WEEKLY REPORT FOR WEEK 46
(JUNE 16, 2019 – JUNE 22, 2019)

Report No. 53005-81-RPT-064

September 2019

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Record of Revision

Revision	Date	Pages/Sections Changed	Brief Description
0	09/2019	All	Original Issue.

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Acronyms and Abbreviations

AOP	Abnormal Operating Procedure
COPC	Chemical of Potential Concern
CSM	Central Shift Manager
CSO	Central Shift Office
DR	Deficiency Report
MBK	2-hexanone
MDL	Method Detection Limit
ML	Mobile Laboratory
NDEA	N-nitrosodiethylamine
NDMA	N-nitrosodimethylamine
NEMA	N-nitrosomethylethylamine
NMOR	N-nitrosomorpholine
OEL	Occupational Exposure Limit
PST	Pacific Standard Time
PTR-MS	Proton Transfer Reaction – Mass Spectrometer
PTR-TOF	Proton Transfer Reaction – Time of Flight
QA	Quality Assurance
QC	Quality Control
RL	Reporting Limit
SOEN	Shift Office Event Notification
WRPS	Washington River Protection Solutions, LLC

1.0 INTRODUCTION

During the week of June 16, 2019, through June 22, 2019, the Mobile Laboratory (ML) performed area monitoring around the 200 East and 200 West Area of the Hanford Site in support of Washington River Protection Solutions, LLC (WRPS). The data team continued processing data collected from the previous week. The reporting team worked towards the completion of weekly reports for Weeks 42 through 45 and monthly reports for Months 7 through 9.

2.0 JUNE 17, 2019 – STOP WORK

2.1 Quality Assessment

Data from June 17, 2019, were assessed using Procedure 17124-DOE-HS-102, "Mobile Laboratory Data Processing – Analysis." A Data Acceptance Checklist was completed. The data were accepted by TerraGraphics with the following comments. Deficiency Report (DR) DR19-012 was initiated to adequately document the stop work that occurred. See Appendix A for the full DR. This instance will be discussed in detail in a subsequent monthly summary report.

2.2 Summary

On June 17, 2019, ML personnel arrived at the TerraGraphics warehouse at 04:55 Pacific Standard Time (PST), to prepare the ML for deployment. At 05:19, the ML Operators noted that the hydronium counts, and hydrate ration did not meet the parameters for their expected values. The failure to meet Proton Transfer Reaction – Time of Flight (PTR-TOF) parameters initiated a stop work. Deployment to the Hanford Site for area monitoring did not occur. After further investigation, it was discovered that procedural changes to Report No. 66409-RPT-004, *Mobile Laboratory Operational Procedure*, were overlooked upon acquisition of a new PTR-TOF. The remainder of the working day was dedicated to implementing procedural changes and obtaining a new zero-air cylinder from OXARC®[1].

[1] OXARC is a registered trademark of OXARC, Inc., Spokane, Washington.

3.0 JUNE 18, 2019 – AREA MONITORING

3.1 Quality Assessment

Data from June 18, 2019, were assessed using Procedure 17124-DOE-HS-102. A Data Acceptance Checklist was completed. The data were accepted by TerraGraphics with the following comments. Report No. 66409-RPT-004 was adequately documented and all checks passed the acceptance limits.

3.2 Summary[2]

On June 18, 2019, ML personnel arrived at the TerraGraphics warehouse at 04:57 PST. The Quality Assurance/Quality Control (QA/QC) zero-air/span check was performed on the LI-COR®[2] CO_2 monitor, the Picarro NH_3 analyzer, and the Proton Transfer Reaction – Mass Spectrometer (PTR-MS) starting at 05:10 PST. At 05:21, the ML left the TerraGraphics warehouse and stopped for fuel at 05:29. After fueling up the ML, Operators headed for the Hanford Site. Operators arrived at 274-AW Central Shift Office (CSO) at 06:23 and proceeded to check in with the Central Shift Manger (CSM) and check out a radio. The ML drove to U Farm at approximately 06:35 and was parked and sampling downwind by 06:50. The ML Operators noted they were seeing elevated levels of Mass 75 at 07:36 and believed the potential source was ongoing crane work within U Farm. Figure 3-1 shows the crane within U Farm. Area monitoring of U Farm concluded at 07:57 and the ML proceeded with monitoring the TX/TY Tank Farms.

Figure 3-1. Crane Inside of U Farm.

[2] LI-COR is a registered trademark of LI-COR, Inc., Lincoln, Nebraska.

At 08:06 PST, the ML parked near the southeast corner of TY Farm and left this position at 09:15. From 09:24 to 09:39, the ML was in the vicinity of the onsite food trucks and proceeded with site survey loops within the 200 East area. From 10:14 to 11:36, the ML was parked downwind of AX Farm and after leaving this location began a second round of site survey loops. At 12:07, the ML was parked east of AW Farm for downwind tank farm area monitoring, and Operators noted a Utility Gator™[3] drive by the ML at approximately 12:30. At 13:29, the ML left AW Farm for a final round of site survey loops. Operators noted they were smelling asphalt near 4th and Buffalo while conducting site survey loops at 13:43. At 13:56, the ML parked near 274-AW to check out with the CSO and left the site at 14:02. The ML Operators arrived at the TerraGraphics Office at 14:51 for PTR-MS training and finished their day at 15:14 after dropping the ML off at the TerraGraphics warehouse.

Table 3-1. Mobile Laboratory Summary of Events.

Time	Activity	Observed
07:36	Area monitoring at U Farm	Crane
09:24 – 09:39	Area monitoring	On-site food trucks
12:30	Area monitoring at AW Farm	Observed utility Gator
13:43	Area monitoring site survey loops	Observed no potential source

Table 3-1 illustrates the times and locations noted by the ML Operators when a potential source or peak of interest was observed. At 07:36, the ML Operators saw a crane working in U-Farm and there were raised signals of 2-propenal (Figure 3-13) and1-butanol (Figure 3-14). From 09:24 to 09:34, ML Operators observed elevated signals near on-site food trucks as workers gathered for lunch. See Figure 3-51 and Figure 3-53 for signals indicating diesel and generators combustion markers. During this time, acetaldehyde (Figure 3-9), but-3-en-2-one (Figure 3-19), and benzene (Figure 3-22) show elevated levels as well. At 12:30 PST, the operators noted a Utility Gator drove by and a corresponding methyl acetate is seen post-processing (see Figure 3-16). Around 13:43, Operators noted a raise in signal while conducting area monitoring and a correlating marker is seen in Figure 3-52, showing the elevated signals match the gasoline combustion markers.

[3] Gator is a trademark of Deere & Company, Moline, Illinois.

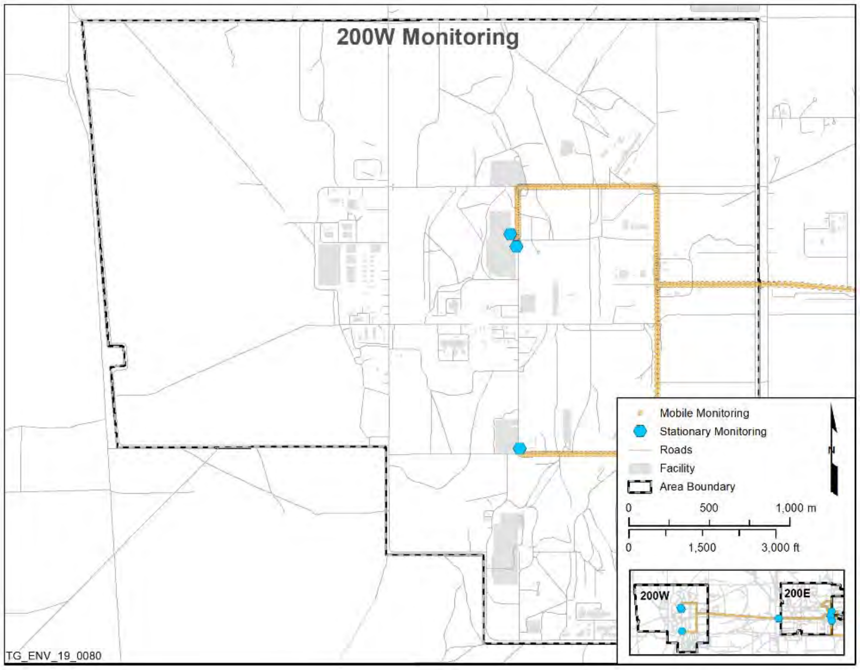

Figure 3-2. Location of the Mobile Laboratory for the Duration of the Monitoring Period in the 200 West Area.

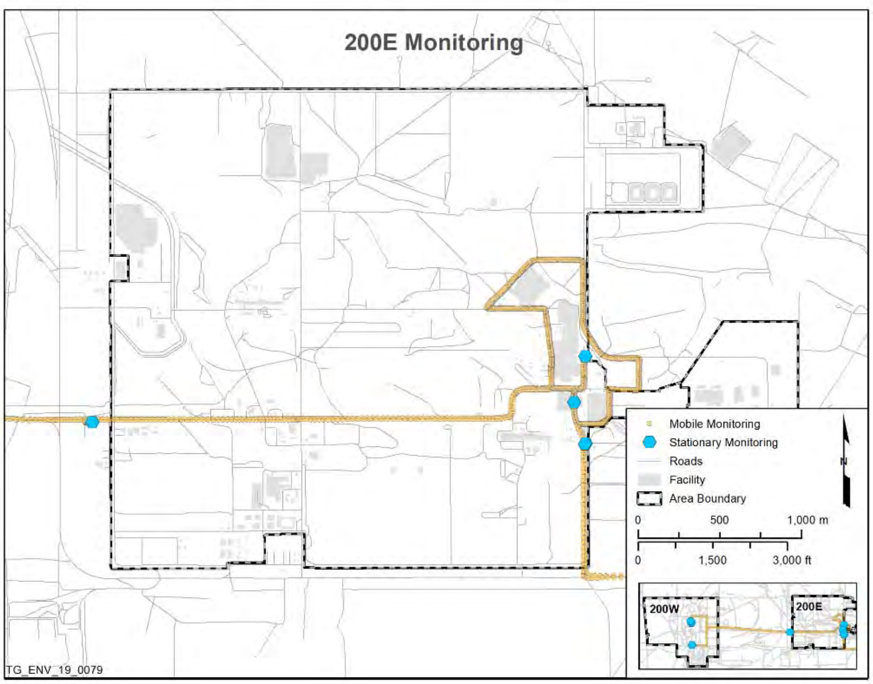

Figure 3-3. Location of the Mobile Laboratory for the Duration of the Monitoring Period in the 200 East Area.

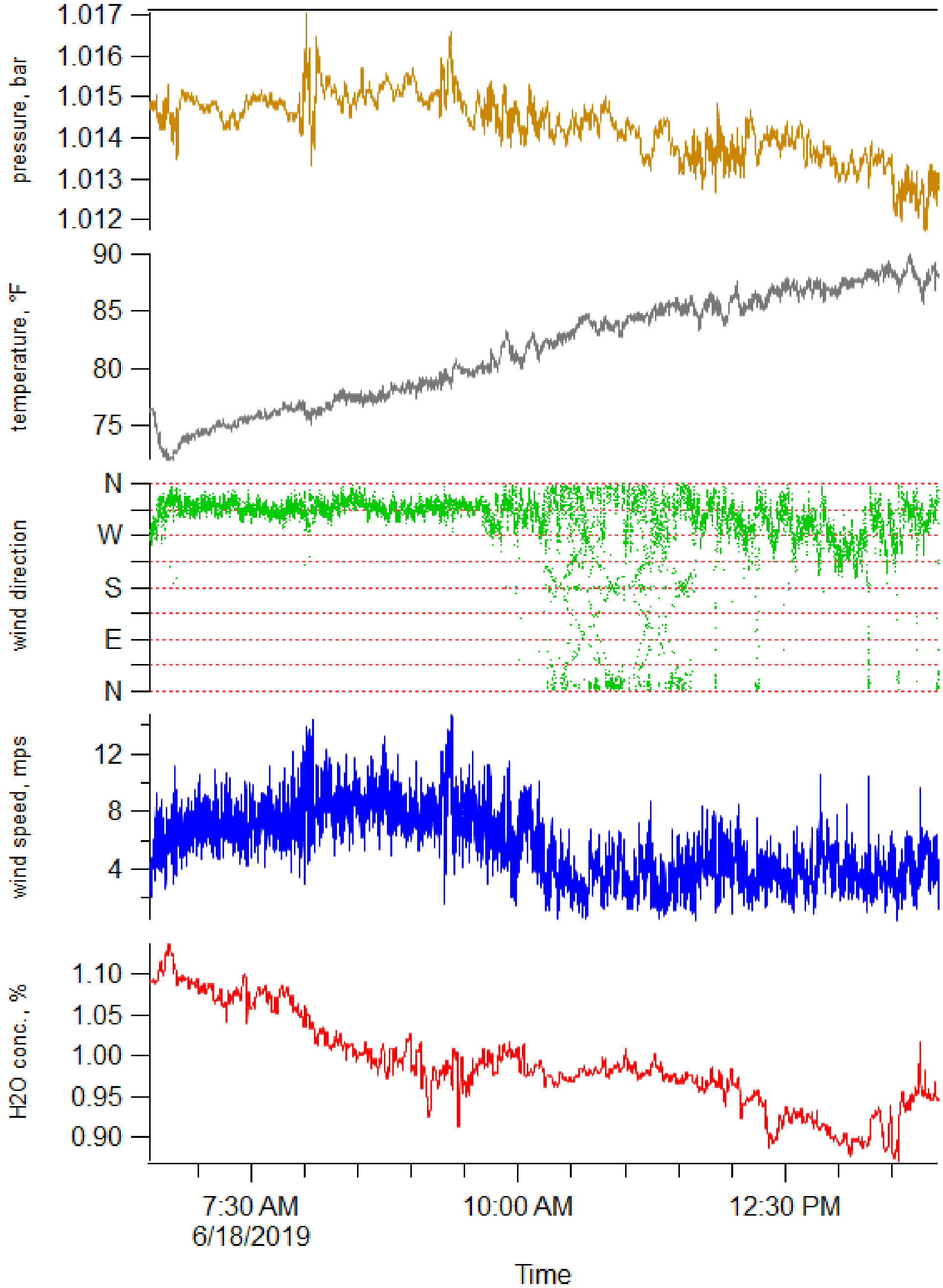

Figure 3-4. Weather Data for the Duration of the Monitoring Period.

Figure 3-3 illustrates the meteorological summary for the monitoring period on June 18, 2019. The temperature gradually rose from 68°F to approximately 89°F. Moderate winds generally came out of the northwest and varied slightly after 10:00 PST.

3.3 Samples Collected

Continuous air monitoring was performed using the following instrumentation:

- PTR-TOF 6000 X2,
- LI-COR CO_2 Monitor,
- Picarro Ammonia Monitor, and
- Airmar®[4] Weather Station.

Confirmatory air samples were not collected during this period.

3.4 Area Monitoring

The ML performed area monitoring from approximately 06:31 to 13:58. Table 3-2 displays the chemical of potential concern (COPC) statistical results during that monitoring period.

[4] Airmar is a registered trademark of Airmar Technology Corporation, Milford, New Hampshire.

Table 3-2. Chemical of Potential Concern Statistical Information for the Area Monitoring on June 18, 2019. (2 Sheets)

COPC #	COPC Name	OEL (ppb)	MDL (ppb)	Ave. (ppb)	St. Dev. (ppb)	Rel St. Dev. (%)	Max. (ppb)	Median (ppb)
1	ammonia	25000	6.225	9.581†	2.159	22.536	16.923	8.76†
2	formaldehyde	300	0.141	0.143†	0.111	77.824	0.926	0.14†
3	methanol	200000	0.379	6.687	2.375	35.520	200.870	6.589
4	acetonitrile	20000	0.044	0.247	0.053	21.625	0.501	0.246
5	acetaldehyde	25000	0.220	1.707	0.562	32.953	11.429	1.642
6	ethylamine	5000	0.021	<0.021	0.018	156.526	0.106	<0.021
7	1,3-butadiene	1000	0.917	21.898	3.251	14.844	36.947	21.806
8	propanenitrile	6000	0.043	0.245	0.064	26.230	0.521	0.243
9	2-propenal	100	0.069	<0.069	0.095	135.121	0.800	<0.069
10	1-butanol + butenes	20000	0.050	0.099†	0.353	358.323	8.176	0.06†
11	methyl isocyanate	20	0.025	<0.025	0.027	133.759	0.148	<0.025
12	methyl nitrite	100	0.030	0.05†	0.030	61.040	0.713	0.048†
13	furan	1	0.021	<0.021	0.016	1130.570	0.077	<0.021
14	butanenitrile	8000	0.013	<0.013	0.014	645.766	0.072	<0.013
15	but-3-en-2-one + 2,3-dihydrofuran + 2,5-dihydrofuran	200, 1, 1	0.017	0.056	0.026	45.607	N/A*	N/A*
16	butanal	25000	0.022	0.155	0.033	21.124	0.347	0.152
17	NDMA	0.3	0.015	<0.015	0.015	3924.510	0.193	<0.015
18	benzene	500	0.066	0.079†	0.063	79.543	1.739	0.07†
19	2,4-pentadienenitrile + pyridine	300, 1000	0.018	<0.018	0.012	348.241	0.124	<0.018
20	2-methylene butanenitrile	300	0.008	<0.008	0.006	786.719	0.032	<0.008
21	2-methylfuran	1	0.016	0.02†	0.015	76.870	0.106	0.019†
22	pentanenitrile	6000	0.008	<0.008	0.007	870.608	0.044	<0.008
23	3-methyl-3-buten-2-one + 2-methyl-2-butenal	20, 30	0.016	0.019†	0.014	76.314	0.092	0.018†
24	NEMA	0.3	0.010	<0.01	0.009	10066.30 0	0.065	<0.01
25	2,5-dimethylfuran	1	0.013	<0.013	0.013	114.015	0.093	<0.013
26	hexanenitrile	6000	0.006	<0.006	0.005	96.213	0.039	<0.006
27	2-hexanone (MBK)	5000	0.010	<0.010	0.010	139.213	0.062	<0.010
28	NDEA	0.1	0.011	<0.011	0.006	272.209	0.025	<0.011
29	butyl nitrite; 2-nitro-2-methylpropane	100, 300	0.006	<0.006	0.006	986.104	0.026	<0.006
30	2,4-dimethylpyridine	500	0.008	<0.008	0.007	351.015	0.192	<0.008
31	2-propylfuran + 2-ethyl-5-methylfuran	1	0.010	<0.010	0.010	370.541	0.055	<0.01

Table 3-2. Chemical of Potential Concern Statistical Information for the Area Monitoring on June 18, 2019. (2 Sheets)

COPC #	COPC Name	OEL (ppb)	MDL (ppb)	Ave. (ppb)	St. Dev. (ppb)	Rel St. Dev. (%)	Max. (ppb)	Median (ppb)
32	heptanenitrile	6000	0.004	<0.004	0.003	360.120	0.016	<0.004
33	4-methyl-2-hexanone	500	0.008	<0.008	0.008	1352.400	0.039	<0.008
34	NMOR	0.6	0.009	<0.009	0.007	119.143	0.106	<0.009
35	butyl nitrate	2500	0.004	<0.004	0.003	1775.320	0.028	<0.004
36	2-ethyl-2-hexenal + 4-(1-methylpropyl)-2,3-dihydrofuran + 3-(1,1-dimethylethyl)-2,3-dihydrofuran	100, 1, 1	0.007	<0.007	0.005	184.355	0.034	<0.007
37	6-methyl-2-heptanone	8000	0.006	<0.006	0.005	118.923	0.031	<0.006
38	2-pentylfuran	1	0.006	0.014†	0.007	50.266	0.054	0.014†
39	biphenyl	200	0.008	<0.008	0.007	173.107	0.039	<0.008
40	2-heptylfuran	1	0.007	<0.007	0.005	28.652	0.021	<0.007
41	1,4-butanediol dinitrate	50	0.005	<0.005	0.002	325.327	0.010	<0.005
42	2-octylfuran	1	0.004	<0.004	0.002	571.414	0.018	<0.004
43	1,2,3-propanetriol 1,3-dinitrate	50	0.002	<0.002	0.001	458.799	0.010	<0.002
44	PCB	1000	0.006	<0.006	0.002	34.668	0.007	<0.006
45	6-(2-furanyl)-6-methyl-2-heptanone	1	0.003	<0.003	0.002	147.434	0.019	<0.003
46	furfural acetophenone	1	0.006	<0.006	0.004	118.819	0.025	<0.006
N/A*	The maximum peak value for but-3-en-2-one + 2,3 dihydrofuran + 2,5 dihydrofuran was 0.216 ppb and the median value was 0.052 ppb. The PTR-MS results for but-3-en-2-one + 2,3 dihydrofuran + 2,5 dihydrofuran are not compared to OEL concentrations because: 1) the result is suspect due to a known biogenic interferant (methacrolein) that is expected to be in concentrations that occasionally exceed the dihydrofuran OEL, and 2) this combination of COPCs have OEL concentrations that differ by a factor of 200, which provide widely variant bases for these numbers.							
**	Nitrosamine results are suspect due to isobaric interferants causing positive bias that have been encountered during previous background [53005-81-RPT-007, *PTR-MS Mobile Laboratory Vapor Monitoring Background Study, (3/18/2018 – 4/20/2018)*, and *Fiscal Year 2017 Mobile Laboratory Vapor Monitoring at the Hanford Site: Monitoring During Waste Disturbing Activities and Background Study*, RJ Lee Group, Inc.].							
<	COPC Averages below the MDL.							
†	COPC Averages between the RL and the MDL.							
	COPC Averages >100% of the OEL.							
	COPC Averages 50-100% of the OEL.							
	COPC Averages 10-50% of the OEL.							

Figure 3-4 through Figure 3-54 display 46 COPC signals, overlaid with the same signal smoothed using a 1-minute moving average (in cases where a moving average assist with data visualization), and CO_2, for the monitoring period June 18, 2019. If within range of the plot's left axis, a green horizontal line representing 50% of the COPC's occupational exposure limit (OEL), a blue horizontal line representing the COPC's OEL, a horizontal purple line representing the reporting limit (RL), and a pink horizontal line representing the method detection limit (MDL) are shown.

Figure 3-4 through Figure 3-54 display the data from the monitoring period, and the data shown were edited from the entire data, eliminating the daily span checks performed as well as any traveling done off the Hanford Site. Figure 3-4 through 3-53 have been baseline subtracted to correct for the baseline signal response observed while the PTR-MS is sampling zero air. Species with low or negligible amounts in ambient background can appear below zero (see Figures 3-42, 3-43, and 3-46) but it has negligible effect on the PTR-MS to accurately detect species above the reporting limit and OEL). Figure 3-4 displays the signal for ammonia for the monitoring period with a slight decay in concentration from the start of monitoring as the sample line equilibrates from the daily ammonia span check. Figure 3-10 displays the signal for 1,3-butadiene and the scalloping denoted by the plot is influenced by the increased humidity in the PTR-MS which has been identified to interfere with signal at this mass. Data displayed in Figure 3-54 have been adjusted to split axes to illustrate the peak saturation without minimizing other plumes or peaks of interest at the lower concentration.

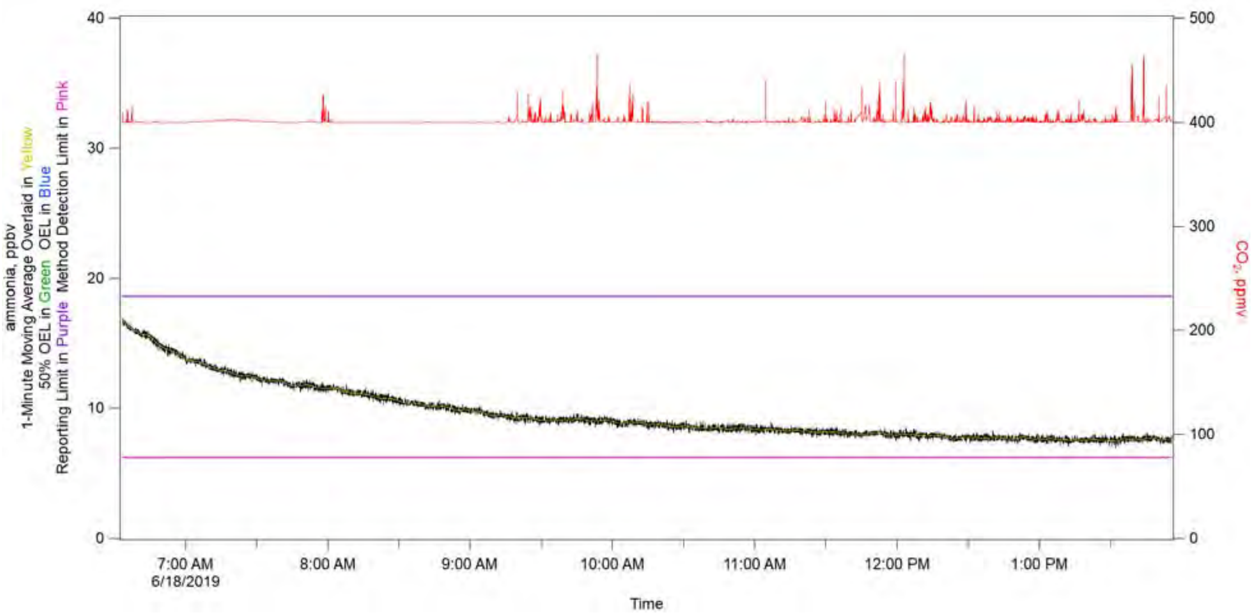

Figure 3-5. Ammonia.

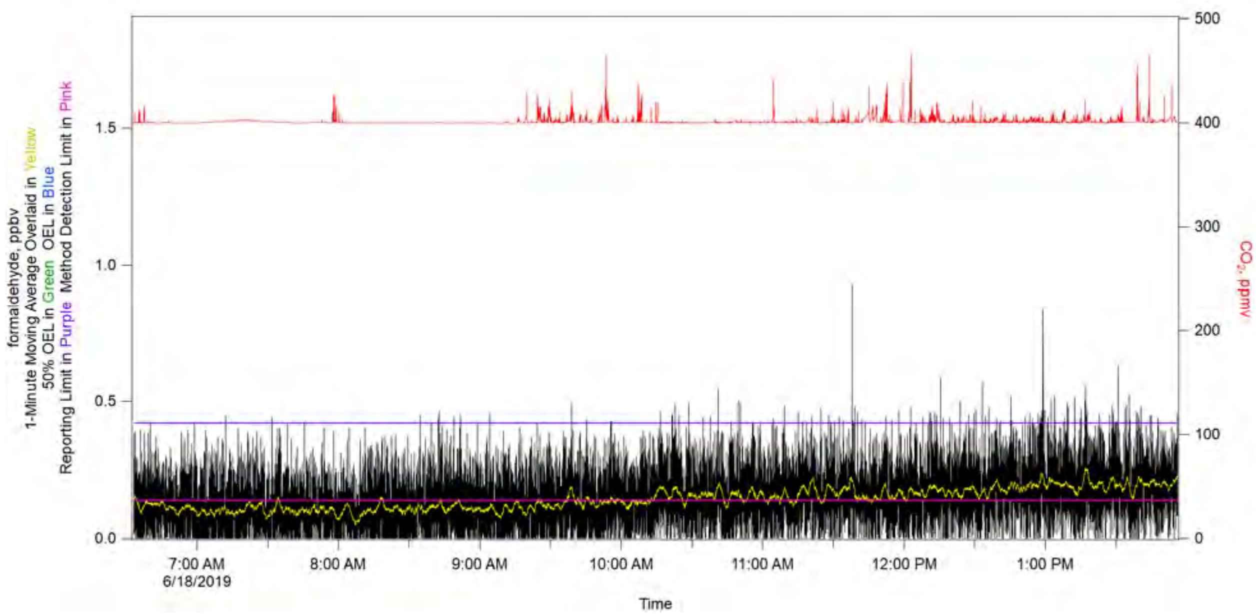

Figure 3-6. Formaldehyde.

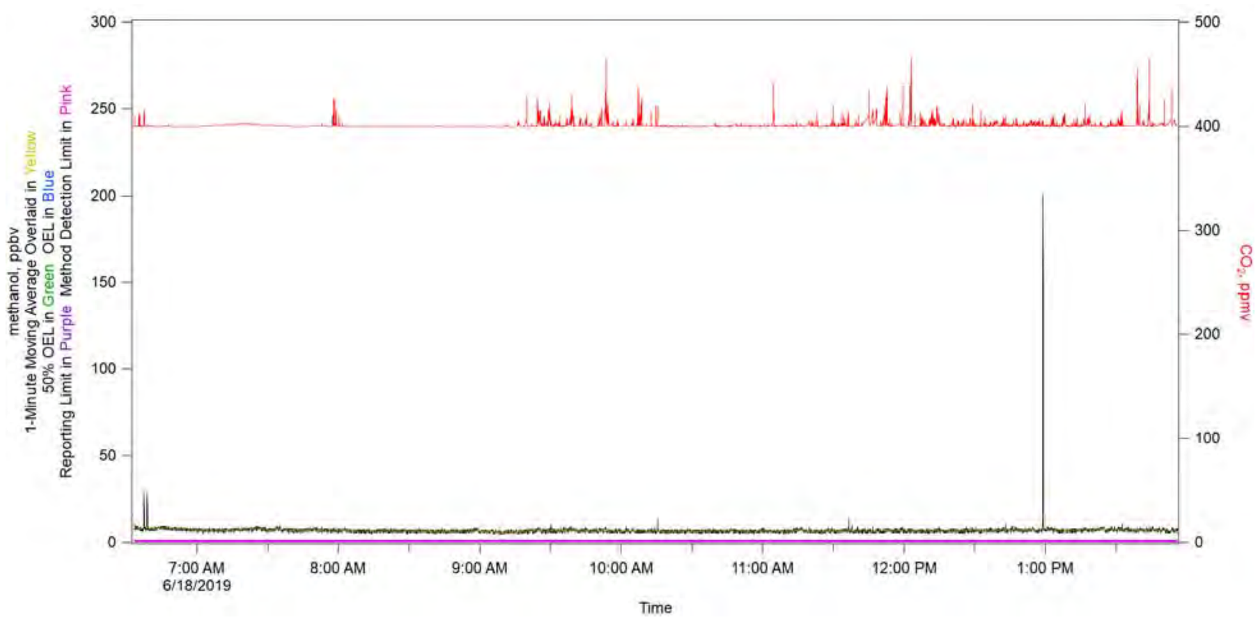

Figure 3-7. Methanol.

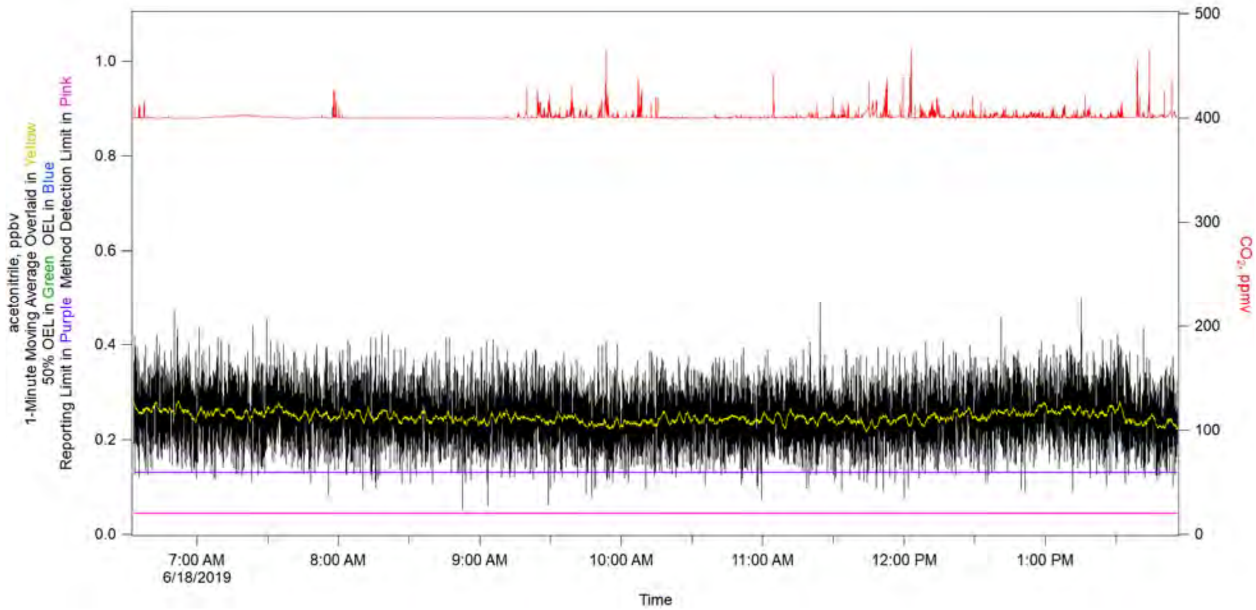

Figure 3-8. Acetonitrile.

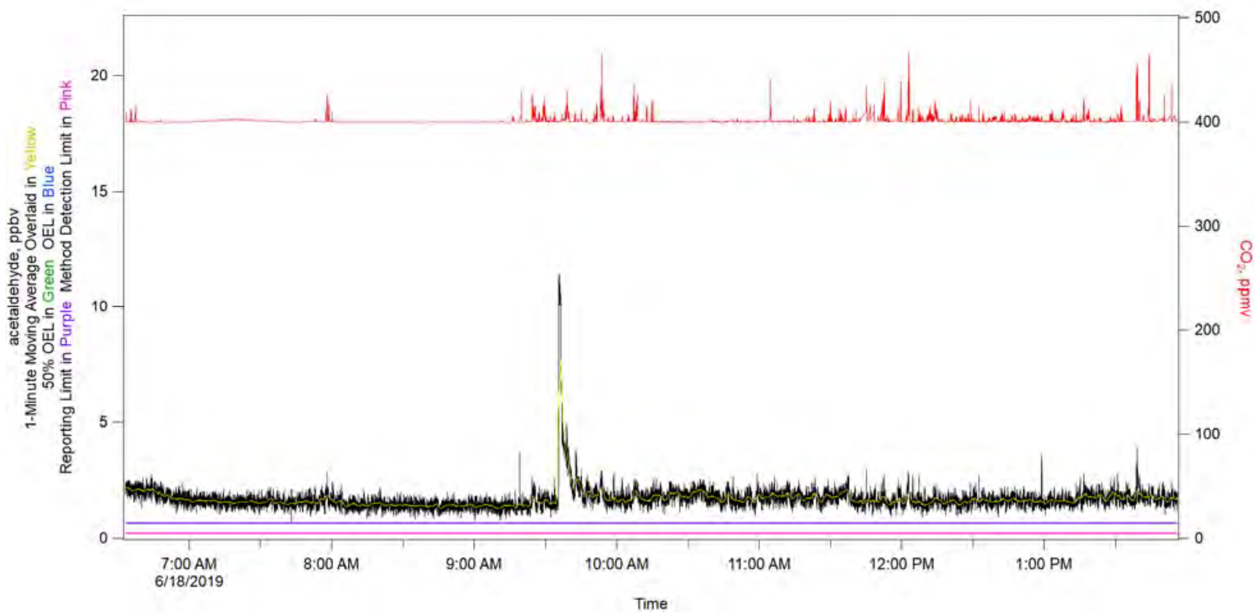

Figure 3-9. Acetaldehyde.

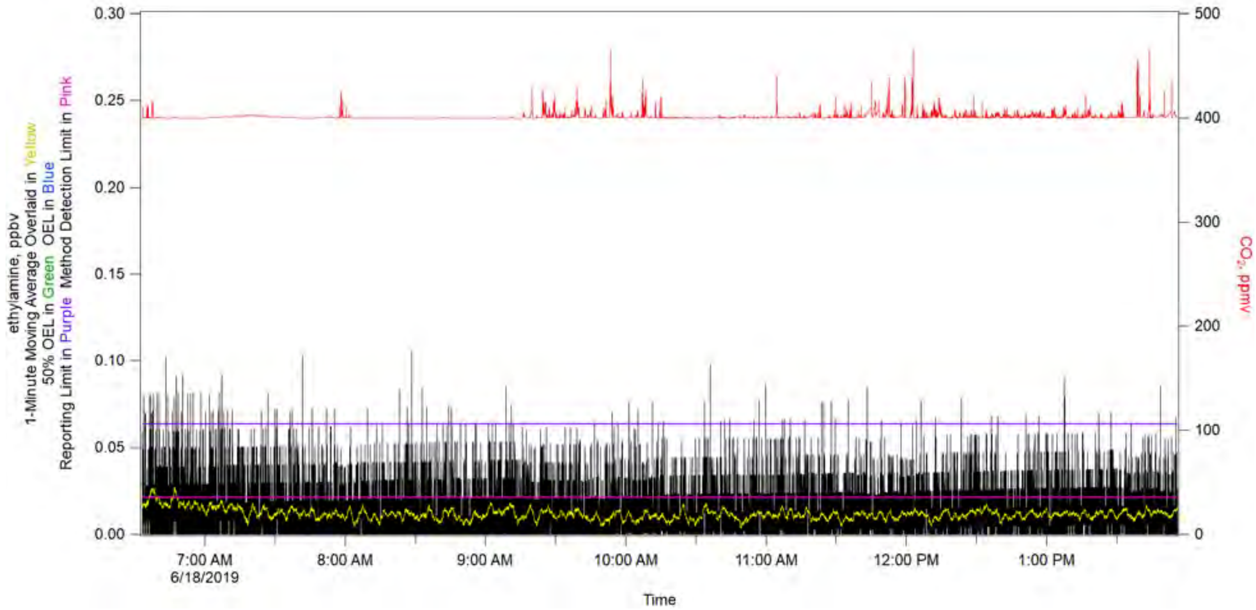

Figure 3-10. Ethylamine.

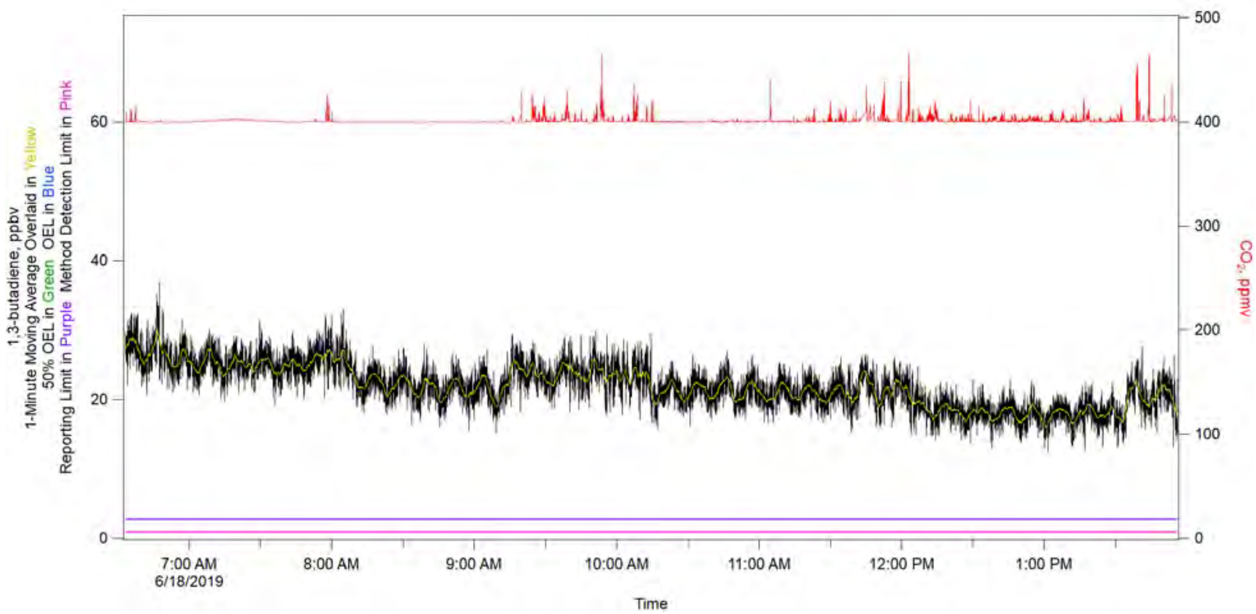

Figure 3-11. 1,3-butadiene.

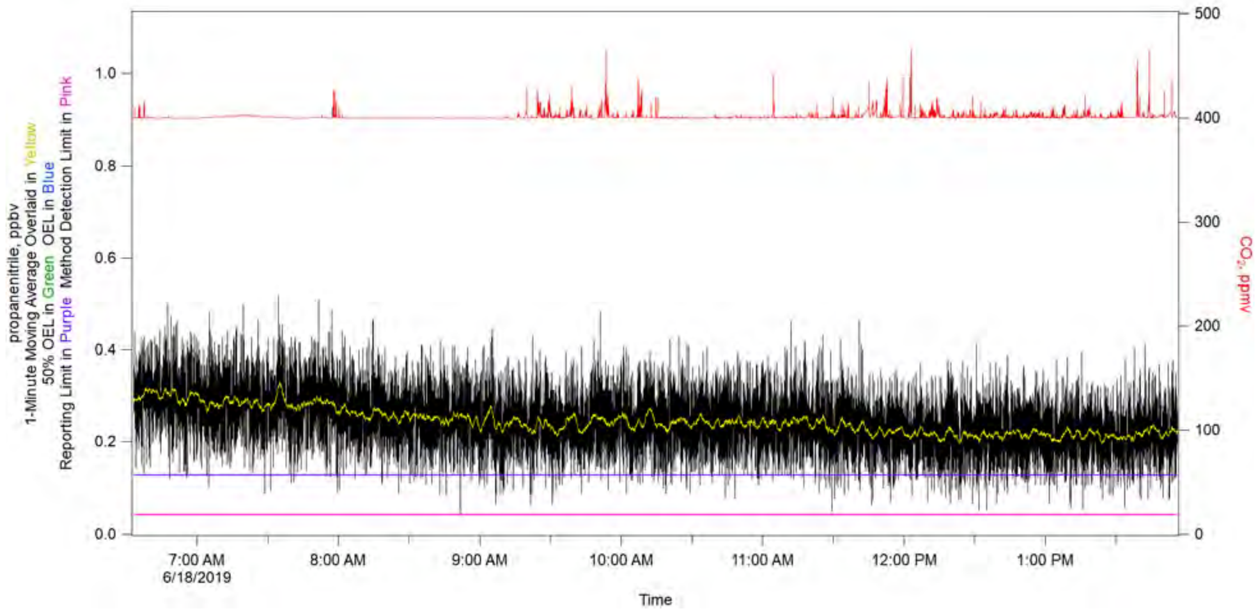

Figure 3-12. Propanenitrile.

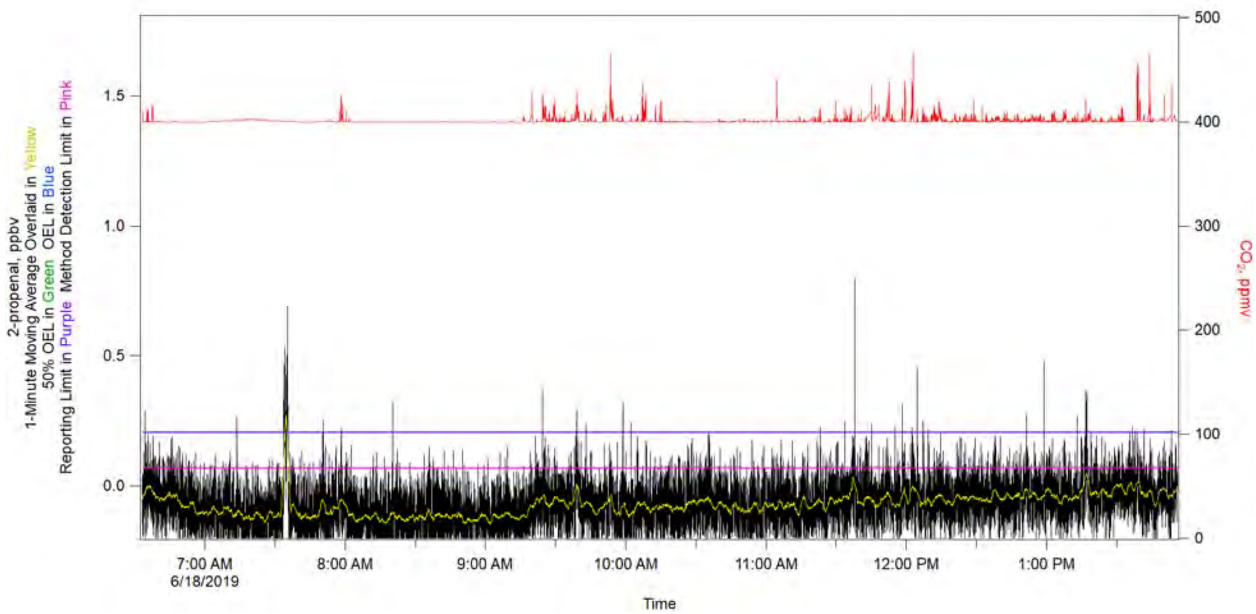

Figure 3-13. 2-propenal.

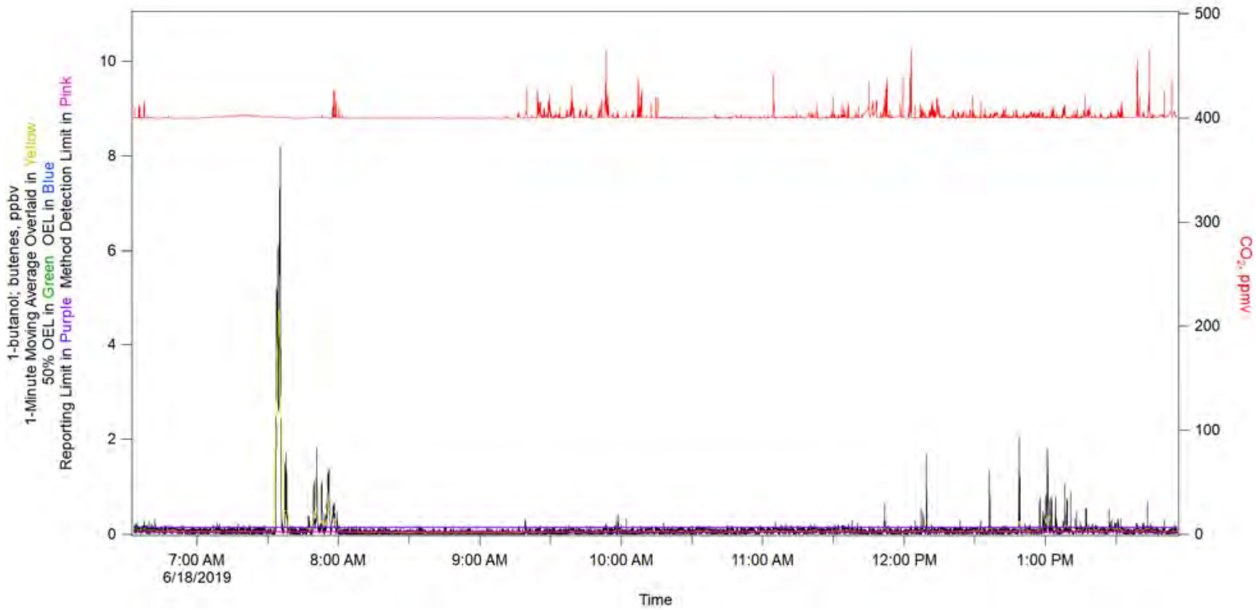

Figure 3-14. 1-butanol; Butenes.

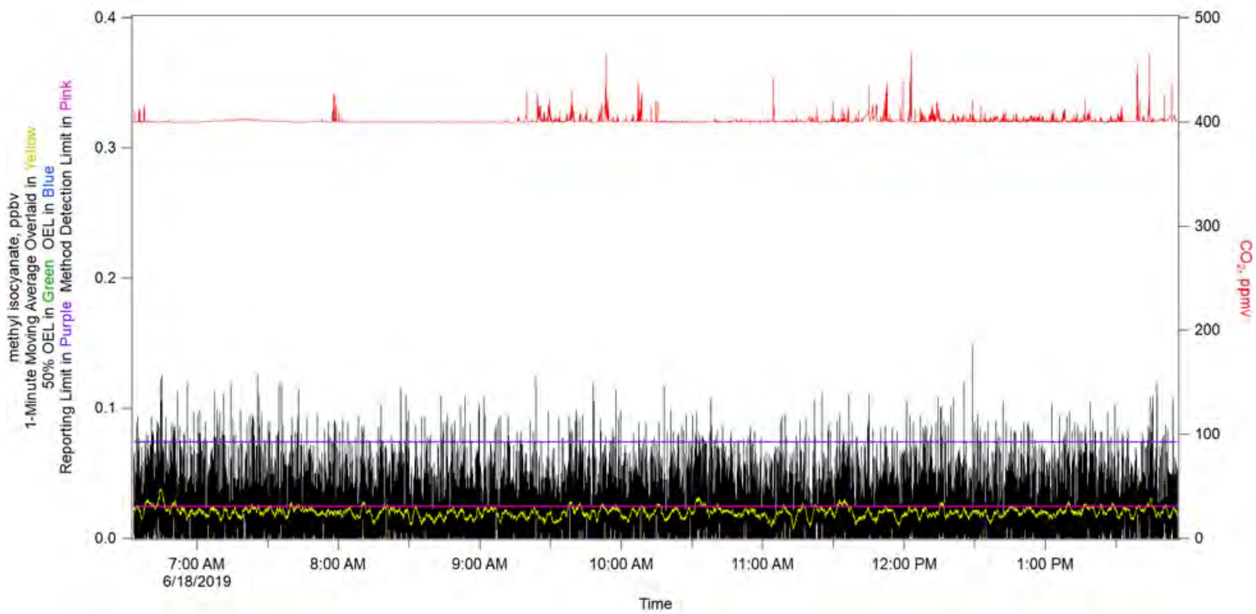

Figure 3-15. Methyl Isocyanate.

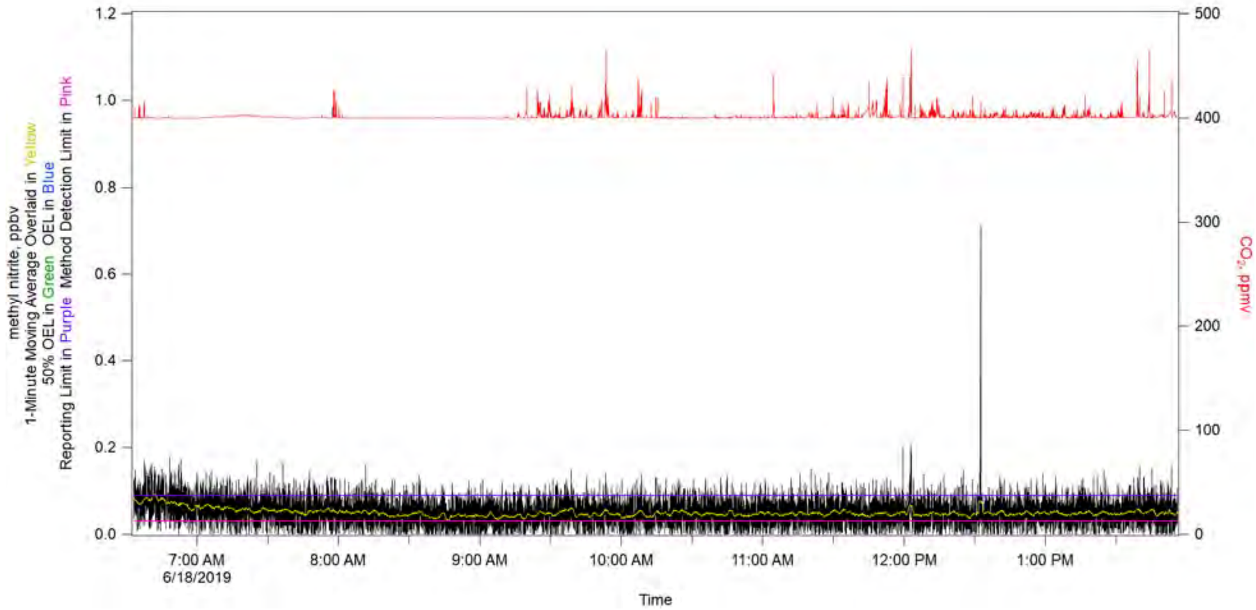

Figure 3-16. Methyl Nitrite.

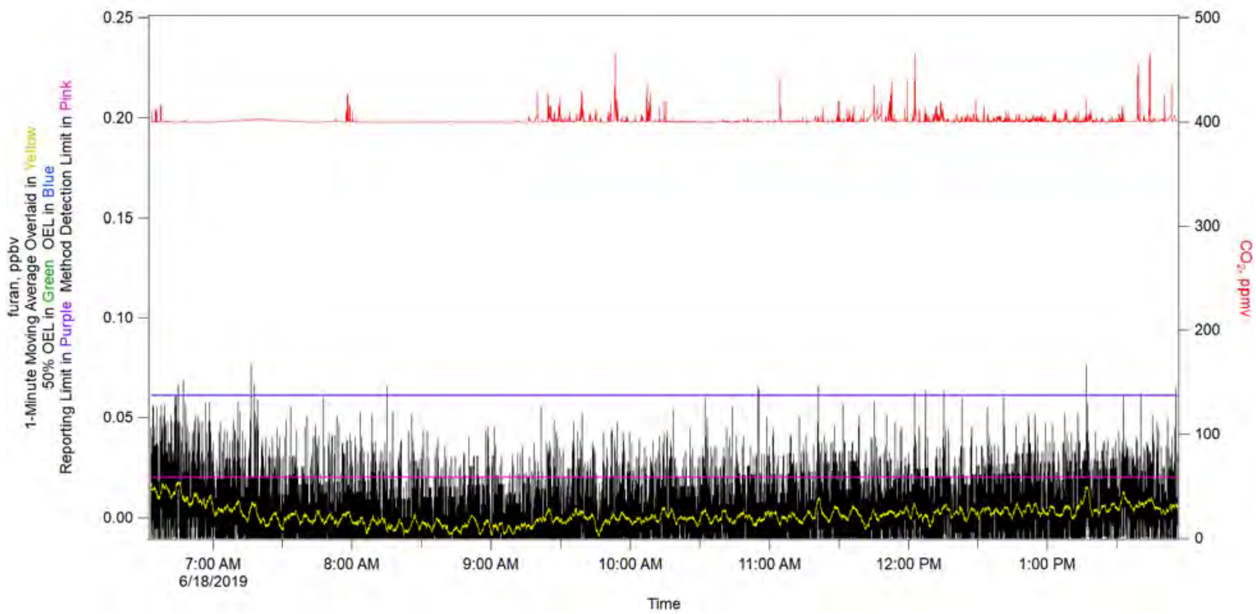

Figure 3-17. Furan.

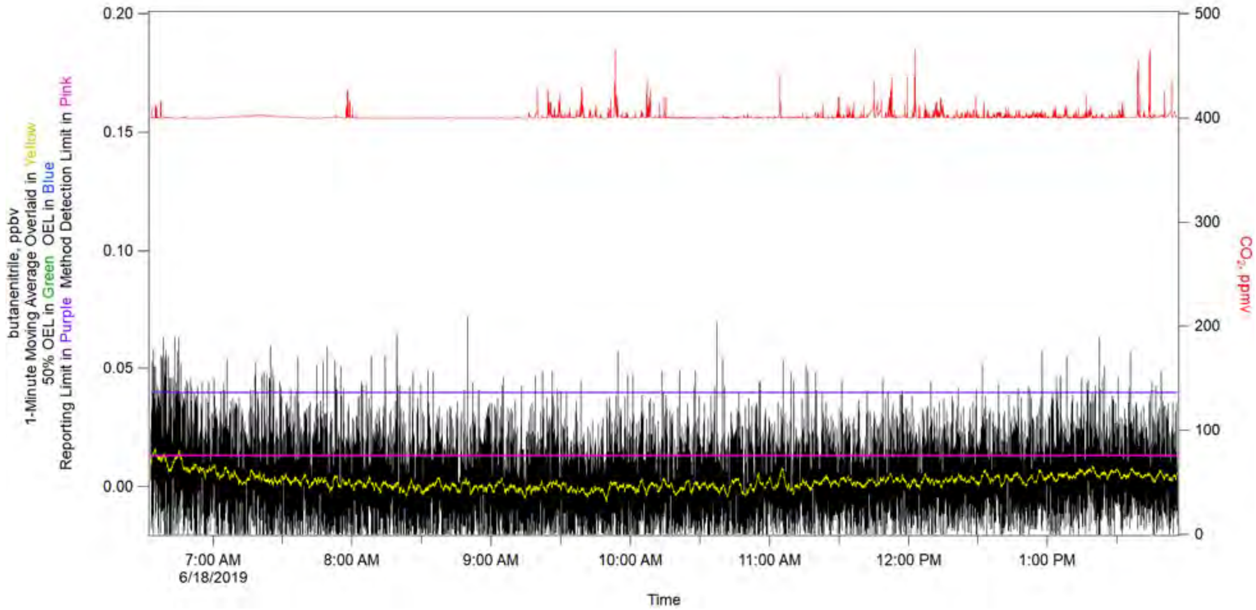

Figure 3-18. Butanenitrile.

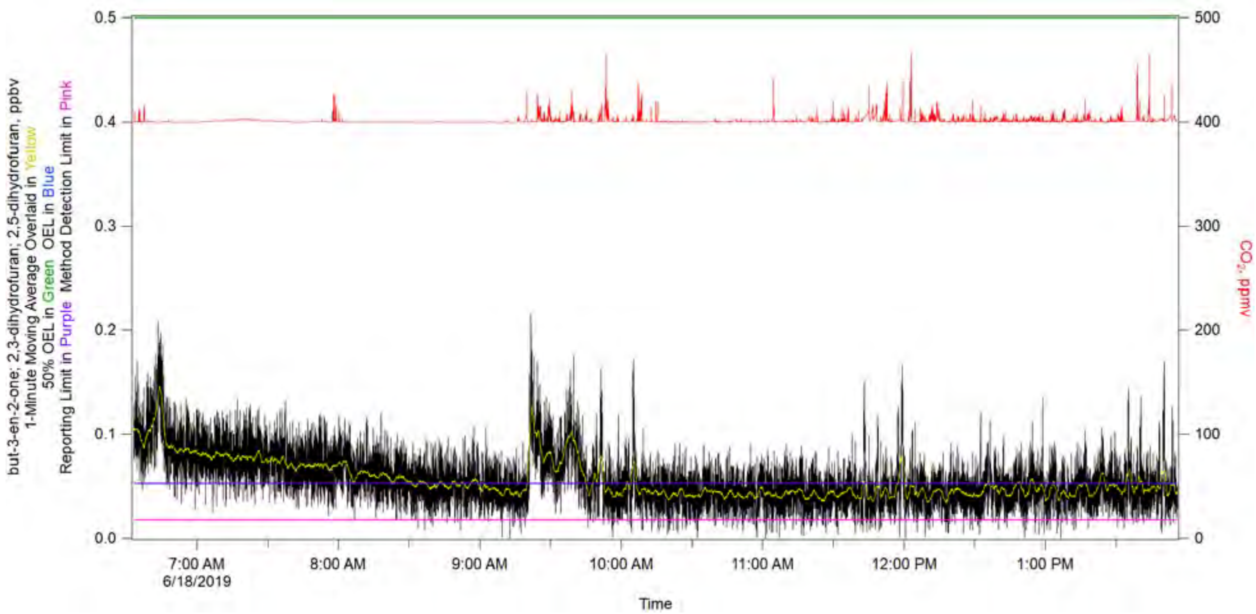

Figure 3-19. But-3-en-2-one; 2,3-dihydrofuran; 2,5-dihydrofuran.

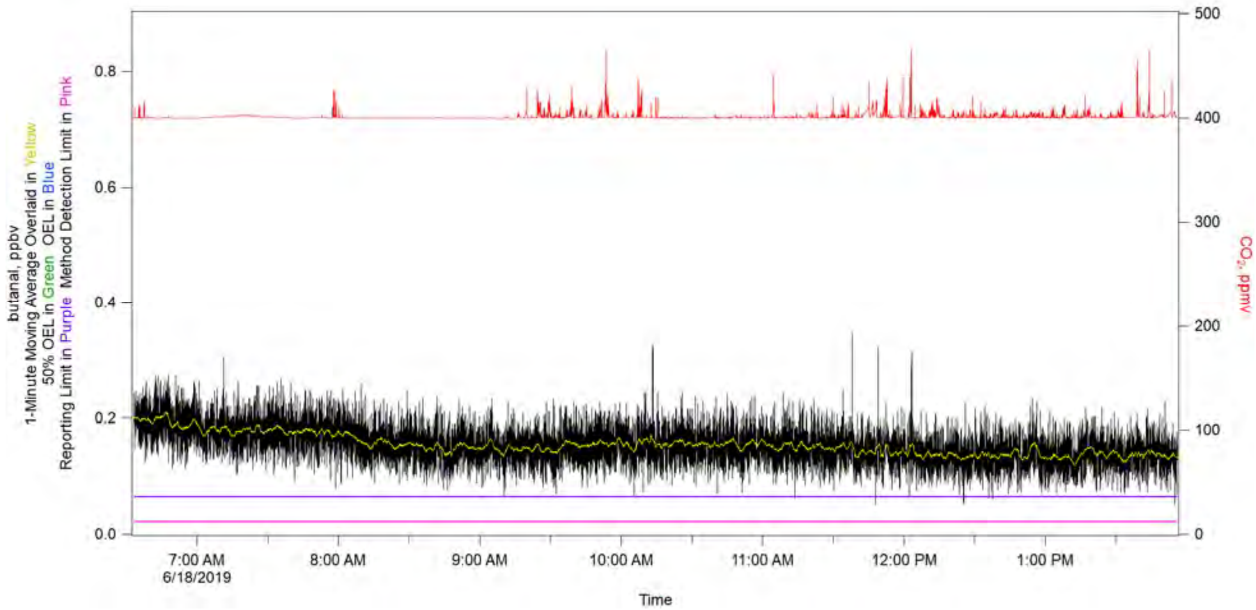

Figure 3-20. Butanal.

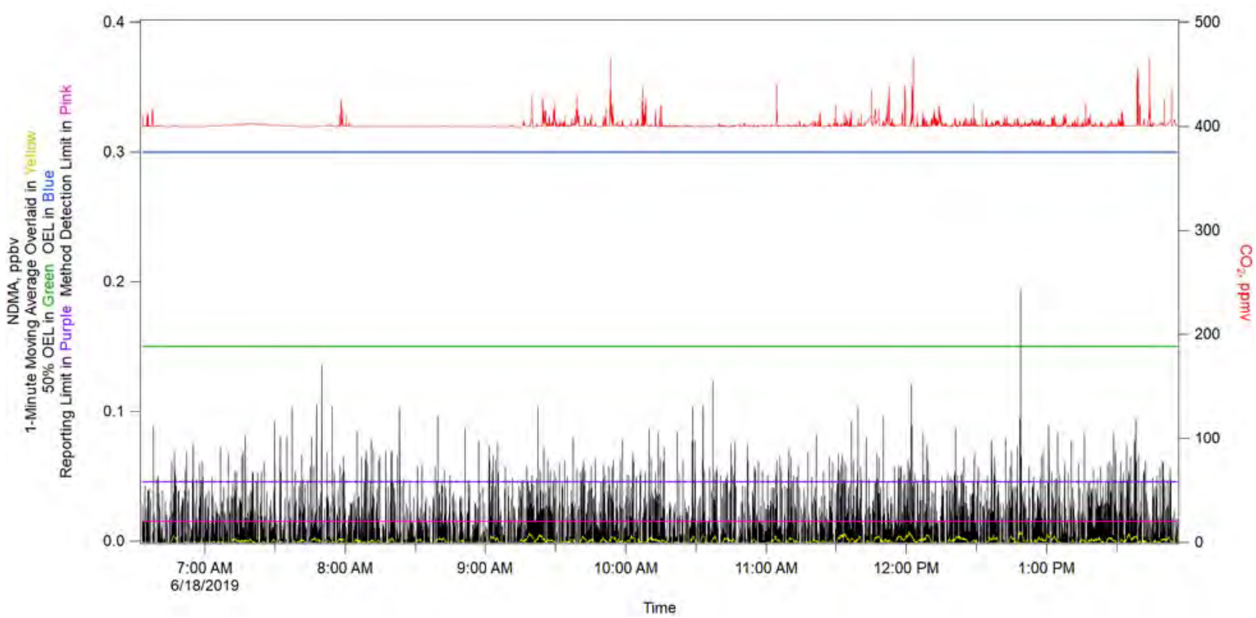

Figure 3-21. N-nitrosodimethylamine (NDMA).

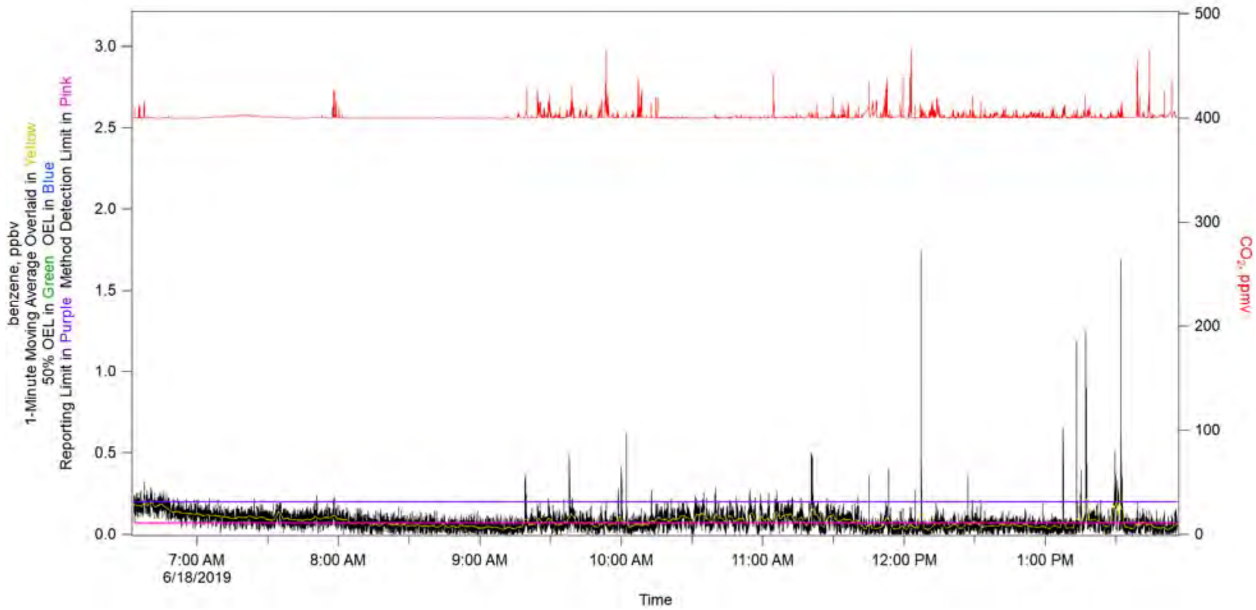

Figure 3-22. Benzene.

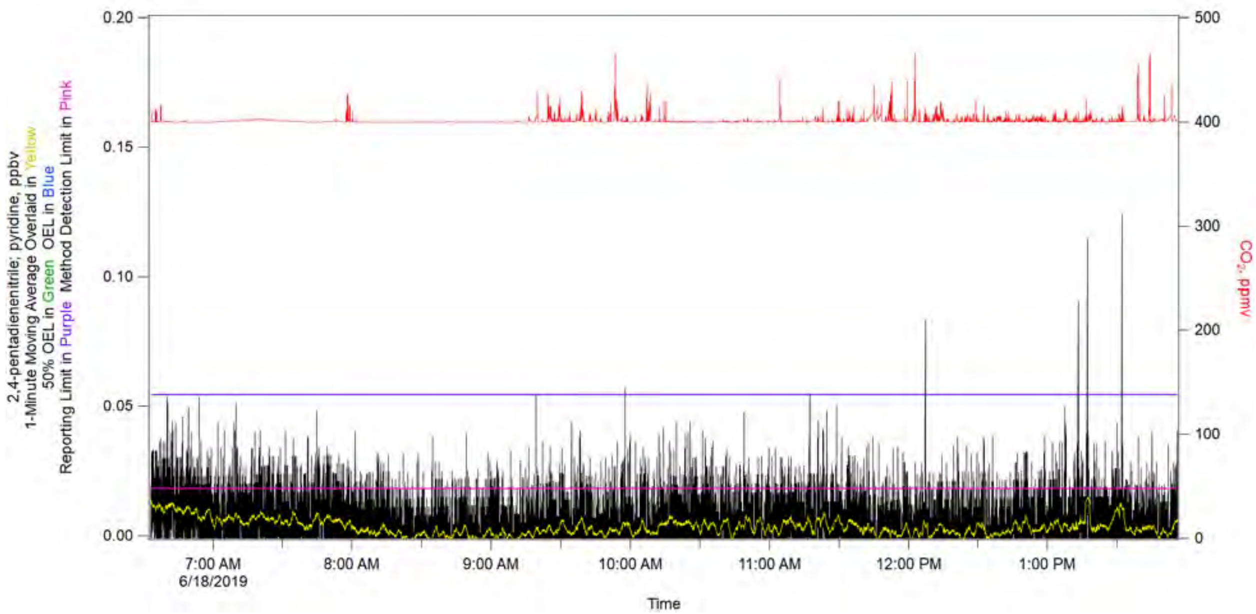

Figure 3-23. 2,4-pentadienenitrile; Pyridine.

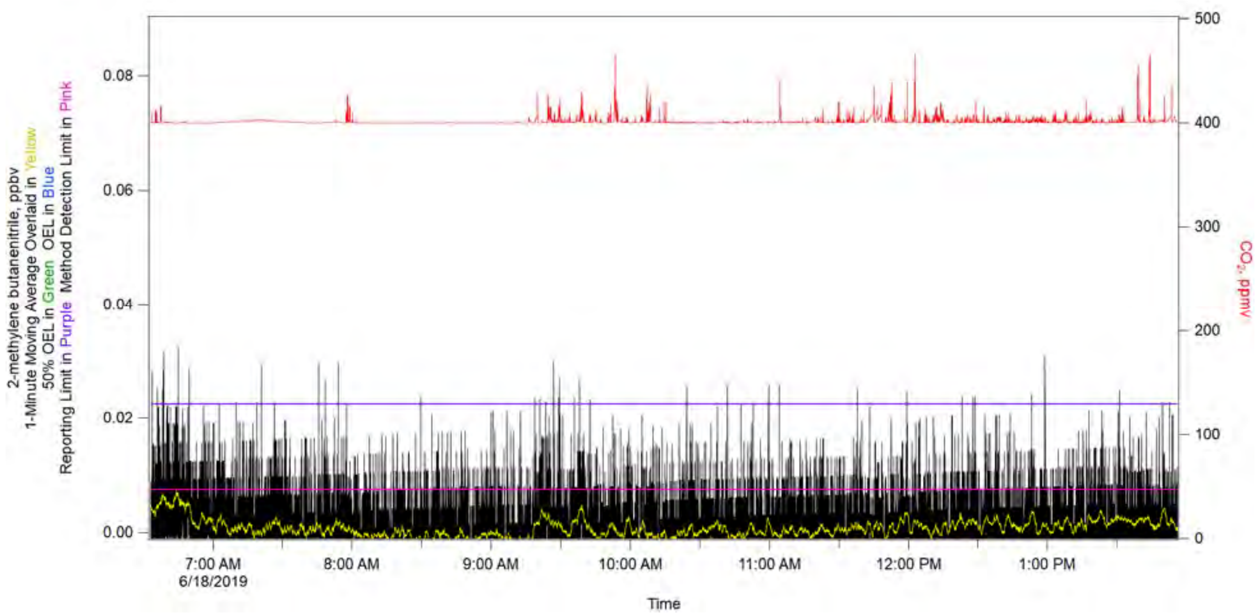

Figure 3-24. 2-methylene Butanenitrile.

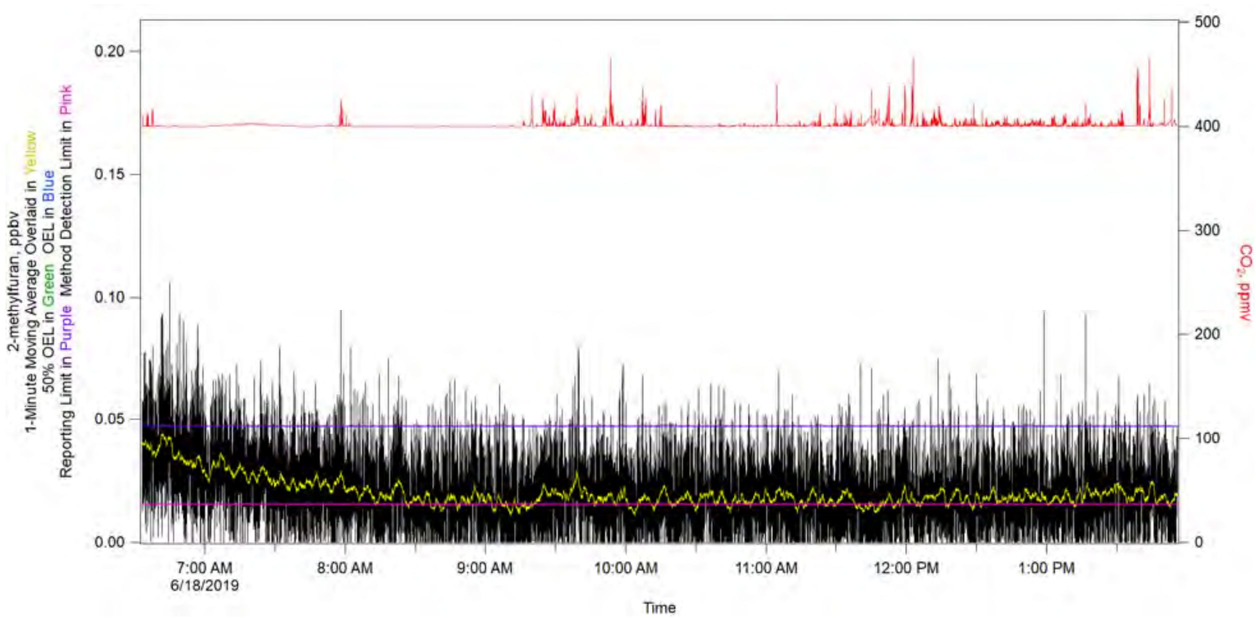

Figure 3-25. 2-methylfuran.

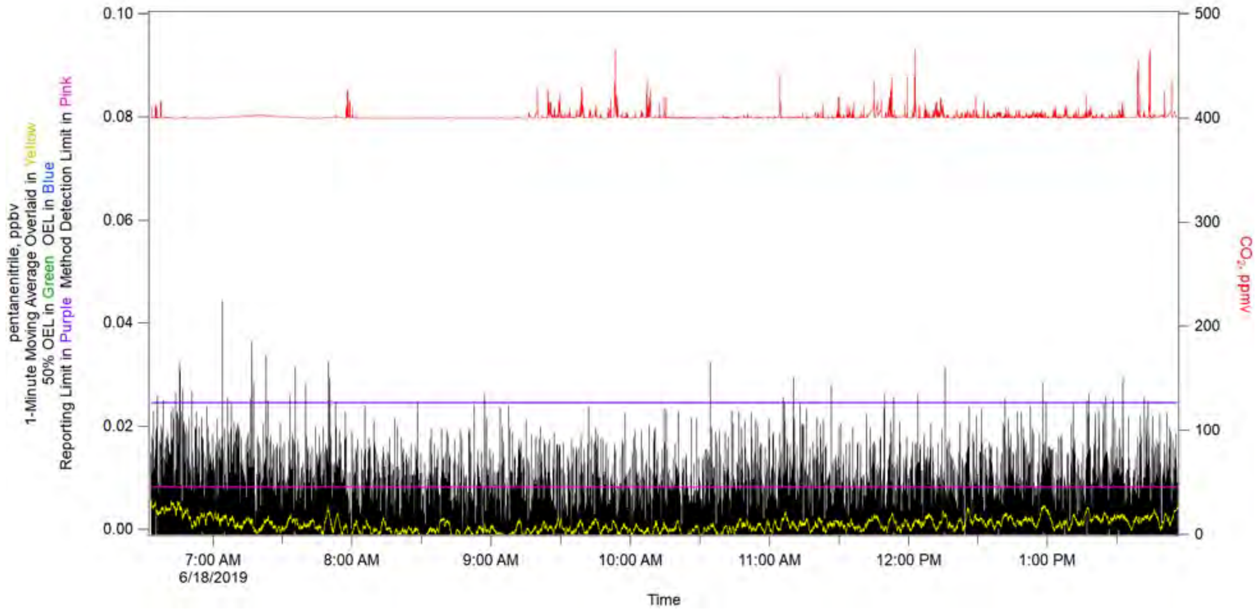

Figure 3-26. Pentanenitrile.

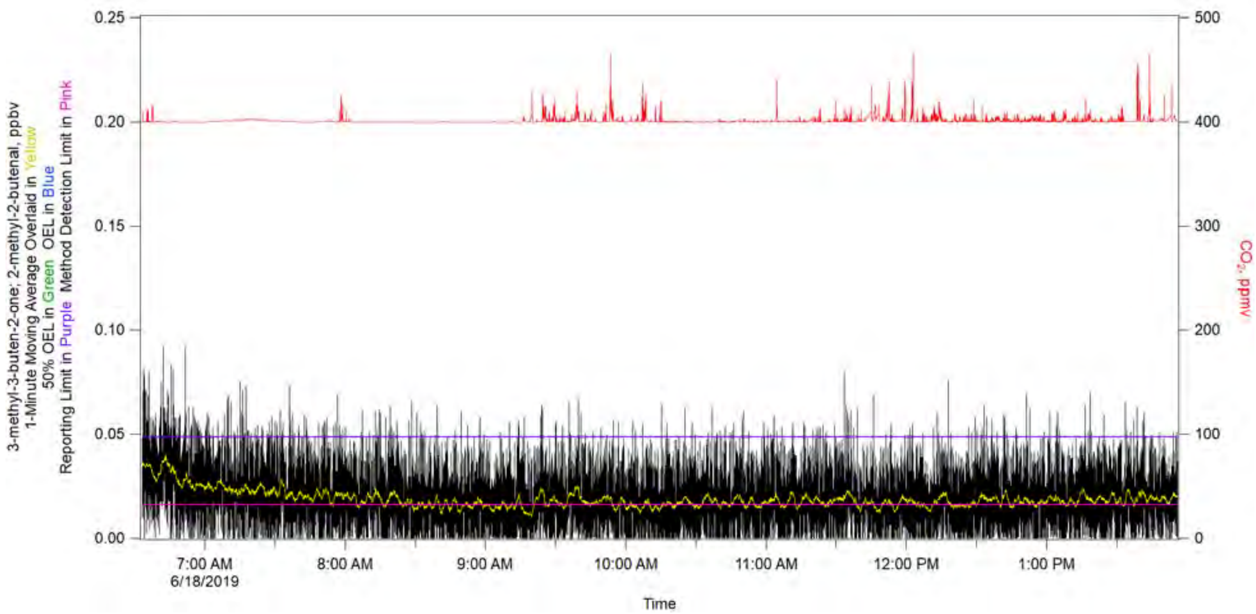

Figure 3-27. 3-methyl-3-buten-2-one; 2-methyl-2-butenal.

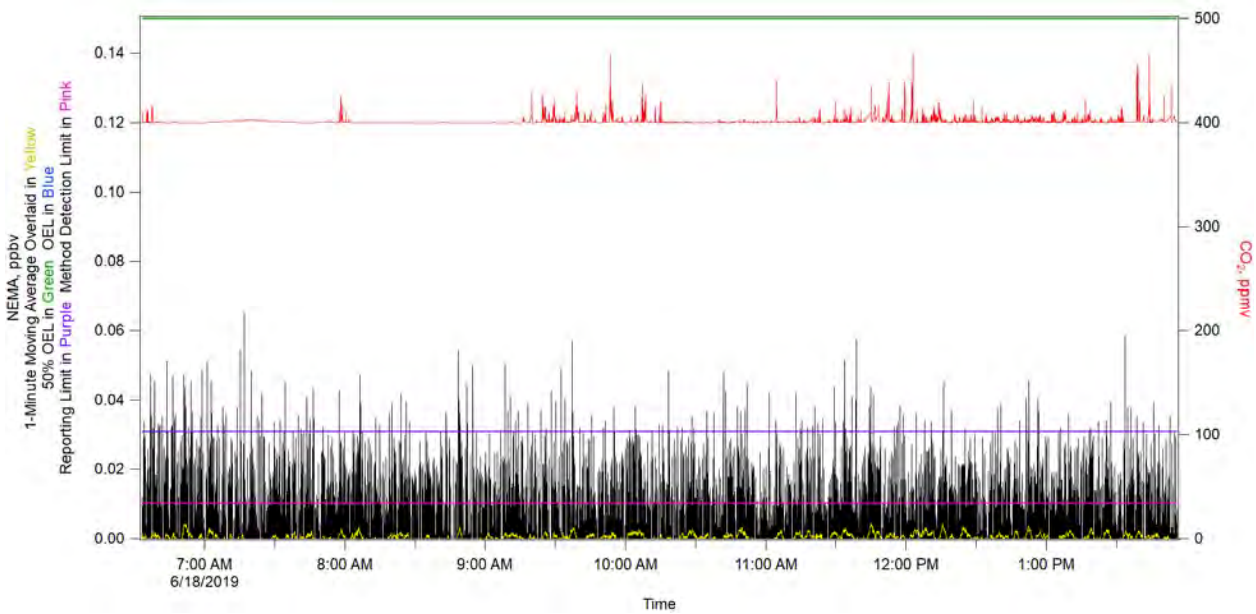

Figure 3-28. N-nitrosomethylethylamine (NEMA).

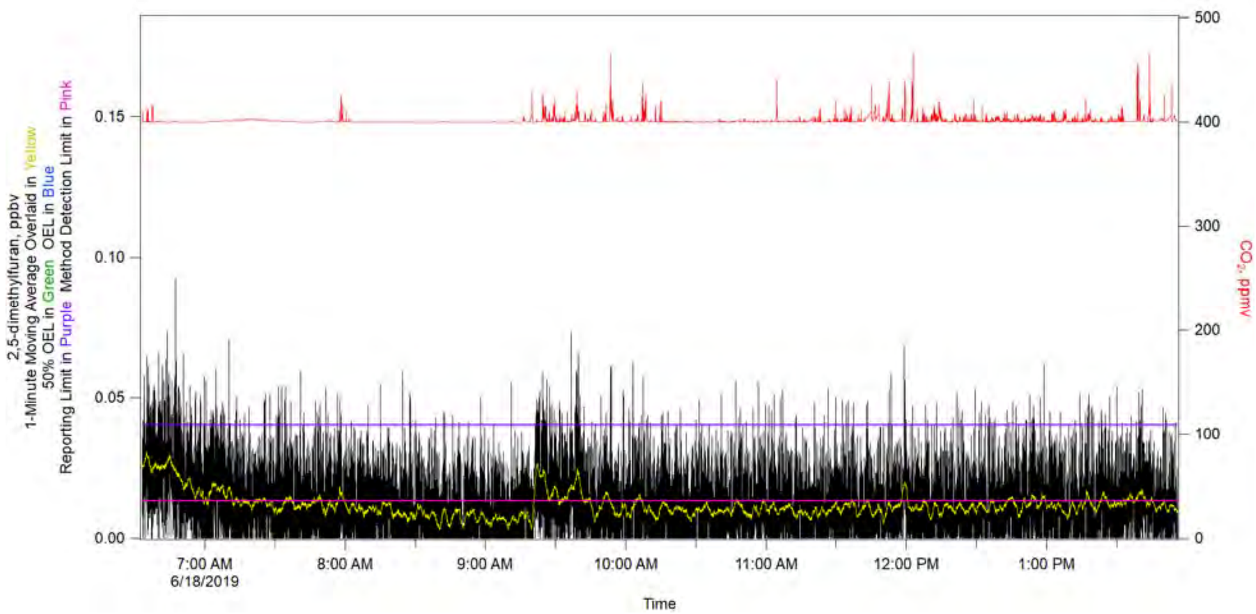

Figure 3-29. 2,5-dimethylfuran.

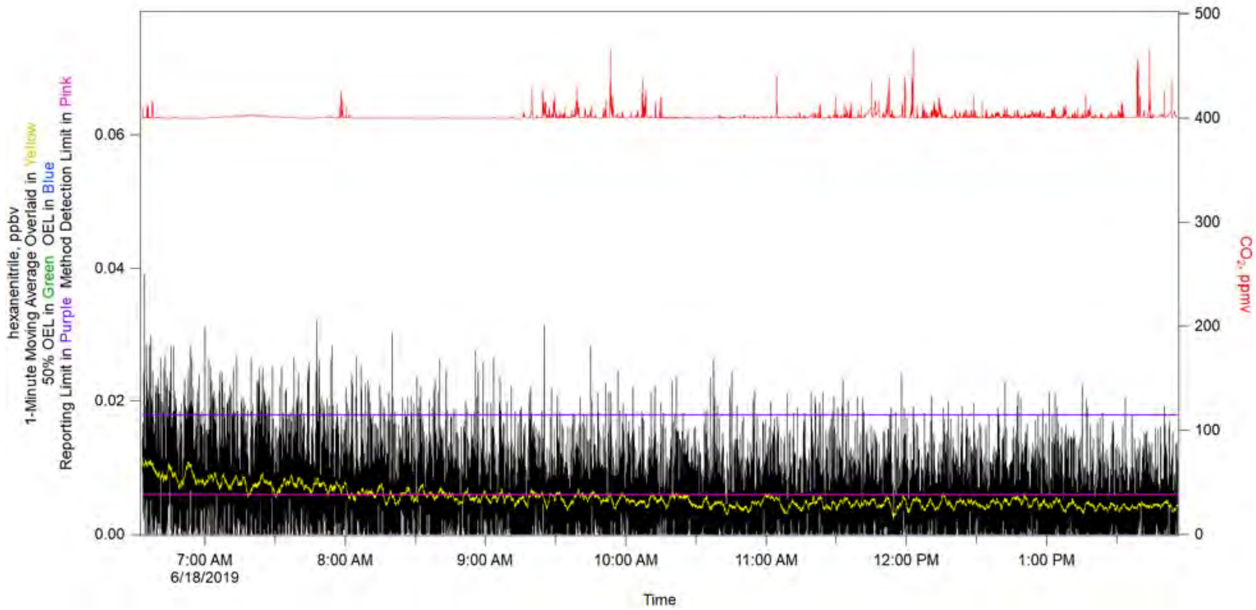

Figure 3-30. Hexanenitrile.

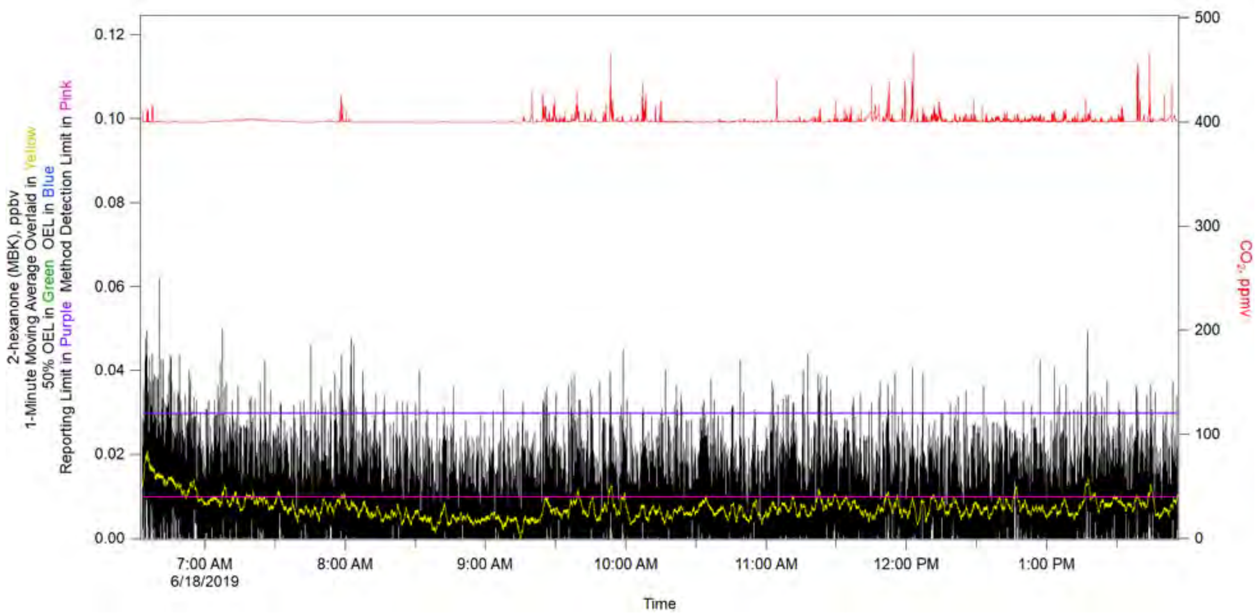

Figure 3-31. 2-hexanone (MBK).

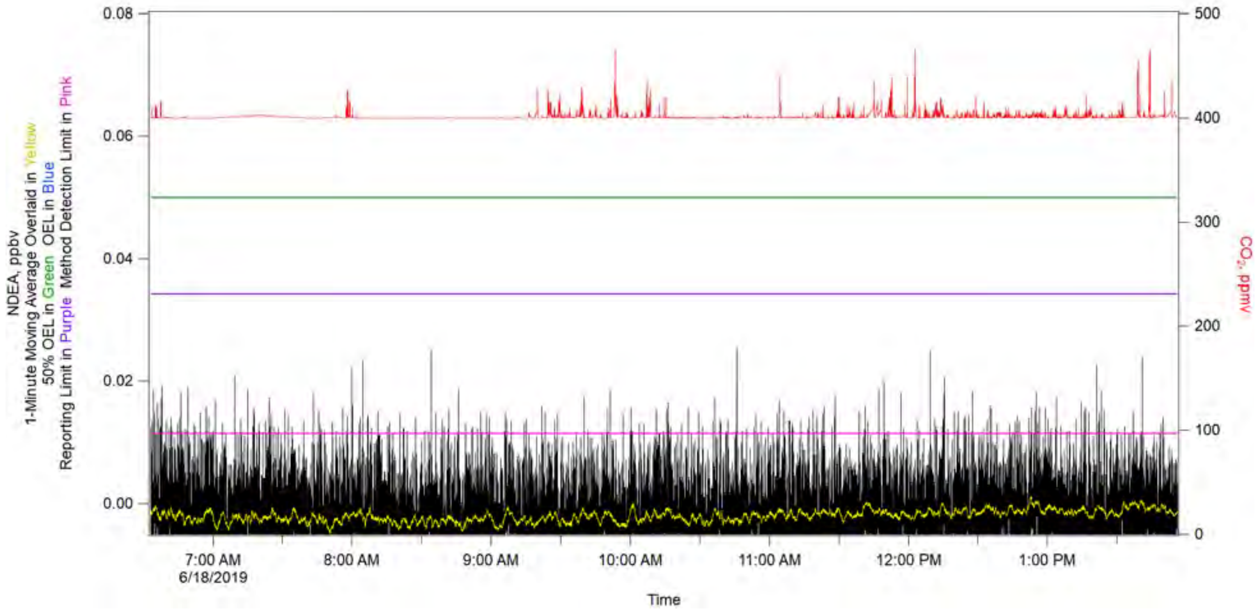

Figure 3-32. N-nitrosodiethylamine (NDEA).

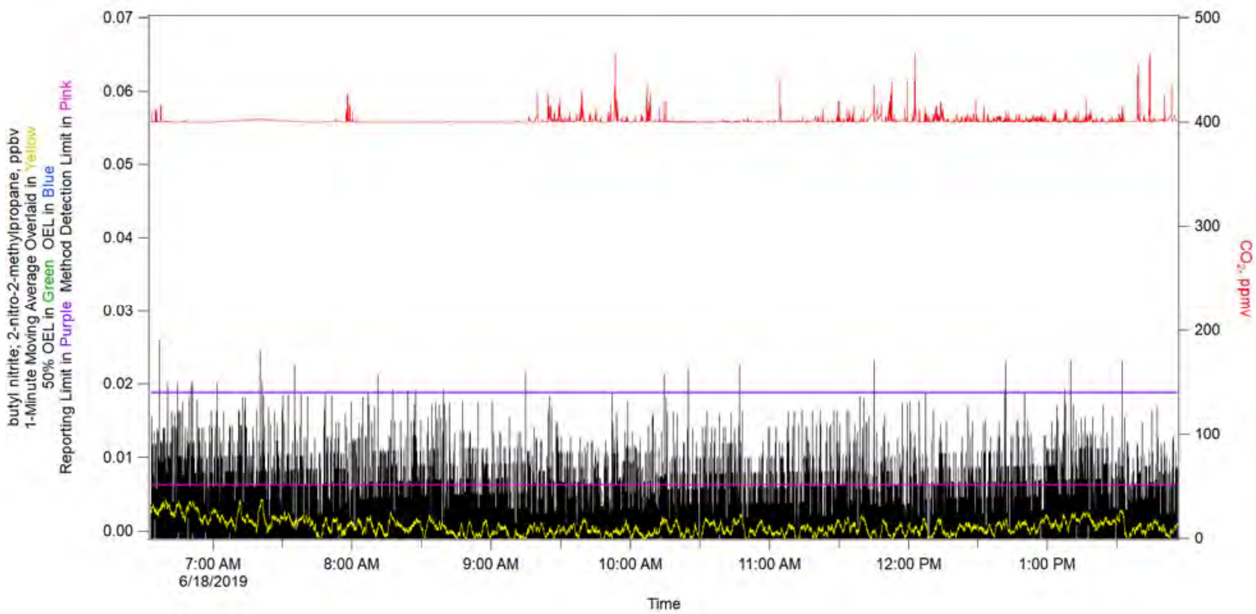

Figure 3-33. Butyl Nitrite; 2-nitro-2-methylpropane.

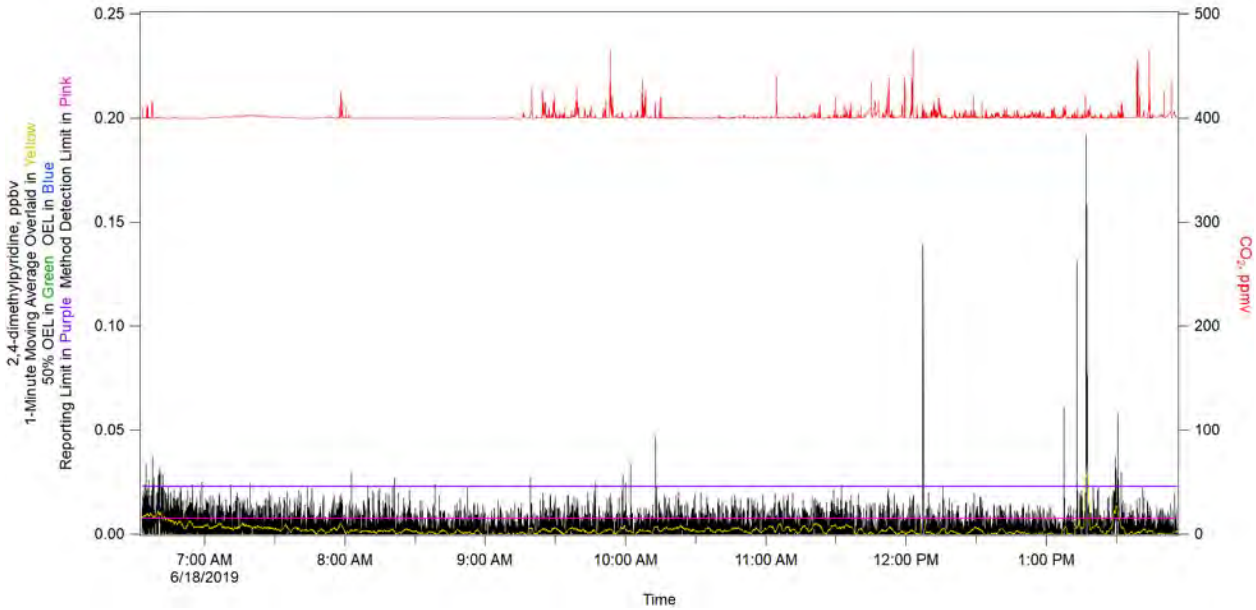

Figure 3-34. 2,4-dimethylpyridine.

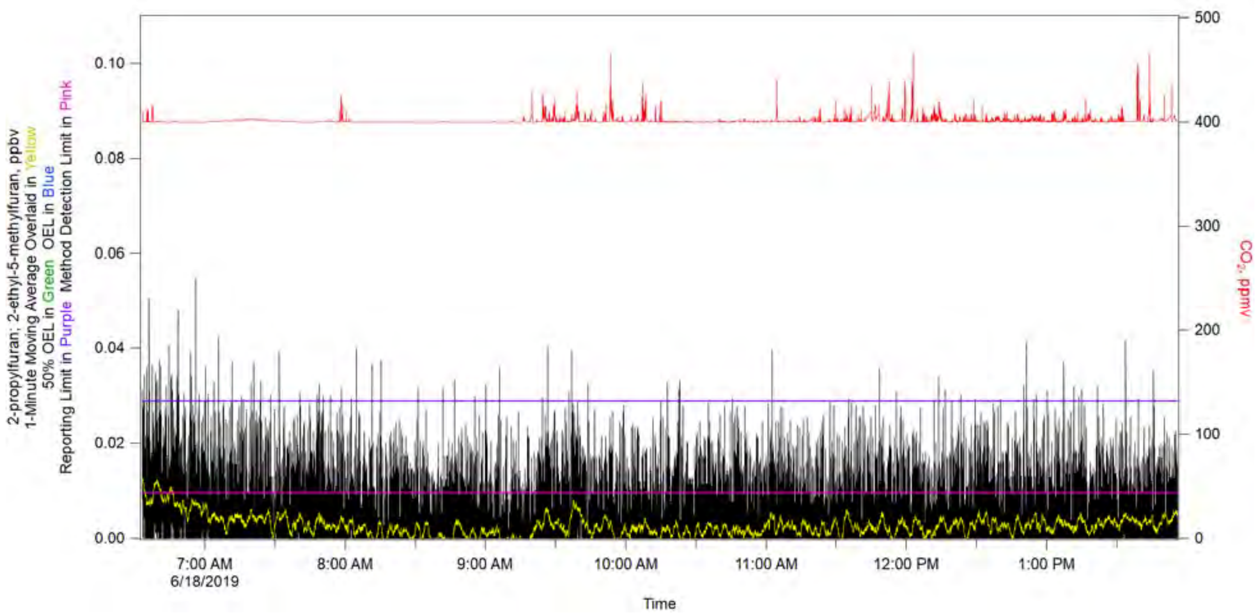

Figure 3-35. 2-propylfuran; 2-ethyl-5-methylfuran.

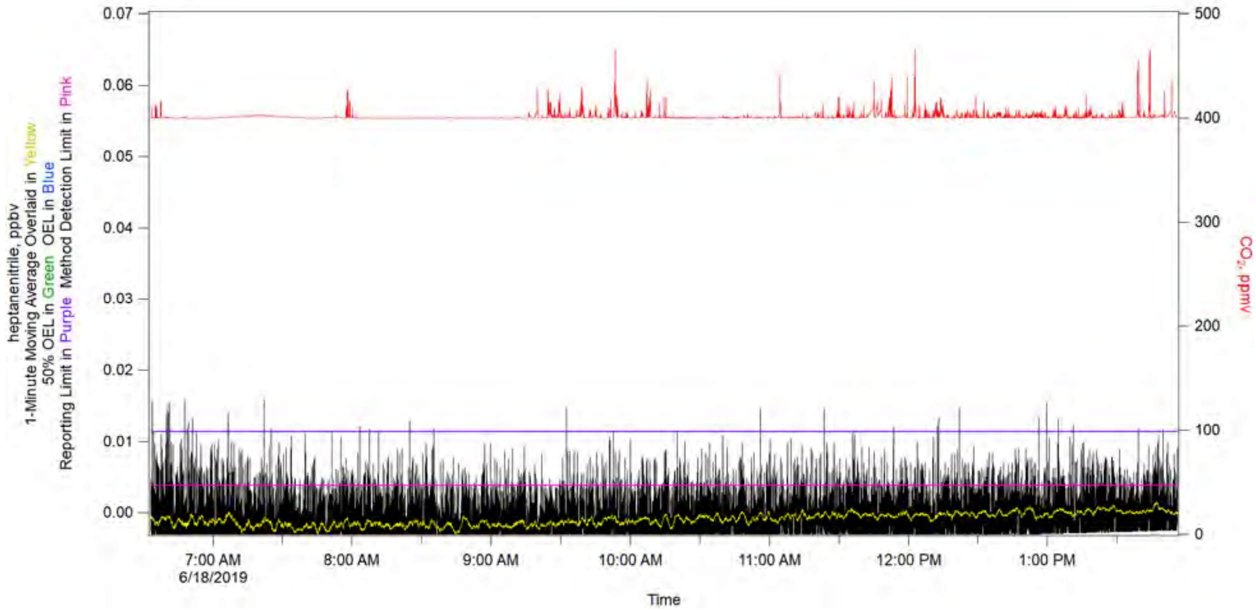

Figure 3-36. Heptanenitrile.

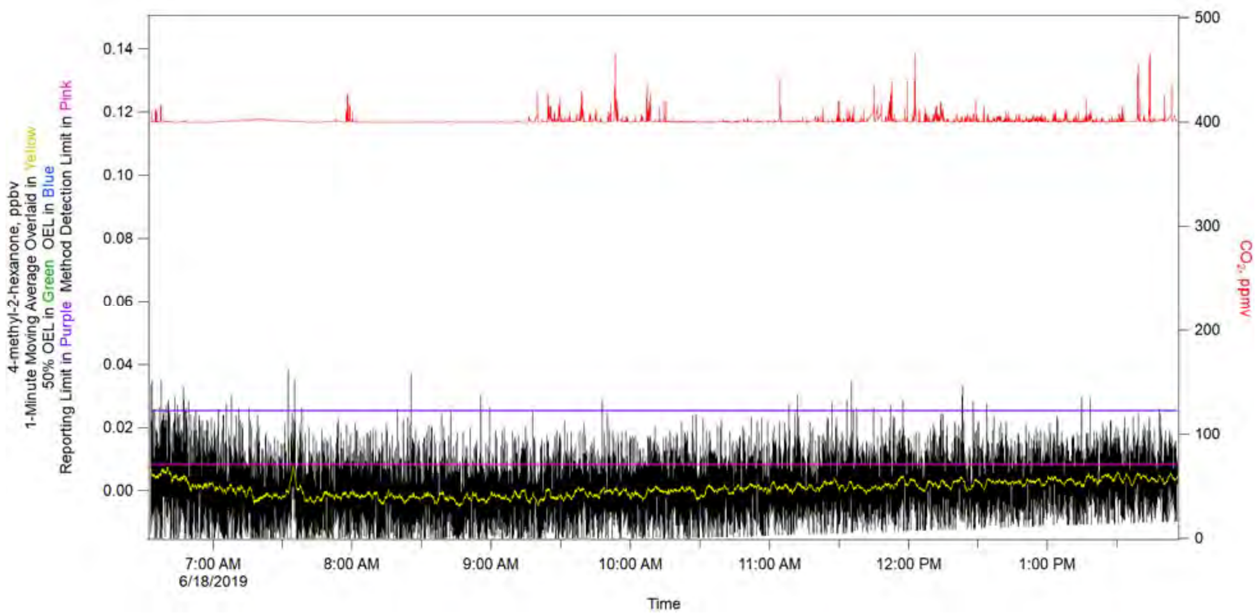

Figure 3-37. 4-methyl-2-hexanone.

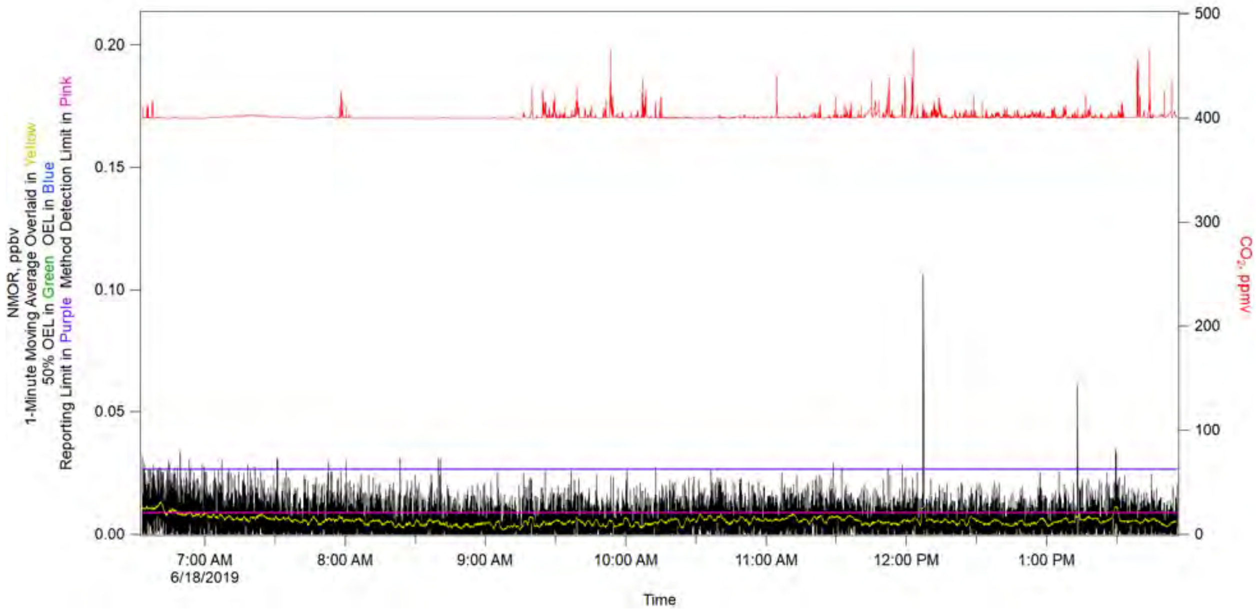

Figure 3-38. N-nitrosomorpholine (NMOR).

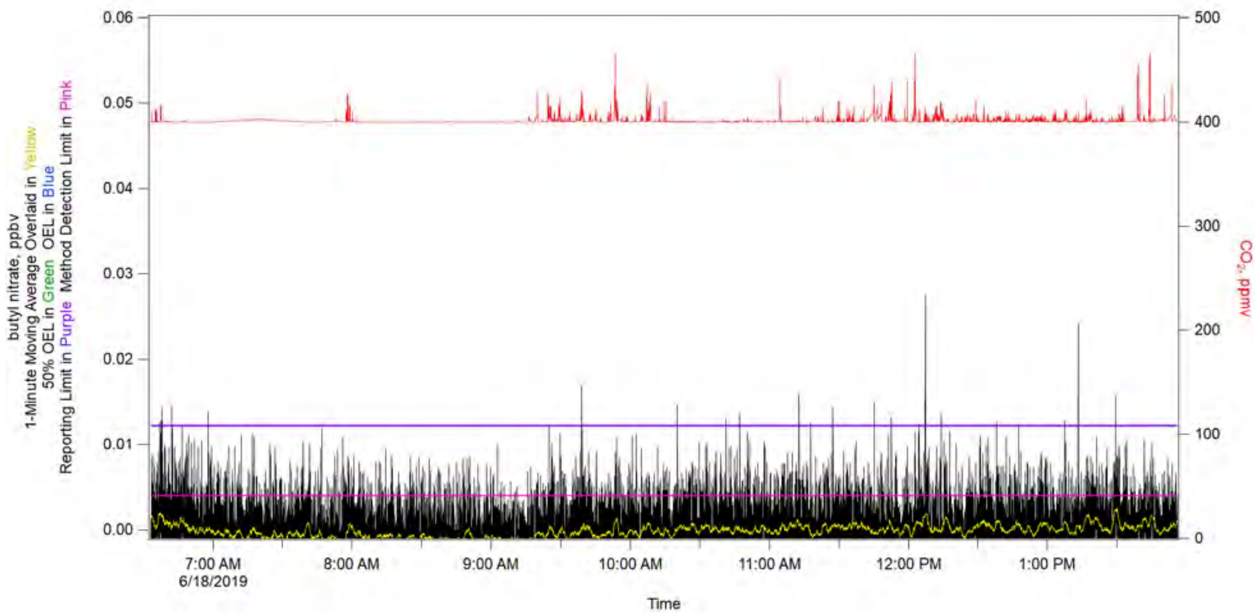

Figure 3-39. Butyl Nitrate.

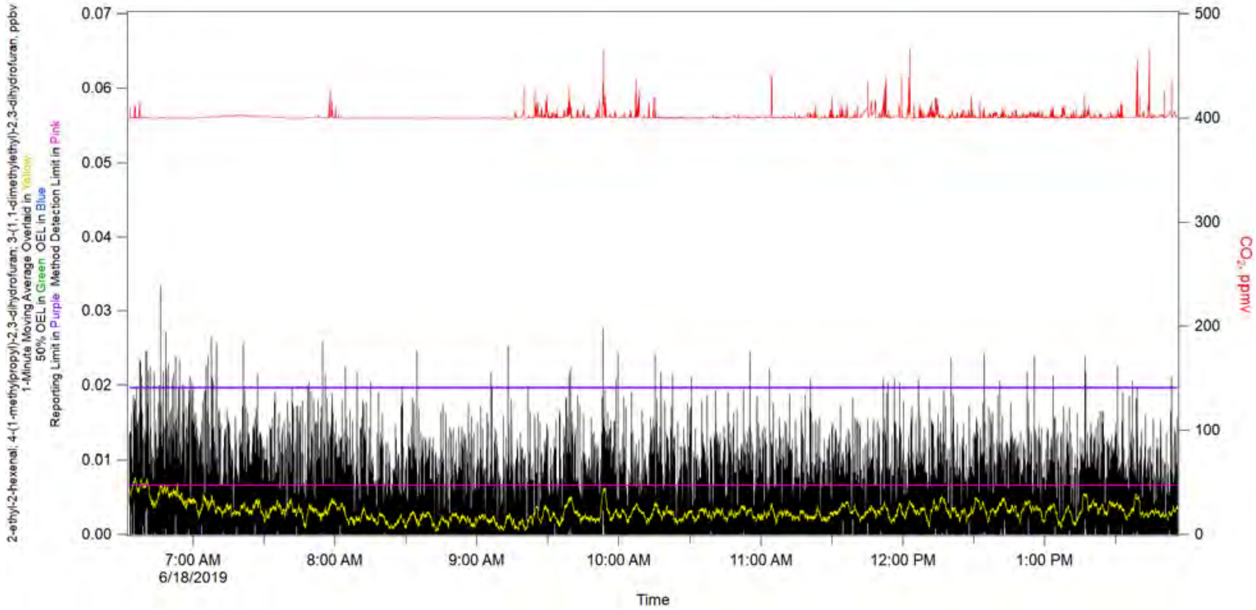

Figure 3-40. 2-ethyl-2-hexenal; 4-(1-methylpropyl)-2,3-dihydrofuran 3-(1,1-dimethylethyl)-2,3-dihydrofuran.

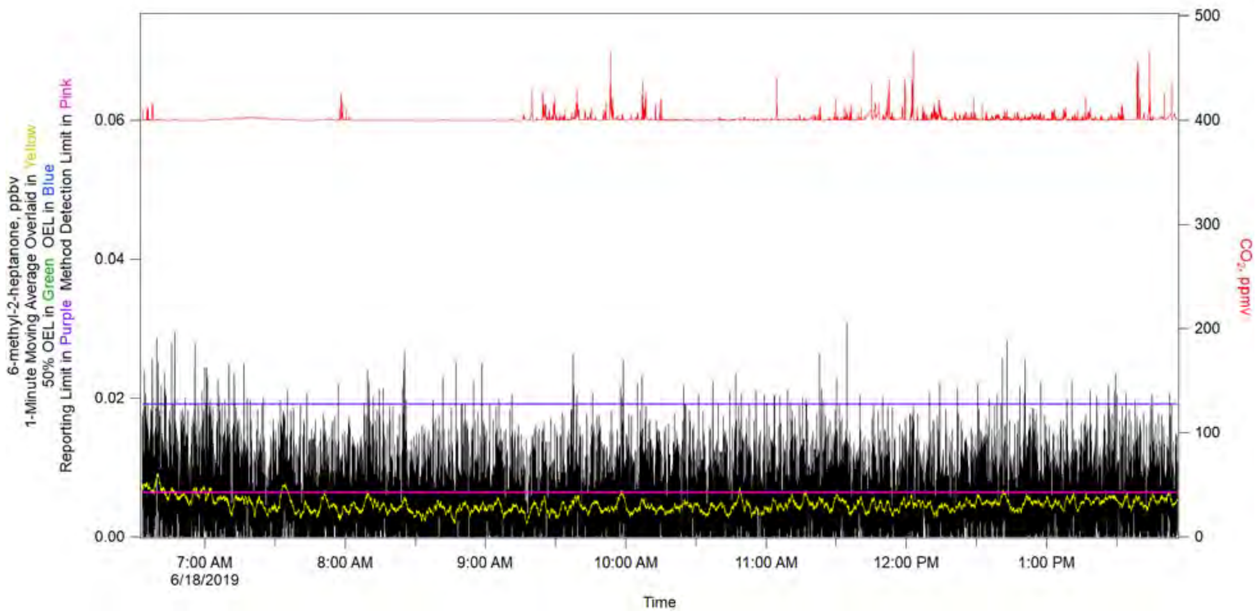

Figure 3-41. 6-methyl-2-heptanone.

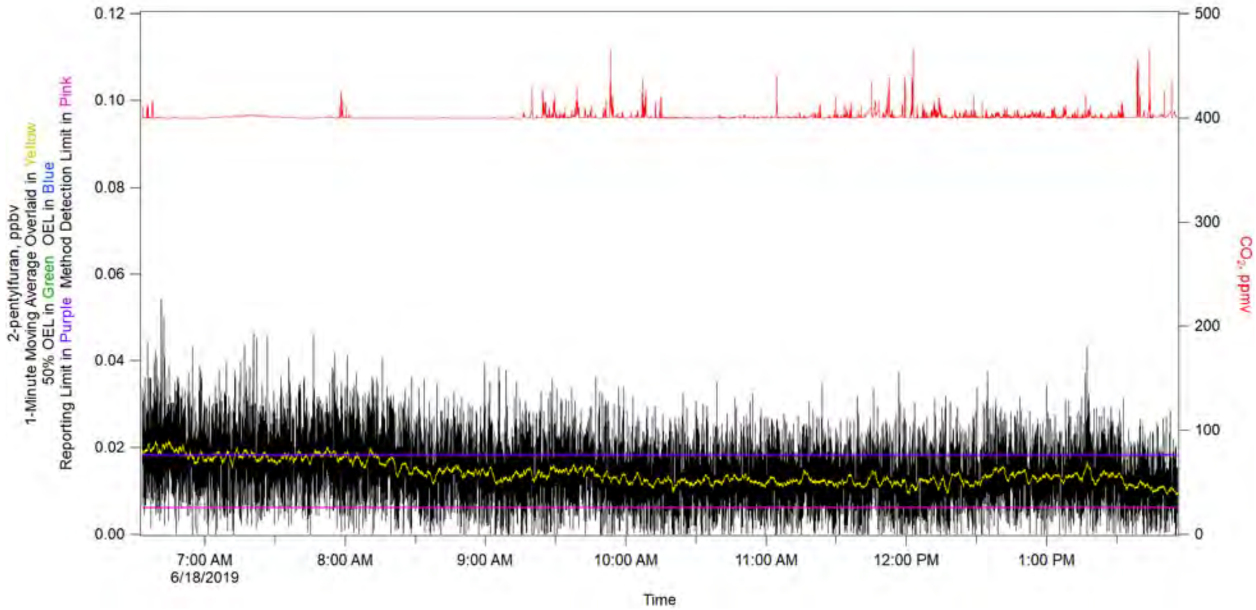

Figure 3-42. 2-pentylfuran.

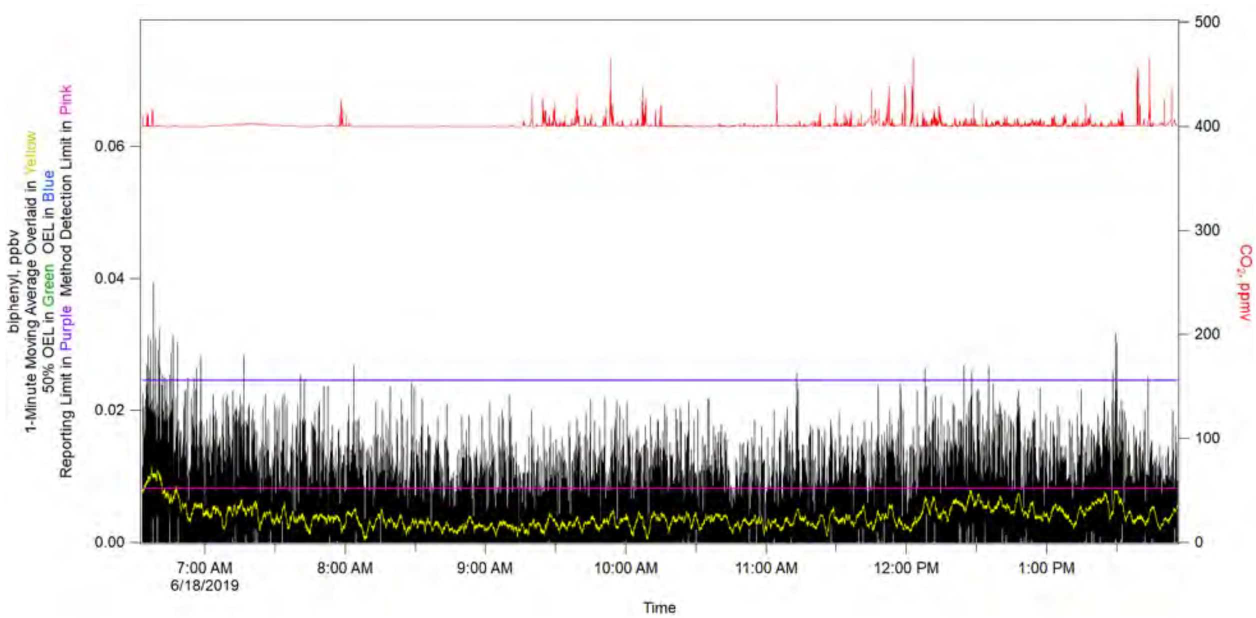

Figure 3-43. Biphenyl.

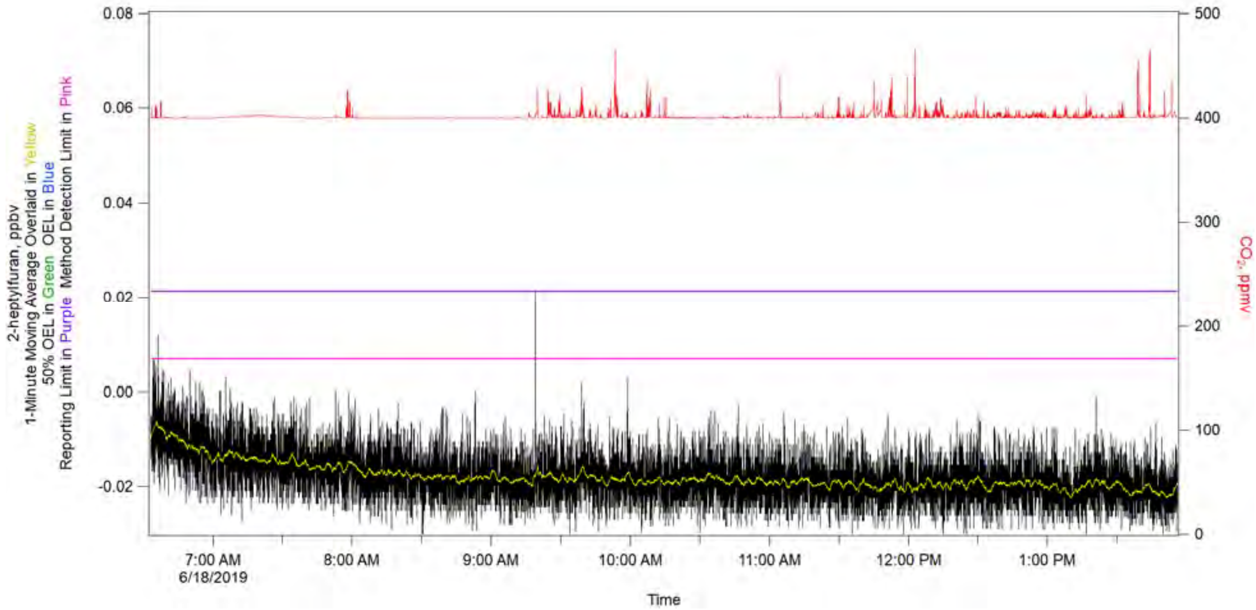

Figure 3-44. 2-heptylfuran.

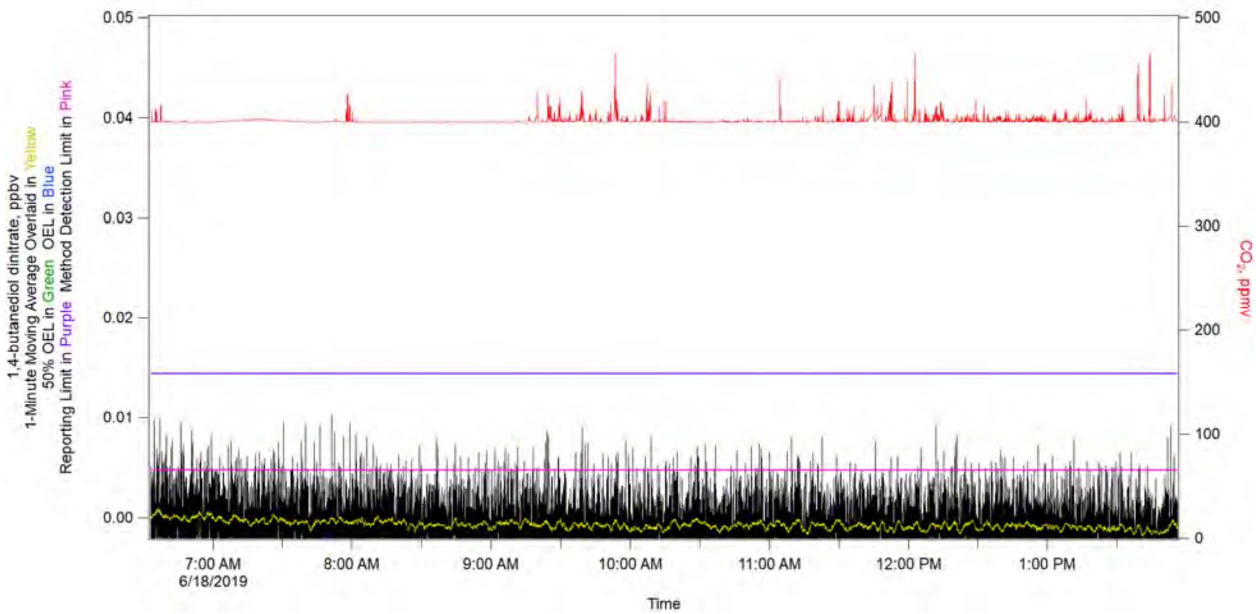

Figure 3-45. 1,4-butanediol Dinitrate.

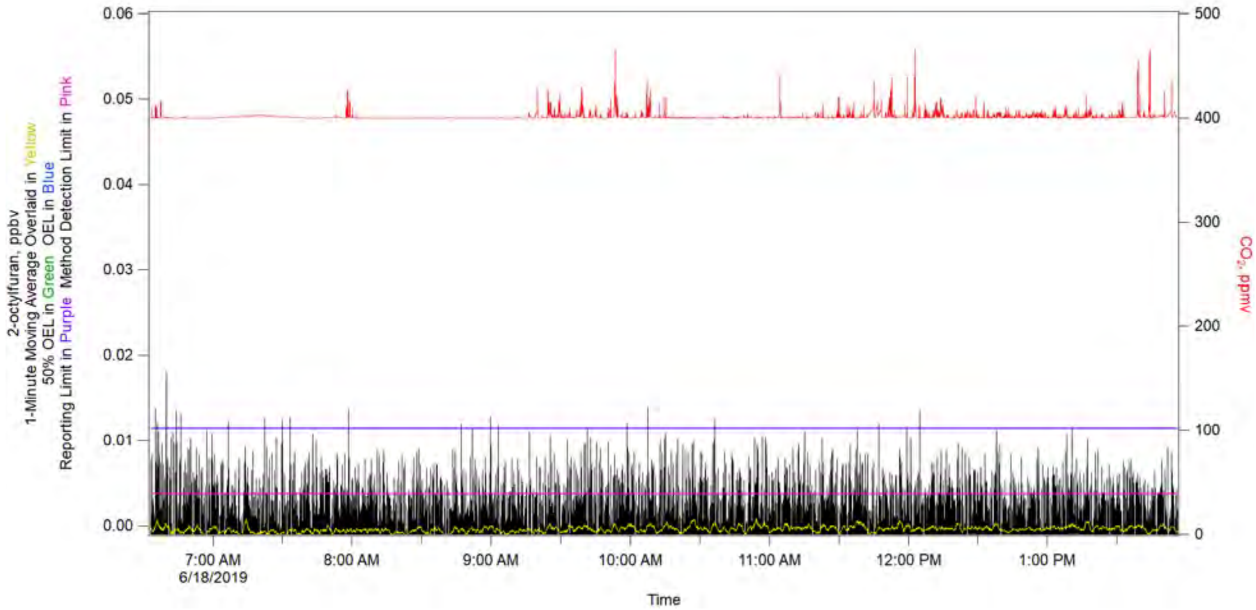

Figure 3-46. 2-octylfuran.

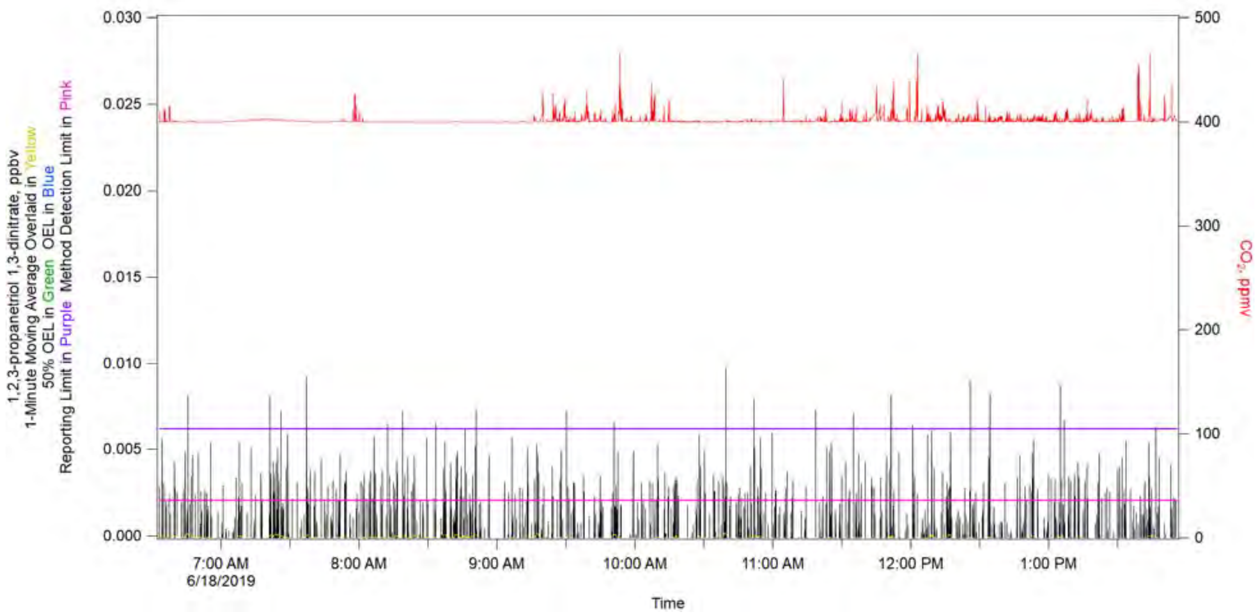

Figure 3-47. 1,2,3-propanetriol 1,3-dinitrate.

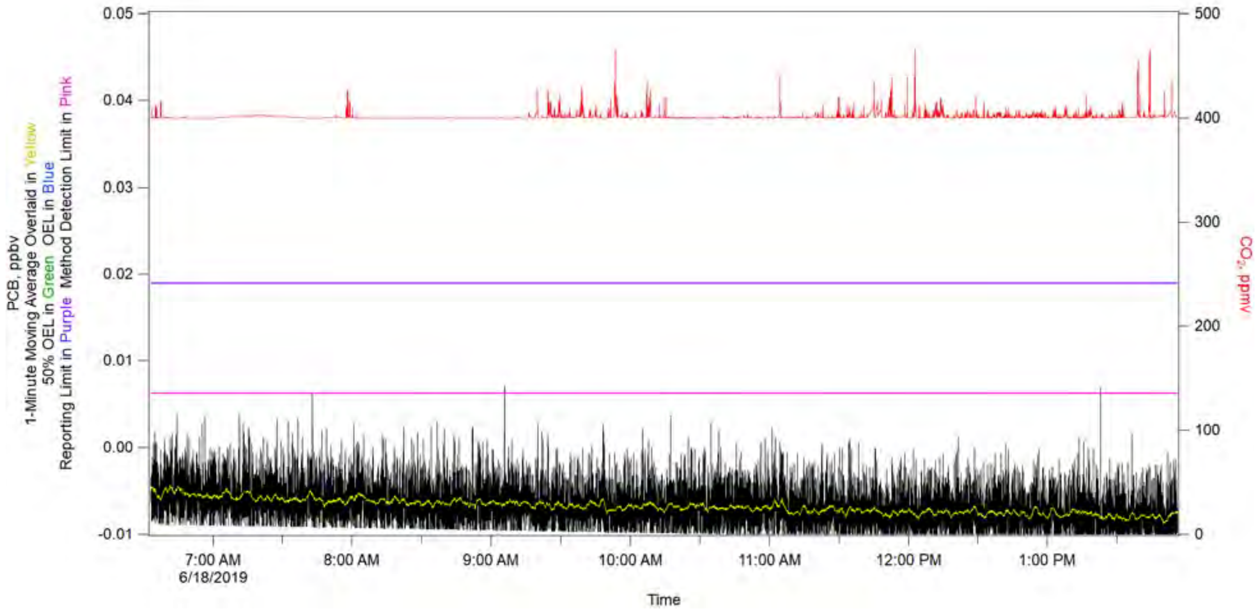

Figure 3-48. PCB.

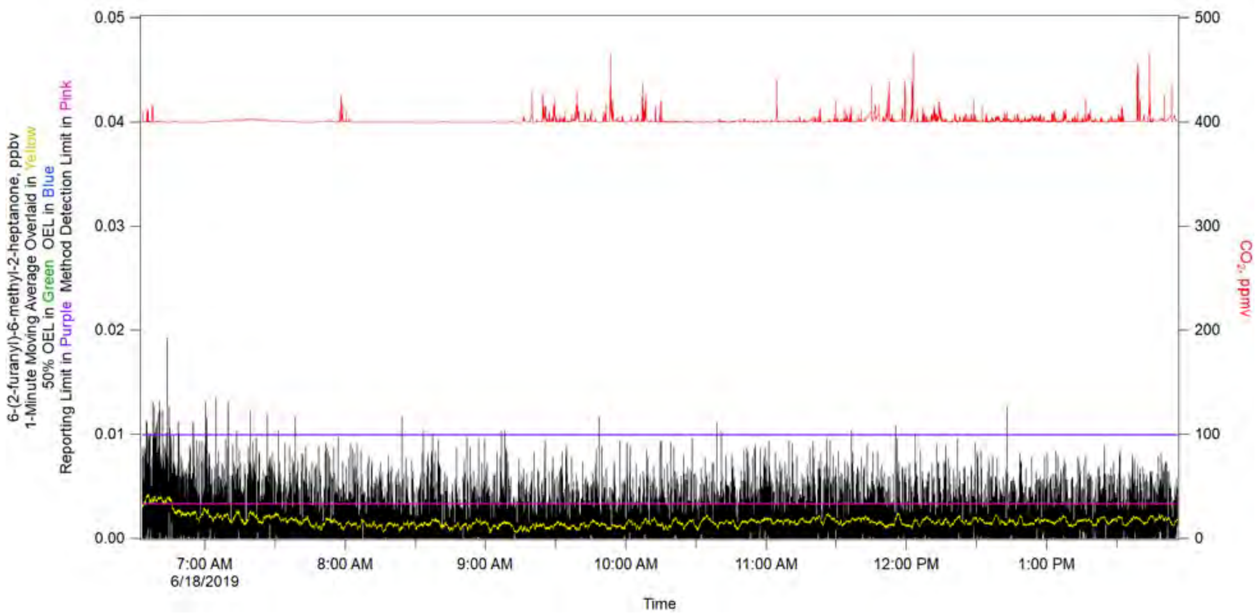

Figure 3-49. 6-(2-furanyl)-6-methyl-2-heptanone.

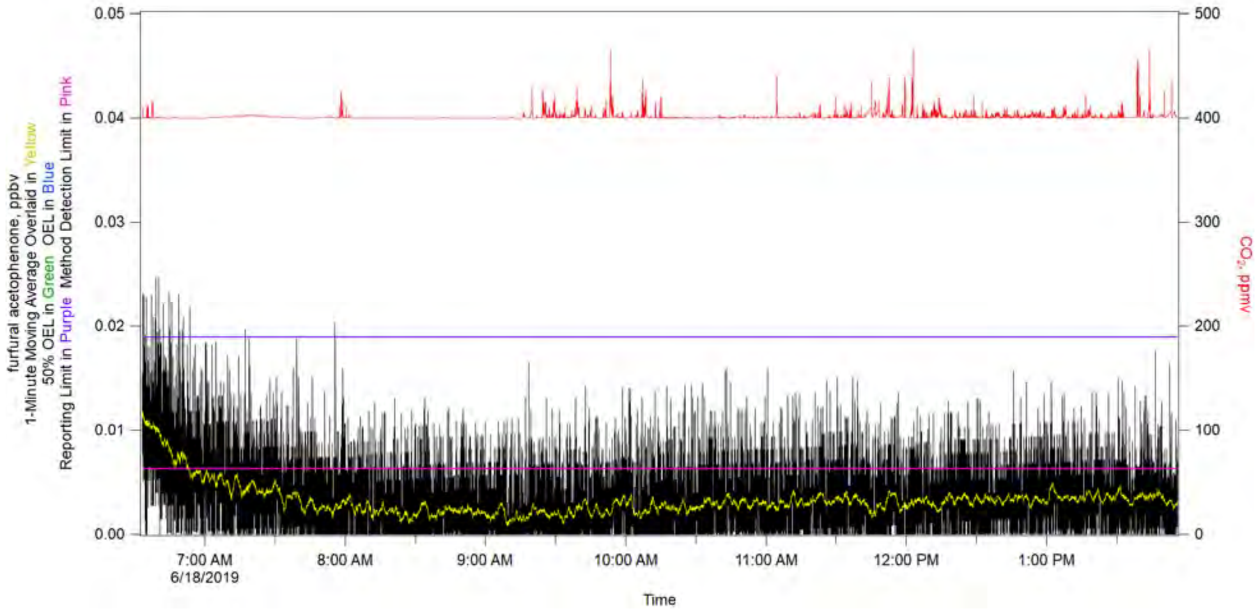

Figure 3-50. Furfural Acetophenone.

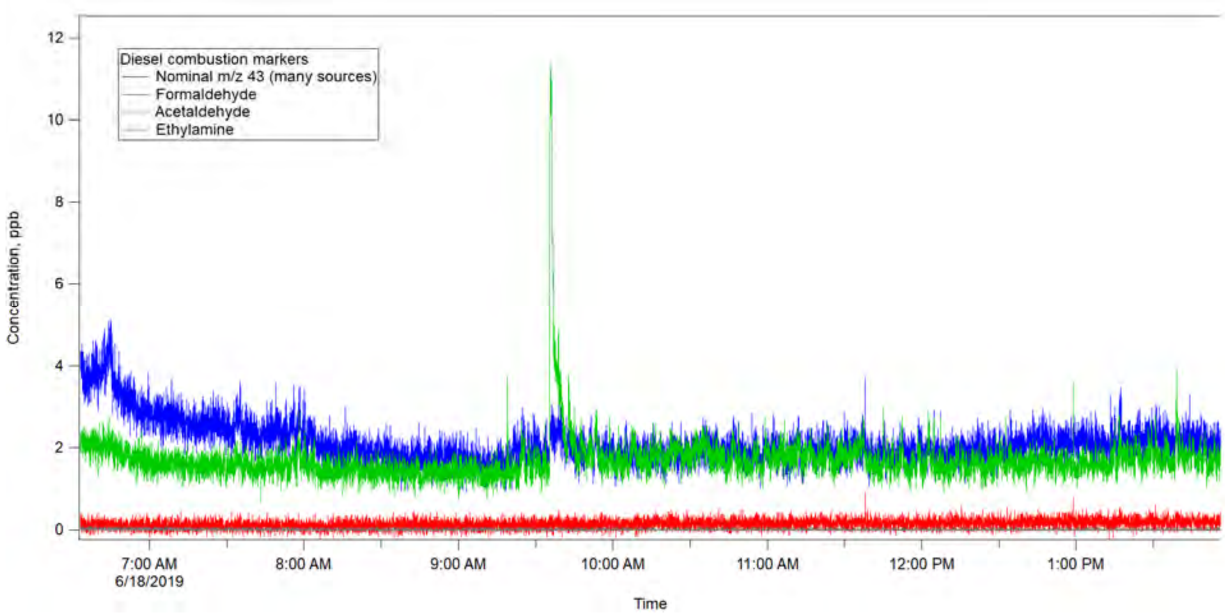

Figure 3-51. Diesel Combustion Markers.

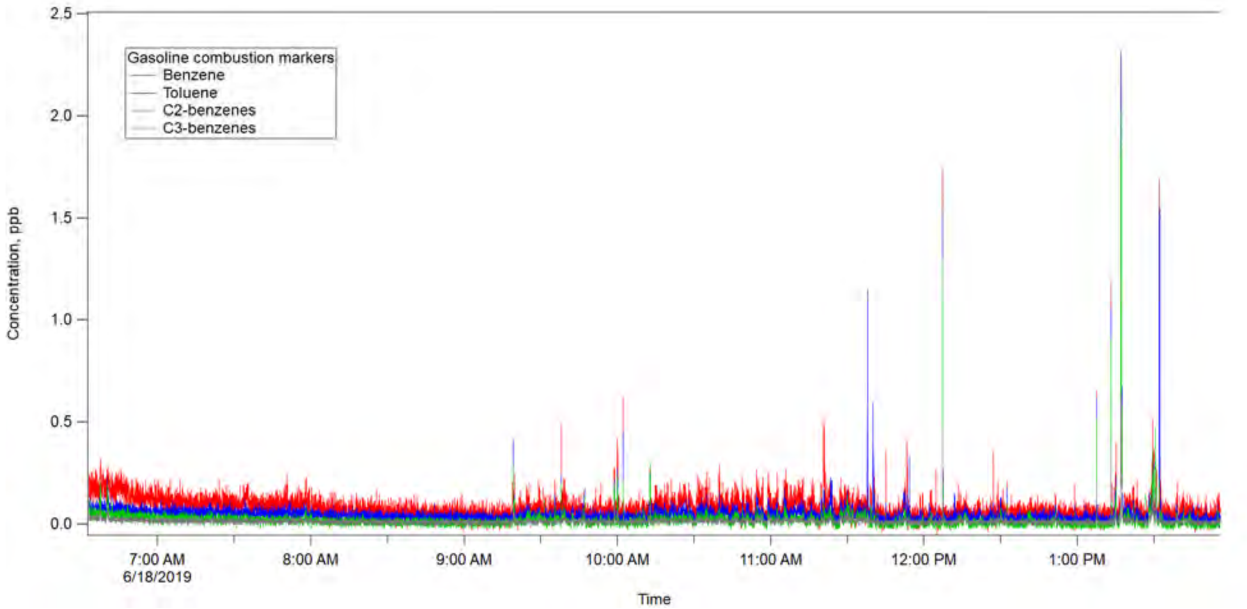

Figure 3-52. Gasoline Combustion Markers.

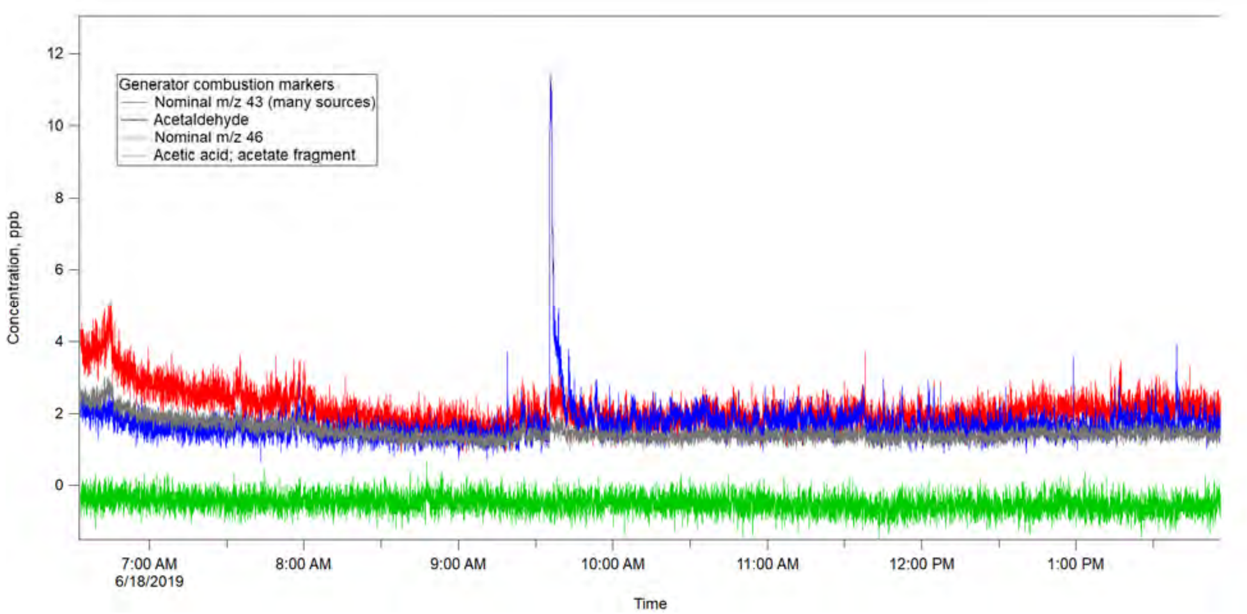

Figure 3-53. Generator Combustion Markers.

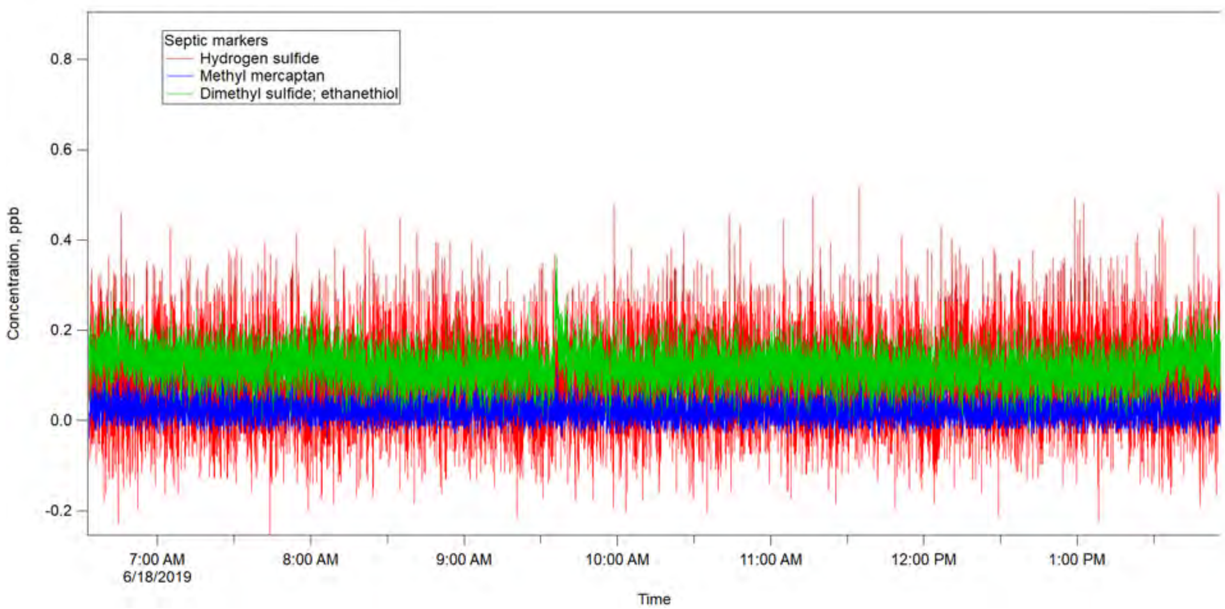

Figure 3-54. Septic Markers.

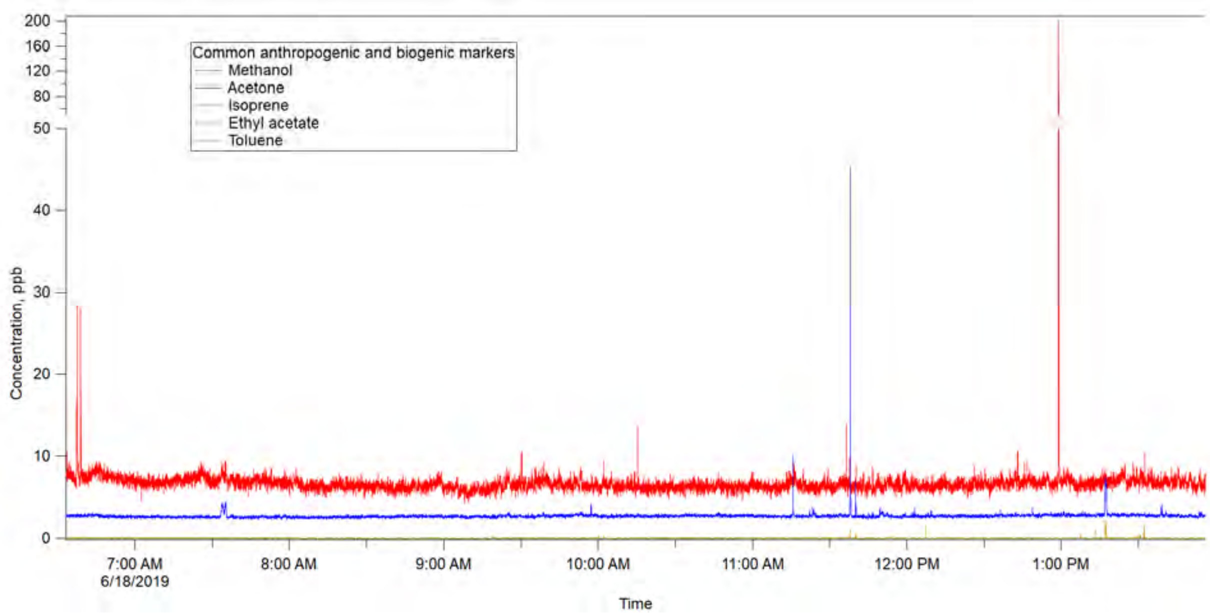

Figure 3-55. Plant and Human Markers.

4.0 JUNE 19, 2019 – AOP-015 EVENT

4.1 Quality Assessment

Data from June 19, 2019, were assessed using Procedure 17124-DOE-HS-102. A Data Acceptance Checklist was completed. The data were accepted by TerraGraphics with the following comments. Report No. 66409-RPT-004 was adequately documented and all checks passed the acceptance limits.

4.2 Summary

On June 19, 2019, ML personnel arrived at the TerraGraphics warehouse in Pasco, WA, at 04:27 to prepare for monitoring activities of the AW-104 Pump Pull Removal on the Hanford Site. The QA/QC zero-air/span checks were performed on the LICOR CO_2 monitor, the Picarro NH_3 analyzer, and the PTR-MS beginning at 04:43. The ML arrived on the Hanford Site and checked in with the CSM at 05:41. During this time, ML Operators were notified that the AW-104 Pump Pull Removal had been delayed. At 06:20, the ML Operators conducted site survey loops and proceeded to park downwind of 214-A Farm at 06:45. A second round of site survey loops began at 07:55 and concluded at 08:26. Operators parked the ML downwind of AW Farm at 08:41. By 09:14, the ML was moved downwind of AP Stack and Operators noted they were smelling sulfur but did not think the source was coming from AP Stack due to a slight shift in the wind direction. Operators moved the ML approximately 50 yards north to further investigate where the sulfur smell was coming from at 09:17.

The ML Operators were notified of an Abnormal Operating Procedure (AOP)-015 event by the CSO announcement at 09:24 PST via digital Shift Office Event Notification (SOEN) text message. The event was reported near the east side of AP Farm, where the ML was located and investigating a sulfur-like smell. The ML reported to the CSO for a briefing at 09:35. By 09:45, the ML parked as close as possible to the reported AOP-015 event and setup of the 208’ hose began. Sampling of the AOP-015 from the 208’ hose ended at 10:31 when Operators switched to sampling from the mast. At 11:07 PST, the CSM announced an exit from the AOP-015. At 11:33, the ML was parked northeast of AP Stack in attempt to find a source for the sulfur smell. At 12:00, Operators moved the ML upwind of AP Farm to see if the smell could be coming from a source upwind of AP. After moving slowly upwind of AP Farm and not seeing any potential sources or elevated signals, Operators returned back to the East side of AP Farm. After seeing multiple elevated signals on the PTR-MS, Operators decided to source hunt with the 35’ hose at 12:25. From 12:29 to 13:53, the ML was sampling from the 35’ hose. During that time, a source of the sulfur smell was identified. At 13:57, the ML began end-of-shift duties and proceeded to check out with the CSM and left the site by 14:06. Further findings from this monitoring day can be found in Appendix B (53005-81-COM-0619-002, *Subcontract 53005, Release 81 – Transmittal of Special Communication Report for AOP-015 Event on June 19, 2019*).

5.0 JUNE 20, 2019 – AREA MONITORING

5.1 Quality Assessment

Data from June 20, 2019, were assessed using Procedure 17124-DOE-HS-102. A Data Acceptance Checklist was completed. The data were accepted by TerraGraphics with the following comments. Report No. 66409-RPT-004 was adequately documented and all checks passed the acceptance limits.

5.2 Summary

On June 20, 2019, ML personnel arrived at the TerraGraphics warehouse at 04:38 PST to prepare the ML for monitoring the AW Pump Pull Removal on the Hanford Site. The QA/QC zero-air/span checks were performed on the LI-COR CO_2 monitor, the Picarro NH_3 analyzer, and the PTR-MS beginning at 04:56 and left the TerraGraphics warehouse for fuel at 05:00. At 05:01, Mr. George Weeks called to inform the ML Operators that the monitoring activity of the AW Pump Pull had been canceled and to proceed with Hanford Site area monitoring. The ML left the fuel station at 05:20 and arrived on the Hanford Site and checked in with the CSM at 05:58. At 06:07, the ML Operators headed to TX/TY Farm. At 06:25, the ML parked east of 241-TY Tank Farm. At 07:00, the ML moved approximately 50' south due to a slight wind shift. From 07:31 to 07:39, the ML was moving to a downwind position from the U Farm change trailer and remained in this location until 08:42. Site survey loops began after leaving U Farm. The ML stopped at a porta potty at 09:03. From 09:30 to 10:27, the ML was parked east southeast of AP Farm and proceeded with site survey loops. At 10:37, the ML stopped near the on-site food trucks and noted an elevation in signals correlated with gas and/or diesel engine emissions. At 10:45, the ML left the food truck site to continue with site survey loops. At 11:15, ML Operators noted they saw elevated signals from Mass 75 near AP Farm. At 11:19, the ML parked northeast of AP Stack, near the trailer that contains corroded batteries. At 11:22, the ML Operators noted an elevation of methyl nitrate signals that could potentially be coming from a nearby running generator. A final round of site survey loops began at 12:18. From 12:53 to 14:01, the ML was parked east of 241-A Farm. At 14:03, the ML Operators checked out with the CSM and headed to the TerraGraphics warehouse.

Table 5-1. Mobile Laboratory Summary of Events.

Time	Activity	Observed
10:44	Area monitoring	Gas/diesel engines near food trucks
11:15	Area monitoring near AP Farm	No potential source identified
11:22	Area monitoring near AP Farm	Running generator
13:38	Area monitoring near A Farm	Exhaust spike

Table 5-1 illustrates the times and locations noted by the ML Operators when a potential source or peaks of interest were observed. Figure 5-49 and Figure 5-50 for diesel and gasoline combustion markers display the significant amounts of traffic observed by the ML Operators throughout the morning. At approximately 10:44, the ML was located near food trucks where workers were driving in and out of the area. The ML Operators also noted plumes of diesel, gasoline and generator combustion markers near 241-AP Farm where a running generator and workers are noted nearby.

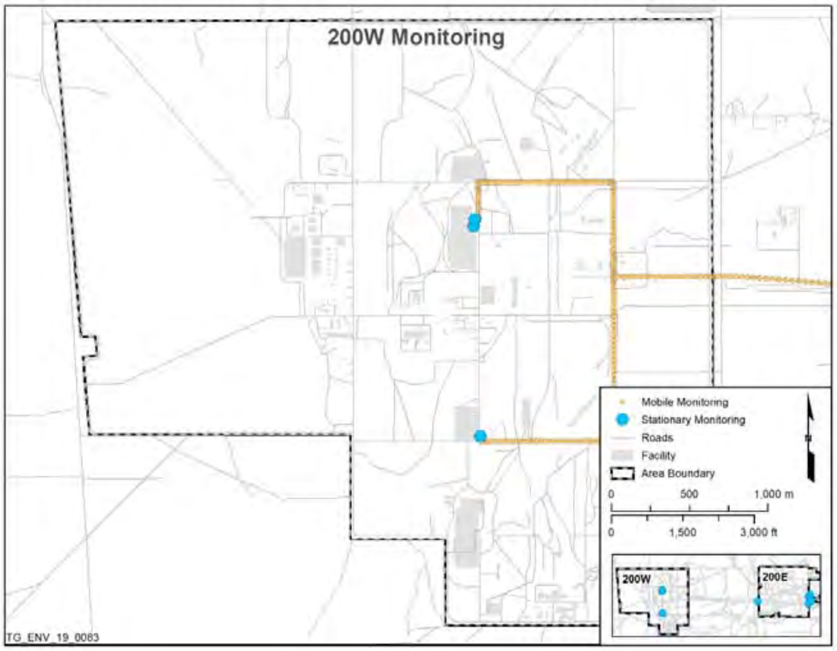

Figure 5-1. Location of the Mobile Laboratory for the Duration of the Monitoring Period in the 200 West Area.

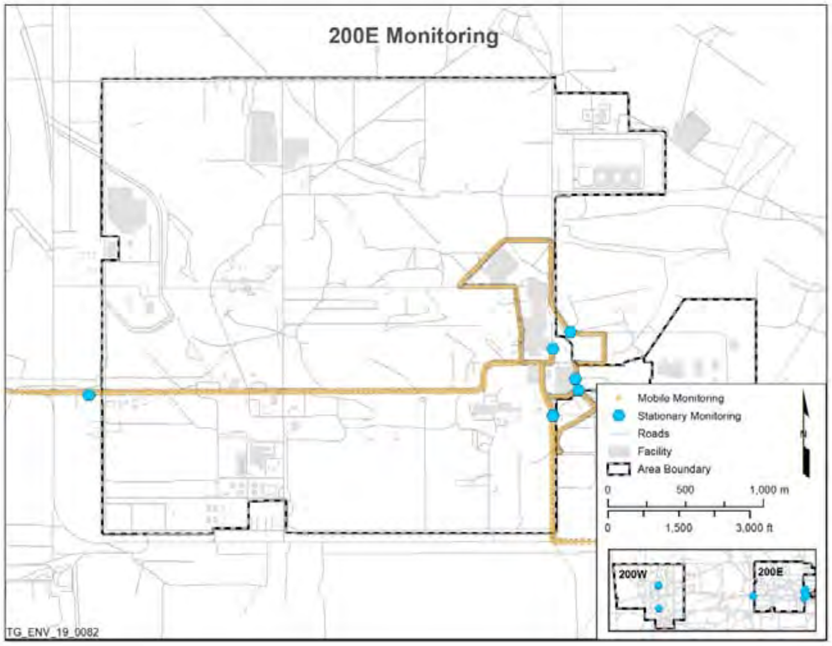

Figure 5-2. Location of the Mobile Laboratory f or the Duration of the Monitoring Period in the 200 East Area.

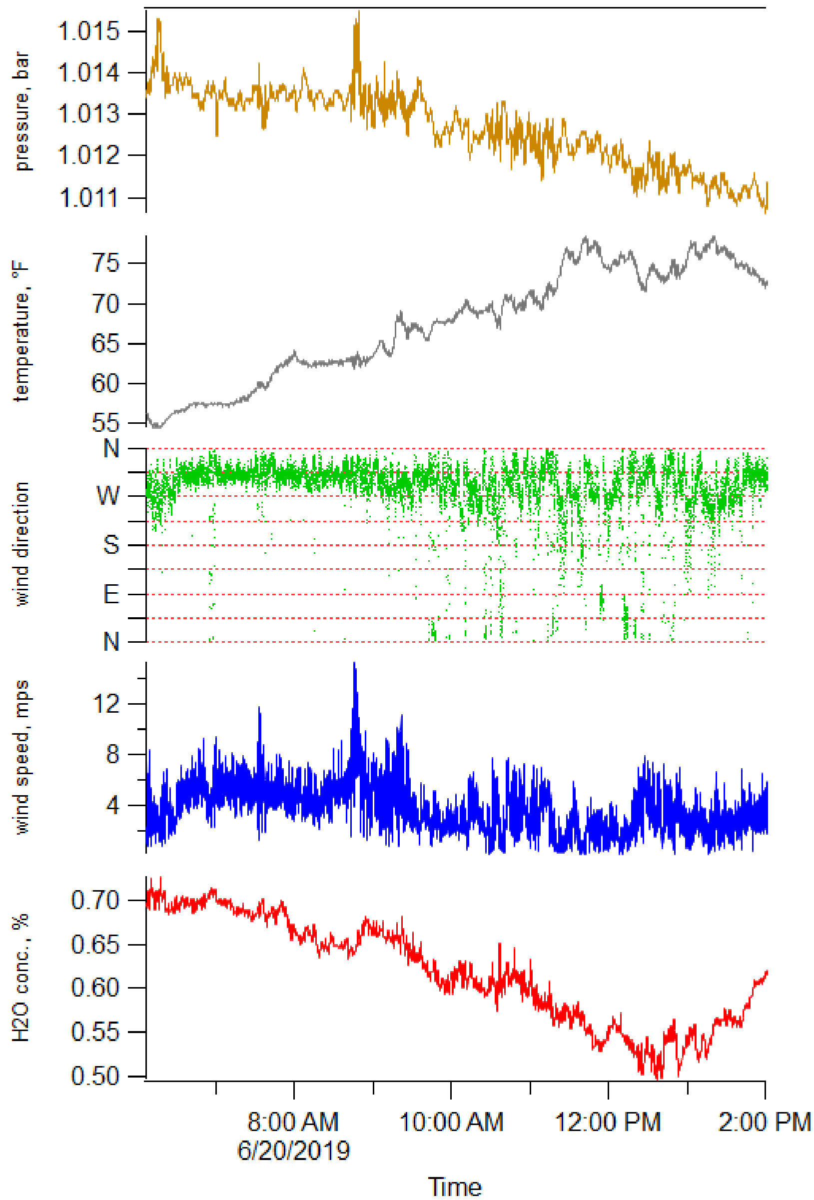

Figure 5-3. Weather Data for the Duration of the Monitoring Period.

Figure 5-2 illustrates the meteorological summary for the monitoring period of June 20, 2019. The temperature rose from 56°F reaching a high of 76°F for the day. Moderate winds came generally from the northwest for most of the monitoring period, as pressure slowly decreased.

5.3 Samples Collected

Continuous air monitoring was performed using the following instrumentation:

- PTR-TOF 6000 X2,
- LI-COR CO_2 Monitor,
- Picarro Ammonia Monitor, and
- Airmar Weather Station.

Confirmatory air samples were not collected during this period.

5.4 Area Monitoring

Table 5-2. Chemical of Potential Concern Statistical Information for the Area Monitoring on June 20, 2019. (2 Sheets)

COPC #	COPC Name	OEL (ppb)	MDL (ppb)	Ave. (ppb)	St. Dev. (ppb)	Rel St. Dev. (%)	Max. (ppb)	Media n (ppb)
1	ammonia	25000	6.225	6.879†	1.526	22.186	12.527	6.385†
2	formaldehyde	300	0.141	<0.141	0.107	90.565	0.798	<0.141
3	methanol	200000	0.379	3.943	3.428	86.930	159.569	3.638
4	acetonitrile	20000	0.044	0.143	0.047	33.060	0.708	0.141
5	acetaldehyde	25000	0.220	1.058	0.386	36.473	8.685	0.996
6	ethylamine	5000	0.021	<0.021	0.015	201.018	0.079	<0.021
7	1,3-butadiene	1000	0.917	10.520	2.589	24.614	25.607	10.424
8	propanenitrile	6000	0.043	0.144	0.052	35.995	0.337	0.143
9	2-propenal	100	0.069	0.084†	0.116	138.552	1.239	0.074†
10	1-butanol + butenes	20000	0.050	<0.050	0.069	490.030	1.904	<0.050
11	methyl isocyanate	20	0.025	<0.025	0.023	179.277	0.112	<0.025
12	methyl nitrite	100	0.030	0.032†	0.027	85.927	0.354	0.03†
13	furan	1	0.021	<0.021	0.016	1156.350	0.307	<0.021
14	butanenitrile	8000	0.013	<0.013	0.012	753.676	0.069	<0.013
15	but-3-en-2-one + 2,3-dihydrofuran + 2,5-dihydrofuran	200, 1, 1	0.017	0.029†	0.021	72.693	N/A*	N/A*
16	butanal	25000	0.022	0.117	0.136	116.893	3.550	0.096
17	NDMA	0.3	0.015	<0.015	0.017	158.160	0.084	<0.015
18	benzene	500	0.066	<0.066	0.104	225.211	4.498	<0.066
19	2,4-pentadienenitrile + pyridine	300, 1000	0.018	<0.018	0.012	15638.600	0.284	<0.018
20	2-methylene butanenitrile	300	0.008	<0.008	0.005	644.713	0.033	<0.008
21	2-methylfuran	1	0.016	<0.016	0.015	127.989	0.154	<0.016
22	pentanenitrile	6000	0.008	<0.008	0.006	491.954	0.039	<0.008
23	3-methyl-3-buten-2-one + 2-methyl-2-butenal	20, 30	0.016	<0.016	0.013	102.028	0.099	<0.016
24	NEMA	0.3	0.010	<0.010	0.005	548.035	0.031	<0.010
25	2,5-dimethylfuran	1	0.013	<0.013	0.012	160.593	0.107	<0.013
26	hexanenitrile	6000	0.006	<0.006	0.004	102.337	0.025	<0.006
27	2-hexanone (MBK)	5000	0.010	<0.01	0.008	234.396	0.046	<0.01
28	NDEA	0.1	0.011	<0.011	0.004	787.661	0.024	<0.011
29	butyl nitrite + 2-nitro-2-methylpropane	100, 300	0.006	<0.006	0.005	295.418	0.039	<0.006

Table 5-2. Chemical of Potential Concern Statistical Information for the Area Monitoring on June 20, 2019. (2 Sheets)

COPC #	COPC Name	OEL (ppb)	MDL (ppb)	Ave. (ppb)	St. Dev. (ppb)	Rel St. Dev. (%)	Max. (ppb)	Median (ppb)
30	2,4-dimethylpyridine	500	0.008	<0.008	0.008	924.842	0.342	<0.008
31	2-propylfuran + 2-ethyl-5-methylfuran	1	0.010	<0.010	0.008	520.666	0.042	<0.010
32	heptanenitrile	6000	0.004	<0.004	0.002	1761.340	0.016	<0.004
33	4-methyl-2-hexanone	500	0.008	<0.008	0.006	418.273	0.043	<0.008
34	NMOR	0.6	0.009	<0.009	0.006	315.750	0.281	<0.009
35	butyl nitrate	2500	0.004	<0.004	0.002	2966.560	0.021	<0.004
36	2-ethyl-2-hexenal + 4-(1-methylpropyl)-2,3-dihydrofuran + 3-(1,1-dimethylethyl)-2,3-dihydrofuran	100, 1, 1	0.007	<0.007	0.005	290.695	0.030	<0.007
37	6-methyl-2-heptanone	8000	0.006	<0.006	0.005	129.345	0.030	<0.006
38	2-pentylfuran	1	0.006	0.006†	0.005	75.779	0.032	0.006†
39	biphenyl	200	0.008	<0.008	0.005	200.470	0.026	<0.008
40	2-heptylfuran	1	0.007	<0.007	0.004	26.079	0.006	<0.007
41	1,4-butanediol dinitrate	50	0.005	<0.005	0.002	437.802	0.011	<0.005
42	2-octylfuran	1	0.004	<0.004	0.002	2340.890	0.015	<0.004
43	1,2,3-propanetriol 1,3-dinitrate	50	0.002	<0.002	0.001	767.493	0.010	<0.002
44	PCB	1000	0.006	<0.006	0.002	45.745	0.006	<0.006
45	6-(2-furanyl)-6-methyl-2-heptanone	1	0.003	<0.003	0.002	186.973	0.016	<0.003
46	furfural acetophenone	1	0.006	<0.006	0.003	128.739	0.020	<0.006
N/A*	The maximum peak value for but-3-en-2-one + 2,3 dihydrofuran + 2,5 dihydrofuran was 0.249 ppb and the median value was 0.026†ppb. The PTR-MS results for but-3-en-2-one + 2,3 dihydrofuran + 2,5 dihydrofuran are not compared to OEL concentrations because: 1) the result is suspect due to a known biogenic interferant (methacrolein) that is expected to be in concentrations that occasionally exceed the dihydrofuran OEL, and 2) this combination of COPCs have OEL concentrations that differ by a factor of 200, which provide widely variant bases for these numbers.							
**	Nitrosamine results are suspect due to isobaric interferants causing positive bias that have been encountered during previous background [53005-81-RPT-007, *PTR-MS Mobile Laboratory Vapor Monitoring Background Study, (3/18/2018 – 4/20/2018)*, and *Fiscal Year 2017 Mobile Laboratory Vapor Monitoring at the Hanford Site: Monitoring During Waste Disturbing Activities and Background Study*, RJ Lee Group, Inc.].							
<	COPC Averages below the MDL.							
†	COPC Averages between the RL and the MDL.							
(red)	COPC Averages >100% of the OEL.							
(peach)	COPC Averages 50-100% of the OEL.							
(yellow)	COPC Averages 10-50% of the OEL.							

Figure 5-4 through Figure 5-54 display 46 COPC signals, overlaid with the same signal smoothed using a 1-minute moving average (in cases where a moving average assist with data visualization), and CO_2, for the source characterization monitoring period June 20, 2019. If within range of the plot's left axis, a green horizontal line representing 50% of the COPC's OEL, a blue horizontal line representing the COPC's OEL, a horizontal purple line representing the RL, and a pink horizontal line representing the MDL are shown.

Figure 5-4 through Figure 5-4 display the data from the monitoring period, and the data shown were edited from the entire data, eliminating the daily span checks performed as well as any traveling done off the Hanford Site. Figure 5-4 through 5-54 have been baseline subtracted to correct for the baseline signal response observed while the PTR-MS is sampling zero-air. Species with low or negligible amounts in ambient background can appear below zero (see Figures 4-43, 5-44, and 5-45) but it has negligible effect on the PTR-MS to accurately detect species above the reporting limit and OEL). Figure 5-4 displays the signal for ammonia for the monitoring period with a slight decay in concentration from the start of monitoring as the sample line equilibrates from the daily ammonia span check. Figure 5-10 displays the signal for 1,3-butadiene and the scalloping denoted by the plot is influenced by the increased humidity in the PTR-MS which has been identified to interfere with signal at this mass. Data displayed in Figure 5-51 and Figure 5-54 have been adjusted to split axes to illustrate the peak saturation without minimizing other plumes or peaks of interest at the lower concentration.

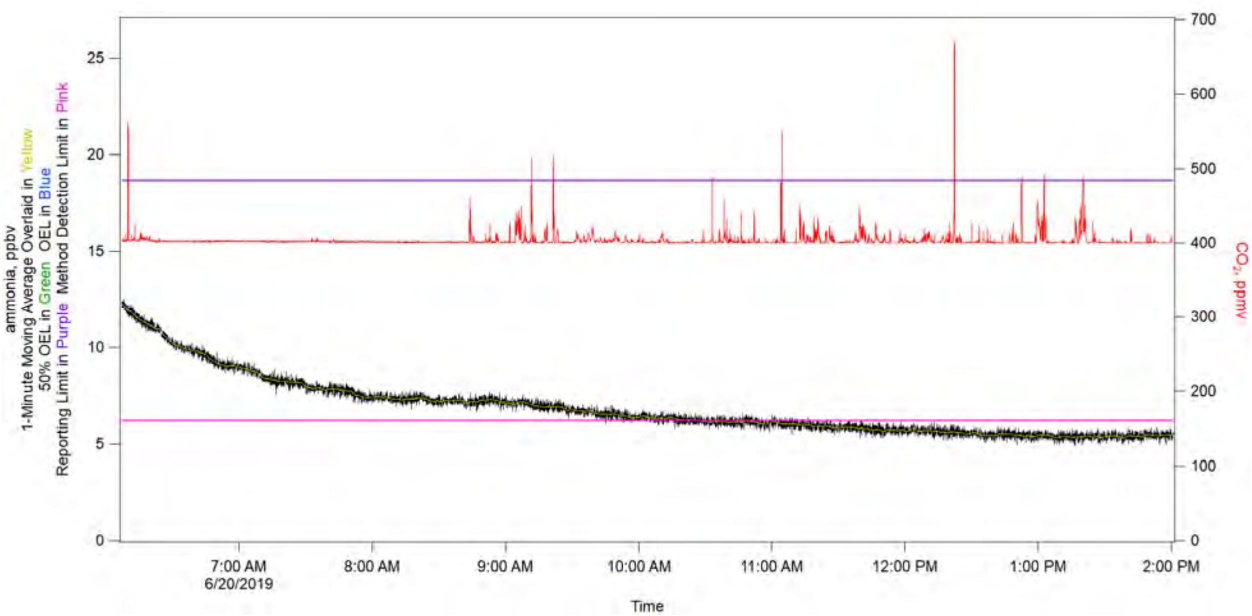

Figure 5-4. Ammonia.

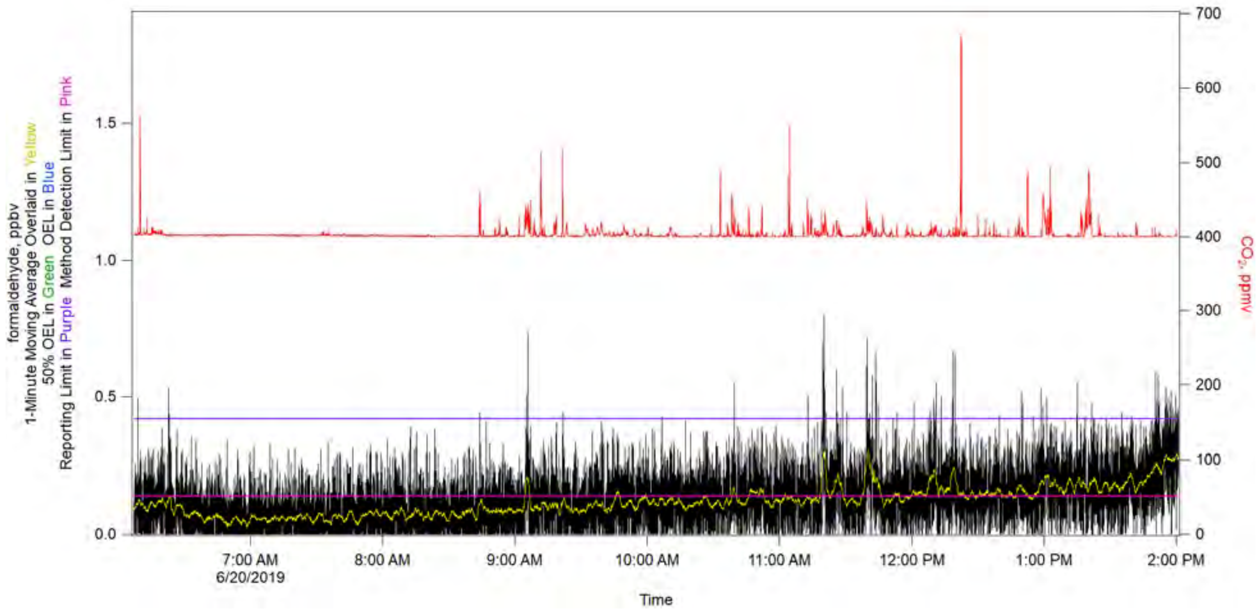

Figure 5-5. Formaldehyde.

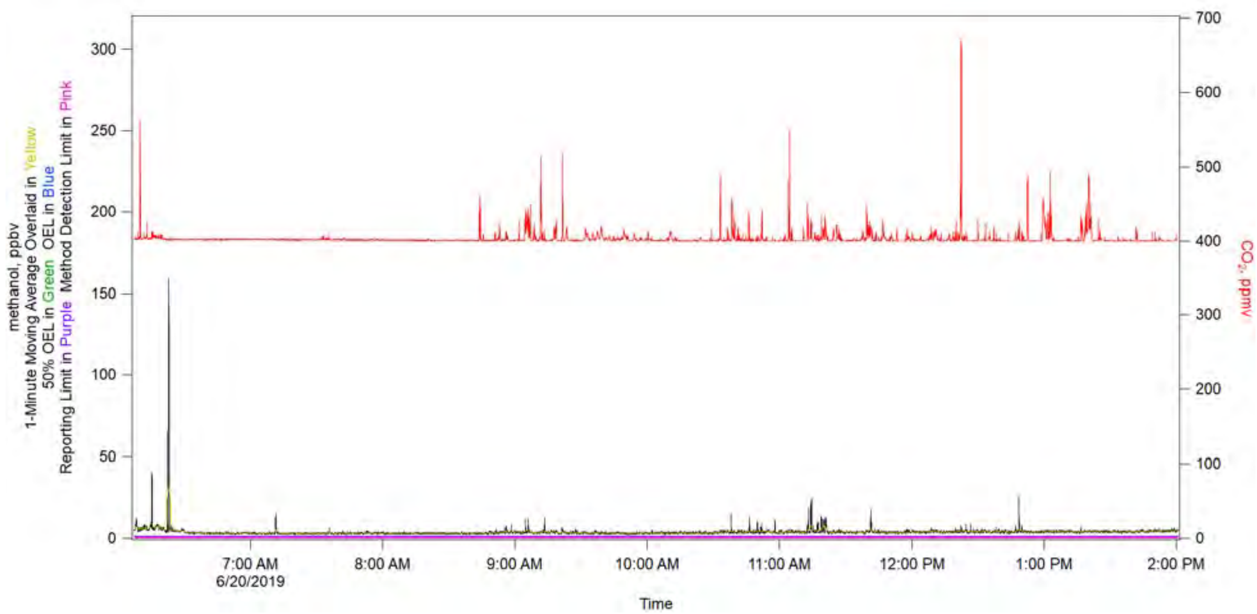

Figure 5-6. Methanol.

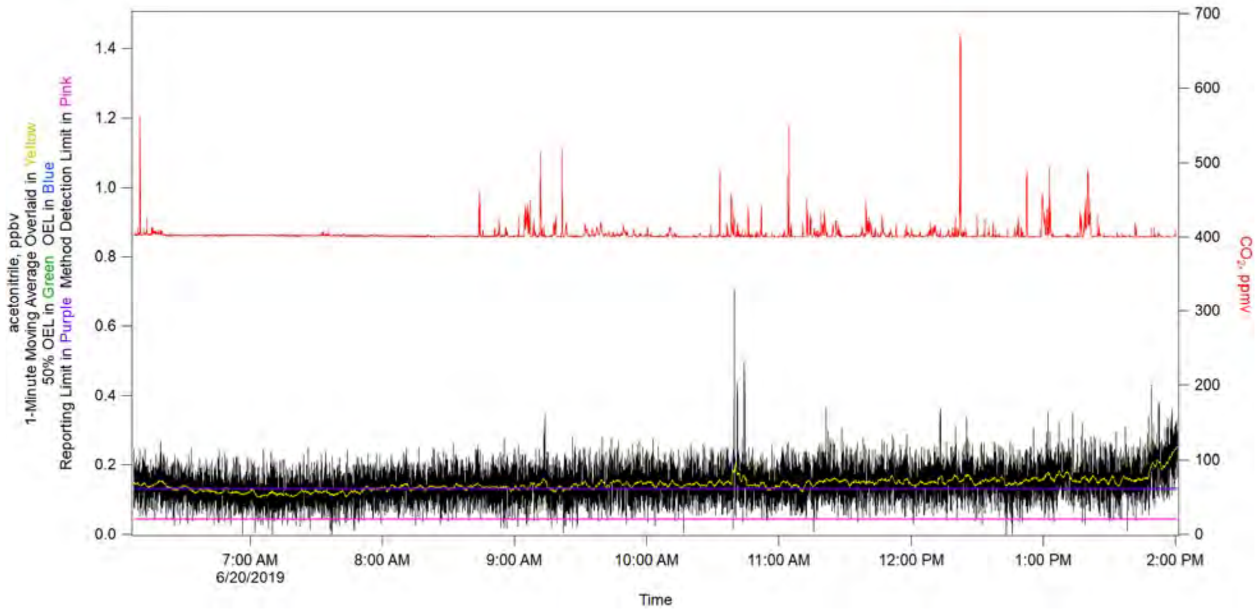

Figure 5-7. Acetonitrile.

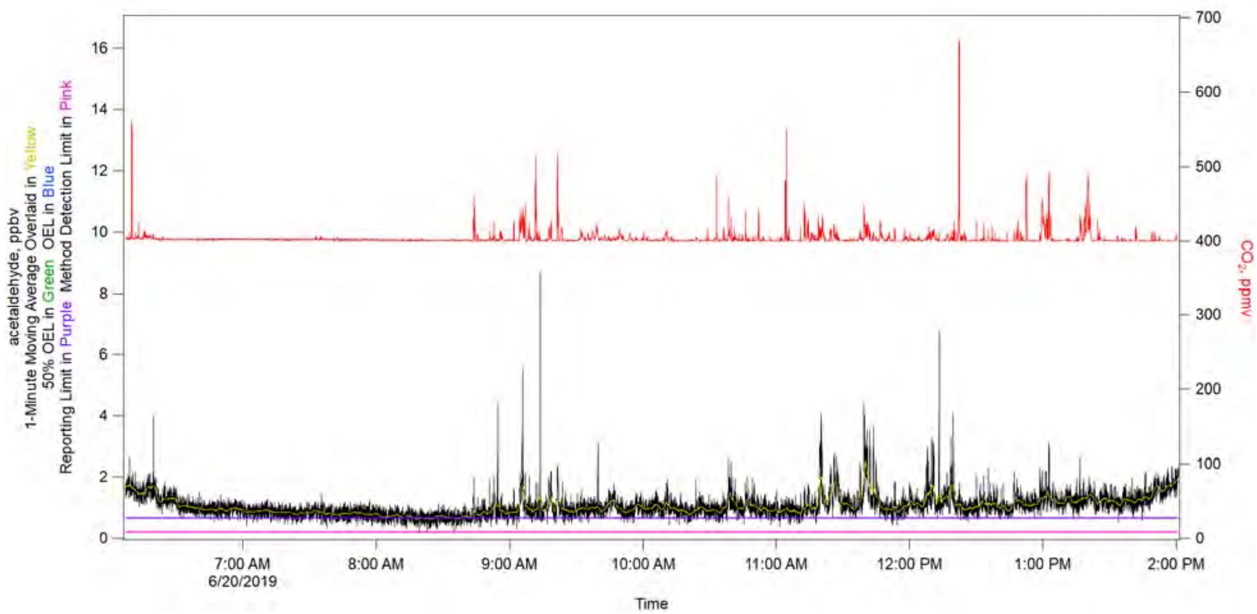

Figure 5-8. Acetaldehyde.

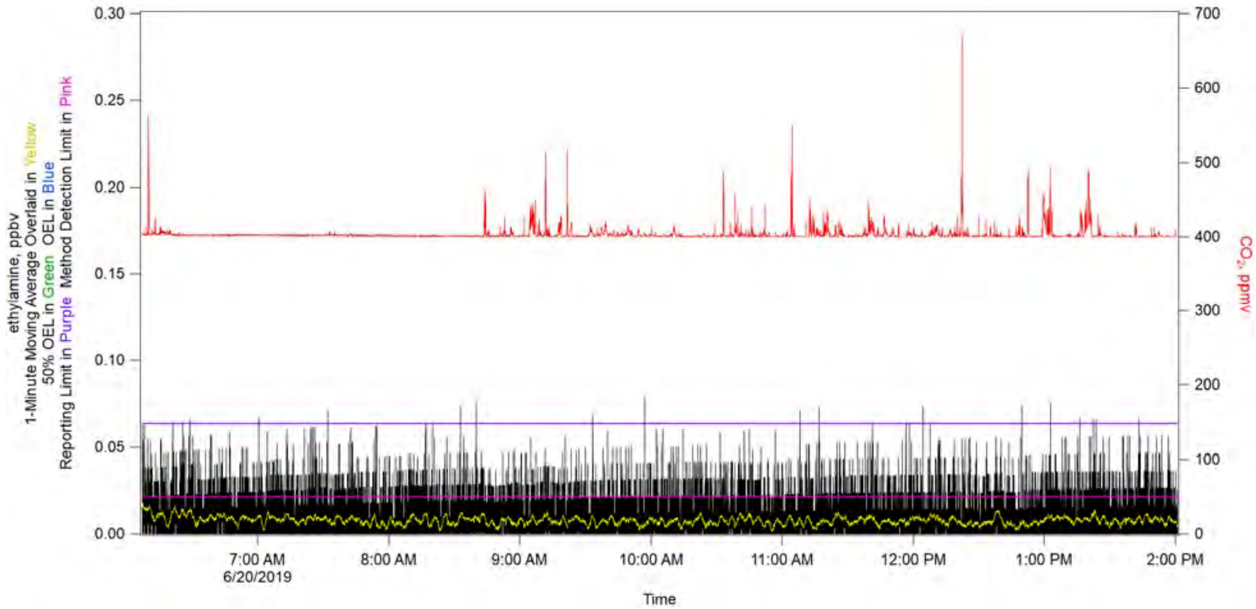

Figure 5-9. Ethylamine.

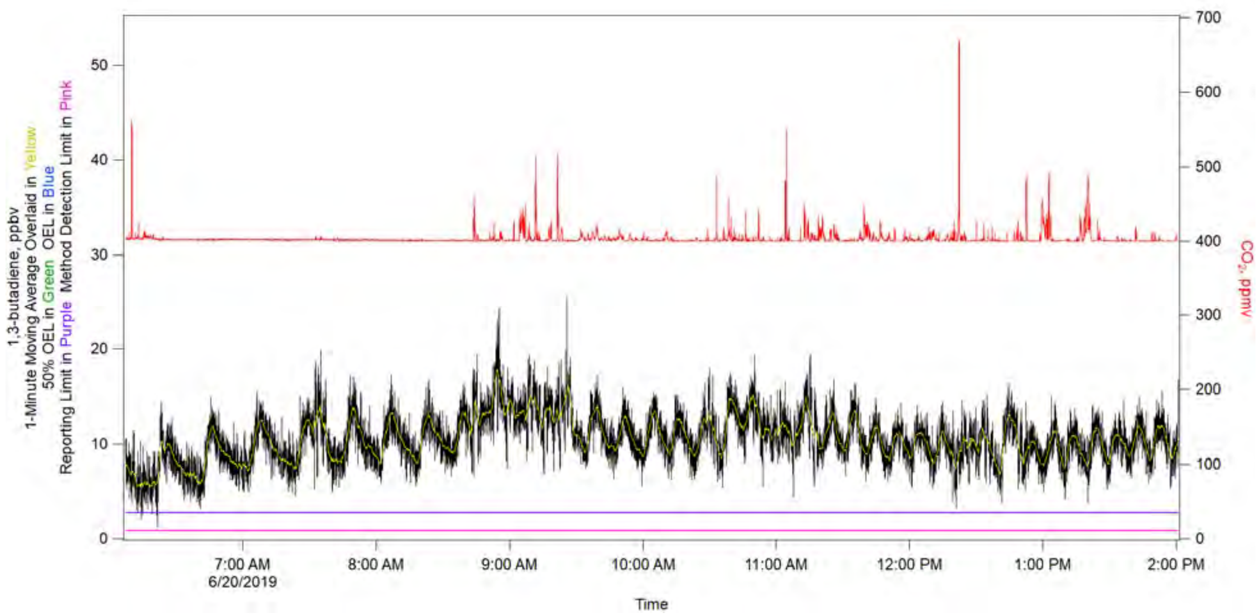

Figure 5-10. 1,3-butadiene.

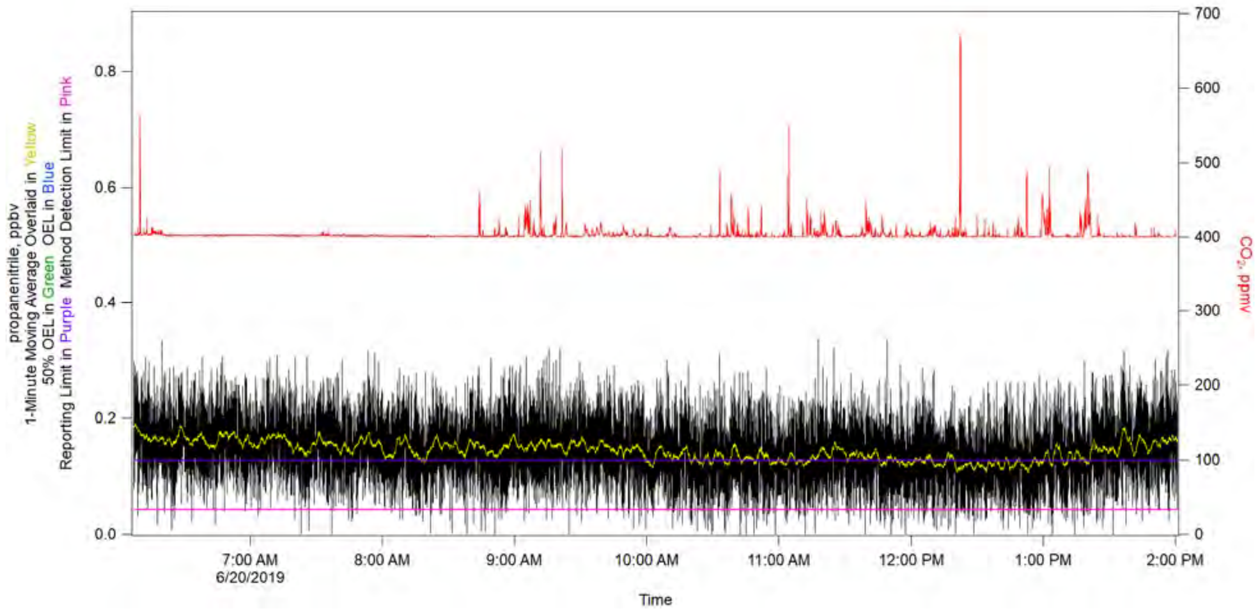

Figure 5-11. Propanenitrile.

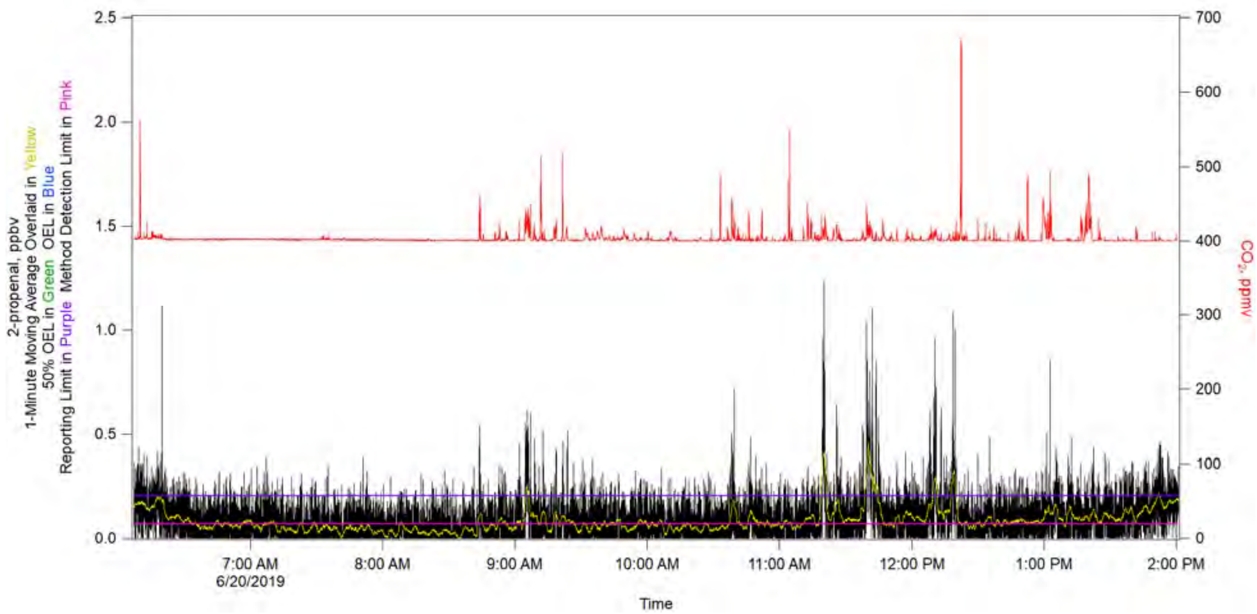

Figure 5-12. 2-propenal.

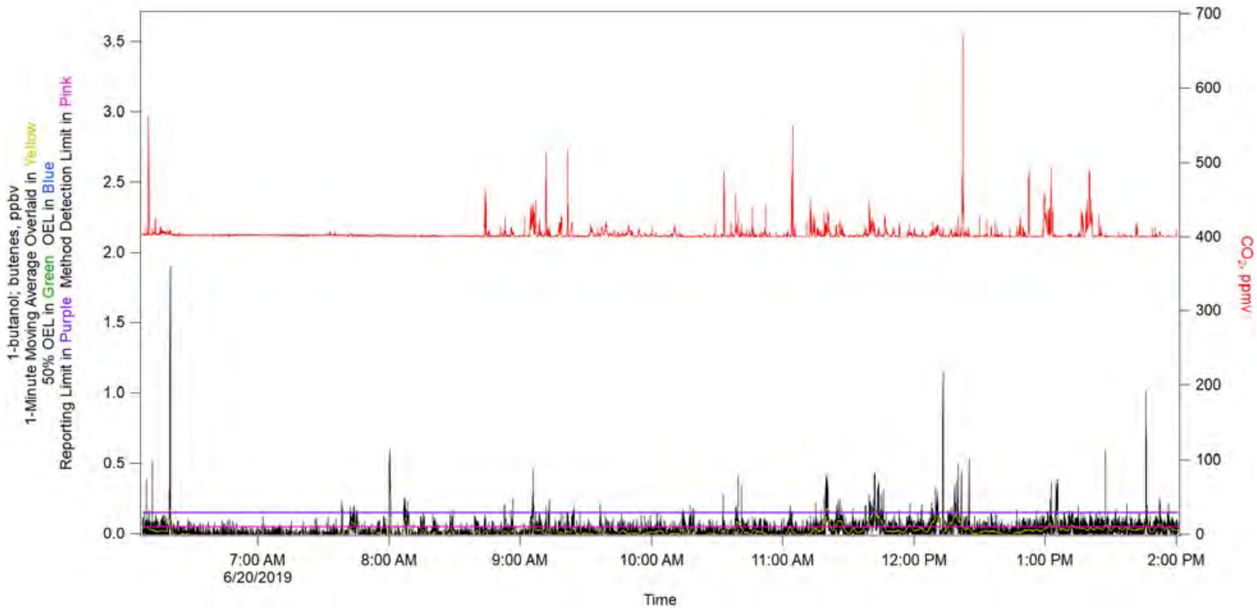

Figure 5-13. 1-butanol; Butenes.

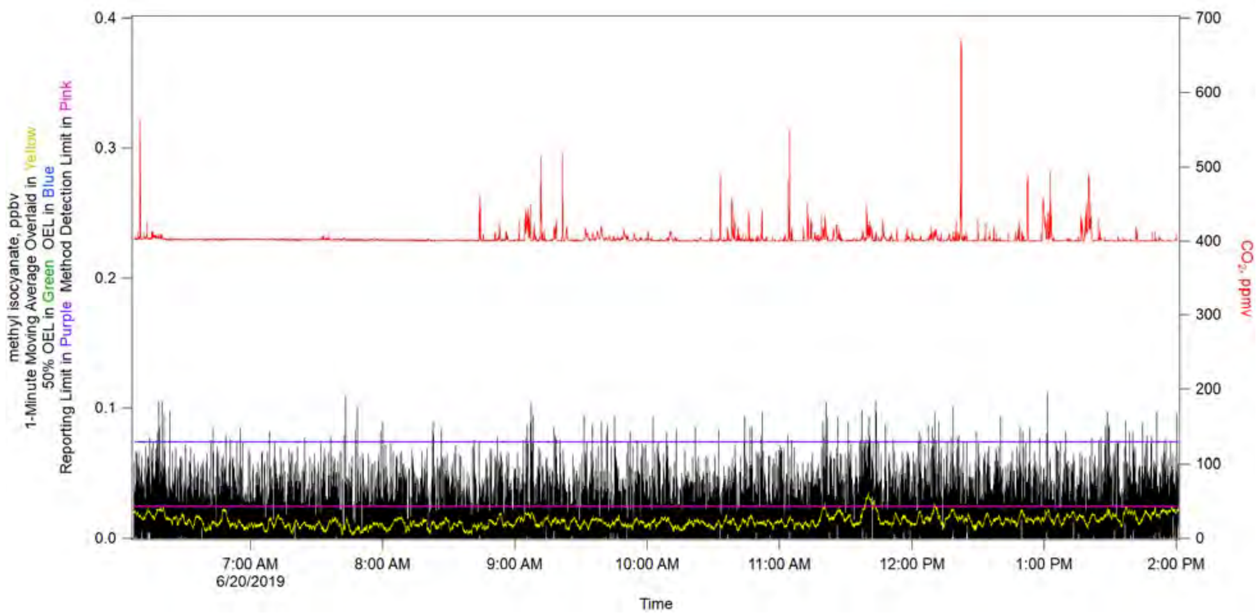

Figure 5-14. Methyl Isocyanate.

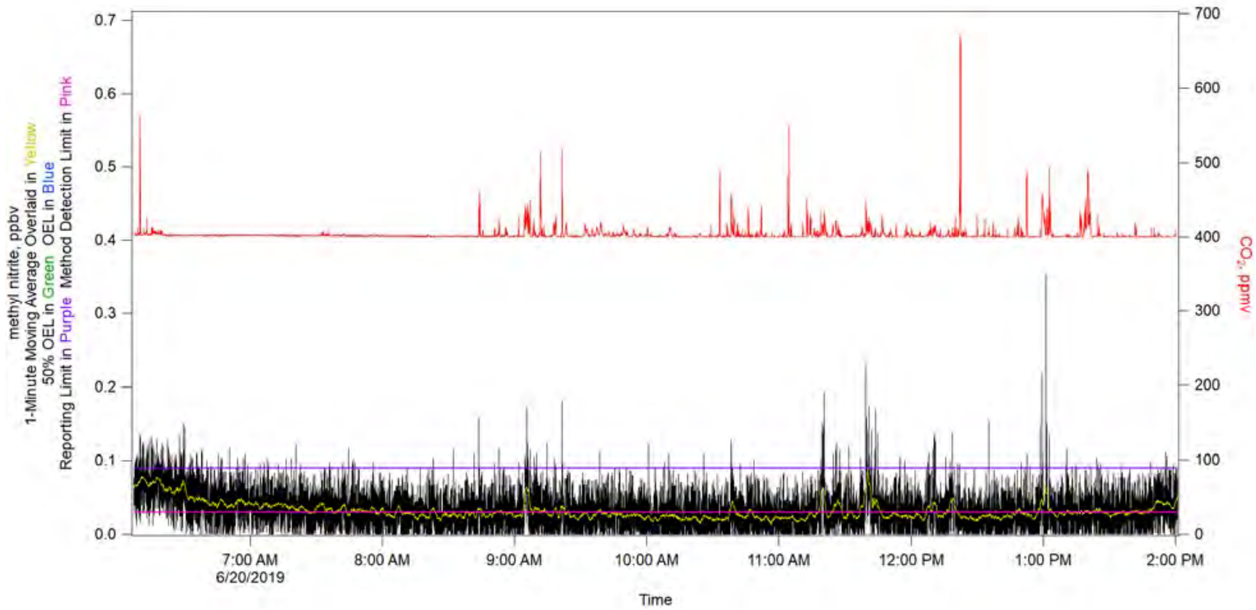

Figure 5-15. Methyl Nitrite.

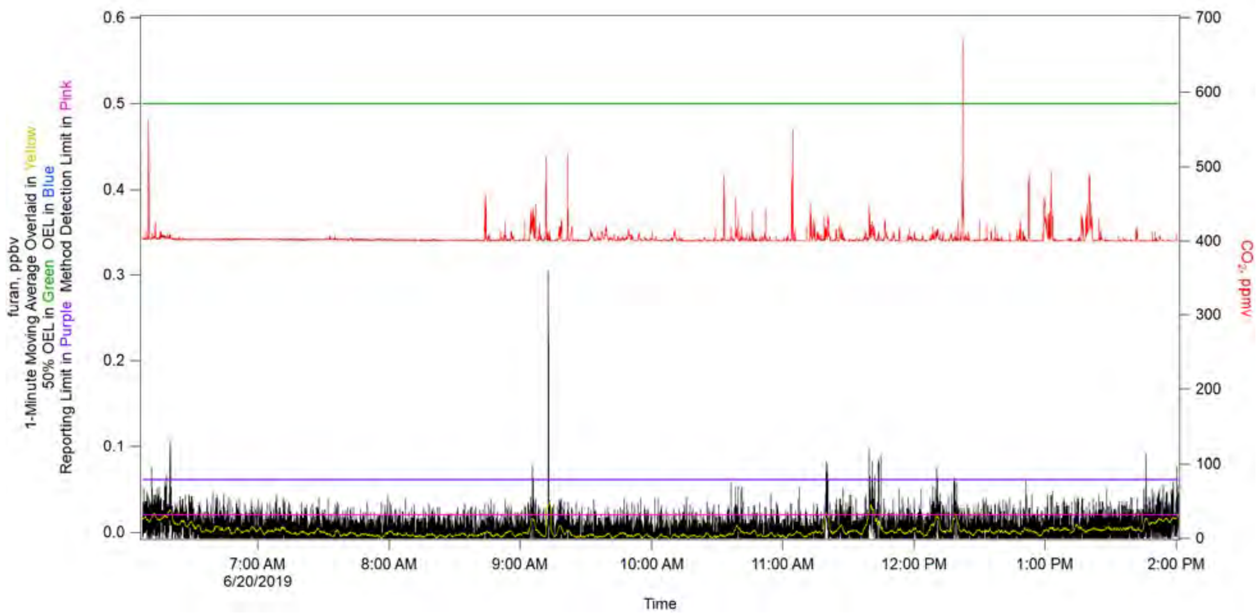

Figure 5-16. Furan.

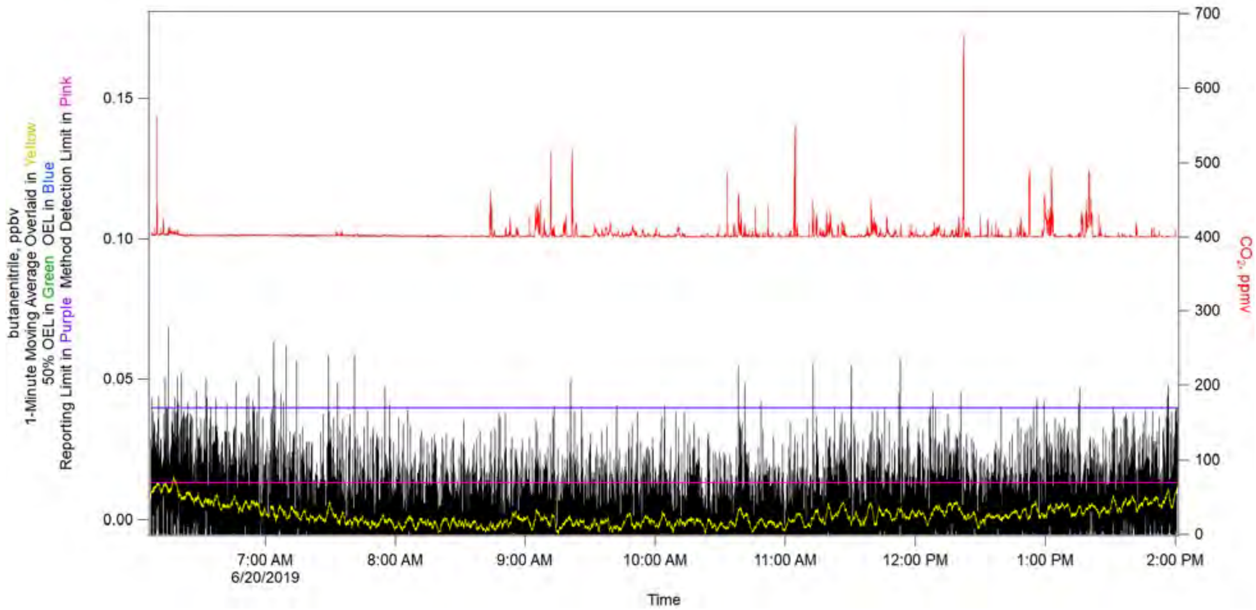

Figure 5-17. Butanenitrile.

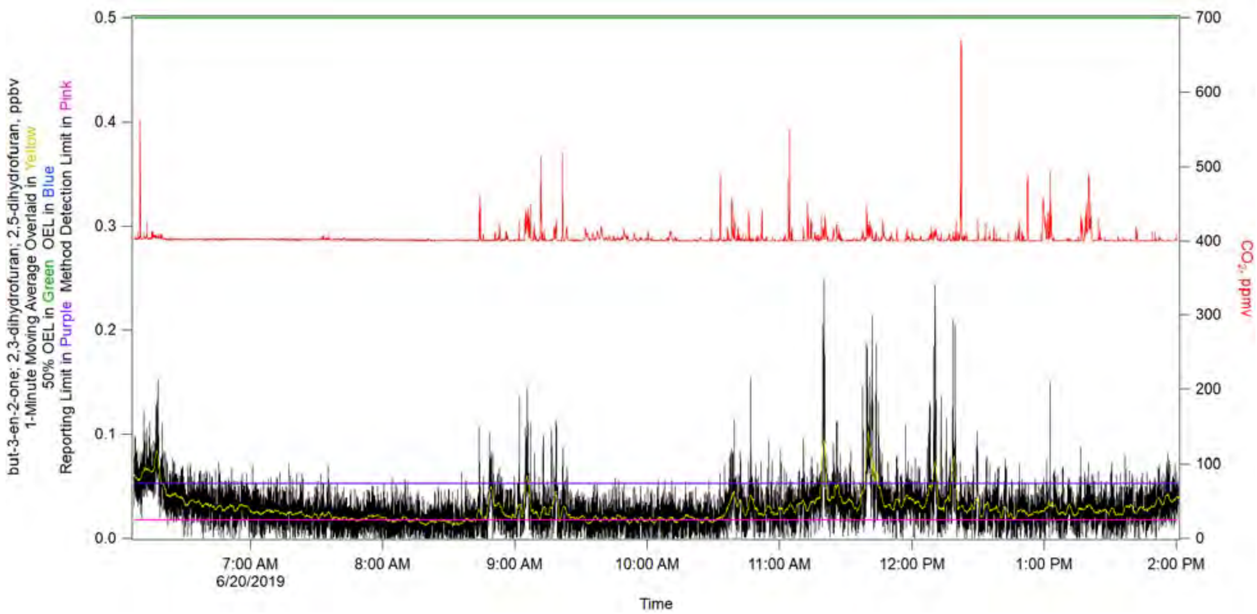

Figure 5-18. But-3-en-2-one; 2,3-dihydrofuran; 2,5-dihydrofuran.

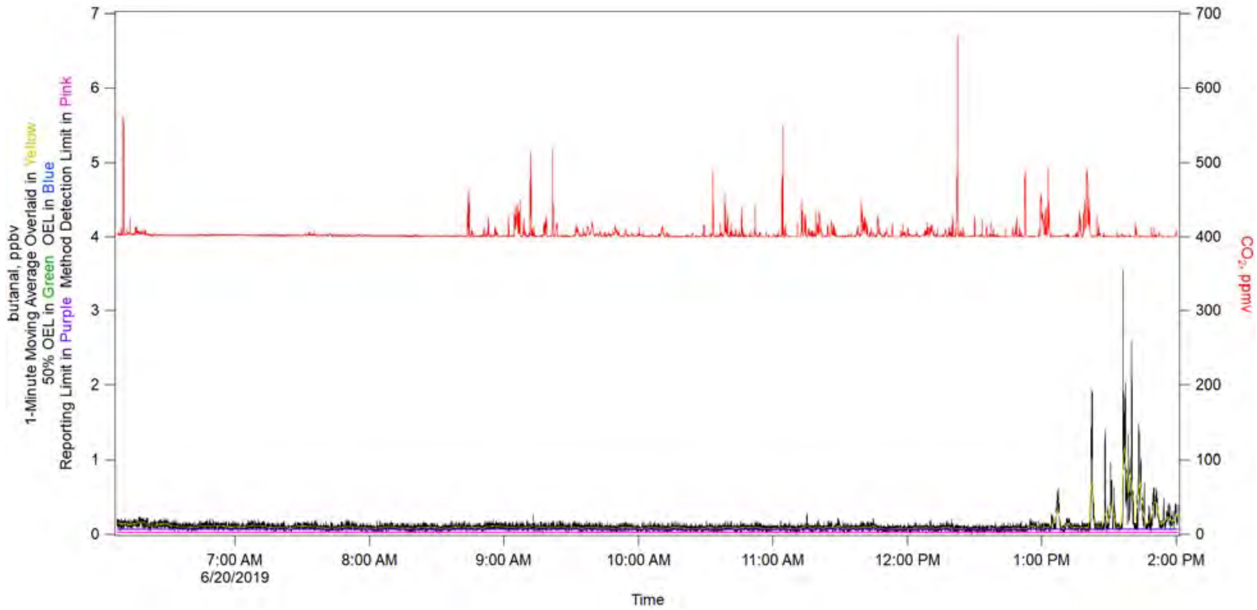

Figure 5-19. Butanal.

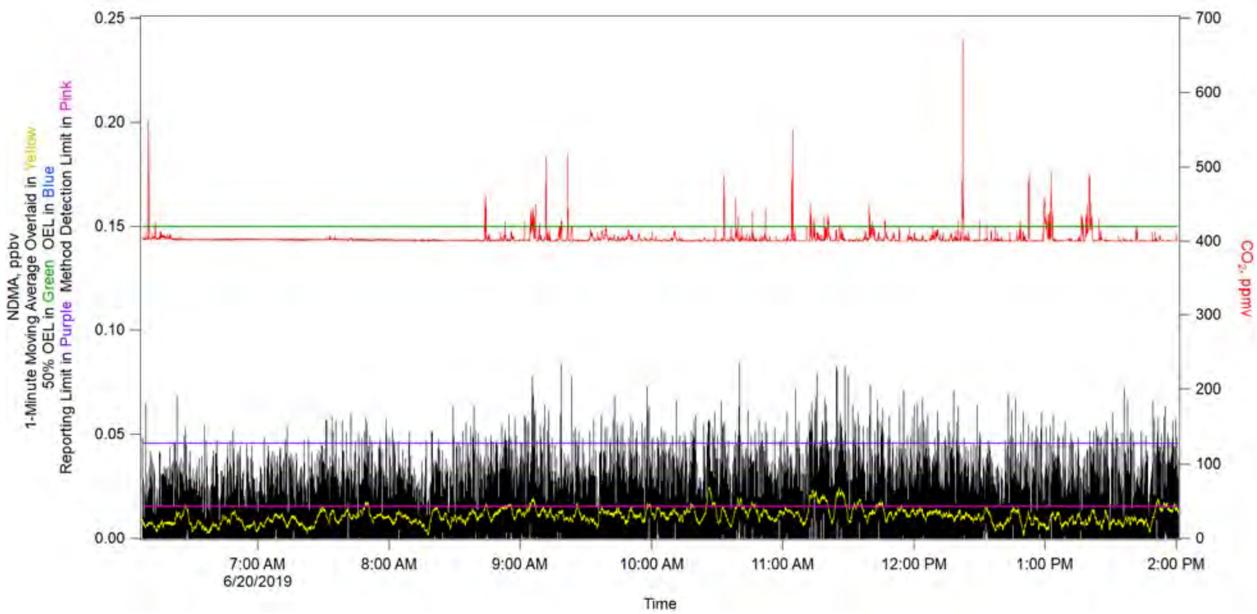

Figure 5-20. N-nitrosodimethylamine (NDMA).

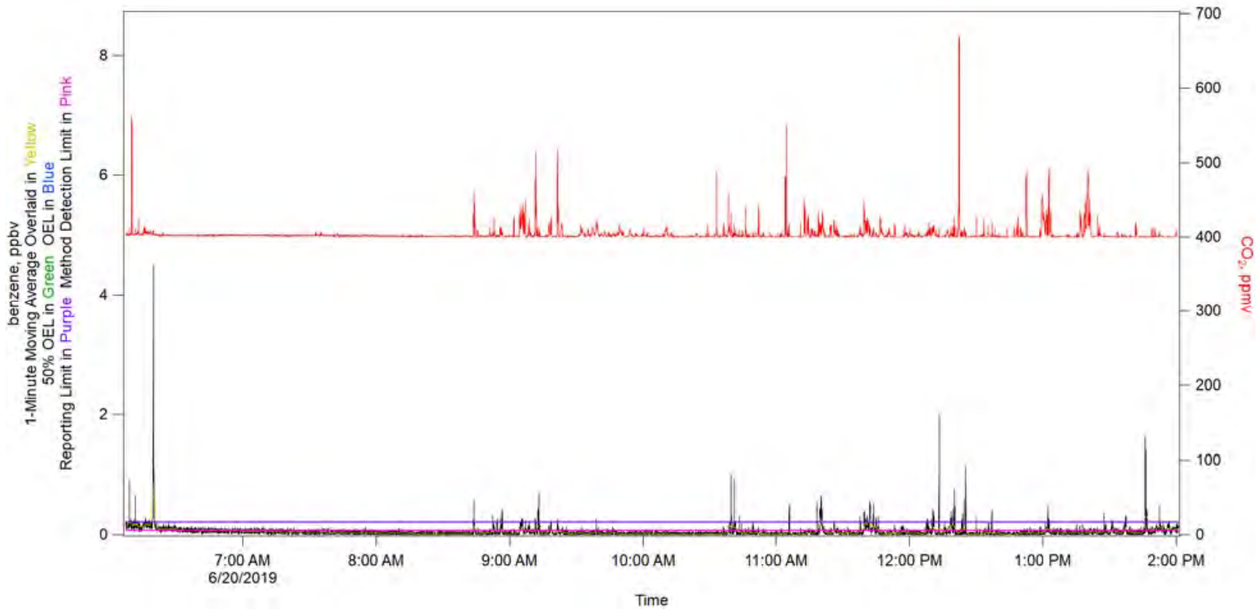

Figure 5-21. Benzene.

Figure 5-22. 2,4-pentadienenitrile; Pyridine.

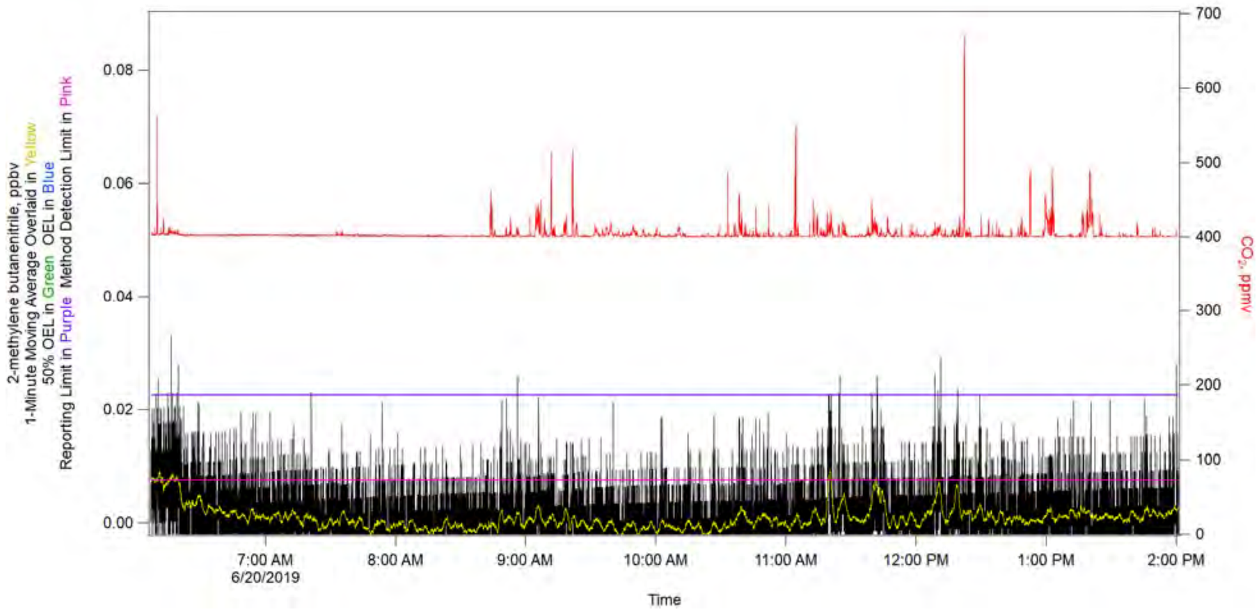

Figure 5-23. 2-methylene Butanenitrile.

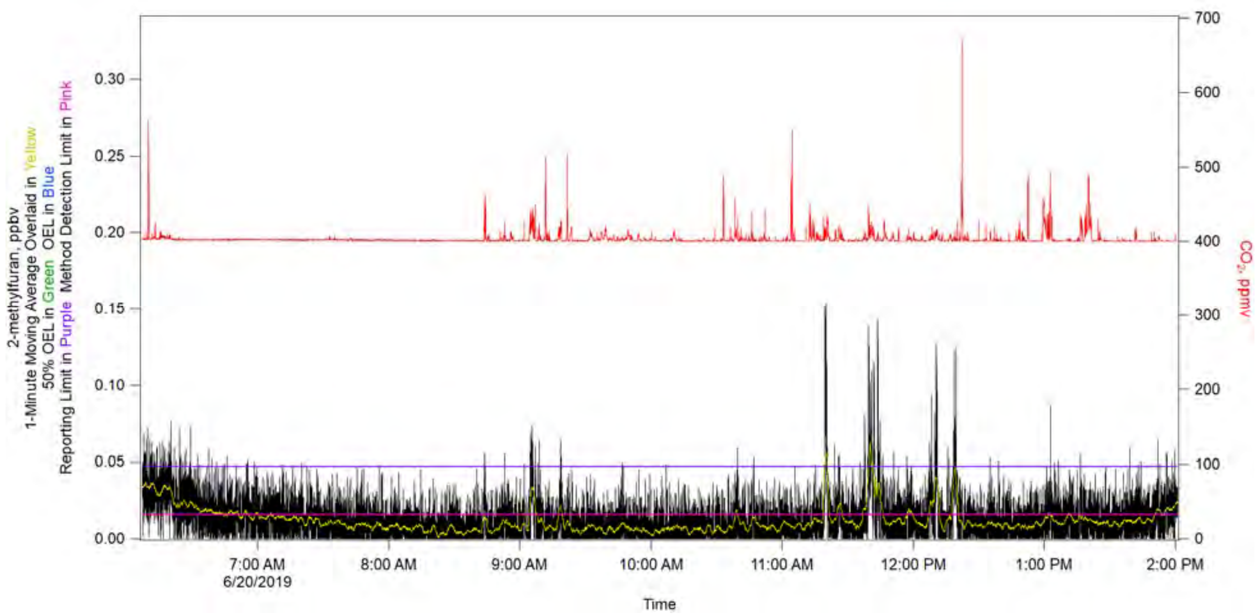

Figure 5-24. 2-methylfuran.

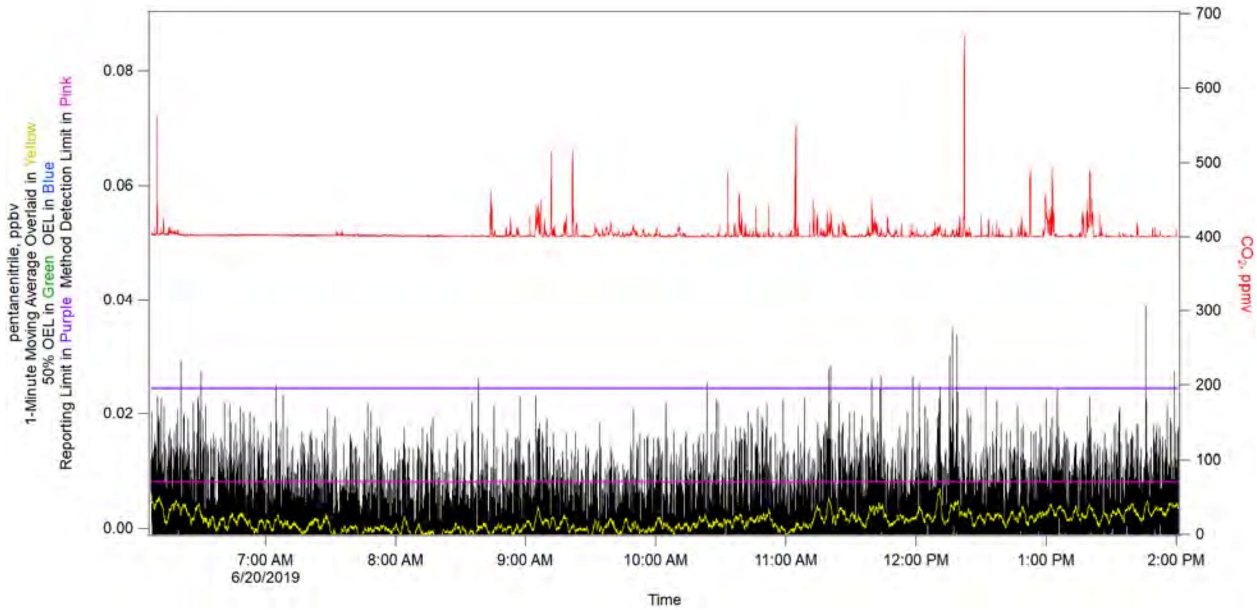

Figure 5-25. Pentanenitrile.

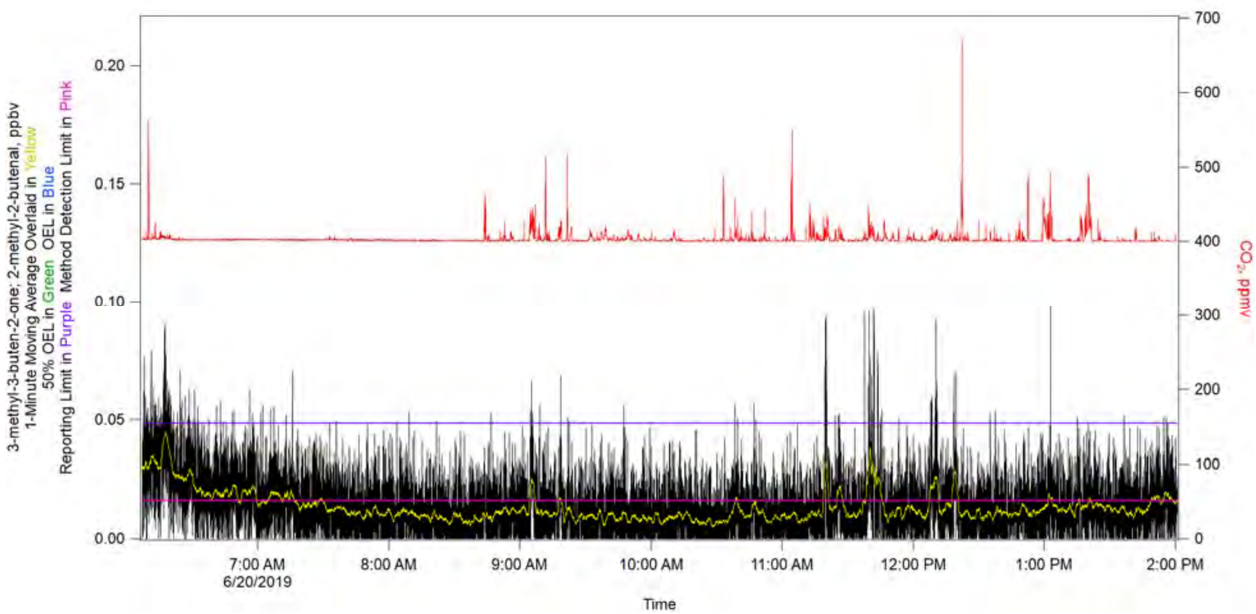

Figure 5-26. 3-methyl-3-buten-2-one; 2-methyl-2-butenal.

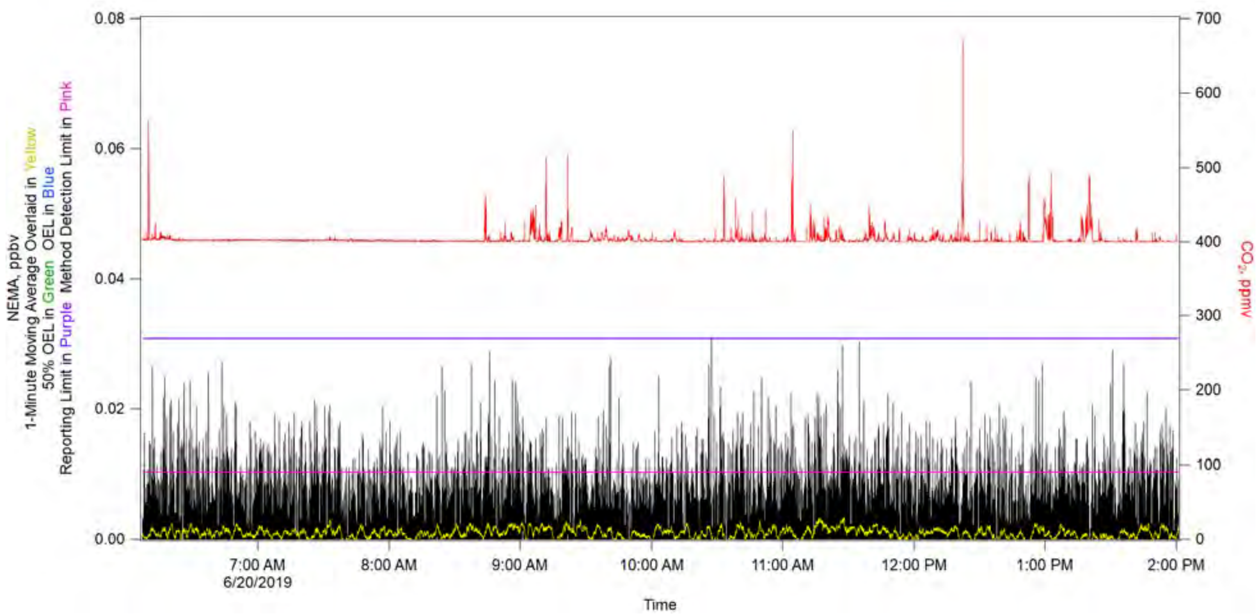

Figure 5-27. N-nitrosomethylethylamine (NEMA).

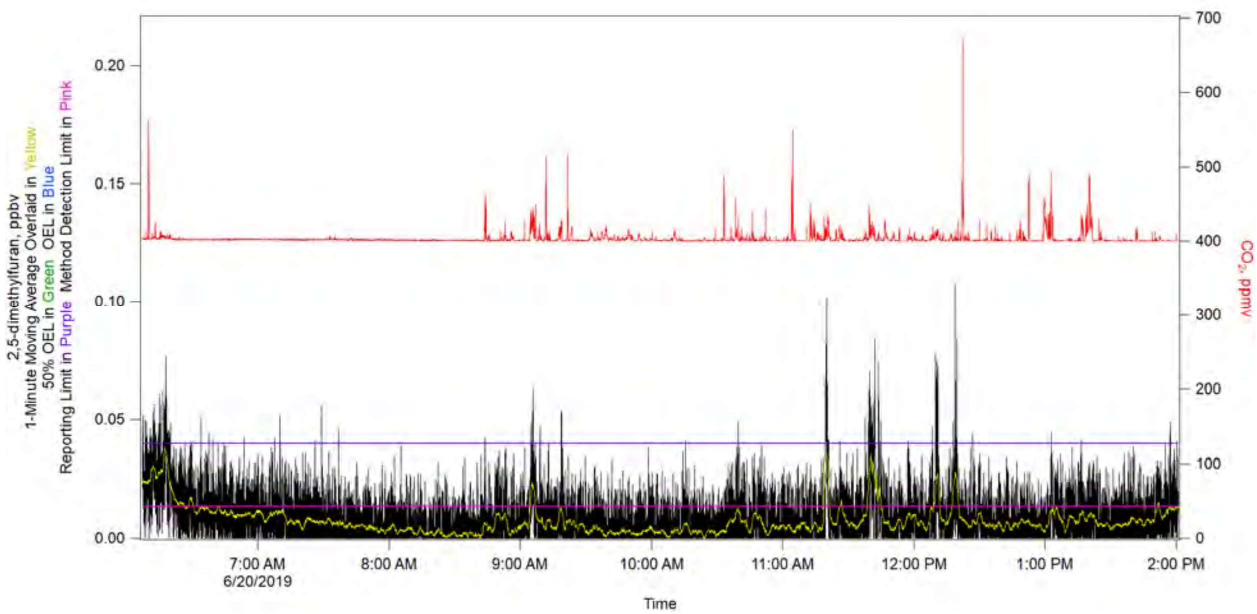

Figure 5-28. 2,5-dimethylfuran.

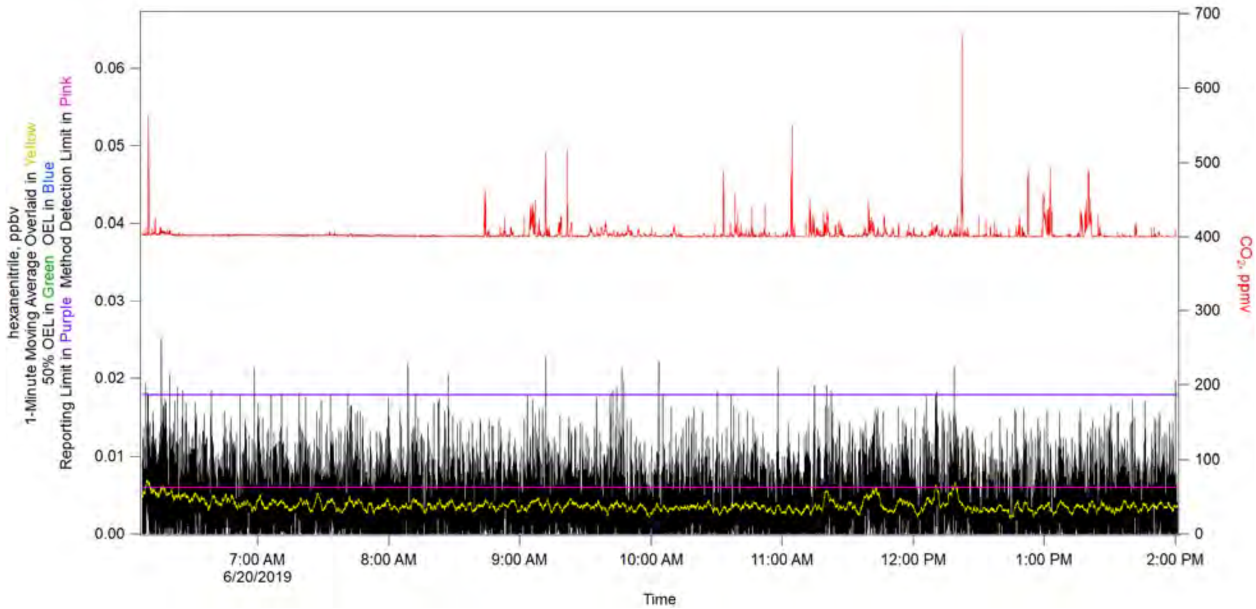

Figure 5-29. Hexanenitrile.

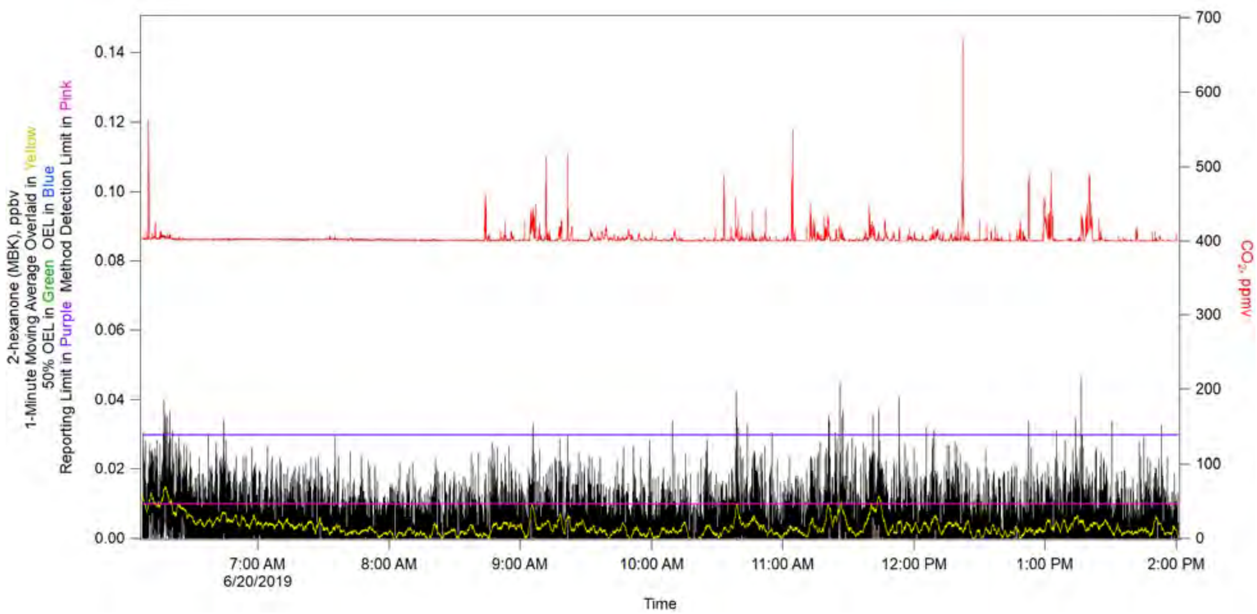

Figure 5-30. 2-hexanone (MBK).

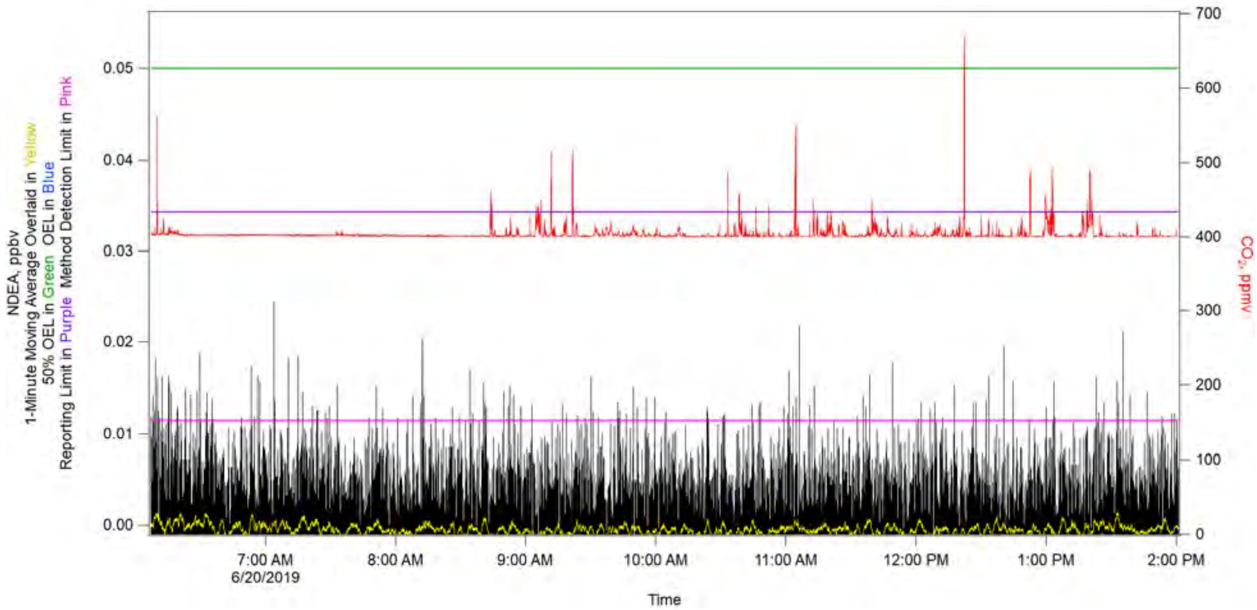

Figure 5-31. N-nitrosodiethylamine (NDEA).

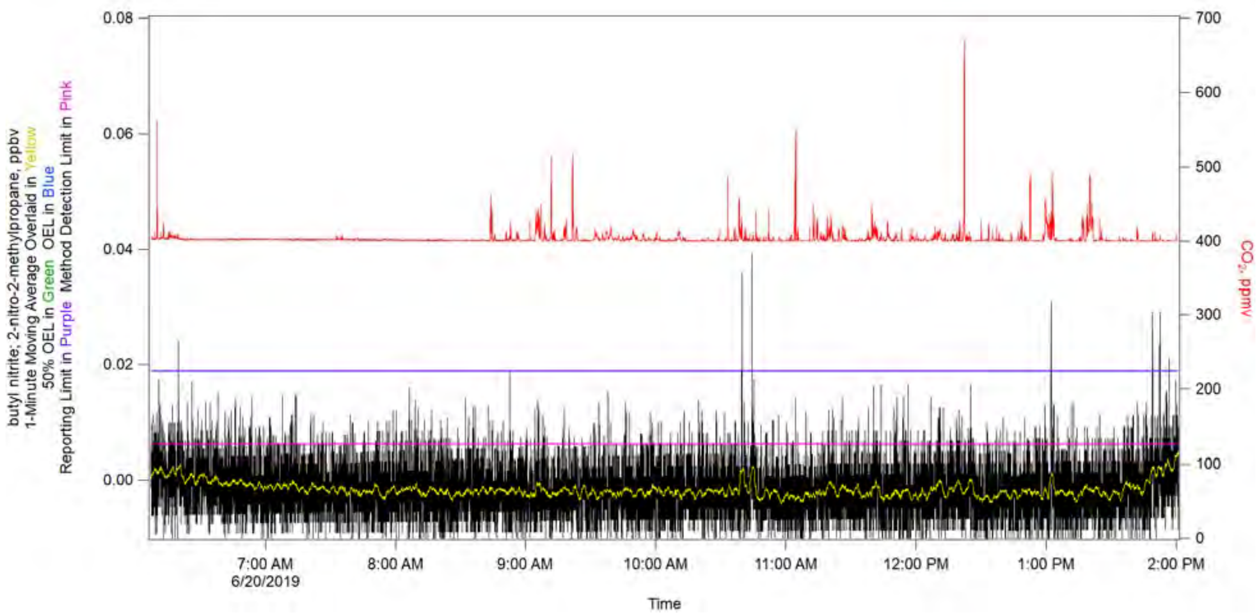

Figure 5-32. Butyl Nitrite; 2-nitro-2-methylpropane.

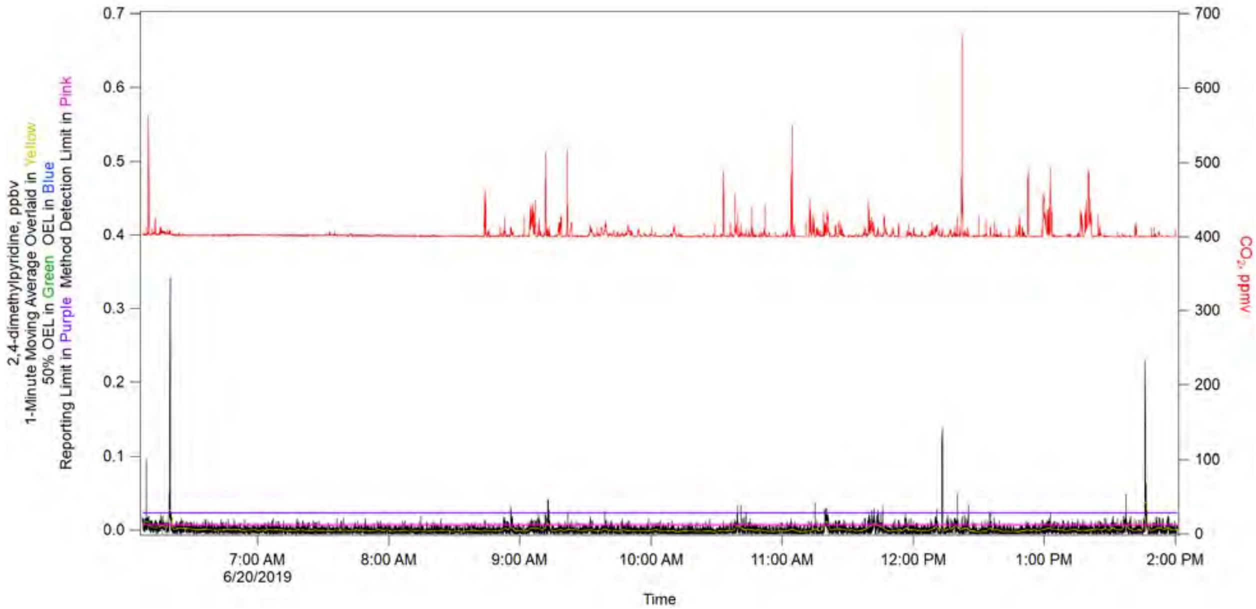

Figure 5-33. 2,4-dimethylpyridine.

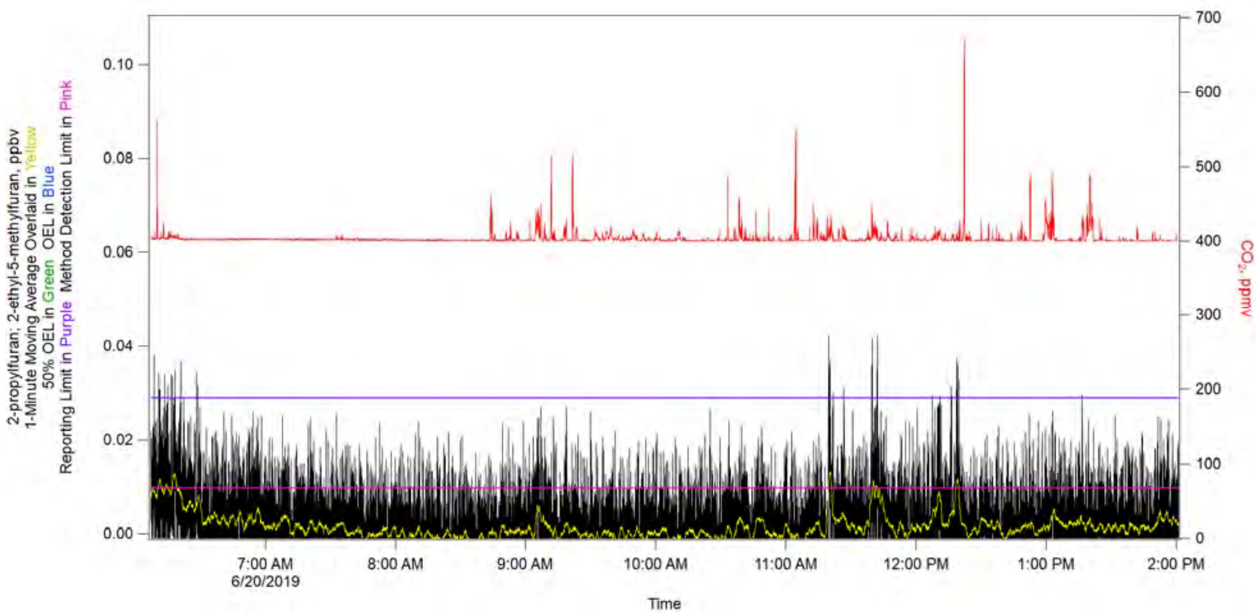

Figure 5-34. 2-propylfuran; 2-ethyl-5-methylfuran.

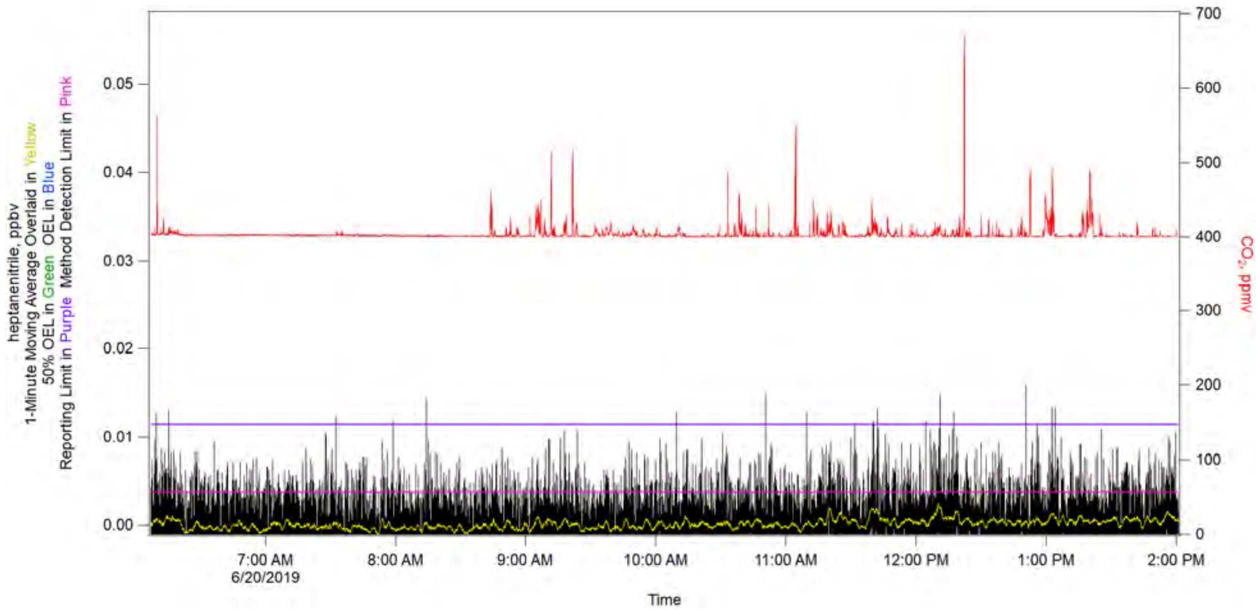

Figure 5-35. Heptanenitrile.

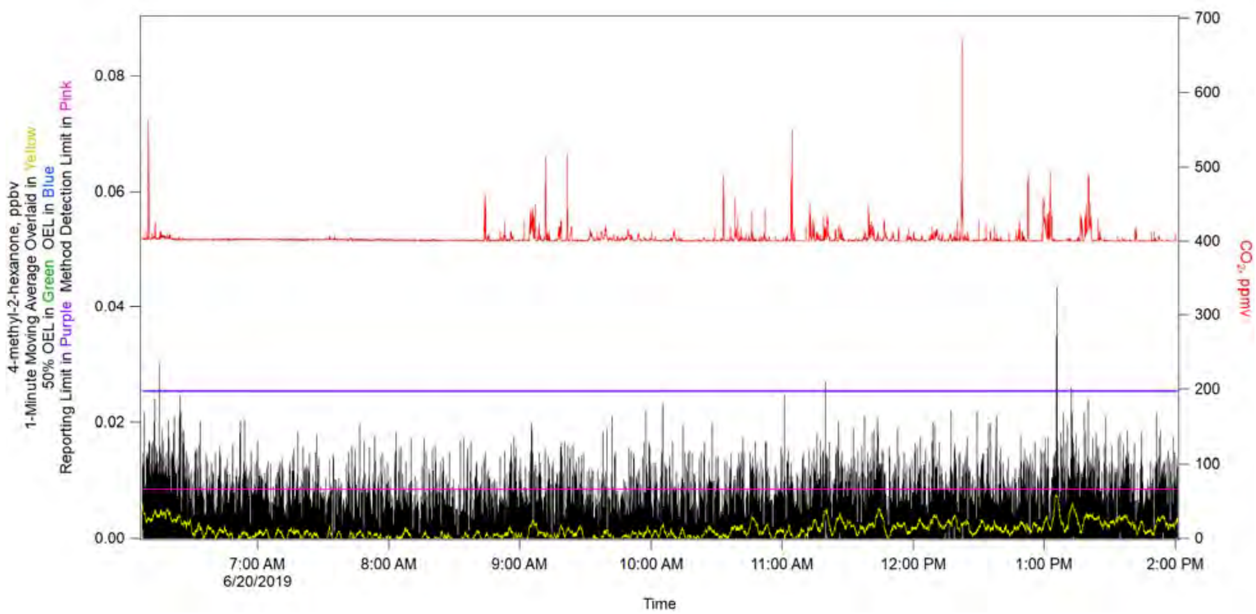

Figure 5-36. 4-methyl-2-hexanone.

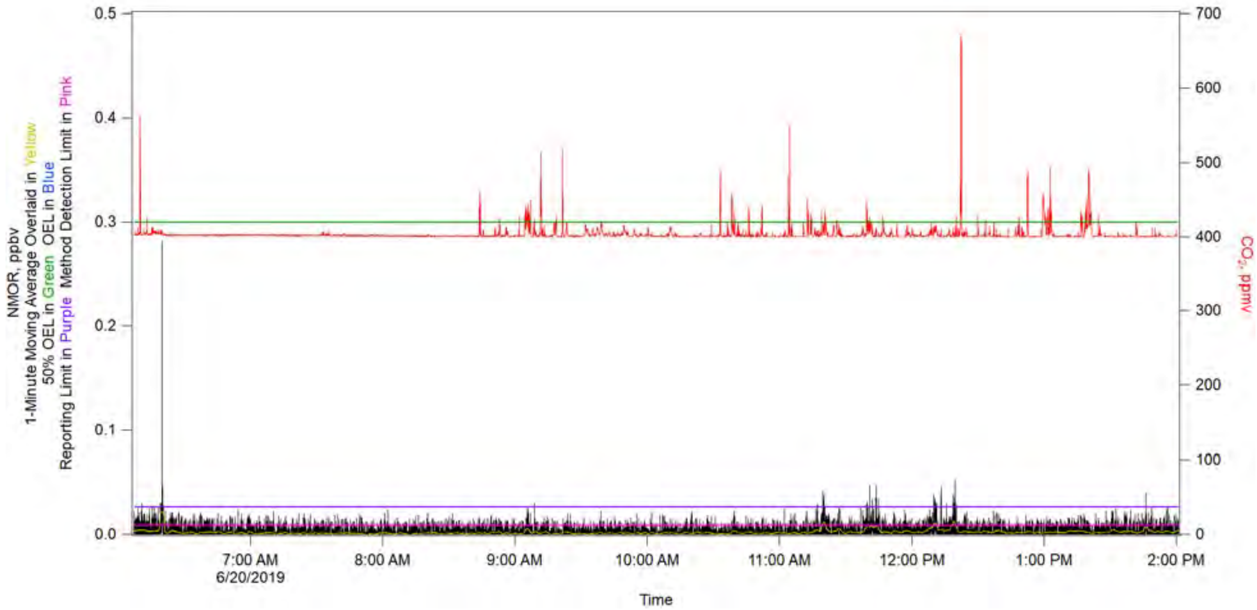

Figure 5-37. N-nitrosomorpholine (NMOR).

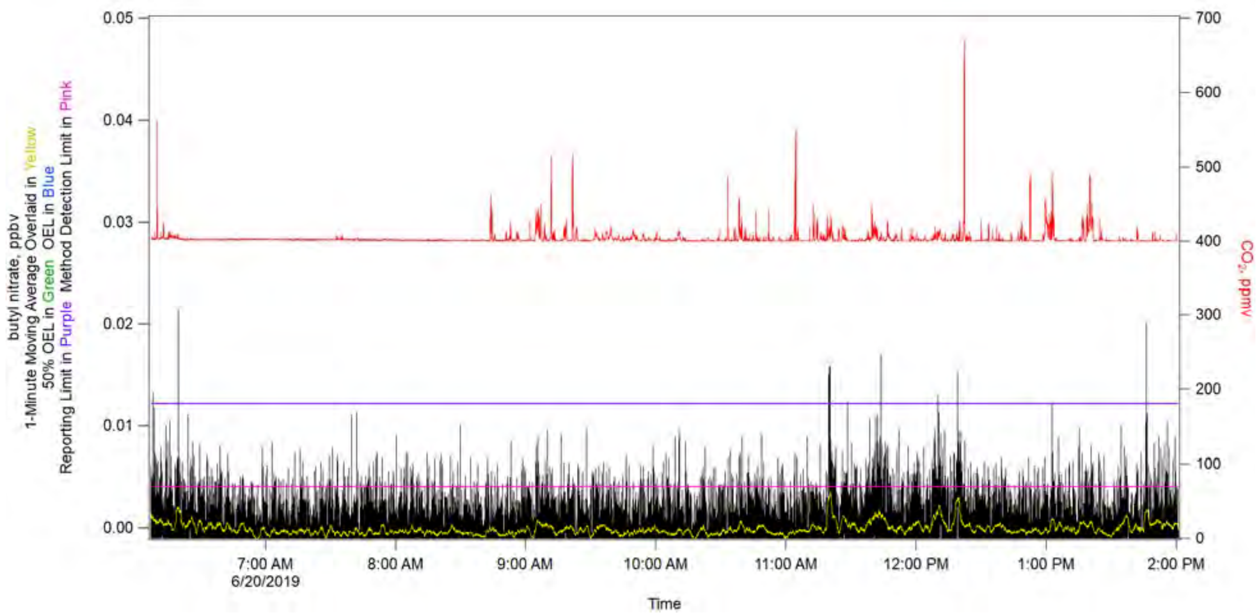

Figure 5-38. Butyl Nitrate.

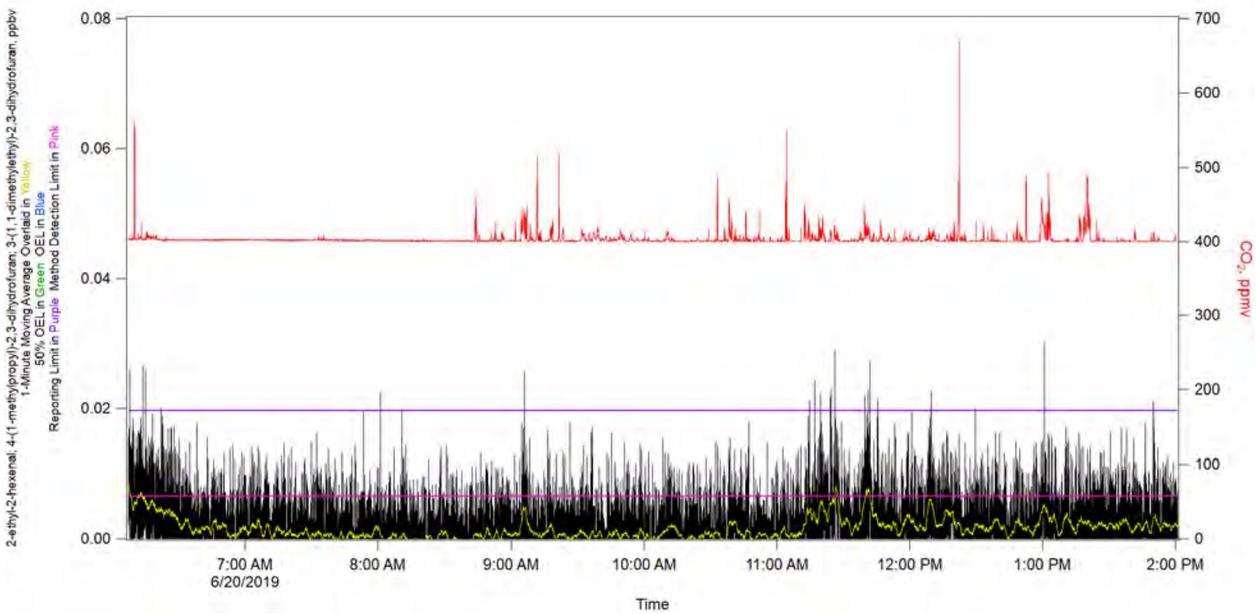

Figure 5-39. 2-ethyl-2-hexenal; 4-(1-methylpropyl)-2,3-dihydrofuran 3-(1,1-dimethylethyl)-2,3-dihydrofuran.

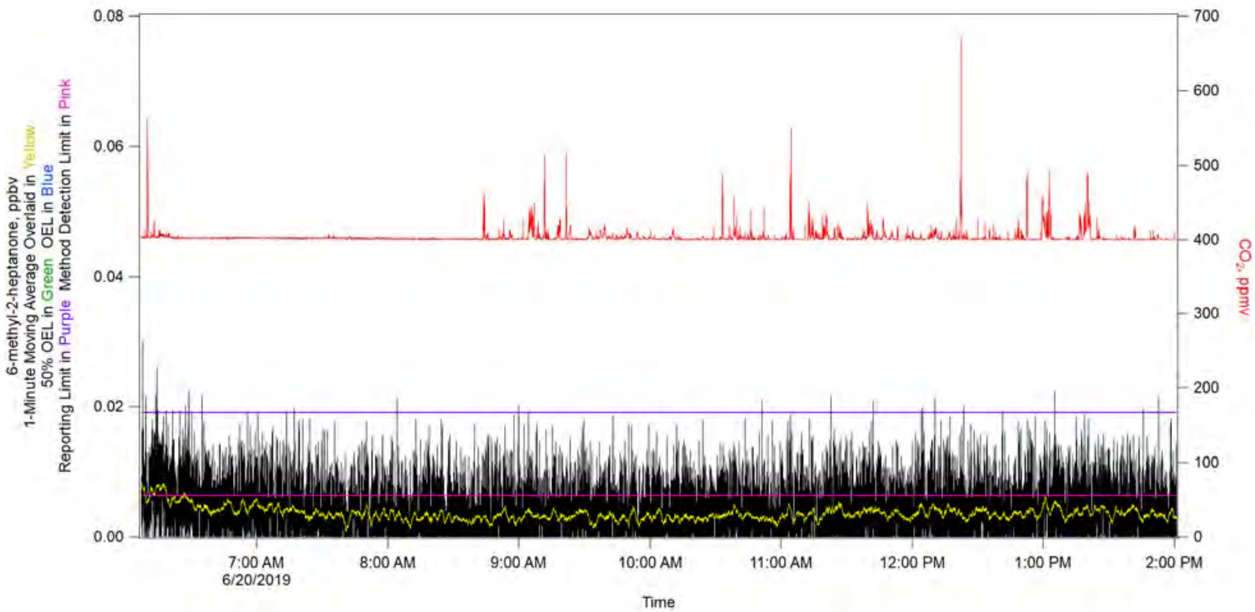

Figure 5-40. 6-methyl-2-heptanone.

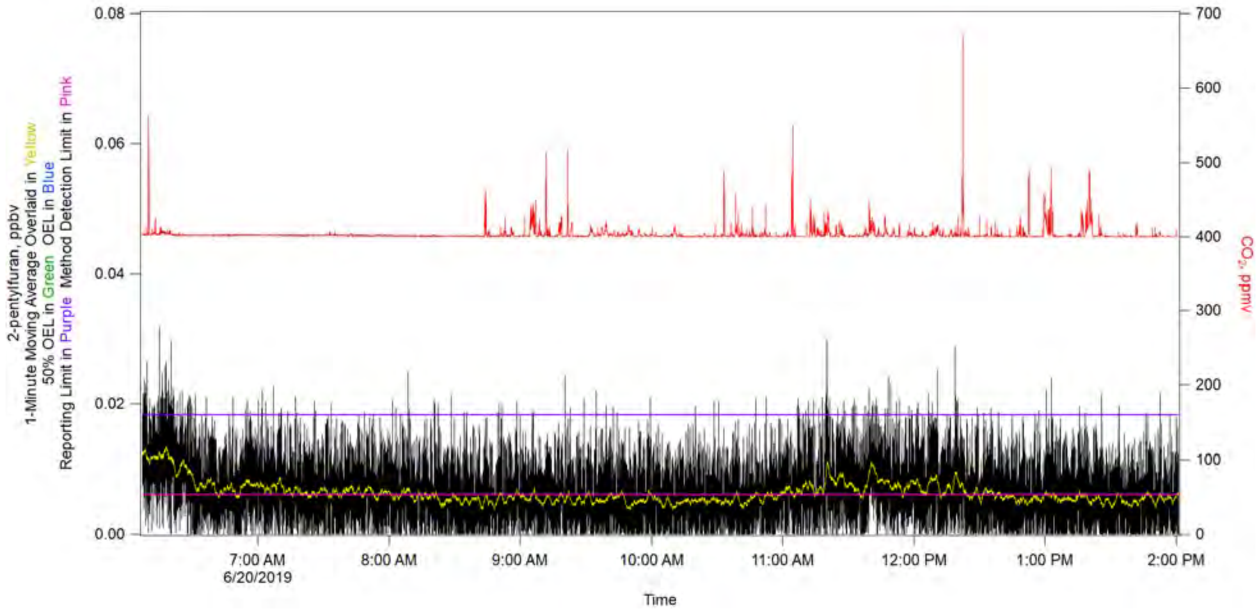

Figure 5-41. 2-pentylfuran.

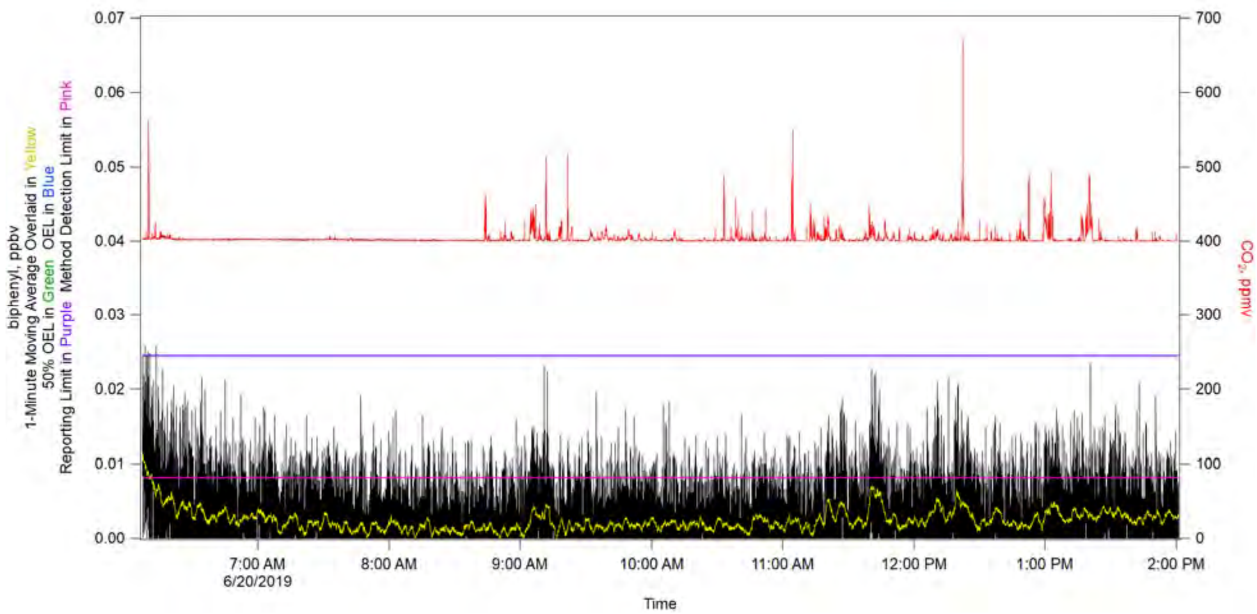

Figure 5-42. Biphenyl.

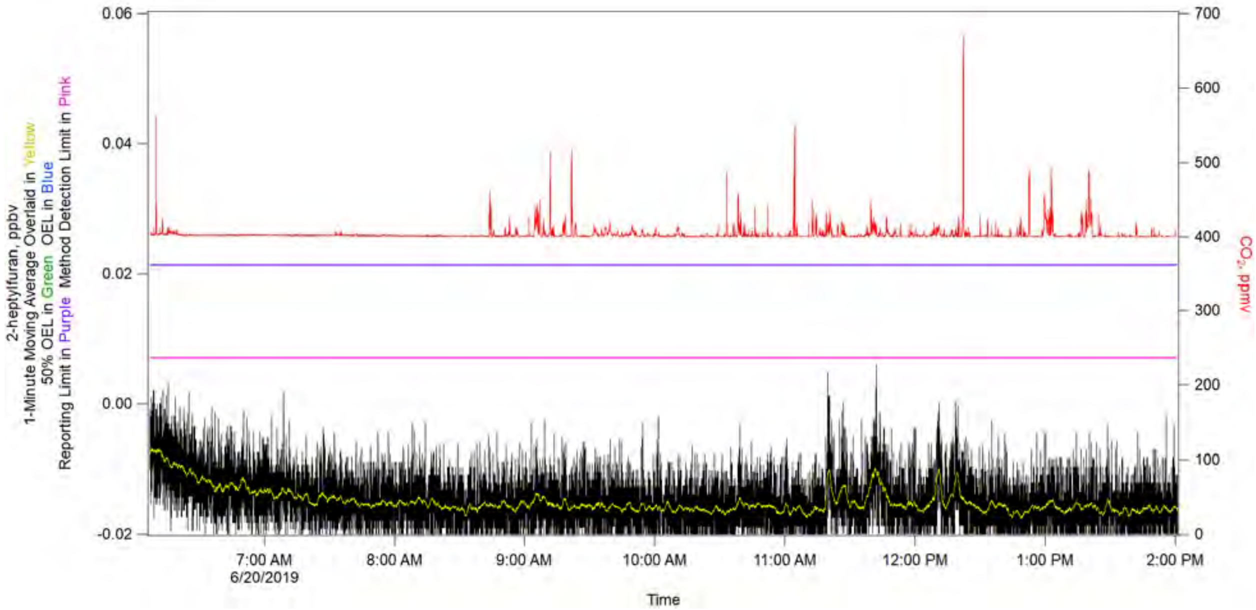

Figure 5-43. 2-heptylfuran.

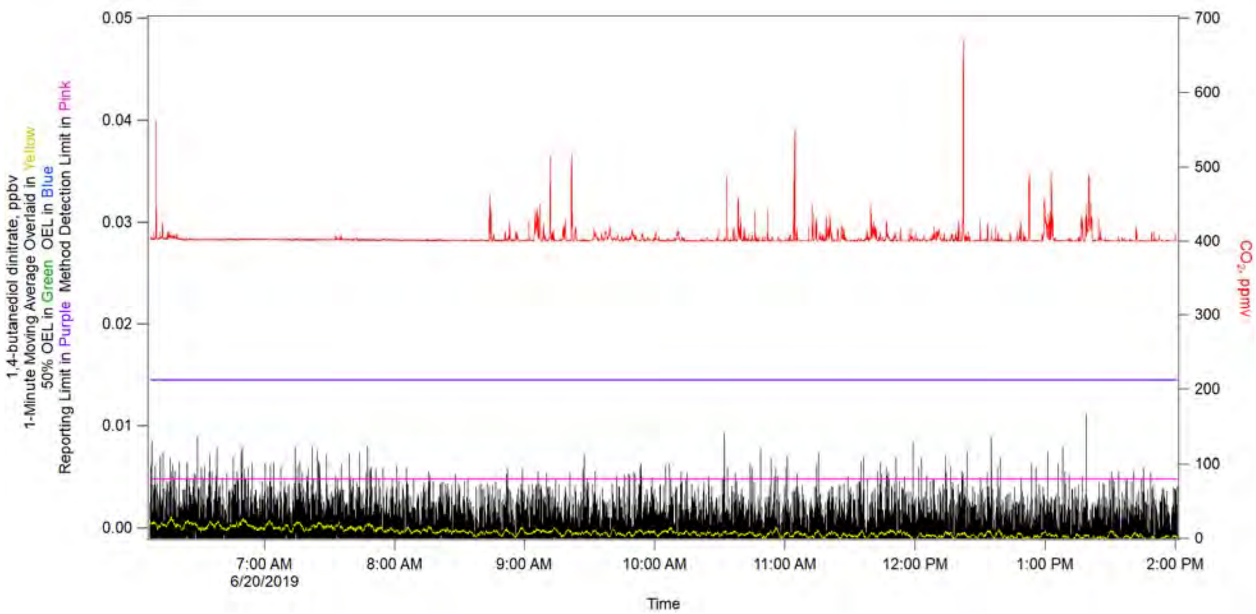

Figure 5-44. 1,4-butanediol Dinitrate.

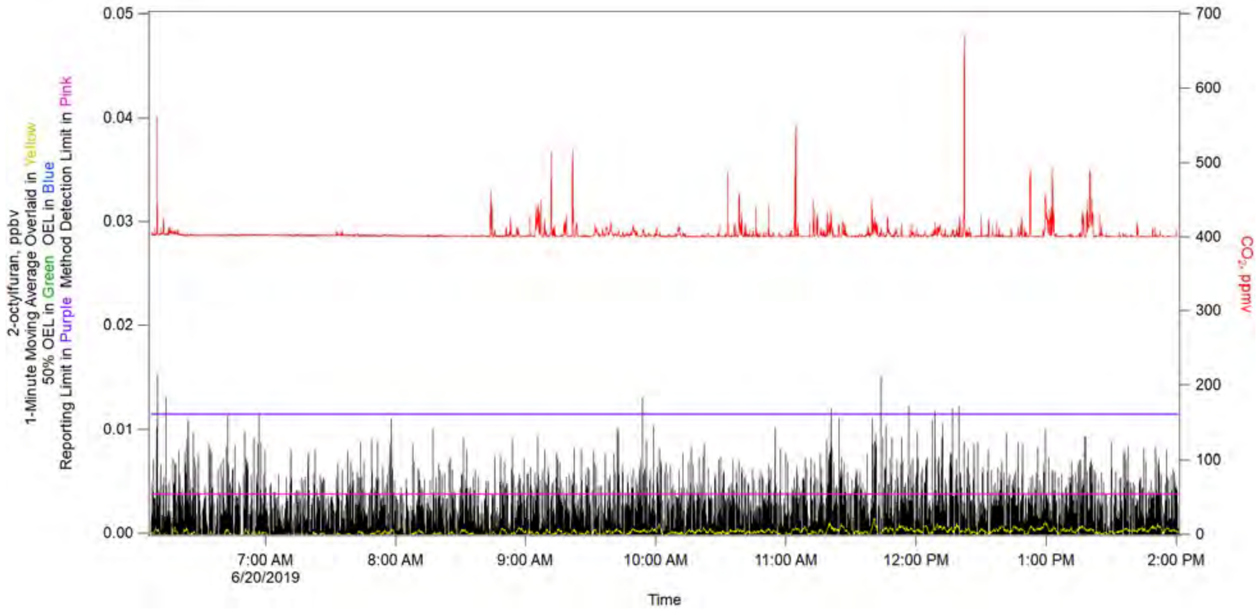

Figure 5-45. 2-octylfuran.

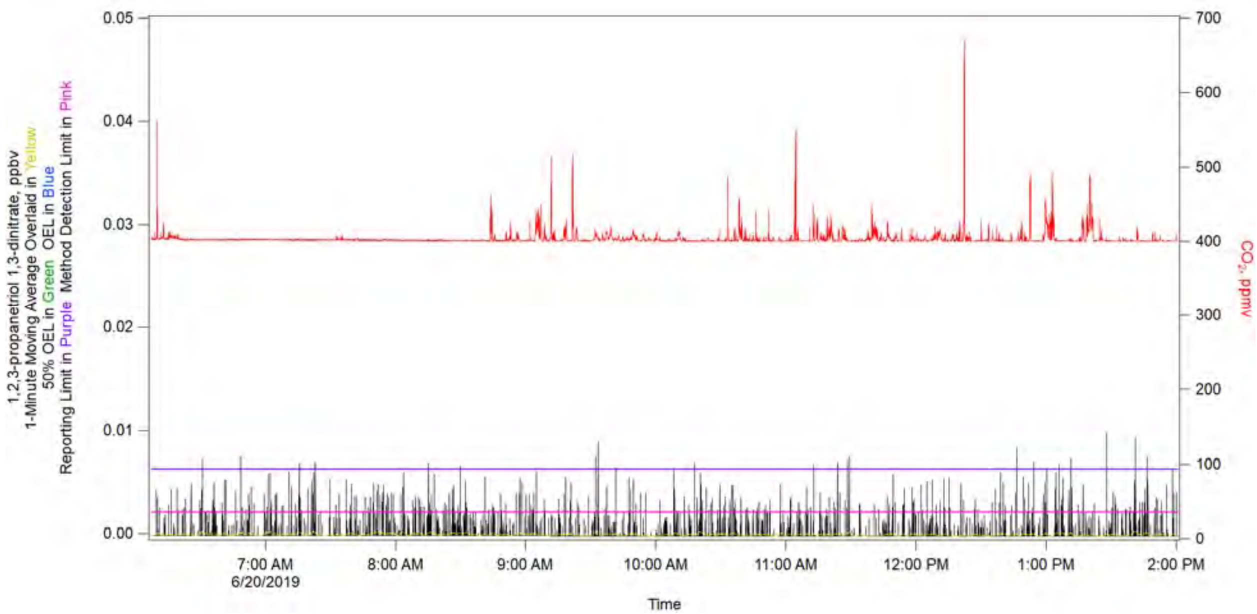

Figure 5-46. 1,2,3-propanetriol 1,3-dinitrate.

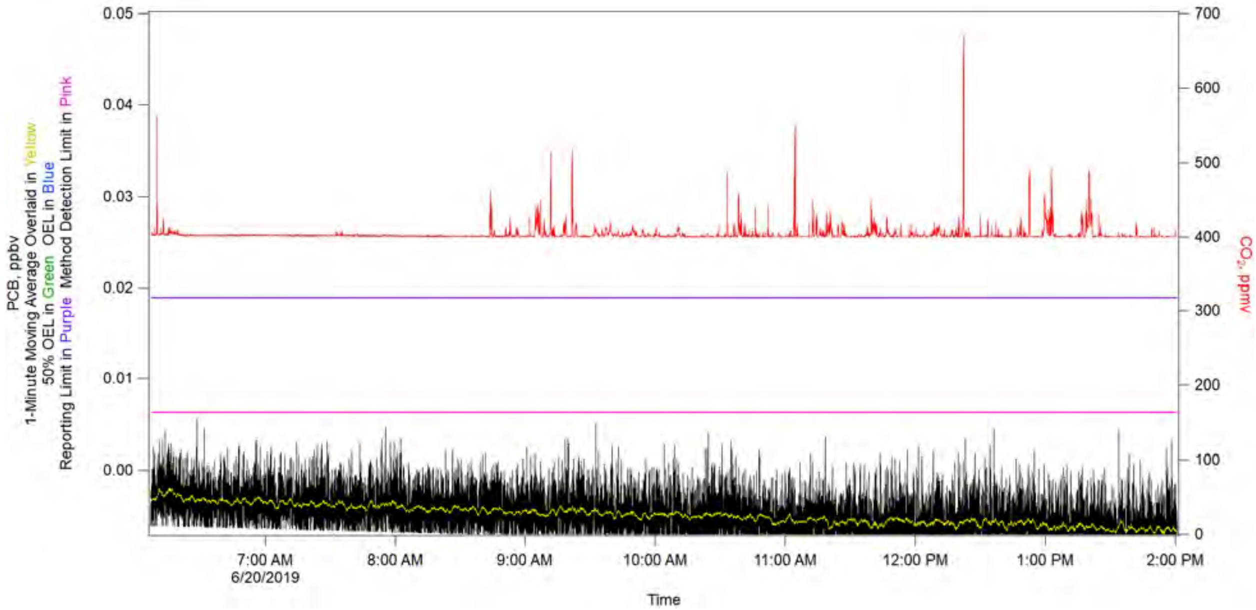

Figure 5-47. PCB.

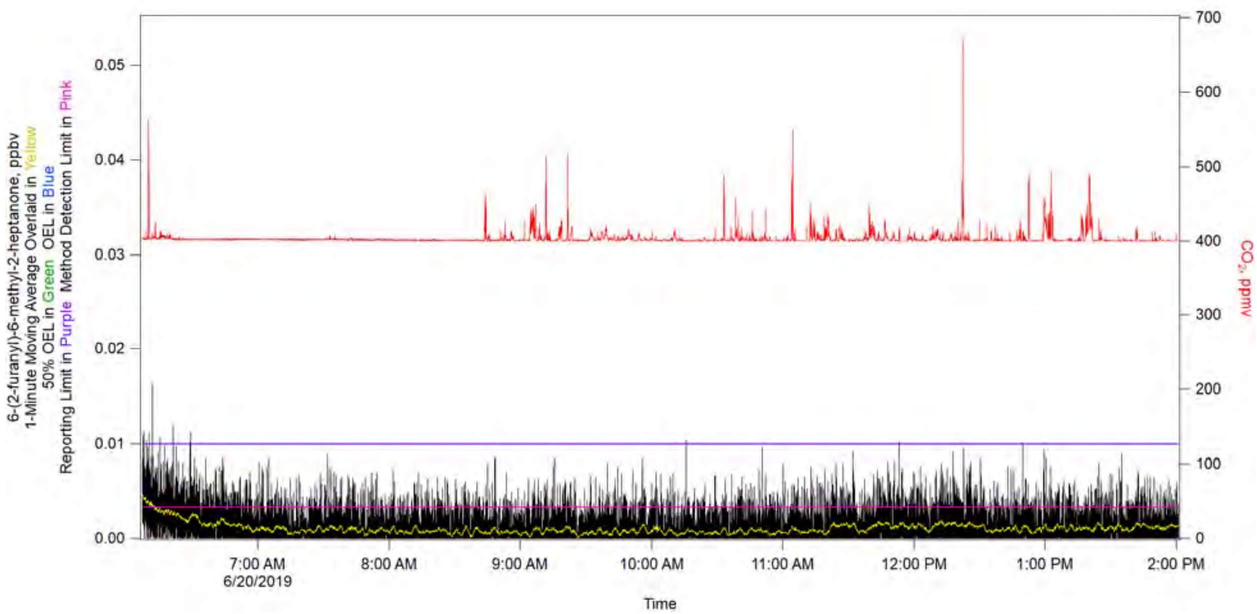

Figure 5-48. 6-(2-furanyl)-6-methyl-2-heptanone.

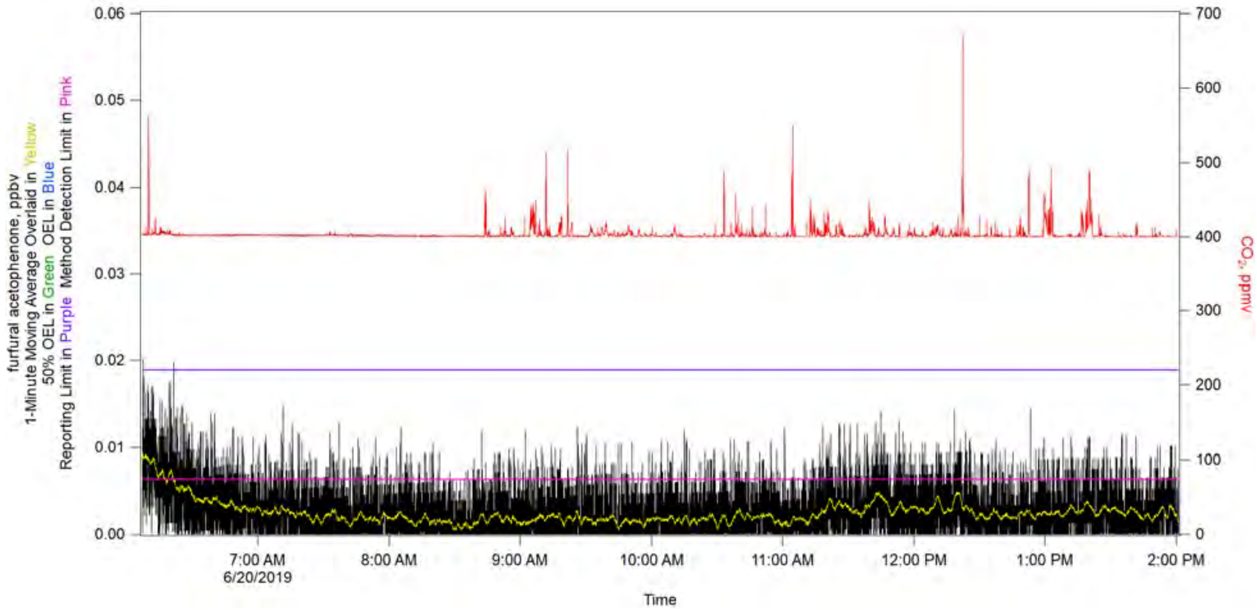

Figure 5-49. Furfural Acetophenone.

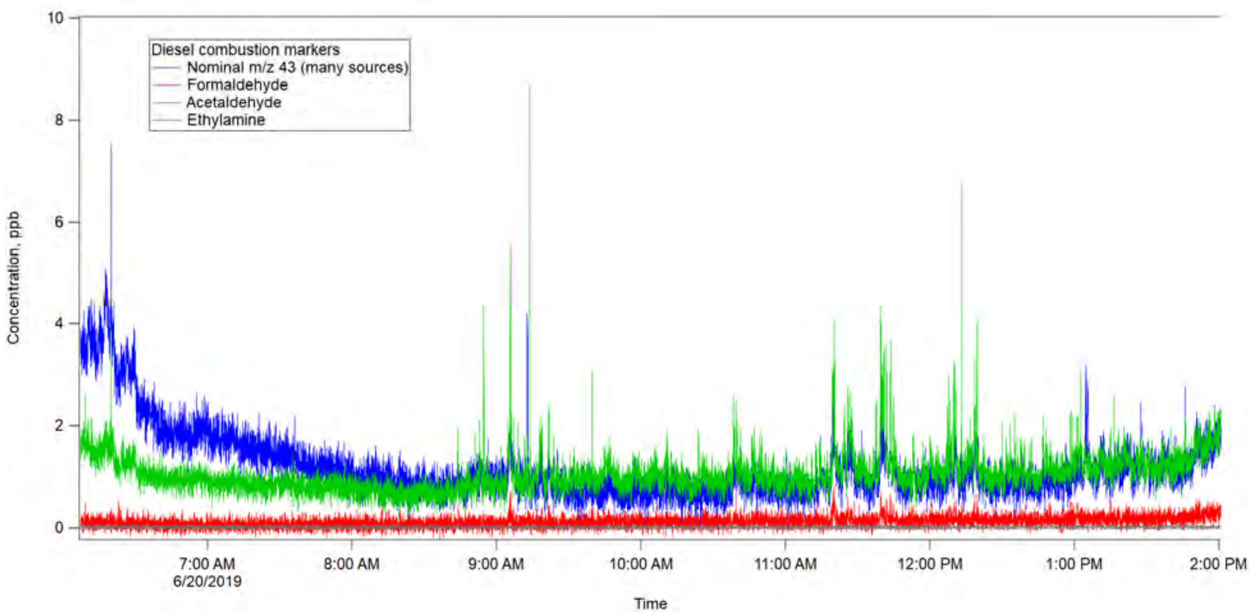

Figure 5-50. Diesel Combustion Markers.

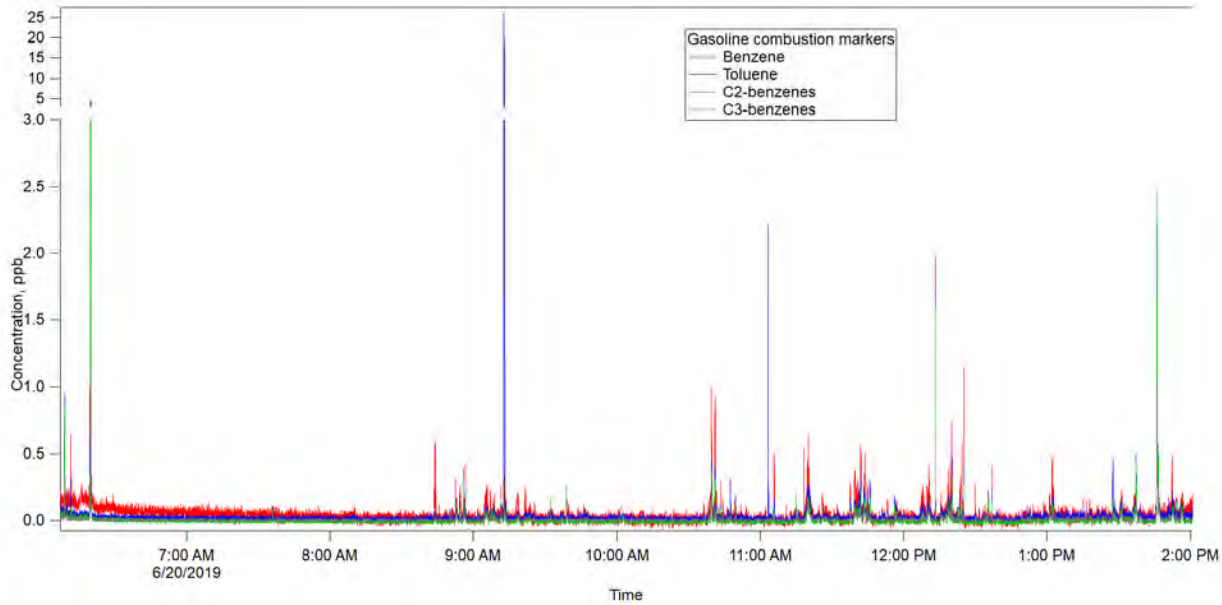

Figure 5-51. Gasoline Combustion Markers.

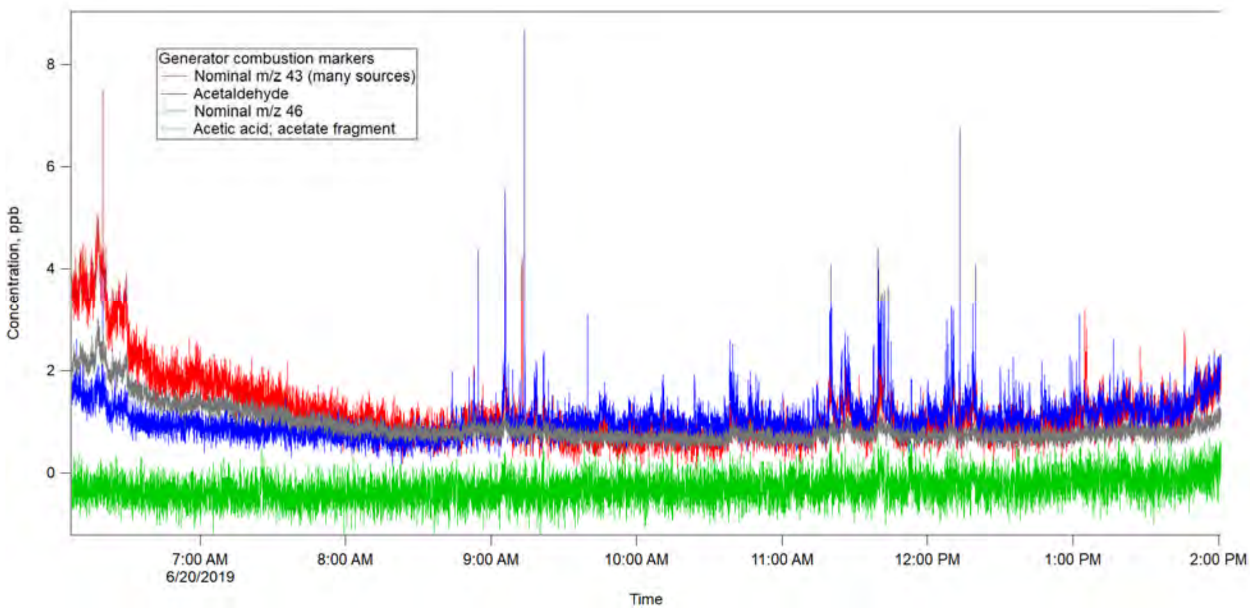

Figure 5-52. Generator Combustion Markers.

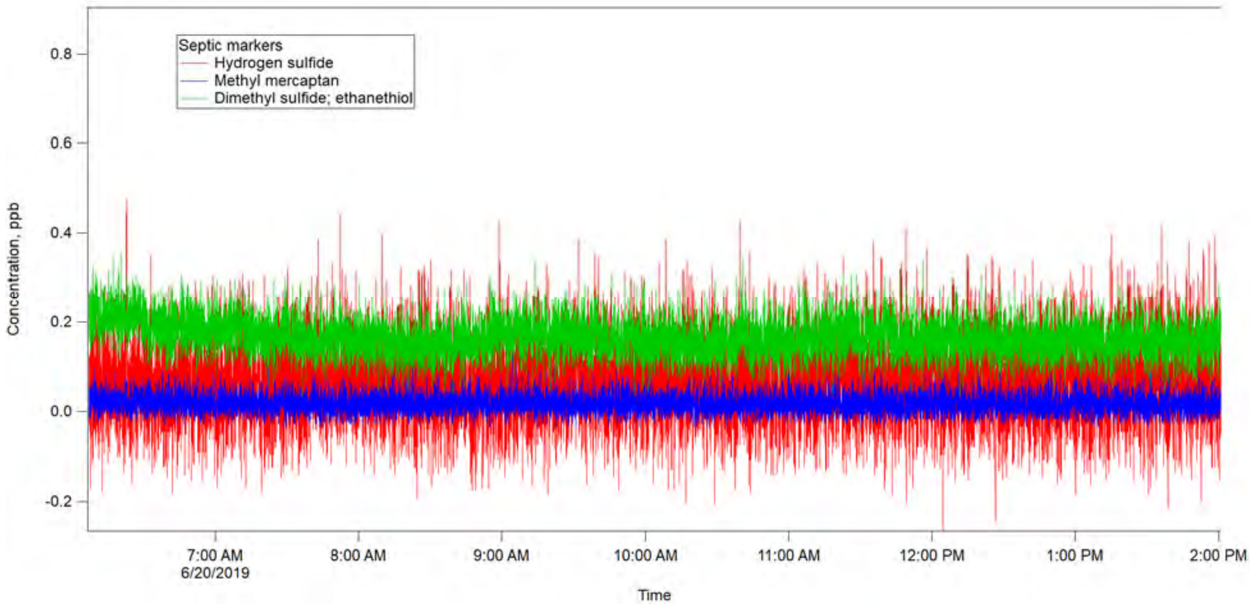

Figure 5-53. Septic Markers.

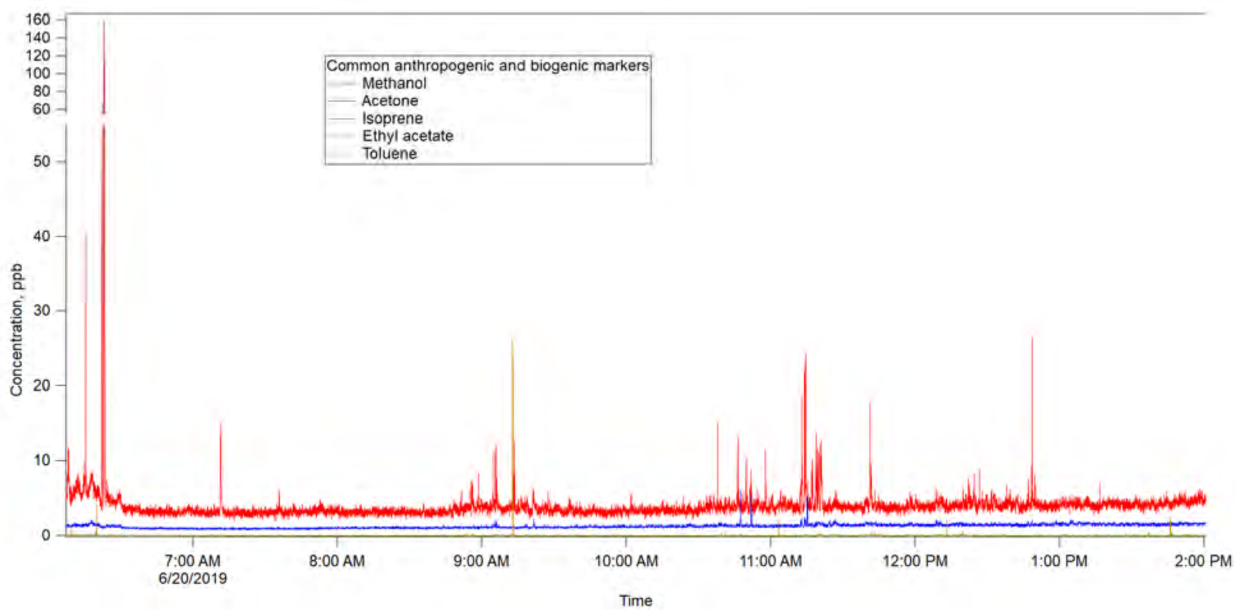

Figure 5-54. Plant and Human Markers.

6.0 ZERO-AIR AND SPAN VERIFICATION

Tables 6-1 through 6-6 display the zero-air and span checks.

Table 6-1. Zero-air Checks for the LI-COR CO_2 Monitor.

Date	Time	Instrument Check	Observed Result (ppm)	Expected Result (ppm)	% Difference	Acceptance Criteria (%)	Pass/Fail
06/18/19	05:42	Zero	-2.805	<50	N/A	N/A	Pass
06/19/19	05:15	Zero	-2.834	<50	N/A	N/A	Pass
06/20/19	05:28	Zero	-3.029	<50	N/A	N/A	Pass

Table 6-2. Span Checks for the LI-COR CO_2 Monitor.

Date	Time	Instrument Check	Observed Result (ppm)	Expected Result (ppm)	% Difference	Acceptance Criteria (%)	Pass/Fail
06/18/19	05:44	Span	358	384.5	7	20	Pass
06/19/19	05:17	Span	361	385.1	6.2	20	Pass
06/20/19	05:30	Span	361	385	6.3	20	Pass

Table 6-3. Zero-air Checks for the Proton Transfer Reaction - Time-of-Flight.

Date	Time	Instrument Check	Observed Result (ppb)	Expected Result (ppb)	% Difference	Acceptance Criteria (%)	Pass/Fail
06/18/19	05:50	Zero	0.2	<0.5 ppb	N/A	N/A	Pass
06/19/19	05:27	Zero	0.18	<0.5 ppb	N/A	N/A	Pass
06/20/19	05:41	Zero	0.16	<0.5 ppb	N/A	N/A	Pass

Table 6-4. Span Checks for the Proton Transfer Reaction - Time-of-Flight.

Date	Time	Instrument Check	Observed Result (ppb)	Expected Result (ppb)	% Difference	Acceptance Criteria (%)	Pass/Fail
06/18/19	06:00	Span	10.75	10.8	0.46	30	Pass
06/19/19	05:38	Span	10.7	10.8	0.93	30	Pass
06/20/19	05:51	Span	10.6	10.8	1.8	30	Pass

In Tables 6-3 and 6-4, the ML Operators used the toluene span for zero and span checks to ensure accuracy.

Table 6-5. Zero-air Checks for the Picarro.

Date	Time	Instrument Check	Observed Result (ppb)	Expected Result (ppb)	% Difference	Acceptance Criteria (%)	Pass/Fail
06/18/19	05:24	Zero	5.054	< 20 ppb	N/A	N/A	Pass
06/19/19	04:56	Zero	4.528	< 20 ppb	N/A	N/A	Pass
06/20/19	05:11	Zero	4.2	< 20 ppb	N/A	N/A	Pass

Table 6-6. Span Checks for the Picarro.

Date	Time	Instrument Check	Observed Result (ppb)	Expected Result (ppb)	% Difference	Acceptance Criteria (%)	Pass/Fail
06/18/19	05:37	Span	3151	3281	4	20	Pass
06/19/19	05:10	Span	3163	3284	3.7	20	Pass
06/20/19	05:24	Span	3171	3280	3.3	20	Pass

7.0 DATA PROCESSING AND REPORTING

During the Week of June 16, 2019, through June 22, 2019, the data processing team continued processing data from the previous week and current week. The reporting team worked towards the completion of reports for Weeks 42 through Week 45, and Months 7 through Month 9.

8.0 REFERENCES

17124-DOE-HS-102, 2018, "Mobile Laboratory Data Processing – Analysis," Revision 2, TerraGraphics Environmental Engineering, Inc., Pasco, Washington.

53005-81-COM-0619-002, 2019, From Mr. Rich Westberg to Mr. Kyle Dickman, *Subcontract 53005, Release 81 – Transmittal of Special Communication Report for AOP-015 Event on June 19, 2019*, TerraGraphics Environmental Engineering, Inc., Pasco, Washington.

53005-81-RPT-007, 2018, *PTR-MS Mobile Laboratory Vapor Monitoring Background Study, (3/18/2018 – 4/20/2018)*, Revision 0, TerraGraphics Environmental Engineering, Inc., Pasco, Washington.

66409-RPT-004, 2019, *Mobile Laboratory Operational Procedure*, Revision 14, TerraGraphics Environmental Engineering, Inc., Pasco, Washington.

Fiscal Year 2017 Mobile Laboratory Vapor Monitoring at the Hanford Site: Monitoring During Waste Disturbing Activities and Background Study, 2017, RJ Lee Group, Inc., Pasco, Washington.

APPENDIX A

DEFICIENCY REPORT DR19-012

TerraGraphics

AUTHENTIC QUALITY RECORDS Initials AW Date 06/24/19 TERRAGRAPHICS

DEFICIENCY REPORT

Deficiency Report No.: DR19-012		Page: 1 of 1
Originator (Print Name): Matthew Erickson	Signature: [signature]	Date: 06/17/19
Project No./Title: 66409 Mobile Laboratory Service & Lease		
PAAA Reportable: ☒ No ☐ Yes	10 CFR 21 Reportable: ☒ No ☐ Yes	

Description of Requirement that was Violated and of Deficiency:
On 06/17/19 the PTR-TOF did not meet the acceptance criteria for Raw H_3O^+ counts and the Hydrate ratio as listed in 66409-RPT-004, *Mobile Laboratory Operational Procedure.*

CORRECTIVE ACTION

Corrective Action:
A stop work was called and the SME, Matthew Erickson, was notified. The Mobile Laboratory Operational Procedure was revised to reflect the accurate PTR-MS acceptance criteria and the ML operators were trained to this revision.
The revised acceptance criteria are listed below:

Corrected H_3O+ cps (Hydronium)	**>1x10[illegible] cps**
Water Cluster	**<40% of H_3O+**

Completion Date: 06/17/19

Deficiency Cause and Extent of Condition:
On 06/17/19, while prepping for deployment, the ML Operational Procedure was followed but the revision at the time did not take into account that each new instrument has a different transmission efficiency and therefore different acceptance criteria. The TG SME, Matthew Erickson, and WRPS PM, George Weeks, were notified of the issue immediately. After consulting the SME, a revision to the procedure was finalized to update the PTR-TOF acceptance criteria.

Action to Preclude Recurrence:
There are no specific actions identified to preclude recurrence at this time.

Completion Date: 06/17/19

Resp. Manager/TL (Print & Sign):	Date:	QA Rep. (Print & Sign): Heath Low [signature]	Date: 06/24/19

CLOSURE

Deficiency Report (01-2018)

TerraGraphics

DEFICIENCY REPORT

Comments and Notes (if applicable): None.		
QA Manager (Print Name): Heath Low	Signature: [signature]	Date: 06/24/19

Deficiency Report (01-2018)

APPENDIX B

53005-81-COM-0619-002, SPECIAL COMMUNICATION REPORT FOR AOP-015 EVENT ON JUNE 19, 2019

TerraGraphics

www.terragraphics.com

VIA E-MAIL – TOCVND@rl.gov / Kyle_R_Dickman@rl.gov

53005-81-COM-0619-002

June 25, 2019

Kyle Dickman
Buyer's Technical Representative
Washington River Protection Solutions, LLC
Post Office Box 850
Richland, Washington 99352

Dear Mr. Dickman:

SUBJECT: **SUBCONTRACT 53005, RELEASE 81 – TRANSMITTAL OF SPECIAL COMMUNICATION REPORT FOR AOP-015 EVENT ON JUNE 19, 2019**

TerraGraphics is pleased to transmit the attached letter report for the Abnormal Operating Procedure (AOP)-015 event that took place on June 19, 2019.

Please note that TOCVND@rl.gov is included as a recipient of this submittal for reference only. This submittal is not listed on the Master Submittal Register (MSR) for this task.

Thank you for the opportunity to support this task. If you have any questions, please feel free to contact me at (509) 547-3883.

Sincerely,

Rich Westberg
Business Unit Manager, Health, Safety, & Analytical Services
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/kls

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Attachment to 53005-81-COM-0619-002
June 25, 2019

Attachment 1

LETTER REPORT FOR AOP-015 EVENT ON JUNE 19, 2019

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1.0 INTRODUCTION

On June 19, 2019, the TerraGraphics Mobile Laboratory (ML) was deployed to the Hanford Site to perform area monitoring near the 200 East location. The overall objective of the ML was to conduct vapor monitoring for a range of compounds, primarily focused on chemicals of potential concern (COPCs) and odor-causing compounds. At approximately 09:24 Pacific Standard Time (PST), an Abnormal Operating Procedure (AOP)-015 event was reported near the east side of AP Farm. At the time the AOP-015 event was reported, the ML observed odor-causing species in the air north of the AP stack.

The ML operators were notified of the AOP-015 event by the Central Shift Office (CSO) announcement at 09:24 PST via digital Shift Office Event Notification (SOEN) text message and called the Washington River Protection Solutions, LLC (WRPS) Project Manager, Mr. George Weeks. The ML operators reported to the CSO at approximately 09:35 PST for further instruction. After briefing, the operators positioned the ML southeast of the A Farm change trailer and set up the 208-foot heated inlet line for vapor monitoring at 09:57. After the arrival of the Industrial Hygiene Technicians (IHTs) at approximately 10:09 PST, the heated inlet line was extended by the IHTs toward the potential source of the AOP-015 event. At 10:25, after the IHTs completed their site examination, they brought the inlet hose back to the ML operators. The ML operators then switched the sampling inlet from the 208-foot hose back to the mast at 10:30 and continued vapor monitoring in this position until 11:07 PST at which time the CSO announced an exit from the AOP-015.

This report will first present the information that is contained within previous AOP-015 letter reports detailing the concentration of every monitored mass during the AOP-015 investigation. Following this is an explanation of the observations and timeline before, during, and after the AOP-015 event. Using the live Proton Transfer Reaction – Mass Spectrometer (PTR-MS) data, wind direction, and olfactory observations, the ML operators were successful in tracking down and identifying the source of the odors. In this instance, the PTR-MS observed two odor plumes before the ML operators logged the odor experience. The low detection limits of the PTR-MS allow detection of compounds that are either below odor thresholds or do not produce an odor making it an asset for tracking down plumes from unknown sources. This capability coupled with the mobility and meteorological data provides the ML operators with the necessary tools for identifying sources.

2.0 JUNE 19, 2019 – AOP-015 EVENT

2.1 Quality Assessment

Data from June 19, 2019, were assessed using Procedure 17124-DOE-HS-102, "Mobile Laboratory Data Processing-Analysis." A Data Acceptance Checklist was completed. The data were accepted by TerraGraphics with the following comments. Report No. 66409-RPT-004, *Mobile Laboratory Operational Procedure*, was adequately documented and all checks passed the acceptance limits.

2.2 Summary

Figure 2-1 below illustrates the timeline of events for the ML before, during and after the AOP-015 event. Non-reportable data are greyed out and described in Table 2-2. Area monitoring data are highlighted in green. Sideport sampling data are highlighted in red and include sampling from the 208-foot heated line (Time Period 4) and the 35-foot heated line (Time Period 7).

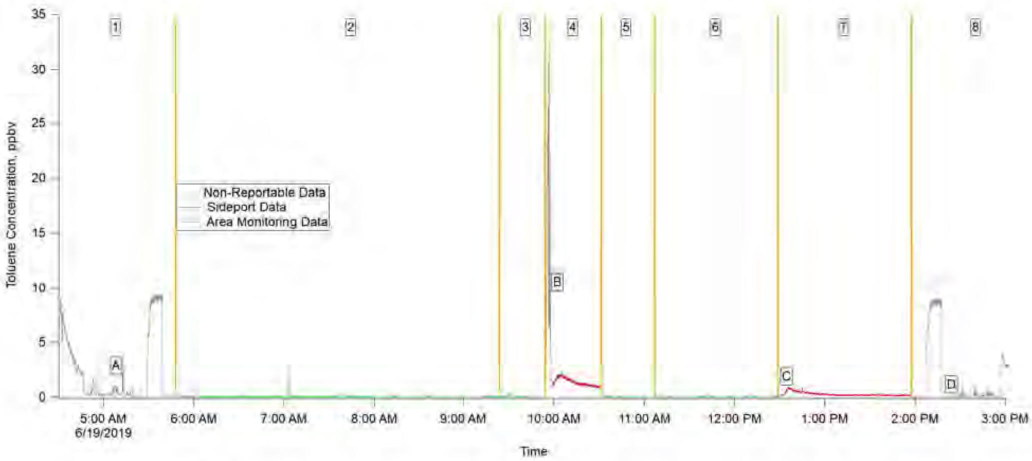

Figure 2-1. Visual Timeline of Events for AOP-015 Event on June 19, 2019.

Table 2-1 provides specific time ranges and descriptions for each of the periods labeled in Figure 2-1.

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Table 2-1. Timeline of Events for AOP-015 Event on June 19, 2019.

Name	Time Period	Description
Time Period 1	04:31 – 05:48 PST	Pre-arrival on Hanford Site; pre-shift zero air/span check passed
Time Period 2	05:48 – 09:24 PST	Mobile mast area monitoring in 200E area
Time Period 3	09:24 – 09:54 PST	AOP-015 was called; area monitoring in the vicinity of AP Farm
Time Period 4	09:54 – 10:31 PST	Sideport sampling alongside E AP fence line with 208-foot heated line
Time Period 5	10:31 – 11:07 PST	Disconnected the sideport line and resumed mobile mast area monitoring
Time Period 6	11:07 – 12:29 PST	AOP-015 was exited; ML continued to monitor in the vicinity of AP Farm
Time Period 7	12:29 – 13:57 PST	Sideport sampling potential odor source with 35-foot heated line
Time Period 8	13:57 – 15:02 PST	Post-departure of Hanford Site; post-shift zero air/span check passed

Table 2-2 below describes the purpose for the data omissions labeled in Figure 2-1. The data described below are non-reportable for quality assurance/quality control (QA/QC) purposes.

Table 2-2. Data Omitted from Reporting on June 19, 2019.

Name	Time Period	Purpose
A	04:31 – 05:48 PST	Pre-arrival on Hanford Site; pre-shift zero air/span check
B	09:54 – 09:59 PST	Configuration change; ML sampling system re-equilibrating
C	12:29 – 12:31 PST	Configuration change; ML sampling system re-equilibrating
D	13:57 – 15:02 PST	Post-departure of Hanford Site; post-shift zero air/span check

Figure 2-2 below shows the position of the ML and its 208-foot heated line inlet for the duration of the monitoring period.

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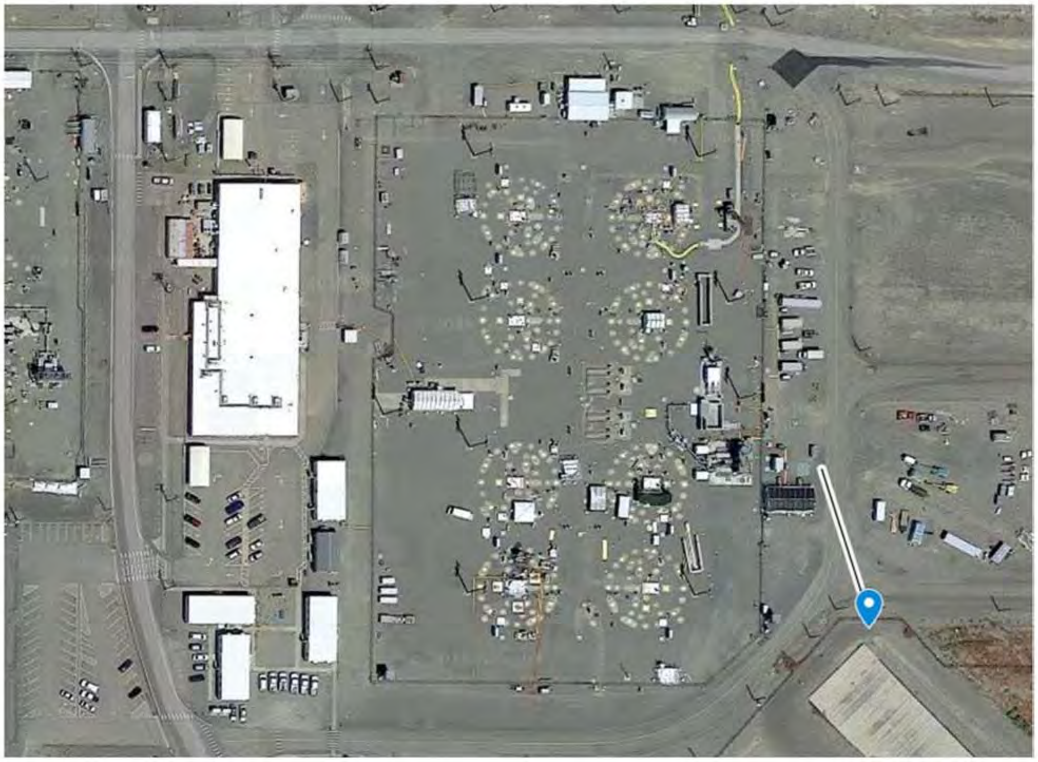

Figure 2-2. Mobile Laboratory Location for the Duration of the Monitoring Period.

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Figure 2-3 shows the position of the ML 208-foot heated inlet line during the AOP-015 event. Circled in red is the stand supporting the end of the inlet. The inlet is extended toward the structures to the east of the AP fenceline.

Figure 2-3. Mobile Laboratory 208-foot Heated Line Placement During June 19, 2019, AOP-015 Event (Inlet Stand Circled in Red).

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Figure 2-4 shows meteorological data from the ML mast for the duration of the 208-foot heated line sampling that occurred during Time Period 4. Wind was generally from the northwest. Temperature was relatively constant at approximately 72ºF to 73ºF. Pressure and humidity remained relatively constant throughout the monitoring period.

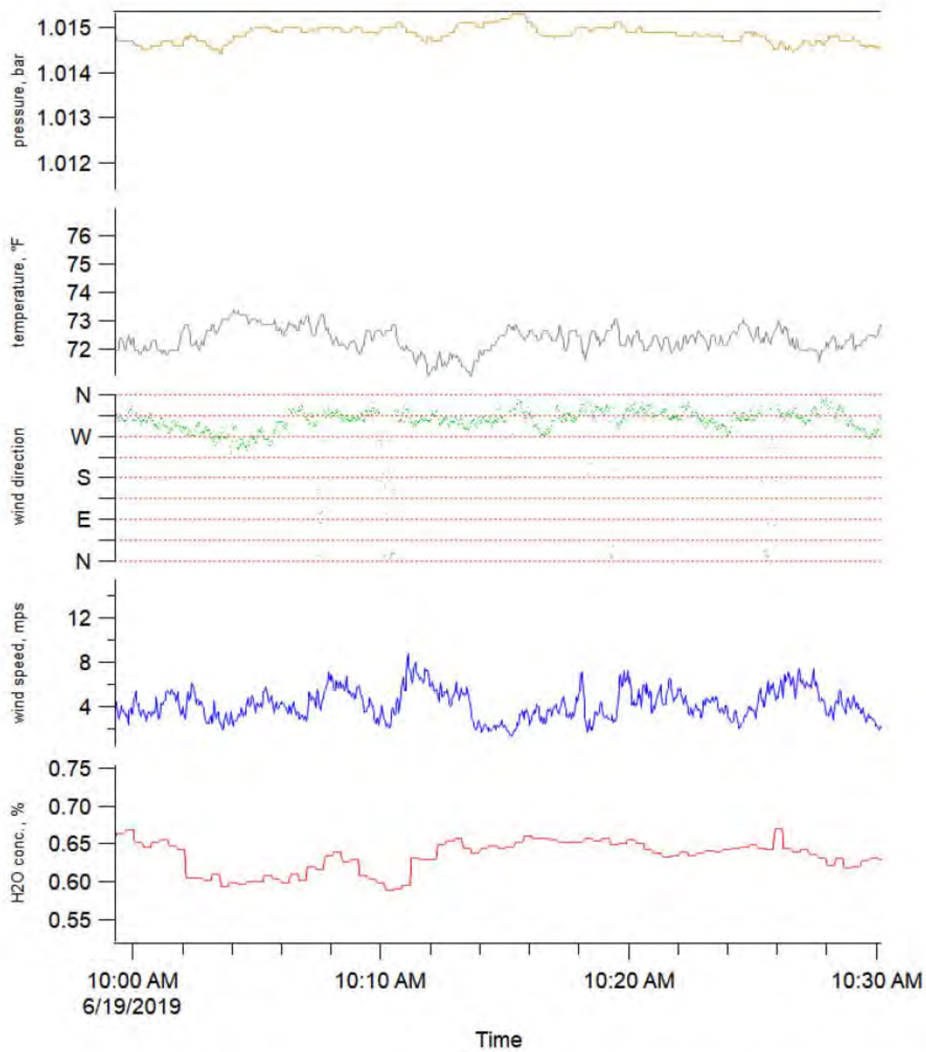

Figure 2-4. Meteorological Data from Mobile Laboratory Mast for the Duration of 208-foot Heated Line Monitoring.

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Figures 2-5 through 2-8 are wind roses representing prevailing wind patterns over the course of various stationary periods throughout the monitoring period. Concentric rings on these plots indicate percentage of total winds over the time period. Figure 2-5 shows a wind rose during the time period of 06:45 to 08:00 and depicts winds primarily out of the northwest and west, rarely exceeding 5 m/s. Figure 2-6 shows the time period of 08:45 to 09:15 and illustrates a shift in wind to be slightly more out of the west, while staying predominantly out of the northwest. Winds also pick up in speed to mostly above 5 m/s. Figure 2-7 shows wind data during the stationary monitoring period in which the 208-foot heated line was in use. Once again, winds were mostly out of the northwest, with some from the north and west. Figure 2-8 shows the time period during which the 35-foot heated line was in use. Winds picked up again to exceed 10 m/s at times, while still being principally out of the northwest.

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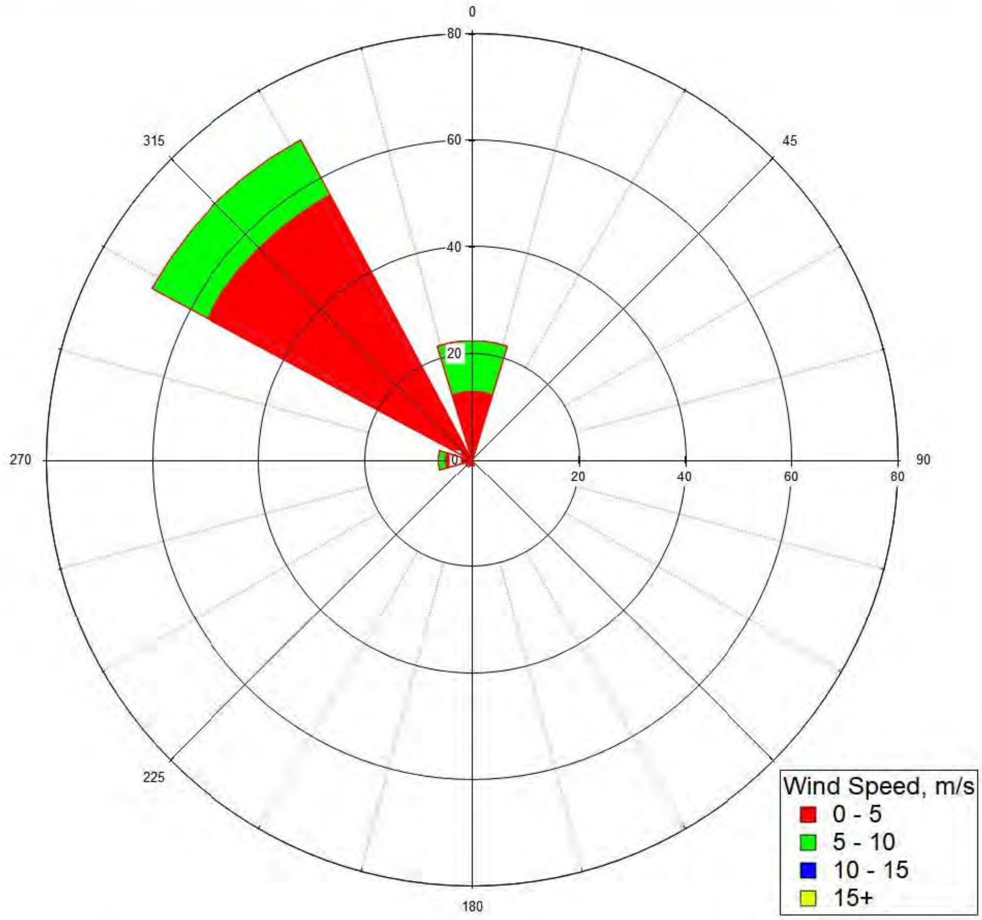

Figure 2-5. Wind Rose Showing the Stationary Monitoring Period from 06:45 to 08:00.

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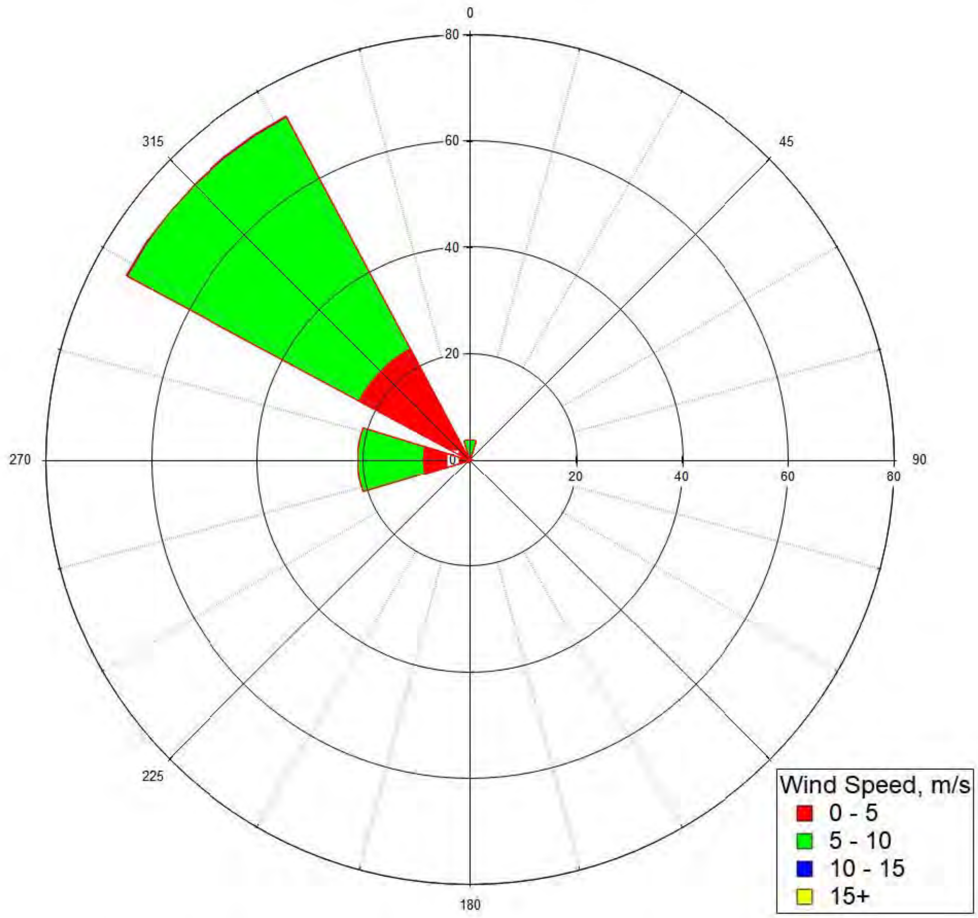

Figure 2-6. Wind Rose Showing the Stationary Monitoring Period from 08:45 to 09:15.

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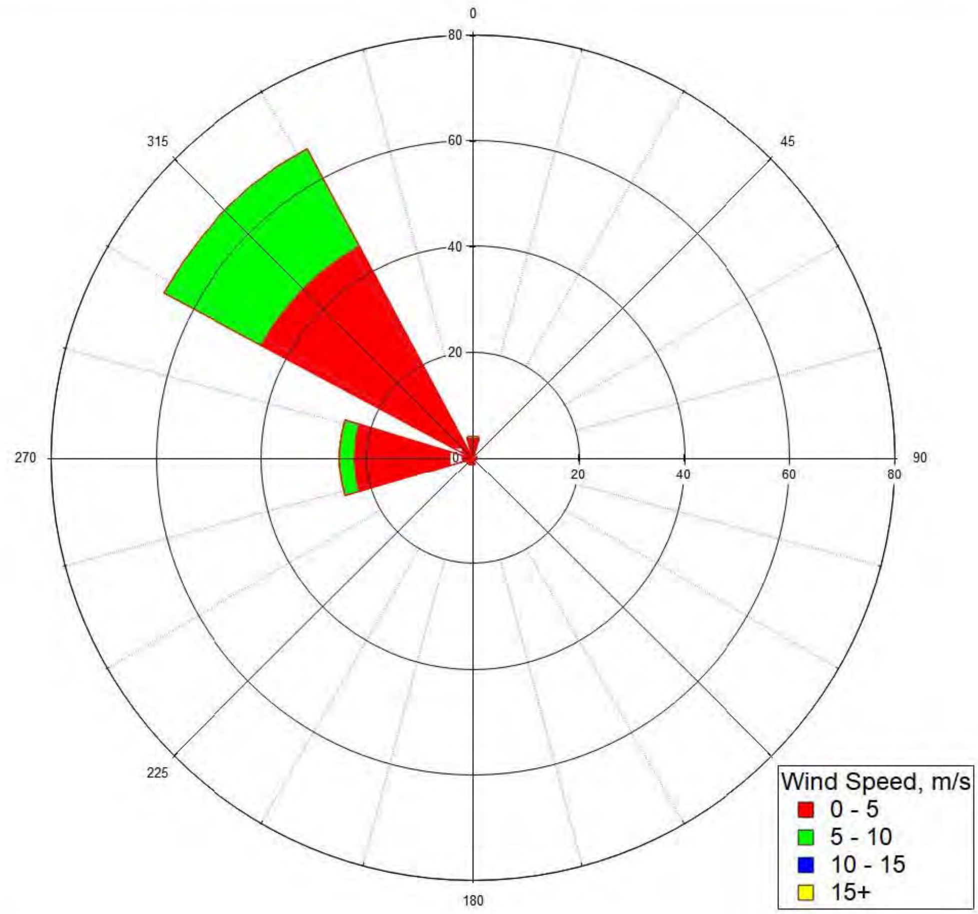

Figure 2-7. Wind Rose Showing Time Period 4 (208-foot Heated Line Sampling).

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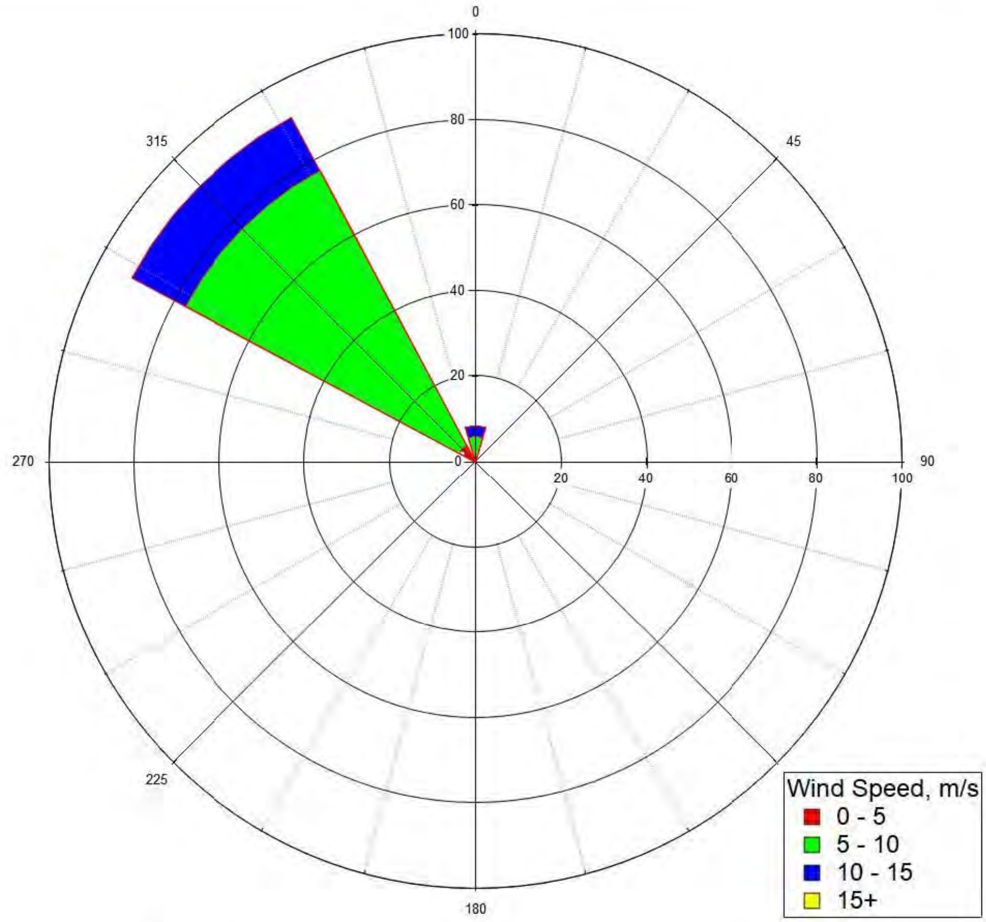

Figure 2-8. Wind Rose Showing Time Period 7 (35-foot Heated Line Sampling).

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2.3 Chemicals of Potential Concern

Table 2-3. Chemical of Potential Concern Statistical Information for the Monitoring Period of June 19, 2019. (2 Sheets)

COPC #	COPC Name	OEL (ppb)	MDL (ppb)	Ave. (ppb)	St. Dev. (ppb)	Rel. St. Dev. %	Max (ppb)	Median (ppb)
1	Ammonia	25000	6.225	8.382†	1.965	23.443	11.978	8.012†
2	Formaldehyde	300	0.273	0.804†	0.183	22.697	1.467	0.812†
3	Methanol	200000	0.576	29.904	4.661	15.586	38.073	29.748
4	Acetonitrile	20000	0.036	0.241	0.051	21.048	0.404	0.238
5	Acetaldehyde	25000	0.202	5.022	0.903	17.979	11.114	5.154
6	Ethylamine	5000	0.037	<0.037	0.019	87.262	0.126	<0.037
7	1,3-butadiene	1000	0.073	7.544	1.549	20.531	12.483	7.487
8	Propanenitrile	6000	0.046	0.153	0.052	33.845	0.334	0.15
9	2-propenal	100	0.090	0.792	0.260	32.771	1.493	0.763
10	1-butanol + butenes	20000	0.079	0.804	0.330	41.074	1.657	0.709
11	methyl isocyanate	20	0.037	0.056†	0.034	59.823	0.179	0.056†
12	methyl nitrite	100	0.042	0.323	0.098	30.352	0.592	0.313
13	Furan	1	0.031	0.081†	0.031	38.408	0.195	0.079†
14	Butanenitrile	8000	0.023	<0.023	0.018	77.769	0.088	<0.023
15	but-3-en-2-one + 2,3-dihydrofuran + 2,5-dihydrofuran	100, 1, 1	0.020	0.094	0.027	28.221	N/A*	N/A*
16	Butanal	25000	0.027	0.291	0.075	25.697	0.491	0.281
17	NDMA**	0.3	0.046	<0.046	0.003	299.155	0.057	<0.046
18	Benzene	500	0.068	1.312	0.412	31.388	2.236	1.193
19	2,4-pentadienenitrile + pyridine	300, 1000	0.036	0.085†	0.034	40.446	0.210	0.08†
20	2-methylene butanenitrile	30	0.020	0.025†	0.014	58.298	0.082	0.022†
21	2-methylfuran	1	0.024	0.06†	0.023	37.617	0.181	0.059†
22	Pentanenitrile	6000	0.021	0.024†	0.014	59.273	0.077	0.022†
23	3-methyl-3-buten-2-one + 2-methyl-2-butenal	20, 30	0.024	0.043†	0.020	47.058	0.107	0.041†
24	NEMA**	0.3	0.034	<0.034	0.010	829.263	0.077	<0.034
25	2,5-dimethylfuran	1	0.021	0.044†	0.018	41.706	0.102	0.043†
26	Hexanenitrile	6000	0.019	<0.019	0.007	58.750	0.044	<0.019
27	2-hexanone (MBK)	5000	0.021	0.200	0.091	45.824	0.434	0.17
28	NDEA**	0.1	0.022	<0.022	0.003	443.84	0.039	<0.022

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Table 2-3. Chemical of Potential Concern Statistical Information for the Monitoring Period of June 19, 2019. (2 Sheets)

COPC #	COPC Name	OEL (ppb)	MDL (ppb)	Ave. (ppb)	St. Dev. (ppb)	Rel. St. Dev. %	Max (ppb)	Median (ppb)
29	butyl nitrite + 2-nitro-2-methylpropane	100, 30	0.027	<0.027	0.009	52.357	0.048	<0.027
30	2,4-dimethylpyridine	500	0.020	0.057†	0.023	40.087	0.131	0.055†
31	2-propylfuran + 2-ethyl-5-methylfuran	1	0.018	0.025†	0.014	57.067	0.068	0.025†
32	Heptanenitrile	6000	0.017	<0.017	0.005	70.979	0.031	<0.017
33	4-methyl-2-hexanone	500	0.020	0.031†	0.018	58.003	0.100	0.027†
34	NMOR**	0.6	0.015	0.028†	0.021	75.226	0.088	0.026†
35	butyl nitrate	2500	0.014	<0.014	0.006	84.448	0.035	<0.014
36	2-ethyl-2-hexenal + 4-(1-methylpropyl)-2,3-dihydrofuran + 3-(1,1-dimethylethyl)-2,3-dihydrofuran	100,1, 1	0.017	0.03†	0.024	78.064	0.212	0.025†
37	6-methyl-2-heptanone	8000	0.017	0.022†	0.010	47.163	0.057	0.021†
38	2-pentylfuran	1	0.020	0.033†	0.014	43.364	0.086	0.031†
39	Biphenyl	200	0.014	0.033†	0.015	45.537	0.087	0.032†
40	2-heptylfuran	1	0.031	0.045†	0.017	37.841	0.095	0.044†
41	1,4-butanediol dinitrate	50	0.018	<0.018	0.006	38.779	0.038	<0.018
42	2-octylfuran	1	0.018	<0.018	0.004	1648.46	0.024	<0.018
43	1,2,3-propanetriol 1,3-dinitrate	50	0.031	<0.031	0.009	182.775	0.041	<0.031
44	PCB	1000	0.036	<0.036	0.012	33.752	0.077	<0.036
45	6-(2-furanyl)-6-methyl-2-heptanone	1	0.018	<0.018	0.004	76.560	0.023	<0.018
46	furfural acetophenone	1	0.032	0.045†	0.014	30.691	0.085	0.045†
N/A*	The maximum peak value for but-3-en-2-one + 2,3-dihydrofuran + 2,5-dihydrofuran was 0.168 ppb and the median value was 0.093 ppb. The PTR-MS results for but-3-en-2-one + 2,3-dihydrofuran + 2,5-dihydrofuran are not compared to OEL concentrations because: 1) the result is suspect due to a known biogenic interferant (methacrolein) that is expected to be in concentrations that occasionally exceed the dihydrofuran OEL, and 2) this combination of COPCs have OEL concentrations that differ by a factor of 200, which provide widely variant bases for these numbers.							
**	Nitrosamine results are suspect due to isobaric interferants causing positive bias that have been encountered during previous background studies the Spring 2018 background study [53005-81-RPT-007, *PTR-MS Mobile Laboratory Vapor Monitoring Background Study, (3/18/2018 – 4/20/2018)*, and *Fiscal Year 2017 Mobile Laboratory Vapor Monitoring at the Hanford Site: Monitoring During Waste Disturbing Activities and Background Study*, RJ Lee Group, Inc.].							
<	COPC Average/Median Below the MDL.							
†	COPC Average/Median Between the RL and the MDL.							

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2.4 Odor Compounds

Table 2-4. Odor Statistical Information for the Monitoring Period of June 19, 2019.

Odor #	Odor Name	MDL (ppb)	Ave. (ppb)	St. Dev. (ppb)	Rel. St. Dev. (ppb)	Max (ppb)	Median (ppb)
1	hydrogen sulfide	0.367	<0.367	0.099	71.178	0.527	<0.367
2	methyl mercaptan	0.060	0.068†	0.032	46.579	0.197	0.068†
3	dimethylsulfide; ethanethiol	0.038	0.269	0.053	19.854	0.447	0.268
4	allyl mercaptan	0.021	0.216	0.072	33.279	0.429	0.209
5	1-propanethiol; isopropyl mercaptan	0.027	0.096	0.041	42.294	0.233	0.094
6	2-butene-1-thiol	0.038	0.084†	0.038	44.677	0.222	0.081†
7	diethyl sulfide; 2-methylpropane-2-thiol	0.080	1.610	0.558	34.650	2.814	1.444
8	thiopropanal sulfuroxide	0.018	0.197	0.069	35.080	0.408	0.186
9	dimethyl disulfide	0.019	<0.019	0.004	620.592	0.041	<0.019
10	1-pentanethiol; 2,2-dimethylpropane-1-thiol	0.030	<0.03	0.000	-2.975	-0.002	<0.03
11	benzenethiol	0.020	0.042†	0.025	60.080	0.117	0.041†
12	diallyl sulfide	0.017	<0.017	0.018	143.955	0.075	<0.017
13	methyl propyl disulfide	0.013	<0.013	0.017	144.009	0.083	<0.013
14	methylbenzenethiol	0.018	<0.018	0.003	413.961	0.034	<0.018
15	dimethyl trisulfide	0.014	0.098	0.029	29.335	0.193	0.098
16	(1-oxoethyl) thiophene	0.024	<0.024	0.009	985.342	0.062	<0.024
17	(1-oxopropyl) thiophene	0.017	0.024†	0.013	54.550	0.080	0.023†
18	dipropyl disulfide	0.015	0.017†	0.009	52.397	0.053	0.017†
19	methyl propyl trisulfide	0.028	<0.028	0.004	1155.040	0.031	<0.028
20	dimethyl tetrasulfide	0.030	<0.03	0.002	987.335	0.007	<0.03
21	dipropyl trisulfide	0.017	<0.017	0.013	122.051	0.053	<0.017
22	diphenyl sulfide	0.019	<0.019	0.010	95.626	0.051	<0.019
<	COPC Average/Median Below the MDL.						
†	COPC Average/Median Between the RL and the MDL.						

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2.5 All Other Mass Signals Detected by Proton Transfer Reaction – Mass Spectrometer

Table 2-5. Other Mass Signals Statistical Information for the Monitoring Period of June 19, 2019. (14 Sheets)

#	Species Name	MDL (ppb)	Ave. (ppb)	St. Dev. (ppb)	Rel. St. Dev. (ppb)	Max (ppb)	Median (ppb)
1	nominal m/z 26	0.054	<0.054	0.037	217.363	0.152	<0.054
2	nominal m/z 27	0.124	0.135†	0.100	73.883	0.458	0.138†
3	nominal m/z 36	0.403	1.634	0.348	21.285	2.855	1.627
4	nominal m/z 38	0.945	5.894	0.663	11.241	8.219	5.904
5	nominal m/z 39	1.047	14.939	2.456	16.442	20.871	15.023
6	nominal m/z 40	0.125	0.429	0.131	30.675	0.826	0.422
7	nominal m/z 41	0.136	1.728	0.516	29.876	3.072	1.624
8	unknown m/z 42	0.161	<0.161	0.114	299.230	0.380	<0.161
9	nominal m/z 43	0.283	21.188	6.415	30.279	34.329	18.597
10	nominal m/z 44	0.129	0.484	0.208	43.006	1.176	0.456
11	nominal m/z 45	0.062	0.809	0.101	12.439	1.160	0.803
12	nominal m/z 46	0.228	1.081	0.369	34.094	2.579	1.086
13	formamide	0.114	0.478	0.169	35.243	0.992	0.464
14	formic acid	0.203	8.624	1.780	20.636	12.583	8.033
15	ethanol	0.028	0.118	0.055	46.972	0.301	0.114
16	nominal m/z 48	0.087	0.16†	0.080	49.649	0.399	0.16†
17	nominal m/z 50	0.060	<0.06	0.035	1570.860	0.113	<0.06
18	nominal m/z 51	0.072	0.751	0.158	21.082	1.224	0.751
19	nominal m/z 52	0.039	<0.039	0.031	125.117	0.121	<0.039
20	nominal m/z 53	0.117	0.637	0.232	36.455	1.236	0.589
21	nominal m/z 54	0.040	<0.04	0.033	91.321	0.146	<0.04
22	unknown m/z 55	0.000	0.000	0.000	0.000	0.000	0.000
23	unknown m/z 58	0.068	<0.068	0.039	169.873	0.086	<0.068
24	C_3H_7N	0.029	0.076†	0.041	54.224	0.209	0.073†
25	acetone	0.071	9.695	1.746	18.010	12.620	9.172
26	nominal m/z 60	0.061	0.784	0.176	22.472	1.217	0.762

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Table 2-5. Other Mass Signals Statistical Information for the Monitoring Period of June 19, 2019. (14 Sheets)

#	Species Name	MDL (ppb)	Ave. (ppb)	St. Dev. (ppb)	Rel. St. Dev. (ppb)	Max (ppb)	Median (ppb)
27	acetic acid; acetate fragment	0.126	10.667	3.228	30.265	17.060	9.446
28	nominal m/z 64	0.021	0.022†	0.019	84.930	0.085	0.022†
29	nominal m/z 65	0.039	0.511	0.127	24.856	0.838	0.493
30	nominal m/z 66	0.022	0.035†	0.023	67.390	0.111	0.034†
31	nominal m/z 67	0.028	0.266	0.101	38.152	0.598	0.251
32	nominal m/z 68	0.017	0.023†	0.017	73.133	0.080	0.024†
33	isoprene	0.029	0.343	0.125	36.433	0.767	0.314
34	unknown m/z 70	0.011	<0.011	0.011	166.278	0.045	<0.011
35	C_5H_{10}	0.013	0.160	0.072	45.233	0.368	0.148
36	unknown m/z 71	0.017	0.053	0.022	42.168	0.138	0.053
37	nominal m/z 72	0.026	<0.026	0.021	130.303	0.083	<0.026
38	nominal m/z 73	0.030	<0.03	0.015	53.851	0.030	<0.03
39	$C_3H_4O_2$	0.035	0.191	0.050	26.455	0.352	0.189
40	nominal m/z 74	0.028	0.077†	0.044	56.583	0.205	0.073†
41	methyl acetate	0.045	0.599	0.174	28.979	1.098	0.568
42	nominal m/z 76	0.031	0.032†	0.024	76.376	0.119	0.031†
43	unknown m/z 77	0.021	0.057†	0.031	53.943	0.152	0.057†
44	unknown m/z 77	0.018	0.155	0.041	26.323	0.280	0.155
45	nominal m/z 78	0.038	0.046†	0.029	63.847	0.142	0.045†
46	nominal m/z 81	0.037	0.494	0.185	37.450	0.953	0.446
47	C_6H_{10}	0.020	0.278	0.111	40.014	0.588	0.244
48	unknown m/z 84	0.013	<0.013	0.009	276.280	0.035	<0.013
49	nominal m/z 85	0.008	0.012†	0.008	69.361	0.044	0.012†
50	$C_4H_4O_2$	0.017	0.127	0.038	29.733	0.243	0.124
51	C_6H_{12}	0.009	0.046	0.022	47.843	0.122	0.044
52	nominal m/z 86	0.016	<0.016	0.014	140.749	0.065	<0.016
53	nominal m/z 87	0.031	0.313	0.079	25.370	0.523	0.297

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Table 2-5. Other Mass Signals Statistical Information for the Monitoring Period of June 19, 2019. (14 Sheets)

#	Species Name	MDL (ppb)	Ave. (ppb)	St. Dev. (ppb)	Rel. St. Dev. (ppb)	Max (ppb)	Median (ppb)
54	nominal m/z 88	0.018	0.034†	0.016	45.730	0.088	0.034†
55	nominal m/z 89	0.025	<0.025	0.014	62.090	0.025	<0.025
56	ethyl acetate	0.019	0.114	0.042	37.171	0.246	0.108
57	unknown m/z 89	0.017	<0.017	0.021	410.547	0.069	<0.017
58	nominal m/z 90	0.033	<0.033	0.019	67.596	0.027	<0.033
59	unknown m/z 91	0.115	<0.115	0.058	16.430	0.000	<0.115
60	unknown m/z 91	0.018	0.021†	0.023	111.935	0.140	0.013†
61	nominal m/z 92	0.038	0.153	0.064	42.253	0.317	0.141
62	unknown m/z 93	0.024	0.221	0.063	28.432	0.505	0.214
63	toluene	0.017	1.377	0.368	26.747	2.153	1.292
64	nominal m/z 94	0.044	0.181	0.060	33.056	0.360	0.176
65	unknown m/z 95	0.083	1.087	0.328	30.152	1.945	0.993
66	unknown m/z 95	0.036	0.153	0.065	42.403	0.341	0.146
67	unknown m/z 95	0.031	0.294	0.094	31.933	0.665	0.279
68	nominal m/z 96	0.032	0.108	0.043	40.058	0.255	0.103
69	unknown m/z 97	0.016	0.02†	0.014	70.196	0.074	0.02†
70	$C_5H_4O_2$	0.017	0.104	0.036	34.878	0.219	0.100
71	C_7H_{12}	0.011	0.090	0.036	39.355	0.195	0.085
72	unknown m/z 98	0.011	<0.011	0.007	531.061	0.029	<0.011
73	unknown m/z 98	0.011	0.013†	0.010	78.944	0.049	0.012†
74	unknown m/z 98	0.011	<0.011	0.007	672.949	0.032	<0.011
75	nominal m/z 99	0.022	0.176	0.060	33.935	0.334	0.171
76	nominal m/z 100	0.017	0.029†	0.015	51.192	0.082	0.029†
77	nominal m/z 101	0.007	0.028	0.009	32.873	0.056	0.028
78	unknown m/z 101	0.019	0.038†	0.018	47.615	0.098	0.038†
79	$C_5H_8O_2$	0.018	0.078	0.032	41.603	0.218	0.074
80	nominal m/z 102	0.015	0.042†	0.021	49.928	0.121	0.041†

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Table 2-5. Other Mass Signals Statistical Information for the Monitoring Period of June 19, 2019. (14 Sheets)

#	Species Name	MDL (ppb)	Ave. (ppb)	St. Dev. (ppb)	Rel. St. Dev. (ppb)	Max (ppb)	Median (ppb)
81	nominal m/z 103	0.018	<0.018	0.015	146.648	0.046	<0.018
82	ethyl propionate	0.005	0.045	0.019	43.125	0.112	0.042
83	unknown m/z 103	0.012	0.066	0.022	32.866	0.140	0.063
84	nominal m/z 104	0.009	<0.009	0.006	216.648	0.019	<0.009
85	unknown m/z 105	0.010	0.114	0.036	31.874	0.236	0.110
86	styrene	0.022	0.377	0.151	40.047	0.743	0.345
87	nominal m/z 106	0.021	<0.021	0.012	35.186	0.030	<0.021
88	nominal m/z 107	0.032	<0.032	0.022	56.963	0.024	<0.032
89	unknown m/z 107	0.027	0.256	0.100	38.969	0.488	0.228
90	C_2benzenes	0.013	0.480	0.164	34.217	0.870	0.437
91	nominal m/z 108	0.061	<0.061	0.030	13.663	-0.115	<0.061
92	unknown m/z 108	0.010	0.03†	0.013	44.876	0.075	0.028†
93	nominal m/z 109	0.077	0.608	0.146	24.061	1.045	0.592
94	nominal m/z 110	0.024	0.036†	0.023	65.255	0.114	0.035†
95	unknown m/z 111	0.007	0.030	0.016	54.683	0.084	0.031
96	$C_6H_6O_2$	0.014	0.025†	0.019	78.160	0.101	0.024†
97	C_8H_{14}	0.008	0.075	0.028	38.102	0.153	0.073
98	unknown m/z 112	0.006	<0.006	0.006	122.747	0.028	<0.006
99	C_6H_9NO	0.007	<0.007	0.005	170.558	0.022	<0.007
100	nominal m/z 113	0.027	0.124	0.043	34.856	0.251	0.121
101	nominal m/z 114	0.022	<0.022	0.012	67.698	0.028	<0.022
102	unknown m/z 115	0.010	0.016†	0.011	65.568	0.051	0.016†
103	unknown m/z 115	0.017	<0.017	0.015	364.037	0.052	<0.017
104	unknown m/z 115	0.013	0.032†	0.017	53.909	0.098	0.032†
105	nominal m/z 116	0.009	0.016†	0.009	57.461	0.043	0.015†
106	$C_6H_{12}O_2$	0.007	0.040	0.016	40.213	0.096	0.037
107	unknown m/z 117	0.007	0.009†	0.014	164.679	0.058	0.008†

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Table 2-5. Other Mass Signals Statistical Information for the Monitoring Period of June 19, 2019. (14 Sheets)

#	Species Name	MDL (ppb)	Ave. (ppb)	St. Dev. (ppb)	Rel. St. Dev. (ppb)	Max (ppb)	Median (ppb)
108	nominal m/z 118	0.009	0.013†	0.009	71.422	0.048	0.012†
109	nominal m/z 119	0.015	0.325	0.089	27.270	0.529	0.305
110	nominal m/z 120	0.024	<0.024	0.024	103.689	0.051	<0.024
111	unknown m/z 120	0.004	0.019	0.011	56.553	0.063	0.018
112	unknown m/z 121	0.008	0.121	0.033	27.056	0.217	0.116
113	unknown m/z 121	0.010	0.402	0.120	29.894	0.686	0.367
114	C_3benzenes	0.009	0.230	0.090	39.082	0.456	0.209
115	nominal m/z 122	0.011	0.091	0.032	35.250	0.187	0.086
116	unknown m/z 123	0.012	0.042	0.017	39.698	0.105	0.042
117	unknown m/z 123	0.012	0.042	0.017	39.698	0.105	0.042
118	unknown m/z 123	0.007	0.053	0.023	42.588	0.122	0.050
119	nominal m/z 124	0.034	<0.034	0.029	107.272	0.111	<0.034
120	unknown m/z 125	0.007	0.023	0.011	47.908	0.065	0.023
121	unknown m/z 125	0.007	0.023	0.011	47.908	0.065	0.023
122	unknown m/z 125	0.005	0.038	0.016	41.333	0.090	0.035
123	nominal m/z 126	0.100	0.173†	0.080	46.266	0.453	0.173†
124	unknown m/z 127	0.021	0.116	0.034	28.850	0.218	0.118
125	unknown m/z 127	0.008	0.011†	0.009	87.184	0.038	0.01†
126	nominal m/z 128	0.014	0.03†	0.014	47.723	0.078	0.029†
127	unknown m/z 129	0.010	0.025†	0.016	66.161	0.087	0.023†
128	unknown m/z 129	0.006	0.065	0.016	24.765	0.123	0.065
129	naphthalene	0.010	0.054	0.019	34.556	0.118	0.052
130	nominal m/z 130	0.008	0.025	0.009	35.928	0.056	0.024
131	nominal m/z 131	0.011	0.080	0.020	25.508	0.134	0.080
132	nominal m/z 132	0.006	0.008†	0.005	69.445	0.024	0.007†
133	nominal m/z 133	0.008	0.111	0.039	34.884	0.213	0.105
134	nominal m/z 134	0.009	0.015†	0.008	56.075	0.046	0.014†

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Table 2-5. Other Mass Signals Statistical Information for the Monitoring Period of June 19, 2019. (14 Sheets)

#	Species Name	MDL (ppb)	Ave. (ppb)	St. Dev. (ppb)	Rel. St. Dev. (ppb)	Max (ppb)	Median (ppb)
135	C_4benzenes	0.009	0.184	0.070	37.985	0.358	0.170
136	nominal m/z 136	0.015	0.477	0.183	38.308	0.874	0.416
137	nominal m/z 138	0.008	0.046	0.017	37.672	0.107	0.043
138	unknown m/z 139	0.010	0.031	0.012	39.962	0.084	0.030
139	unknown m/z 139	0.004	0.019	0.010	52.483	0.060	0.018
140	nominal m/z 140	0.006	0.028	0.011	37.634	0.070	0.028
141	unknown m/z 141	0.008	0.01†	0.009	91.288	0.056	0.009†
142	unknown m/z 141	0.008	0.01†	0.009	91.288	0.056	0.009†
143	unknown m/z 141	0.006	0.014†	0.009	63.555	0.052	0.014†
144	nominal m/z 142	0.013	0.026†	0.012	45.508	0.061	0.025†
145	nominal m/z 143	0.013	0.138	0.047	33.978	0.259	0.125
146	nominal m/z 144	0.018	0.089	0.020	22.700	0.161	0.088
147	nominal m/z 145	0.009	0.094	0.024	25.113	0.158	0.094
148	nominal m/z 146	0.006	0.01†	0.006	59.008	0.030	0.01†
149	nominal m/z 147	0.009	0.199	0.055	27.392	0.351	0.189
150	nominal m/z 148	0.006	0.028	0.010	34.065	0.056	0.027
151	nominal m/z 149	0.014	0.204	0.054	26.296	0.346	0.194
152	nominal m/z 150	0.007	0.029	0.010	35.646	0.060	0.029
153	unknown m/z 151	0.005	0.012†	0.010	80.729	0.047	0.01†
154	unknown m/z 151	0.005	0.012†	0.010	80.729	0.047	0.01†
155	unknown m/z 151	0.004	0.027	0.014	52.758	0.077	0.025
156	nominal m/z 152	0.005	0.014†	0.006	45.664	0.041	0.013†
157	nominal m/z 153	0.007	0.113	0.031	27.511	0.194	0.109
158	nominal m/z 154	0.005	0.023	0.009	38.418	0.050	0.022
159	unknown m/z 155	0.008	0.008†	0.012	155.839	0.065	0.002†
160	unknown m/z 155	0.008	0.008†	0.012	155.839	0.065	0.002†
161	unknown m/z 155	0.005	0.011†	0.008	68.819	0.037	0.01†

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Table 2-5. Other Mass Signals Statistical Information for the Monitoring Period of June 19, 2019. (14 Sheets)

#	Species Name	MDL (ppb)	Ave. (ppb)	St. Dev. (ppb)	Rel. St. Dev. (ppb)	Max (ppb)	Median (ppb)
162	nominal m/z 156	0.006	0.011†	0.006	54.314	0.029	0.011†
163	nominal m/z 157	0.012	0.091	0.026	28.438	0.176	0.088
164	nominal m/z 158	0.007	0.018†	0.007	36.589	0.045	0.017†
165	unknown m/z 159	0.006	0.021	0.008	38.747	0.055	0.020
166	unknown m/z 159	0.005	0.019	0.008	43.907	0.047	0.018
167	nominal m/z 160	0.005	0.009†	0.005	60.560	0.026	0.008†
168	nominal m/z 161	0.007	0.121	0.038	31.325	0.213	0.115
169	nominal m/z 162	0.004	0.020	0.008	38.166	0.052	0.020
170	nominal m/z 163	0.010	0.107	0.031	29.324	0.183	0.103
171	nominal m/z 164	0.007	<0.007	0.009	357.330	0.036	<0.007
172	nominal m/z 165	0.007	0.059	0.017	29.507	0.116	0.059
173	nominal m/z 166	0.004	0.01†	0.005	50.785	0.030	0.009†
174	nominal m/z 168	0.004	0.015	0.007	44.279	0.036	0.015
175	nominal m/z 169	0.009	0.110	0.031	28.285	0.201	0.106
176	nominal m/z 170	0.004	0.018	0.007	38.636	0.043	0.017
177	nominal m/z 171	0.010	0.069	0.019	27.392	0.126	0.067
178	nominal m/z 172	0.005	0.008†	0.005	67.036	0.028	0.008†
179	nominal m/z 173	0.008	0.040	0.011	27.293	0.068	0.040
180	nominal m/z 174	0.007	<0.007	0.005	296.286	0.020	<0.007
181	nominal m/z 175	0.008	0.085	0.024	28.540	0.156	0.082
182	nominal m/z 176	0.004	0.011†	0.005	48.805	0.029	0.01†
183	nominal m/z 177	0.008	0.076	0.021	28.136	0.142	0.074
184	nominal m/z 178	0.004	0.013	0.005	41.708	0.032	0.013
185	nominal m/z 179	0.007	0.058	0.015	25.065	0.099	0.058
186	nominal m/z 180	0.004	0.01†	0.005	48.005	0.026	0.009†
187	unknown m/z 181	0.006	0.007†	0.006	90.025	0.030	0.007†
188	unknown m/z 181	0.006	0.007†	0.006	90.025	0.030	0.007†

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Table 2-5. Other Mass Signals Statistical Information for the Monitoring Period of June 19, 2019. (14 Sheets)

#	Species Name	MDL (ppb)	Ave. (ppb)	St. Dev. (ppb)	Rel. St. Dev. (ppb)	Max (ppb)	Median (ppb)
189	unknown m/z 181	0.002	0.009	0.007	73.779	0.038	0.009
190	nominal m/z 182	0.005	<0.005	0.005	200.027	0.019	<0.005
191	unknown m/z 183	0.007	0.030	0.010	34.119	0.070	0.030
192	unknown m/z 183	0.004	0.005†	0.005	100.522	0.026	0.005†
193	unknown m/z 183	0.003	0.004†	0.008	183.866	0.042	0.001†
194	nominal m/z 184	0.004	0.006†	0.004	61.354	0.020	0.006†
195	nominal m/z 185	0.006	0.031	0.011	34.563	0.065	0.030
196	nominal m/z 186	0.004	0.005†	0.004	81.777	0.021	0.004†
197	unknown m/z 187	0.004	0.020	0.010	50.432	0.058	0.019
198	unknown m/z 187	0.004	0.012†	0.008	62.820	0.043	0.011†
199	nominal m/z 188	0.004	0.006†	0.004	70.392	0.020	0.005†
200	unknown m/z 189	0.005	0.029	0.013	45.031	0.070	0.028
201	nominal m/z 190	0.004	0.007†	0.005	74.063	0.026	0.006†
202	nominal m/z 191	0.008	0.090	0.022	24.546	0.156	0.091
203	nominal m/z 192	0.007	<0.007	0.006	1044.710	0.033	<0.007
204	nominal m/z 193	0.006	0.033	0.015	43.837	0.079	0.032
205	nominal m/z 194	0.007	<0.007	0.004	98.579	0.019	<0.007
206	unknown m/z 195	0.007	0.029	0.010	32.699	0.066	0.029
207	unknown m/z 195	0.003	0.007†	0.005	67.465	0.027	0.007†
208	nominal m/z 196	0.004	0.005†	0.004	75.396	0.019	0.005†
209	nominal m/z 197	0.006	0.024	0.009	37.294	0.058	0.023
210	nominal m/z 198	0.004	0.004†	0.004	82.429	0.017	0.004†
211	nominal m/z 200	0.004	0.007†	0.004	59.295	0.022	0.006†
212	nominal m/z 201	0.005	0.031	0.011	33.497	0.064	0.031
213	nominal m/z 202	0.004	0.005†	0.004	75.868	0.020	0.005†
214	nominal m/z 203	0.004	0.020	0.007	36.059	0.047	0.020
215	nominal m/z 205	0.044	<0.044	0.025	340.290	0.069	<0.044

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Table 2-5. Other Mass Signals Statistical Information for the Monitoring Period of June 19, 2019. (14 Sheets)

#	Species Name	MDL (ppb)	Ave. (ppb)	St. Dev. (ppb)	Rel. St. Dev. (ppb)	Max (ppb)	Median (ppb)
216	nominal m/z 206	0.009	<0.009	0.005	32974.800	0.020	<0.009
217	nominal m/z 207	0.006	0.036	0.011	31.257	0.070	0.035
218	nominal m/z 208	0.004	<0.004	0.003	92.355	0.015	<0.004
219	nominal m/z 209	0.005	0.038	0.011	28.749	0.065	0.038
220	nominal m/z 210	0.003	<0.003	0.003	98.011	0.014	<0.003
221	nominal m/z 211	0.006	0.014†	0.007	52.152	0.042	0.014†
222	nominal m/z 212	0.003	<0.003	0.003	118.776	0.011	<0.003
223	nominal m/z 213	0.005	0.039	0.011	28.263	0.072	0.040
224	nominal m/z 214	0.006	<0.006	0.004	844.608	0.015	<0.006
225	nominal m/z 215	0.006	0.035	0.013	36.265	0.076	0.034
226	nominal m/z 216	0.005	<0.005	0.004	101.960	0.019	<0.005
227	nominal m/z 217	0.006	0.028	0.011	38.114	0.062	0.027
228	nominal m/z 218	0.024	<0.024	0.014	327.546	0.048	<0.024
229	nominal m/z 219	0.007	0.02†	0.008	39.730	0.050	0.02†
230	nominal m/z 220	0.006	<0.006	0.004	351.982	0.015	<0.006
231	nominal m/z 221	0.007	0.041	0.018	44.247	0.100	0.038
232	diethyl_phthalate	0.017	<0.017	0.015	17.758	0.000	<0.017
233	nominal m/z 224	0.008	<0.008	0.004	12.906	0.000	<0.008
234	nominal m/z 225	0.016	<0.016	0.010	11.382	0.000	<0.016
235	nominal m/z 226	0.007	<0.007	0.003	17.924	0.000	<0.007
236	nominal m/z 227	0.009	<0.009	0.013	157.336	0.060	<0.009
237	nominal m/z 228	0.004	<0.004	0.003	-86.997	0.009	<0.004
238	nominal m/z 229	0.005	<0.005	0.004	919.732	0.016	<0.005
239	nominal m/z 230	0.003	<0.003	0.002	330.217	0.005	<0.003
240	nominal m/z 231	0.003	0.007†	0.004	58.421	0.022	0.007†
241	nominal m/z 232	0.003	<0.003	0.003	260.849	0.009	<0.003
242	dimethylmercury	0.002	0.015	0.006	39.770	0.035	0.014

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Table 2-5. Other Mass Signals Statistical Information for the Monitoring Period of June 19, 2019. (14 Sheets)

#	Species Name	MDL (ppb)	Ave. (ppb)	St. Dev. (ppb)	Rel. St. Dev. (ppb)	Max (ppb)	Median (ppb)
243	nominal m/z 234	0.002	<0.002	0.002	147.742	0.010	<0.002
244	nominal m/z 235	0.003	0.014	0.006	40.909	0.033	0.013
245	nominal m/z 236	0.005	<0.005	0.004	160.089	0.016	<0.005
246	nominal m/z 237	0.003	0.021	0.007	34.742	0.048	0.021
247	nominal m/z 238	0.002	<0.002	0.002	122.791	0.009	<0.002
248	nominal m/z 239	0.004	0.011†	0.007	60.930	0.035	0.011†
249	nominal m/z 240	0.003	<0.003	0.002	141.718	0.009	<0.003
250	nominal m/z 241	0.005	0.015	0.008	57.161	0.042	0.015
251	nominal m/z 242	0.007	<0.007	0.003	6.664	0.000	<0.007
252	nominal m/z 243	0.006	<0.006	0.007	865.395	0.022	<0.006
253	nominal m/z 244	0.005	<0.005	0.003	81.308	0.007	<0.005
254	nominal m/z 245	0.006	0.012†	0.008	68.016	0.034	0.011†
255	nominal m/z 246	0.005	<0.005	0.003	229.198	0.012	<0.005
256	nominal m/z 247	0.005	<0.005	0.005	183.775	0.020	<0.005
257	nominal m/z 248	0.003	<0.003	0.002	589.097	0.007	<0.003
258	nominal m/z 249	0.003	0.006†	0.004	65.727	0.024	0.006†
259	nominal m/z 250	0.002	<0.002	0.002	181.635	0.009	<0.002
260	nominal m/z 251	0.002	0.012	0.005	39.530	0.030	0.012
261	nominal m/z 252	0.002	<0.002	0.002	149.187	0.008	<0.002
262	nominal m/z 253	0.002	0.013	0.005	40.753	0.032	0.013
263	nominal m/z 254	0.002	<0.002	0.002	165.965	0.007	<0.002
264	nominal m/z 255	0.002	0.016	0.006	38.460	0.039	0.016
265	nominal m/z 256	0.002	<0.002	0.002	176.641	0.008	<0.002
266	nominal m/z 257	0.003	0.014	0.005	40.217	0.030	0.013
267	nominal m/z 258	0.002	<0.002	0.002	243.134	0.008	<0.002
268	nominal m/z 259	0.003	0.023	0.008	33.227	0.047	0.023
269	nominal m/z 260	0.003	<0.003	0.003	94.876	0.007	<0.003

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Table 2-5. Other Mass Signals Statistical Information for the Monitoring Period of June 19, 2019. (14 Sheets)

#	Species Name	MDL (ppb)	Ave. (ppb)	St. Dev. (ppb)	Rel. St. Dev. (ppb)	Max (ppb)	Median (ppb)
270	nominal m/z 261	0.004	0.016	0.006	39.202	0.037	0.016
271	nominal m/z 262	0.003	<0.003	0.002	116.304	0.011	<0.003
272	nominal m/z 263	0.003	0.016	0.006	36.093	0.034	0.016
273	nominal m/z 264	0.003	<0.003	0.002	216.850	0.008	<0.003
274	nominal m/z 265	0.002	0.009	0.004	45.127	0.023	0.009
275	nominal m/z 266	0.002	<0.002	0.001	236.941	0.008	<0.002
276	nominal m/z 267	0.002	0.008	0.004	51.935	0.022	0.007
277	nominal m/z 268	0.002	<0.002	0.002	9062.380	0.006	<0.002
278	nominal m/z 270	0.002	<0.002	0.002	453.306	0.006	<0.002
279	nominal m/z 271	0.003	0.012	0.005	45.442	0.032	0.012
280	nominal m/z 272	0.002	<0.002	0.002	383.312	0.009	<0.002
281	nominal m/z 273	0.002	0.015	0.006	38.700	0.034	0.014
282	nominal m/z 274	0.002	<0.002	0.002	345.943	0.009	<0.002
283	nominal m/z 275	0.003	0.019	0.007	34.884	0.040	0.019
284	nominal m/z 276	0.002	<0.002	0.002	119.997	0.009	<0.002
285	nominal m/z 277	0.003	0.020	0.007	33.841	0.043	0.021
286	nominal m/z 278	0.002	<0.002	0.002	136.900	0.010	<0.002
287	nominal m/z 279	0.002	0.008	0.004	48.628	0.020	0.008
288	nominal m/z 280	0.003	<0.003	0.002	205.815	0.007	<0.003
289	nominal m/z 281	0.009	<0.009	0.004	21.221	0.000	<0.009
290	nominal m/z 282	0.006	<0.006	0.002	22.351	0.000	<0.006
291	nominal m/z 283	0.013	<0.013	0.005	4.941	0.000	<0.013
292	nominal m/z 284	0.007	<0.007	0.002	5.572	0.000	<0.007
293	nominal m/z 285	0.007	<0.007	0.004	20.059	0.000	<0.007
294	nominal m/z 286	0.004	<0.004	0.002	23.688	0.000	<0.004
295	nominal m/z 287	0.004	<0.004	0.004	436.232	0.016	<0.004
296	nominal m/z 288	0.002	<0.002	0.001	86.890	0.004	<0.002

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#	Species Name	MDL (ppb)	Ave. (ppb)	St. Dev. (ppb)	Rel. St. Dev. (ppb)	Max (ppb)	Median (ppb)
297	nominal m/z 289	0.003	0.010	0.005	49.703	0.026	0.009
298	nominal m/z 290	0.002	<0.002	0.001	1120.490	0.006	<0.002
299	nominal m/z 291	0.003	0.013	0.006	43.262	0.031	0.013
300	nominal m/z 292	0.003	<0.003	0.002	103.890	0.005	<0.003
301	nominal m/z 293	0.002	0.009	0.004	47.263	0.024	0.008
302	nominal m/z 294	0.002	0.003†	0.002	72.840	0.013	0.003†
303	nominal m/z 295	0.003	0.006†	0.004	74.624	0.026	0.005†
304	nominal m/z 296	0.002	<0.002	0.002	238.793	0.005	<0.002
305	nominal m/z 297	0.044	<0.044	0.043	6.524	0.000	<0.044
306	nominal m/z 298	0.021	<0.021	0.005	2.230	0.000	<0.021
307	nominal m/z 299	0.082	<0.082	0.030	1.745	0.000	<0.082
308	nominal m/z 300	0.033	<0.033	0.009	1.809	0.000	<0.033
309	nominal m/z 301	0.027	<0.027	0.009	2.688	0.000	<0.027
310	nominal m/z 302	0.011	<0.011	0.002	3.341	0.000	<0.011
311	nominal m/z 303	0.008	<0.008	0.004	14.596	0.000	<0.008
312	nominal m/z 304	0.004	<0.004	0.002	22.800	0.000	<0.004
313	nominal m/z 305	0.003	<0.003	0.004	19095.100	0.014	<0.003
314	nominal m/z 306	0.002	<0.002	0.001	74.872	0.004	<0.002
315	nominal m/z 307	0.003	0.006†	0.004	63.416	0.017	0.006†
316	nominal m/z 308	0.002	<0.002	0.001	1105.840	0.005	<0.002
317	nominal m/z 309	0.003	0.009	0.004	49.543	0.031	0.008
318	nominal m/z 310	0.002	<0.002	0.002	260.384	0.007	<0.002
319	nominal m/z 311	0.003	0.013	0.006	44.745	0.034	0.013
320	nominal m/z 312	0.002	<0.002	0.002	320.729	0.009	<0.002
321	nominal m/z 313	0.003	0.006†	0.004	77.849	0.021	0.006†
322	nominal m/z 314	0.011	<0.011	0.003	4.609	0.000	<0.011
323	nominal m/z 315	0.007	<0.007	0.003	10.374	0.000	<0.007

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Table 2-5. Other Mass Signals Statistical Information for the Monitoring Period of June 19, 2019. (14 Sheets)

#	Species Name	MDL (ppb)	Ave. (ppb)	St. Dev. (ppb)	Rel. St. Dev. (ppb)	Max (ppb)	Median (ppb)
324	nominal m/z 316	0.009	<0.009	0.002	3.162	0.000	<0.009
325	nominal m/z 317	0.008	<0.008	0.003	6.891	0.000	<0.008
326	nominal m/z 318	0.005	<0.005	0.001	7.311	0.000	<0.005
327	nominal m/z 319	0.004	<0.004	0.004	129.566	0.012	<0.004
328	nominal m/z 320	0.003	<0.003	0.002	72.008	0.004	<0.003
329	nominal m/z 321	0.002	0.005†	0.003	63.870	0.021	0.005†
330	nominal m/z 322	0.002	<0.002	0.001	403.859	0.006	<0.002
331	nominal m/z 323	0.002	0.004†	0.003	69.044	0.018	0.004†
332	nominal m/z 324	0.002	<0.002	0.001	518.492	0.006	<0.002
333	nominal m/z 325	0.002	0.006†	0.004	63.057	0.018	0.005†
334	nominal m/z 326	0.002	<0.002	0.002	587.122	0.006	<0.002
335	nominal m/z 327	0.003	0.012	0.005	40.999	0.029	0.012
336	nominal m/z 328	0.002	<0.002	0.002	177.328	0.006	<0.002
337	nominal m/z 329	0.002	0.006†	0.003	56.135	0.020	0.005†
338	nominal m/z 330	0.027	<0.027	0.014	53.318	0.021	<0.027
339	nominal m/z 332	0.048	<0.048	0.023	55.498	0.036	<0.048
340	nominal m/z 333	0.004	<0.004	0.003	91.628	0.015	<0.004
341	nominal m/z 334	0.003	<0.003	0.002	462.765	0.006	<0.003
342	nominal m/z 335	0.003	0.003†	0.003	87.539	0.013	0.003†
343	nominal m/z 336	0.002	<0.002	0.002	531.184	0.007	<0.002
344	nominal m/z 337	0.003	0.004†	0.003	73.431	0.014	0.004†
345	nominal m/z 338	0.002	<0.002	0.001	428.243	0.008	<0.002
346	nominal m/z 339	0.003	0.005†	0.003	64.586	0.016	0.004†
347	nominal m/z 340	0.002	<0.002	0.002	3097.030	0.006	<0.002
348	nominal m/z 341	0.002	0.003†	0.003	97.738	0.012	0.002†
349	nominal m/z 342	0.003	<0.003	0.001	52.761	0.005	<0.003
350	nominal m/z 343	0.002	<0.002	0.002	142.708	0.010	<0.002

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Table 2-5. Other Mass Signals Statistical Information for the Monitoring Period of June 19, 2019. (14 Sheets)

#	Species Name	MDL (ppb)	Ave. (ppb)	St. Dev. (ppb)	Rel. St. Dev. (ppb)	Max (ppb)	Median (ppb)
351	nominal m/z 344	0.002	<0.002	0.001	801.277	0.006	<0.002
352	nominal m/z 345	0.002	0.003†	0.003	85.243	0.016	0.003†
353	nominal m/z 346	0.002	<0.002	0.001	927.672	0.006	<0.002
354	nominal m/z 347	0.002	<0.002	0.002	126.519	0.009	<0.002
355	nominal m/z 348	0.002	<0.002	0.002	815.744	0.007	<0.002
356	nominal m/z 349	0.002	<0.002	0.002	116.687	0.011	<0.002
357	nominal m/z 350	0.001	<0.001	0.001	808.073	0.005	<0.001
<	Signal Average/Median Below the MDL.						
†	Signal Average/Median Between the MDL and the RL (i.e., 3*MDL).						

2.6 Preliminary Analysis and Discussion

For the duration of the deployment of the 208-foot heated line, which occurred during Time Period 4 (09:54 – 10:31 PST), elevated signals were detected by the PTR-MS. This is made clear in Figure 2-1, which shows this effect highlighted in red. The baseline is elevated during this time due to the effect of sampling down 208 feet of additional tubing, conditioned with an unaccounted-for quantity of volatile organic compounds (VOCs). After a sufficient amount of time and heating, the baseline is generally observed to trend down towards zero, but the initial "hump" witnessed in the dataset across a wide range of masses is solely caused by the heated line itself. This effect is illustrated in the example below in Figure 2-9.

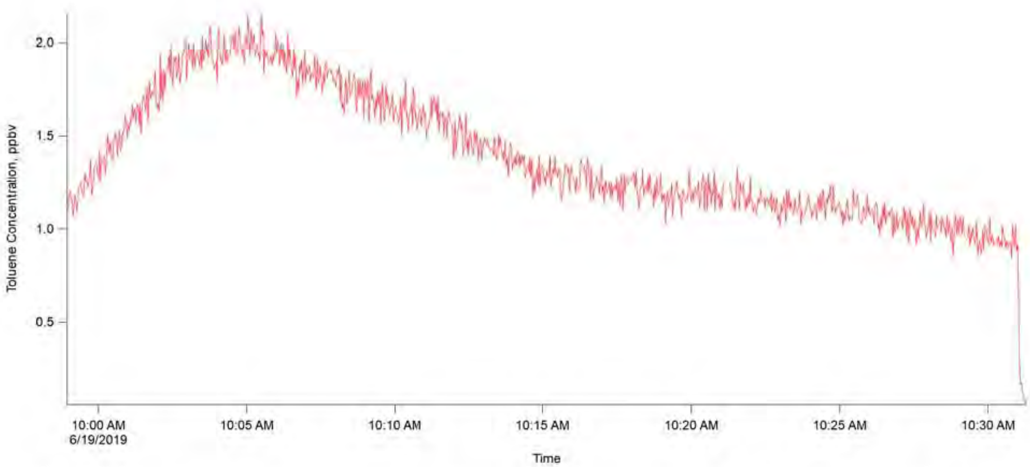

Figure 2-9. Toluene Concentration Using 208-foot Heated Line During Time Period 4.

Heating the line drives off VOCs, as is observable in the time series plot above from roughly 09:54 to 10:05 PST. Then concentration stabilizes as the system reaches equilibrium. The sharp decrease shown at the far right of the plot is the ML switching its sampling system from the sideport back to the mast. This shows that the elevated concentration observed during this time period was principally caused by the heated line.

While the baseline is indeed elevated during this time, the PTR-MS can still easily distinguish actual spikes of VOC concentration. This is made clear in the following plot, Figure 2-10, which shows a toluene response above a similar elevated baseline of the 35-foot heated line used during Time Period 7.

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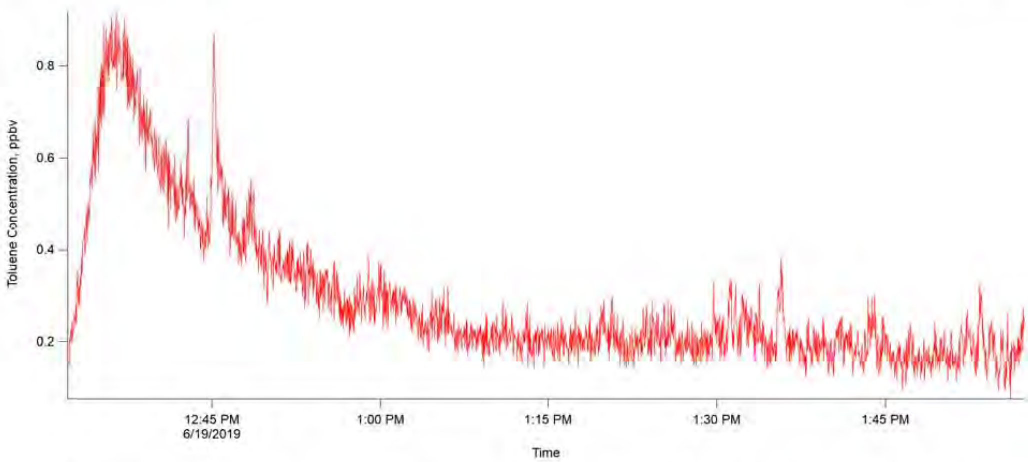

Figure 2-10. Toluene Concentration Using 35' Heated Line During Time Period 7.

The spike in concentration observed at roughly 12:45 PST is clearly distinguishable from baseline and features in the source characterization analysis shown later in this section. It is recommended that tests of the 208-foot heated line be conducted in conjunction with the PTR-MS to determine average signal response attributable to the heated line while ambient air monitoring.

After reviewing the response of all COPCs, odors, and other masses as detected by PTR-MS, any average or maximum concentrations found to exceed the reporting limit (RL) for PTR-MS were determined to be caused by the heightened baseline effect caused by use of the 208-foot heated line. No spikes above the baseline were observed for any species while monitoring the immediate vicinity of the AOP-015.

Even though no odors were detected during the monitoring at the AOP-015 event location, the ML was monitoring in the area of the event before (period 2), during (periods 3-5), and after (period 6). The PTR-MS can detect species below their odor thresholds so all odor compounds were inspected by the subject matter expert (SME) and the species that showed a response above background are displayed in Figure 2-11. There was not much response in odors throughout the entire day of area monitoring with the exception of diethyl sulfide + 2-methylpropane-1-thiol (hereafter referred to as diethyl sulfide). The diethyl sulfide showed an order of magnitude higher response than all the other odor compounds. During the AOP-015 event, the SME logged in remotely to assist the ML operators with response to the event. The SME inspected the data at this time and identified the diethyl sulfide as a potential source of the odors. The ML operators used this information in parallel with wind direction (Figures 2-5 through 2-8) and olfactory observations (smells) to monitor the plumes and track down the source.

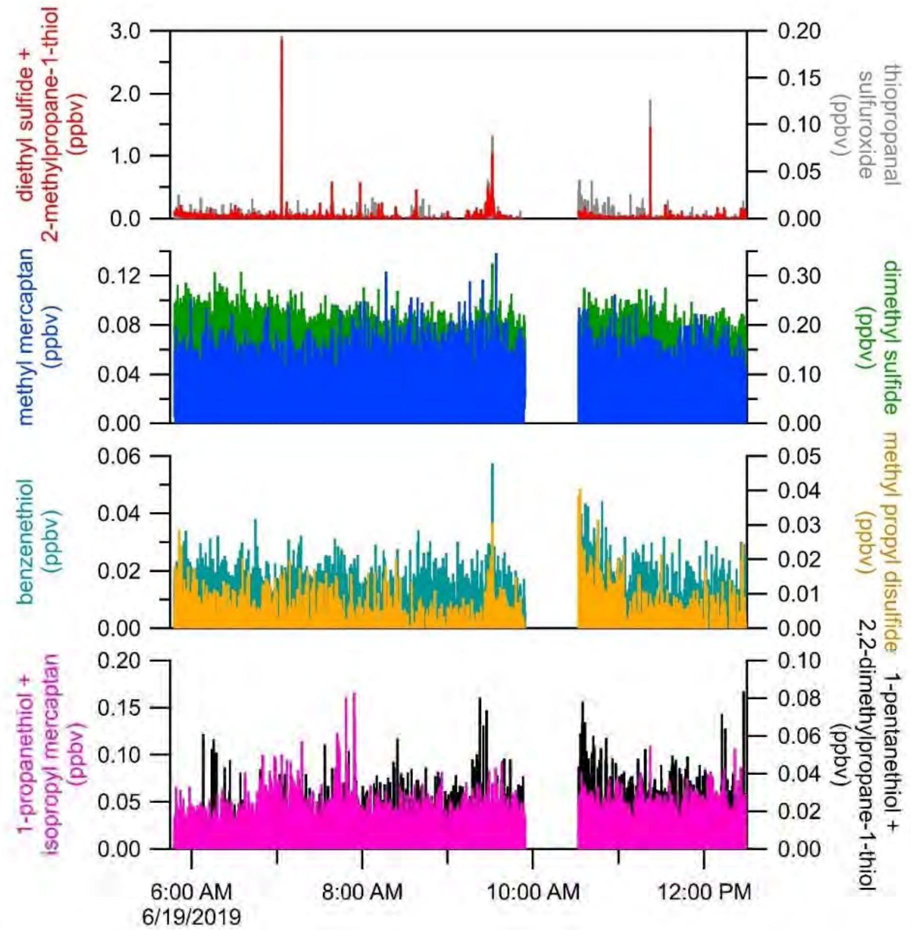

Figure 2-11. Odor Compounds that Showed a Response During Area Monitoring Before, During, and After the AOP-015 Event on June 19, 2019.

Figure 2-12 shows the location of eight plumes that were selected for additional analysis by the SME. These plumes were selected based off the response of diethyl sulfide within the plume and their proximity to the AOP-015 event. These plumes are identified alphabetically (A-H) in order of occurrence and will be referenced as such for the remainder of the report. Plumes A and B were at 08:23 and 08:38, respectively, which was prior to the AOP-015 event called at 09:24. Plumes C and D were during the AOP-015 event at 09:27 and 10:35, respectively. Plumes E through H were after the AOP-015 event at 11:35, 11:44, 12:13, and 12:25, respectively. Figure 2-12 shows most of the plumes (A, C, E, F, G, H) clustered around an area along the east fence line of AP Farm with two of the plumes (B, D) located further south. Given the wind direction was primarily from the northwest direction with some variation to the west and north (Figures 2-5 through 2-8), the location of the plumes is consistent with a source around that area. The ML operators were able to identify the source of the odors to a trailer parked along the east fence line of AP Farm and this is shown as a trailer icon in Figure 2-12. This is consistent with the frequency and location of the observed plumes.

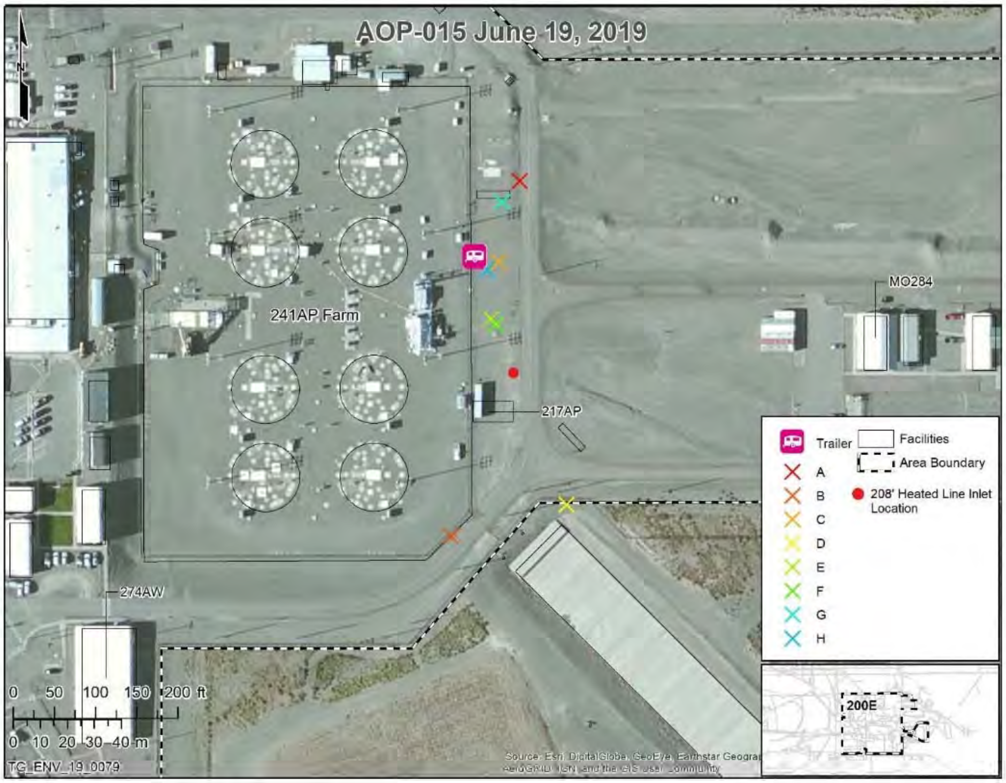

Figure 2-12. Locations of Response at Odor Compounds Diethyl Sulfide + 2-methylpropane-2-thiol on Before, During, and After the AOP-015 Event on June 19, 2019, Along with the Location of the Identified Source.

As stated previously, the tracking of the plume was a combination of PTR-MS response of diethyl sulfide, wind direction, and olfactory observations (smell) by the ML operators. Figure 2-13 breaks down the observed plumes (A-H) of diethyl sulfide and the time at which the ML operators noted the sulfur smell in the logbook. The dashed lines signify the period of the AOP-015 event with the red vertical lines representing the diethyl sulfide plumes (A-H). The vertical blue lines are the times the operators logged smelling sulfur. The PTR-MS observed diethyl sulfide within Plumes A and B which was over 30 minutes before the operators first noted the sulfur smell in the logbook at 09:14. The first smell was shortly followed by observation of a large diethyl sulfide plume at 09:27 (Plume C) that began minutes after the AOP-015 event was called at 09:24. After this plume, the ML operators relocated to the CSO as directed by AOP-015 procedure and were instructed to move to the location of the AOP-015 event. These observations were covered previously in Tables 2-3 to 2-5. There was a period of observations at the exact location of the AOP-015 event using the ML 208-foot sample line, but no odors were detected. At 10:31, the ML was sampling from the mast again and the odor smell returned shortly after at 10:33 which was followed by a small diethyl sulfide plume at 10:35 (Plume D). The AOP-015 event was ended at 11:07 and ML operators remained on location until 11:13 with only one other instance of odor smell occurring at 10:57.

There was a short diversion of the ML from the area between 11:13 and 11:33 in which the ML was located near the food trucks on 4th street on the western edge of the 200E area. During this time there was a response of diethyl sulfide. It was not analyzed for this report due to its distance away from the AOP-015 event because the likely source is the emissions from the food truck cooking activities but can be investigated further outside of this report. The ML returned to location by 11:33 and the PTR-MS observed a small diethyl sulfide plume at 11:35 (Plume E). After this point there was an increase in instances of sulfur odors and responses of diethyl sulfide (Plumes F, G, H) that gradually led the ML operators to the source of the odors. At 12:29, the ML operators connected the 35-foot sample line to the side port and sampled the emissions directly from the trailer determined to be the source.

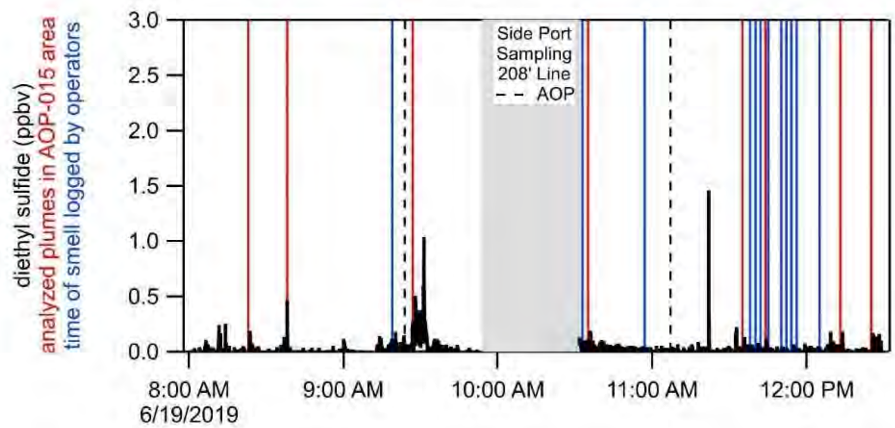

Figure 2-13. Timeline of Diethyl Sulfide Plumes and Instances the ML Operators Logged Smelling Sulfur Before, During, and After the AOP-015 Event on June 19, 2019.

Figure 2-14 shows a trailer located along the east fence line of AP Farm and is indicated in Figure 2-12 as stated previously. Located within the trailer were two batteries being actively charged with the battery to the right appearing to have a leak. The overcharging of lead acid batteries can cause generation of a large variety of sulfur compounds which would produce a sewer or rotten egg odor. Dihydrogen sulfide is among the list of sulfur compounds that can be generated in this manner, is detectable by the PTR-MS, and has been observed in previous fugitive emission work focused on characterizing sewer emission (53005-81-RPT-019, *PTR-MS Mobile Laboratory Vapor Monitoring Report – Month 1*; 53005-81-RPT-027, *PTR-MS Mobile Laboratory Vapor Monitoring Report – Month 2*; 53005-81-RPT-032, *PTR-MS Mobile Laboratory Vapor Monitoring Report – Month 3*; 53005-81-RPT-039, *PTR-MS Mobile Laboratory Vapor Monitoring Report – Month 4*; and 53005-81-RPT-048, *PTR-MS Mobile Laboratory Vapor Monitoring Report – Month 5* contain septic information). Smaller amounts of other sulfur compounds may also be generated either as primary emissions from the overcharging of the battery or reaction products from H_2S, hydrogen, and oxygen gases evolved reacting with ambient VOCs, other gases, surfaces, and each other.

Figure 2-14. Trailer Located Along the East Fence Line of AP Farm.

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Figure 2-15. Sampling Setup for Monitoring the Emissions from the Trailer Emitting Strong Odors and Containing Overcharged Batteries Located on the East Side of AP Farm.

Figure 2-16 shows the observations made while the ML was sampling from the 35-foot sample line near the trailer. The sample line was initially positioned upwind of the trailer at 12:33 to get a baseline response that omits the influence from the trailer. At 12:44, the sample line was brought close to the batteries as shown in Figure 2-15. Immediately there was a large response in dihydrogen sulfide reaching a peak concentration of 599 ppbv. Sampling this close continued until 13:02 then the operators periodically moved the sample line to monitor the trailer emissions further downwind. The initial plume was analyzed between 12:44 and 12:46 to determine the most abundant species within the trailer emissions. Figure 2-16 shows the eight species that were prominent within the trailer emissions. It is important to note that some of the species show a smooth increase and decreasing trend in the beginning of sampling from the 35-foot sample line. This is a function of interferences introduced by the sample line. During analysis of these emissions, the increase in the signal baseline due to the 35-foot sample line is quantified and accounted for to ensure it does not skew the analysis results.

Dihydrogen sulfide showed the largest response which coincides with the previous statement that it can be the primary gaseous sulfur compound generated by the overcharging of lead batteries. Methyl mercaptan is another odor and showed a response up to 1.99 ppbv. Also shown in Figure 2-16 are acetic acid + acetate fragment, toluene, acetaldehyde, and benzene. These species are labeled as such because they are the primary species that generate a response at specific ranges within the PTR-MS. However, the response in this case could be attributed to organosulfur compounds (OSCs) that have been documented to respond at the same range as these species (Perraud, 2016) and was detailed further in 53005-81-RPT-039, *PTR-MS Mobile Laboratory Vapor Monitoring Report – Month 4*. These species are also labeled as OSC fragments and can respond as the result of the presence of a variety of OSC within a plume. The only signal shown in Figure 2-16 that cannot be attributed to the presence of OSC is nominal m/z 43. The response at nominal m/z 43 is a common result of fragmentation of a large variety of species within the PTR-MS (Gueneron, 2015) and therefore its presence within a complex mixture is not unexpected. There was also the presence of diethyl sulfide but at suppressed levels compared to the other species. For further information, the fingerprint of the trailer emissions is shown in Appendix A, Figure A-9. A significant point to note is the absence of dimethyl sulfide observed in the sewer fingerprints presented in 53005-81-RPT-048, *PTR-MS Mobile Laboratory Vapor Monitoring Report – Month 5*. This serves as a distinguishing feature that can be used to determine the source of plumes observed in the future. Furthermore, dimethyl sulfide is a key product of sulfur metabolism in microorganisms such as would be found in a sewer or body of water suggesting that fingerprints determined by the PTR-MS can help distinguish inorganic versus biological sources of sulfur containing VOCs.

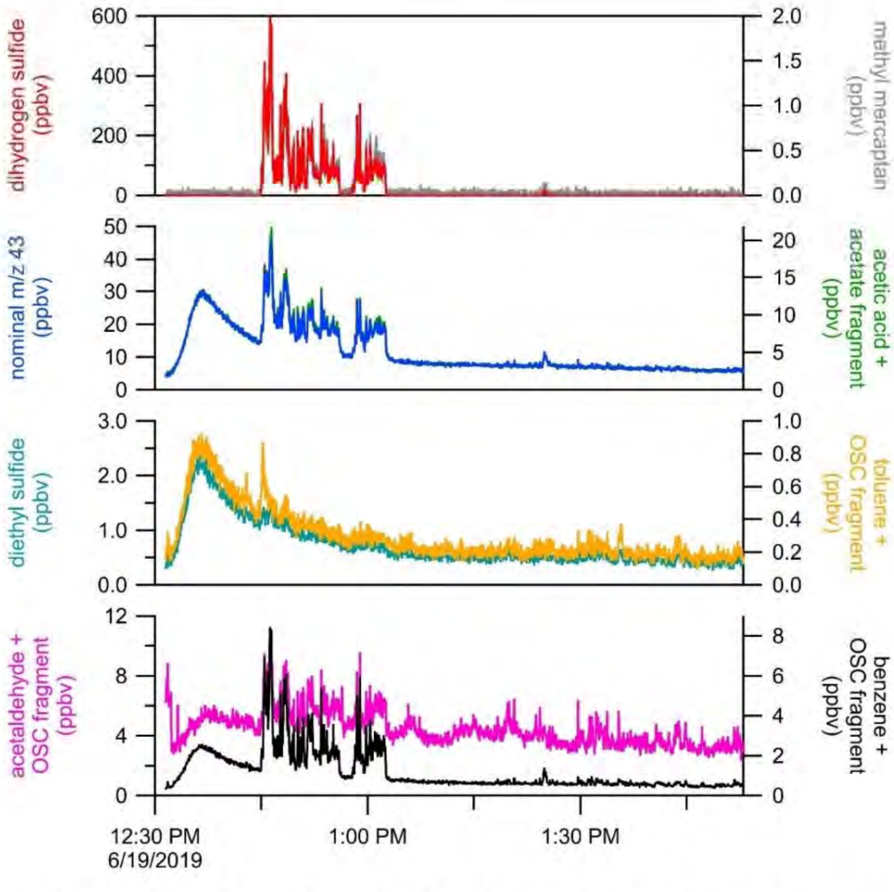

Figure 2-16. Response of Key Species Within the Odor Plume Emitting from the Trailer Containing Overcharged Batteries.

When attempting to attribute a particular plume to a source, it is important to consider the overall composition of a plume rather than the just checking for the presence of one species of interest. There are a large variety of potential sources the ML is exposed to with the most common being exhaust from combustion engines. This can be either from vehicles or generators but the large number and potential for the ML to be in their proximity means they are the most commonly observed plume. Therefore, it is crucial further analysis is performed to determine plume composition. Table 2-6 shows further analysis of the eight plumes and comparisons of their composition to that of vehicle and generator exhaust. The goal is to highlight the differences between the eight observed diethyl sulfide plumes and other potential sources. Also included in the table is a column that identifies where OSC fragments also produce a signal and the average concentrations of species found within the battery trailer identified as the source of odors. To aid in interpretation of the table, some cells are colored. The orange color either signifies an odor-causing species or OSC fragment. The dark green color identifies the most abundant species within the plume and the light green identifies the second more abundant species. The species listed in Table 2-6 were a subset derived by the SME from the Appendix A, Figures A-1 through A-8 plume fingerprints. Further details on how source fingerprints are developed can be found in previous monthly reports (reference monthly reports). The vehicle and generator exhaust ranks show the importance of the species within a respective vehicle or generator exhaust plume. A rank of 1 means it is the most important and most abundant species found within the respective exhaust. If no rank is assigned, then the species is either not found within the exhaust emissions or has a negligible presence.

Before the differences between the eight plumes and exhaust are explained, it is important to point out how these plumes differ from septic plumes. Multiple previous reports (reference monthlies with septic) explored septic emissions. They identified three key species within septic emissions as dihydrogen sulfide, methyl mercaptan, and the OSC fragment at m/z 93 (toluene). Looking at Table 2-6, there was minimal response of dihydrogen sulfide or no response of methyl mercaptan within the eight plumes and it is highly unlikely that septic emissions would be the source of these plumes.

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Table 2-6. Time and Average Response of Key Species Within the Plumes Observed Before, During, and After the AOP-015 Event on June 19, 2019.

Vehicle Exhaust Rank	Generator Exhaust Rank	OSC Fragment		Before AOP-015		During AOP-015		After AOP-015				Trailer Emissions
			Plume ID	A	B	C	D	E	F	G	H	
			Time	08:23	08:38	09:27	10:35	11:35	11:44	12:13	12:25	
			Species	ppbv	ppbv	ppbv	ppbv	ppbv	ppbv	ppbv	ppbv	ppbv
2	6		formaldehyde	-	0.026	0.215	0.069	0.069	0.028	-	0.066	0.26
3	8		methanol	-	-	0.487	-	-	11.106	0.091	0.124	5.70
-	-		dihydrogen sulfide	0.005	-	0.017	0.025	-	0.026	0.056	0.035	267.82
5	5		nominal m/z 41	0.056	0.073	0.589	0.164	0.022	-	0.085	0.120	2.43
4	2		nominal m/z 43	0.016	0.048	1.235	0.717	-	-	0.262	0.468	15.72
1	4	X	acetaldehyde	-	0.282	1.570	0.474	-	-	0.281	0.591	3.04
-	1		nominal m/z 46	-	-	0.262	0.589	0.044	0.014	-	0.133	0.05
-	3	X	acetic acid + acetate fragment	-	-	0.274	0.192	-	-	0.093	0.124	7.63
6	7		methyl nitrite	-	-	0.052	0.011	-	-	-	0.017	0.22
7	10	X	benzene	0.071	0.144	0.303	0.142	0.068	0.010	0.135	0.090	3.34
10	9	X	nominal m/z 81	-	0.018	0.258	0.055	-	-	0.008	0.064	0.56
-	-		diethyl sulfide	0.148	0.194	0.259	0.129	0.101	0.088	0.130	0.063	0.11
8	-	X	toluene	0.113	0.160	0.130	0.079	0.078	0.139	0.125	0.030	0.12
-	-	X	unknown m/z 95	0.057	0.088	0.183	0.088	0.064	0.101	0.083	0.049	0.21
9	-		C_2-benzenes	0.132	0.112	0.096	0.064	0.068	0.007	0.110	0.020	-

Table 2-6 contains an abundance of information; therefore, to ease in the interpretation, each plume will be evaluated based on simple parameters. The two important parameters are the relative abundance of odors (diethyl sulfide and OSC fragments) within the plume and the low abundance or absence of exhaust (vehicle and generator) species. The most important species within generator exhaust is nominal m/z 46 followed by nominal m/z 43. Except for Plume D, the lack of or low abundance of nominal m/z 46 in the seven other plumes eliminates it as a potential source. Although the order is reversed, the high presence of nominal m/z 43 and nominal m/z 46 suggests that there may be generator exhaust influence. Even if this is the case, there is still a prominent abundance of diethyl sulfide within the plume. The diethyl sulfide to nominal m/z 46 ratio is 0.22. This means the diethyl sulfide is contributing significantly to the plume composition. Considering diethyl sulfide is not found within generator exhaust, Plume D is potentially a mixture of the odor source and nearby generator exhaust.

Plumes A, B, and E are relatively similar in composition with diethyl sulfide being either the most abundant or second most abundant. These three plumes seem to be the best representation of the odor plume the ML operators were tracking. Looking at the most important species within vehicle exhaust, acetaldehyde was not found in Plumes A or E meaning vehicle emissions were not the source of the plume and had no influence. Acetaldehyde was the most abundant species within Plume B, but this response could be due to an OSC fragment. What distinguishes Plume B the most from vehicle exhaust is the low concentration of formaldehyde, nominal m/z 41, and nominal m/ z 43. There is also a lack of methanol and methyl nitrite which are commonly observed on vehicle exhaust plumes.

Plumes C, G and H had similar composition with acetaldehyde being the most abundant followed by nominal m/z 43, which suggests potential vehicle exhaust influence. Formaldehyde is often found to be the second most abundant species within vehicle exhaust. Diethyl sulfide is present in all three of the plumes at a similar concentration along with a comparable amount of OSC fragments at m/z 81 and 95. The strong presence of these odor-related species suggests these plumes are a mixture of vehicle exhaust and the odor plume.

Plume F is different than the other plumes since it contains a high amount of methanol. There is a lack of nominal m/z 43 and acetaldehyde which means it is not influenced by either vehicle or generator exhaust. Toluene is the second most abundant species, but this could be the influence of an OSC fragment. The presence of diethyl sulfide and the OSC fragment at m/z 95 suggests that the plume is still influenced by the odor source. Methanol is found in high concentrations within windshield wiper fluid and could explain its presence. The plume is likely a mixture of the odor plume combined with the source of methanol.

3.0 CONCLUSION

Multiple diethyl sulfide odor plumes were detected by the PTR-MS before, during, and after the AOP-015 event on June 19, 2019. Many of these plumes were accompanied by observations of a strong sulfur smell by the ML operators. By utilizing the PTR-MS response, wind direction, and the sense of smell, the source of the odor was tracked to a trailer housing two overcharged batteries near the east fence line of AP Farm. The trailer emissions contained multiple odor compounds including dihydrogen sulfide, methyl mercaptan, and common OSC fragmentation responses. Eight odor plumes detected around the vicinity of the AOP-015 event were analyzed to determine if the composition was consistent with initial observations. Three plumes were found to be dominated by odor related species (A, B, E), three were determined to be a mixture of odor plume and vehicle exhaust (C, G, H), one had presence of traces of generator exhaust which likely mixed with the odor plume (D), and one odor plume was influenced by an unknown source of methanol. Diethyl sulfide was present within each of the plumes at levels not previously observed. As previously noted, no dimethyl sulfide was observed as opposed to the fingerprints for sewer emission presented in 53005-81-RPT-048, *PTR-MS Mobile Laboratory Vapor Monitoring Report – Month 5*. Due to the wide variety of sources encountered on site, events like this provide valuable information that can lend to future analysis and identification of sources. It is difficult to monitor the hundreds of signals the PTR-MS measures every 2 seconds making live interpretation of data extremely challenging. The practice of tracking unknown plumes and generating fingerprints of the source will continue to expand the ML capabilities and strengthen the confidence in identifying sources.

4.0 REFERENCES

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APPENDIX A

FINGERPRINTS

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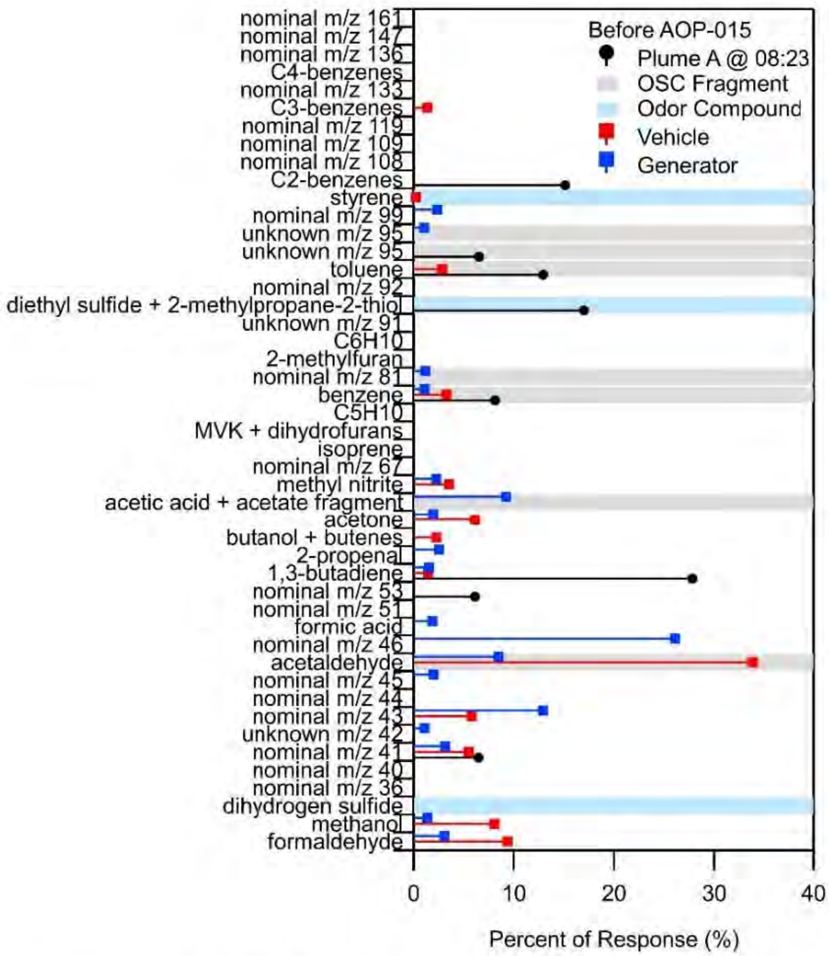

Figure A-1. Fingerprint of Plume A at 08:23 Containing Diethyl Sulfide Observed Before the AOP-015 Event on June 19, 2019.

1-44

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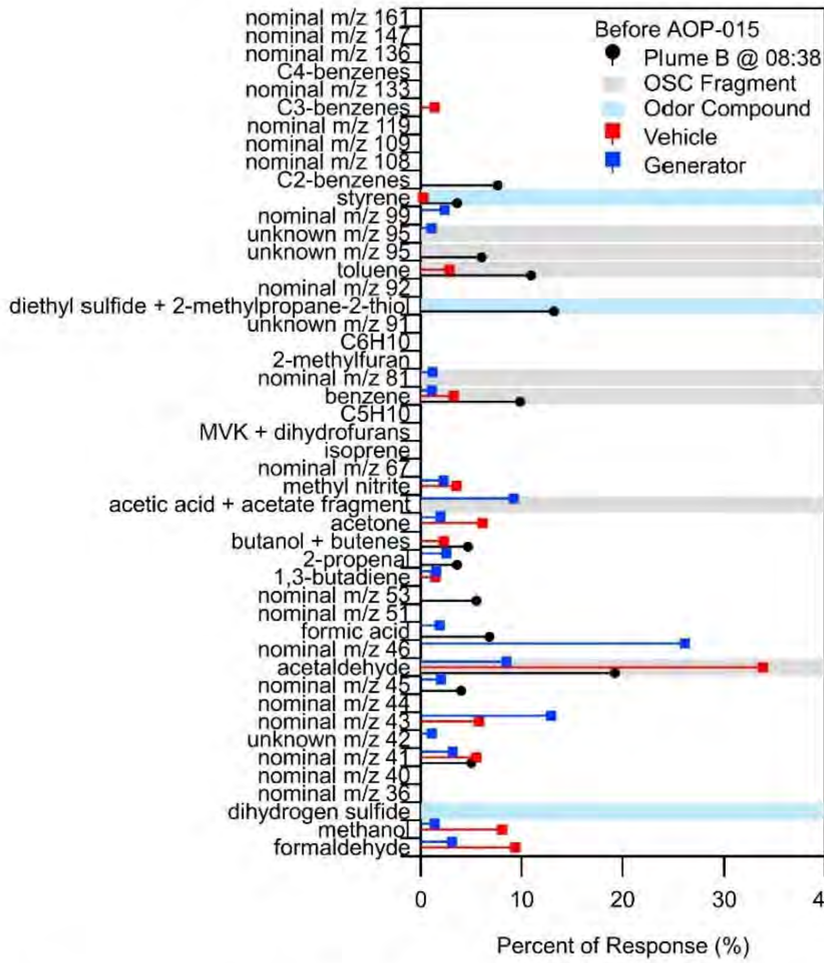

Figure A-2. Fingerprint of Plume B at 08:38 Containing Diethyl Sulfide Observed Before the AOP-015 Event on June 19, 2019.

1-45

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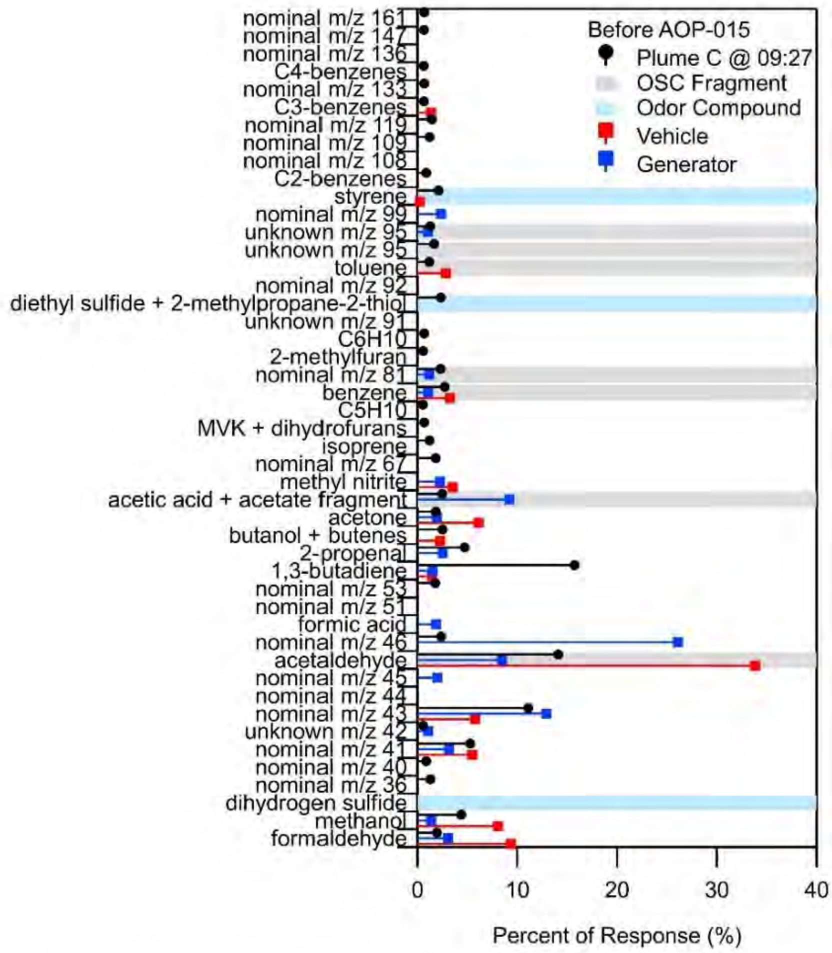

Figure A-3. Fingerprint of Plume C at 09:27 Containing Diethyl Sulfide Observed During the AOP-015 Event on June 19, 2019.

1-46

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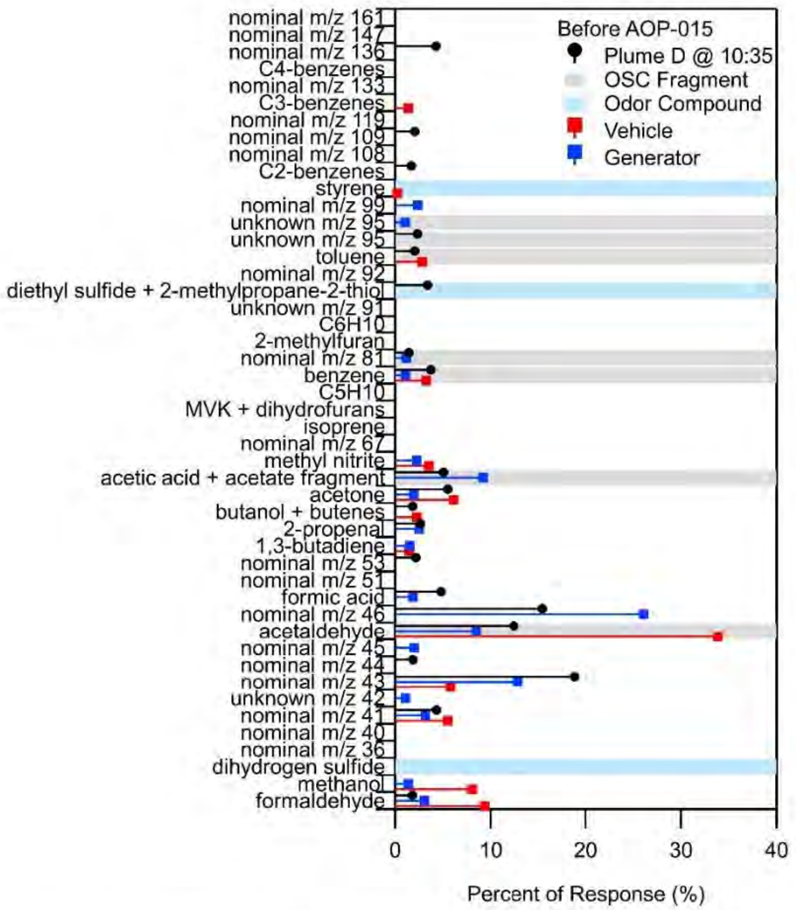

Figure A-4. Fingerprint of Plume D at 10:35 Containing Diethyl Sulfide Observed During the AOP-015 Event on June 19, 2019.

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June 25, 2019

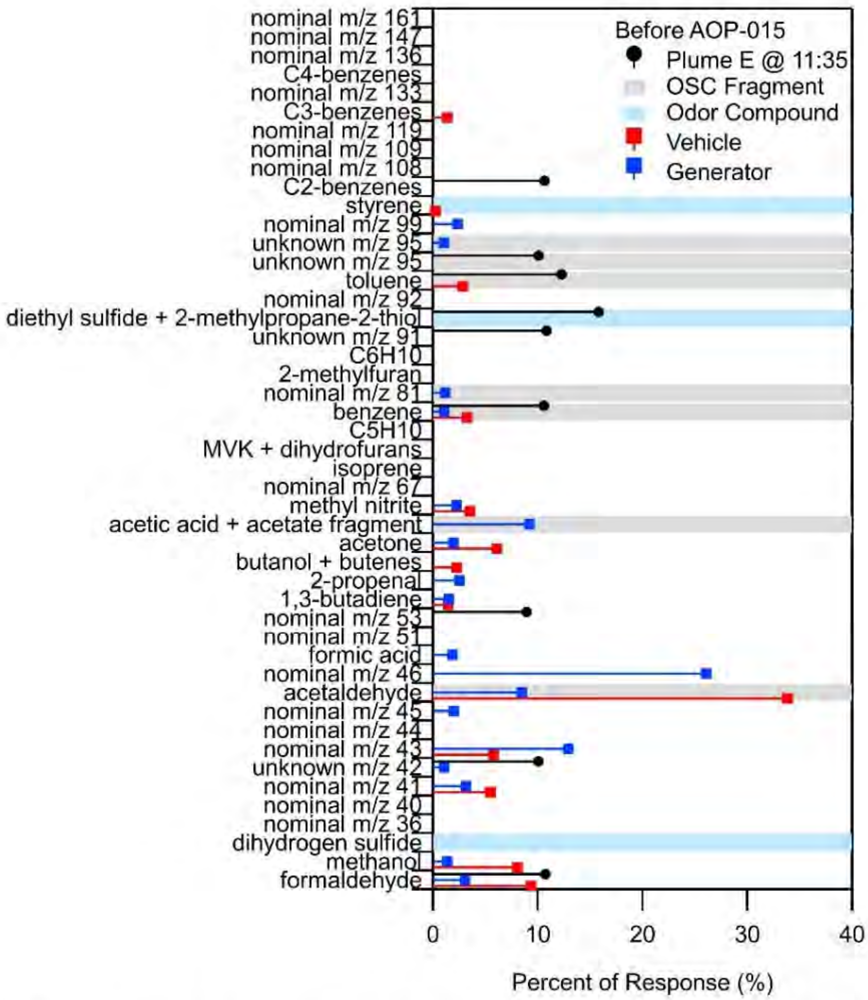

Figure A-5. Fingerprint of Plume E at 11:35 Containing Diethyl Sulfide Observed After the AOP-015 Event on June 19, 2019.

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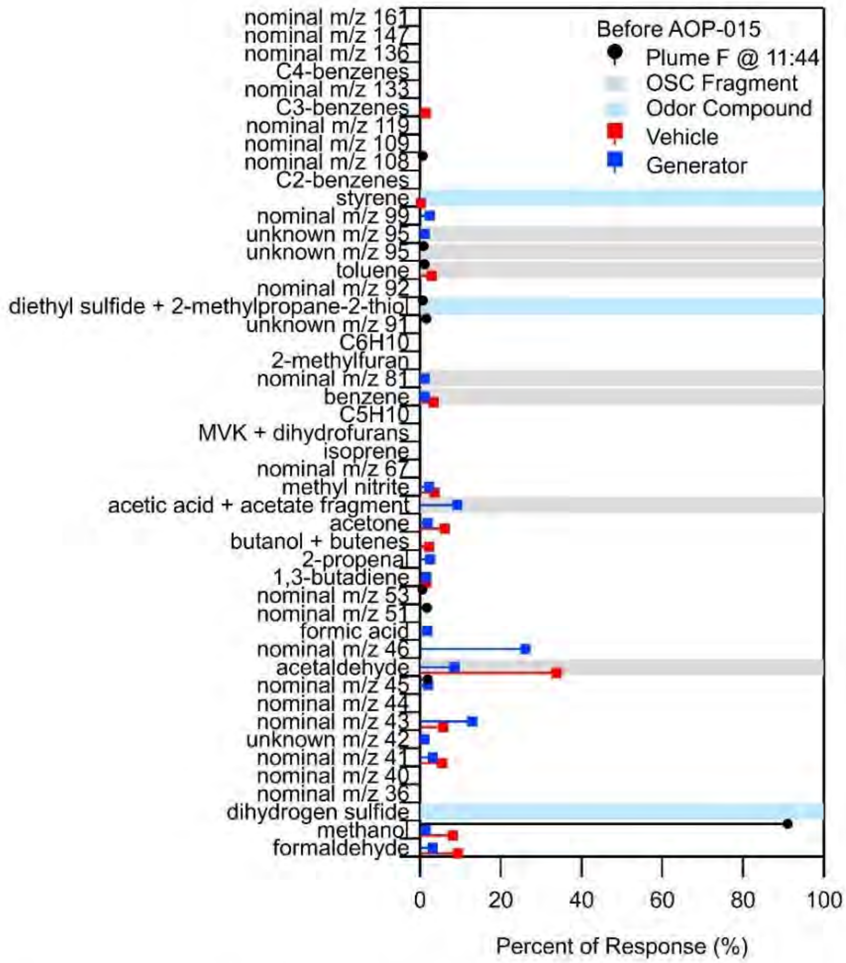

Figure A-6. Fingerprint of Plume F at 11:44 Containing Diethyl Sulfide Observed After the AOP-015 Event on June 19, 2019.

1-49

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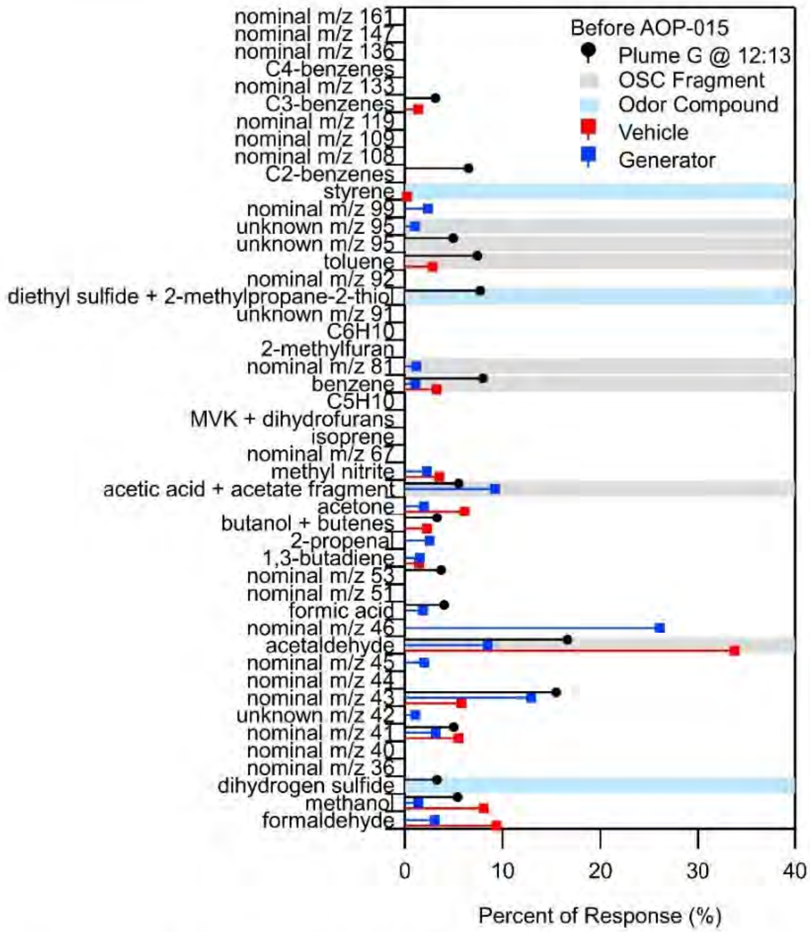

Figure A-7. Fingerprint of Plume G at 12:13 Containing Diethyl Sulfide Observed After the AOP-015 Event on June 19, 2019.

1-50

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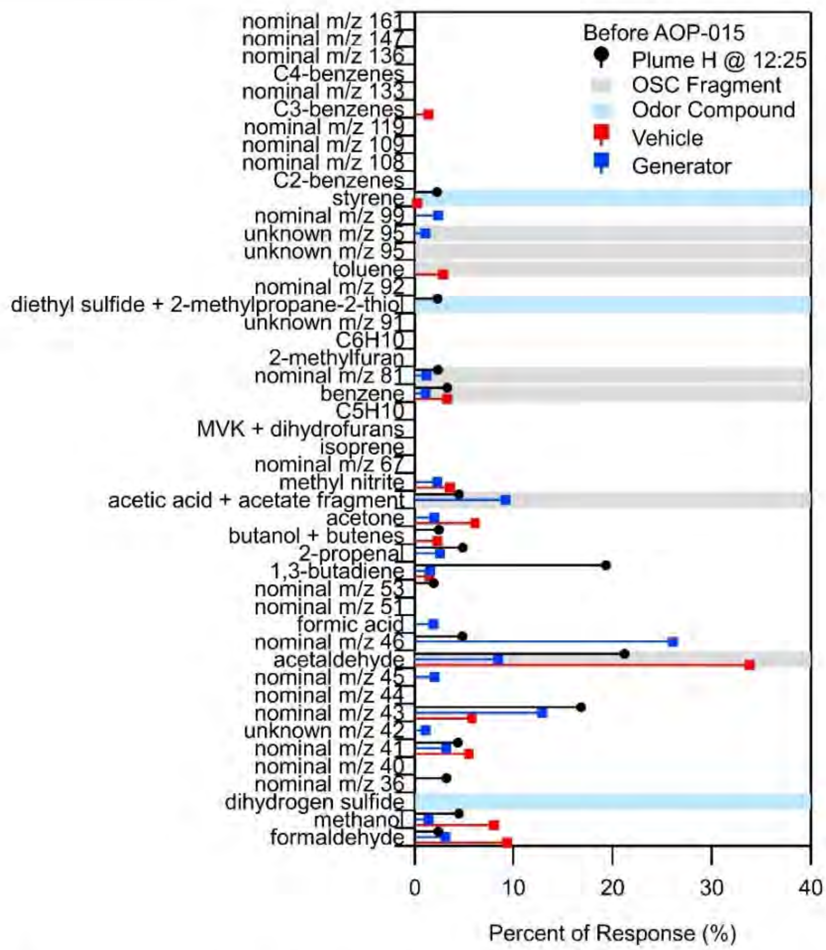

Figure A-8. Fingerprint of Plume H at 12:25 Containing Diethyl Sulfide Observed After the AOP-015 Event on June 19, 2019.

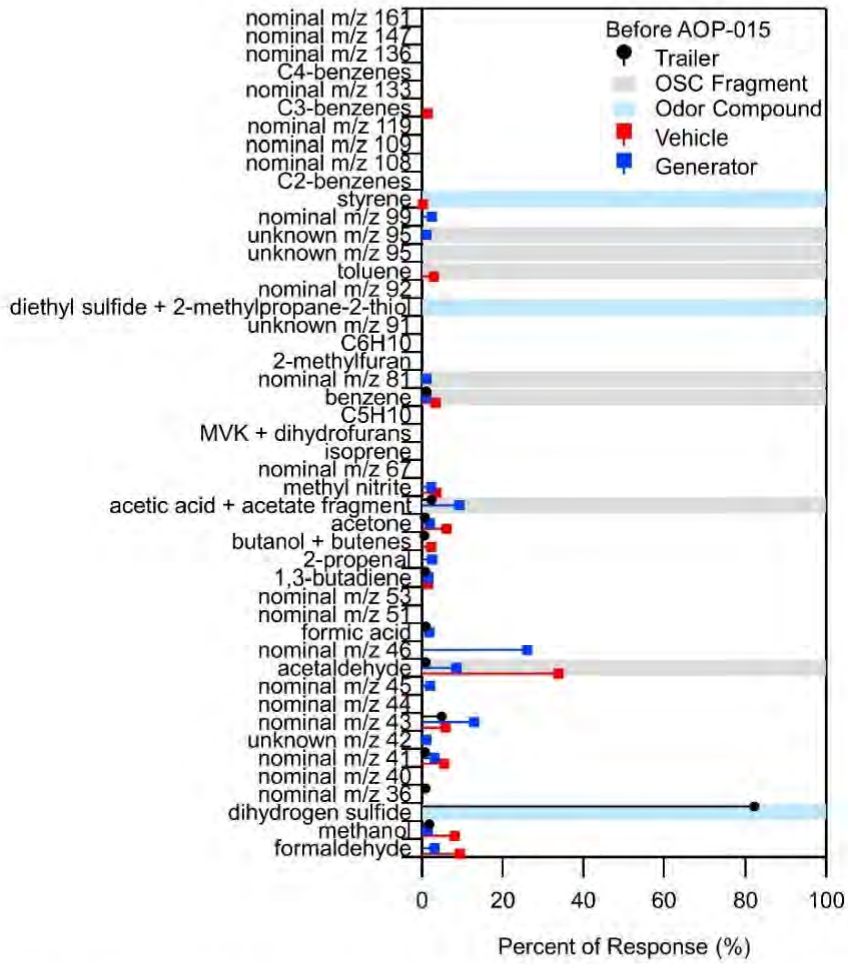

Figure A-9. Fingerprint of the Emissions from the Odor Source Trailer Containing Overcharged Batteries near the East Fence Line of AP Farm After the AOP-015 Event on June 19, 2019.