (zebra fish)): > 12.6 mg/l Exposure time: 96 h
Toxicity to daphnia and other aquatic invertebrates	:	EC50 (Daphnia magna (Water flea)): 24 mg/l Exposure time: 48 h
Toxicity to algae/aquatic plants	:	ErC50 (Pseudokirchneriella subcapitata (algae)): 14.3 mg/l Exposure time: 72 h
		EC10 (Pseudokirchneriella subcapitata (algae)): 10.4 mg/l Exposure time: 72 h

Phenol, isopropylated, phosphate (3:1):

Toxicity to fish	:	LC50 (Oncorhynchus mykiss (rainbow trout)): 0.36 mg/l Exposure time: 96 h LC50 (Cyprinodon variegatus (sheepshead minnow)): > 1.3 mg/l Exposure time: 96 h
Toxicity to daphnia and other aquatic invertebrates	:	LC50 (Daphnia magna (Water flea)): 1 mg/l Exposure time: 48 h LC50 (Mysidopsis bahia (opossum shrimp)): > 1 mg/l
Toxicity to algae/aquatic plants	:	NOEC (Desmodesmus subspicatus (green algae)): 0.25 - 2.5 mg/l Exposure time: 72 h Test Type: Alga, Growth Inhibition Test
M-Factor (Acute aquatic toxicity)	:	1
M-Factor (Chronic aquatic toxicity)	:	1

triphenylphosphate:

Toxicity to fish	:	LC50 (Oncorhynchus mykiss (rainbow trout)): 0.4 mg/l Exposure time: 96 h
Toxicity to daphnia and other aquatic invertebrates	:	LC50 (Americamysis): > 0.18 - < 0.32 mg/l Exposure time: 96 h
Toxicity to algae/aquatic plants	:	NOEC (Pseudokirchneriella subcapitata (algae)): 0.25 mg/l Exposure time: 72 h
Toxicity to fish (Chronic toxicity)	:	EC10 (Oncorhynchus mykiss (rainbow trout)): 0.037 mg/l Exposure time: 30 d
Toxicity to daphnia and other aquatic invertebrates (Chronic toxicity)	:	NOEC (Daphnia magna (Water flea)): 0.254 mg/l Exposure time: 21 d

7-Oxabicyclo[4.1.0]heptane-3-carboxylic acid, 2-ethylhexyl ester:

Toxicity to fish	:	LC50 (Oncorhynchus mykiss (rainbow trout)): 2.9 mg/l Exposure time: 96 h
Toxicity to daphnia and other aquatic invertebrates	:	EC50 (Daphnia magna (Water flea)): 6.5 mg/l Exposure time: 48 h
Toxicity to algae/aquatic plants	:	ErC50 (Pseudokirchneriella subcapitata (algae)): 2.6 mg/l Exposure time: 72 h NOEC (Pseudokirchneriella subcapitata (algae)): 0.11 mg/l Exposure time: 72 h

Toxicity to microorganisms	:	EC50: 2.6 mg/l Exposure time: 72 h

butylated hydroxytoluene:

Toxicity to fish	:	LC50 (Danio rerio (zebra fish)): > 0.57 mg/l Exposure time: 96 h
Toxicity to daphnia and other aquatic invertebrates	:	EC50 (Daphnia magna (Water flea)): 0.48 mg/l Exposure time: 48 h
Toxicity to algae/aquatic plants	:	EC50 (Pseudokirchneriella subcapitata (algae)): > 0.24 mg/l Exposure time: 72 h NOEC (Pseudokirchneriella subcapitata (algae)): 0.24 mg/l Exposure time: 72 h
Toxicity to fish (Chronic toxicity)	:	NOEC (Oryzias latipes (Orange-red killifish)): 0.053 mg/l Exposure time: 30 d
Toxicity to daphnia and other aquatic invertebrates (Chronic toxicity)	:	NOEC (Daphnia magna (Water flea)): 0.069 mg/l Exposure time: 21 d

Persistence and degradability

Components:

Tributyl phosphate:

Biodegradability	:	Result: Readily biodegradable.

Triisobutyl phosphate:

Biodegradability	:	Result: Readily biodegradable. Biodegradation: 70 - 80 % Exposure time: 28 d Method: Ready Biodegradability: CO2 Evolution Test

Phenol, isopropylated, phosphate (3:1):

Biodegradability	:	Remarks: Not readily biodegradable.

triphenylphosphate:

Biodegradability	:	Result: Readily biodegradable.

7-Oxabicyclo[4.1.0]heptane-3-carboxylic acid, 2-ethylhexyl ester:

Biodegradability	:	Concentration: 100 mg/l Method: Ready Biodegradability: Modified MITI Test (I) Remarks: Readily biodegradable

Bioaccumulative potential

Components:

Tributyl phosphate:

Bioaccumulation	:	Species: Cyprinus carpio (Carp) Bioconcentration factor (BCF): 20 Exposure time: 56 d Method: OECD Test Guideline 305 Bioconcentration factor (BCF): 35 Exposure time: 38 d
Partition coefficient: n-octanol/water	:	Pow: 10,100

Triisobutyl phosphate:

Bioaccumulation	:	Remarks: Bioaccumulation is unlikely.
Partition coefficient: n-octanol/water	:	log Pow: 3.72

Phenol, isopropylated, phosphate (3:1):

Bioaccumulation	:	Remarks: Potential bioaccumulation

triphenylphosphate:

Partition coefficient: n-octanol/water	:	log Pow: 4.63

Mobility in soil

Components:

Phenol, isopropylated, phosphate (3:1):

Distribution among environmental compartments	:	log Koc: 3.43 - 3.93

Other adverse effects

No data available

SECTION 13. DISPOSAL CONSIDERATIONS

Disposal methods

Waste from residues	:	This product meets the criteria for a synthetic used oil under the U.S. EPA Standards for the Management of Used Oil (40 CFR 279). Those standards govern recycling and disposal in lieu of 40 CFR 260 -272 of the Federal hazardous waste program in states that have adopted these used oil regulations. Consult your attorney or appropriate regulatory official to be sure these standards have been adopted in your state. Recycle or burn in accordance with the applicable

standards.
Dispose of in accordance with local regulations.

SECTION 14. TRANSPORT INFORMATION

International Regulations

IATA-DGR

UN/ID No.	:	UN 3082
Proper shipping name	:	Environmentally hazardous substance, liquid, n.o.s. (triphenyl phosphate)
Class	:	9
Packing group	:	III
Labels	:	Miscellaneous
Packing instruction (cargo aircraft)	:	964
Packing instruction (passenger aircraft)	:	964
Remarks	:	Shipping in package sizes of less than 5 L (liquids) or 5 KG (solids) may lead to a non-regulated classification.

IMDG-Code

UN number	:	UN 3082
Proper shipping name	:	ENVIRONMENTALLY HAZARDOUS SUBSTANCE, LIQUID, N.O.S. (triphenyl phosphate)
Class	:	9
Packing group	:	III
Labels	:	9
EmS Code	:	F-A, S-F
Marine pollutant	:	yes
Remarks	:	Shipping in package sizes of less than 5 L (liquids) or 5 KG (solids) may lead to a non-regulated classification.

Transport in bulk according to Annex II of MARPOL 73/78 and the IBC Code

Not applicable for product as supplied.

Domestic regulation

49 CFR

UN/ID/NA number	:	UN 3082
Proper shipping name	:	Environmentally hazardous substance, liquid, n.o.s. (triphenyl phosphate)
Class	:	9
Packing group	:	III
Labels	:	CLASS 9
ERG Code	:	171
Marine pollutant	:	yes(triphenyl phosphate)
Remarks	:	Above applies only to containers over 119 gallons or 450 liters. Not regulated if shipped in packages less than or equal to 119 gallons (450 liters).

Special precautions for user

The transport classification(s) provided herein are for informational purposes only, and solely based upon the properties of the unpackaged material as it is described within this Safety Data Sheet. Transportation classifications may vary by mode of transportation, package sizes, and variations in regional or country regulations.

SECTION 15. REGULATORY INFORMATION

CERCLA Reportable Quantity

This material does not contain any components with a CERCLA RQ.

SARA 304 Extremely Hazardous Substances Reportable Quantity

This material does not contain any components with a section 304 EHS RQ.

SARA 302 Extremely Hazardous Substances Threshold Planning Quantity

This material does not contain any components with a section 302 EHS TPQ.

SARA 311/312 Hazards : Skin corrosion or irritation
Carcinogenicity
Reproductive toxicity
Specific target organ toxicity (single or repeated exposure)
Acute toxicity (any route of exposure)

SARA 313 : This material does not contain any chemical components with known CAS numbers that exceed the threshold (De Minimis) reporting levels established by SARA Title III, Section 313.

California Prop. 65

This product does not contain any chemicals known to the State of California to cause cancer, birth, or any other reproductive defects.

The ingredients of this product are reported in the following inventories:

DSL : All components of this product are on the Canadian DSL

AIIC : On the inventory, or in compliance with the inventory

ENCS : On the inventory, or in compliance with the inventory

IECSC : On the inventory, or in compliance with the inventory

TCSI : On the inventory, or in compliance with the inventory

TSCA : All substances listed as active on the TSCA inventory

TSCA list

The following substance(s) is/are subject to a Significant New Use Rule:

Potassium decafluoro(pentafluoroethyl)cyclohexanesulphonate	67584-42-3

The following substance(s) is/are subject to TSCA 12(b) export notification requirements:

Phenol, isopropylated, phosphate (3:1)	68937-41-7

The following substance(s) is/are subject to TSCA - 6 Risk Management Rules List of Chemicals:

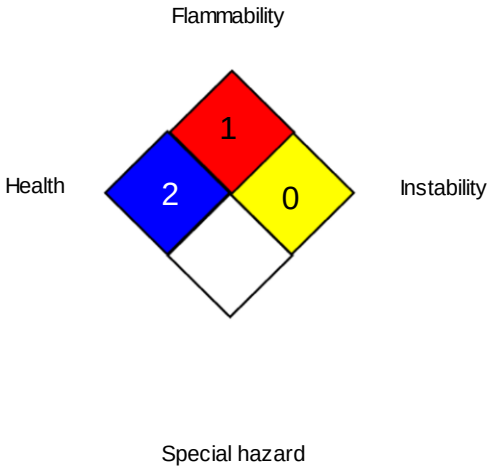
Phenol, isopropylated, phosphate (3:1) 68937-41-7

The Environmental Protection Agency prohibits processing and distribution of this chemical/product for any use other than: (1) In hydraulic fluids either for the aviation industry or to meet military specifications for safety and performance where no alternative chemical is available that meets U.S. Department of Defense specification requirements, (2) lubricants and greases, (3) new or replacement parts for motor and aerospace vehicles, (4) as an intermediate in the manufacture of cyanoacrylate glue, (5) in specialised engine air filters for locomotive and marine applications, and (6) in adhesives and sealants before January 6, 2025, after which use in adhesives and sealants is prohibited. In addition, all persons are prohibited from releasing PIP (3:1) to water during manufacturing, processing and distribution in commerce, and must follow all existing regulations and best practices to prevent the release of PIP (3:1) to water during the commercial use of PIP (3:1).

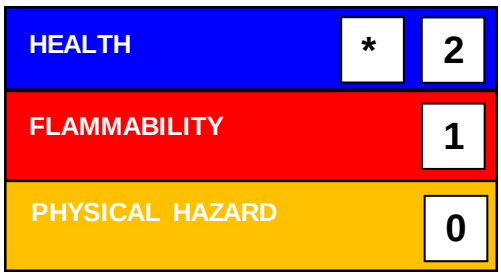
SECTION 16. OTHER INFORMATION

Further information

NFPA 704:



HMIS® IV:



HMIS® ratings are based on a 0-4 rating scale, with 0 representing minimal hazards or risks, and 4 representing significant hazards or risks. The "*" represents a chronic hazard, while the "/" represents the absence of a chronic hazard.

Full text of other abbreviations

ACGIH	:	USA. ACGIH Threshold Limit Values (TLV)
NIOSH REL	:	USA. NIOSH Recommended Exposure Limits
OSHA P0	:	USA. OSHA - TABLE Z-1 Limits for Air Contaminants - 1910.1000
OSHA Z-1	:	USA. Occupational Exposure Limits (OSHA) - Table Z-1 Limits for Air Contaminants
ACGIH / TWA	:	8-hour, time-weighted average
NIOSH REL / TWA	:	Time-weighted average concentration for up to a 10-hour workday during a 40-hour workweek
OSHA P0 / TWA	:	8-hour time weighted average
OSHA Z-1 / TWA	:	8-hour time weighted average

AIIC - Australian Inventory of Industrial Chemicals; ASTM - American Society for the Testing of Materials; bw - Body weight; CERCLA - Comprehensive Environmental Response, Compensation, and Liability Act; CMR - Carcinogen, Mutagen or Reproductive Toxicant; DIN - Standard of the German Institute for Standardisation; DOT - Department of Transportation; DSL - Domestic Substances List (Canada); ECx - Concentration associated with x% response; EHS - Extremely Hazardous Substance; ELx - Loading rate associated with x% response; EmS - Emergency Schedule; ENCS - Existing and New Chemical Substances (Japan); ErCx - Concentration associated with x% growth rate response; ERG - Emergency Response Guide; GHS - Globally Harmonized System; GLP - Good Laboratory Practice; HMIS - Hazardous Materials Identification System; IARC - International Agency for Research on Cancer; IATA - International Air Transport Association; IBC - International Code for the Construction and Equipment of Ships carrying Dangerous Chemicals in Bulk; IC50 - Half maximal inhibitory concentration; ICAO - International Civil Aviation Organization; IECSC - Inventory of Existing Chemical Substances in China; IMDG - International Maritime Dangerous Goods; IMO - International Maritime Organization; ISHL - Industrial Safety and Health Law (Japan); ISO - International Organisation for Standardization; KECI - Korea Existing Chemicals Inventory; LC50 - Lethal Concentration to 50 % of a test population; LD50 - Lethal Dose to 50% of a test population (Median Lethal Dose); MARPOL - International Convention for the Prevention of Pollution from Ships; MSHA - Mine Safety and Health Administration; n.o.s. - Not Otherwise Specified; NFPA - National Fire Protection Association; NO(A)EC - No Observed (Adverse) Effect Concentration; NO(A)EL - No Observed (Adverse) Effect Level; NOELR - No Observable Effect Loading Rate; NTP - National Toxicology Program; NZIoC - New Zealand Inventory of Chemicals; OECD - Organization for Economic Co-operation and Development; OPPTS - Office of Chemical Safety and Pollution Prevention; PBT - Persistent, Bioaccumulative and Toxic substance; PICCS - Philippines Inventory of Chemicals and Chemical Substances; (Q)SAR - (Quantitative) Structure Activity Relationship; RCRA - Resource Conservation and Recovery Act; REACH - Regulation (EC) No 1907/2006 of the European Parliament and of the Council concerning the Registration, Evaluation, Authorisation and Restriction of Chemicals; RQ - Reportable Quantity; SADT - Self-Accelerating Decomposition Temperature; SARA - Superfund Amendments and Reauthorization Act; SDS - Safety Data Sheet; TCSI - Taiwan Chemical Substance Inventory; TSCA - Toxic Substances Control Act (United States); UN - United Nations; UNRTDG - United Nations Recommendations on the Transport of Dangerous Goods; vPvB - Very Persistent and Very Bioaccumulative

Revision Date : 07/02/2021

The information provided in this Safety Data Sheet is correct to the best of our knowledge, information and belief at the date of its publication. The information given is designed only as a guidance for safe handling, use, processing, storage, transportation, disposal and release and is not to be considered a warranty or quality specification. The information relates only to the specific material designated and may not be valid for such material used in combination with any other materials or in any process, unless specified in the text.

US / Z8

SDS Exxon Mobil HyJetIV-A Plus

SAFETY DATA SHEET

SECTION 1 PRODUCT AND COMPANY IDENTIFICATION

PRODUCT

Product Name: **HYJET IV-A PLUS**
Product Description: Synthetic Base Stocks and Additives
Product Code: 201550303010, 430314-00, 97P282
Intended Use: Aviation hydraulic fluid

Restrictions on Use: The Environmental Protection Agency prohibits processing and distribution of this chemical/product for any use other than: (1) In hydraulic fluids either for the aviation industry or to meet military specifications for safety and performance where no alternative chemical is available that meets U.S. Department of Defense specification requirements, (2) lubricants and greases, (3) new or replacement parts for motor and aerospace vehicles, (4) as an intermediate in the manufacture of cyanoacrylate glue, (5) in specialized engine air filters for locomotive and marine applications, and (6) in adhesives and sealants before January 6, 2025, after which use in adhesives and sealants is prohibited. In addition, all persons are prohibited from releasing PIP (3:1) to water during manufacturing, processing and distribution in commerce, and must follow all existing regulations and best practices to prevent the release of PIP (3:1) to water during the commercial use of PIP (3:1).

COMPANY IDENTIFICATION

Supplier: **EXXON MOBIL CORPORATION**
22777 Springwoods Village Parkway
Spring, TX 77389 USA

24 Hour Health Emergency	609-737-4411
Transportation Emergency Phone	800-424-9300 or 703-527-3887 CHEMTREC
Product Technical Information	800-662-4525
MSDS Internet Address	www.exxon.com, www.mobil.com

SECTION 2 HAZARDS IDENTIFICATION

This material is hazardous according to regulatory guidelines (see (M)SDS Section 15).

CLASSIFICATION:

Acute oral toxicant: Category 4. Eye irritation: Category 2A. Reproductive toxicant (developmental): Category 2. Reproductive toxicant (fertility): Category 2. Specific target organ toxicant (repeated exposure): Category 2.

LABEL:
Pictogram:

Signal Word: Warning

Hazard Statements:
H302: Harmful if swallowed. H319: Causes serious eye irritation. H361: Suspected of damaging fertility or the unborn child. H373: May cause damage to organs through prolonged or repeated exposure. Adrenal, Liver

Precautionary Statements:
P201: Obtain special instructions before use. P202: Do not handle until all safety precautions have been read and understood. P260: Do not breathe mist / vapours. P264: Wash skin thoroughly after handling. P270: Do not eat, drink or smoke when using this product. P273: Avoid release to the environment. P280: Wear protective gloves/protective clothing/eye protection/face protection.P301 + P312: IF SWALLOWED: Call a POISON CENTER or doctor/physician if you feel unwell. P305 + P351 + P338: IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. P308 + P313: IF exposed or concerned: Get medical advice/ attention. P314: Get medical advice/attention if you feel unwell. P330: Rinse mouth. P337 + P313: If eye irritation persists: Get medical advice/attention. P391: Collect spillage.P405: Store locked up.P501: Dispose of contents and container in accordance with local regulations.

Contains: PHENOL, ISOPROPYLATED, PHOSPHATE (3:1) [TRIPHENYL PHOSPHATE > 5%]; TRIBUTYL PHOSPHATE

Other hazard information:

HAZARD NOT OTHERWISE CLASSIFIED (HNOC): None as defined under 29 CFR 1910.1200.

PHYSICAL / CHEMICAL HAZARDS
No significant hazards.

HEALTH HAZARDS
High-pressure injection under skin may cause serious damage. When heated, the vapors/fumes given off may cause respiratory tract irritation.

ENVIRONMENTAL HAZARDS
Expected to be very toxic to aquatic organisms. May cause long-term adverse effects in the aquatic environment. Expected to be harmful to aquatic organisms.

NFPA Hazard ID:	Health:	2	Flammability:	1	Reactivity:	0
HMIS Hazard ID:	Health:	2*	Flammability:	1	Reactivity:	0

NOTE: This material should not be used for any other purpose than the intended use in Section 1 without expert advice. Health studies have shown that chemical exposure may cause potential human health risks which may vary from person to person.

SECTION 3 COMPOSITION / INFORMATION ON INGREDIENTS

This material is defined as a mixture.

Hazardous Substance(s) or Complex Substance(s) required for disclosure

Name	CAS#	Concentration*	GHS Hazard Codes
2,6-DI-TERT-BUTYL-P-CRESOL	128-37-0	0.1 - < 1%	H400(M factor 1), H410(M factor 1)

CALCIUM ALKYLNAPHTHALENESULFONATE/CARBOXYLATE	57855-77-3	0.1 - < 1%	H315, H319(2A), H317
PHENOL, ISOPROPYLATED, PHOSPHATE (3:1) [TRIPHENYL PHOSPHATE > 5%]	68937-41-7	10 - < 20%	H361(D), H361(F), H373, H401, H410(M factor 10)
TRIBUTYL PHOSPHATE	126-73-8	70 - < 80%	H302, H315, H402, H412

* All concentrations are percent by weight unless material is a gas. Gas concentrations are in percent by volume.

As per paragraph (i) of 29 CFR 1910.1200, formulation is considered a trade secret and specific chemical identity and exact percentage (concentration) of composition may have been withheld. Specific chemical identity and exact percentage composition will be provided to health professionals, employees, or designated representatives in accordance with applicable provisions of paragraph (i).

SECTION 4 FIRST AID MEASURES

INHALATION
Immediately remove from further exposure. Get immediate medical assistance. For those providing assistance, avoid exposure to yourself or others. Use adequate respiratory protection. Give supplemental oxygen, if available. If breathing has stopped, assist ventilation with a mechanical device.

SKIN CONTACT
Wash contact areas with soap and water. Remove contaminated clothing. Launder contaminated clothing before reuse. If product is injected into or under the skin, or into any part of the body, regardless of the appearance of the wound or its size, the individual should be evaluated immediately by a physician as a surgical emergency. Even though initial symptoms from high pressure injection may be minimal or absent, early surgical treatment within the first few hours may significantly reduce the ultimate extent of injury.

EYE CONTACT
Flush thoroughly with water for at least 15 minutes. Get medical assistance.

INGESTION
Seek immediate medical attention. Do not induce vomiting.

SECTION 5 FIRE FIGHTING MEASURES

EXTINGUISHING MEDIA
Appropriate Extinguishing Media: Use water fog, foam, dry chemical or carbon dioxide (CO2) to extinguish flames.

Inappropriate Extinguishing Media: Straight Streams of Water

FIRE FIGHTING
Fire Fighting Instructions: Evacuate area. Prevent runoff from fire control or dilution from entering streams, sewers, or drinking water supply. Firefighters should use standard protective equipment and in enclosed spaces, self-contained breathing apparatus (SCBA). Use water spray to cool fire exposed surfaces and to protect personnel.

Unusual Fire Hazards: May generate irritating and harmful gases/vapors/fumes when burning. Pressurized mists may form a flammable mixture. Hazardous material. Firefighters should consider protective equipment indicated in Section 8.

Hazardous Combustion Products: Aldehydes, Incomplete combustion products, Nitrogen oxides, Phosphorus oxides, Smoke, Fume, Sulfur oxides

FLAMMABILITY PROPERTIES

Flash Point [Method]: 160°C (320°F) [ASTM D-92]
Flammable Limits (Approximate volume % in air): LEL: N/D UEL: N/D
Autoignition Temperature: 400°C (752°F)

SECTION 6 ACCIDENTAL RELEASE MEASURES

NOTIFICATION PROCEDURES

In the event of a spill or accidental release, notify relevant authorities in accordance with all applicable regulations. US regulations require reporting releases of this material to the environment which exceed the applicable reportable quantity or oil spills which could reach any waterway including intermittent dry creeks. The National Response Center can be reached at (800)424-8802.

PROTECTIVE MEASURES

Avoid contact with spilled material. Warn or evacuate occupants in surrounding and downwind areas if required due to toxicity or flammability of the material. See Section 5 for fire fighting information. See the Hazard Identification Section for Significant Hazards. See Section 4 for First Aid Advice. See Section 8 for advice on the minimum requirements for personal protective equipment. Additional protective measures may be necessary, depending on the specific circumstances and/or the expert judgment of the emergency responders.

SPILL MANAGEMENT

Land Spill: Eliminate all ignition sources (no smoking, flares, sparks or flames in immediate area). Stop leak if you can do it without risk. Prevent entry into waterways, sewer, basements or confined areas. Ventilate the area. Recover by pumping or with suitable absorbent. Absorb or cover with dry earth, sand or other non-combustible material and transfer to containers.

Water Spill: Stop leak if you can do it without risk. Material will sink. Remove material, as much as possible, using mechanical equipment.

Water spill and land spill recommendations are based on the most likely spill scenario for this material; however, geographic conditions, wind, temperature, (and in the case of a water spill) wave and current direction and speed may greatly influence the appropriate action to be taken. For this reason, local experts should be consulted. Note: Local regulations may prescribe or limit action to be taken.

ENVIRONMENTAL PRECAUTIONS

Large Spills: Dike far ahead of liquid spill for later recovery and disposal. Prevent entry into waterways, sewers, basements or confined areas.

SECTION 7 HANDLING AND STORAGE

HANDLING

Avoid all personal contact. Avoid vapors from heated materials to prevent exposure to potentially toxic/irritating fumes. Prevent small spills and leakage to avoid slip hazard.

Static Accumulator: This material is not a static accumulator.

STORAGE

Do not store in open or unlabelled containers.

SECTION 8 EXPOSURE CONTROLS / PERSONAL PROTECTION

EXPOSURE LIMIT VALUES

Exposure limits/standards (Note: Exposure limits are not additive)

Substance Name	Form	Limit / Standard			NOTE	Source
2,6-DI-TERT-BUTYL-P-CRESOL	Inhalable fraction and vapor	TWA	2 mg/m3		N/A	ACGIH
TRIBUTYL PHOSPHATE		TWA	5 mg/m3		N/A	OSHA Z1
TRIBUTYL PHOSPHATE	Inhalable fraction and vapor	TWA	5 mg/m3		N/A	ACGIH

NOTE: Limits/standards shown for guidance only. Follow applicable regulations.

No biological limits allocated.

ENGINEERING CONTROLS

The level of protection and types of controls necessary will vary depending upon potential exposure conditions. Control measures to consider:

Adequate ventilation should be provided so that exposure limits are not exceeded.

PERSONAL PROTECTION

Personal protective equipment selections vary based on potential exposure conditions such as applications, handling practices, concentration and ventilation. Information on the selection of protective equipment for use with this material, as provided below, is based upon intended, normal usage.

Respiratory Protection: If engineering controls do not maintain airborne contaminant concentrations at a level which is adequate to protect worker health, an approved respirator may be appropriate. Respirator selection, use, and maintenance must be in accordance with regulatory requirements, if applicable. Types of respirators to be considered for this material include:

No protection is ordinarily required under normal conditions of use and with adequate ventilation.

For high airborne concentrations, use an approved supplied-air respirator, operated in positive pressure mode. Supplied air respirators with an escape bottle may be appropriate when oxygen levels are inadequate, gas/vapor warning properties are poor, or if air purifying filter capacity/rating may be exceeded.

Hand Protection: Any specific glove information provided is based on published literature and glove manufacturer data. Glove suitability and breakthrough time will differ depending on the specific use conditions. Contact the glove manufacturer for specific advice on glove selection and breakthrough times for your use conditions. Inspect and replace worn or damaged gloves. The types of gloves to be considered for this material include:

Chemical resistant gloves are recommended.

Eye Protection: Chemical goggles are recommended.

Skin and Body Protection: Any specific clothing information provided is based on published literature or manufacturer data. The types of clothing to be considered for this material include:
Chemical/oil resistant clothing is recommended.

Specific Hygiene Measures: Always observe good personal hygiene measures, such as washing after handling the material and before eating, drinking, and/or smoking. Routinely wash work clothing and protective equipment to remove contaminants. Discard contaminated clothing and footwear that cannot be cleaned. Practice good housekeeping.

ENVIRONMENTAL CONTROLS

Comply with applicable environmental regulations limiting discharge to air, water and soil. Protect the environment by applying appropriate control measures to prevent or limit emissions.

SECTION 9 PHYSICAL AND CHEMICAL PROPERTIES

Note: Physical and chemical properties are provided for safety, health and environmental considerations only and may not fully represent product specifications. Contact the Supplier for additional information.

GENERAL INFORMATION

Physical State: Liquid
Form: Clear
Color: Violet
Odor: Sweet
Odor Threshold: N/D

IMPORTANT HEALTH, SAFETY, AND ENVIRONMENTAL INFORMATION

Relative Density (at 15 °C): 1.001
Flammability (Solid, Gas): N/A
Flash Point [Method]: 160°C (320°F) [ASTM D-92]
Flammable Limits (Approximate volume % in air): LEL: N/D UEL: N/D
Autoignition Temperature: 400°C (752°F)
Boiling Point / Range: 288°C (550°F)
Decomposition Temperature: N/D
Vapor Density (Air = 1): N/D
Vapor Pressure: 0.067 kPa (0.5 mm Hg) at 20 °C
Evaporation Rate (n-butyl acetate = 1): N/D
pH: N/D
Log Pow (n-Octanol/Water Partition Coefficient): N/D
Solubility in Water: Negligible
Viscosity: 10.1 cSt (10.1 mm2/sec) at 40 °C | 3.5 cSt (3.5 mm2/sec) at 100°C
Oxidizing Properties: See Hazards Identification Section.

OTHER INFORMATION

Freezing Point: N/D
Melting Point: N/D
Pour Point: < -62°C (-80°F)

SECTION 10 STABILITY AND REACTIVITY

REACTIVITY: See sub-sections below.

STABILITY: Material is stable under normal conditions.

CONDITIONS TO AVOID: Excessive heat.

MATERIALS TO AVOID: Strong oxidizers

HAZARDOUS DECOMPOSITION PRODUCTS: Material does not decompose at ambient temperatures.

POSSIBILITY OF HAZARDOUS REACTIONS: Hazardous polymerization will not occur.

SECTION 11 TOXICOLOGICAL INFORMATION

INFORMATION ON TOXICOLOGICAL EFFECTS

Hazard Class	Conclusion / Remarks
Inhalation	
Acute Toxicity: No end point data for material.	Minimally Toxic. Based on assessment of the components.
Irritation: No end point data for material.	Elevated temperatures or mechanical action may form vapors, mist, or fumes which may be irritating to the eyes, nose, throat, or lungs.
Ingestion	
Acute Toxicity (Rat): LD50 1671 mg/kg	Slightly toxic. Based on test data for the material. Test(s) equivalent or similar to OECD Guideline 401
Skin	
Acute Toxicity: No end point data for material.	Minimally Toxic. Based on assessment of the components.
Skin Corrosion/Irritation (Rabbit): Data available.	Negligible irritation to skin at ambient temperatures. Based on test data for the material. Test(s) equivalent or similar to OECD Guideline 404
Eye	
Serious Eye Damage/Irritation (Rabbit): Data available.	Irritating and will injure eye tissue. Based on test data for structurally similar materials. Test(s) equivalent or similar to OECD Guideline 405
Sensitization	
Respiratory Sensitization: No end point data for material.	Not expected to be a respiratory sensitizer.
Skin Sensitization: No end point data for material.	Not expected to be a skin sensitizer. Based on assessment of the components.
Aspiration: Data available.	Not expected to be an aspiration hazard. Based on physico-chemical properties of the material.
Germ Cell Mutagenicity: No end point data for material.	Not expected to be a germ cell mutagen. Based on assessment of the components.
Carcinogenicity: No end point data for material.	Not expected to cause cancer. Based on assessment of the components.
Reproductive Toxicity: No end point data for material.	Caused damage to fertility in laboratory animals, but the relevance to humans is uncertain. Caused damage to the fetus in laboratory animals, but the relevance to humans is uncertain.

	Based on assessment of the components.
Lactation: No end point data for material.	Not expected to cause harm to breast-fed children.
Specific Target Organ Toxicity (STOT)	
Single Exposure: No end point data for material.	Not expected to cause organ damage from a single exposure.
Repeated Exposure: No end point data for material.	Contains a substance that may cause damage to organs from prolonged or repeated exposure. Based on assessment of the components.

TOXICITY FOR SUBSTANCES

NAME	ACUTE TOXICITY
TRIBUTYL PHOSPHATE	Oral Lethality: LD50 1552 ml/kg (Rat)

OTHER INFORMATION

For the product itself:

Target Organs Repeated Exposure: Adrenal, Liver

Component concentrations in this formulation would not be expected to cause skin sensitization, based on tests of the components, this formulation, or similar formulations.

Contains:

Tributyl phosphate (TBP): Studies in rats have shown an increased incidence of urinary bladder tumors following long-term feeding of TBP in the diet. No bladder tumors were observed in similar studies in mice. The relevance of these findings for humans is uncertain.

Isopropylphenyl phosphate (iPP). Reproductive / developmental toxicity screening studies in rats of products containing high concentrations of iPP adversely affected male and female reproductive performance with significant reductions in fertility and conception indices. Number of rat pups born and live litter size were decreased in groups exposed to the iPP-containing products, while pup mortality was increased.

The following ingredients are cited on the lists below: None.

--REGULATORY LISTS SEARCHED--

1 = NTP CARC
2 = NTP SUS
3 = IARC 1
4 = IARC 2A
5 = IARC 2B
6 = OSHA CARC

SECTION 12 ECOLOGICAL INFORMATION

The information given is based on data for the material, components of the material, or for similar materials, through the application of bridging principals.

ECOTOXICITY

Material -- Expected to be very toxic to aquatic organisms. May cause long-term adverse effects in the aquatic environment.

Material -- Expected to be harmful to aquatic organisms.

SECTION 13 DISPOSAL CONSIDERATIONS

Disposal recommendations based on material as supplied. Disposal must be in accordance with current applicable laws and regulations, and material characteristics at time of disposal.

DISPOSAL RECOMMENDATIONS

Dispose of waste at an appropriate treatment & disposal facility in accordance with applicable laws and regulations, and product characteristics at time of disposal. Protect the environment. Dispose of used oil at designated sites. Minimize skin contact. Do not mix used oils with solvents, brake fluids or coolants. Product is suitable for burning in an enclosed, controlled burner for fuel value or disposal by supervised incineration.

REGULATORY DISPOSAL INFORMATION

RCRA Information: The unused product, in our opinion, is not specifically listed by the EPA as a hazardous waste (40 CFR, Part 261D), nor is it formulated to contain materials which are listed as hazardous wastes. It does not exhibit the hazardous characteristics of ignitability, corrositivity or reactivity and is not formulated with contaminants as determined by the Toxicity Characteristic Leaching Procedure (TCLP). However, used product may be regulated.

Empty Container Warning Empty Container Warning (where applicable): Empty containers may contain residue and can be dangerous. Do not attempt to refill or clean containers without proper instructions. Empty drums should be completely drained and safely stored until appropriately reconditioned or disposed. Empty containers should be taken for recycling, recovery, or disposal through suitably qualified or licensed contractor and in accordance with governmental regulations. DO NOT PRESSURISE, CUT, WELD, BRAZE, SOLDER, DRILL, GRIND, OR EXPOSE SUCH CONTAINERS TO HEAT, FLAME, SPARKS, STATIC ELECTRICITY, OR OTHER SOURCES OF IGNITION. THEY MAY EXPLODE AND CAUSE INJURY OR DEATH.

SECTION 14 TRANSPORT INFORMATION

LAND (DOT): Not Regulated for Land Transport

Footnote: This material is not regulated under 49 CFR if in a container of 119 gallon capacity or less, except when transported by vessel.

LAND (TDG): Not Regulated for Land Transport

Footnote: Regulated under TDG as UN 3082, Environmentally Hazardous Substance, liquid, Class 9, Marine Pollutant, only when transported by ship.

SEA (IMDG)

Proper Shipping Name: ENVIRONMENTALLY HAZARDOUS SUBSTANCE, LIQUID, N.O.S. (PHENOL, ISOPROPYLATED, PHOSPHATE (3:1) [TRIPHENYL PHOSPHATE > 5%])
Hazard Class & Division: 9
EMS Number: F-A, S-F
UN Number: 3082
Packing Group: III
Marine Pollutant: Yes
Label(s): 9
Transport Document Name: UN3082, ENVIRONMENTALLY HAZARDOUS SUBSTANCE, LIQUID, N.O.S. (PHENOL, ISOPROPYLATED, PHOSPHATE (3:1) [TRIPHENYL PHOSPHATE > 5%]), 9, PG III

Footnote: Not subject to the provisions of UN3082 Environmentally hazardous substances liquid, n.o.s., if

shipped in quantities of 5 liters or less per single or inner combination packaging as per IMDG code 2.10.2.7.

AIR (IATA)

Proper Shipping Name: ENVIRONMENTALLY HAZARDOUS SUBSTANCES, LIQUID, N.O.S. (PHENOL, ISOPROPYLATED, PHOSPHATE (3:1) [TRIPHENYL PHOSPHATE > 5%])
Hazard Class & Division: 9
UN Number: 3082
Packing Group: III
Label(s) / Mark(s): 9, EHS
Transport Document Name: UN3082, ENVIRONMENTALLY HAZARDOUS SUBSTANCES, LIQUID, N.O.S. (PHENOL, ISOPROPYLATED, PHOSPHATE (3:1) [TRIPHENYL PHOSPHATE > 5%]), 9, PG III

[Footnote: Not subject to the provisions of UN3082 Environmentally hazardous substances liquid, n.o.s., if shipped in quantities of 5 liters or less per single or inner combination packaging as per Special Provision A197.]

SECTION 15 REGULATORY INFORMATION

OSHA HAZARD COMMUNICATION STANDARD: This material is considered hazardous in accordance with OSHA HazCom 2012, 29 CFR 1910.1200.

Listed or exempt from listing/notification on the following chemical inventories: AIIC, DSL, IECSC, TSCA
Special Cases:

Inventory	Status
KECI	Restrictions Apply

SARA 302: No chemicals in this material are subject to the reporting requirements of SARA Title III, Section 302

SARA (311/312) REPORTABLE GHS HAZARD CLASSES: Acute Toxicity (any route of exposure), Reproductive toxicity, Serious eye damage or eye irritation, Specific Target Organ toxicity (single or repeated exposure)

SARA (313) TOXIC RELEASE INVENTORY: This material contains no chemicals subject to the supplier notification requirements of the SARA 313 Toxic Release Program.

Regulation of Persistent, Bioaccumulative, and Toxic Chemicals Under TSCA Section 6(h): The Environmental Protection Agency prohibits processing and distribution of this chemical/product for any use other than: (1) In hydraulic fluids either for the aviation industry or to meet military specifications for safety and performance where no alternative chemical is available that meets U.S. Department of Defense specification requirements, (2) lubricants and greases, (3) new or replacement parts for motor and aerospace vehicles, (4) as an intermediate in the manufacture of cyanoacrylate glue, (5) in specialized engine air filters for locomotive and marine applications, and (6) in adhesives and sealants before January 6, 2025, after which use in adhesives and sealants is prohibited. In addition, all persons are prohibited from releasing PIP (3:1) to water during manufacturing, processing and distribution in commerce, and must follow all existing regulations and best practices to prevent the release of PIP (3:1) to water during the commercial use of PIP (3:1).

The following ingredients are cited on the lists below:

Chemical Name	CAS Number	List Citations

2,6-DI-TERT-BUTYL-P-CRESOL	128-37-0	1
CYCLOHEXANESULFONIC ACID, DECAFLUORO(PENTAFLUOROETHYL)-, POTASSIUM SALT	67584-42-3	6
TRIBUTYL PHOSPHATE	126-73-8	1, 4, 13, 16, 18

--REGULATORY LISTS SEARCHED--

1 = ACGIH ALL	6 = TSCA 5a2	11 = CA P65 REPRO	16 = MN RTK
2 = ACGIH A1	7 = TSCA 5e	12 = CA RTK	17 = NJ RTK
3 = ACGIH A2	8 = TSCA 6	13 = IL RTK	18 = PA RTK
4 = OSHA Z	9 = TSCA 12b	14 = LA RTK	19 = RI RTK
5 = TSCA 4	10 = CA P65 CARC	15 = MI 293	

Code key: CARC=Carcinogen; REPRO=Reproductive

SECTION 16 OTHER INFORMATION

N/D = Not determined, N/A = Not applicable

KEY TO THE H-CODES CONTAINED IN SECTION 3 OF THIS DOCUMENT (for information only):
H302: Harmful if swallowed; Acute Tox Oral, Cat 4
H315: Causes skin irritation; Skin Corr/Irritation, Cat 2
H317: May cause allergic skin reaction; Skin Sensitization, Cat 1
H319(2A): Causes serious eye irritation; Serious Eye Damage/Irr, Cat 2A
H361: Suspected of damaging fertility or the unborn child.; Repro Tox, Cat 2
H361(D): Suspected of damaging the unborn child; Repro Tox, Cat 2 (Develop)
H361(F): Suspected of damaging fertility; Repro Tox, Cat 2 (Fertility)
H373: May cause damage to organs through prolonged or repeated exposure; Target Organ, Repeated, Cat 2
H400: Very toxic to aquatic life; Acute Env Tox, Cat 1
H401: Toxic to aquatic life; Acute Env Tox, Cat 2
H402: Harmful to aquatic life; Acute Env Tox, Cat 3
H410: Very toxic to aquatic life with long lasting effects; Chronic Env Tox, Cat 1
H412: Harmful to aquatic life with long lasting effects; Chronic Env Tox, Cat 3

THIS SAFETY DATA SHEET CONTAINS THE FOLLOWING REVISIONS:
Composition: Component Table information was modified.
Hazard Identification: Physical/Chemical Hazard information was added.
Hazard Identification: Physical/Chemical Hazard information was deleted.
Section 12: Ecological Information - Acute Aquatic Toxicity information was added.
Section 12: Ecological Information - Acute Aquatic Toxicity information was deleted.

Internal Use Only

MHC: 1, 0, 0, 2, 0, 1 PPEC: D

DGN: 2027160XUS (552689)

SDS Safewing Type I ACFT Deicing

SECTION 1. IDENTIFICATION

Identification of the company:

Clariant Corporation
4000 Monroe Road
Charlotte, NC, 28205
Telephone No.: +1 704 331 7000

Information of the substance/preparation:
BU Industrial & Consumer Specialties
Product Stewardship, +1-704-331-7710

Emergency tel. number: +1 800-424-9300(CHEMTREC)

Trade name: **Safewing MP I LFD 88**
Material number: 304580

Primary product use: Aircraft de-icing

Chemical family: Aqueous solution of corrosion inhibitors and surface active agents in propylene glycol

SECTION 2. HAZARDS IDENTIFICATION

GHS classification in accordance with 29 CFR 1910.1200

Not a hazardous substance or mixture.

GHS label elements

Not a hazardous substance or mixture.

Other hazards

None known.

SECTION 3. COMPOSITION/INFORMATION ON INGREDIENTS

Substance / Mixture : Mixture

Substance name : Aqueous solution of corrosion inhibitors and surface active agents in propylene glycol

Hazardous components

Chemical name	CAS-No.	Concentration (% w/w)
Propylene Glycol	57-55-6	70 - 90

Any concentration shown as a range is to protect confidentiality or is due to batch variation.

SECTION 4. FIRST AID MEASURES

General advice : Remove/Take off immediately all contaminated clothing. Get medical advice/ attention if you feel unwell.

If inhaled : Move the victim to fresh air.

Give oxygen or artificial respiration if needed.
Get immediate medical advice/ attention.

In case of skin contact	:	Remove contaminated clothing and shoes. Wash off with soap and plenty of water. Wash off immediately with plenty of water for at least 15 minutes. Get medical attention if irritation develops and persists.
In case of eye contact	:	Rinse immediately with plenty of water, also under the eyelids, for at least 15 minutes. Get immediate medical advice/ attention.
If swallowed	:	Rinse mouth. Do NOT induce vomiting. Never give anything by mouth to an unconscious person. Get medical advice/ attention.
Most important symptoms and effects, both acute and delayed	:	The possible symptoms known are those derived from the labelling (see section 2). No additional symptoms are known.
Notes to physician	:	Treat symptomatically.

SECTION 5. FIREFIGHTING MEASURES

Suitable extinguishing media	:	Water spray jet Alcohol-resistant foam Dry powder Carbon dioxide (CO2)
Unsuitable extinguishing media	:	High volume water jet
Specific hazards during firefighting	:	In case of fires, hazardous combustion gases are formed: Carbon monoxide (CO) Carbon dioxide (CO2) Sulphur dioxide (SO2)
Further information	:	In the event of fire and/or explosion do not breathe fumes. Do not allow run-off from fire fighting to enter drains or water courses. Fire residues and contaminated fire extinguishing water must be disposed of in accordance with local regulations.
Special protective equipment for firefighters	:	Wear an approved positive pressure self-contained breathing apparatus in addition to standard fire fighting gear.

SECTION 6. ACCIDENTAL RELEASE MEASURES

Personal precautions, protective equipment and emergency procedures	:	Refer to protective measures listed in sections 7 and 8. Avoid contact with skin, eyes and clothing. Wash thoroughly after handling.
Environmental precautions	:	The product should not be allowed to enter drains, water courses or the soil.
Methods and materials for containment and cleaning up	:	Prevent product from entering drains. Non-sparking tools should be used. Take measures to prevent the build up of electrostatic charge. Contain spillage, soak up with non-combustible absorbent material, (e.g. sand, earth, diatomaceous earth, vermiculite) and transfer to a container for disposal according to local / national regulations (see section 13). Clean contaminated surface thoroughly.

SECTION 7. HANDLING AND STORAGE

Advice on protection against fire and explosion	:	Observe the general rules of industrial fire protection
Advice on safe handling	:	Handle in accordance with good industrial hygiene and safety practice. For personal protection see section 8. Avoid contact with skin, eyes and clothing. Use only with adequate ventilation. Do not breathe dust/ fume/ gas/ mist/ vapours/ spray. Keep away from heat, sparks and open flames. Store in proper container and keep container closed when not in use.
Technical measures/Precautions	:	Keep containers tightly closed in a cool, well-ventilated place. Handle and open container with care.

SECTION 8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Components with workplace control parameters

Components	CAS-No.	Value type (Form of exposure)	Control parameters / Permissible concentration	Basis
Propylene Glycol	57-55-6	TWA	10 mg/m3	US WEEL

Engineering measures : Use engineering controls such as local or general exhaust to maintain airborne concentrations below exposure limits.

Personal protective equipment

Respiratory protection : Use respiratory protection in case of insufficient exhaust ventilation or prolonged exposure

Hand protection
Remarks : Chemical resistant gloves (butyl rubber, nitrile rubber,

polyvinyl alcohol). However, please note that PVA degrades in water.

Eye protection	:	Chemical splash goggles with face shield.
Skin and body protection	:	Wear suitable protective equipment.
Protective measures	:	Observe the usual precautions for handling chemicals. Avoid contact with skin and eyes.
Hygiene measures	:	Wash hands before breaks and at the end of workday. Use protective skin cream before handling the product. Take off immediately all contaminated clothing and wash it before reuse.

SECTION 9. PHYSICAL AND CHEMICAL PROPERTIES

Appearance	:	Liquid
Colour	:	orange
Odour	:	characteristic
Odour Threshold	:	no data available
pH	:	ca. 7.5 (20 °C)
pour point	:	< -50 °C
Boiling point	:	125 °C
Flash point	:	ca. 100 °C
Evaporation rate	:	not determined
Flammability (solid, gas)	:	Not applicable
Self-ignition	:	no data available
Upper explosion limit	:	no data available
Lower explosion limit	:	no data available
Vapour pressure	:	no data available
Relative vapour density	:	no data available
Relative density	:	no data available
Density	:	ca. 1.042 g/cm3 (25 °C)

		ca. 1.107 g/cm3 (40 °C)
Bulk density	:	no data available
Solubility(ies)		
Water solubility	:	completely soluble
Partition coefficient: n-octanol/water	:	Not applicable
Auto-ignition temperature	:	no data available
Decomposition temperature	:	no data available
Viscosity		
Viscosity, dynamic	:	ca. 39 mPa.s (15 °C)
		ca. 22 mPa.s (25 °C)
Viscosity, kinematic	:	no data available
Explosive properties	:	Not explosive
Oxidizing properties	:	The substance or mixture is not classified as oxidizing. The product does not contain organic peroxide-groups which result from either the manufacturing process or from added ingredients.
Metal corrosion rate	:	Not corrosive to metals

SECTION 10. STABILITY AND REACTIVITY

Reactivity	:	No dangerous reaction known under conditions of normal use.
Chemical stability	:	Stable under normal conditions.
Possibility of hazardous reactions	:	No dangerous reaction known under conditions of normal use. Stable
Conditions to avoid	:	None known.
Incompatible materials	:	not known
Hazardous decomposition products	:	When handled and stored appropriately, no dangerous decomposition products are known

SECTION 11. TOXICOLOGICAL INFORMATION

Acute toxicity

Product:

Acute oral toxicity	:	Remarks: not tested.

Acute inhalation toxicity : Remarks: not tested.

Acute dermal toxicity : Acute toxicity estimate: 2,841 mg/kg
Method: Calculation method

Components:

Propylene Glycol:

Acute oral toxicity : LD50 (Rat, male and female): 22,000 mg/kg
Method: Other
GLP: no

Acute inhalation toxicity : LC50 (Rabbit): > 317.042 mg/l
Exposure time: 2 h
Test atmosphere: vapour
Method: Other
GLP: no

Acute dermal toxicity : LD50 (Rabbit): > 2,000 mg/kg
Method: Other
GLP: no

Skin corrosion/irritation

Components:

Propylene Glycol:

Species: Rabbit
Exposure time: 4 h
Method: OECD Test Guideline 404
Result: No skin irritation
GLP: No information available.

Serious eye damage/eye irritation

Components:

Propylene Glycol:

Species: rabbit eye
Result: non-irritant
Method: OECD Test Guideline 405
GLP: No information available.

Respiratory or skin sensitisation

Product:

Remarks: no data available

Components:

Propylene Glycol:

Test Type: Guinea pig maximization test
Exposure routes: Skin contact

Species: Guinea pig
Method: OECD Test Guideline 406
Result: Does not cause skin sensitisation.
GLP: No information available.

Test Type: Mouse local lymphnode assay
Exposure routes: Skin contact
Species: Mouse
Method: OECD Test Guideline 429
Result: Does not cause skin sensitisation.
GLP: No information available.

Germ cell mutagenicity

Product:

Germ cell mutagenicity - Assessment : No information available.

Components:

Propylene Glycol:

Genotoxicity in vitro : Test Type: Ames test
Species: Salmonella typhimurium
Concentration: <= 10 mg/plate
Metabolic activation: with
Method: Ames test
Result: negative
GLP: No information available.

: Test Type: Chromosome aberration test in vitro
Species: Cultured peripheral human lymphocytes
Concentration: 7,4 - 3810 µg/ml
Metabolic activation: with and without metabolic activation
Method: OECD Test Guideline 473
Result: negative
GLP: yes

Genotoxicity in vivo : Test Type: Chromosome Aberration Test
Species: Rat (male)
Strain: Sprague-Dawley
Cell type: Bone marrow
Application Route: oral (gavage)
Exposure time: 6 - 24 - 48 h
Dose: 30 - 2500 - 5000 mg/kg
Method: Other
Result: negative
GLP: no

Test Type: Chromosome Aberration Test
Species: Mouse (male)
Cell type: Erythrocytes
Application Route: Intraperitoneal injection
Exposure time: 18 h

Dose: 2500-5000-10000-15000 mg/kg
Method: Other
Result: negative
GLP: No information available.

Germ cell mutagenicity - Assessment : It is concluded that the product is not mutagenic based on evaluation of several mutagenicity tests.

Carcinogenicity

Product:

Carcinogenicity - Assessment : No information available.

Components:

Propylene Glycol:

Carcinogenicity - Assessment : Not classifiable as a human carcinogen.

IARC Not listed

OSHA Not listed

NTP Not listed

Reproductive toxicity

Product:

Reproductive toxicity - Assessment : No information available.

No information available.

Components:

Propylene Glycol:

Effects on fertility : Test Type: Two-generation study
Species: Mouse, male and female
Strain: CD1
Application Route: oral (gavage)
Dose: 1820 - 4800 - 10100 mg/kg
General Toxicity - Parent: NOAEL: 10,100 mg/kg body weight
General Toxicity F1: NOAEL: 10,100 mg/kg body weight
General Toxicity F2: NOAEL: 10,100 mg/kg body weight
Method: Other
GLP: No information available.

Effects on foetal development : Species: Mouse
Strain: CD1
Application Route: oral (gavage)
Dose: 52 - 520 - 10400 mg/kg

General Toxicity Maternal: NOAEL: 52 mg/kg body weight
Teratogenicity: NOAEL: 10,400 mg/kg body weight
Method: OECD Test Guideline 414
GLP: yes

Reproductive toxicity - Assessment : No reproductive toxicity to be expected.
No teratogenic effects to be expected.

STOT - single exposure

Components:

Propylene Glycol:

Assessment: The substance or mixture is not classified as specific target organ toxicant, single exposure.

STOT - repeated exposure

Product:

Remarks: no data available

Components:

Propylene Glycol:

Assessment: The substance or mixture is not classified as specific target organ toxicant, repeated exposure.

Repeated dose toxicity

Product:

Remarks: no data available

Components:

Propylene Glycol:

Species: Rat, male and female
NOAEL: 1,700 - 2,100 mg/kg
Application Route: oral (feed)
Exposure time: 2 a
Number of exposures: daily
Dose: 200-2100 mg/kg
Group: yes
Method: Other
GLP: no

Species: Cat, male
NOAEL: 443 mg/kg
Application Route: oral (feed)
Exposure time: 69 - 94 d
Number of exposures: daily
Dose: 80 - 4239 mg/kg
Group: yes

Method: Other
GLP: no

Species: Rat, male and female
NOAEL: 1 - 2.2 mg/l
Application Route: Inhalation
Exposure time: 90 d
Number of exposures: 6 hours/day, 5 days/week
Dose: 0,16 - 1,01 - 2,18 mg/l
Group: yes
Method: Other
GLP: No information available.

Species: Mouse, female
NOAEL: 0.02
Application Route: Skin contact
Exposure time: Lifespan
Number of exposures: 2x / w
Dose: 10-50-100% / 0.02 ml acetone
Group: yes
Method: Other
GLP: no
Remarks: No pathological findings

Aspiration toxicity

Product:

no data available

Components:

Propylene Glycol:

No aspiration toxicity classification

Experience with human exposure

Product:

General Information : The possible symptoms known are those derived from the labelling (see section 2).

SECTION 12. ECOLOGICAL INFORMATION

Ecotoxicity

Product:

Toxicity to fish :
Remarks: no data available

Toxicity to daphnia and other aquatic invertebrates :
Remarks: no data available

Toxicity to algae :
Remarks: no data available

Toxicity to microorganisms : Remarks: no data available

Components:

Propylene Glycol:

Toxicity to fish : LC50 (Oncorhynchus mykiss (rainbow trout)): 40,613 mg/l
Exposure time: 96 h
Test Type: static test
Analytical monitoring: yes
Method: Other
GLP: no

Toxicity to daphnia and other aquatic invertebrates : LC50 (Mysidopsis bahia (opossum shrimp)): 18,800 mg/l
Exposure time: 96 h
Test Type: static test
Analytical monitoring: yes
Method: Other
GLP: yes

Toxicity to algae : EC50 (Pseudokirchneriella subcapitata (green algae)): 19,000 mg/l
End point: Growth rate
Exposure time: 96 h
Test Type: static test
Analytical monitoring: yes
Method: OECD Test Guideline 201
GLP: yes

NOEC (Pseudokirchneriella subcapitata (green algae)): 15,000 mg/l
End point: Growth rate
Exposure time: 14 d
Test Type: static test
Analytical monitoring: yes
Method: OECD Test Guideline 201
GLP: yes

Toxicity to fish (Chronic toxicity) : Chronic Toxicity Value (Fish): 2,500 mg/l
End point: Other
Exposure time: 30 d
Method: Other
GLP: no

Toxicity to daphnia and other aquatic invertebrates (Chronic toxicity) : NOEC (Ceriodaphnia spec.): 13,020 mg/l
End point: Reproduction rate
Exposure time: 7 d
Test Type: semi-static test
Analytical monitoring: yes
Method: Other
GLP: No information available.

Toxicity to microorganisms	:	NOEC (Pseudomonas putida): > 20,000 mg/l End point: Growth rate Exposure time: 18 h Test Type: aquatic Analytical monitoring: no Method: Other GLP: no Remarks: The details of the toxic effect relate to the nominal concentration.
Toxicity to soil dwelling organisms	:	Remarks: The study is not necessary from a scientific perspective.
Plant toxicity	:	Remarks: The study is not necessary from a scientific perspective.
Sediment toxicity	:	Remarks: The study is not necessary from a scientific perspective.
Toxicity to terrestrial organisms	:	Remarks: The study is not necessary from a scientific perspective.

Persistence and degradability

Product:

Biodegradability	:	Remarks: Not applicable

Components:

Propylene Glycol:

Biodegradability	:	aerobic Inoculum: activated sludge, domestic Concentration: 100 mg/l ThOD BOD in % of theoretical OD Result: Readily biodegradable. Biodegradation: 100 % Exposure time: 28 d Method: OECD Test Guideline 301F GLP: yes aerobic Inoculum: activated sludge, domestic Concentration: 50.3 mg/l CO2 formation in % of theoretical value Result: Readily biodegradable. Biodegradation: 90.6 % Exposure time: 64 d Method: OECD Test Guideline 306 GLP: yes

Bioaccumulative potential

Components:

Propylene Glycol:

Bioaccumulation	:	Bioconcentration factor (BCF): 0.09 Method: calculated GLP: no

Mobility in soil

Components:

Propylene Glycol:

Distribution among environmental compartments	:	Adsorption/Soil Medium: water - soil log Koc: 0.46 Method: other (calculated)

Other adverse effects

Product:

Additional ecological information	:	no data available

Components:

Propylene Glycol:

Environmental fate and pathways	:	not available
Results of PBT and vPvB assessment	:	This substance is not considered to be persistent, bioaccumulating and toxic (PBT).
Additional ecological information	:	Do not allow to enter ground water, waterways or waste water.

SECTION 13. DISPOSAL CONSIDERATIONS

Disposal methods

RCRA - Resource Conservation and Recovery Authorization Act	:	This product, if discarded as sold, is not a Federal RCRA hazardous waste.
Waste Code	:	NONE
Waste from residues	:	Small quantities may be treated in aerobic wastewater treatment systems. Larger quantities may be incinerated or landfilled after solidification in permitted systems.
Contaminated packaging	:	Packaging that cannot be cleaned should be disposed of as product waste

SECTION 14. TRANSPORT INFORMATION

DOT not restricted

IATA not restricted

IMDG not restricted

SECTION 15. REGULATORY INFORMATION

EPCRA - Emergency Planning and Community Right-to-Know Act

CERCLA Reportable Quantity

Components	CAS-No.	Component RQ (lbs)	Calculated product RQ (lbs)
Potassium hydroxide	1310-58-3	1000	*

*: Calculated RQ exceeds reasonably attainable upper limit.

SARA 304 Extremely Hazardous Substances Reportable Quantity

This material does not contain any components with a section 304 EHS RQ.

SARA 302 Extremely Hazardous Substances Threshold Planning Quantity

This material does not contain any components with a section 302 EHS TPQ.

SARA 311/312 Hazards : No SARA Hazards

SARA 313 : This material does not contain any chemical components with known CAS numbers that exceed the threshold (De Minimis) reporting levels established by SARA Title III, Section 313.

Clean Water Act

This product does not contain any toxic pollutants listed under the U.S. Clean Water Act Section 307

The components of this product are reported in the following inventories:

TSCA : On TSCA Inventory

SECTION 16. OTHER INFORMATION

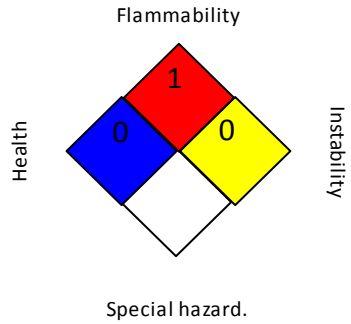
Full text of other abbreviations

AICS - Australian Inventory of Chemical Substances; ASTM - American Society for the Testing of Materials; bw - Body weight; CERCLA - Comprehensive Environmental Response, Compensation, and Liability Act; CMR - Carcinogen, Mutagen or Reproductive Toxicant; DIN - Standard of the German Institute for Standardisation; DOT - Department of Transportation; DSL - Domestic Substances List (Canada); ECx - Concentration associated with x% response; EHS - Extremely Hazardous Substance; ELx - Loading rate associated with x% response; EmS - Emergency Schedule; ENCS - Existing and New Chemical Substances (Japan); ErCx - Concentration associated with x% growth rate response; ERG - Emergency Response Guide; GHS - Globally Harmonized System; GLP - Good Laboratory Practice; HMIS - Hazardous Materials Identification System; IARC - International Agency for Research on Cancer; IATA -

International Air Transport Association; IBC - International Code for the Construction and Equipment of Ships carrying Dangerous Chemicals in Bulk; IC50 - Half maximal inhibitory concentration; ICAO - International Civil Aviation Organization; IECSC - Inventory of Existing Chemical Substances in China; IMDG - International Maritime Dangerous Goods; IMO - International Maritime Organization; ISHL - Industrial Safety and Health Law (Japan); ISO - International Organisation for Standardization; KECI - Korea Existing Chemicals Inventory; LC50 - Lethal Concentration to 50 % of a test population; LD50 - Lethal Dose to 50% of a test population (Median Lethal Dose); MARPOL - International Convention for the Prevention of Pollution from Ships; MSHA - Mine Safety and Health Administration; n.o.s. - Not Otherwise Specified; NFPA - National Fire Protection Association; NO(A)EC - No Observed (Adverse) Effect Concentration; NO(A)EL - No Observed (Adverse) Effect Level; NOELR - No Observable Effect Loading Rate; NTP - National Toxicology Program; NZIoC - New Zealand Inventory of Chemicals; OECD - Organization for Economic Co-operation and Development; OPPTS - Office of Chemical Safety and Pollution Prevention; PBT - Persistent, Bioaccumulative and Toxic substance; PICCS - Philippines Inventory of Chemicals and Chemical Substances; (Q)SAR - (Quantitative) Structure Activity Relationship; RCRA - Resource Conservation and Recovery Act; REACH - Regulation (EC) No 1907/2006 of the European Parliament and of the Council concerning the Registration, Evaluation, Authorisation and Restriction of Chemicals; RQ - Reportable Quantity; SADT - Self-Accelerating Decomposition Temperature; SARA - Superfund Amendments and Reauthorization Act; SDS - Safety Data Sheet; TCSI - Taiwan Chemical Substance Inventory; TSCA - Toxic Substances Control Act (United States); UN - United Nations; UNRTDG - United Nations Recommendations on the Transport of Dangerous Goods; vPvB - Very Persistent and Very Bioaccumulative

Further information

NFPA:



Revision Date : 09/20/2017

This information corresponds to the present state of our knowledge and is intended as a general description of our products and their possible applications. Clariant makes no warranties, express or implied, as to the information's accuracy, adequacy, sufficiency or freedom from defect and assumes no liability in connection with any use of this information. Any user of this product is responsible for determining the suitability of Clariant's products for its particular application. NO EXPRESS OR IMPLIED WARRANTY IS MADE OF THE MERCHANTABILITY, SUITABILITY, FITNESS FOR A PARTICULAR PURPOSE OR OTHERWISE OF ANY PRODUCT OR SERVICE. Nothing included in this information waives any of Clariant's General Terms and Conditions of Sale, which control unless it agrees otherwise in writing. Any existing intellectual/industrial property rights must be observed. Due to possible changes in our products

and applicable national and international regulations and laws, the status of our products could change. Material Safety Data Sheets providing safety precautions, that should be observed when handling or storing Clariant products, are available upon request and are provided in compliance with applicable law. You should obtain and review the applicable Material Safety Data Sheet information before handling any of these products. For additional information, please contact Clariant.

US / EN