Chemical Vapor Initiative, Rev 0.

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Executive Summary

A mobile vapor monitoring laboratory developed by RJ Lee Group, Inc. (RJLG) was used for a field campaign study occurring over the course of several weeks in support of the Chemical Vapor Initiative by Washington River Protection Solutions, LLC (WRPS).

The original objective of the mobile laboratory and PTR-MS system was to provide supportive data for the various direct reading instruments deployed by the Vapor Monitoring Group. Although designed as a research and development project to demonstrate overall feasibility of the technology, the study quickly evolved into a combined R&D and field monitoring activity.

Characterizations relevant to quality assurance and hazard mitigation included assessment of the impact of the sampling system, HEPA filtration, and hazards associated with sampling air from the tank farms. The addition of fugitive emission identification and plume chasing required additional assessment of sampling methods and analytical instrument calibrations, including continuing calibration verifications (CCVs) in the field.

The sampling campaigns encompassed a total of seven 1-week area monitoring events, support of an aerosol particulate sampling campaign, intensive sampling at the AP-farm actively ventilated stack and the A-103 passive breather filter, and finally, monitoring of emissions from the newly installed AP-farm ventilation stack. This report includes data from four weeks of general area monitoring and of the aerosol sampling activity. A brief description is provided for the AP- and A-farm intensive sampling studies and the remaining three weeks of area monitoring. Details of these events will be provided in the final report.

A mobile laboratory containing a Proton Transfer Reaction Mass Spectrometer (PTR-MS) has been utilized to support vapor monitoring activities at the Hanford Tank Farms. The PTR-MS measurement campaigns have detected anywhere from 3-20 individual vapor plumes occurring on any given day. Detailed data analysis indicates that the majority of the vapor plumes do not exceed occupational exposure limits. However, there were certain instances where OELs were approached or exceeded for specific compounds. Numerous point sources of vapor emissions have been observed in the general area of the tank farms that contribute to the overall vapor burden. The discovery of and observation of vapor plumes, previously undetected by the former technologies and approaches, has demonstrated the effectiveness of PTR-MS as an analytical tool for this application.

The data in the report includes 44 ion signals, representing 52 of the 59 compounds of potential concern (COPCs). The instrument was shown to be effective for the real time measurement of 46 of the COPCs at trace levels, plus numerous other secondary compounds of an industrial hygiene or environmental interest. Although 52 COPCs are represented by the 44 ion signals, 6 of those compounds have been determined to be incompatible with the measurement process applied to this project. Two of the 46 remaining compounds cannot be fully resolved from other COPC signals. Area measurements were taken with one second time resolutions to be able to effectively observe short duration bolus events. It is notable that several vapor plumes were observed throughout each day's sampling period. The origin of the plumes remains largely unclear. Identification of vapor plume sources and durations was not a primary focus of the

study as was the goal of identifying fugitive emissions. This is due to the numerous point sources and possible fugitive emissions in the area of the tank farms and their contribution to the vapor burden. Continued monitoring activities should include detailed monitoring and evaluation of known and suspected vapor sources.

Several recommendations for improvement of the sampling and analysis campaigns have been provided, including specific instrumentation that will allow direct correlation of vapor plumes to tank emissions.

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List of Terms

ASTM	American Society of the International Association for Testing and Materials
amu	Atomic mass unit
COPC	compound of potential concern
DOE	Department of Energy
DRI	Direct reading instrument
EPA	Environmental Protection Agency
GC-MS	Gas Chromatograph - Mass Spectrometry or Spectrometer
GPS	Global Positioning System
HEPA	high-efficiency particulate arrestance
HLW	High Level Waste
NDIR	Non-dispersive infrared spectroscopy
NEMA	National Electrical Manufacturers Association
NIOSH	National Institute for Occupational Safety and Health
OGI	optical gas imaging infrared
PEEK	Polyether ether ketone
PBF	Passive Breather Filter
PFA	Perfluoroalkoxy alkanes
ppbV	parts per billion by volume
pptV	parts per trillion by volume
PTR-MS	Proton Transfer Reaction Spectrometry or Spectrometer
SOW	Statement of Work
SRNL	Savannah River National Laboratory
TDU	thermal desorption unit
TOF	Time of Flight
UV-DOAS and OP-FTIR	Open path differential optical absorption spectroscopy
UV-FTIR	Ultraviolet-fourier transform infrared spectroscopy
VMDS	Vapor Monitoring and detection system
VOC	Volatile organic compound
WRPS	Washington River Protection Solutions, LLC

1.0 INTRODUCTION

RJ Lee Group's Mobile Organic Monitoring Laboratory was used for a field campaign over the course of several weeks in support of the Chemical Vapor Initiative by the contractor, Washington River Protection Solutions, LLC (WRPS). The Department of Energy Hanford site contains 177 underground storage tanks filled with legacy waste from the cold war era. This waste contains a highly complex mixture of compounds in combination with a high amount of radioactivity. This causes organic molecules to be disintegrated and become highly volatile. These volatile organic compounds (VOCs) can have health impacts if inhaled by site workers or the public. The headspace of the tanks needs to be vented into the atmosphere in order to prevent the accumulation of flammable gases in concentrations of concern. Venting is performed through high-efficiency particulate arrestance (HEPA) filters, so that no radioactive particles are emitted to the area outside tank farms. However, vapor emissions are still being released, some of which contain what is known as compounds of potential concern (COPCs); theoretically identified as possibly 1500+ different compounds, actual measurements of vapors at concentrations greater than 10% of the recognized Occupational Exposure Limit (OEL) have resulted in the specification of 59 COPCs. These compounds were the target of the field campaign reported herein.

The work was based on Statement of Work #283842 "Proton Transfer Reaction-Mass Spectrometer Mobile Laboratory", Rev. 0, and dated October 26, 2015. Subcontract #55816 was awarded on January 12, 2016, with three subsequent amendments to date. The contract required the performance of five weeks of mobile sampling and analysis on the Hanford site, a study on the impact of using a 100' tube for sampling on the retention times of the individual COPCs, one week of stationary sampling at the Passive Breather Filter system of A-103 tank in the A farm and at the Stack Sampler of AP farm, respectively and a one-week support campaign for the Aerosol study conducted by the Savannah River National Laboratory (SRNL).

Sampling started on May 17 and ended on September 9; the campaigns were not continuous, but set up to best cover the periods of high activity on the Hanford site. Originally, the aim was to monitor a full evaporator campaign of the 242-A evaporator; however, due to the restriction of waste-disturbing activities imposed by judicial injunction, this campaign was not performed.

RJ Lee Group's Mobile Organic Monitoring Laboratory consists primarily of a state-of-the-art VOC analyzer, namely the Ionicon Proton Transfer Reaction-Mass Spectrometer (PTR-MS) Time of Flight (TOF) Model 1000. This instrument is capable of detecting a wide range of VOCs down to the parts per trillion by volume (pptV) level. Within the 59 COPCs, it can specifically identify 46 of these compounds; though, overall 175 masses were continuously tracked. It is important to note that the PTR-MS is only sensitive to the mass of these compounds. There may be several compounds exhibiting the same signal at each mass number. The instrument will combine concentrations of these interfering compounds into a single result. Therefore it is necessary to use a Gas Chromatograph – Mass Spectrometer (GC-MS) to differentiate between interfering compounds. Besides the PTR-MS, the laboratory contains a carbon dioxide and moisture monitor, a full weather station and multiple ports to quickly add additional instrumentation to the sampling line if needed by a customer (e.g., NO_x or Ozone monitors).

For confirmatory aspects, a complete GC-MS system with an auto sampler for thermal desorption (TDU) tubes and for canister sampling is permanently installed. This allows for validation of the

PTR-MS results during field campaigns. Since PTR-MS is a method that is not yet based on accredited methods by EPA or ASTM, periodic checks and validation by GC-MS are recommended. This instrument was also used for the analysis of the aerosol collection plates used in the SRNL study.

The analysts within the mobile laboratory have two options of tracking emissions; either by handheld devices that are mounted beside the driver and passenger seat, or directly in the back of the van on two computer monitors. A laptop and two desktops are available for direct data evaluation; a Wi-Fi hotspot is setup for internal communication.

The tasks within the study had two main goals:

1) Evaluating the validity of the currently installed instrumentation at the PBF and Stack systems.

2) Perform mobile monitoring across the 200 East and 200 West areas on the Hanford site to identify and track bolus emissions ("plume chasing").

The sampling campaigns to achieve the first goal were performed at the end of the campaign and the results are not yet finalized; therefore, results are pending.

Concerning the second goal, the field campaign was highly successful. The results of the daily monitoring showed the long term need of such a device on the Hanford site. During a typical day in the field, the mobile organic monitoring lab detected anywhere from 3 to 20 significant VOC plumes, mostly based on diesel exhaust fumes from generators or construction equipment, but also some emissions that were clearly not associated with combustion engines.

The report is structured based on the tasks within the original statement of work.

2.0 TEST STRATEGY/TECHNOLOGY OVERVIEW/MOBILE LAB

2.1 TEST STRATEGY

The primary objectives of the PTR-MS measurements and the use of the mobile laboratory were to identify and quantify volatile chemical constituents in the air within the bounds of a Tank Farm and the surrounding areas outside the vapor control zones, and to correlate that data with concurrent direct read instruments (DRIs) of various types. This work was coordinated to support a broader Tank Farm Vapor Study, a Tank Farm stack aerosol emission study, and a 'Leading Indicator' study.

In detail, the study was to perform vapor analyses with the following subtasks:

1) Fugitive Emissions Identification: emissions of gases or vapors from equipment due to leaks and other unintended or irregular releases of gases from various activities. The data from the mobile laboratory will be utilized in conjunction with the currently existing tank farm monitoring equipment.

2) Primary Source Emissions Identification (Vapor Stacks and Passive Breather Filters): emissions from the ventilation sources on the waste storage tanks were directly monitored by the mobile laboratory. This data is to be evaluated against the measurements from, e.g., the optical gas imaging equipment and samples collected by the auto sampler systems.

3) Plume Chasing: an attempt will be made to "chase" vapor plumes outside the recognized boundary of a vapor source in an effort to understand the temporal and spatial distribution of tank or fugitive emissions.

4) Aerosol Studies Support: aerosol collection plates from a selected tank passive breather filter were analyzed to determine if there are any VOCs specifically associated with sub-micron aerosols.

The strategic approach was based on the overall agenda and hazard mitigation for the unique environment of the Hanford site. Two different types of sampling were available: using the built-in sampler on the roof of the mobile laboratory or sampling through a 100 foot Teflon line running out from the van when parked. The height of the roof mount sampling point is approximately 18 inch above the surface of the vehicle (~ 11 feet above ground level). While the first was primarily used to identify fugitive emission sources ("plume-chasing") throughout the site area, the latter was used to validate the currently installed vapor monitoring equipment within the tank farm boundaries. The mobile laboratory was not to be used within the perimeter of the actual tank farms, making a remote sampling system necessary.

Besides the four subtasks, the following aspects needed to be addressed for quality assurance and hazard mitigation:

- Characterize the lag time for the 100 foot tubing and the uncertainty introduced by the sampling system for each of the provided compounds of concern (COPCs).

- Characterize the impact of HEPA filters on the identification and quantification of each COPC.

- Identify the potential hazards introduced by sampling from the tank farms, analyzing outside the fence and reintroducing the air into tank farms.

These three objectives were based on the original emphasis of the project to primarily perform the analyses of primary source emissions while being stationary at the tank farm perimeters using the 100' sample line. However, due to the shift in focus early on in the program, a larger emphasis was put on using the unique ability of the mobile laboratory for fugitive emission identification and plume chasing.

2.2 TECHNOLOGY OVERVIEW

The mobile laboratory used for this project consists of several instruments ideally suited to perform routine mobile emission monitoring, stationary monitoring and validation of the analyses by a standardized method. The key instrument of the mobile setup is a PTR-MS; model Ionicon PTR-TOF 1000. Supporting instrumentation includes a LI-COR Carbon Dioxide Sensor and Weather Station. For validation and stationary measurements, a GC-MS is built into the laboratory as well. Sampling options include air canisters or thermal desorption tubes (TDU). The GC-MS system is setup for auto-sampling of both options. Each of the instruments is described in detail within the test plan, which can be found in Appendix A.

The laboratory is set up to quickly and easily incorporate other air monitoring devices for specific field campaign tasks, such as NO_x monitors or Ozone detection instrumentation. The internal gas sampling system allows for sampling through the roof sampler or a sampler installed on the driver's side for external tubing. The manifold is setup for controlled flow, the ability to inject calibration gas or to add additional instrumentation within minutes.

Stationary sampling of the stacks and passive breather filters required the construction of an interface (gas manifold) that would facilitate the transfer of emissions from the respective exhaust risers to the mobile laboratory. The purpose of this interface is to allow the mobile laboratory to remain outside the tank farm control zone while conducting measurements of the tank emissions.

A detailed description of each device used in or in support of the mobile laboratory will be discussed in sections 3.1 through 3.8. Included are drawings to support the electrical and pneumatics layout of the laboratory.

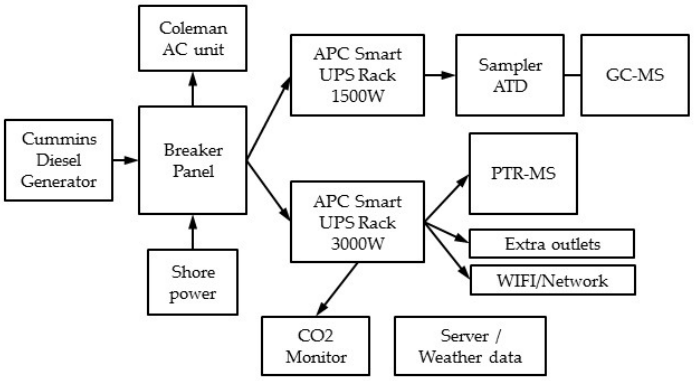
2.3 MOBILE LAB

The mobile laboratory is housed in a retrofitted Mercedes Sprinter van with added power lines, gas plumbing, and communications wiring to support the variety of instruments used in the real time measurement of volatile constituents in air. The van can be used year round, is fully insulated and contains an on-board air conditioner/heater to manage internal temperatures needed for instrument operation and worker comfort. The laboratory is designed to be operated for mobile monitoring by a single person.

Figure 2-1. Mobile Laboratory used for real time monitoring of vapor emissions.

The electrical system is based on the utilization of shore power via a 208V, 50A RV-type plug or the on-board Cummins diesel generator**.** All power for the PTR-MS and associated instrumentation is routed through a 3000VA uninterruptable power supply (UPS) which is a UL listed device. A 1500VA UPS is available for supplying uninterruptable power to the GC-MS system and associated equipment. The mobile laboratory has been inspected and certified by an NRTL.

Figure 2-2. Sketch of electrical connections for mobile laboratory.



The laboratory comes equipped with a server which can be interfaced to all test equipment and also supports a Wi-Fi system for remote operation of some of the equipment and/or data transfer to alternate locations for processing and review. It also serves as the interface to the notebook systems for mobile operations. The server can accommodate up to 6 2-TB solid state data storage drives for collection and storage of information from the various instruments.

There are two sample collection options in the laboratory. A gas sampling mast is located on the roof of the van approximately 18 inches above the vehicle surface with its inlet above the wind shear zone for on-the-road, real time collection and analysis of emission plumes. The mast is retractable and contains the sample line and the weather station (see Figure 2-3). The other sampling interface is used for stationary measurements where a sample line can be run to a distant suspected source from a quick-connect port on the outside of the van.

Figure 2-3. The sampling mast used for the mobile real time plume chasing.

The gas sampling manifold internal to the mobile laboratory consists entirely of PFA Teflon from the point of origin (sample mast or side port) to the PTR-MS or auxiliary sampling stations. A return line provides a flow-through system with exhaust gases from the PTR-MS and unused sample gases exiting a side port on the laboratory. The air sample delivery system is entirely sealed with no sample released to the interior of the laboratory. The air sample is pulled into the sampling system by an oil-free diaphragm pump located under the van. The pumping of the air sample is controlled by a needle valve located after a digital flow meter that is in series with the flow stream and co-located with the analytical sampling stations. The 3/8 inch PFA tubing is generally pumped at a volumetric flow rate of approximately 20-25 liters per minute which corresponds to a linear velocity of approximately 5 meters per second. Alternate tube sizes are available for sampling activities and may include 1/2, 1/4, or 1/8 inch external diameters.

Associated with the internal gas manifold is a 25 foot heated sample transfer line that can be connected between an external sampling station and the laboratory's pumped system. This transfer line is heated using heat trace tubing to reduce potential condensation effects when operating in colder temperatures. The heated line is operated at a nominal temperature of 50^{o}C and consists of a heated 3/8 inch PFA tube and an unheated 3/8 inch PFA tube. Power to the heat trace is provided by the mobile laboratory. An unheated tube is used to make sample dilutions at the point of an external gas manifold, as required.

Below are more detailed descriptions of the main instrumentation within the mobile laboratory:

2.3.1 Proton Transfer Reaction-Mass Spectrometer

The PTR-MS is the key instrument in the mobile laboratory; it is designed to continuously measure VOCs in air. The technology is partially based on the well understood gas phase ion-molecule reactions which are the foundation of modern chemical ionization mass spectrometry systems. The combination of the ion-molecule reactions in a drift field at reduced pressure with subsequent detection of the ions of interest by a mass spectrometer is the basis of the commercial systems. The instrument in the mobile laboratory is a PTR-MS from IONICON Analytik[1], model PTR-TOF 1000. IONICON is a spinoff from the University of Innsbruck, Austria; where, the theoretical and academic research was performed to result in a commercially available instrument. Since the first instruments in 1998, numerous improvements have been implemented, one of the later ones being the use of a TOF detector instead of a quadrupole detector.

The instrument of choice for the mobile laboratory and this application incorporates a TOF mass spectrometer interfaced to a high-sensitivity drift tube and ion optics interface. The instrument is operated in real time using bulk air samples with no pre-concentration of the gas sample and no pre-separation of the VOCs of interest.

Due to the nature of the underlying physics of chemical ionization with hydronium ions, the instrument is insensitive to the major constituents of air (N_2, O_2, or noble gases) and the dominant trace gases (CO_2, CH_4, N_2O, CO, O_3, SO_2, NO_x). It is also insensitive to alkanes < C_9, ethene, and acetylene. Atmospheric moisture, a problem for many air pre-concentration systems, does not influence the measurement process for the majority of compounds of interest.

Time resolutions of 100 milliseconds are possible with the instrument while maintaining detection sensitivities at approximately 10 parts per billion by volume (ppbV). Detection limits are improved by increasing the signal integration time such that five pptV is achievable with a 60 second integrated measurement. These are all features that are essential to the objectives of this project.

The technology has been globally used for over nearly two decades in applications with hundreds of peer-reviewed publications. Even though the technology is widely used in the research arena and has proven to be indispensable for many applications, there remain no fully established and recognized methods among the United States regulatory agencies such as the EPA, ASTM, and NIOSH. The end user of the technology is expected to provide the 'best practice' in its use by adhering to established operational parameters governed by the scope of the project and the nature of the sample(s) to be measured.

2.3.2 Gas Chromatograph-Mass Spectrometer

The GC-MS system consists of an Agilent 6890 GC coupled to an Agilent 5973 MS. A Perkin Elmer thermal desorption instrument is interfaced to the gas chromatograph. In addition, there is an interface that is used for the preparation of samples from air canisters or TDUs. Cylinders of ultrahigh purity helium and nitrogen are available in the van in support of the GC-MS. Standards for calibration and batch quality control are stored in stainless steel canisters for routine use. The

[1] IONICON is a registered trademark of IONICON Analytik Ges. m. b. H., Innsbruck, Austria.

GC-MS system has been set up to support the sampling and analysis activities based on the recognized EPA Methods TO-15 (air canisters) and TO-17 (thermal desorption tubes). The instrument may also be used for other regulatory methods by reconfiguring the interfaces, installation of an appropriate column, or other minor alterations to the system. For this project, the GC-MS and gas sampling procedures for canisters and thermal desorption tubes are used only to support and validate the PTR-MS measurements.

2.3.3 Carbon-Dioxide Sensor

Since the PTR-MS is insensitive to CO_2, a specific carbon dioxide sensor is integrated in the mobile lab; the model of choice is the LI-COR Model 840A. This instrument is an absolute, non-dispersive infrared (NDIR) gas analyzer based upon a single path, dual wavelength infrared detection system. It is a low-maintenance, high performance monitoring solution that gives accurate, stable readings over a wide range of environmental conditions. It has a range of 0-20,000 ppm (0-2%), low power consumption (4W after power-up), and fast one second signal averaging to allow for real time source apportionment such as monitoring vehicle exhaust or other combustion sources while driving. The instrument operates on a gas flow of less than 1 liter per minute.

2.3.4 Weather Station

The weather station is a key instrument in the mobile laboratory to monitor the wind speed and direction, air temperature and barometric pressure and provide data from the global positioning system (GPS). The model is an Airmar 150WX that has a control unit mounted in the server cabinet with the transducer mounted on top of the gas manifold mast. Real time display of the outputs is possible on a video monitor. It is a stand-alone system that receives its power from the UPS via a 24VDC transformer. The output data is fed to the server with a clock time-stamp that is correlated to the other monitoring systems in the laboratory.

2.3.5 Gas Sampling Manifold for Stationary Sampling

An external sampling manifold was developed specifically for this project. It is used for the transport of a gas sample from either a tank ventilation stack or a tank passive breather filter. Two separate systems were constructed; one for each application. The external sampling manifolds were left in place at the respective tank farms to provide support of continued tank farm sampling activities upon completion of the mobile laboratory project support. The external sampling manifolds are identical with the exception of the length of heat trace tubing. One system is 100 feet in length and the other is 130 feet. The length of tubing is defined by the distance from the respective ventilation source to the nearest fence line point where the mobile laboratory can be located. All but 6 inches of the 3/8" PFA tubing on both ends of the sampling systems will be heated. The heating is by a commercially prepared constant power density electric trace tubing (Dekoron/Unitherm[2]) with an aluminum Mylar thermal barrier which is a non-hydroscopic inorganic fibrous glass thermal insulation. It is covered by a 105°C black flame retardant low temperature polyvinyl chloride jacket. The constant power density tubing operates at a current

[2] DEKORON is a registered trademark of DEKORON® Unitherm™, Cape Coral, FL.

draw of 0.10 amp per foot, whether at initial startup or at constant operation at its final temperature. The temperature is controlled by a SPDT UL listed line sensing thermostat (NEMA 4x,7,9) which provides current flow to the heater based on a preset temperature. Power to the two heat trace lines for stack sampling was provided by a local source.

The heat trace tube is connected to a manifold that permits the connection of various sampling devices one of which was the mobile laboratory. The air sampling side of manifold is constructed of PFA with the exception of a stainless steel bulkhead fitting and a stainless steel ball valve. Both of these items are Silonite treated to reduce reactivity to VOCs. The return gas side of the manifold is plumbed with a combination of stainless steel and PFA. The system is pumped by an oil-free diaphragm pump (110V, 4.8A) with all gas being returned to the source through a 1/2" line. The manifold components are enclosed in a protective National Electrical Manufacturers Association (NEMA) shell.

3.0 TEST PLAN

The purpose of this test plan was to identify the testing and data collection requirements for the use of a mobile laboratory to measure and quantify the chemical constituents associated with Hanford High Level Waste (HLW) tank vapors. This test plan lists the required tests and supporting documentation which verify system conformance to established systems used in similar field campaigns.

The PTR-MS, although not based on any regulatory methodology, has been widely utilized to monitor and elucidate a multitude of vapor related issues over the course of the past 20 years as evidenced by the hundreds of peer reviewed publications in the literature. This test plan will define how the instrument will be utilized for vapor monitoring support at the Hanford Tank Farms.

The test plan discusses the testing requirements and acceptance criteria for the mobile laboratory and associated instrumentation as well as how it will be used in the field to collect, analyze, and process data. The PTR-MS/mobile laboratory was to be used to support other vapor monitoring and detection systems as defined in the "241A Vapor Monitoring and Detection System Pilot-Scale Test Plan", WRPS document 241-TP-043. Within that plan, *Figure 2.1, Sampling areas for the Pilot-Scale testing of the vapor monitoring and detection system (VMDS),* shows how the mobile laboratory interfaces to the overall scope of the vapor monitoring project. It was anticipated that the mobile laboratory will be coordinated with the pilot-scale test performed at the AP and A tank farms in the 200 East Area of the Hanford Tank Farms.

Many aspects of the overall VMDS, the SOW governing the test plan, and the specifics of the test plan were subject to change as the programs evolve. Communication among the respective project managers and plan authors was imperative to ensure that the requirements of the project were met.

The mobile laboratory was to be utilized in the following vapor monitoring studies;

- Fugitive Emissions; emissions of gases or vapors from equipment due to leaks and other unintended or irregular releases of gases from various activities. The data from the mobile laboratory will be utilized in conjunction with the DRIs, data from the autosampler systems, and the optical gas imaging equipment, to include open path differential optical absorption spectroscopy (UV-DOAS and OP-FTIR), and the optical gas imaging infrared camera (OGI).

- Primary Source Emissions (Vapor Stacks and Passive Breather Filters); emissions from the ventilation sources on the waste storage tanks were directly monitored by the mobile laboratory. These data will support the measurements from the optical gas imaging equipment, the DRIs, and samples collected by the auto sampler systems.

- Plume Chasing; an attempt was made to 'chase' vapor plumes outside the recognized boundary of a vapor source in an effort to understand the temporal and spatial distribution of tank or fugitive emissions.

- Aerosol Studies; aerosol collection plates from a selected tank passive breather filter were analyzed by the mobile laboratory to determine if there were any VOCs specifically associated with sub-micron aerosols.

To meet the objectives listed above, the test plan defined how the mobile laboratory and the PTR-MS were to be operated in the field to ensure adherence to 'best practice' utilization of the instrumentation for sample collection, analysis, and data interpretation and correlation to other monitors.

The complete test plan can be found in Appendix A.

4.0 QUALITY ASSURANCE/MASS SPECTRA OF COPCS/SAMPLING SYSTEM CHARACTERIZATION REPRESENTATIVE MASS SPECTRA OF THE COMPOUNDS OF POTENTIAL CONCERN

4.1 PTR-MS Spectral Characterization of the COPCs and Other Relevant Compounds

The evaluation of the mass spectra from the compounds measured in any study is essential for the understanding and evaluation of the data obtained from the PTR-MS. This includes any target compounds of interest plus any other compounds that are expected to be present in the normal background or of lesser interest. Generally, most compounds will provide spectra with strong protonated molecular ion signals, however, some will result in fragmentation to give a mixture of ion signals that contribute to the total ion signal for a given compound. Evaluation of data requires the knowledge of the degree of fragmentation as this will affect both the qualitative and quantitative assessment.

PTR-MS spectra of the COPCs for which standards were readily available are shown in Appendix D. All spectra were obtained under the standard operating conditions used in the acquisition of all data in the project. The pertinent instrument parameters affecting the spectra are drift tube temperature (60^{o}C), electric field vs neutral density (E/N = 120), and drift tube pressure (2.2 mbar). 34 of the 59 COPCs are represented in this data set. Included at the end of the data set are additional compounds that may occur in common environmental backgrounds or that may be of other significance to the project.

4.2 Characterization of the Sampling System

The characterization of a gas phase sampling system is important for the understanding of the overall implications of the experimental process. This project will require sampling of gas phase compounds while performing mobile area monitoring and static monitoring using short sampling lines. It will also require the transport of gaseous samples through PFA tubes 100-150 feet from a source to the detection device. These substantially different sample transport mechanisms require an understanding of how each compound of interest behaves as it is being drawn through the sampling device.

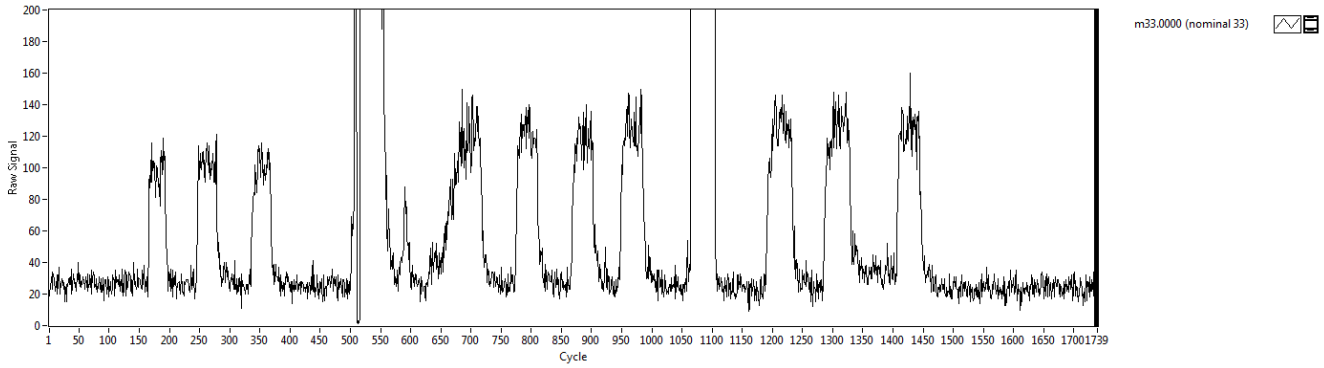
The evaluation process involves the introduction of a constant concentration of a standard into the end of a transport tube located near the entrance to the PTR-MS (Figure 4.1). This short length of sample tubing consists of approximately five feet of PFA and three feet of PEEK. The PFA tubing is maintained at ambient temperature (~25^{o}C) and the PEEK, which is part of the PTR-MS inlet system, is held at 70^{o}C. The resulting signal is monitored to determine the time required to reach a steady state response. The source standard is removed and the time profile of clearing of the sampling tube (decay signal) is monitored. The experiment is repeated with the addition of 100 feet of PFA sampling tube and again with 100 feet of PFA sampling tube plus a dual filter system for removal of radionuclides. A comparison of the resulting data provides information regarding sampling lag time, potential individual compound losses in the sampling system, and compound retention by the sampling system.

Figure 4.1. System for the sample line characterization studies.

Compounds were introduced in one of two ways; using a previously prepared gas standard, or the preparation of mixtures of compounds in either water or hexane. Mixtures were prepared to ensure that there would be no interfering signals generated by one species that might interfere with the interpretation of the data from another. Both preparation approaches allowed the introduction of the standard mixture into the Liquid Calibration Unit that is part of the PTR-MS system.

The initial results (signal profiles) of the analysis of the various standard mixtures are shown in Appendix E. Figure 4.2 is a single example of the general signal profiles developed in the experiment. In each Figure, the data on the left is from the analysis of the compound through the short PFA/PEEK tubing, the middle section is from the introduction of the mixture through a 100 foot PFA tube interface to the PFA/PEEK inlet, and the right side of the figure is the 100 foot PFA plus filter assembly interfaced to the PFA/PEEK inlet. Generally, three sample introductions were performed for each sampling configuration. The compound name is followed by a designator that is an indication of the standard prep mixture. For example, "Methanol (0)" indicates that the methanol was part of standard mix zero. All experiments were performed under the standard instrument conditions for actual field measurements; that is E/N=120 and drift tube temperature = 60°C.

Figure 4.2. Measurement of COPCs and other compound through the sampling system.



Methanol (0) E/N=120, T=60°C

The initial evaluation of the data suggested that something unexpected was occurring in the experimental process. As an example, toluene and m-xylene in Mix-1 showed an unusual behavior as compared to the toluene and p-xylene in Mix 0. Mix 0 is a gas phase standard that was directly introduced to the LCU, whereas Mix-1 is a liquid standard that was sprayed and nebulized into the LCU evaporation chamber. It was determined that back pressure changes in the LCU evaporation chamber was occurring when different lengths of sample tubing was added to the system. This resulted in varying concentrations of the standard mix introduced to the

sample line and, thus, to the PTR-MS. Consequently, with the exception of the Mix-0 preparations, it is not possible to evaluate possible losses of analyte in the sampling system as a result of changing the length or composition of the tubing. Alternate experimental conditions will be formalized to fully evaluate compound losses through the sampling system. It should be noted that the evaluation process only takes into account the introduction of a clean matrix containing specific compounds of interest. It is virtually impossible to fully replicate the composition of the gas from the measured environment and how it may affect surface characteristics and the transport of the material through the sampling system. For example, high ammonia or moisture levels may result in either increased or decreased passivation of a surface, thereby changing the rate of individual analyte equilibration with the surface, rate of release from the surface, or degree of loss to the surface.

The experiments performed do include sufficient data points to determine sampling equilibration coefficients for the various compounds and their decay coefficients (time required to remove the compound from the sampling system). These data are still under evaluation. The figures themselves indicate that for the majority of the compounds studied, equilibration occurs fairly rapidly as does signal decay when the source is removed. There are a few exceptions. These are 2,4-Lutidine, the heavier nitriles and furans, and N-nitrosopyrrolidine. These compounds appear to be poorly sampled through the sampling system and/or have less than favorable vapor pressures for low level detection in the gas phase. Further experiments are being conducted to evaluate all of the compounds as gas phase mixtures rather than solutions in water to verify if the experimental process led to the apparent poor sampling results or if the compounds actually behave as observed.

A considerable amount of similar work was previously performed by our group and reported to the IH section within the tank farm operations. The report is found in “Final Report of Phase II Activities; Proton Transfer Reaction Mass Spectrometry Monitoring: Hanford Tank Farm Real-Time Monitoring of Volatile Organic Compounds; WRPS 21065-41”.

Table 4-1 represents the 25 COPCs that were not evaluated in the sample line characterization study. There were several criteria that were taken into account for the testing process, including availability of authentic standards, compound volatility, acceptable proton affinity, toxicity of handling pure materials, and interferences imposed by the analytical system. The 'comments' column contains a designator that specifies the criteria for not performing the sample line characterization for the specific compound.

Table 4-1. Compounds not tested in the sample line characterization study.

COMPOUNDS		COMMENT
Tributylphosphate	Dibutylbutylphosphonate	(1)
Chlorinated biphenyls (1-Cl)	Diethylphthalate	(1)
Chlorinated biphenyls (2-Cl)		(1)
Mercury	Nitrous Oxide	(2)
Ammonia		(3)
Methyl isocyanate	Formaldehyde	(4)
2-Fluoropropene	2-(3-Oxo-3-phenylprop-1-enyl)furan	(5)
2-(2-Methyl-6-oxoheptyl)furan	1,2,3-Propanetriol, 1,3-dinitrate	(5)
Butyl nitrate	Methyl nitrite	(5)
2-Methylene butanenitrile	2,4-Pentadienenitrile	(5)
Ethylamine	1,3-Butadiene	(5)
4-Methyl-2-hexanone	2-Ethyl-5-methylfuran	(5)
4-(1-Methylpropyl)-2,3-dihydrofuran	3-(1,1-Dimmethylethyl)-2,3-dihydrofuran	(5)
2-Octylfuran		(5)

1) These five compounds were evaluated for their spectral quality only, however, it was found that their vapor pressures were too low to provide useable signal for the PTR-MS. They were not evaluated in the raw sample data from the routine monitoring activities.

2) Mercury and nitrous oxide do not have proton affinities that enable their detection in the standard proton transfer mode of operation.

3) Ammonia, although readily detectable by the PTR-MS, has the same ion mass as an interfering ion that exists in high intensity (H_2O^+).

4) Methyl isocyanate was not analyzed due to its high toxicity, however, data from the literature was used to predict it mass spectrum. No formaldehyde standard was available, however, its spectrum is well known. They were evaluated in the raw sample data from the routine monitoring activities.

5) No authentic pure reference standards could be found, or they were not readily available (i.e., lead times of several months).

5.0 TANK FARM VAPOR MONITORING ACTIVITIES

The mobile laboratory was used in the field for several one week-long campaigns. In Table 5-1 below, the dates of monitoring on site and specifics are described. In May, three weeks were performed; two days were used to verify the proper performance of the mobile setup on site, and to check how the day-to-day monitoring could fit into the schedule of activities on the Hanford site. The lessons learned from these days fed into the general routine thereafter. The PTR-MS turned out to be as useful as hoped for with a distinct identification of several plumes within the first day. A slight change in setup of the mobile laboratory resulted from these days, by adding the ability to sample with a SUMMA canister directly within the driver cabin by the co-driver. This came in particularly handy for the one week of supporting the SRNL aerosol study. In that case, the particulates captured on the aerosol samplers were analyzed using the GC-MS and could be directly compared to the VOCs identified in the field. Detailed descriptions of each of these days are to be found in the individual chapters.

In June, two additional weeks of mobile monitoring were performed and two more in July. For two of the days within July, the PTR-MS data turned out to be unusable. In the first case, July 7, it appears that a computer glitch occurred during the recording of the data. The second instance on July 12 appears to be an instrument problem which produced compromised data. In both instances, the analyst in the field could not identify the issue while monitoring. It only became apparent during data processing after the fact. Therefore, these two days are not reported in the results section. We have recently discovered that it may be possible to recover both data sets, although there is insufficient time to process the data for this report.

Each day started in the Hanford Site 200 East area in the morning with a stop at the shift office to pick up a radio for the purpose of relaying pertinent information regarding tank farm operations and potential vapor events. The period of monitoring was chosen based on the maximum worker activity level in the tank farms. The location monitored were primarily the Hanford 200 East area. Some days included a drive to monitor the tank farms at the 200 West area. The routes were determined on a day-to-day basis and directed by the central shift office. Their location in the 200 East area was also the starting point of each day's monitoring.

In all cases some of the time was used to perform stationary sampling. These stationary periods within the Hanford site were independent from the times that were dedicated to sampling of the passive breathers and the stacks. Locations for stationary monitoring were directed by the central shift office through phone or radio communications to optimize the ability to identify plume sources. Identification of plume sources associated with AOP15 events was a primary goal. Another prime goal was to identify the compounds that are not monitored by the current Vapor Monitoring and Detection System (VMDS); this system is designed to monitor leading indicator compounds, but not all of the COPCs. Besides validating the VMDS results by having instrumentation in use that does not have the same analytical interferences, the PTR-MS results provide an opportunity to validate the selection and use of leading indicators to provide alarm thresholds that provide additional protection of worker health and safety.
Table 5-1 summarizes the dates, monitoring activity, and start/stop times of the daily measurements.

Table 5-1. Dates of monitoring on site.

DATE	DESCRIPTION	START TIME	END TIME		NOTES
05/17/16	mobile	11:45	18:50		
05/18/16	mobile + stationary	11:10	15:50		"onion smell"
05/19/16	mobile	15:00	17:15		
05/24/16	Aerosol, mob/stat	6:00	16:30		
05/25/16	Aerosol, mob/stat	6:00	15:00		
05/26/16	Aerosol, mob/stat	6:00	15:30		
06/20/16	mobile + stationary	7:16	11:16		
06/22/16	mobile + stationary	7:30	13:30		
06/23/16	mobile + stationary	6:40	12:15		"onion smell"
06/27/16	mobile + stationary	7:30	12:20		
06/28/16	mobile + stationary	6:55	12:15		
06/29/16	mobile + stationary	6:35	11:45		
06/30/16	mobile + stationary	6:30	12:30		
07/05/16	mobile + stationary	6:27	12:33		
07/06/16	mobile + stationary	6:30	12:30		
07/07/16	mobile + stationary	6:35	12:40		Incorrect PTR-MS data recording
07/11/16	mobile + stationary	6:27	13:02		
07/12/16	mobile + stationary	NA	NA		Incorrect PTR-MS data recording
07/13/16	mobile + stationary	6:47	12:38		
07/14/16	mobile + stationary	6:49	11:19		
07/18/16	mobile + stationary	6:48	11:56		

5.1 INTENSIVE MONITORING AT STACKS AND PASSIVE BREATHER FILTERS

1) Forced ventilation at AP Farm
   Campaign began on August 29, 2016 and ran continuously for four days at the old exhauster assembly. Due to complications with the data handling system, the first day's data was lost. The remaining data was collected and stored in eleven data files, each of 6 hours duration. The data is currently under evaluation.

2) Passive Breather Filters at A Farm
   Campaign began on September 6, 2016 and was originally scheduled to run continuously for four days. Due to various scheduling issues within WRPS, the actual sampling campaign only ran from September 6, 2016 14:30 to September 8, 2016 12:00. The mobile laboratory was then moved to the new AP exhauster assembly for emission monitoring on September 9, 2016 12:00.

An unexpected requirement of the monitoring campaigns at the AP-Stack and A-PBF was the restriction of access to the mobile laboratory for radiological control purposes. The original intent of the project was to periodically collect canister samples for validation of the PTR-MS results. The inability to gain access to the mobile laboratory resulted in no co-sampled canister samples for data correlation at specific sample times. However, the vapor project did have an automated canister sampling system co-located on the same gas sampling line. These samples, although not ideal due to the very long time averaged sampling process, could be used to provide some limited data validation. The report of these autosampler acquisitions is pending and not expected to be available for several weeks.

Additionally, as a result of no access to the mobile laboratory, there was no opportunity to fine-tune the measurement process by adjusting the sample gas volume introduced to the PTR-MS. This may lead to non-optimal conditions for performing the measurement. A full evaluation of the data will be necessary to determine if there was any effect of excessive sample concentrations on the measurement process.

The monitoring of the emissions from the forced ventilation stacks in AP-Farm and the passive breather filters in A-Farm is being conducted to determine;

1) Chemical signature of the compounds in the emission stream.

2) Qualitative identification of the compounds.

3) Relative variation in individual compound emissions as a result of changes in ambient conditions such as barometric pressure and temperature.

Historical and current projects include the qualitative and quantitative assessment of the various VOCs present in tank headspace. Prior projects have attempted to assess the 'breathing rate' of various tanks through correlation of specific compound emission profiles to the bulk emission patterns. All of these measurement activities have been centered on the well accepted 'grab' sample approach where samples are collected periodically over a period of time. These measurements have provided useful data for estimation of tank farm emissions but there is

potential for loss of information resulting from bolus events of short duration and variations due to meteorological conditions.

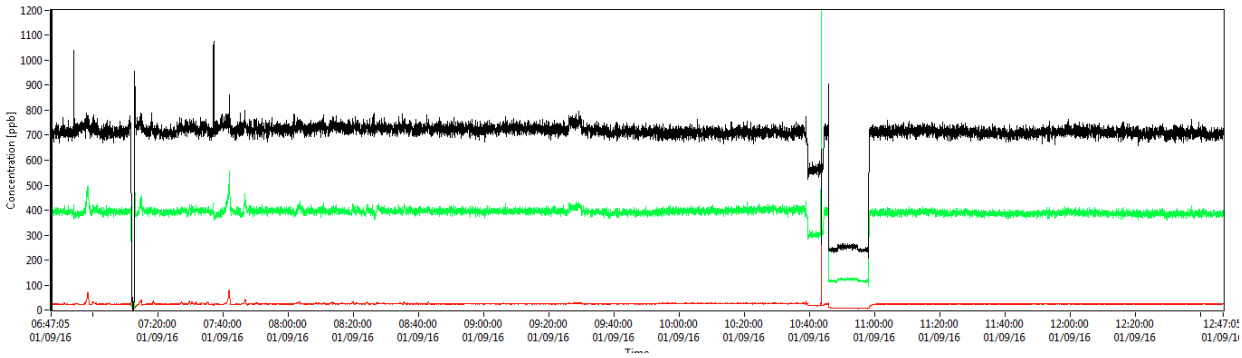
This study includes data from three consecutive days of continuous monitoring with the PTR-MS at the old AP-Farm stack and 48 hours of continuous monitoring at the A-Farm passive breather filter. Data collected by the PTR-MS was at a 0.5 Hz interval for the entire sampling period. This data rate ensured that bolus events are accurately captured and characterized, and will allow the careful evaluation of specific compound concentration variations with respect to other compounds and the bulk emission.

A significant difference in the emission profiles of the actively ventilated tanks in AP-Farm is expected as compared to the ventilated filter systems in A-Farm. AP-Farm emissions should, in principle, be relatively constant with only minor variations due to meteorological conditions. A-Farm emissions from the passive systems should be more dynamic as the conditions in the individual tanks respond to external influence from temperature, barometric pressure, and wind (Venturi effect).

The chemical signature of the emission from the stack and passive breather filter is important to understand what ion signals are pertinent in the PTR-MS measurements from the area samples. The area measurement campaigns were completed prior to the direct tank emission campaigns, however, the data collected from the 'outside the fence' area monitoring activities can be further evaluated to determine if a specific tank emission signature is present.

Below, shown in Figure 5-1, is a time slice from the AP-Farm stack data from 06:47 to 12:47 on September 1, 2016. The three colored traces are as follows: Black; m/z=33 (methanol), Green; m/z=59 (acetone), and Red; m/z=142 (unknown). Mass 142 is presented here due to its persistence in the data and correlation to other major signals observed during the monitoring period. The mass does not correlate to any of the COPCs. Its significance is pending further evaluation. The y-axis is in units of ppbv. The decrease in signal at approximately 10:45 is due to the routine evaluation of the Rad-Con filter where the sample flow to the manifold is turned off. The signal decrease does not go to zero as might be expected, but rather to an ambient background level measured under the existing instrument conditions. It is important to note that this is very preliminary data from the AP-farm sampling campaign and has not been fully reviewed. Many more compounds were actually seen than are represented here. Concentrations should be considered as estimates. The figure is presented here as an example of data collected for the project. Extensive analysis of the data sets is in progress.

Figure 5-1. A data slice from the AP-stack (old system) sampling campaign showing three selected signals over the course of 6 hours.



The emissions from the A-103 passive breather filter are, as expected, much different than those observed from the AP-stack. Figure 5-2 through Figure 5-5 represent the emission from the A-103 PBF over a 24 hour period starting on 09/07/16 at 06:38 AM and ending on 09/08/16 at 06:38 AM. These data are also preliminary and are subject to full evaluation and review. The concentrations should be considered estimates. The black trace is for m/z=33 (methanol), green is for m/z=59 (acetone), and red for m/z=42 (acetonitrile).

Figure 5-2. A data slice from the A-PBF sampling campaign showing three selected signals over the course of 6 hours from 09/07/16, 06:38 to 12:38.

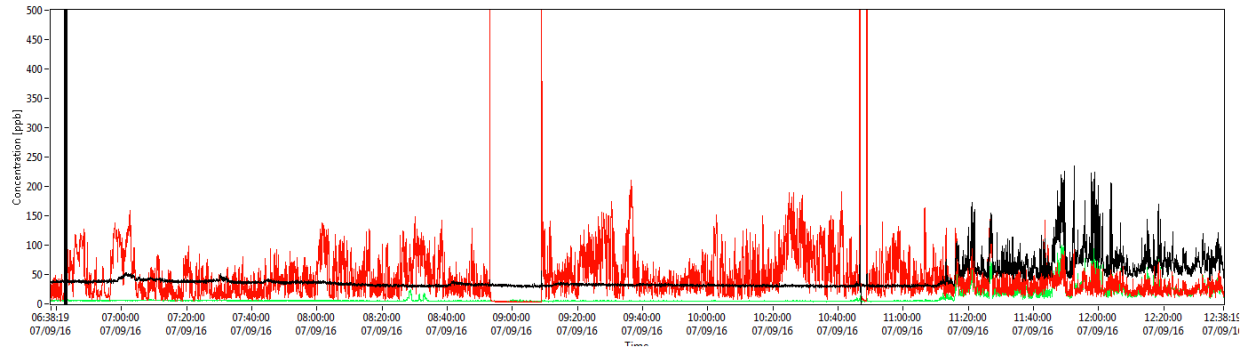


Figure 5-3. A data slice from the A-PBF sampling campaign showing three selected signals over the course of 6 hours from 09/07/16 12:38 to 18:38.

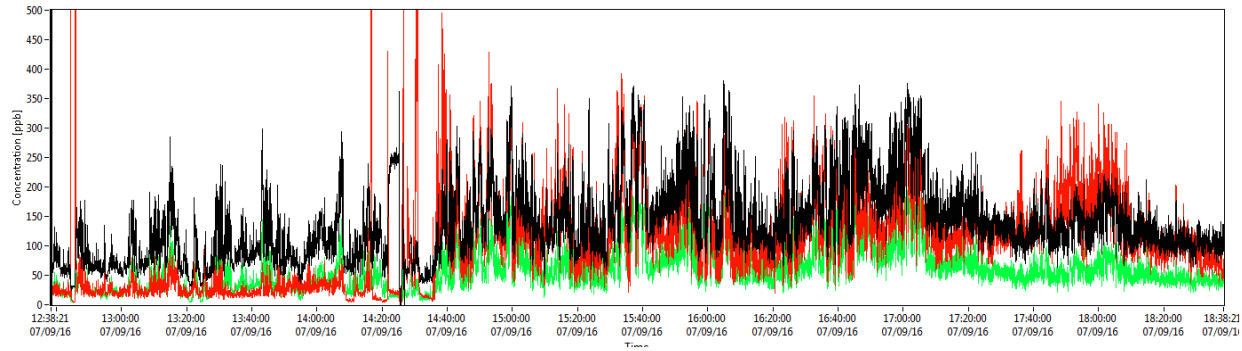


Figure 5-4. A data slice from the A-PBF sampling campaign showing three selected signals over the course of 6 hours from 09/07/16 to 09/08/16, 18:38 to 00:38.

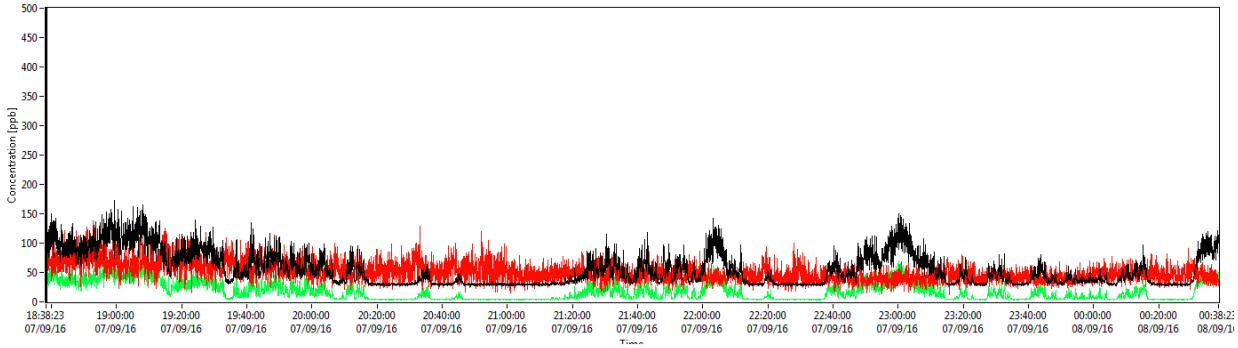
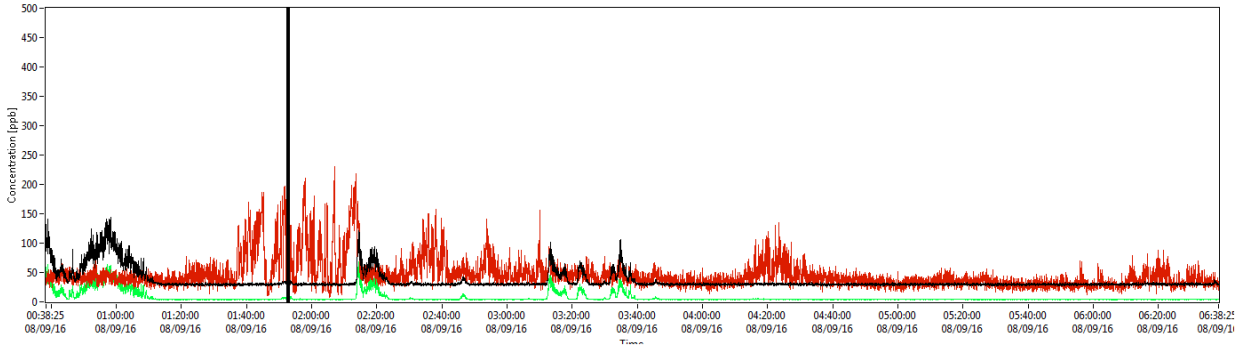


Figure 5-5. A data slice from the A-PBF sampling campaign showing three selected signals over the course of 6 hours from 09/08/16, 00:38 to 06:38.



The data from the A-farm intensive sampling campaign represents a limited period of time but does suggests a diurnal variation in emissions as observed over the hours of 20:00 the evening of the 7th to 06:30 the morning of the 8th. The data was collected with a 2 second time window providing excellent temporal variation in signal intensity. What appears to be noise embedded in the data a sharp signal spikes is actually believed to be dilution of the emissions by the wind blowing under the passive breather filter.

6.0 SRNL/AEROSOL CAMPAIGN

6.1 SRNL AEROSOL SUPPORT MAY 24-26 (TASK 4)

The PTR-MS and the GC-MS system in the mobile laboratory were used to support the aerosol collection and analysis activities performed by personnel from the Savanna River National Laboratory (SRNL). Of particular interest in this phase of the project was the determination of potential aerosol releases from the emission stack in 241-AP tank farm and the passive breather filters in 241-A tank farm.

The PTR-MS system was used to help identify possible vapor plumes emitting from the tank farms. This in turn would help direct the placement of the aerosol collection units. Each electrostatic precipitator aerosol collection unit contained two electrostatic plates. One plate was used for the determination of aerosol particulate contribution to the emissions, while the second was used to evaluate the potential for associated vapors with the aerosol particulates.

The samples, collected May 24 - 26, 2016, were received at Columbia Basin Analytical Laboratory (CBAL) on May 26, 2016 and assigned Laboratory Order Number W605131. A total of 17 samples were submitted. A blank precipitator plate was submitted at a later date (W608016-01). The analysis of the blank plate is pending. Note that samples W605131-01 through W605131-06 were analyzed in one analytical batch and samples W605131-07 through W605131-17 were analyzed under a second analytical batch.

The samples were analyzed in accordance with EPA Compendium Method TO-17-Modified. The sample was transferred from its plastic storage container to a thermal desorption vessel equipped with a gas inlet and gas outlet. The vessel was sealed and then heated to 75^{o}C for 30 minutes under a stream of ultrahigh purity nitrogen. Thermally desorbed VOCs were transferred by the nitrogen flow to a CarboTrap-300 thermal desorption tube that was maintained at room temperature (~23^{o}C). The trapped VOCs were desorbed into a GC-MS system for analysis.

The report of the results from the electrostatic precipitator plates can be found in Appendix D.

Two suspect vapor signals were detected in the process of locating vapor plumes by the PTR-MS system. Air canister samples were obtained concurrent with the PTR-MS measurements. This was done to correlate GC-MS results with the PTR-MS results. Although, attempts were made to ensure collocated collection, the transient nature of the vapor plume may have resulted in a partial sample or even no vapor sample being collected in these canisters.

Sample W606001-01 was collected during a static PTR-MS measurement located on the north side of the 244AR building. The sample was obtained on May 25, 2016 at 10:14 AM (PTR-MS cycle time; 11,190). The purpose of the first sample collection was to attempt the capture of VOCs that may be associated with an ‘onion’ odor that could be periodically detected by human smell. The odor was intermittent, probably due to the variability in the prevailing air movement at the site, and never reached an olfactory response that would be considered noxious.

Sample W606001-02 was obtained during a static PTR-MS measurement at the northeast corner of the 241A Evaporator Unit. This sample was collected slowly over a period of approximately 6 minutes on May 26, 2016 in the afternoon. The sample corresponds to an increase in PTR-MS signal observed at that time (PTR-MS cycle time; 30,735 – 31,110).

The samples were analyzed in accordance with EPA Compendium Method TO-15. The results of the TO-15 analyses was compared to the PTR-MS data and was used to facilitate the processing of the real-time sampling events by the PTR-MS. The reports for the two air canister samples can be found in Appendix E.

Note that later observations of the suspect 'onion' odor have been tentatively traced to the soil in the gravel drive area north of 244-AR building. Soil analyses are currently underway by WRPS personnel to determine the compound that is responsible for that particular odor, possible microbial identification, and the root-cause/effect that leads to the production of that odor. The odor appears to be unrelated to tank farm emission.

7.0 EXPERIMENTAL DESIGN

7.1 MEASUREMENT SYSTEMS DESIGNS

Gas sampling and handling systems are an important aspect of any vapor monitoring activity. Various gas sampling manifolds and test systems were constructed or modified to meet the goals of this project.

A gas distribution system previously existed in the mobile laboratory; however, its design was modified to ensure that the compounds of interest in this study would see a minimum length of active surface area in the sampling system. All sampling surfaces in the design were modified to include only PFA material.

A gas manifold (2) for sampling the vapors from the AP-Farm stacks and the A-Farm passive breather filers was designed and constructed at RJ Lee Group. The initial units were rebuilt by Apollo to meet the requirements of the Hanford construction group. One of the units was installed on the east fence line of AP-Farm and connected to the main ventilation stack. The other unit was installed on the southeast fence line of A-Farm and connected to A-103 passive breather filter. Both units are located outside the farm fence.

A sample line support adapter was designed by RJ Lee Group and manufactured by Pacific Northwest National Laboratory. This device, a circular ring with holes of various diameters, is attached to the riser tube of the passive breather filter on A-103. The 3/8 inch heated PFA line from the 130 foot heat trace line is fed through one of the holes and clamped into place. The inlet to the sampling line is located up under the breather filter cone which results in minimal dilution by the ambient atmosphere and minimal perturbation of sample by local wind.

The 3/8 inch heated PFA tube for the AP-Farm stack is connected to a ‘shepherd’s hook’ device which is placed over the top of the stack in a position where the end of the tube falls approximately four inches into the stack opening.

7.1.1 Design of the Mobile Laboratory Internal Sampling System

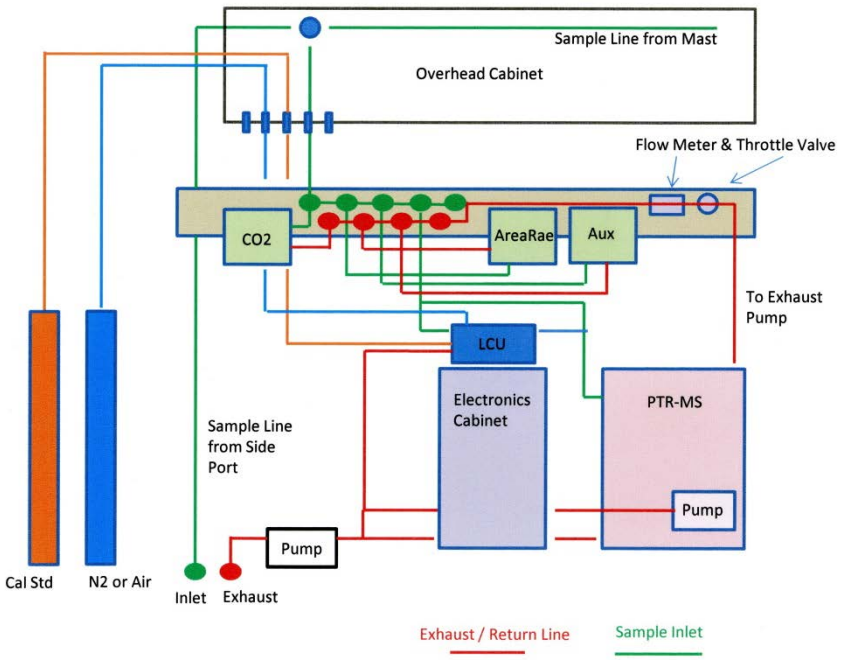
A significant portion of the mobile laboratory’s support to the program involved plume chasing and area surveys where the laboratory was driven from one location to another. In this application, the laboratory utilized its internal gas sampling manifold to bring an air sample to the various monitors inside the vehicle with exhaust back to the source environment.

The gas sampling system within the mobile laboratory consists entirely of PFA Teflon parts and tubing from both points of origin, the roof mounted sampling mast or the side mount sampling port, to the PTR-MS or auxiliary sampling stations. The main line of the system is built with 3/8 inch diameter PFA tubing; the individual instruments sampling lines from the main line are usually smaller, e.g., the PTR-MS inlet consists of 1/4 inch PFA tubing that feeds into 1/16 inch PEEK tubing. The return lines provide a flow-through system with exhaust gases from the PTR-MS and unused sample gases exiting a side port on the mobile laboratory. The air sample delivery system

is entirely sealed with no sample released to the interior of the mobile unit. The air sample is pulled into the sampling system by an oil-free diaphragm pump mounted under the van. The flow rate of the air sample is controlled by a needle valve located after a digital flow meter that is in series with the flow stream after the analytical sampling stations. The main line is generally pumped at a volumetric flow rate of approximately 20-25 liters per minute which corresponds to a linear velocity of approximately 5 meters per second.

Alternatively, the system can be run by using the pumping system of the PTR-MS to draw the air sample to the instrument, particularly when using 1/4 inch or 1/8 inch sampling lines. Figure 7-1 shows the general layout of the internal gas sampling system.

Figure 7-1. The mobile laboratory internal gas manifold system.



A 25 foot heated sample transfer line can be connected between an external sampling station and the laboratory's pumped system. This transfer line is heated using heat trace tubing to reduce potential condensation effects when sampling during colder temperatures. The heated line can be operated at a nominal temperature of 50°C and consists of a heated 3/8 inch PFA tube and an unheated 3/8" PFA tube. The constant power density tubing operates at a current draw of 0.1 amp per foot, whether at initial startup or at constant operation at its final temperature. The temperature is controlled by a SPDT UL listed line sensing thermostat. Power to the heat trace is provided by the mobile laboratory. The unheated tube is used to make sample dilutions at the point of the external gas manifold, as required. The relative humidity of the dilution gas is very low, therefore, heating this sample dilution line is not necessary.

7.1.2 Design of the Stationary External Sampling Systems

For operations at the two tank farm sites, a specific external sampling manifold was developed for this project. It is used to transport vapor samples from a forced vented tank emission stack or a passive ventilated filter system to the mobile laboratory. Two separate systems were constructed, one for each application. These external sampling manifolds will be left in place upon completion of the mobile laboratory project to provide support for continued tank farm sampling activities. The external sampling manifolds are identical with the exception of the length of heat trace tubing. The sample line for the AP stack is 100' in length and the sample line for the A-103 PBF is 130'. The length of tubing is defined by the distance from the respective ventilation source to the nearest fence line point where the mobile laboratory can be located. All but 6 inches of the 3/8" PFA tubing on both ends of the sampling system were heated. A commercially prepared constant power density electric trace tubing (Dekoron®-Unitherm) with an aluminum Mylar thermal barrier was used as the heat source. This non-hydroscopic inorganic fibrous glass thermal insulation is covered by a 105ºC black flame retardant low temperature PVC jacket. Power to the two heat trace lines for stack sampling was provided from a local tank farm source.

The heat trace was operated at 60ºC which is well above the exhaust temperature of the stacks. This effectively eliminated moisture condensation on the walls of the transport tubing and also aided in the reduction of sample loss and sample retention effects of the tubing walls.

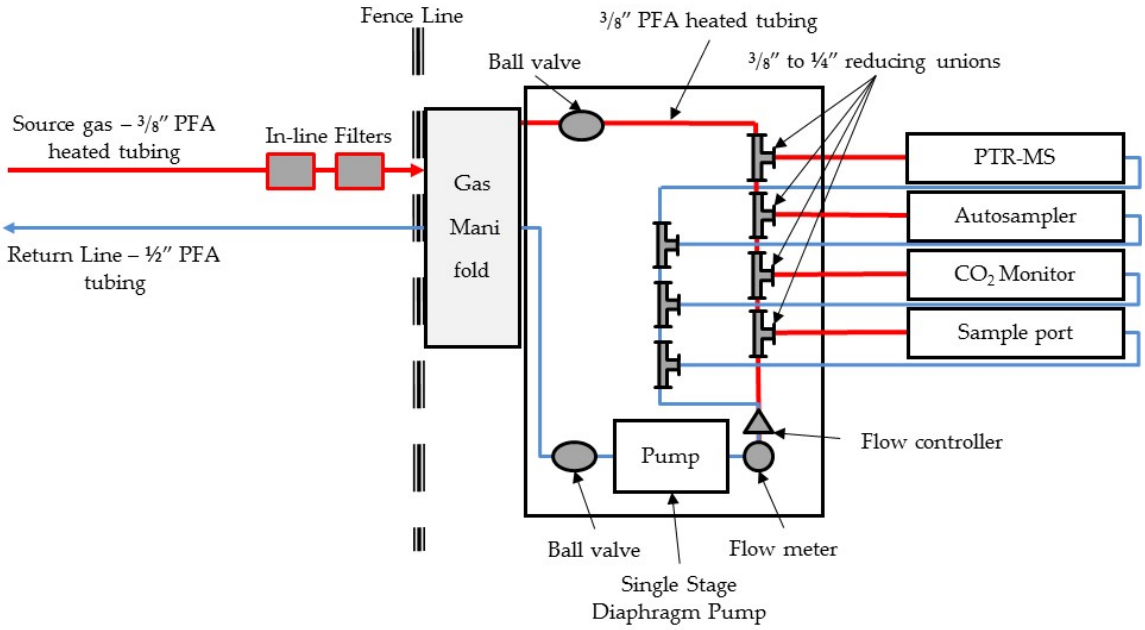
The heat trace tube is connected from the respective emission source to a gas manifold that permits the connection of various sampling devices outside the tank farm fence. Coupling of the sampling lines to the gas manifold is accomplished using "quick connectors" for both the gas input and gas return. The mobile laboratory, or other gas sampling equipment, will couple to the manifold using appropriately sized and heated lines.

The air sampling side of the manifold is constructed of PFA with the exception of a stainless steel bulkhead fitting and a stainless steel ball valve. Both of these items are Silonite[3] treated to reduce reactivity to VOCs. The return gas side of the manifold is plumbed with a combination of stainless steel and PFA. During operation with the mobile laboratory, the gas manifold will be operated with the pump associated with the internal sampling manifold in the mobile lab. When the mobile lab is away from the external manifold, the system will be pumped by a GAST 150WX vacuum pump located inside the manifold box. The manifold components are enclosed in a protective NEMA shell.

A general layout of the gas manifold/sampling lines is shown in Figure 7-2.

[3] SILONITE® is a registered trademark by Entech Instruments, Inc, Simi Valley, CA 93065.

Figure 7-2. Schematic of the general concept for the external gas sampling manifold.



The sampling pump pulled the gas sample from the source to the manifold where it was distributed to the mobile lab. The pumped system then returns all unused gas and the sample exhaust from the mobile lab back to the area of the source in a manner that ensures the gas is not resampled.

8.0 INSTRUMENTATION OPERATION & CALIBRATION

The mobile laboratory was used in various configurations in support of the measurement of tank farm vapor emissions. Common to all configurations is the instrumentation within the laboratory and its operation.

The main component within the mobile laboratory is the PTR-MS. In addition, a carbon dioxide and moisture sensor and a weather station for metrological data and GPS coordinates are available. For confirmatory measurements, a GC-MS is installed with an auto sampler for thermal desorption unit tubes.

The gas samples were introduced to the PTR-MS (and the CO_2 monitor) via the laboratory's internal gas sampling manifold. The PTR-MS requires a flow of only 20 - 50 milliliters per minute; however, the internal manifold is capable of providing a gas flow of 20-30 liters per minute. The CO_2 monitor has its own pump associated to the sensor to ensure appropriate sample flow of less than 1 liter per minute through the sensor cell. The manifold accommodates multiple sampling ports which can feed other monitors or sampling devices. The total flow through the manifold is determined by the individual testing requirements and is controlled by the in-line needle valve located prior to the pump but after all sampling ports. Excess sample gas is fed to a return port located outside the laboratory. During mobile plume chasing the excess source gas was returned to the outside environment; in case of the stationary sampling, the excess gas was returned to tank farms as shown in Figure 7-2 rather than being released to the surrounding environment.

8.1 PTR-MS OPERATION

Prior to being brought onto the Hanford site, the PTR-MS was calibrated for several compounds of interest. Calibration was performed by operating the instrument under a fixed set of conditions while introducing a VOC standard of known concentrations. Calibration serves two functions: (1) It provides data for the determination of the ion transmission efficiency over the mass range of interest and (2) it provides response factors for specific compounds that are used for determining absolute quantification of those compounds. The ion transmission efficiency is required to allow the semi-quantitative determination of VOCs using classic kinetics and published ion-molecule reaction rate constants for each compound. The calibration response factors for individual compounds are determined by running a 4-point calibration curve at various concentrations, similar to typical gas analysis calibrations.

Calibration verifications and zero air analysis were performed periodically in the field to ensure that the instrument was performing as expected and to provide corrections to the response factors from errors introduced by small drifts in the micro-channel plate detector response and the reagent ion production in the ion source. Zero air, calibrations and/or Continuing Calibration Verifications (CCVs) were generally performed at the beginning and end of daily operations or whenever there may have been a significant change in physical conditions, or as defined in a project statement of work. Zero air was supplied by a compressed gas cylinder and CCVs were run from an air canister or compressed gas cylinder containing a known concentration of VOCs.

It should be noted that the expiration date of the certification of the PTR-MS standard used for calibration was exceeded (June 29, 2014). There is a significant lead time in the purchase of a new

custom made standard. Unfortunately, there was inadequate time for acquisition of a new standard from the time the project was awarded to the time of the first field measurements. Continued use of the standard from the date of purchase through its use in this project has shown consistent performance, therefore, confidence remains high in its validity. To ensure its validity, the standard will be recertified against a recently purchased and certified TO-15 standard for as many components as possible. The recertification will take place prior to the release of the final report for this project. Additionally, a new PTR-MS standard will be purchased containing the same components represented in the standard used for this project. This new standard will be used for full re-certification and validation of the current PTR-MS standard used in this project. A follow up report regarding the recertification will be provided to the project management. It is the intent to purchase a custom blended standard with as many of the COCPs as possible should these studies be extended into FY'17.

Table 8-1 is a listing of the 16 compounds in the PTR-MS standard. Each compound is at a nominal concentration of 2 ppmv.

Table 8-1. VOCs contained in the CCV gas standard.

Vinyl chloride	Methanol	Acetonitrile
Trichloroethylene	Acetone	1,2-Dichloroethylene
Isoprene	Methyl vinyl ketone	Methyl ethyl ketone
Benzene	Toluene	Styrene
p-Xylene	1,3,5-Trimethylbenzene	Tetrachloroethylene
1,2,3,5-Tetramethylbenzene		

The entire process of performing a zero air background check, calibration, and/or a CCV evaluation requires only a few minutes.

8.2 CARBON DIOXIDE SENSOR OPERATION

The carbon dioxide sensor LI-COR Model 840A is a direct read instrument based on a single path, dual wavelength infrared detection system. It is interfaced to the laboratory's internal gas manifold just downstream of the PTR-MS sampling port. The unit provides continuous 1 second integrated time responses from a non-dispersive infrared (NDIR) gas analyzer system. The data from the CO_2 monitor is for the correlation of CO_2 data to the VOC measurements from the PTR-MS. It is a strong indicator of contribution of VOCs from combustion sources.

The CO_2 monitor has been factory calibrated. Periodic checks of the unit were made with background air obtained from an upwind location to ensure continued system operation. Relative changes in carbon dioxide concentrations are pertinent to this project, not absolute quantification. A sample gas flow of approximately 1 liter per minute was pulled from the main sampling line by a small pump. The gas line was plumbed close to the port used for sample transfer to the PTR-MS to ensure that both instruments are simultaneously sampling the same source. The system has a continuous direct readout which can be displayed on a computer monitor in real time. Data from the measurement process were periodically downloaded to the computer for permanent storage.

8.3 GC-MS OPERATION

The GC-MS system was only scheduled for use in conjunction with the SRNL aerosol emission study and as support to the PTR-MS quantification effort. The analyses performed on the GC-MS include those associated with EPA's Compendium Methods TO-15 and TO-17.

The GC-MS was configured with an interface that facilitated the thermal desorption of the VOCs associated with the aerosol collection plates. The desorption unit consists of a small chamber that can be opened and resealed to permit transfer of the aerosol sample plate. Two ports are attached to the chamber. One is for the inlet of ultrahigh purity helium and the other is the outlet for the desorbed VOCs. The outlet is connected to a CarboTrap 300 thermal desorption tube. The sample/desorption chamber is placed in the oven of the gas chromatograph which provides controlled heating of the sample. Once the sample is collected, the thermal desorption tube undergoes analysis using the Perkin Elmer TD-50 instrument interfaced to the GC-MS.

The GC-MS system was calibrated off-site for a large list of analytes. A listing of the compounds and the certification sheet from the vendor of the standard can be found in the materials and testing equipment section of the test plan. The analytical protocol includes the analysis of a CCV to demonstrate continued system calibration for the SRNL aerosol study, the analysis of a laboratory control sample (LCS), and the analysis of a zero air sample (BLK) to demonstrate system cleanliness. The analysis of VOCs associated the aerosols is not intended to be a comprehensive analytical study, but rather, an exploratory study to determine if there are any associated VOCs. It is, therefore, not necessary to run a full quality control analytical batch with the sample; only sufficient quality control samples (CCV, LCS, BLK) to ensure proper instrument operation.

Several air canisters were collected to support and validate the PTR-MS measurements. There is no connection of the air canister samples to any type of industrial hygiene or environmental monitoring activity. Two of the canister samples were in support of PTR-MS measurements during the SNRL aerosol particulate campaign. These results can be found in Appendix F and are discussed in Section 6.1. Five were collected to support other PTR-MS observed events during routine area monitoring activities. The results of two of the five samples are found in Appendix G. The analysis of the remaining three samples is pending and is not expected to be completed by the submission time of this report. This data will be available for the final project report.

Canister sampling as a means of supporting the PTR-MS measurements may be problematic. The majority of vapor plumes observed in the data are of 1-5 second duration with component concentrations in the low part per billion range. Taking a grab sample into a canister typically requires 30-40 seconds. The resulting concentration of any VOC observed by the PTR-MS is effectively diluted to the point where it may fall below an analytical reporting limit. Therefore, co-located in-time canister grab samples for support of the PTR-MS data will generally be limited to higher concentration vapor plumes.

8.4 CALIBRATION METHODS AND CALIBRATION GASES USED

Calibration of the GC-MS system and the PTR-MS system is discussed in detail in the Test Plan. Some of the details of the calibration routines will be discussed below and a listing of the certified

gas standards will follow. Section 8.1 discusses the use of an expired certification for the PTR-MS standards and is repeated in Section 8.4.1.

8.4.1 Calibration and Verification of the PTR-MS System

The PTR-MS is typically used for real-time continuous measurement activities where the primary objective is to observe temporal variations of compound concentration, location, or both. To achieve this measurement objective, it is generally less critical to have absolute compound quantification vs. volume of air sample and more importantly to ensure long term instrument response or response factors of each component.

The general operation of the PTR-MS system is discussed in CBAL LAP-150. The appendix of this document contains forms used to document the daily operation of the instrument. These forms are 1) PTR-MS Start-up Record and 2) PTR-MS Daily Record for Continuous Measurements. The forms contain information pertinent to the tracking of daily instrument operation and data collection. Note, that at the time of release of CBAL LAP-150, the form used for the PTR-MS Start-up Record pertained to the operation of the quadrupole based instrument. Data is still being compiled that will allow us to properly represent the ion abundance characteristics for the TOF instrument.

Compound 'quantification', particularly in the absence of an authentic gas phase standard, is conveniently performed using classic kinetics and published ion-molecule reaction rate constants for each compound. This essentially means that semi-quantitative data can be obtained from the PTR-MS measurements without the use of standards. The majority of gas phase ion-molecule reaction rate coefficients range from 1×10^{-9} cm^3 s^{-1} to 4×10^{-9} cm^3 s^{-1}. For compounds with no published rate constant, a typical collisional rate constant of 2×10^{-9} cm^3 s^{-1} was applied. Quantification using kinetic data will generally result in estimated absolute compound concentrations within the range of +/-30% of the true value, assuming no interfering compounds at the same ion signal. For many measurements, such as those encountered in this project, this range of precision is adequate, assuming that they are consistent over the long term. Other experiments may require a higher level of precision necessitating the use of authentic standards of known concentrations to prepare calibration curves over a concentration range of interest. For this measurement campaign, it is impractical to secure gas phase standards for every compound that may be encountered.

The TOF mass spectrometer system in the mobile laboratory was used to ensure long term measurement stability to enable the comparison of the relative concentration of each component. In addition to providing response data for every mass at high temporal resolution, the system incorporates an internal reference standard that is measured with each data cycle. This standard is introduced to the gas phase from a permeation tube that is maintained at a constant temperature for all experiments, thus ensuring that there is a constant leak rate into the instrument at all times. The primary purpose of the internal standard is to provide mass scale correction in each data cycle to account for minute variations in instrument parameters such as power supply voltages and temperature changes, which may change effective flight path of the ions. The internal standard can be used in a similar fashion that an internal standard is used in GC-MS data; to provide a fixed reference to account for instrument signal variations due to ion source tuning, overall ion

transmission variations, and detector response variations. In this study, the response of the internal standard is primarily used to verify that the system is in nominal working condition and can provide an acceptable level of measurement that is repeatable on a daily basis.

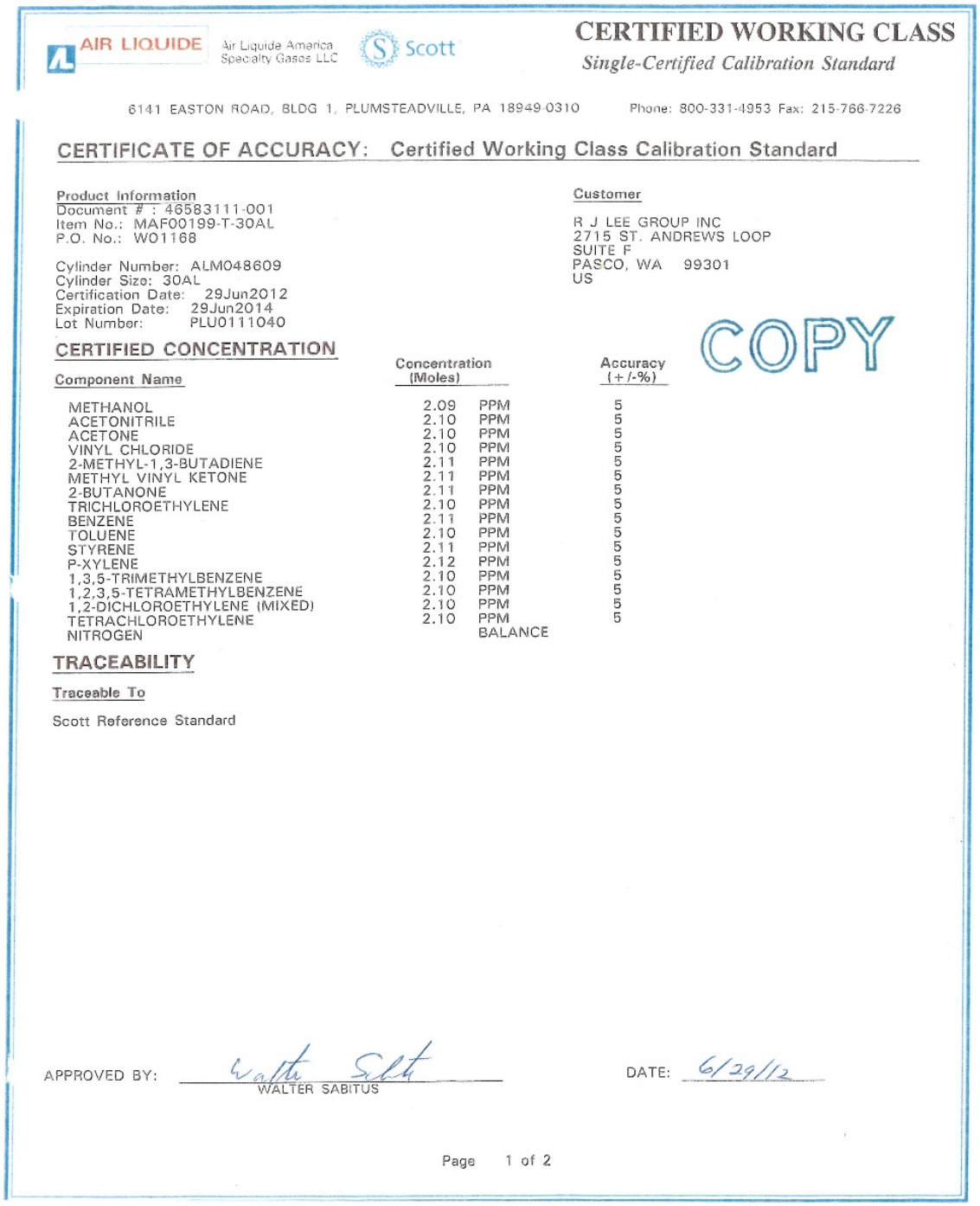
In addition to the instrument's internal standard, daily calibrations and tune checks were performed using a multicomponent standard and a zero air or nitrogen source. The multicomponent standard was run as either a full calibration curve (7 points) or as periodic calibration verification. A full calibration was performed prior to the start of the daily campaign. In some cases, a full calibration was repeated at the end of a daily campaign in lieu of a calibration verification. The calibration is not for the absolute quantification of individual components but rather a mechanism to ensure that the instrument is in a nominal operational mode and can achieve the desired detection limits.

It is expected that long term instrument variations affecting semi-quantitative assessments, should vary by no more than +/-5%. This is different than the error introduced by quantitation of responses without the use of authentic standards (Kinetic Data). An advantage of PTR-MS measurements is that the quantitative process is self-correcting as all measurements are compared against the measured signal of the reagent ion (see page 8 of the Test Plan for a discussion of the theory of the PTR-MS).

The calibration process is performed using the Liquid Calibration Unit manufactured by IONICON as a specific tool for their PTR-MS systems. The certification of the LCU (Figure 8-2) is shown after the listing of the compounds in the calibration mixture (Figure 8-1)

It should be noted that the expiration date of the certification of the PTR-MS standard used for calibration was exceeded (June 29, 2014). There is a significant lead time in the purchase of a new custom made standard. Unfortunately, there was inadequate time for acquisition of a new standard from the time the project was awarded to the time of the first field measurements. Continued use of the standard from the date of purchase through its use in this project has shown consistent performance, therefore, confidence remains high in its validity. To ensure its validity, the standard will be recertified against a recently purchased and certified TO-15 standard for as many components as possible. The recertification will take place prior to the release of the final report for this project. Additionally, a new PTR-MS standard will be purchased containing the same components represented in the standard used for this project. This new standard will be used for full re-certification and validation of the current PTR-MS standard used in this project. A follow up report regarding the recertification will be provided to the project management. It is the intent to purchase a custom blended standard with as many of the COCPs as possible should these studies be extended into FY'17.

Figure 8-1. Compounds in the Calibration Mixture for the PTR-MS.



AIR LIQUIDE Air Liquide America Specialty Gases LLC Scott

CERTIFIED WORKING CLASS
Single-Certified Calibration Standard

6141 EASTON ROAD, BLDG 1, PLUMSTEADVILLE, PA 18949-0310 Phone: 800-331-4953 Fax: 215-766-7226

CERTIFICATE OF ACCURACY: Certified Working Class Calibration Standard

Product Information
Document # : 46583111-001
Item No.: MAF00199-T-30AL
P.O. No.: WO1168

Cylinder Number: ALM048609
Cylinder Size: 30AL
Certification Date: 29Jun2012
Expiration Date: 29Jun2014
Lot Number: PLU0111040

Customer

R J LEE GROUP INC
2715 ST. ANDREWS LOOP
SUITE F
PASCO, WA 99301
US

COPY

CERTIFIED CONCENTRATION

Component Name	Concentration (Moles)		Accuracy (+/-%)
METHANOL	2.09	PPM	5
ACETONITRILE	2.10	PPM	5
ACETONE	2.10	PPM	5
VINYL CHLORIDE	2.10	PPM	5
2-METHYL-1,3-BUTADIENE	2.11	PPM	5
METHYL VINYL KETONE	2.11	PPM	5
2-BUTANONE	2.11	PPM	5
TRICHLOROETHYLENE	2.10	PPM	5
BENZENE	2.11	PPM	5
TOLUENE	2.10	PPM	5
STYRENE	2.11	PPM	5
P-XYLENE	2.12	PPM	5
1,3,5-TRIMETHYLBENZENE	2.10	PPM	5
1,2,3,5-TETRAMETHYLBENZENE	2.10	PPM	5
1,2-DICHLOROETHYLENE (MIXED)	2.10	PPM	5
TETRACHLOROETHYLENE	2.10	PPM	5
NITROGEN		BALANCE	

TRACEABILITY

Traceable To

Scott Reference Standard

APPROVED BY: Walter Sabitus
WALTER SABITUS

DATE: 6/29/12

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Figure 8-2. Certification and Specification of the Liquid Calibration Unit.

IONICON

Inspection and Quality Certificate

IONICON Analytik GmbH

Type: LCU-a
S/N: 16-A03-La-029

Date: 3/31/2016

IONICON ANALYTIK
Gesellschaft mbH
Eduard-Bodem-Gasse 3
6020 Innsbruck, Austria
Tel.: +43 (0) 512 214 800
Fax: +43 (0) 512 214 800-099
office@ionicon.com
www.IONICON.com

Customer: RJ Lee
With PTR-MS: -

LIQUID
CALIBRATION
UNIT

IONICON

LCU Tests

Software	Installed	Tested
Software	ok	ok

Inlet Leaktest	Passed
Gas Inlet 1	ok
Gas Inlet 2	ok

Heating	Set (°C)	Reached
Spray Chamber	110	ok
Hose	100	ok

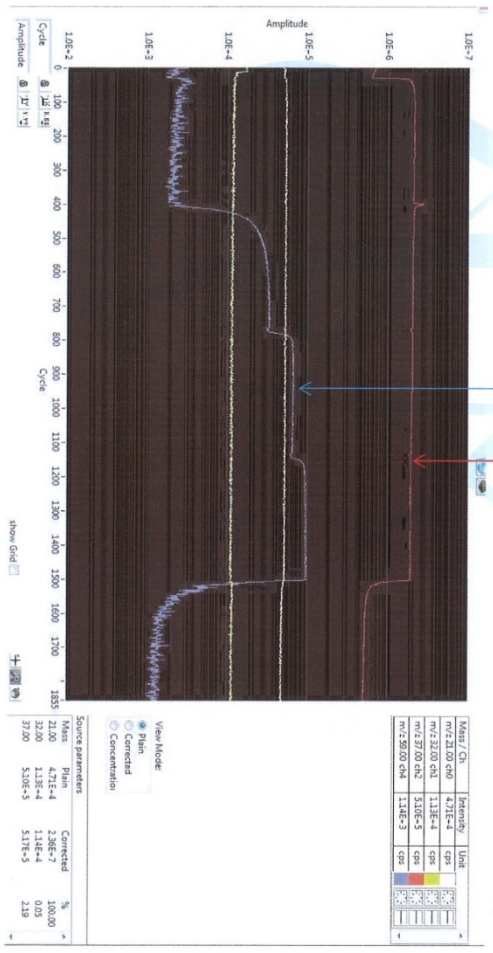
MFC Test	Set (sccm)	Act. MFC (sccm)	Measured DryCal (sccm)	Meas. error	Acceptance Range (sccm)
Gas Flow Nebulizer	500	500	505	±10	494 ... 506
SN: M15214005U	250	250	251	±2.5	247 ... 253
Gas Flow Std. Gas	100	100	99,8	±1	99.4 ... 100.6
SN: M15213940C	20	20	20,0	±0.2	19.8 ... 20.2

aLFC Test	Serial Number	Checked	Emptied (pump air)
aLFC 1	16-05(050)		ok
aLFC 2	16-06(051)		ok
Spare pump	---	ok	ok

3/31/2016 2

IONICON

Calibration test



Test	Passed
Humidity	ok
VOC	ok

- Calibration sequence with aqueous acetone standard
- LCU-a only: maintain constant humidity

3/31/2016 3

IONICON

aLFC 1
Test Report

IONICON Analytik GmbH

Type: aLFC-50
S/N: 16-05(050)

Set (µl/min)	Measured (µl/min)	Meas. error	Acceptance range (µl/min)	Power <60%
50	51,3	±1.5	49.0 ... 51.0	43%
10	10,2	±0.5	9.8 ... 10.2	--

3/31/2016 4

IONICON

aLFC 2
Test Report

IONICON Analytik GmbH

Type: aLFC-50
S/N: 16-06(051)

Set (µl/min)	Measured (µl/min)	Meas. error	Acceptance range (µl/min)	Power <60%
50	50,8	±1.5	49.0 ... 51.0	44%
10	10,1	±0.5	9.8 ... 10.2	--

3/31/2016 5

8.4.2 Calibration and Verification of the GC-MS System

The GC-MS data were qualified on a per batch basis by running the BFB tune check, a CCV, an LCS, and method blank with each data set, as specified in the CBAL standard operating procedure LAP-013.03. This level of qualification differs somewhat from normal laboratory protocol but will satisfy the quality control criteria for the project which is to ensure relative comparison of data collected throughout the project rather than absolute quantification of each measured component. The calibration curve will be generated from a multi-component certified standard. The certificate from the standard is shown below in Figure 8-3.

Acceptance criteria for the qualifying data from the GC-MS sample analysis batches can be found in CBAL LAP-013.03 and is summarized below. Any deviations of data beyond the range of acceptance will be appropriately qualified in the report using descriptive flags. The following sub-sections discuss the relative merit and use of the various types of qualifications used in the GC/MS analyses.

8.4.2.1 BFB Tune Check. A specific compound (4-bromofluorobenzene; BFB) is specified in the TO-15 method for use as a means of ensuring that the mass spectrometer is capable of providing representative signals for all measured compounds. The acceptance criteria of the fragmentation pattern of the BFB is shown in Table 8-2. A slight variation of the fragment response does not necessarily invalidate the quantitative results. For quantitative purposes, it is more important to show that the mass spectrometer response remains constant over the time period of the analyses.

Table 8-2. Acceptance criteria for the qualifying the response from the mass spectrometer.

MASS	ION ABUNDANCE CRITERIA
50	8.0 to 40.0 Percent of m/e 95
75	30.0 to 66.0 Percent of m/e 95
95	Base Peak, 100 Percent Relative Abundance
96	5.0 to 9.0 Percent of m/e 95 (See note)
173	Less than 2.0 Percent of m/e 174
174	50.0 to 120.0 Percent of m/e 95
175	4.0 to 9.0 Percent of m/e 174
176	93.0 to 101.0 Percent of m/e 174
177	5.0 to 9.0 Percent of m/e 176

8.4.2.2 Continuing Calibration Verification. The continuing calibration verification, or CCV, is used to periodically check the validity of the instrument's short term operation. It involves the introduction of a mid-range calibration standard and comparison of its response to the initial calibration curve. The recovery of each analyte in the CCV with respect to the initial calibration should be within +/-30% of the expected value. CCVs are run prior to the analysis of samples, after every 10^{th} sample, and at the conclusion of a sample batch.

8.4.2.3 Laboratory Control Sample. A laboratory control sample, or LCS, consists of a clean matrix free of expected analytes of interest that is spiked with a known amount of standard. The LCS is used for the determination of the recovery of each target analyte from the analytical process. When used in conjunction with an LCS duplicate, precision and bias data can be determined for a

clean matrix. The recovery of each analyte in the LCS should be within +/-30% of the expected value.

8.4.2.4 Method Blank. The method blank, or MBLK, is representative sample of the matrix that is used for the preparation of the calibration curve, CCV, LCS, MBLK, or other quality control samples. An aliquot of the clean matrix is prepared and run as a sample to ensure that there are no target analytes in the matrix that may bias the overall quality measurements. Target analytes from the project based objectives should not be present in the MBLK that exceeds 50% of the reporting limit of the project.

Figure 8-3. The multicomponent standard used for calibration of the GC-MS system.

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Shipped From: 6141 Easton Road
Plumsteadville, PA 18949
Phone: 215-766-8860
Fax: 215-766-7226

CERTIFICATE OF ANALYSIS

R J LEE GROUP INC
R J LEE GROUP INC
2710 N 20th Ave
Pasco, WA 99301-3398
US

Sales Order # : 3798917
P.O. #.: W02622
Item No.: A0909185
Date: 12Jul2016

Cylinder #: ST0000166462
Fill Pressure: 1800 PSIG
CGA: 180

Product Expiration: 13Jul2017
Lot #: 403-474931

Blend Type: CERTIFIED SCOTTY

Component Name	Requested Gas Conc (Moles)	Analysis (Mole)	Accuracy (+ / - %)
1,1,1-TRICHLOROETHANE	1.00 PPM	1.04 PPM	5
1,1,2,2-TETRACHLOROETHANE	1.00 PPM	1.01 PPM	5
1,1,2-TRICHLOROETHANE	1.00 PPM	1.05 PPM	5
1,1,2-TRICHLOROTRIFLUOROETHANE	1.00 PPM	1.07 PPM	5
1,1-DICHLOROETHANE	1.00 PPM	1.03 PPM	5
1,1-DICHLOROETHYLENE	1.00 PPM	1.06 PPM	5
1,2,4-TRICHLOROBENZENE	1.00 PPM	1.05 PPM	5
1,2,4-TRIMETHYLBENZENE	1.00 PPM	1.06 PPM	5
1,2-DIBROMOETHANE	1.00 PPM	1.04 PPM	5
1,2-DICHLOROBENZENE	1.00 PPM	1.05 PPM	5
1,2-DICHLOROETHANE	1.00 PPM	1.04 PPM	5
1,2-DICHLOROPROPANE	1.00 PPM	1.04 PPM	5
1,2-DICHLOROTETRAFLUOROETHANE	1.00 PPM	1.04 PPM	5
1,3,5-TRIMETHYLBENZENE	1.00 PPM	1.04 PPM	5
1,3-BUTADIENE	1.00 PPM	0.96 PPM	5
1,3-DICHLOROBENZENE	1.00 PPM	1.05 PPM	5
1,4-DICHLOROBENZENE	1.00 PPM	1.04 PPM	5
2-PROPANOL	1.00 PPM	1.02 PPM	5
3-CHLORO-1-PROPENE	1.00 PPM	1.02 PPM	5
4-ETHYL TOLUENE	1.00 PPM	0.99 PPM	5
ACETONE	1.00 PPM	0.99 PPM	5
ACROLEIN	1.00 PPM	1.02 PPM	5
BENZENE	1.00 PPM	1.03 PPM	5
BENZYL CHLORIDE	1.00 PPM	1.04 PPM	5
BROMODICHLOROMETHANE	1.00 PPM	1.04 PPM	5
BROMOETHENE	1.00 PPM	1.00 PPM	5
CARBON DISULFIDE	1.00 PPM	1.03 PPM	5
CARBON TETRACHLORIDE	1.00 PPM	1.05 PPM	5
CHLOROBENZENE	1.00 PPM	1.02 PPM	5
CHLORODIBROMOMETHANE	1.00 PPM	1.05 PPM	5
CHLOROFORM	1.00 PPM	1.03 PPM	5
CIS-1,2-DICHLOROETHYLENE	1.00 PPM	1.04 PPM	5
CIS-1,3-DICHLOROPROPENE	1.00 PPM	1.04 PPM	5
CYCLOHEXANE	1.00 PPM	1.03 PPM	5
DICHLORODIFLUOROMETHANE	1.00 PPM	1.01 PPM	5
ETHANOL	1.00 PPM	1.02 PPM	5

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ETHYL ACETATE	1.00	PPM	1.04 PPM	5
ETHYL CHLORIDE	1.00	PPM	1.02 PPM	5
ETHYLBENZENE	1.00	PPM	1.01 PPM	5
ETHYLENE 1,2 DICHLORO (TRANS)	1.00	PPM	1.04 PPM	5
HEXACHLORO-1,3-BUTADIENE	1.00	PPM	1.06 PPM	5
ISOOCTANE	1.00	PPM	1.03 PPM	5
ISOPROPYL BENZENE	1.00	PPM	1.04 PPM	5
METHACRYLIC ACID METHYL ESTER	1.00	PPM	1.03 PPM	5
METHYL BROMIDE	1.00	PPM	1.00 PPM	5
METHYL CHLORIDE	1.00	PPM	1.02 PPM	5
METHYL ETHYL KETONE	1.00	PPM	1.02 PPM	5
METHYL ISOBUTYL KETONE	1.00	PPM	1.01 PPM	5
METHYL N-BUTYL KETONE	1.00	PPM	1.01 PPM	5
METHYL TRIBROMIDE	1.00	PPM	1.01 PPM	5
METHYLENE CHLORIDE	1.00	PPM	1.04 PPM	5
M-XYLENE	1.00	PPM	1.00 PPM	5
N-BUTANE	1.00	PPM	1.02 PPM	5
N-HEPTANE	1.00	PPM	1.03 PPM	5
N-HEXANE	1.00	PPM	1.01 PPM	5
N-NONANE	1.00	PPM	1.02 PPM	5
N-PENTANE	1.00	PPM	1.00 PPM	5
O-CHLOROTOLUENE	1.00	PPM	1.03 PPM	5
O-XYLENE	1.00	PPM	1.03 PPM	5
P-DIOXANE	1.00	PPM	1.05 PPM	5
PROPYL BENZENE	1.00	PPM	1.03 PPM	5
PROPYLENE	1.00	PPM	1.01 PPM	5
P-XYLENE	1.00	PPM	1.00 PPM	5
STYRENE	1.00	PPM	1.04 PPM	5
TERT-BUTYL METHYL ETHER	1.00	PPM	1.05 PPM	5
TERTIARY BUTANOL	1.00	PPM	1.03 PPM	5
TETRACHLOROETHYLENE	1.00	PPM	1.04 PPM	5
TETRAHYDROFURAN	1.00	PPM	1.05 PPM	5
TOLUENE	1.00	PPM	1.02 PPM	5
TRANS-1,3-DICHLOROPROPENE	1.00	PPM	1.04 PPM	5
TRICHLOROETHYLENE	1.00	PPM	1.03 PPM	5
TRICHLOROFLUOROMETHANE	1.00	PPM	1.02 PPM	5
VINYL ACETATE	1.00	PPM	0.97 PPM	5
VINYL CHLORIDE	1.00	PPM	1.02 PPM	5
NITROGEN		BALANCE	BALANCE	

SPECIFICATIONS

Component Name	Requested Concentration (Mole)	Gravimetric Concentration (Mole)	Analyzed Concentration (Mole)	Blend Tolerance Result (+/- %)	Blend Process Accuracy Result (+/- %)	Analytical Accuracy Result (+/- %)	Interlocking Result (+/- %)
1,1,1-TRICHLOROETHANE	1.000 PPM	N/A PPM	1.04 PPM	4.00	N/A	5.00	N/A
1,1,2,2-TETRACHLOROETHANE	1.000 PPM	N/A PPM	1.01 PPM	1.00	N/A	5.00	N/A
1,1,2-TRICHLOROETHANE	1.000 PPM	N/A PPM	1.05 PPM	5.00	N/A	5.00	N/A
1,1,2-TRICHLOROTRIFLUOROETHANE	1.000 PPM	N/A PPM	1.07 PPM	7.00	N/A	5.00	N/A
1,1-DICHLOROETHANE	1.000 PPM	N/A PPM	1.03 PPM	3.00	N/A	5.00	N/A
1,1-DICHLOROETHYLENE	1.000 PPM	N/A PPM	1.06 PPM	6.00	N/A	5.00	N/A
1,2,4-TRICHLOROBENZENE	1.000 PPM	N/A PPM	1.05 PPM	5.00	N/A	5.00	N/A
1,2,4-TRIMETHYLBENZENE	1.000 PPM	N/A PPM	1.06 PPM	6.00	N/A	5.00	N/A
1,2-DIBROMOETHANE	1.000 PPM	N/A PPM	1.04 PPM	4.00	N/A	5.00	N/A
1,2-DICHLOROBENZENE	1.000 PPM	N/A PPM	1.05 PPM	5.00	N/A	5.00	N/A

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1,2-DICHLOROETHANE	1.000 PPM	N/A PPM	1.04 PPM	4.00	N/A	5.00	N/A
1,2-DICHLOROPROPANE	1.000 PPM	N/A PPM	1.04 PPM	4.00	N/A	5.00	N/A
1,2-DICHLOROTETRAFLUOROETHANE	1.000 PPM	N/A PPM	1.04 PPM	4.00	N/A	5.00	N/A
1,3,5-TRIMETHYLBENZENE	1.000 PPM	N/A PPM	1.04 PPM	4.00	N/A	5.00	N/A
1,3-BUTADIENE	1.000 PPM	N/A PPM	0.96 PPM	4.00	N/A	5.00	N/A
1,3-DICHLOROBENZENE	1.000 PPM	N/A PPM	1.05 PPM	5.00	N/A	5.00	N/A
1,4-DICHLOROBENZENE	1.000 PPM	N/A PPM	1.04 PPM	4.00	N/A	5.00	N/A
2-PROPANOL	1.000 PPM	N/A PPM	1.02 PPM	2.00	N/A	5.00	N/A
3-CHLORO-1-PROPENE	1.000 PPM	N/A PPM	1.02 PPM	2.00	N/A	5.00	N/A
4-ETHYL TOLUENE	1.000 PPM	N/A PPM	0.99 PPM	1.00	N/A	5.00	N/A
ACETONE	1.000 PPM	N/A PPM	0.99 PPM	1.00	N/A	5.00	N/A
ACROLEIN	1.000 PPM	N/A PPM	1.02 PPM	2.00	N/A	5.00	N/A
BENZENE	1.000 PPM	N/A PPM	1.03 PPM	3.00	N/A	5.00	N/A
BENZYL CHLORIDE	1.000 PPM	N/A PPM	1.04 PPM	4.00	N/A	5.00	N/A
BROMODICHLOROMETHANE	1.000 PPM	N/A PPM	1.04 PPM	4.00	N/A	5.00	N/A
BROMOETHENE	1.000 PPM	N/A PPM	1.00 PPM	0.00	N/A	5.00	N/A
CARBON DISULFIDE	1.000 PPM	N/A PPM	1.03 PPM	3.00	N/A	5.00	N/A
CARBON TETRACHLORIDE	1.000 PPM	N/A PPM	1.05 PPM	5.00	N/A	5.00	N/A
CHLOROBENZENE	1.000 PPM	N/A PPM	1.02 PPM	2.00	N/A	5.00	N/A
CHLORODIBROMOMETHANE	1.000 PPM	N/A PPM	1.05 PPM	5.00	N/A	5.00	N/A
CHLOROFORM	1.000 PPM	N/A PPM	1.03 PPM	3.00	N/A	5.00	N/A
CIS-1,2-DICHLOROETHYLENE	1.000 PPM	N/A PPM	1.04 PPM	4.00	N/A	5.00	N/A
CIS-1,3-DICHLOROPROPENE	1.000 PPM	N/A PPM	1.04 PPM	4.00	N/A	5.00	N/A
CYCLOHEXANE	1.000 PPM	N/A PPM	1.03 PPM	3.00	N/A	5.00	N/A
DICHLORODIFLUOROMETHANE	1.000 PPM	N/A PPM	1.01 PPM	1.00	N/A	5.00	N/A
ETHANOL	1.000 PPM	N/A PPM	1.02 PPM	2.00	N/A	5.00	N/A
ETHYL ACETATE	1.000 PPM	N/A PPM	1.04 PPM	4.00	N/A	5.00	N/A
ETHYL CHLORIDE	1.000 PPM	N/A PPM	1.02 PPM	2.00	N/A	5.00	N/A
ETHYLBENZENE	1.000 PPM	N/A PPM	1.01 PPM	1.00	N/A	5.00	N/A
ETHYLENE 1,2 DICHLORO (TRANS)	1.000 PPM	N/A PPM	1.04 PPM	4.00	N/A	5.00	N/A
HEXACHLORO-1,3-BUTADIENE	1.000 PPM	N/A PPM	1.06 PPM	6.00	N/A	5.00	N/A
ISOOCTANE	1.000 PPM	N/A PPM	1.03 PPM	3.00	N/A	5.00	N/A
ISOPROPYL BENZENE	1.000 PPM	N/A PPM	1.04 PPM	4.00	N/A	5.00	N/A
METHACRYLIC ACID METHYL ESTER	1.000 PPM	N/A PPM	1.03 PPM	3.00	N/A	5.00	N/A
METHYL BROMIDE	1.000 PPM	N/A PPM	1.00 PPM	0.00	N/A	5.00	N/A
METHYL CHLORIDE	1.000 PPM	N/A PPM	1.02 PPM	2.00	N/A	5.00	N/A
METHYL ETHYL KETONE	1.000 PPM	N/A PPM	1.02 PPM	2.00	N/A	5.00	N/A
METHYL ISOBUTYL KETONE	1.000 PPM	N/A PPM	1.01 PPM	1.00	N/A	5.00	N/A
METHYL N-BUTYL KETONE	1.000 PPM	N/A PPM	1.01 PPM	1.00	N/A	5.00	N/A
METHYL TRIBROMIDE	1.000 PPM	N/A PPM	1.01 PPM	1.00	N/A	5.00	N/A
METHYLENE CHLORIDE	1.000 PPM	N/A PPM	1.04 PPM	4.00	N/A	5.00	N/A
M-XYLENE	1.000 PPM	N/A PPM	1.00 PPM	0.00	N/A	5.00	N/A
N-BUTANE	1.000 PPM	N/A PPM	1.02 PPM	2.00	N/A	5.00	N/A
N-HEPTANE	1.000 PPM	N/A PPM	1.03 PPM	3.00	N/A	5.00	N/A
N-HEXANE	1.000 PPM	N/A PPM	1.01 PPM	1.00	N/A	5.00	N/A
N-NONANE	1.000 PPM	N/A PPM	1.02 PPM	2.00	N/A	5.00	N/A
N-PENTANE	1.000 PPM	N/A PPM	1.00 PPM	0.00	N/A	5.00	N/A
O-CHLOROTOLUENE	1.000 PPM	N/A PPM	1.03 PPM	3.00	N/A	5.00	N/A
O-XYLENE	1.000 PPM	N/A PPM	1.03 PPM	3.00	N/A	5.00	N/A
P-DIOXANE	1.000 PPM	N/A PPM	1.05 PPM	5.00	N/A	5.00	N/A
PROPYL BENZENE	1.000 PPM	N/A PPM	1.03 PPM	3.00	N/A	5.00	N/A
PROPYLENE	1.000 PPM	N/A PPM	1.01 PPM	1.00	N/A	5.00	N/A

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P-XYLENE	1.000 PPM	N/A PPM	1.00 PPM	0.00	N/A	5.00	N/A
STYRENE	1.000 PPM	N/A PPM	1.04 PPM	4.00	N/A	5.00	N/A
TERT-BUTYL METHYL ETHER	1.000 PPM	N/A PPM	1.05 PPM	5.00	N/A	5.00	N/A
TERTIARY BUTANOL	1.000 PPM	N/A PPM	1.03 PPM	3.00	N/A	5.00	N/A
TETRACHLOROETHYLENE	1.000 PPM	N/A PPM	1.04 PPM	4.00	N/A	5.00	N/A
TETRAHYDROFURAN	1.000 PPM	N/A PPM	1.05 PPM	5.00	N/A	5.00	N/A
TOLUENE	1.000 PPM	N/A PPM	1.02 PPM	2.00	N/A	5.00	N/A
TRANS-1,3-DICHLOROPROPENE	1.000 PPM	N/A PPM	1.04 PPM	4.00	N/A	5.00	N/A
TRICHLOROETHYLENE	1.000 PPM	N/A PPM	1.03 PPM	3.00	N/A	5.00	N/A
TRICHLOROFLUOROMETHANE	1.000 PPM	N/A PPM	1.02 PPM	2.00	N/A	5.00	N/A
VINYL ACETATE	1.000 PPM	N/A PPM	0.97 PPM	3.00	N/A	5.00	N/A
VINYL CHLORIDE	1.000 PPM	N/A PPM	1.02 PPM	2.00	N/A	5.00	N/A

Instrumentation

Instrument/Model/Serial#	Last Date Calibrated	Analytical Principle
AGILENT 7890A GC-MS -- S/N CN10813101	07/11/2016	GC-MS

APPROVED BY: COLIN MCCARTY

DATE: 12Jul2016

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8.4.3 Calibration of the Carbon-Dioxide Monitor

The absolute CO_2 concentration is of less importance than the ability to measure concentration variations over time. We rely upon the specifications of the instrument from the vendor as the source of data qualification, both absolute and long term. The instrument certification is available for review upon request. To ensure that the instrument is performing within acceptable limits, an ambient air sample free from a combustion source will be monitored on a daily basis to track reproducibility. We expect the measured value to be at the currently observed CO_2 atmospheric background of ~370-385 ppm.

The instrument vendor quotes an accuracy of 1.5% of the true measured value with an RMS noise at 370 ppm with 1 second filtering at less than 1 ppm. The calibration drift is specified as the following; zero drift < 0.15 ppm/^{o}C and span drift < 0.03%/^{o}C.

9.0 MOBILE FINDINGS

There are 44 ion signals from the PTR-TOF instrument that are assigned to a total of 52 Hanford COPCs. There are more COPCs than ion signals due to the fact that some compounds are indistinguishable by the instrument. For example, 2,3-dihydrofuran and 2,5-dihydrofuran have identical spectra. In these cases, the concentration is reported as a worst case scenario of being solely from the presence of the compound with the highest toxicity (lowest OEL). Many of these ion signals have additional interfering compounds that are found in nature that elevate the predicted concentration. A listing of compounds for each of the 44 ion signals that may be potential interferences is shown in Appendix H. This is not meant to be all inclusive nor is it meant to show information that is relevant to the tank farm vapor issue. Rather, it is meant to show the broad range of compounds that contribute signals to the respective masses of interest. There are literally hundreds of compounds that may potentially interfere with the measurements. The task is to determine which compounds are actually relevant. For example, furan is a COPC with an OEL of 1.0 ppbV. The PTR-TOF detects isoprene at the same nominal mass as furan, and isoprene is known to have common biogenic sources. Despite knowing that isoprene is likely a significant contributor to the ion signal at mass 69, this ion signal is quantified as if it were pure furan to provide the most conservative measurement to ensure the safest possible interpretation of this measurement. This essentially eliminates the chance for false negative measurement but does require the reader to understand that what appears to be OEL breaches may still be safe situations for workers. This is particularly true for the COPCs with the lowest OELs; namely, the furans and nitrosamines.

Results from the mobile/stationary field work is presented in three ways within this report. First, the 44 ion signals that represent 52 COPCs are summarized in tables that show the maximum and average concentrations observed per day in the field. This is provided to show a general trend for each compound that spans many different weather and active work situations. There is also a discussion on the quantification approach for each ion signal and a discussion of possible sources, where appropriate. Situations where the OEL is exceeded are shown in red.

Individual plumes of interest are then shown in more detail. The overall amount of data created by continuous monitoring of such a duration is staggering and can pose an overwhelming challenge to interpret in a simple manner. Deconvolution and trending (i.e., identification of plume signatures) is a highly sophisticated and labor and time intensive operation, but is presented here to better understand what is considered to be the most important plumes encountered each day. Many of the most concerning plumes observed in at the tank farms have origins of combustion. As a result, interferences from the mobile lab's own generator was removed when possible. The chemical signature of the lab generator is somewhat similar to other generators found around the tank farm and at times is difficult to differentiate. The onboard diesel generator is needed for electrical support during the field campaigns[4].

Additional plots showing the daily concentration plotted with CO_2 are provided in Appendix B as a reference.

[4] The main draw on the electrical system are the air condition units in order to keep the laboratory at an operational temperature. The PTR-MS per se had only a minimal impact on the system.

9.1 MAXIMA AND AVERAGE AMOUNTS OF EACH IDENTIFIED COMPOUND OF CONCERN

Two suspect vapor signals were detected in the process of locating vapor plumes by the PTR-MS system. Air canister samples were obtained concurrent with the PTR-MS measurements. Although attempts were made to ensure collocated collection, the transient nature of the vapor plume may have resulted in a partial vapor sample, or even no vapor sample being collected in the canister that was representative of the PTR-MS signal.

Sample W606001-01 was collected during a static PTR-MS measurement located on the north side of the 244AR building. The sample was obtained on May 25, 2016 at 10:14 AM (PTR-MS cycle time; 11,190). The purpose of the first sample collection was to attempt the capture of VOCs that may be associated with an 'onion' odor that could be periodically detected by human smell. The odor was intermittent, probably due to the variability in the prevailing air movement at the site, and never reached an olfactory response that would be considered noxious.

Sample W606001-02 was obtained during a static PTR-MS measurement at the northeast corner of the 241A Evaporator Unit. This sample was collected slowly over a period of approximately 6 minutes on May 26, 2016 in the afternoon. The sample corresponds to an increase in PTR-MS signal observed at that time (PTR-MS cycle time; 30,735 – 31,110).

The samples were analyzed in accordance with EPA Compendium Method TO-15. The results of the TO-15 analyses were compared to the PTR-MS data and were used to facilitate the processing of the real-time sampling events by the PTR-MS. The reports for the two air canister samples can be found in Appendix E.

Note that later observations of the suspect 'onion' odor have been tentatively traced to the soil in the gravel drive area north of 244-AR building. Soil analyses are currently underway by WRPS personnel to determine the compound that is responsible for that particular odor, potential microbial identification, and the root-cause/effect that leads to the production of that odor. The odor is not a result of a tank farm emission.

9.1.1 Mass 31, Formaldehyde

The ion signal at nominal mass 31 atomic mass units (amu) is interpreted as protonated formaldehyde. Quantification of formaldehyde is done using the collisional ion-molecule rate constant of 2 $x10^{-9}$ cm^3s^{-1}, although quantification of formaldehyde is expected to carry the greatest uncertainty of any compound in this study. Formaldehyde is a difficult compound to quantify reliably by PTR-TOF due to ionization efficiencies that are heavily influenced by humidity in the sampled air. When air is quite dry, such as less than 20% humidity, the quantification of formaldehyde is reasonable and sensitivity can be acceptable down to about 1 ppbV. Once the humidity increases the sensitivity drops considerably and in a non-linear fashion. To report formaldehyde concentrations with confidence the sample needs to be dried to eliminate this humidity dependence, or you must calibrate based on humidity and apply a dynamic calibration factor throughout your data. Taking extensive measures to ensure a quality formaldehyde measurement was beyond the scope of this work. As a result, formaldehyde was going to be omitted from this report. However, upon interrogation of the ion signal at mass 31 it is clear that over short durations when the humidity is relatively stable you can draw anecdotal conclusions about the presence of formaldehyde from a source. The quantification reported, however, may have errors of up to 300%, especially in air masses with mid or high humidity where the reported concentration would be too low.

Table 9-1 summarizes the maximum and average concentrations observed during the initial four weeks of mobile/stationary monitoring. The OEL of formaldehyde is 300 ppbV, which is never exceeded.

Table 9-1. Daily maximum and Average Concentrations, Formaldehyde

Date	Max (ppbV)	Average (ppbV)
5/18/2016	8	2
6/20/2016	10	3
6/22/2016	5	2
6/23/2016	15	2
6/27/2016	8	2
6/28/2016	2	1
6/29/2016	14	2
6/30/2016	4	1
7/5/2016	10	1
7/6/2016	4	1
7/11/2016	5	1
7/13/2016	4.0	1.8
7/14/2016	4.5	1.8
7/18/2016	4.8	1.9

Daily maximum and average concentrations in ppbV for formaldehyde. Formaldehyde is a COPC with an OEL of 300 ppbV.

9.1.2 Mass 33, Methanol

The ion signal at nominal mass 33 amu is interpreted as protonated methanol. There are no known interfering hydrocarbons at this nominal mass. Quantification of methanol is done using the ion-molecule rate constant of 2.69 $x10^{-9}$ cm^3s^{-1}. Methanol is a common atmospheric compound with background concentrations ranging from 4-40 ppbV in the Columbia Basin. There can be significant biogenic and anthropogenic sources depending on the geographical location and time of year. In this study, we perform background subtraction and report a concentration of methanol that exceeds the typical background rather than an absolute concentration. Methanol is known to be present at high concentrations in some waste tanks at Hanford.

Table 9-2**Error! Reference source not found.** Summarizes the maximum and average concentrations observed during the initial four weeks of mobile/stationary monitoring. The OEL of methanol is 200,000 ppbV, which is never exceeded, even considering an additional background concentration of 40 ppbV.

Table 9-2. Daily maximum and Average Concentrations, Methanol

Date	Max (ppbV)	Average (ppbV)
5/18/2016	192	4.3
6/20/2016	10.2	4.1
6/22/2016	20.5	4.3
6/23/2016	37.0	4.7
6/27/2016	96.8	6.2
6/28/2016	78.0	2.9
6/29/2016	19.8	4.7
6/30/2016	17.1	5.0
7/5/2016	40.8	3.6
7/6/2016	9.01	3.4
7/11/2016	23.0	3.6
7/13/2016	255	3.6
7/14/2016	191	5.0
7/18/2016	28.7	3.8

Daily maximum and average concentrations in ppbV for methanol. Methanol is a COPC with an OEL of 200,000 ppbV.

9.1.3 Mass 42, Acetonitrile

The ion signal at nominal mass 42 amu is interpreted as protonated acetonitrile. It is quantified using an ion-molecule rate constant of 4.74 $x10^{-9}$ cm^3s^{-1}. Acetonitrile is commonly produced during biomass burning events, but is also used as a solvent. Local or regional wildfires may elevate the background concentration of acetonitrile. Local point sources are expected to be from workers smoking cigarettes, solvent use and waste tank emissions.

Table 9-3 summarizes the maximum and average concentrations observed during the four weeks of mobile/stationary monitoring. The OEL of acetonitrile is 20,000 ppbV, which is never exceeded; in actuality, the maximum recorded amount during the campaigns was below 0.01% of this limit.

Table 9-3. Daily Maximum and Average Concentrations, Acetonitrile

Date	Max (ppbV)	Average (ppbV)
5/18/2016	1.1	0.3
6/20/2016	0.4	0.2
6/22/2016	0.6	0.2
6/23/2016	0.8	0.3
6/27/2016	1.7	0.2
6/28/2016	0.5	0.1
6/29/2016	0.6	0.2
6/30/2016	1.3	0.2
7/5/2016	0.5	0.3
7/6/2016	0.4	0.3
7/11/2016	1.0	0.2
7/13/2016	1.0	0.2
7/14/2016	0.7	0.2
7/18/2016	0.5	0.2

Daily maximum and average concentrations in ppbV for acetonitrile. Acetonitrile is a COPC with an OEL of 20,000 ppbV.

9.1.4 Mass 45, Acetaldehyde

The ion signal at nominal mass 45 amu is interpreted as protonated acetaldehyde. Known interfering compounds at this mass include a fragment from ethylene glycol and high levels of CO_2. Ethylene glycol is used in some coolants and can be observed from overheated engines. CO_2 can contribute ion signal through an endothermic charge transfer within a differential pumping region of the PTR-TOF instrument to form the HCO_2^+ ion. Laboratory testing showed that this contributed an acetaldehyde signal of roughly 1 ppbV for every 1 ppmV of CO_2 present. This is a small enough interference that it is ignored in this work. The mass 45 ion signal is quantified assuming it is entirely made up of acetaldehyde using the ion-molecule rate constant of 3.36 $x10^{-9}$ cm^3s^{-1}. Acetaldehyde is a COPC and will also be found in exhaust throughout the tank farms.

Table 9-4 summarizes the maximum and average concentrations observed during the four weeks of mobile/stationary monitoring. The OEL of acetaldehyde is 25,000 ppbV, which is never exceeded; in actuality, the maximum recorded amount during the campaigns was below 0.2% of this limit.

Table 9-4. Daily Maximum and Average Concentrations, Acetaldehyde.

Date	Max (ppbV)	Average (ppbV)
5/18/2016	11.9	1.3
6/20/2016	8.35	2.7
6/22/2016	8.29	4.7
6/23/2016	47.0	2.3
6/27/2016	10.7	0.9
6/28/2016	3.84	1.3
6/29/2016	5.48	1.3
6/30/2016	23.6	0.9
7/5/2016	3.59	1.1
7/6/2016	8.11	0.9
7/11/2016	5.13	0.8
7/13/2016	9.92	0.8
7/14/2016	3.31	1.0
7/18/2016	3.57	0.9

Daily maximum and average concentrations in ppbV for acetaldehyde. Acetaldehyde is a COPC with an OEL of 25,000 ppbV.

9.1.5 Mass 46, Ethylamine

The ion signal at nominal mass 46 amu is interpreted as protonated ethylamine. Ethylamine appears in many combustion plumes and is quantified using an ion-molecule rate constant of 1.97 $x10^{-9}$ cm^3s^{-1}.

Table 9-5 summarizes the maximum and average concentrations observed during the four weeks of mobile/stationary monitoring. The OEL of ethylamine is 5,000 ppbV, which is never exceeded; in actuality, the maximum recorded amount during the campaigns was below 0.6% of this limit.

Table 9-5. Daily Maximum and Average Concentrations, Ethylamine.

Date	Max (ppbV)	Average (ppbV)
5/18/2016	16.2	1.7
6/20/2016	7.7	3.3
6/22/2016	4.1	1.5
6/23/2016	4.8	1.5
6/27/2016	13.6	3.8
6/28/2016	7.3	1.2
6/29/2016	26.7	1.8
6/30/2016	3.0	1.4
7/5/2016	4.4	1.4
7/6/2016	2.9	1.2
7/11/2016	2.9	1.1
7/13/2016	3.6	1.2
7/14/2016	2.6	1.3
7/18/2016	3.0	1.3

Daily maximum and average concentrations in ppbV for ethylamine. Ethylamine is a COPC with an OEL of 5,000 ppbV.

9.1.6 Mass 55, 1,3-Butadiene.

The ion signal at nominal mass 55 amu is interpreted as 1,3-butadiene. A large background ion signal is observed at mass 55 from the second hydration of hydronium ions in the ion source. This background is very sensitive to humidity, with higher humidity greatly increasing the background ion signal. The background is estimated each day and subtracted to try to provide a reasonable worst case possibility for 1,3-Butadiene above ambient concentration. It is quantified using the collisional ion-molecule rate constant of 2 $x10^{-9}$ cm^3s^{-1}. These results should be carefully interpreted, however, since a sharp change in humidity (such as an exhaust plume or someone's breath) would produce a false positive for the presence of 1,3-butadiene. 1,3-butadiene is a colorless gas with a gasoline-like odor. The main sources are combustion engines, forest fires, and cigarette smoke, but it is also produced in manufacturing of, e.g., rubber or resins.

Table 9-6 summarizes the maximum and average concentrations observed during the four weeks of mobile/stationary monitoring. The OEL of 1,3-butadiene is 1,000 ppbV, which is never exceeded; in actuality, the maximum recorded amount during the campaigns was below 1.5% of this limit.

Table 9-6. Daily Maximum and Average Concentrations, 1,3-Butadiene.

Date	Max (ppbV)	Average (ppbV)
5/18/2016	6.7	3.0
6/20/2016	4.8	1.8
6/22/2016	5.7	3.2
6/23/2016	5.8	2.3
6/27/2016	7.9	2.1
6/28/2016	6.4	2.4
6/29/2016	7.9	3.7
6/30/2016	10.3	3.6
7/5/2016	8.3	5.2
7/6/2016	8.9	5.4
7/11/2016	6.5	4.0
7/13/2016	6.2	4.3
7/14/2016	5.9	3.1
7/18/2016	14.9	7.1

Daily maximum and average concentrations in ppbV for 1,3-butadiene. 1,3-Butadiene is a COPC with an OEL of 1,000 ppbV .

9.1.7 Mass 56, Propanenitrile

The ion signal at nominal mass 56 amu is interpreted as propanenitrile. It is quantified using the collisional ion-molecule rate constant of 2 $x10^{-9}$ cm^3s^{-1}. Propanenitrile, also known as propionitrile or ethyl cyanide, is a solvent that is produced in the chemical industry, either as a byproduct or an educt in processing. Vapors have a sweet odor and creep along the surface due to their density.

Table 9-7 summarizes the maximum and average concentrations observed during the four weeks of mobile/stationary monitoring. The OEL of propanenitrile is 6,000 ppbV, which is never exceeded; in actuality, the maximum recorded amount during the campaigns was below 0.1% of this limit. Table 9-7. Daily Maximum and Average Concentrations, Propanenitrile.

Date	Max (ppbV)	Average (ppbV)
5/18/2016	2.5	0.6
6/20/2016	2.8	1.2
6/22/2016	0.9	0.6
6/23/2016	0.9	0.5
6/27/2016	3.6	0.9
6/28/2016	1.1	0.2
6/29/2016	1.1	0.5
6/30/2016	1.0	0.6
7/5/2016	1.1	0.7
7/6/2016	1.1	0.7
7/11/2016	1.8	0.6
7/13/2016	0.8	0.5
7/14/2016	1.0	0.5
7/18/2016	0.6	0.4

Daily maximum and average concentrations in ppbV for propanenitrile. Propanenitrile is a COPC with an OEL of 6,000 ppbV.

9.1.8 Mass 57, 1-Butanol; Butenes

The ion signal at nominal mass 57 amu is interpreted as the sum of 1-butanol and the butene isomers. Quantification is done using the ion-molecule rate constant of 1-butanol, 2.16 $x10^{-9}$ cm^3s^{-1}, since it is a COPC and the butenes are not. 1-Butanol is a product of natural and anthropogenic sources. Natural contributions come from animal waste or composting, human sources include mostly volatilization of solvents within surface coatings and an intermittent product in the manufacturing of, e.g., adhesives, building materials, fertilizers and others. Butene isomers are primarily used as additives to gasoline and are highly volatile.

Table 9-8 summarizes the maximum and average concentrations observed during the four weeks of mobile/stationary monitoring. The OEL of 1-butanol is 20,000 ppbV, which is never exceeded; in actuality, the maximum recorded amount during the campaigns was below 0.2% of this limit.

Table 9-8. Daily Maximum and Average Concentrations, 1-Butanol; Butenes.

Date	Max (ppbV)	Average (ppbV)
5/18/2016	25.6	0.6
6/20/2016	6.9	2.2
6/22/2016	11.0	3.7
6/23/2016	6.6	1.6
6/27/2016	14.7	0.5
6/28/2016	9.8	0.7
6/29/2016	8.6	1.3
6/30/2016	3.2	0.5
7/5/2016	3.4	0.6
7/6/2016	2.6	0.5
7/11/2016	11.6	0.5
7/13/2016	4.0	0.5
7/14/2016	5.9	0.5
7/18/2016	2.7	0.6

Daily maximum and average concentrations in ppbV for the sum of 1-butanaol and the butenes. 1-Butanol is a COPC with an OEL of 20,000 ppbV.

9.1.9 Mass 58, Methyl isocyanate

The ion signal at nominal mass 58 amu is interpreted as methyl isocyanate. It is quantified using the collisional ion-molecule rate constant of 2 $x10^{-9}$ cm^3s^{-1}. Methyl isocyanate is an intermittent product in the manufacturing processes of pesticides, rubber and adhesives.

Table 9-9 summarizes the maximum and average concentrations observed during the four weeks of mobile/stationary monitoring. The OEL of methyl isocyanate is 20 ppbV, which is never exceeded; in actuality, the maximum recorded amount during the campaigns was below 7.5% of this limit.

Table 9-9. Daily Maximum and Average Concentrations, Methyl isocyanate

Date	Max (ppbV)	Average (ppbV)
5/18/2016	1.5	0.4
6/20/2016	0.8	0.4
6/22/2016	1.0	0.5
6/23/2016	0.9	0.5
6/27/2016	1.1	0.3
6/28/2016	0.6	0.2
6/29/2016	0.9	0.3
6/30/2016	0.6	0.3
7/5/2016	0.8	0.5
7/6/2016	0.7	0.4
7/11/2016	1.0	0.4
7/13/2016	0.7	0.4
7/14/2016	0.8	0.4
7/18/2016	0.6	0.4

Daily maximum and average concentrations in ppbV for methyl isocyanate. Methyl isocyanate is a COPC with an OEL of 20 ppbV.

9.1.10 Mass 62, Methyl nitrite

The ion signal at nominal mass 62 amu is interpreted as methyl nitrite. It is quantified using the collisional ion-molecule rate constant of 2 $x10^{-9}$ cm^3s^{-1}. Methyl nitrite is a byproduct of combustion of gasoline and can be produced by the reaction of NOx with methanol and is a key component in the formation of ozone.

Table 9-10 summarizes the maximum and average concentrations observed during the four weeks of mobile/stationary monitoring. The OEL of methyl nitrite is 100 ppbV, which is never exceeded; in actuality, the maximum recorded amount during the campaigns was below 2.7% of this limit.

Table 9-10. Daily Maximum and Average Concentrations, Methyl nitrite.

Date	Max (ppbV)	Average (ppbV)
5/18/2016	2.1	0.4
6/20/2016	1.0	0.3
6/22/2016	1.8	0.5
6/23/2016	2.2	0.5
6/27/2016	2.2	0.3
6/28/2016	0.5	0.2
6/29/2016	2.0	0.4
6/30/2016	0.7	0.3
7/5/2016	1.0	0.4
7/6/2016	0.9	0.4
7/11/2016	2.7	0.4
7/13/2016	1.1	0.3
7/14/2016	1.8	0.4
7/18/2016	1.6	0.4

Daily maximum and average concentrations in ppbV for methyl nitrite. Methyl nitrite is a COPC with an OEL of 100 ppbV.

9.1.11 Mass 69, Furans and isoprene

The ion signal at nominal mass 69 amu is interpreted as the sum of furan and isoprene in this work. High concentrations of isoprene are released by some tree and shrub species during daylight hours. There are no significant isoprene sources known near the tank farms although there are significant emitters 30 miles to the east. Isoprene is oxidized and destroyed within a few hours, depending on atmospheric conditions. An elevated and fluctuating background signal at mass 69 is expected from natural isoprene emission and destruction, likely with diurnal patterns that reach maximum concentrations in afternoon hours. Since isoprene is of no concern from a safety perspective, this mass was interpreted to be furan only. It is quantified using furan's reaction rate constant of 1.7 $x10^{-9}$ cm^3s^{-1} and should be interpreted as a worst case scenario of being pure furan without isoprene present.

Table 9-11 summarizes the maximum and average concentrations observed during the four weeks of mobile/stationary monitoring. The OEL of furan is 1.0 ppbV, which is exceeded on a handful of plumes throughout the four weeks. Individual plumes are interrogated in the next section.

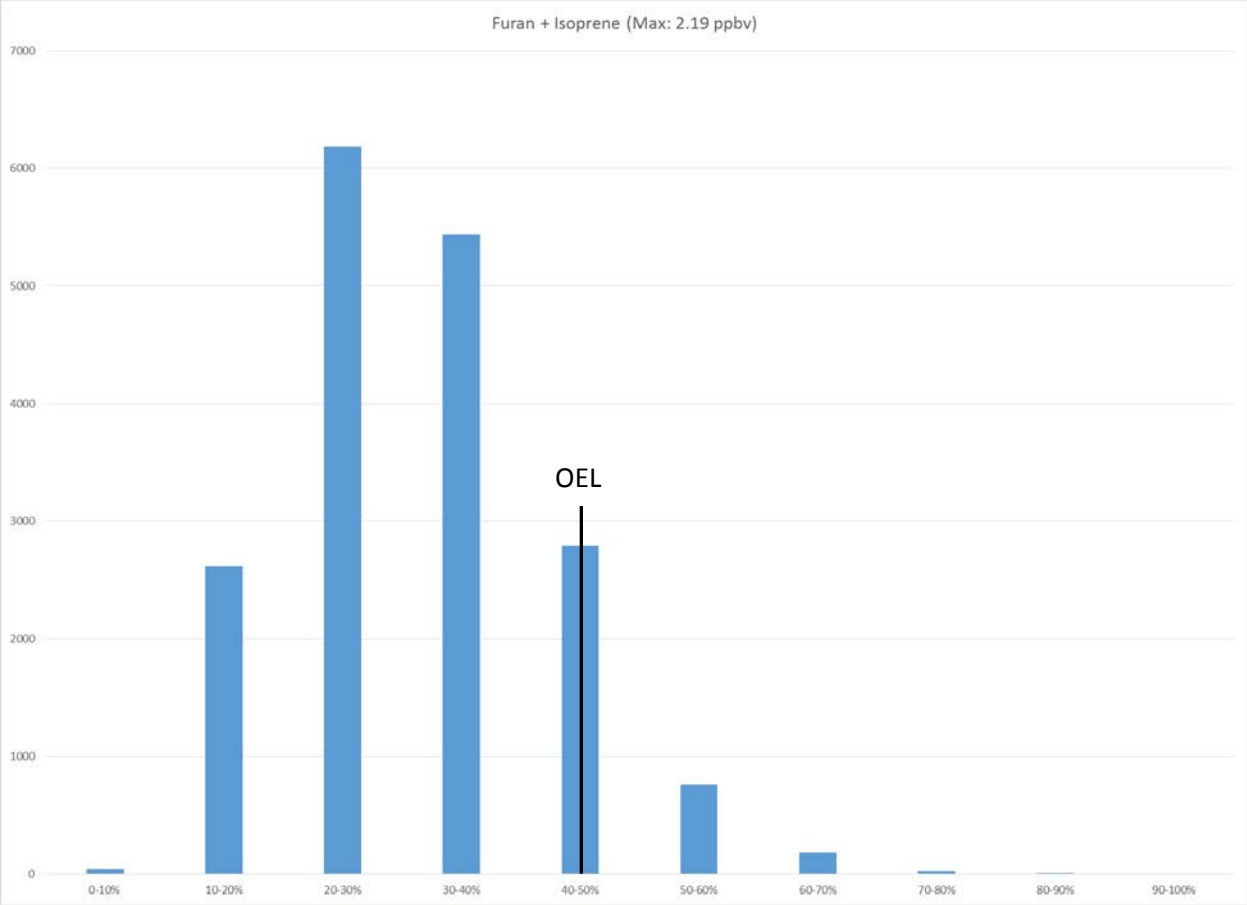
Table 9-11. Daily Maximum and Average Concentrations, Furans and isoprene.

Date	Max (ppbV)	Average (ppbV)
5/18/2016	**4.2**	0.5
6/20/2016	0.7	0.3
6/22/2016	**1.7**	0.6
6/23/2016	**1.6**	0.5
6/27/2016	**2.8**	0.3
6/28/2016	**2.1**	0.4
6/29/2016	**2.2**	0.7
6/30/2016	**3.5**	0.3
7/5/2016	**1.1**	0.5
7/6/2016	0.9	0.4
7/11/2016	**2.0**	0.4
7/13/2016	**1.3**	0.4
7/14/2016	**1.5**	0.4

Daily maximum and average concentrations in ppbV for the sum of furan and isoprene. Furan is a COPC with an OEL of 1.0 ppbV. Numbers in red and bold exceed the OEL.

Figure 9.1.11-1 represents the histogram of the furan/isoprene data collected in 200-E area on June 29, 2016. The data approaches a Gaussian distribution which suggests that there is a constant distribution of the measured signal throughout the measurement period. This is an indication that the measured material is not from random plumes but from a constant background.

Figure 9.1.11-1. Histogram of the furan/isoprene data from June 29, 2016.



The data suggest that signal assigned to furan exceeds the OEL on numerous occasions. The data, obtained from a non-Hanford monitoring location east of Pasco, WA, also show levels of furan that exceed the OEL. The plots in Figures 9.1.11-2 and 9.1.11-3 show the measured furan/isoprene signals at two different times, 6 PM to 10 PM on August 5, 2016 and 12 AM to 8 AM on August 7, 2016. In both cases, the level of furan (ppbv) approaches or exceeds the OEL for a significant period of time. On both days, it is believed that this signal is due to ambient levels of isoprene or other interfering compounds.

Figure 9.1.11-21. The temporal profile of furan relation signals from a data set obtained on August 5, 2016 at a non-Hanford location east of Pasco.

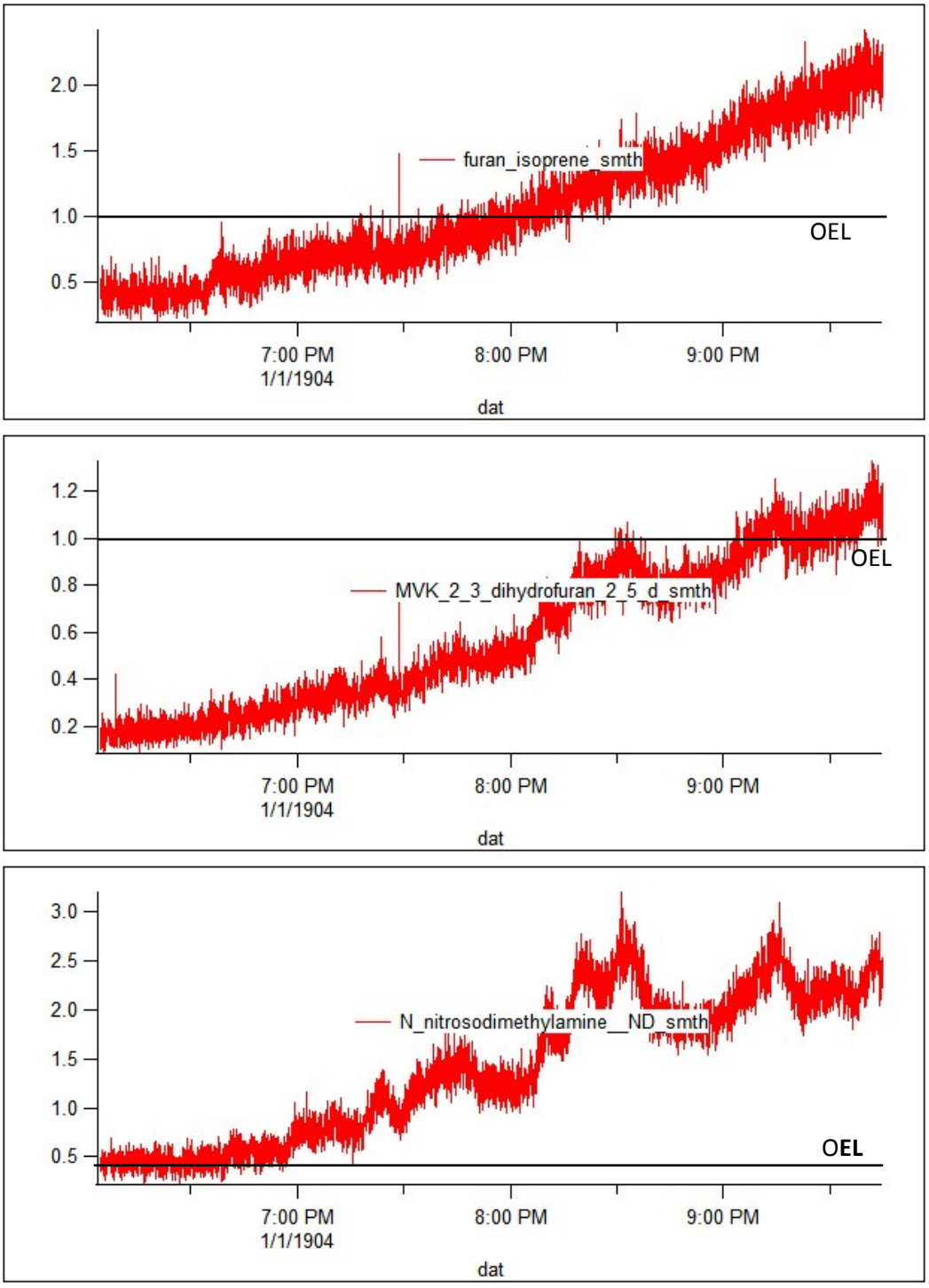
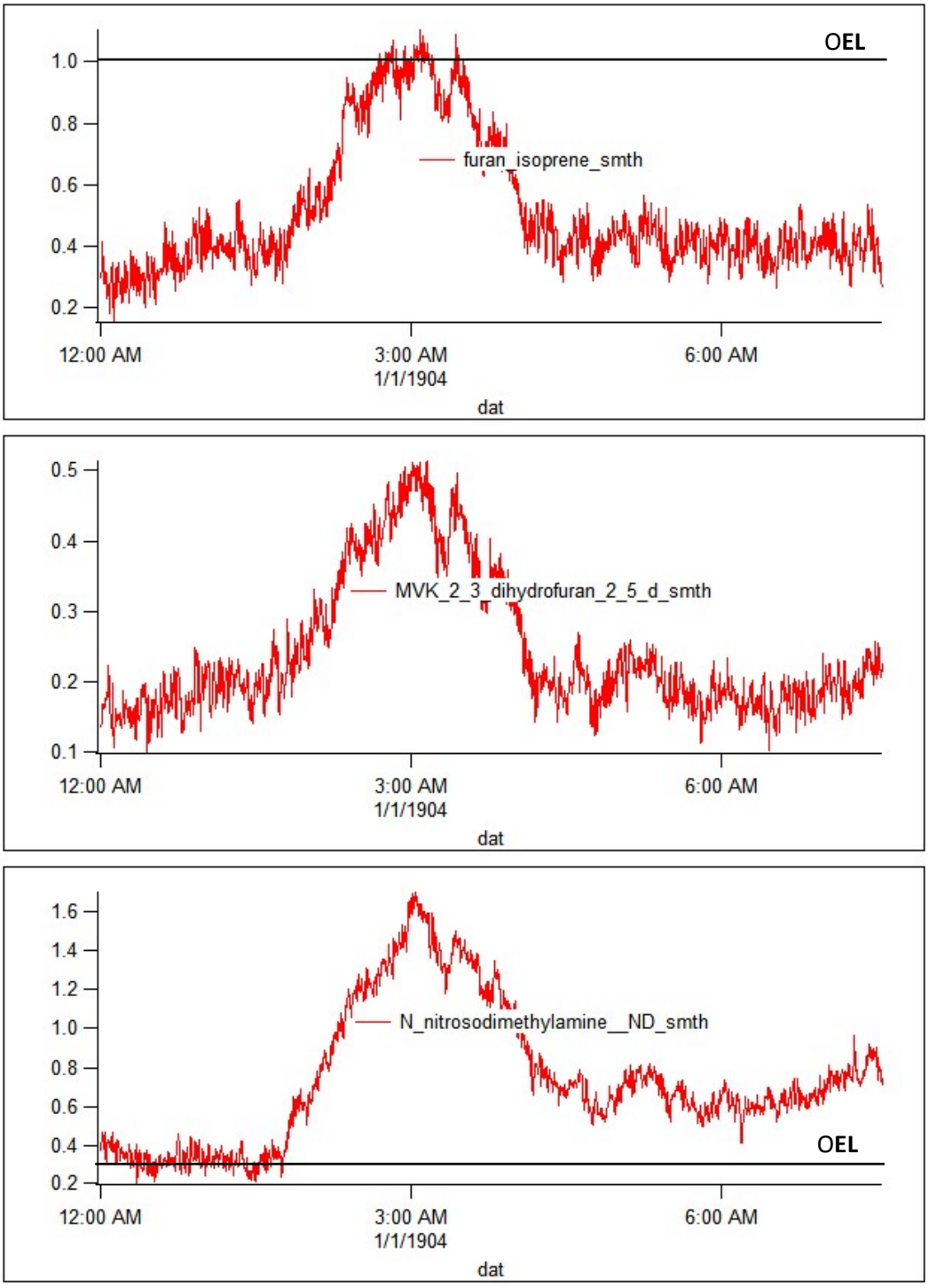


Figure 9.1.11-3. The temporal profile of furan relation signals from a data set obtained on August 7, 2016 at a non-Hanford location east of Pasco.



9.1.12 Mass 70, Butanenitrile

The ion signal at nominal mass 70 amu is interpreted as butanenitrile. It is quantified using the collisional ion-molecule rate constant of 2 $x10^{-9}$ cm^3s^{-1}. Also known as 1-cyano propane, it is used in the manufacturing of drugs. It is colorless and has a sharp suffocating odor, due to the formation of cyanides when inhaled.

Table 9-12 summarizes the maximum and average concentrations observed during the four weeks of mobile/stationary monitoring. The OEL of butanenitrile is 8000 ppbV, which is never exceeded; in actuality, the maximum recorded amount during the campaigns was below 0.05% of this limit.

Table 9-12. Daily Maximum and Average Concentrations, Butanenitrile.

Date	Max (ppbV)	Average (ppbV)
5/18/2016	1.3	0.3
6/20/2016	0.3	0.2
6/22/2016	0.6	0.3
6/23/2016	0.5	0.3
6/27/2016	0.7	0.2
6/28/2016	0.5	0.1
6/29/2016	0.6	0.2
6/30/2016	0.4	0.2
7/5/2016	0.5	0.3
7/6/2016	0.5	0.3
7/11/2016	0.7	0.3
7/13/2016	0.5	0.3
7/14/2016	0.5	0.3
7/18/2016	0.5	0.3

Daily maximum and average concentrations in ppbV for butanenitrile. Butanenitrile is a COPC with an OEL of 8000 ppbV.

9.1.13 Mass 71, Methylvinylketone (MVK, 3-buten-2-one), 2,3-Dihydrofuran and 2,5-Dihydrofuran

The ion signal at nominal mass 71 amu is interpreted as the combined signal of 3-buten-2-one (MVK), 2,3-Dihydrofuran and 2,5-Dihydrofuran. MVK is an oxidation product of isoprene and is expected to be observed in ambient air measurements. Therefore, the ion signal at mass 71 was quantified using the ion-molecule rate constant of MVK which is 4.1 $x10^{-9}$ cm^3s^{-1}. All three of these compounds are COPCs with the two dihydrofuran compounds posing a greater health risk.

Table 9-13 summarizes the maximum and average concentrations observed during the four weeks of mobile/stationary monitoring. The OEL of MVK is 200 ppbV, the OELs for the dihydrofurans are 1 ppbV, respectively. The signals from the three compounds are indistinguishable with the current instrument. Several days had plume maxima that exceeded the 1 ppbV OEL for the dihydrofurans. Individual plumes are interrogated in the next section.

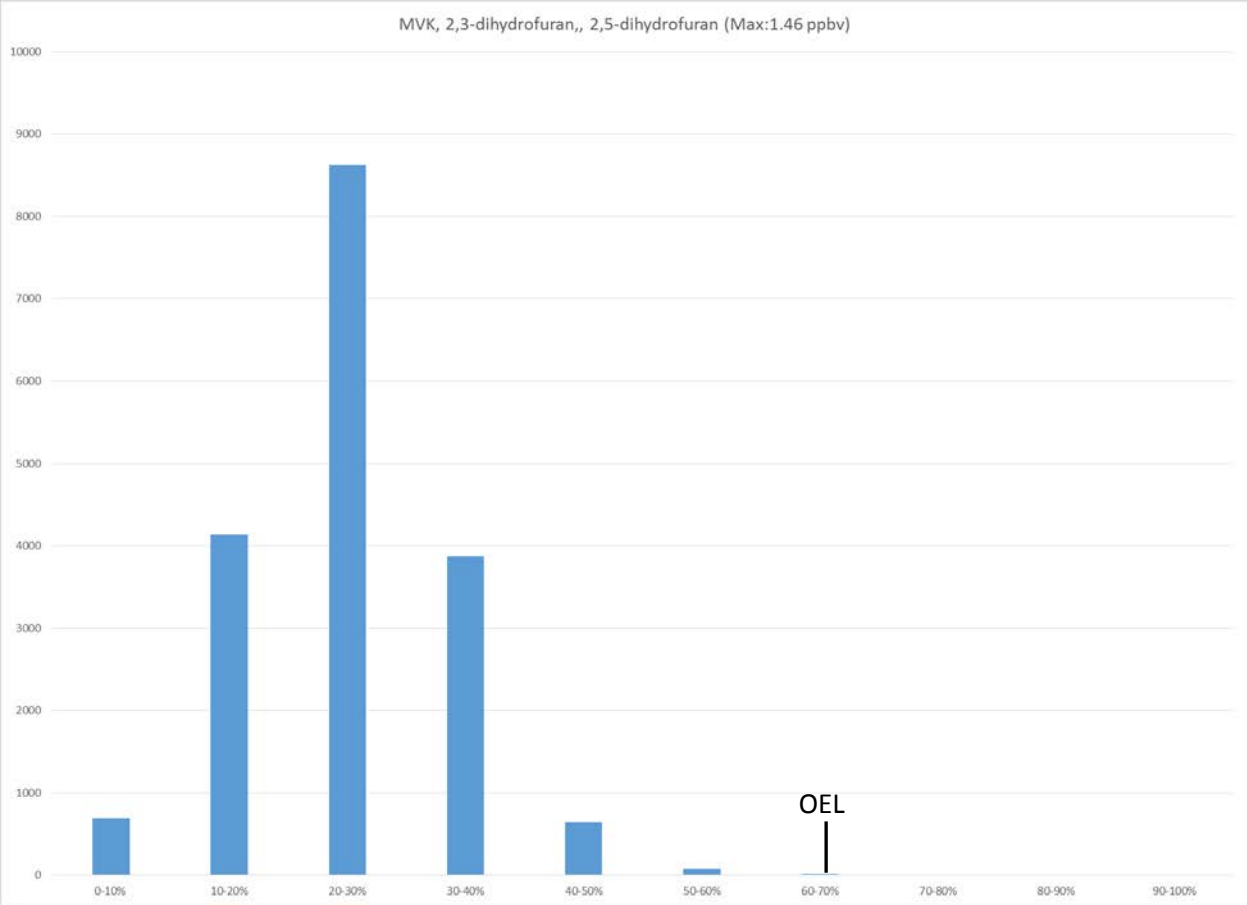
Table 9-13. Daily Maximum and Average Concentrations, Methylvinylketyone (MVK), 2,3-Dihyudrofuran, and 2.5-Dihydrofuran.

Date	Max (ppbV)	Average (ppbV)
5/18/2016	**5.3**	0.2
6/20/2016	0.4	0.1
6/22/2016	**1.1**	0.2
6/23/2016	**1.1**	0.2
6/27/2016	**1.7**	0.2
6/28/2016	**1.9**	0.2
6/29/2016	**1.5**	0.4
6/30/2016	**1.3**	0.2
7/5/2016	0.7	0.2
7/6/2016	0.6	0.2
7/11/2016	**6.1**	0.2
7/13/2016	0.8	0.2
7/14/2016	**1.2**	0.2
7/18/2016	0.5	0.2

Daily maximum and average concentrations in ppbV for MVK, 2,3-DIhydrofuran and 2,5-Dihydrofuran. The three are COPCs with the lowest OEL being 1 ppbV. Numbers in red and bold exceed the OEL.

Figure 9.1.13-1 represents the histogram of the Methylvinylketyone (MVK), 2,3-Dihyudrofuran, and 2.5-Dihydrofuran. data collected in 200-E area on June 29, 2016. The data approaches a Gaussian distribution which suggests that there is a constant distribution of the measured signal throughout the measurement period. This is an indication that the measured material is not from random plumes but from a constant background.

Figure 9.1.13-1. Histogram of the Methylvinylketyone (MVK), 2,3-Dihyudrofuran, and 2.5-Dihydrofuran. data from June 29, 2016.



9.1.14 Mass 73, Butanal

The ion signal at nominal mass 73 amu is interpreted as butanal. It is quantified using an ion-molecule rate constant of 3.11 $x10^{-9}$ cm^3s^{-1}. Also known as butyraldehyde, it has a pungent odor due to the formation of butyric acid in air. It is used in the food and flavor industry and in the drug industry.

Table 9-14 summarizes the maximum and average concentrations observed during the four weeks of mobile/stationary monitoring. The OEL of butanal is 25,000 ppbV, which is never exceeded; in actuality, the maximum recorded amount during the campaigns was below 0.05% of this limit.

Table 9-14. Daily Maximum and Average Concentrations, Butanal.

Date	Max (ppbV)	Average (ppbV)
5/18/2016	2.1	0.4
6/20/2016	1.0	0.3
6/22/2016	1.8	0.5
6/23/2016	2.2	0.5
6/27/2016	2.2	0.3
6/28/2016	0.5	0.2
6/29/2016	2.0	0.4
6/30/2016	0.7	0.3
7/5/2016	1.0	0.4
7/6/2016	0.9	0.4
7/11/2016	2.7	0.4
7/13/2016	1.1	0.3
7/14/2016	1.8	0.4
7/18/2016	1.6	0.4

Daily maximum and average concentrations in ppbV for butanal. Butanal is a COPC with an OEL of 25,000 ppbV.

9.1.15 Mass 75, N-nitrosodimethylamine

The ion signal at nominal mass 75 amu is interpreted as N-nitrosodimethylamine (NDMA). It is quantified using the collisional ion-molecule rate constant of 2 x10^{-9} cm^3s^{-1}. NDMA is an odorless compound and is highly unstable in air breaking down rapidly in sunlight. It can be found in consumer products as well as a byproduct of pesticides and disinfection of wastewater. It is highly toxic to the liver.

Table 9-15 summarizes the maximum and average concentrations observed during the four weeks of mobile/stationary monitoring. The OEL of NDMA is 0.3 ppbV, which is exceeded even on average every day, in some instances up to 20 fold throughout the four weeks. It is likely that an unidentified compound is interfering with this ion signal to obstruct the actual concentration of NDMA at any given time. One possible interfering compound could be protonated methyl acetate ($C_3H_6O_2H^+$). Individual plumes are interrogated in the next section.

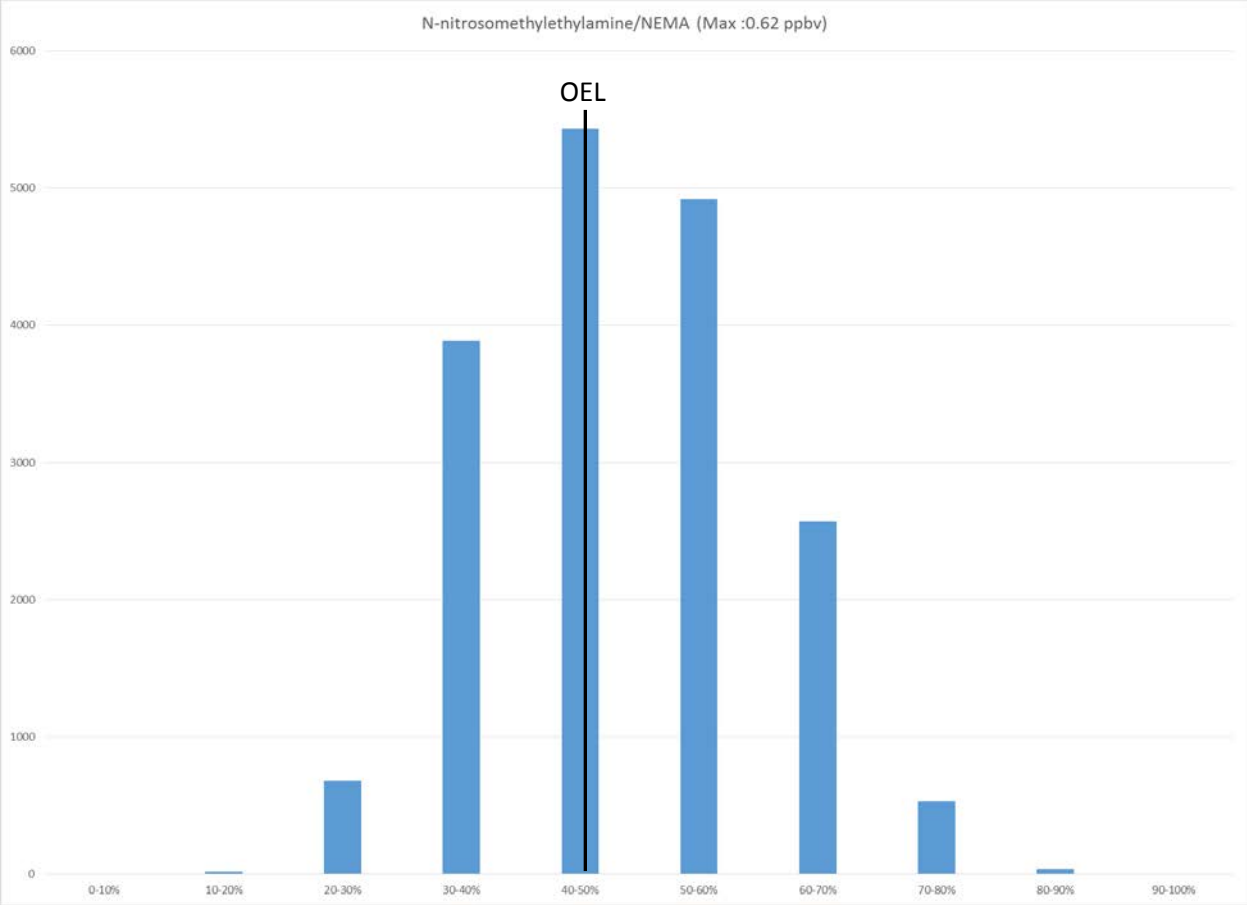
Table 9-15. Daily Maximum and Average Concentrations, N-nitrosodimethylamine.

Date	Max (ppbV)	Average (ppbV)
5/18/2016	**0.9**	**0.5**
6/20/2016	**7.0**	**2.1**
6/22/2016	**6.5**	**3.7**
6/23/2016	**5.7**	**1.5**
6/27/2016	**0.5**	**0.3**
6/28/2016	**0.9**	**0.4**
6/29/2016	**0.8**	**0.5**
6/30/2016	**0.7**	**0.4**
7/5/2016	**0.9**	**0.5**
7/6/2016	**0.8**	**0.4**
7/11/2016	**0.7**	**0.4**
7/13/2016	**0.6**	**0.4**
7/14/2016	**0.8**	**0.4**
7/18/2016	**0.6**	**0.4**

Daily maximum and average concentrations in ppbV for NDMA. NDMA is a COPC with an OEL of 0.3 ppbV.

The figure 9.1.15-1 represents the histogram of the NDMA data collected in 200-E area on June 29, 2016. The data approaches a Gaussian distribution which suggests that there is a constant distribution of the measured signal throughout the measurement period. This is an indication that the measured material is not from random plumes but from a constant background.

Figure 9.1.15-1. The histogram of the NDMA data collected in 200-E area on June 29, 2016.



As with the data set shown for furan in Section 9.1.11, we can compare observed NDMA results from measurements at the Hanford Site to those from non-Hanford related sources. The data in Figures 9.1.11-2 and 9.1.11-3 contain plots of signals assigned to NDMA. In both cases, the observed signal intensity exceeds the OEL for NDMA for a considerable portion of the monitoring period. These signals are believed to be associated with other compounds in the background environment and not NDMA. This may also be expected of the signals observed in the Hanford Site data.

Listed below is a sampling of the many compounds that may provide interfering signals at the same nominal mass of NDMA. The data come from the Wiley™ mass spectral database.

1-Carbahexaborane
Acetic acid, oxo-
Hydrazinecarboximidamide
Acetic acid, hydrazide
Methyl urea
Dimethyl diazene
Glycinamide hydrochloride
Glycinamide

o-Methylisourea
1-Methyl-3(-(15)N)-urea
Ethyl boronic acid
Dimethoxyborane
3-Chloro-1-propyne
1,2-Propadiene
Acryloyl fluoride
Propanoic acid

Methyl acetate
Ethyl formate
Hydroxypropionaldehyde
Methoxy acetaldehyde
1-Hydroxy-2-propanone
Oxiranemethanol
1,2-Dioxolane
1,3-Dioxolane
Oxiranemethanol
1-Propene-1-thiol
2-Propene-1-thiol
Propylene sulfide
Trimethylene sulfide
2-Propanethione
Methyl vinyl sulfide

1,2-Propanediamine
1-3-Propanediamine
N-Methyl-1,2-ethanediamine
Propyl hydrazine
1-Methylethyl-hydrazine
Trimethyl hydrazine
Trimethyl silane
2-Fluoro-2-butene
1-Propyl-methylether
2-Propyl-methylether
2-Butanol
2-Methyl-1-propanol
2-Methyl-2-propanol
2-Methoxy-propane
Diethylether

9.1.16 Mass 79, Benzene

The ion signal at nominal mass 79 amu is interpreted as benzene. Quantification is done using the ion-molecule rate constant of 1.92 $x10^{-9}$ cm^3s^{-1}. Possible interferences can arise from fragmentation of alkylated benzenes, such as ethyl benzene. Most of these compounds would have similar sources so the influence of these fragmentations is likely to be the minority contributor to this ion signal. Benzene is a natural part of crude oil, thus a component in gasoline. The primary exposure to benzene is from cigarette smoke or gasoline fuel (combustion or evaporation).

Table 9-16 summarizes the maximum and average concentrations observed during the four weeks of mobile/stationary monitoring. The OEL of benzene is 500 ppbV, which is never exceeded; in actuality, the maximum recorded amount during the campaigns was below 2.4% of this limit.

Table 9-16. Daily Maximum and Average Concentrations, Benzene.

Date	Max (ppbV)	Average (ppbV)
5/18/2016	11.6	0.4
6/20/2016	2.8	0.2
6/22/2016	6.0	0.3
6/23/2016	1.7	0.3
6/27/2016	10.5	0.2
6/28/2016	5.6	0.1
6/29/2016	5.5	0.3
6/30/2016	1.7	0.2
7/5/2016	1.7	0.3
7/6/2016	1.2	0.3
7/11/2016	4.9	0.3
7/13/2016	6.0	0.3
7/14/2016	3.6	0.3
7/18/2016	0.9	0.3

Daily maximum and average concentrations in ppbV for benzene. Benzene is a COPC with an OEL of 500 ppbV

9.1.17 Mass 80, Pyridine and 2,4-pentadienenitrile

The ion signal at nominal mass 80 amu is interpreted as the sum of pyridine and 2,4-Pentadienenitrile. It is quantified using the collisional ion-molecule rate constant of 2 $x10^{-9}$ cm^3s^{-1}. Pyridine is a major raw material in the chemical industry. It is mostly used in pesticide production and has an unpleasant odor.

Table 9-17 summarizes the maximum and average concentrations observed during the four weeks of mobile/stationary monitoring. High C-13 isotope from benzene to the mass 80 signal could be falsely interpreted as pyridine or 2,4-pentdienenitrile, if present at high concentration. The expected contribution of the C-13 isotope from benzene to the mass 80 signal is approximately 6-7% of the mass 79 signal. The OEL of pyridine is 1000 ppbV and 2,4-pentadienenitrile is 300 ppbV, which is never exceeded; in actuality, the maximum recorded amount during the campaigns was below 0.4% of 2,4-pentadienenitrile's OEL.

Table 9-17. Daily Maximum and Average Concentrations.

Date	Max (ppbV)	Average (ppbV)
5/18/2016	1.0	0.3
6/20/2016	0.3	0.1
6/22/2016	0.6	0.2
6/23/2016	0.5	0.3
6/27/2016	0.8	0.2
6/28/2016	0.4	0.1
6/29/2016	0.6	0.2
6/30/2016	0.4	0.2
7/5/2016	0.5	0.3
7/6/2016	0.5	0.2
7/11/2016	0.5	0.3
7/13/2016	0.6	0.2
7/14/2016	0.5	0.2
7/18/2016	0.4	0.3

Daily maximum and average concentrations in ppbV for pyridine and 2,4-pentadienenitrile. Pyridine and 2,4-pentadienenitrile are COPCs with OELs of 1000 ppbV and 300 ppbV, respectively.

9.1.18 Mass 82, 2-methylene butanenitrile

The ion signal at nominal mass 82 amu is interpreted as 2-methylene butanenitrile. It is quantified using the collisional ion-molecule rate constant of 2 $x10^{-9}$ cm^3s^{-1}. This compound is industrially used as a biocatalyst. There is no known biogenic source.

Table 9-18 summarizes the maximum and average concentrations observed during the four weeks of mobile/stationary monitoring. The OEL of 2-methylene butanenitrile is 30 ppbV, which is never exceeded; in actuality, the maximum recorded amount during the campaigns was below 1.7% of this limit.

Table 9-18. Daily Maximum and Average Concentrations, 2-Methylene Butanenitrile.

Date	Max (ppbV)	Average (ppbV)
5/18/2016	0.5	0.3
6/20/2016	0.3	0.1
6/22/2016	0.5	0.2
6/23/2016	0.5	0.2
6/27/2016	0.3	0.2
6/28/2016	0.2	0.1
6/29/2016	0.4	0.2
6/30/2016	0.4	0.2
7/5/2016	0.4	0.3
7/6/2016	0.4	0.3
7/11/2016	0.5	0.3
7/13/2016	0.4	0.2
7/14/2016	0.4	0.2
7/18/2016	0.5	0.3

Daily maximum and average concentrations in ppbV for 2-methylene butanenitrile. 2-methylene butanenitrile is a COPC with an OEL of 30 ppbV.

9.1.19 Mass 83, 2-methylfuran

The ion signal at nominal mass 83 amu is interpreted as 2-methyfuran. It is quantified using the collisional ion-molecule rate constant of 2 x10^{-9} cm^3s^{-1}. With a specific chocolate odor, it is used as a flavoring agent, but also in the chemical manufacturing of pharmaceuticals and agricultural products. It is naturally part of myrtle and lavender.

Table 9-19 summarizes the maximum and average concentrations observed during the four weeks of mobile/stationary monitoring. The OEL of 2-methylfuran is 1 ppbV, which is exceeded in plumes on occasion throughout the field campaign. A potential interfering compound at this ion signal could be hexanal. Individual plumes are interrogated in the next section.

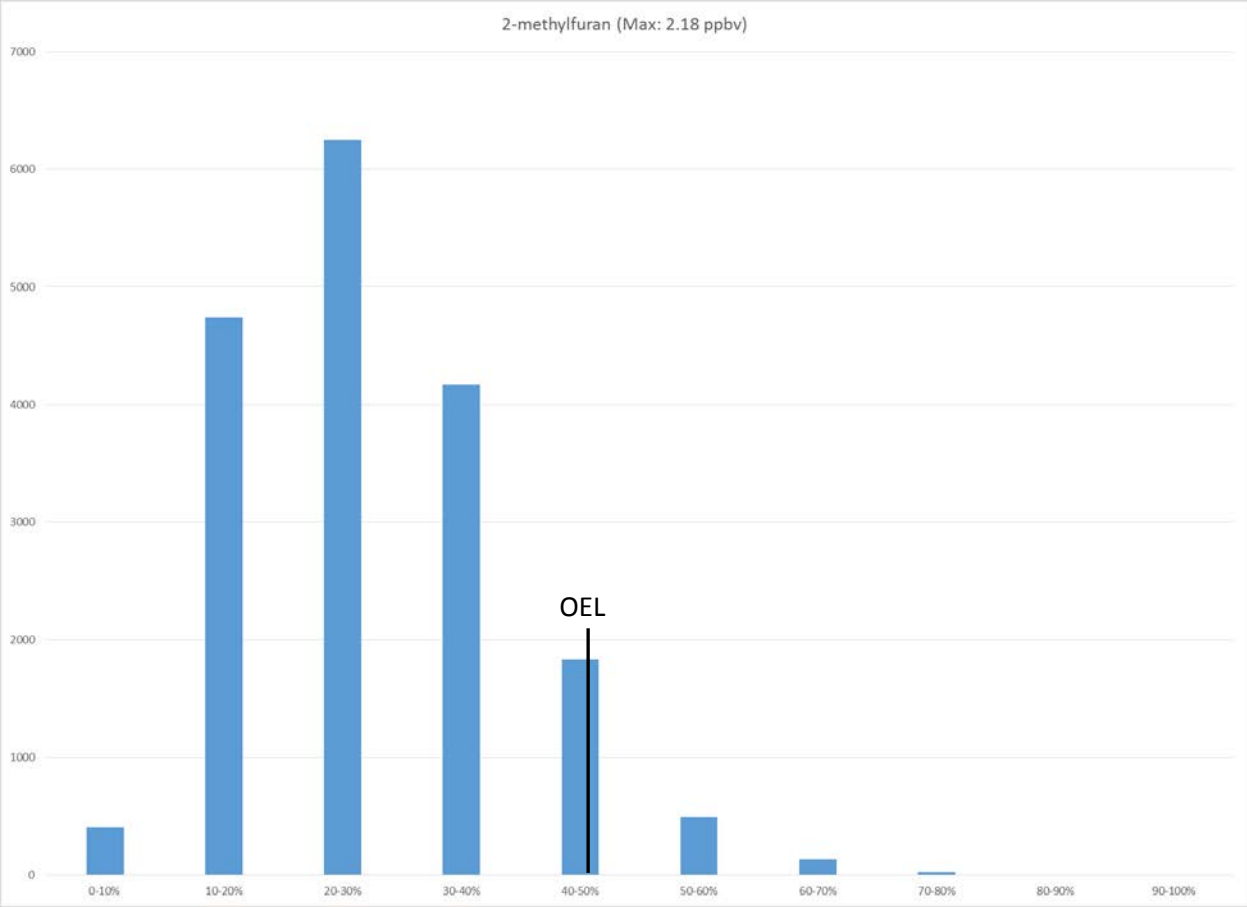
Table 9-19. Daily Maximum and Average Concentrations, 2-Methylfuran.

Date	Max (ppbV)	Average (ppbV)
5/18/2016	**3.2**	0.4
6/20/2016	0.5	0.2
6/22/2016	**1.4**	0.5
6/23/2016	**1.1**	0.4
6/27/2016	**1.4**	0.2
6/28/2016	**1.4**	0.3
6/29/2016	**2.2**	0.6
6/30/2016	**1.3**	0.3
7/5/2016	0.9	0.4
7/6/2016	0.7	0.3
7/11/2016	**1.5**	0.3
7/13/2016	0.8	0.3
7/14/2016	0.9	0.3
7/18/2016	0.5	0.3

Daily maximum and average concentrations in ppbV for 2-methylfuran. 2-methylfuran is a COPC with an OEL of 1 ppbV.

The figure 9.1.19-1 represents the histogram of the 2-methylfuran data collected in 200-E area on June 29, 2016. The data approaches a Gaussian distribution which suggests that there is a constant distribution of the measured signal throughout the measurement period. This is an indication that the measured material is not from random plumes but from a constant background.

Figure 9.1.19-1. The histogram of the 2-methylfuran data collected in 200-E area on June 29, 2016.



9.1.20 Mass 84, pentanenitrile

The ion signal at nominal mass 84 amu is interpreted as pentanenitrile. It is quantified using the collisional ion-molecule rate constant of 2 $x10^{-9}$ cm^3s^{-1}. It is used in organic syntheses as an intermediate product and has no known biogenic sources.

Table 9-20 summarizes the maximum and average concentrations observed during the four weeks of mobile/stationary monitoring. The OEL of pentanenitrile is 6000 ppbV, which is never exceeded; in actuality, the maximum recorded amount during the campaigns was below 0.01% of this limit.

Table 9-20. Daily Maximum and average Concentrations, Pentanenitrile.

Date	Max (ppbV)	Average (ppbV)
5/18/2016	0.6	0.3
6/20/2016	0.3	0.1
6/22/2016	0.5	0.3
6/23/2016	0.6	0.3
6/27/2016	0.3	0.2
6/28/2016	0.2	0.1
6/29/2016	0.5	0.2
6/30/2016	0.4	0.2
7/5/2016	0.5	0.3
7/6/2016	0.5	0.3
7/11/2016	0.5	0.3
7/13/2016	0.4	0.2
7/14/2016	0.5	0.2
7/18/2016	0.4	0.3

Daily maximum and average concentrations in ppbV for pentanenitrile. Pentanenitrile is a COPC with an OEL of 6000 ppbV.

9.1.21 Mass 85, 3-methyl-3-buten-2-one and 2-methyl-2-butenal

The ion signal at nominal mass 85 amu is interpreted as 3-methyl-3-buten-2-one and 2-methyl-2-butenal. Quantification of this ion signal is done using the collisional ion-molecule rate constant of 2 $x10^{-9}$ cm^3s^{-1}. 3-methyl-3-buten-2-one is an irritant if inhaled and an intermediate product in the chemical industry. 2-methyl-2-butenal is a food and flavor industry ingredient and used in organic syntheses.

Table 9-21 summarizes the maximum and average concentrations observed during the four weeks of mobile/stationary monitoring. The OEL of 3-methyl-3-buten-2-one and 2-methyl-2-butenal is 20 ppbV, which is never exceeded; in actuality, the maximum recorded amount during the campaigns was below 20% of this limit.

Table 9-21. Daily maximum and average concentrations in ppbV for 3-methyl-3-buten-2-one and 2-methyl-2-butenal. 3-methyl-3-buten-2-one and 2-methyl-2-butenal are COPCs with an OEL of 20 ppbV.

Date	Max (ppbV)	Average (ppbV)
5/18/2016	3.9	0.4
6/20/2016	0.4	0.2
6/22/2016	1.1	0.4
6/23/2016	1.0	0.4
6/27/2016	1.2	0.3
6/28/2016	1.9	0.2
6/29/2016	1.3	0.5
6/30/2016	0.8	0.3
7/5/2016	0.7	0.4
7/6/2016	0.6	0.4
7/11/2016	3.0	0.3
7/13/2016	0.8	0.3
7/14/2016	1.0	0.3
7/18/2016	0.5	0.3

9.1.22 Mass 89, N-nitrosomethylethylamine (NMEA)

The ion signal at nominal mass 89 amu is interpreted as N-nitrosomethylethylamine (NMEA). NMEA is one of the nitrosamines that can be found in water treatment systems; it also has been identified in processed food and tobacco smoke. Quantification of NMEA is done using the collisional ion-molecule rate constant of 2 $x10^{-9}$ cm^3s^{-1}.

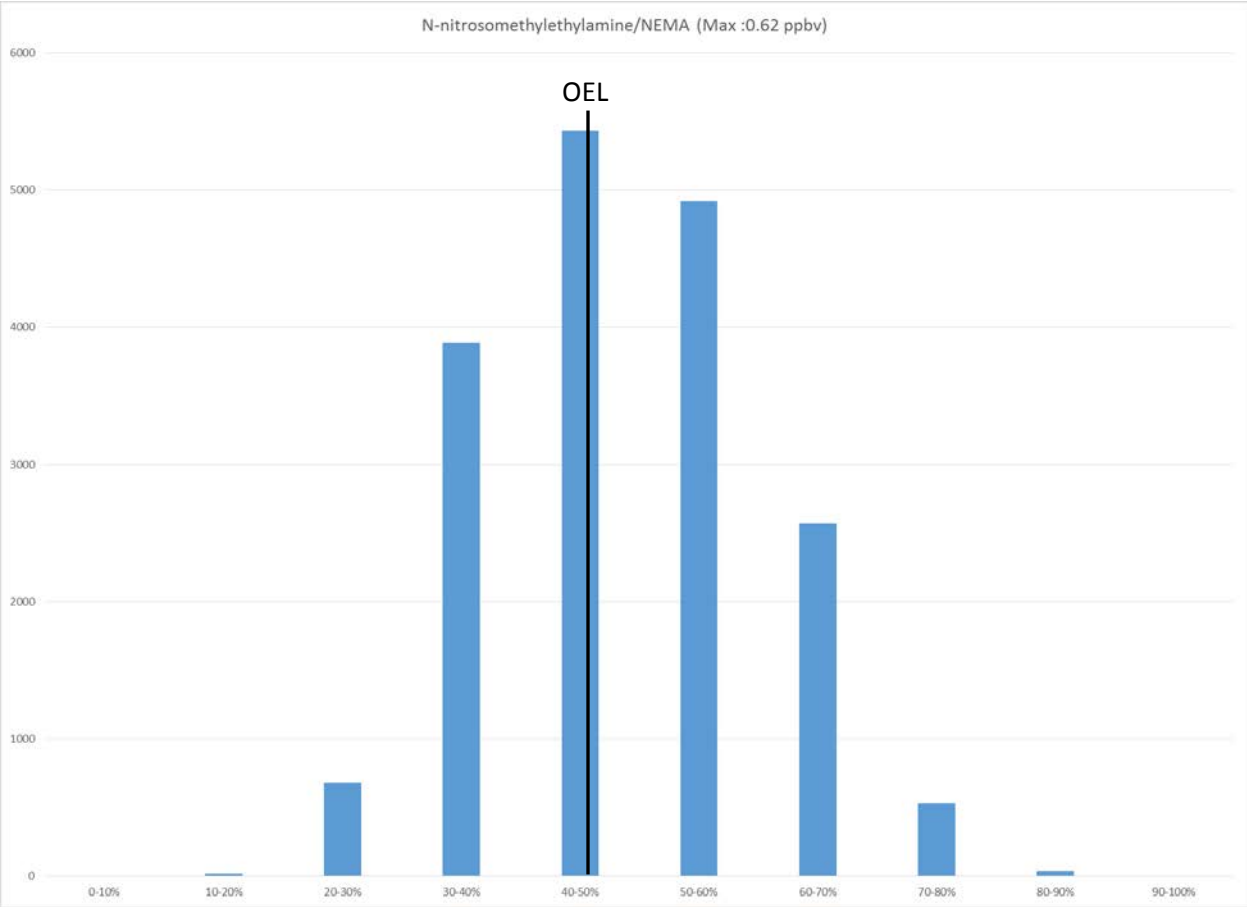
Table 9-22 summarizes the maximum and average concentrations observed during the four weeks of mobile/stationary monitoring The OEL of NMEA is 0.3 ppbV, which is exceeded on every day throughout the four weeks with several days having an average above the OEL. Individual plumes are interrogated in the next section. It is important to note that these concentrations are the highest possible for NMEA and ignore potential interferences from other compounds that may produce ion signal at mass 89, such as the four carbon esters (ethyl acetate).

Table 9-22. Daily maximum and average concentrations in ppbV for NMEA. NMEA is a COPC with an OEL of 0.3 ppbV.

Date	Max (ppbV)	Average (ppbV)
5/18/2016	**0.6**	**0.4**
6/20/2016	**0.5**	**0.3**
6/22/2016	**0.7**	**0.4**
6/23/2016	**0.7**	**0.4**
6/27/2016	**0.4**	0.2
6/28/2016	**0.6**	0.2
6/29/2016	**0.6**	**0.3**
6/30/2016	**0.5**	**0.3**
7/5/2016	**0.7**	**0.4**
7/6/2016	**0.7**	**0.4**
7/11/2016	**0.6**	**0.4**
7/13/2016	**0.5**	**0.3**
7/14/2016	**0.5**	**0.3**
7/18/2016	**0.4**	0.2

The figure 9.1.22-1 represents the histogram of the NMEA data collected in 200-E area on June 29, 2016. The data approaches a Gaussian distribution which suggests that there is a constant distribution of the measured signal throughout the measurement period. This is an indication that the measured material is not from random plumes but from a constant background.

Figure 9.1.22-1. The histogram of the NMEA data collected in 200-E area on June 29, 2016.



9.1.23 Mass 97, 2,5-dimethylfuran

The ion signal at nominal mass 97 amu is interpreted as 2,5-dimethylfuran. Quantification of 2,5-dimethylfuran is done using the collisional ion-molecule rate constant of 2 x10^{-9} cm^3s^{-1}.

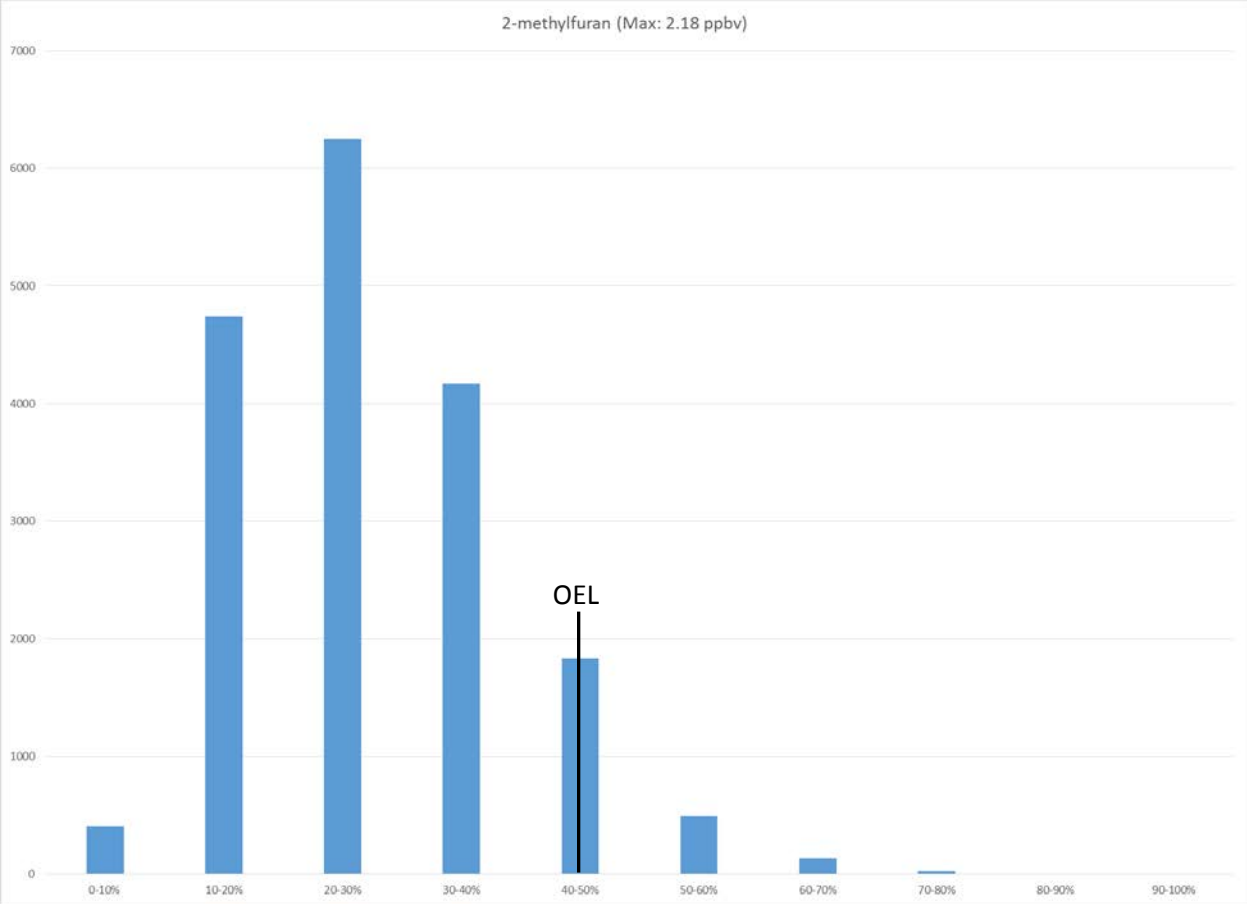
Table 9-23 summarizes the maximum and average concentrations observed during the four weeks of mobile/stationary monitoring The OEL of 2,5-dimethylfuran is 1 ppbV, which is exceeded on many days throughout the four weeks. Individual plumes are interrogated in the next section. Potential interfering compounds at mass 97 could be heptanal and furfural.

Table 9-23. Daily maximum and average concentrations in ppbV for 2,5-dimethylfuran. 2,5-dimethylfuran is a COPC with an OEL of 1 ppbV.

Date	Max (ppbV)	Average (ppbV)
5/18/2016	**2.7**	0.3
6/20/2016	0.4	0.2
6/22/2016	**1.4**	0.4
6/23/2016	0.8	0.3
6/27/2016	**1.1**	0.2
6/28/2016	**1.2**	0.2
6/29/2016	**1.6**	0.5
6/30/2016	0.8	0.3
7/5/2016	0.8	0.4
7/6/2016	0.7	0.3
7/11/2016	**1.0**	0.3
7/13/2016	0.8	0.3
7/14/2016	0.7	0.3
7/18/2016	0.4	0.3

The figure 9.1.23-1 represents the histogram of the 2,5-dimethylfuran data collected in 200-E area on June 29, 2016. The data approaches a Gaussian distribution which suggests that there is a constant distribution of the measured signal throughout the measurement period. This is an indication that the measured material is not from random plumes but from a constant background.

Figure 9.1.23-1. The histogram of the 2,5-dimethylfuran data collected in 200-E area on June 29, 2016.



9.1.24 Mass 98, Hexanenitrile

The ion signal at nominal mass 98 amu is interpreted as Hexanenitrile. Quantification of hexanenitrile is done using the collisional ion-molecule rate constant of 2 $x10^{-9}$ cm^3s^{-1}.

Table 9-24 summarizes the maximum and average concentrations observed during the four weeks of mobile/stationary monitoring. The OEL of hexanenitrile is 6000 ppbV, which is never exceeded; in actuality, the maximum recorded amount during the campaigns was below 0.01% of this limit.

Table 9-24. Daily maximum and average concentrations in ppbV for hexanenitrile. Hexanenitrile is a COPC with an OEL of 6000 ppbV.

Date	Max (ppbV)	Average (ppbV)
5/18/2016	0.6	0.3
6/20/2016	0.3	0.1
6/22/2016	0.5	0.3
6/23/2016	0.5	0.3
6/27/2016	0.3	0.2
6/28/2016	0.3	0.1
6/29/2016	0.4	0.2
6/30/2016	0.4	0.2
7/5/2016	0.4	0.3
7/6/2016	0.4	0.3
7/11/2016	0.4	0.3
7/13/2016	0.4	0.2
7/14/2016	0.4	0.2
7/18/2016	0.4	0.2

9.1.25 Mass 101, 2-Hexanone (MBK)

The ion signal at nominal mass 101 amu is interpreted as 2-Hexanone, also known as Methyl butyl ketone (MBK). MBK is a normally used as a solvent in paints and synthetic resin. It has an acetone-like, sharp odor. Quantification of MBK is done using the collisional ion-molecule rate constant of 2 $x10^{-9}$ cm^3s^{-1}.

Table 9-25 summarizes the maximum and average concentrations observed during the four weeks of mobile/stationary monitoring. The OEL of MBK is 5000 ppbV, which is never exceeded; in actuality, the maximum recorded amount during the campaigns was below 0.02% of this limit.

Table 9-25. Daily maximum and average concentrations in ppbV for MBK. MBK is a COPC with an OEL of 5000 ppbV.

Date	Max (ppbV)	Average (ppbV)
5/18/2016	1.0	0.6
6/20/2016	0.6	0.3
6/22/2016	1.0	0.5
6/23/2016	0.9	0.5
6/27/2016	0.4	0.3
6/28/2016	0.6	0.3
6/29/2016	0.8	0.4
6/30/2016	0.7	0.3
7/5/2016	0.9	0.5
7/6/2016	0.8	0.4
7/11/2016	0.6	0.4
7/13/2016	0.5	0.3
7/14/2016	0.6	0.3
7/18/2016	0.4	0.2

9.1.26 Mass 103, N-nitrosodiethylamine (NDEA)

The ion signal at nominal mass 103 amu is interpreted as N-nitrosodiethylamine (NDEA). NDEA is one of the nitrosamines currently monitored at the tank farms. Quantification of NDEA is done using the collisional ion-molecule rate constant of 2 $x10^{-9}$ cm^3s^{-1}.

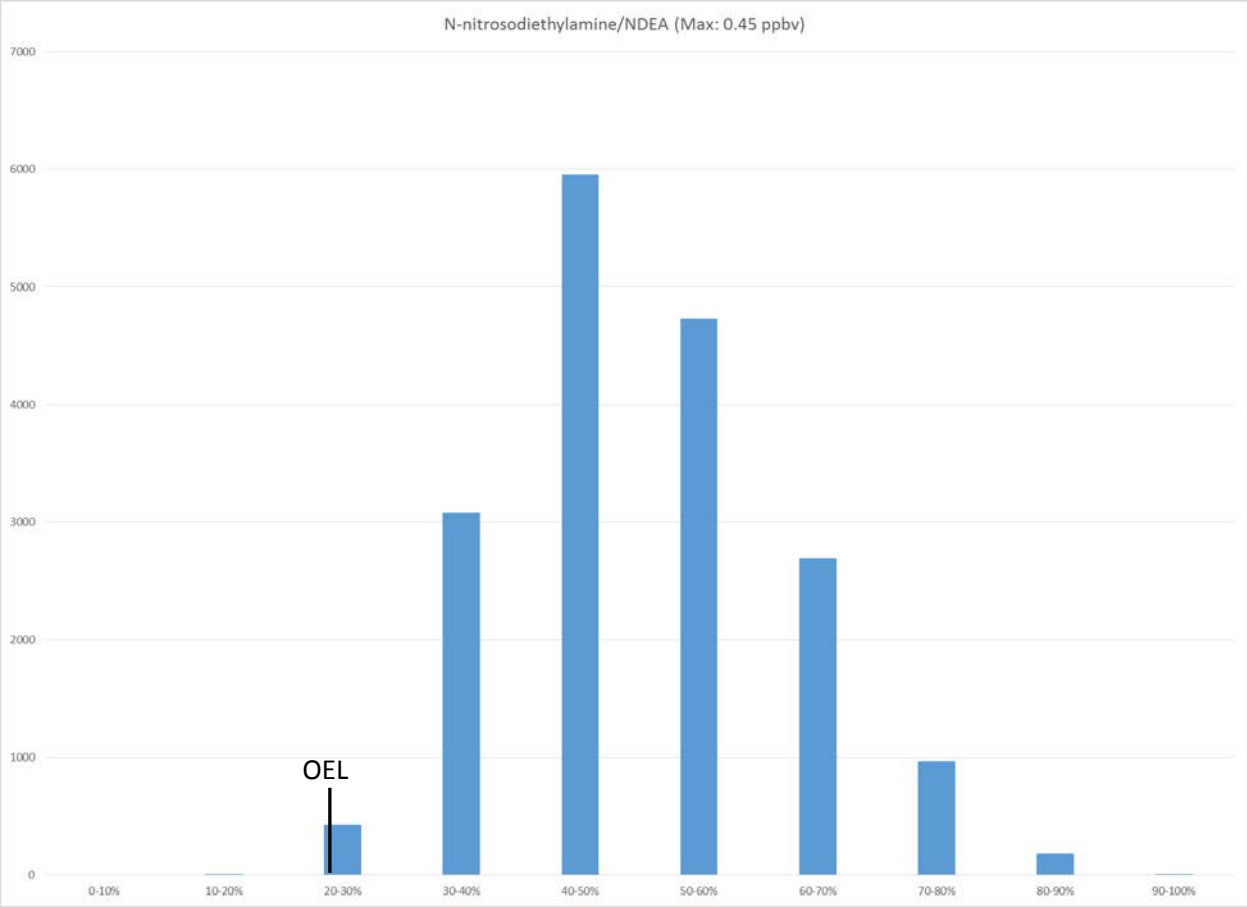
Table 9-26 summarizes the maximum and average concentrations observed during the four weeks of mobile/stationary monitoring. The OEL of NDEA is 0.1 ppbV, which is exceeded as the average on every day throughout the four weeks. Individual plumes are interrogated in the next section. Potential interfering compounds at mass 103 includes a number of esters and methacryloyl peroxynitrate (MPAN).

Table 9-26. Daily maximum and average concentrations in ppbV for NDEA. NDEA is a COPC with an OEL of 0.1 ppbV.

Date	Max (ppbV)	Average (ppbV)
5/18/2016	**0.5**	**0.3**
6/20/2016	**0.4**	**0.2**
6/22/2016	**0.6**	**0.3**
6/23/2016	**0.6**	**0.3**
6/27/2016	**0.4**	**0.2**
6/28/2016	**0.4**	**0.1**
6/29/2016	**0.4**	**0.2**
6/30/2016	**0.5**	**0.2**
7/5/2016	**0.5**	**0.3**
7/6/2016	**0.5**	**0.3**
7/11/2016	**0.5**	**0.3**
7/13/2016	**0.4**	**0.2**
7/14/2016	**0.4**	**0.3**
7/18/2016	**0.4**	**0.2**

The figure 9.1.26-1 represents the histogram of the NDEA data collected in 200-E area on June 29, 2016. The data approaches a Gaussian distribution which suggests that there is a constant distribution of the measured signal throughout the measurement period. This is an indication that the measured material is not from random plumes but from a constant background.

Figure 9.1.26-1. The histogram of the NDEA data collected in 200-E area on June 29, 2016.



9.1.27 Mass 104, Butyl nitrite and 2-nitro-2-methylpropane

The ion signal at nominal mass 104 amu is interpreted as the sum of butyl nitrite and 2-nitro-2-methylpropane. Quantification of this ion signal is done using the collisional ion-molecule rate constant of 2 $x10^{-9}$ cm^3s^{-1}.

Table 9-27 summarizes the maximum and average concentrations observed during the four weeks of mobile/stationary monitoring. The OEL of butyl nitrite is 100 ppbV and 2-nitro-2-methylpropane is 30 ppbV, which is never exceeded; in actuality, the maximum recorded amount during the campaigns was below 1.8% of this limit.

Table 9-27. Daily maximum and average concentrations in ppbV for the sum of butyl nitrite and 2-nitro-2-methylpropane. Butyl nitrite and 2-nitro-2-methylpropane are COPCs with an OEL of 100 and 30 ppbV.

Date	Max (ppbV)	Average (ppbV)
5/18/2016	0.5	0.3
6/20/2016	0.3	0.2
6/22/2016	0.4	0.2
6/23/2016	0.4	0.2
6/27/2016	0.5	0.2
6/28/2016	0.2	0.1
6/29/2016	0.4	0.2
6/30/2016	0.4	0.2
7/5/2016	0.5	0.3
7/6/2016	0.4	0.2
7/11/2016	0.5	0.3
7/13/2016	0.5	0.2
7/14/2016	0.4	0.2
7/18/2016	0.4	0.2

9.1.28 Mass 108, 2,4-dimethylpyridine

The ion signal at nominal mass 108 amu is interpreted as 2,4-dimethylpyridine. 2,4-dimethylpyridine, also known as 2.4-Lutidine, is a naturally occurring compound with a nutty odor (if highly diluted). Quantification of 2,4-dimethylpyridine is done using the collisional ion-molecule rate constant of 2 $x10^{-9}$ cm^3s^{-1}.

Table 9-28 summarizes the maximum and average concentrations observed during the four weeks of mobile/stationary monitoring. The OEL of 2,4-dimethylpyridine is 500 ppbV, which is never exceeded; in actuality, the maximum recorded amount during the campaigns was below 0.9% of this limit.

Table 9-28. Daily maximum and average concentrations in ppbV for 2,4-dimethylpyridine. 2,4-dimethylpyridine is a COPC with an OEL of 500 ppbV.

Date	Max (ppbV)	Average (ppbV)
5/18/2016	4.1	0.3
6/20/2016	0.7	0.2
6/22/2016	0.9	0.3
6/23/2016	0.5	0.3
6/27/2016	1.8	0.3
6/28/2016	1.5	0.1
6/29/2016	1.5	0.3
6/30/2016	1.2	0.3
7/5/2016	0.7	0.4
7/6/2016	0.7	0.4
7/11/2016	0.7	0.4
7/13/2016	0.9	0.3
7/14/2016	0.9	0.3
7/18/2016	0.4	0.2

9.1.29 Mass 111, 2-propylfuran and 2-ethyl-5-methylfuran

The ion signal at nominal mass 111 amu is interpreted as the sum of 2-propylfuran and 2-ethyl-5-methylfuran. Both compounds are used in the chemical industry. Quantification of this ion signal is done using the collisional ion-molecule rate constant of 2 $x10^{-9}$ cm^3s^{-1}.

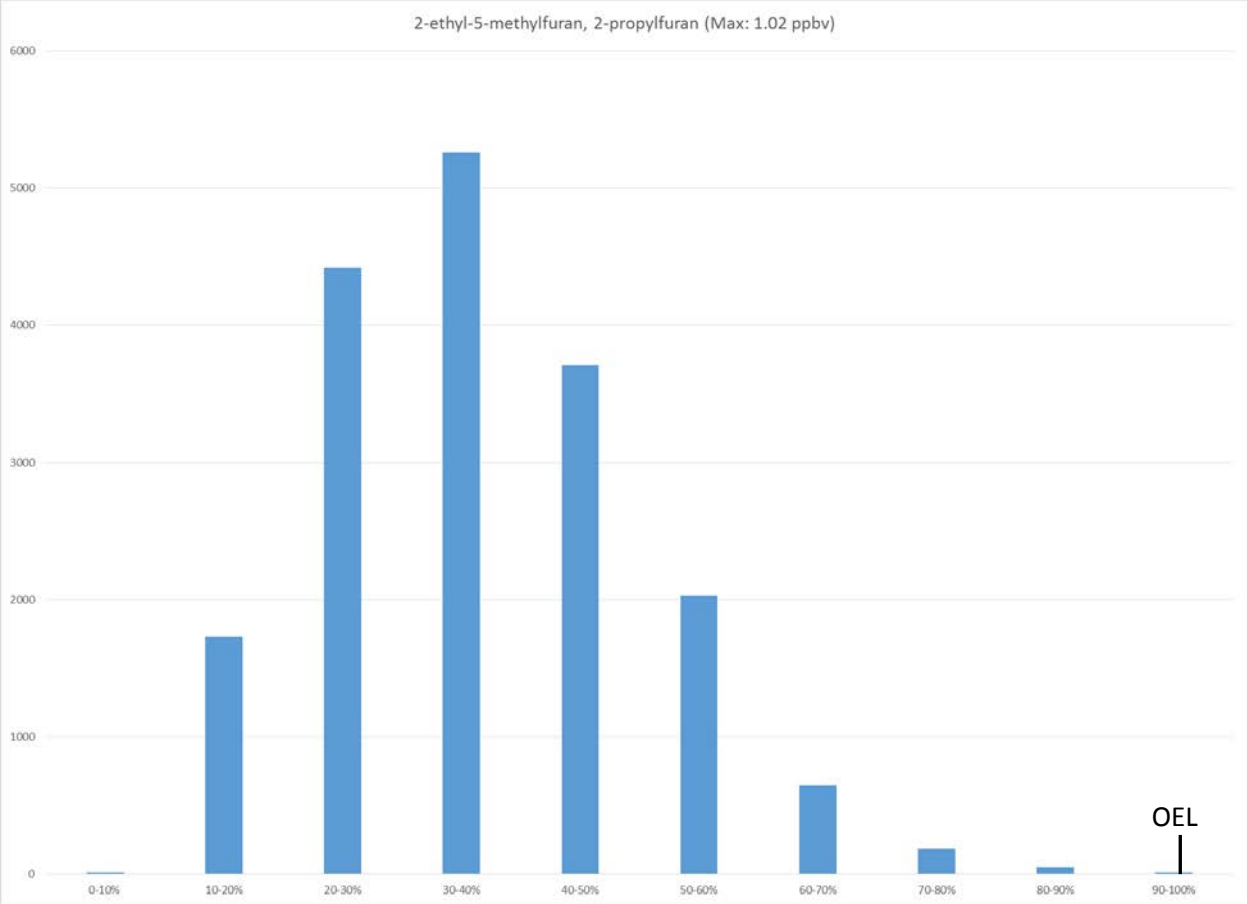
Table 9-29 summarizes the maximum and average concentrations observed during the four weeks of mobile/stationary monitoring. The OEL of 2-propylfuran and 2-ethyl-5-methylfuran is 1 ppbV, which is exceeded on several days throughout the four weeks. Individual plumes are interrogated in the next section.

Table 9-29. Daily maximum and average concentrations in ppbv for 2-propylfuran and 2-ethyl-5methylfuran. 2-propylfuran and 2-ethyl-5methylfuran are COPCs with an OEL of 1 ppbV.

Date	Max (ppbV)	Average (ppbV)
5/18/2016	**1.8**	0.3
6/20/2016	0.3	0.1
6/22/2016	0.9	0.3
6/23/2016	0.7	0.3
6/27/2016	0.6	0.2
6/28/2016	**1.0**	0.2
6/29/2016	**1.0**	0.4
6/30/2016	0.6	0.2
7/5/2016	0.6	0.3
7/6/2016	0.6	0.3
7/11/2016	0.6	0.3
7/13/2016	0.5	0.2
7/14/2016	0.5	0.2
7/18/2016	0.4	0.2

The figure 9.1.29-1 represents the histogram of the 2-propylfuran and 2-ethyl-5-methylfuran data collected in 200-E area on June 29, 2016. The data approaches a Gaussian distribution which suggests that there is a constant distribution of the measured signal throughout the measurement period. This is an indication that the measured material is not from random plumes but from a constant background.

Figure 9.1.29-1. The histogram of the 2-propylfuran and 2-ethyl-5-methylfuran data collected in 200-E area on June 29, 2016.



9.1.30 Mass 112, Heptanenitrile

The ion signal at nominal mass 112 amu is interpreted as heptanenitrile. Quantification of heptanenitrile is done using the collisional ion-molecule rate constant of 2 $x10^{-9}$ cm^3s^{-1}.

Table 9-30 summarizes the maximum and average concentrations observed during the four weeks of mobile/stationary monitoring. The OEL of heptanenitrile is 6000 ppbV, which is never exceeded; in actuality, the maximum recorded amount during the campaigns was below 0.01% of this limit.

Table 9-30. Daily maximum and average concentrations in ppbV for heptanenitrile. Heptanenitrile is a COPC with an OEL of 6000 ppbV.

Date	Max (ppbV)	Average (ppbV)
5/18/2016	0.5	0.3
6/20/2016	0.2	0.1
6/22/2016	0.4	0.2
6/23/2016	0.4	0.2
6/27/2016	0.3	0.2
6/28/2016	0.2	0.1
6/29/2016	0.4	0.2
6/30/2016	0.3	0.2
7/5/2016	0.4	0.3
7/6/2016	0.4	0.2
7/11/2016	0.5	0.3
7/13/2016	0.3	0.2
7/14/2016	0.4	0.2
7/18/2016	0.4	0.2

9.1.31 Mass 115, 4-methyl-2-hexanone

The ion signal at nominal mass 115 amu is interpreted as 4-methyl-2-hexanone. Quantification of 4-methyl-2-hexanone is done using the collisional ion-molecule rate constant of 2 $x10^{-9}$ cm^3s^{-1}.

Table 9-31 summarizes the maximum and average concentrations observed during the four weeks of mobile/stationary monitoring. The OEL of 4-methyl-2-hexanone is 500 ppbV, which is never exceeded; in actuality, the maximum recorded amount during the campaigns was below 0.2% of this limit.

Table 9-31. Daily maximum and average concentrations in ppbV for 4-methyl-2-hexanone. 4-methyl-2-hexanone is a COPC with an OEL of 500 ppbV.

Date	Max (ppbV)	Average (ppbV)
5/18/2016	0.6	0.3
6/20/2016	0.3	0.2
6/22/2016	0.6	0.3
6/23/2016	0.5	0.3
6/27/2016	0.3	0.2
6/28/2016	0.4	0.2
6/29/2016	0.5	0.3
6/30/2016	0.5	0.2
7/5/2016	0.5	0.3
7/6/2016	0.5	0.3
7/11/2016	0.5	0.3
7/13/2016	0.4	0.2
7/14/2016	0.4	0.2
7/18/2016	0.4	0.2

9.1.32 Mass 117, N-nitrosomorpholine (NMOR)

The ion signal at nominal mass 117 amu is interpreted as N-nitrosomorpholine (NMOR). Quantification of NMOR is done using the collisional ion-molecule rate constant of 2 $x10^{-9}$ cm^3s^{-1}.

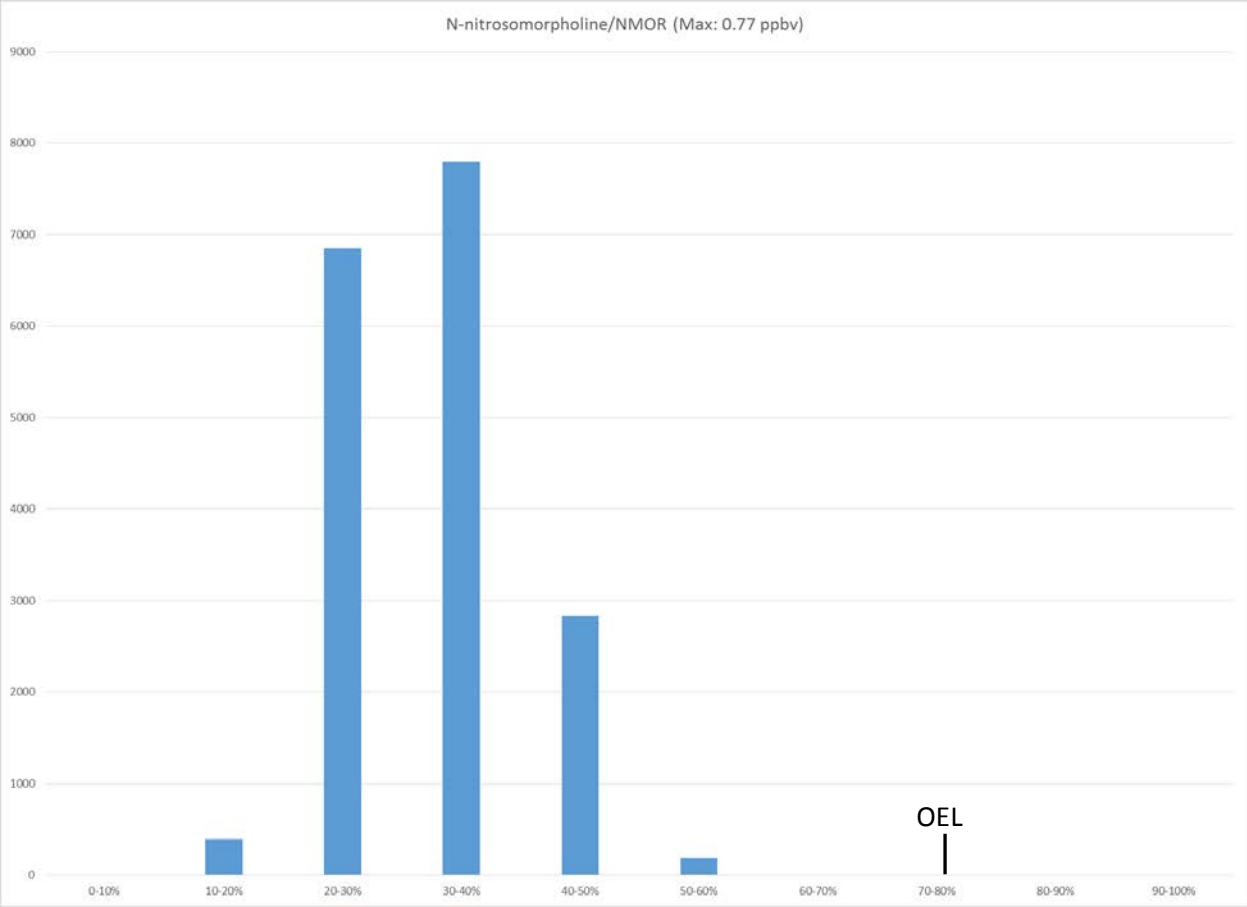
Table 9-32 summarizes the maximum and average concentrations observed during the four weeks of mobile/stationary monitoring. The OEL of NMOR is 0.6 ppbV, which is exceeded on several days throughout the four weeks. Individual plumes are interrogated in the next section. Potential interfering compounds at mass 117 include many esters, such as ethyl butyrate.

Table 9-32. Daily maximum and average concentrations in ppbV for NMOR. NMOR is a COPC with an OEL of 0.6 ppbV.

Date	Max (ppbV)	Average (ppbV)
5/18/2016	**0.6**	0.3
6/20/2016	0.3	0.1
6/22/2016	**0.6**	0.3
6/23/2016	**0.6**	0.3
6/27/2016	**0.6**	0.2
6/28/2016	0.5	0.2
6/29/2016	**0.8**	0.3
6/30/2016	0.5	0.2
7/5/2016	0.5	0.3
7/6/2016	0.4	0.3
7/11/2016	0.5	0.3
7/13/2016	0.5	0.3
7/14/2016	**0.6**	0.3
7/18/2016	0.4	0.2

The figure 9.1.32-1 represents the histogram of the NMOR data collected in 200-E area on June 29, 2016. The data approaches a Gaussian distribution which suggests that there is a constant distribution of the measured signal throughout the measurement period. This is an indication that the measured material is not from random plumes but from a constant background.

Figure 9.1.32-1. The histogram of the NMOR data collected in 200-E area on June 29, 2016.



9.1.33 Mass 120, Butylnitrate

The ion signal at nominal mass 120 amu is interpreted as butylnitrate. Quantification of butylnitrate is done using the collisional ion-molecule rate constant of 2 $x10^{-9}$ cm^3s^{-1}.

Table 9-33 summarizes the maximum and average concentrations observed during the four weeks of mobile/stationary monitoring. The OEL of butylnitrate is 2500 ppbV, which is never exceeded; in actuality, the maximum recorded amount during the campaigns was below 0.1% of this limit.

Table 9-33. Daily maximum and average concentrations in ppbV for butylnitrate. Butylnitrate is a COPC with an OEL of 2500 ppbV.

Date	Max (ppbV)	Average (ppbV)
5/18/2016	1.0	0.2
6/20/2016	0.5	0.2
6/22/2016	0.4	0.2
6/23/2016	0.4	0.2
6/27/2016	1.0	0.2
6/28/2016	0.5	0.1
6/29/2016	0.6	0.2
6/30/2016	0.3	0.2
7/5/2016	0.4	0.3
7/6/2016	0.4	0.2
7/11/2016	0.4	0.3
7/13/2016	0.4	0.2
7/14/2016	0.4	0.2
7/18/2016	0.4	0.2

9.1.34 Mass 127, 2-ethyl-2-hexenal, 4-(1-methylpropyl)-2,3-dihydrofuran, and 3-(1,1-dimethylethyl)-2,3-dihydrofuran

The ion signal at nominal mass 127 amu is interpreted as the sum of 2-ethyl-2-hexenal, 4-(1-methylpropyl)-2,3-dihydrofuran, and3-(1,1-dimethylethyl)-2,3-dihydrofuran. Quantification of the ion signal is done using the collisional ion-molecule rate constant of 2 $x10^{-9}$ cm^3s^{-1}.

Table 9-34 summarizes the maximum and average concentrations observed during the four weeks of mobile/stationary monitoring. The OEL of 2-ethyl-2-hexenal is 100 ppbV, while the OEL of 4-(1-methylpropyl)-2,3-dihydrofuran and 3-(1,1-dimethylethyl)-2,3-dihydrofuran is 1 ppbV, which is never exceeded; in actuality, the maximum recorded amount during the campaigns was below 52% of this limit.

Table 9-34. Daily maximum and average concentrations in ppbV for the sum of 2-ethyl-2-hexenal, 4-(1-methylpropyl)-2,3-dihydrofuran, and3-(1,1-dimethylethyl)-2,3-dihydrofuran. 2-ethyl-2-hexenal has an OEL of 100 ppbV while 4-(1-methylpropyl)-2,3-dihydrofuran, and3-(1,1-dimethylethyl)-2,3-dihydrofuran are COPCs with an OEL of 1 ppbV.

Date	Max (ppbV)	Average (ppbV)
5/18/2016	0.4	0.3
6/20/2016	0.3	0.1
6/22/2016	0.5	0.2
6/23/2016	0.5	0.2
6/27/2016	0.3	0.2
6/28/2016	0.3	0.1
6/29/2016	0.4	0.2
6/30/2016	0.4	0.2
7/5/2016	0.4	0.3
7/6/2016	0.4	0.3
7/11/2016	0.5	0.3
7/13/2016	0.4	0.2
7/14/2016	0.4	0.2
7/18/2016	0.3	0.2

9.1.35 Mass 129, 6-methyl-2-heptanone

The ion signal at nominal mass 129 amu is interpreted as 6-methyl-2-heptanone. Quantification of 6-methyl-2-heptanone is done using the collisional ion-molecule rate constant of 2 $x10^{-9}$ cm^3s^{-1}.

Table 9-35 summarizes the maximum and average concentrations observed during the four weeks of mobile/stationary monitoring. The OEL of 6-methyl-2-heptanone is 8000 ppbV, which is never exceeded; in actuality, the maximum recorded amount during the campaigns was below 0.02% of this limit.

Table 9-35. Daily maximum and average concentrations in ppbV for 6-methyl-2-heptanone. 6-methyl-2-heptanone is a COPC with an OEL of 8000 ppbV.

Date	Max (ppbV)	Average (ppbV)
5/18/2016	0.5	0.3
6/20/2016	0.3	0.1
6/22/2016	0.6	0.3
6/23/2016	0.5	0.3
6/27/2016	1.2	0.2
6/28/2016	0.7	0.1
6/29/2016	0.9	0.3
6/30/2016	0.4	0.2
7/5/2016	0.5	0.3
7/6/2016	0.4	0.2
7/11/2016	0.4	0.2
7/13/2016	0.7	0.2
7/14/2016	0.6	0.2
7/18/2016	0.4	0.2

9.1.36 Mass 139, 2-pentylfuran

The ion signal at nominal mass 139 amu is interpreted as 2-pentylfuran. Quantification of 2-pentylfuran is done using the collisional ion-molecule rate constant of 2 $x10^{-9}$ cm^3s^{-1}.

Table 9-36 summarizes the maximum and average concentrations observed during the four weeks of mobile/stationary monitoring. The OEL of 2-pentylfuran is 1 ppbV, which is never exceeded; in actuality, the maximum recorded amount during the campaigns was below 42% of this limit.

Table 9-36. Daily maximum and average concentrations in ppbV for 2-pentylfuran. 2-pentylfuran is a COPC with an OEL of 1 ppbV.

Date	Max (ppbV)	Average (ppbV)
5/18/2016	0.4	0.2
6/20/2016	0.2	0.1
6/22/2016	0.4	0.2
6/23/2016	0.4	0.2
6/27/2016	0.3	0.1
6/28/2016	0.2	0.1
6/29/2016	0.4	0.2
6/30/2016	0.3	0.1
7/5/2016	0.4	0.2
7/6/2016	0.3	0.2
7/11/2016	0.4	0.2
7/13/2016	0.3	0.2
7/14/2016	0.3	0.2
7/18/2016	0.3	0.2

9.1.37 Mass 155, Biphenyl

The ion signal at nominal mass 155 amu is interpreted as biphenyl. Quantification of biphenyl is done using the collisional ion-molecule rate constant of 2 $x10^{-9}$ cm^3s^{-1}.

Table 9-37 summarizes the maximum and average concentrations observed during the four weeks of mobile/stationary monitoring. The OEL of biphenyl is 200 ppbV, which is never exceeded; in actuality, the maximum recorded amount during the campaigns was below 0.2% of this limit.

Table 9-37. Daily maximum and average concentrations in ppbV for biphenyl. Biphenyl is a COPC with an OEL of 200 ppbV.

Date	Max (ppbV)	Average (ppbV)
5/18/2016	0.3	0.2
6/20/2016	0.2	0.1
6/22/2016	0.3	0.2
6/23/2016	0.3	0.2
6/27/2016	0.2	0.1
6/28/2016	0.2	0.1
6/29/2016	0.4	0.2
6/30/2016	0.3	0.1
7/5/2016	0.3	0.2
7/6/2016	0.3	0.2
7/11/2016	0.3	0.2
7/13/2016	0.3	0.2
7/14/2016	0.3	0.2
7/18/2016	0.3	0.2

9.1.38 Mass 167, 2-heptylfuran

The ion signal at nominal mass 167 amu is interpreted as 2-heptylfuran. Quantification of 2-heptylfuran is done using the collisional ion-molecule rate constant of 2 $x10^{-9}$ cm^3s^{-1}.

Table 9-38 summarizes the maximum and average concentrations observed during the four weeks of mobile/stationary monitoring. The OEL of 2-heptylfuran is 1 ppbV, which is never exceeded; in actuality, the maximum recorded amount during the campaigns was below 35% of this limit.

Table 9-38. Daily maximum and average concentrations in ppbV for 2-heptylfuran. 2-heptylfuran is a COPC with an OEL of 1 ppbV.

Date	Max (ppbV)	Average (ppbV)
5/18/2016	0.3	0.2
6/20/2016	0.2	0.1
6/22/2016	0.3	0.2
6/23/2016	0.3	0.2
6/27/2016	0.2	0.1
6/28/2016	0.1	0.1
6/29/2016	0.3	0.1
6/30/2016	0.3	0.1
7/5/2016	0.3	0.2
7/6/2016	0.3	0.2
7/11/2016	0.3	0.2
7/13/2016	0.3	0.2
7/14/2016	0.3	0.2
7/18/2016	0.3	0.2

9.1.39 Mass 181, 2-octylfuran and 1,4-butanediol dinitrate

The ion signal at nominal mass 181 amu is interpreted as the sum of 2-octylfuran and 1,4-butanediol dinitrate. Quantification of this ion signal is done using the collisional ion-molecule rate constant of 2 $x10^{-9}$ cm^3s^{-1}.
Table 9-39 summarizes the maximum and average concentrations observed during the four weeks of mobile/stationary monitoring. The OEL of 2-octylfuran is 1 ppbV and 1,4-butanediol dinitrate is 50 ppbV. The OEL of 1 ppbV is never exceeded; in actuality, the maximum recorded amount during the campaigns was below 27% of this limit.

Table 9-39. Daily maximum and average concentrations in ppbV for 2-octylfuran and 1,4-butanediol dinitrate. 2-octylfuranand1,4-butanediol dinitrate are COPCs with a OELs of 1 and 50 ppbV.

Date	Max (ppbV)	Average (ppbV)
5/18/2016	0.3	0.2
6/20/2016	0.1	0.1
6/22/2016	0.3	0.1
6/23/2016	0.3	0.1
6/27/2016	0.2	0.1
6/28/2016	0.1	0.0
6/29/2016	0.2	0.1
6/30/2016	0.2	0.1
7/5/2016	0.3	0.2
7/6/2016	0.3	0.1
7/11/2016	0.3	0.2
7/13/2016	0.2	0.1
7/14/2016	0.2	0.1
7/18/2016	0.2	0.1

9.1.40 Mass 183, 1,2,3-propanetriol, 1,3-dinitrate

The ion signal at nominal mass 183 amu is interpreted as 1,2,3-propanetriol, 1,3-dinitrate. Quantification of 1,2,3-propanetriol, 1,3-dinitrate is done using the collisional ion-molecule rate constant of 2 $x10^{-9}$ cm^3s^{-1}.

Table 9-40 summarizes the maximum and average concentrations observed during the four weeks of mobile/stationary monitoring. The OEL of 1,2,3-propanetriol, 1,3-dinitrate is 50 ppbV, which is never exceeded; in actuality, the maximum recorded amount during the campaigns was below 0.7% of this limit.

Table 9-40. Daily maximum and average concentrations in ppbV for 1,2,3-propanetriol, 1,3-dinitrate. 1,2,3-propanetriol, 1,3-dinitrate is a COPC with an OEL of 50 ppbV.

Date	Max (ppbV)	Average (ppbV)
5/18/2016	0.3	0.2
6/20/2016	0.2	0.1
6/22/2016	0.3	0.1
6/23/2016	0.3	0.1
6/27/2016	0.2	0.1
6/28/2016	0.1	0.0
6/29/2016	0.3	0.2
6/30/2016	0.2	0.1
7/5/2016	0.3	0.2
7/6/2016	0.3	0.2
7/11/2016	0.3	0.2
7/13/2016	0.3	0.2
7/14/2016	0.2	0.1
7/18/2016	0.3	0.2

9.1.41 Mass 189, Chlorinated Biphenyls (PCB) with one chlorine

The ion signal at nominal mass 189 amu is interpreted as PCBs with one chlorine. PCBs have a low enough vapor pressure that they are not likely to be encountered in the gas phase around tank farms. Quantification of this ion signal is done using the collisional ion-molecule rate constant of 2 $x10^{-9}$ cm^3s^{-1}.

Table 9-41 summarizes the maximum and average concentrations observed during the four weeks of mobile/stationary monitoring based on mass 189. The OEL of PCB is 1000 ppbV, which is never exceeded; in actuality, the maximum recorded amount during the campaigns was below 0.1% of this limit.

Table 9-41. Daily maximum and average concentrations in ppbV for PCB. PCBs are a COPC with an OEL of 1000 ppbV.

Date	Max (ppbV)	Average (ppbV)
5/18/2016	0.3	0.2
6/20/2016	0.2	0.1
6/22/2016	0.3	0.1
6/23/2016	0.3	0.2
6/27/2016	0.2	0.1
6/28/2016	0.1	0.0
6/29/2016	0.4	0.2
6/30/2016	0.2	0.1
7/5/2016	0.3	0.2
7/6/2016	0.2	0.2
7/11/2016	0.3	0.2
7/13/2016	0.2	0.1
7/14/2016	0.2	0.1
7/18/2016	0.3	0.2

9.1.42 Mass 195, 6-(2-furanyl)-6-methyl-2-heptanone

The ion signal at nominal mass 195 amu is interpreted as 6-(2-furanyl)-6-methyl-2-heptanone. Quantification of 6-(2-furanyl)-6-methyl-2-heptanone is done using the collisional ion-molecule rate constant of 2 $x10^{-9}$ cm^3s^{-1}.

Table 9-42 summarizes the maximum and average concentrations observed during the four weeks of mobile/stationary monitoring. The OEL of 6-(2-furanyl)-6-methyl-2-heptanone is 1 ppbV, which is never exceeded; in actuality, the maximum recorded amount during the campaigns was below 39% of this limit.

Table 9-42. Daily maximum and average concentrations in ppbV for 6-(2-furanyl)-6-methyl-2-heptanone. 6-(2-furanyl)-6-methyl-2-heptanone is a COPC with an OEL of 1 ppbV.

Date	Max (ppbV)	Average (ppbV)
5/18/2016	0.3	0.2
6/20/2016	0.2	0.1
6/22/2016	0.4	0.1
6/23/2016	0.3	0.1
6/27/2016	0.2	0.1
6/28/2016	0.1	0.1
6/29/2016	0.3	0.1
6/30/2016	0.2	0.1
7/5/2016	0.3	0.2
7/6/2016	0.3	0.2
7/11/2016	0.3	0.2
7/13/2016	0.2	0.1
7/14/2016	0.3	0.1
7/18/2016	0.3	0.1

9.1.43 Mass 199, 3-(2-furanyl)-1-phenyl-2-propen-1-one (furfural acetophenone)

The ion signal at nominal mass 195 amu is interpreted as 3-(2-furanyl)-1-phenyl-2-propen-1-one (furfural acetophenone). Quantification of furfural acetophenone is done using the collisional ion-molecule rate constant of 2 $x10^{-9}$ cm^3s^{-1}.

Table 9-43 summarizes the maximum and average concentrations observed during the four weeks of mobile/stationary monitoring. The OEL of furfural acetophenone is 1 ppbV, which is never exceeded; in actuality, the maximum recorded amount during the campaigns was below 49% of this limit.

Table 9-43. Daily maximum and average concentrations in ppbV for furfural acetophenone. Furfural acetophenone is a COPC with an OEL of 1 ppbV.

Date	Max (ppbV)	Average (ppbV)
5/18/2016	0.3	0.2
6/20/2016	0.2	0.1
6/22/2016	0.4	0.2
6/23/2016	0.5	0.2
6/27/2016	0.2	0.1
6/28/2016	0.4	0.1
6/29/2016	0.3	0.1
6/30/2016	0.3	0.1
7/5/2016	0.4	0.2
7/6/2016	0.4	0.2
7/11/2016	0.3	0.2
7/13/2016	0.2	0.1
7/14/2016	0.2	0.1
7/18/2016	0.2	0.2

9.1.44 Mass 223, Polychlorinated Biphenyl (PCB) with two chlorines

The ion signal at nominal mass 223 amu is interpreted as PCBs with two chlorines. Quantification of this ion signal is done using the collisional ion-molecule rate constant of 2 x10^{-9} cm^3s^{-1}.

Table 9-44 summarizes the maximum and average concentrations observed during the four weeks of mobile/stationary monitoring based on mass 189 (see Table 44 for comparison). The OEL of PCB is 1000 ppbV, which is never exceeded; in actuality, the maximum recorded amount during the campaigns was below 0.1% of this limit.

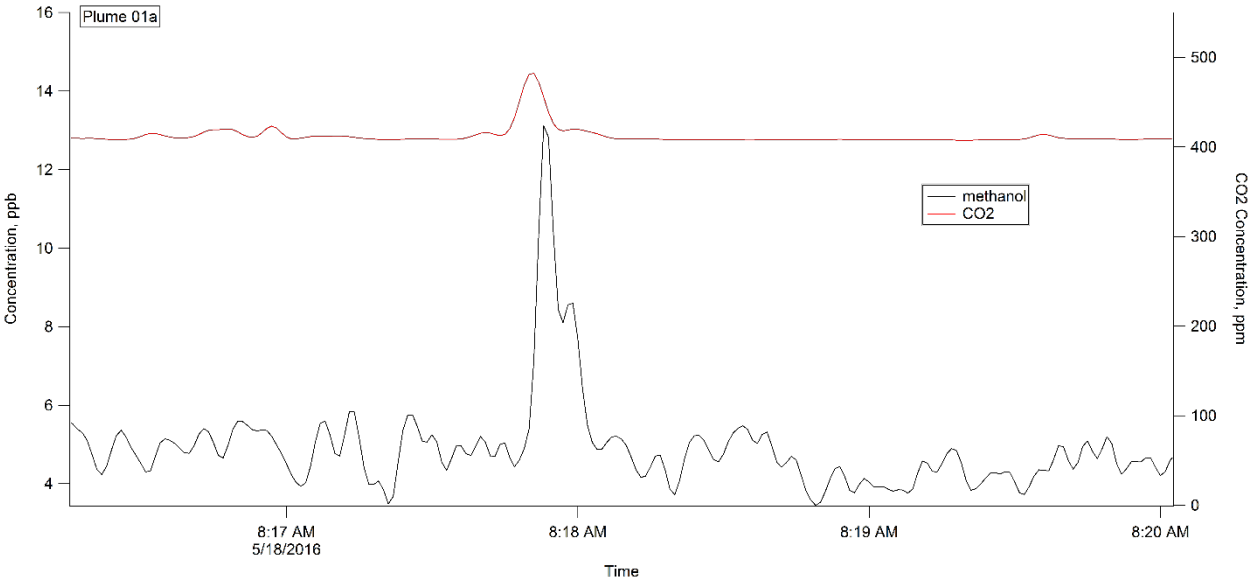
Table 9-44. Daily maximum and average concentrations in ppbV for PCB. PCBs are a COPC with an OEL of 1000 ppbV.

Date	Max (ppbV)	Average (ppbV)
5/18/2016	0.3	0.2
6/20/2016	0.2	0.1
6/22/2016	0.3	0.2
6/23/2016	0.3	0.2
6/27/2016	0.2	0.1
6/28/2016	0.1	0.1
6/29/2016	0.2	0.1
6/30/2016	0.3	0.1
7/5/2016	0.3	0.2
7/6/2016	0.3	0.2
7/11/2016	0.3	0.2
7/13/2016	0.2	0.2
7/14/2016	0.3	0.2
7/18/2016	0.3	0.2

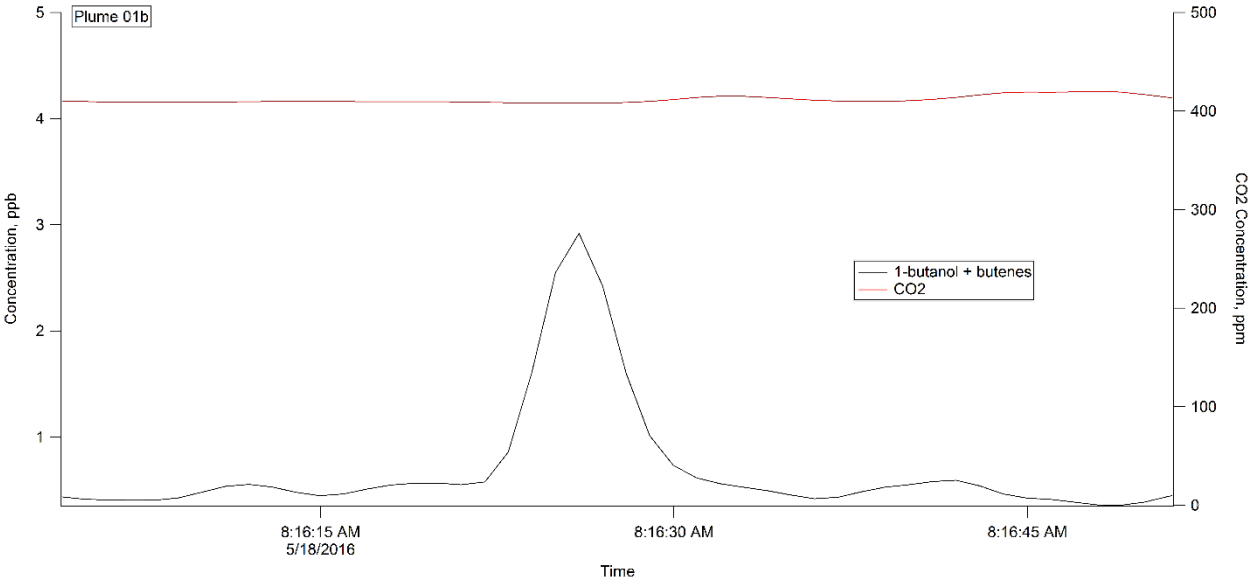
9.2 PLUMES OF INTEREST

Plumes of interest from the mobile/stationary field deployment will be presented in a chronological order. Many of the interesting plumes identified are likely diesel engine exhaust or isolated methanol sources.

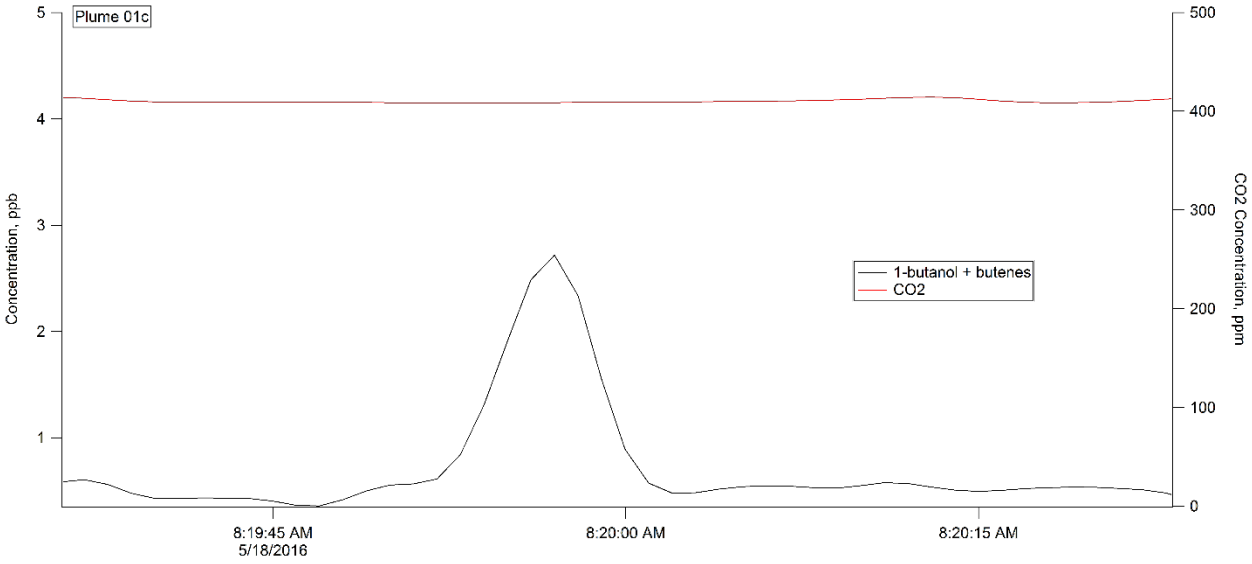
9.2.1 May 18, 2016



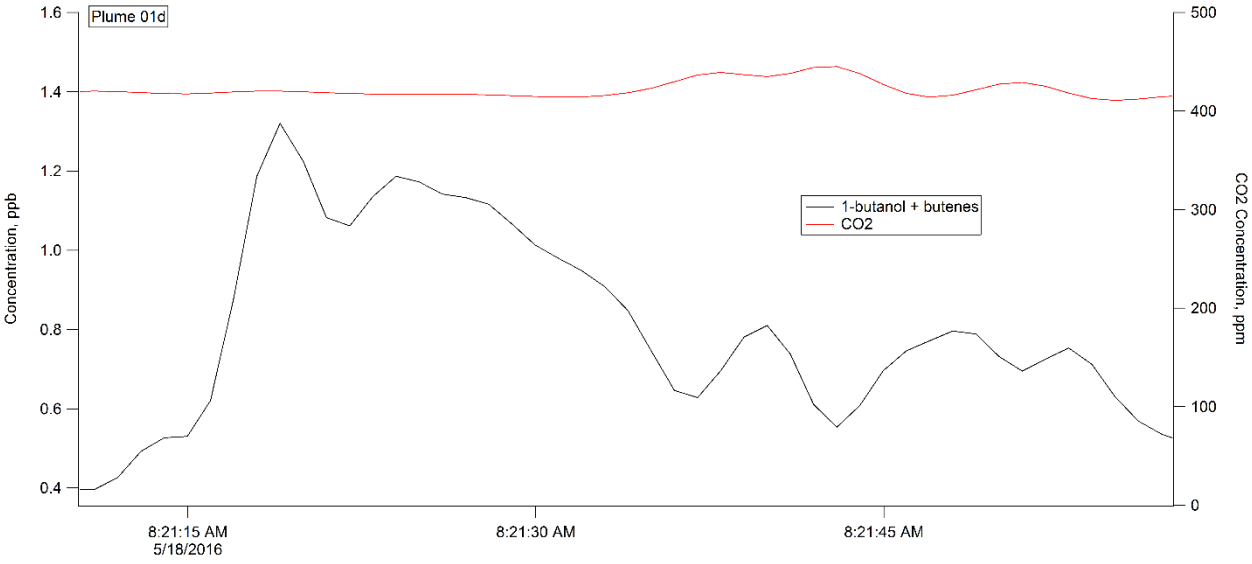
Plume 01a was observed at 8:18 AM on 4th avenue between the evaporator and AP farm. It consisted of elevated methanol with a possible correlation with CO_2. There was a slight time offset between the CO_2 and methanol that makes it difficult to speculate if this was a combustion source or not. There were no other COPC correlated with the methanol.

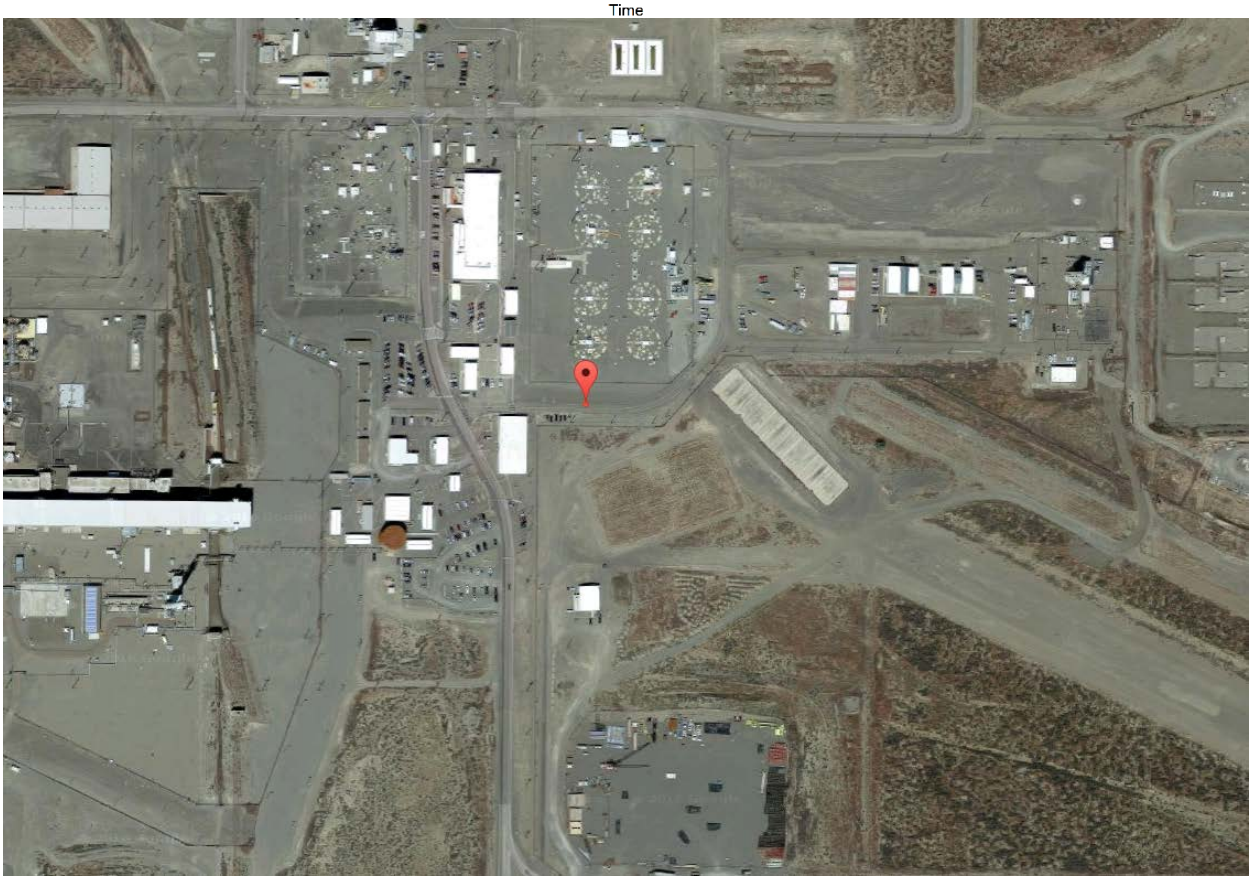


Plume 01b was observed at 8:16 AM, May 18, 2016, near the alley on the west side of AP farm. It consisted of an elevated 1-butanol + butenes ion signal with no other COPCs correlated. It was not from a combustion source.

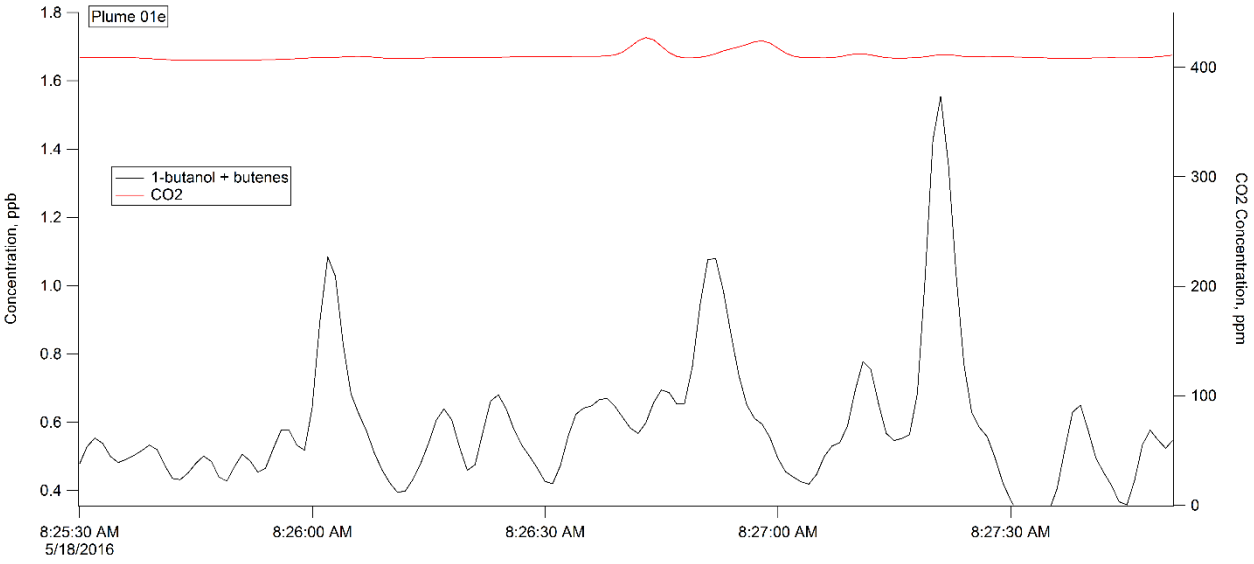


Plume 01c was observed at 8:20 AM, May 18, 2016, one block east of AP farm. It consisted of an elevated 1-butanol + butenes ion signal with no other COPCs correlated. It was not from a combustion source.

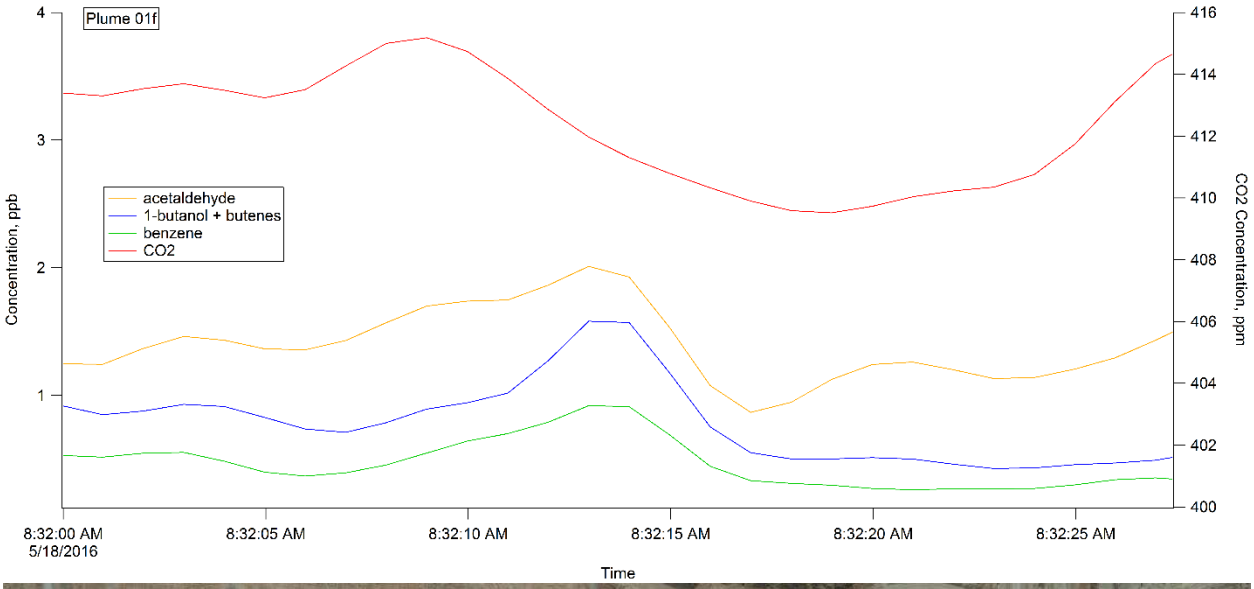


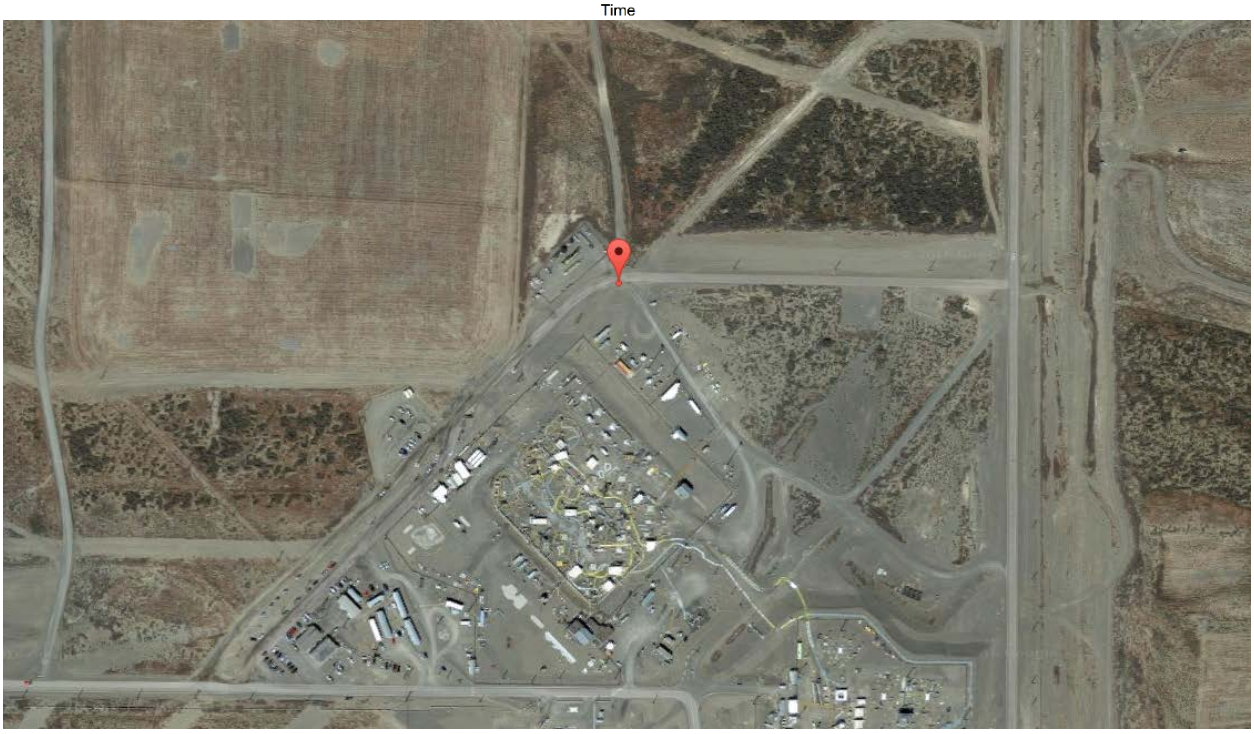


Plume 01d was observed at 8:21 AM, May 18, 2016, on the south side of AP farm. It consisted of an elevated 1-butanol + butenes ion signal with no other COPCs correlated. It was not from a combustion source. This plume was lower in concentration and longer in duration compared to the previous plumes, suggesting a larger distance from the source.

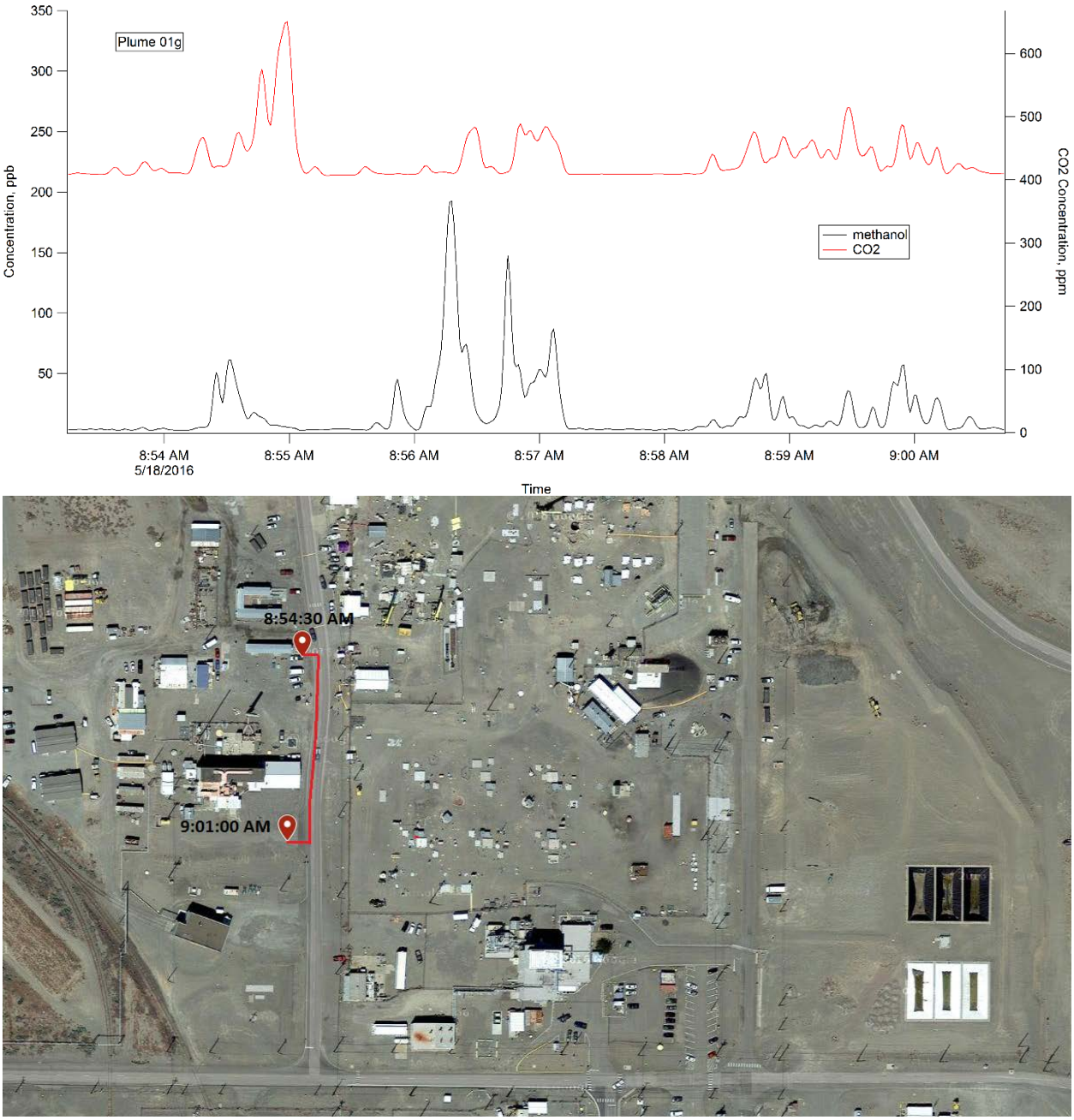


Plume 01e was observed from 8:26 to 8:28 AM, May 18, 2016, while driving from the east side of the evaporator to the west on 4th. It consisted of multiple elevated hits of 1-butanol + butenes ion signal with no other COPCs correlated. It was not from a combustion source.

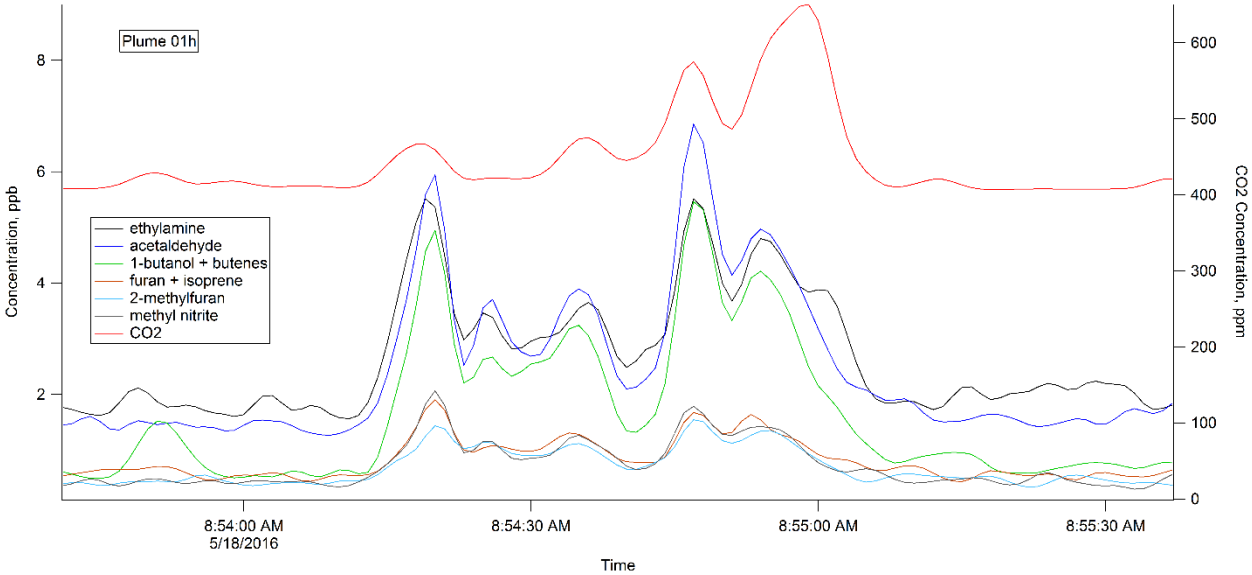




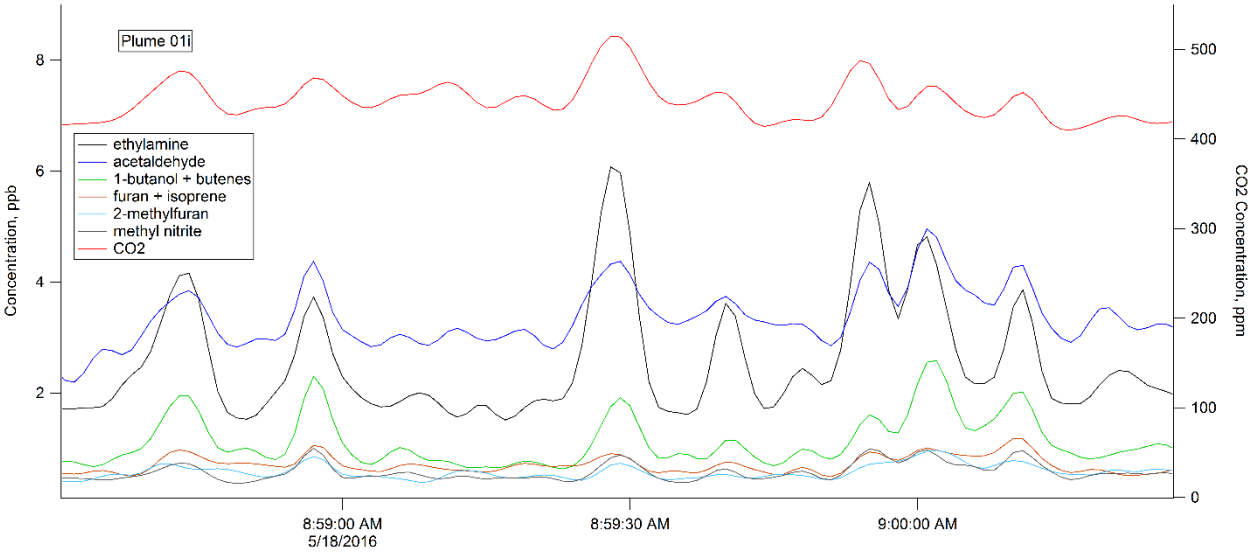
Plume 01f was observed at 8:32 AM, May 18, 2016, on the north side of C farm. It consisted of elevated acetaldehyde, 1-butanol + butenes, and benzene ion signals with no other COPCs correlated. The CO_2 background was slightly elevated but it was not a direct combustion source. It may be a diluted combustion plume from a distance or from a source with very little elevated CO_2 associated with it.

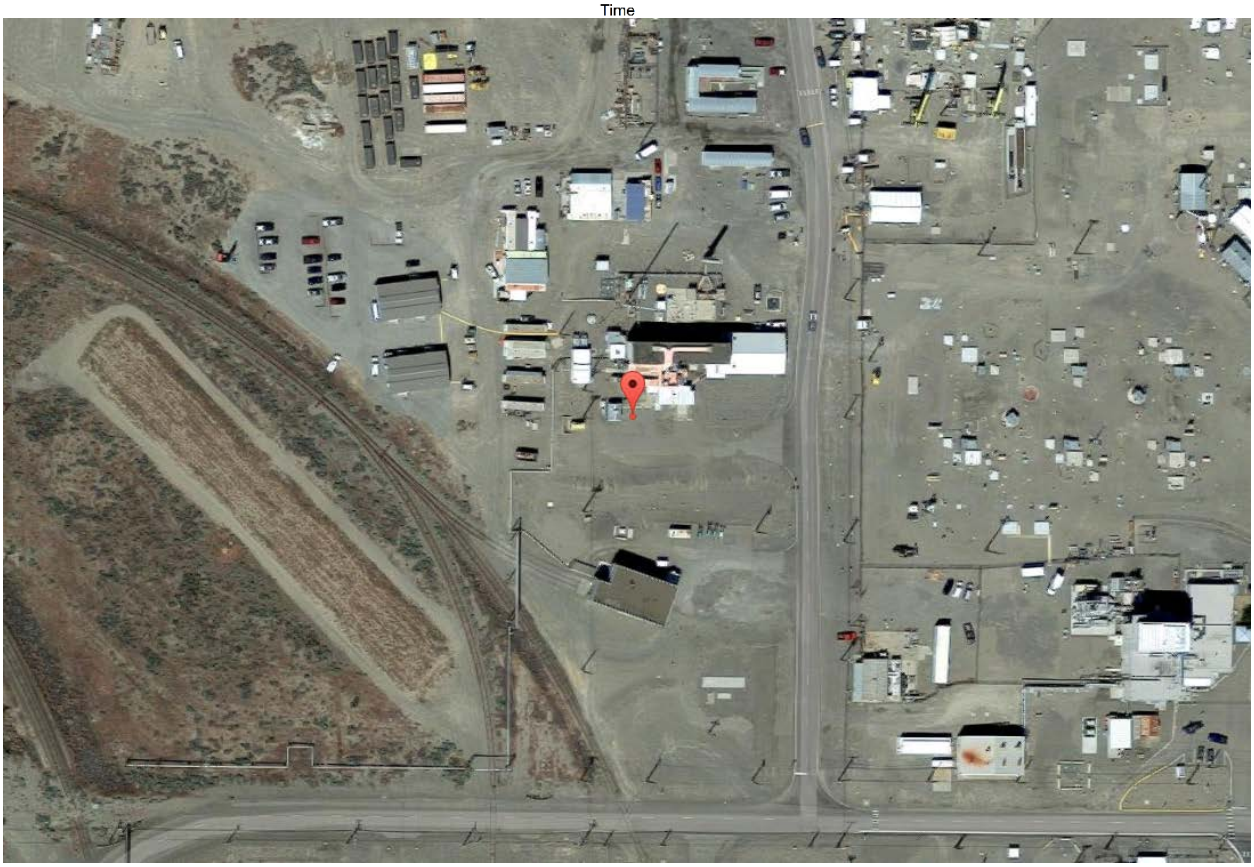


Plume 01g was observed from 8:54 to 9:01 AM, May 18, 2016, on the west side of A farm near 244 AR. Multiple hits of elevated methanol were observed over a long period of time with no other COPC correlated. While there were several combustion sources in the area, the methanol does not correlate with CO_2 and is not believed to be from a combustion source.

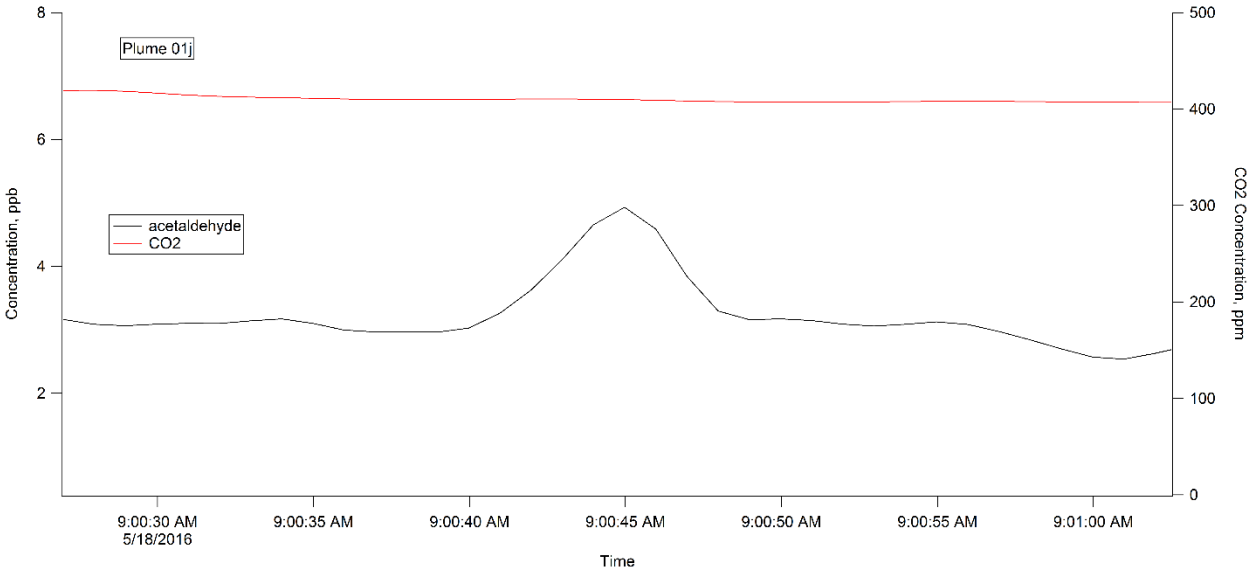


Plume 01h was observed at 8:54 AM, May 18, 2016, on the west side of AY farm. It is a complex combustion plume consisting of ethylamine, acetaldehyde, 1-butanol + butenes, furan + isoprene, 2-methylfuran, and methyl nitrite. This is likely a diesel exhaust plume.

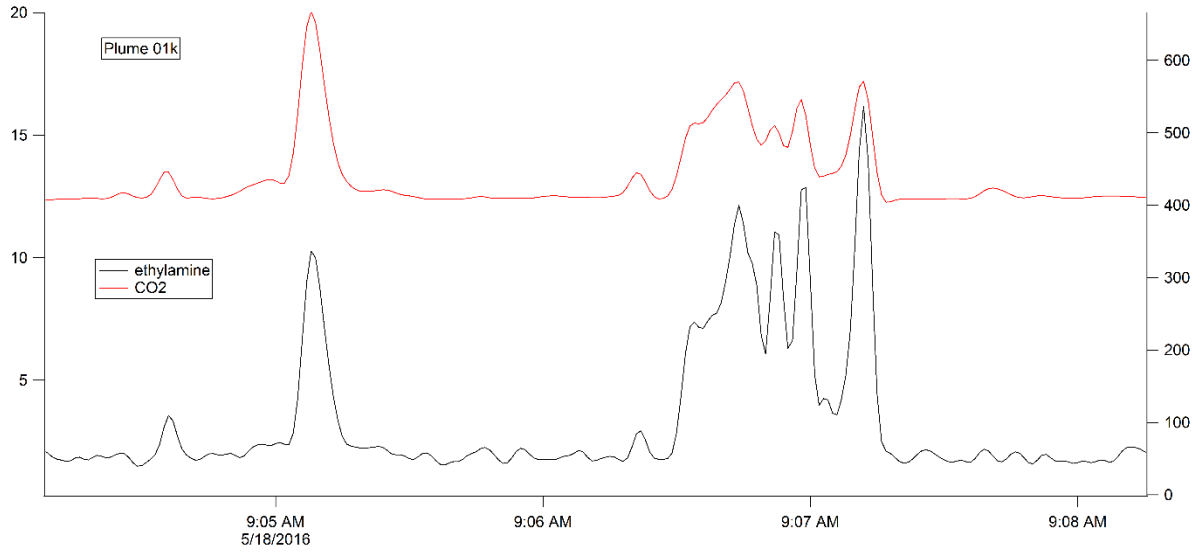


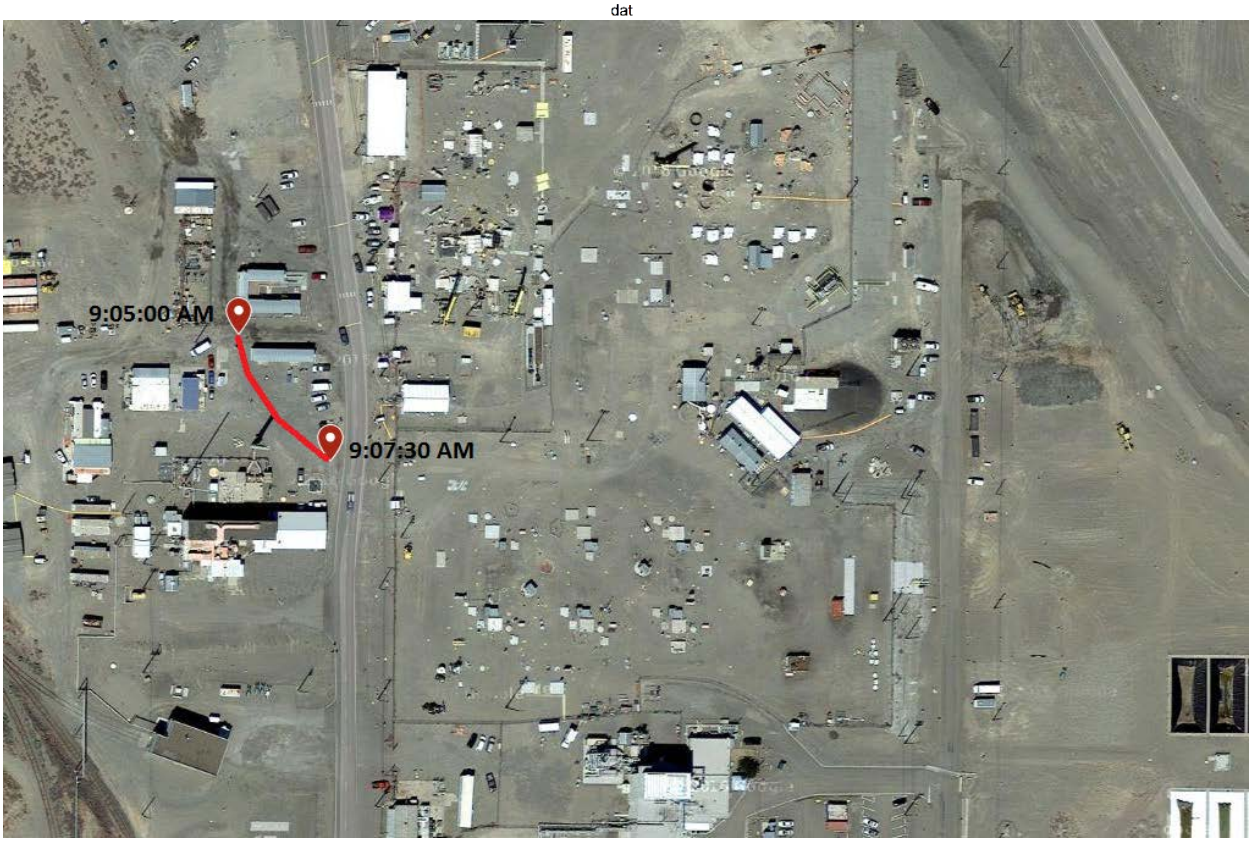


Plume 01i was observed from 8:59 to 9:01 AM, May 18, 2016, on the south side of 244-AR. There are multiple hits of a complex combustion plume consisting of ethylamine, acetaldehyde, 1-butanol + butenes, furan + isoprene, 2-methylfuran, and methyl nitrite. This is likely a diesel exhaust plume.

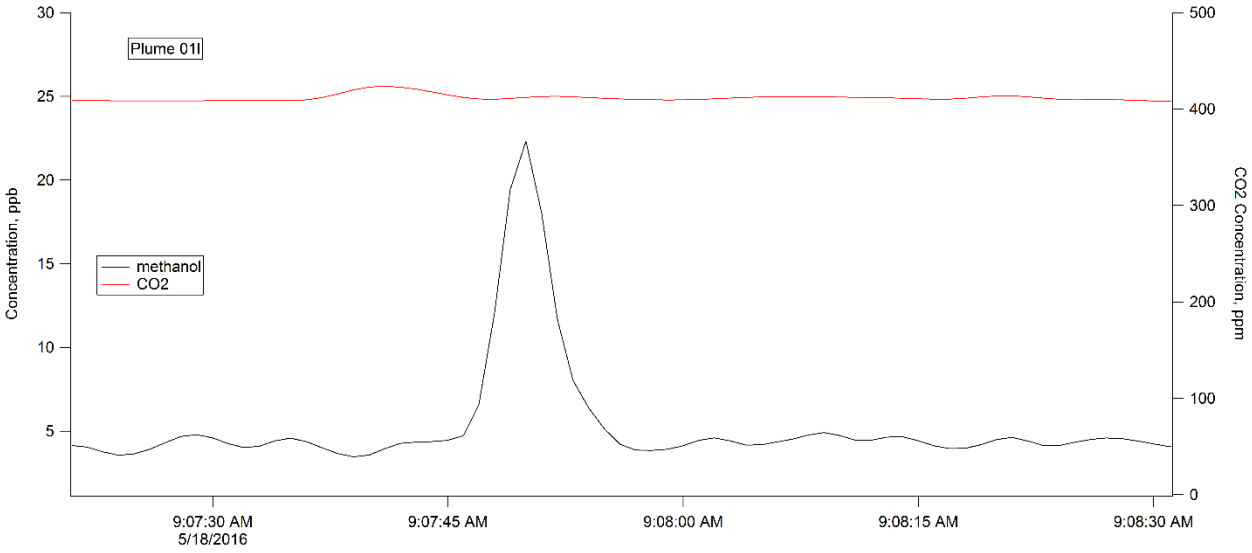


Plume 01j was observed at 9:01 AM, May 18, 2016, on the south side of 244-AR. Acetaldehyde was observed with no other COPC correlated. It does not appear to be from a combustion source.

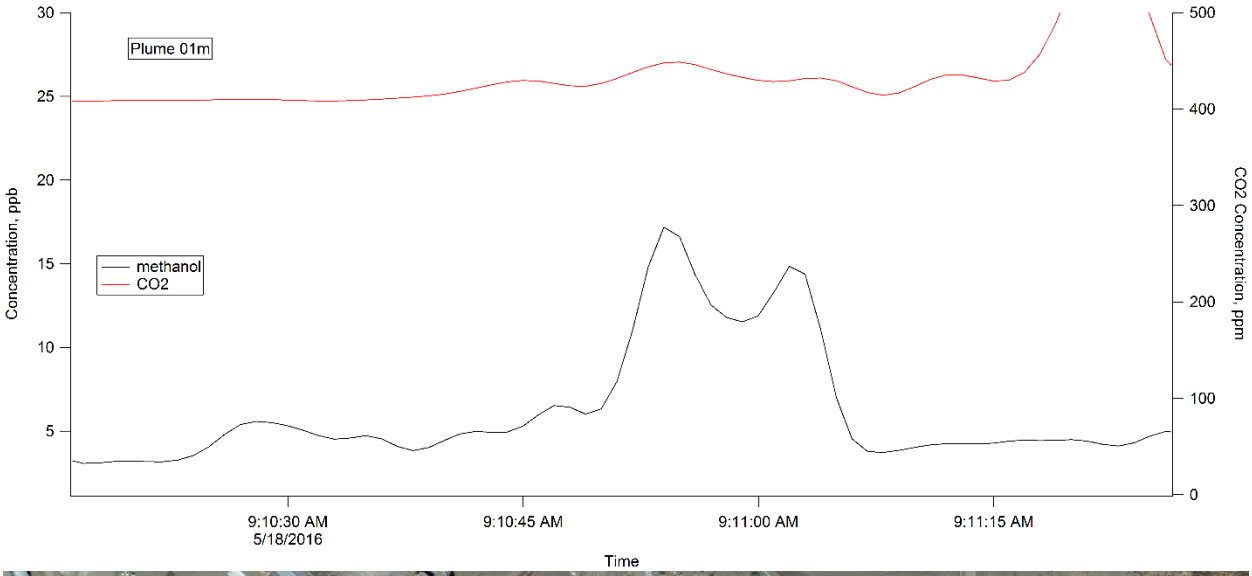




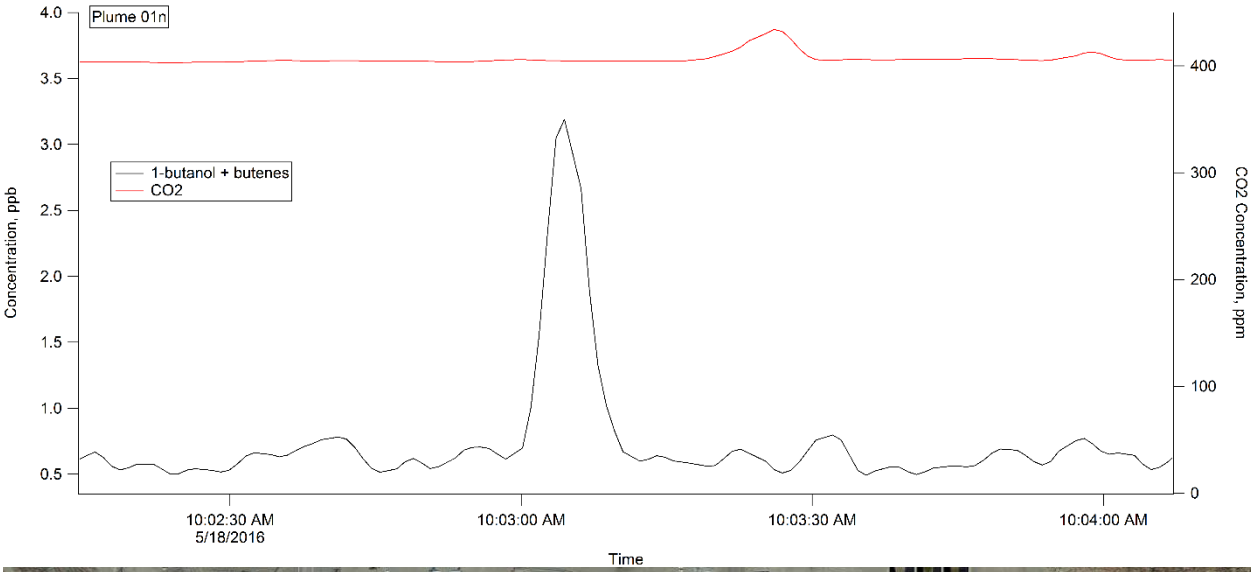
Plume 01k was observed from 9:05 to 9:07 AM, May 18, 2016, on the north side of 244-AR. It consisted of multiple elevated hits of ethylamine correlated with CO_2. Most combustion sources show additional COPCs correlated, making this a unique combustion plume.



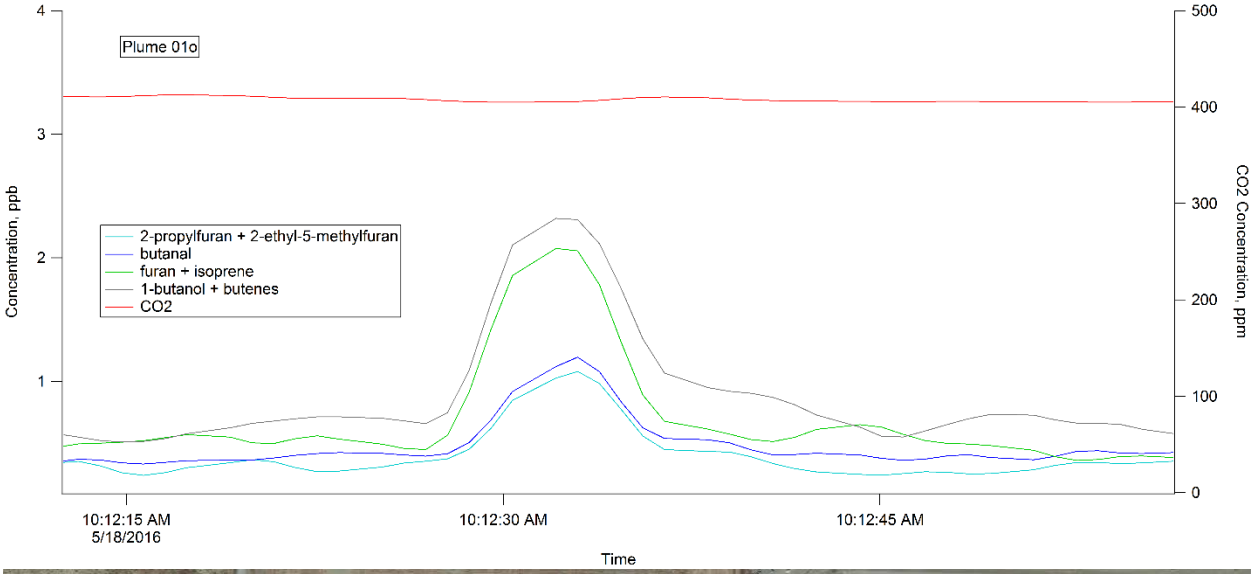
Plume 01l was observed at 9:08, May 18, 2016, on the north side of 244-AR. This is a non-combustion source of methanol with no other COPCs correlated.



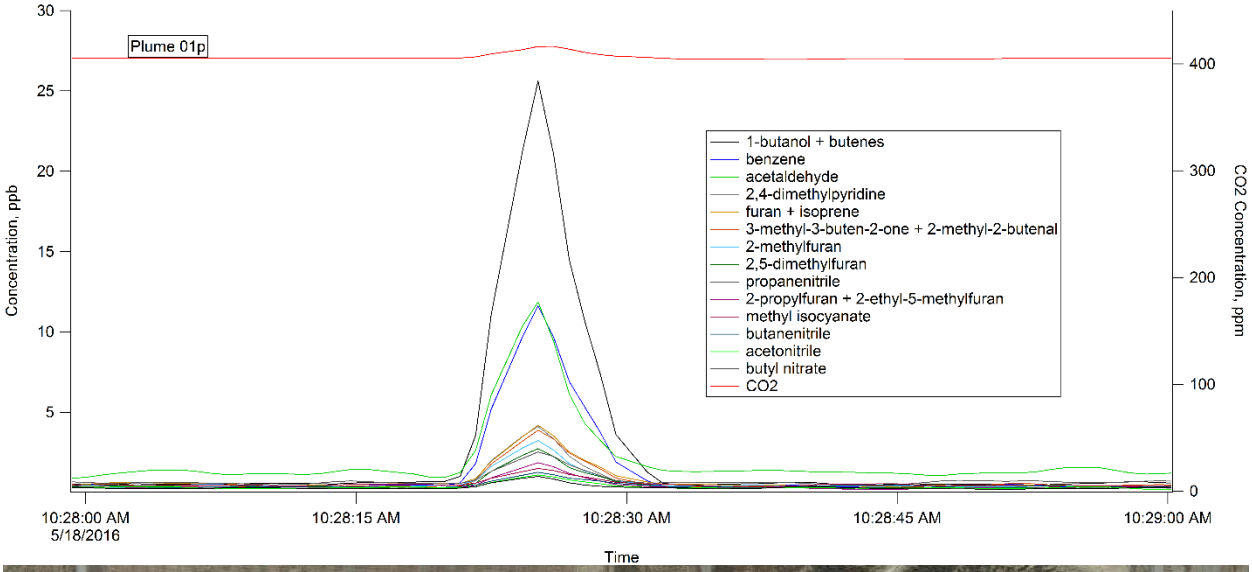
Plume 01m was observed at 9:11, May 18, 2016, on the west side of AZ. This is another methanol source but there appears to be a correlation with CO_2 in this case. It is difficult to speculate if this is a combustion source or if the methanol source is overlapping with a dilute combustion source drifting through the area.

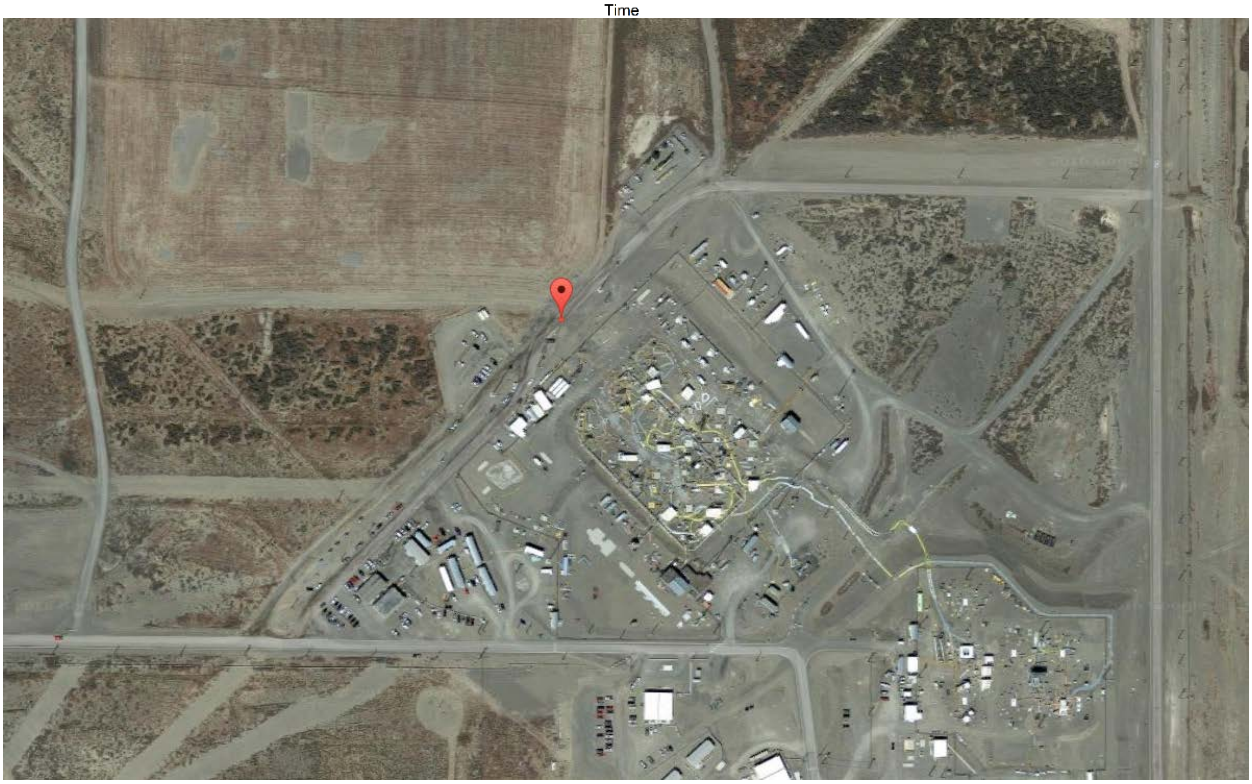


Plume 01n was observed at 10:03, May 18, 2016, on the east side of AW farm. This is a non-combustion source of 1-butanol + butenes with no other COPCs correlated.

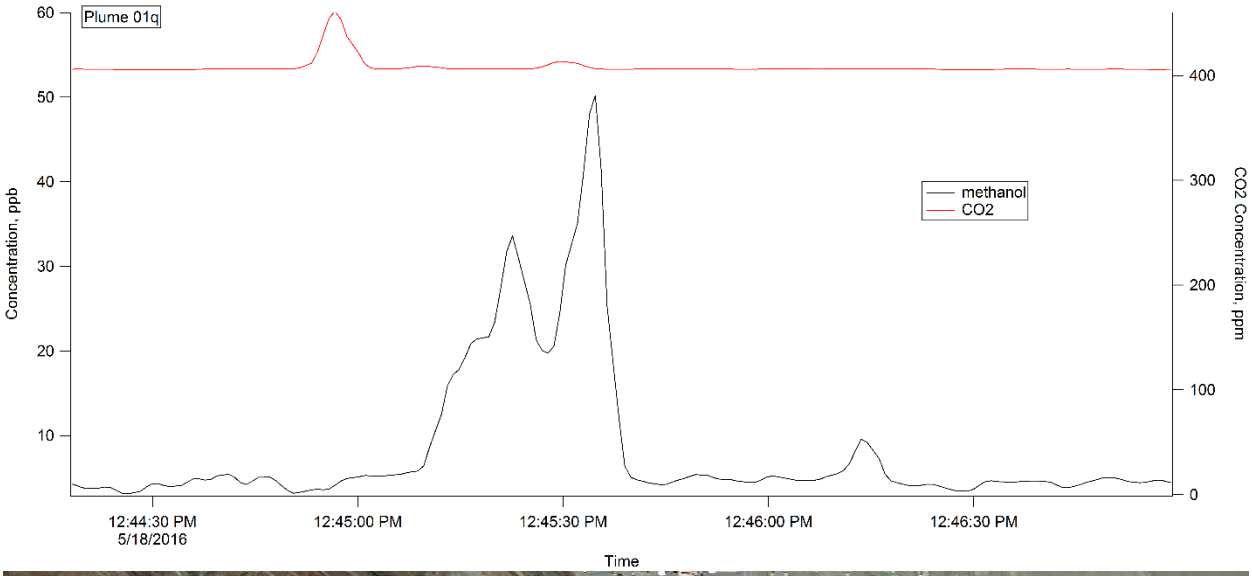


Plume 01o was observed at 10:12 AM, May 18, 2016, on the southwest side of C farm. It is a complex plume without correlation to CO_2, suggesting a non-combustion source. The plume consists of 2-propylfuran + 2-ethyl-5-methylfuran, butanal, furan + isoprene, and 1-butanol + butenes. Some of these ion signals are the most difficult to assign to specific COPCs and it is difficult to predict what the source of this plume may be.



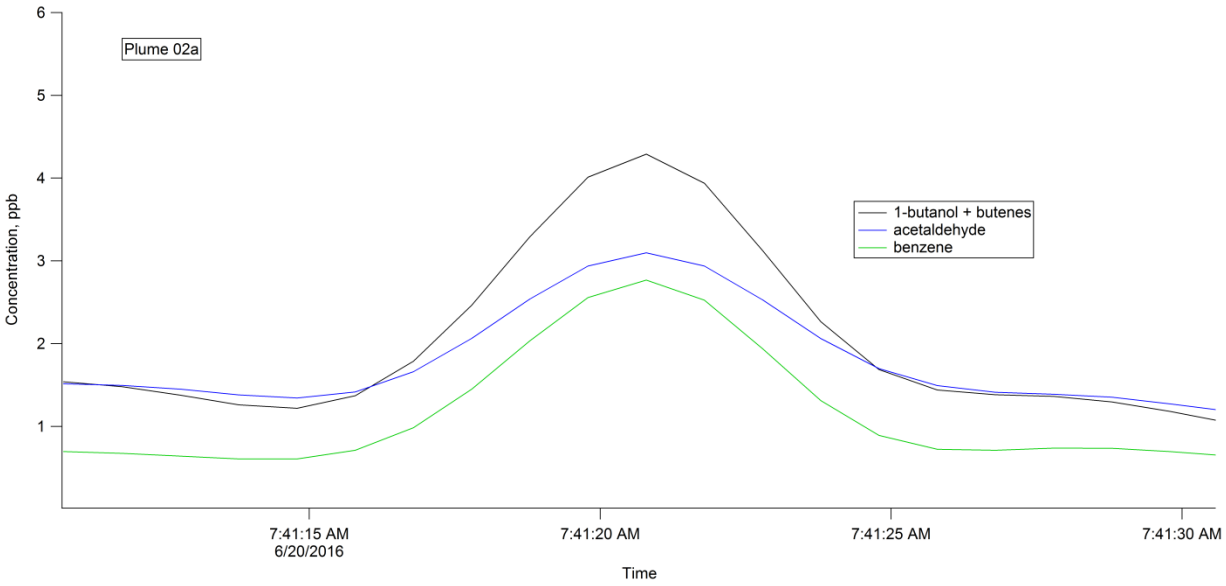


Plume 01p was observed at 10:28 AM, May 18, 2016, on the north side of C farm. It is a complex combustion plume, likely gasoline in origin, with large VOC concentrations compared to CO_2, suggesting the source does not have a functioning exhaust scrubber (catalytic converter if a vehicle). It chemical composition is shown on the graph above.

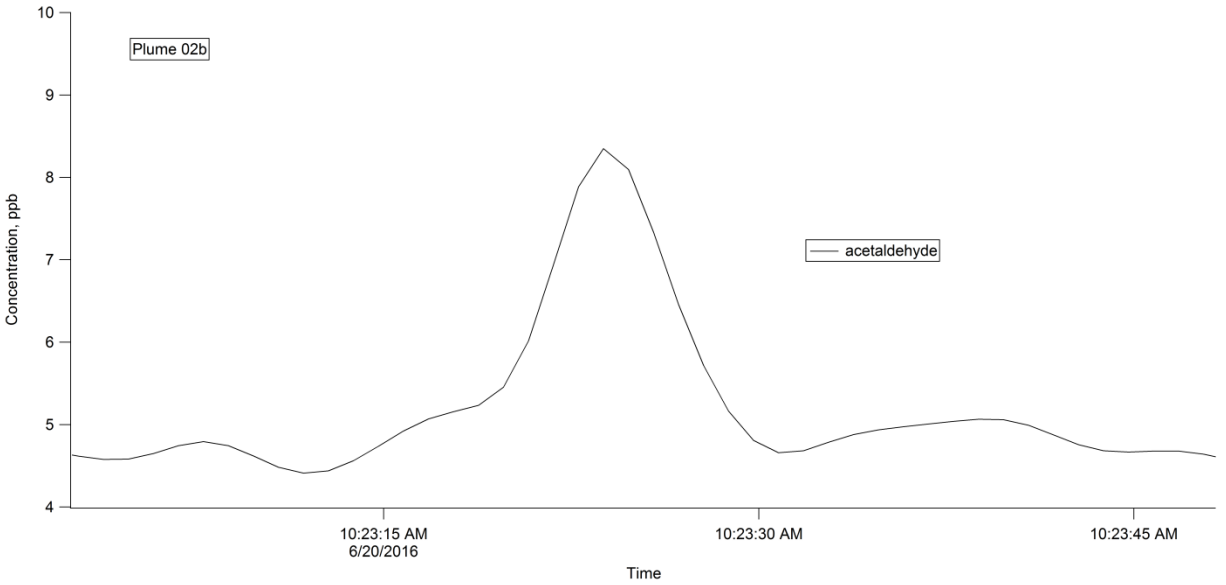


Plume 01q was observed at 12:45, May 18, 2016, on the northwest side of the PUREX plant. This is a non-combustion source of methanol with no other COPCs correlated. Note that there is a small CO_2 hit in-between the two methanol peaks but they are not correlated.

9.2.2 June 20, 2016

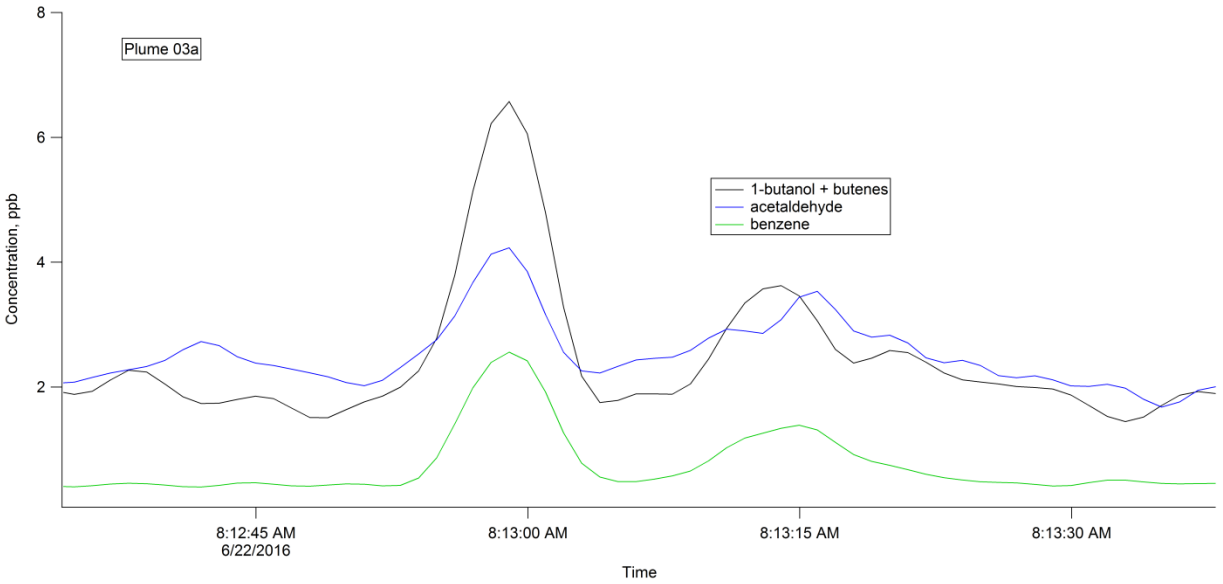


No data for CO_2, weather, or GPS is available for this day. Plume 02a was observed at 7:41 AM and consisted of 1-butanol + butenes, acetaldehyde, and benzene.

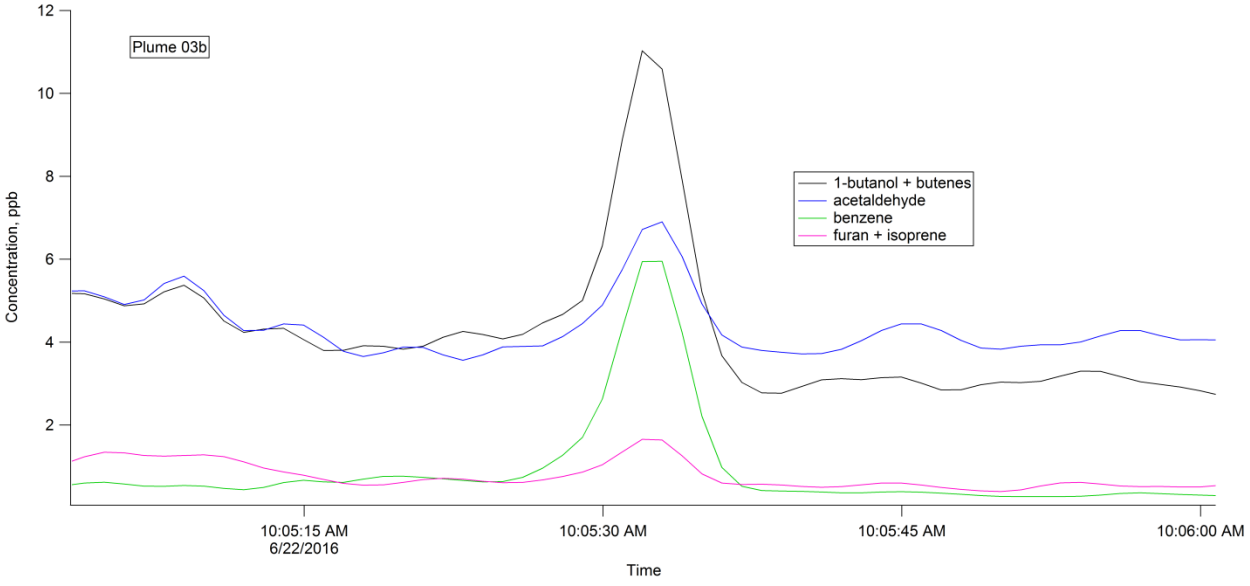


No GPS or CO_2 data available on June 20th. Plume 02b was observed at 10:23 AM and consisted of acetaldehyde.

9.2.3 June 22, 2016

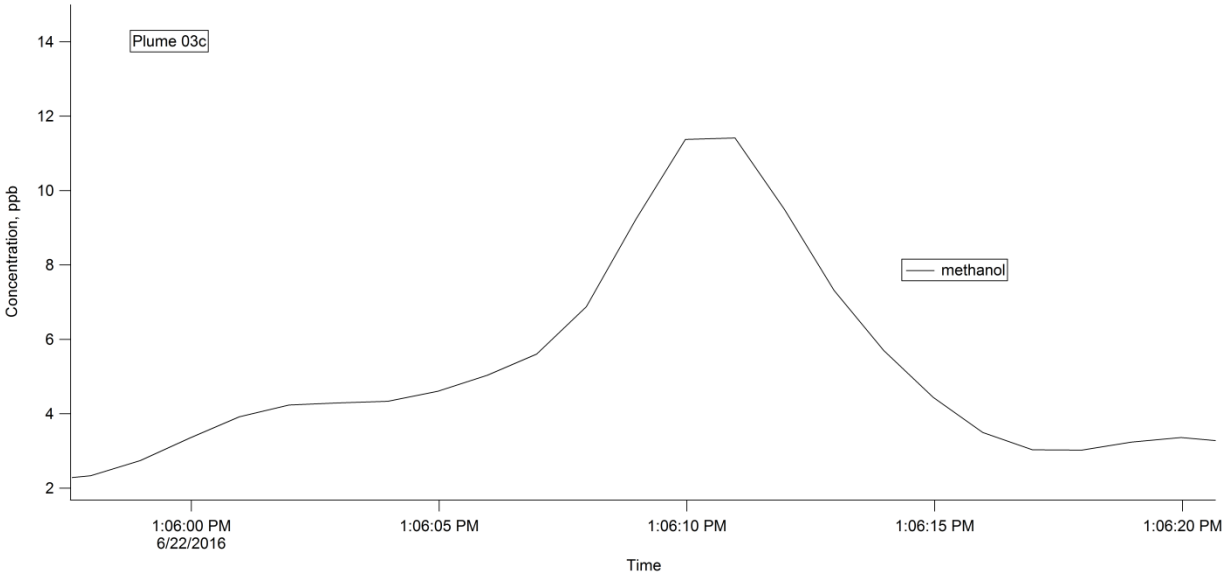


Plume 03a was observed at 8:13 AM and consisted of 1-butanol + butenes, acetaldehyde, and benzene. While this may look like a typical gasoline exhaust plume, no data for CO_2, weather, or GPS is available for this day and no conclusions were drawn as a result.



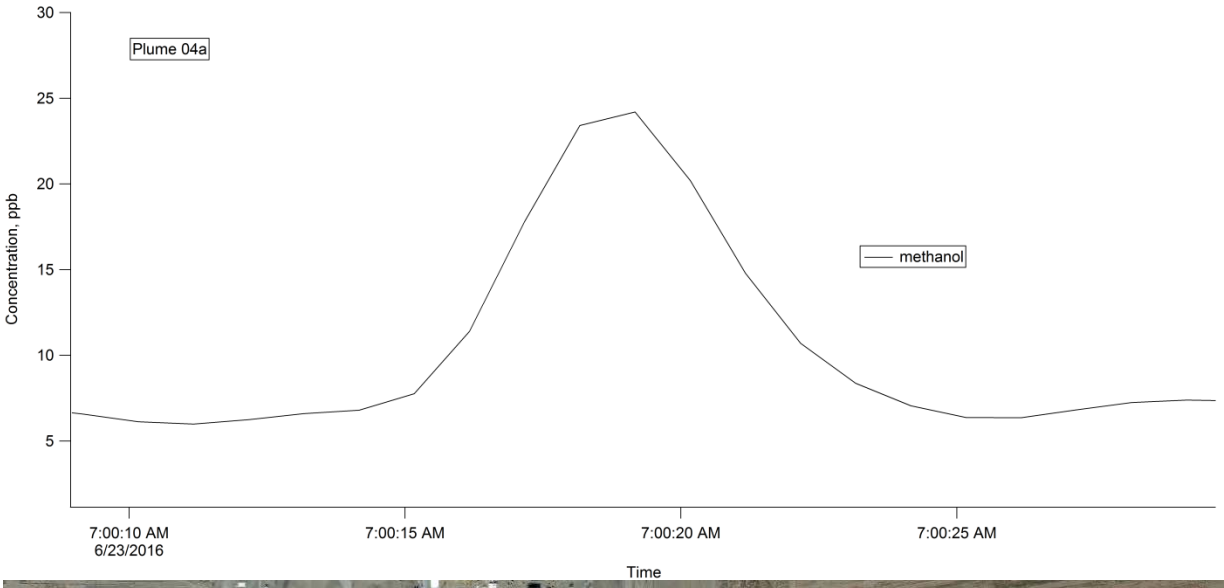
No GPS or CO_2 data available on June 22nd. Plume 03b was observed at 10:05 AM and consisted of 1-butanol + butenes, acetaldehyde, benzene, and furan + isoprene. While this may look like a

typical gasoline exhaust plume, no data for CO_2, weather, or GPS is available for this day and no conclusions were drawn as a result. The furan + isoprene signal exceeded OEL for this plume.

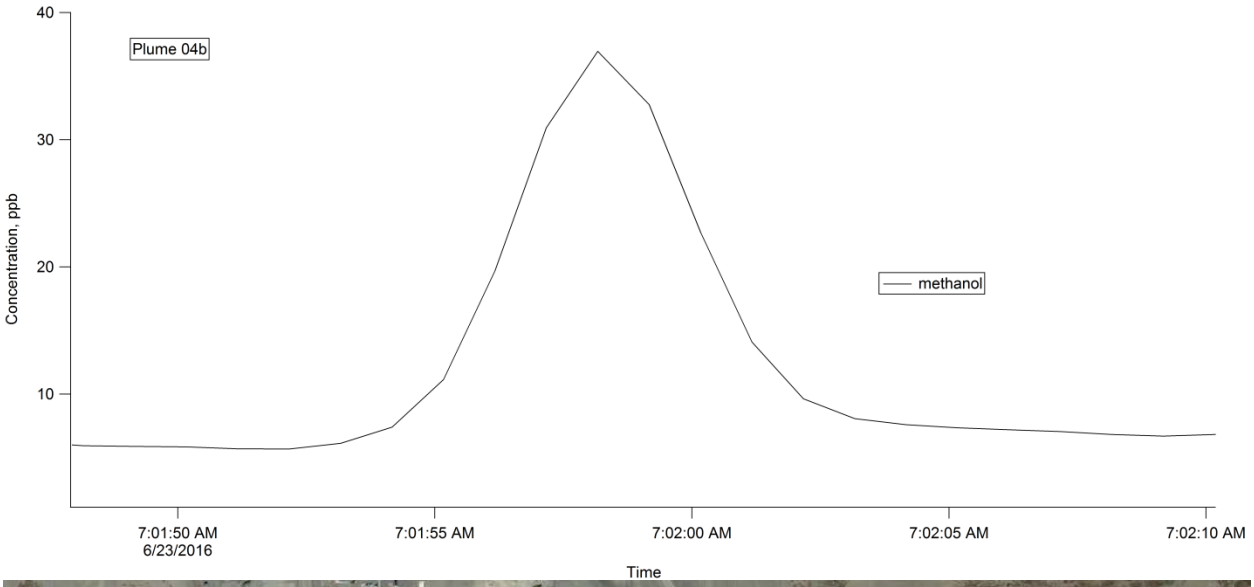


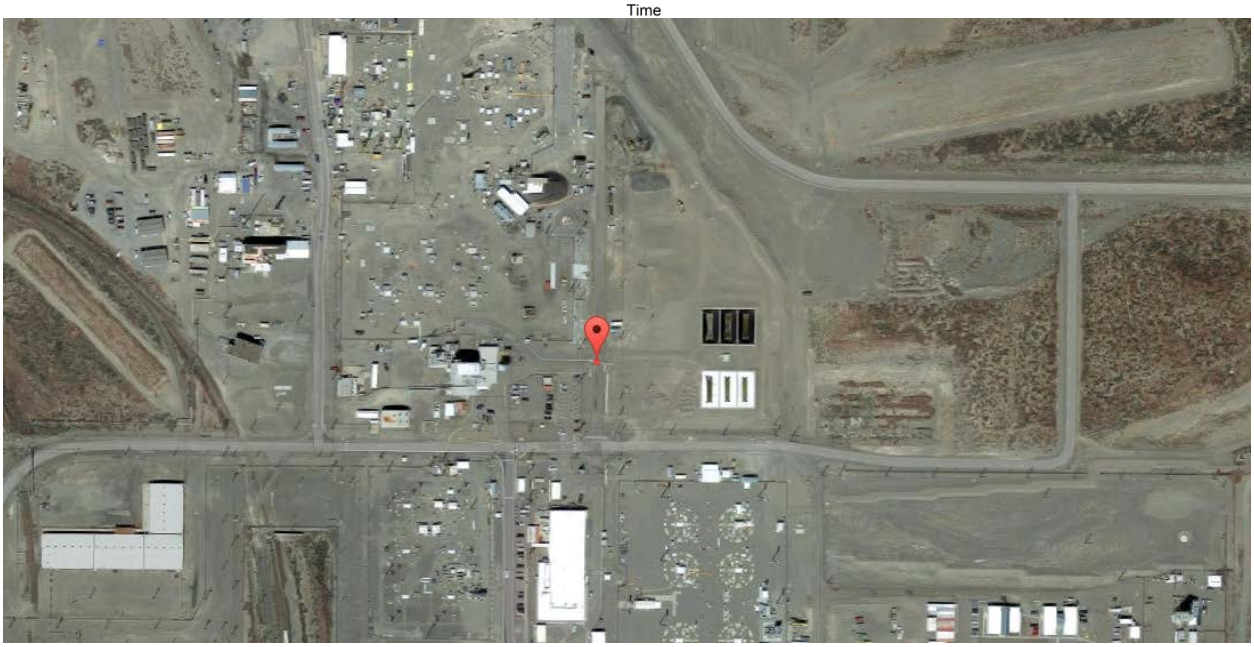
No GPS or CO_2 data available on June 22nd. Plume 03c was observed at 1:06 PM and consisted of methanol. No data for CO_2, weather, or GPS is available for this day and no conclusions were drawn as a result.

9.2.4 June 23, 2016

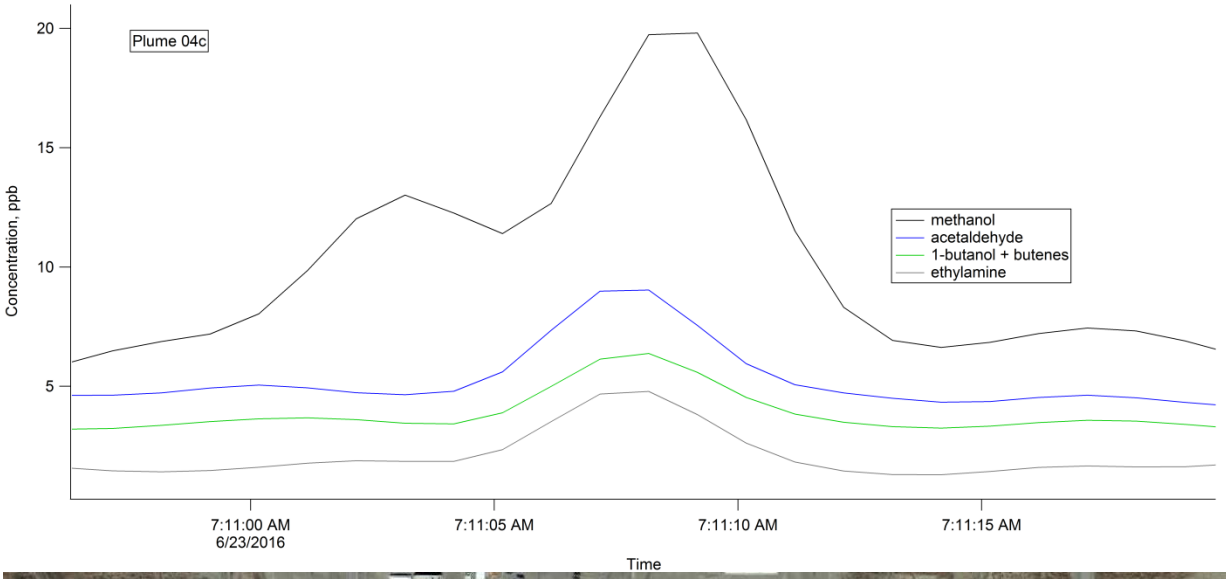


No CO_2 available on June 23rd. Plume 04a was observed at 7:00 AM at the dead end of Canton E of AX Farm. 66.8 °F and 1.01 bar, moderate winds blowing SW. The plume consisted of elevated methanol. No CO_2 data available for correlation.

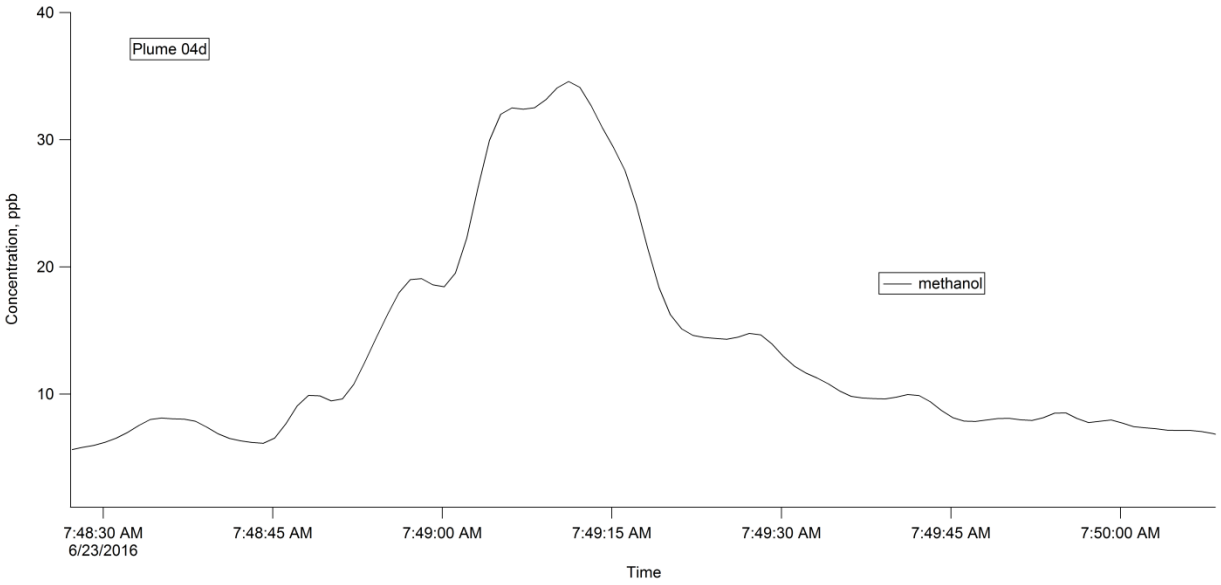


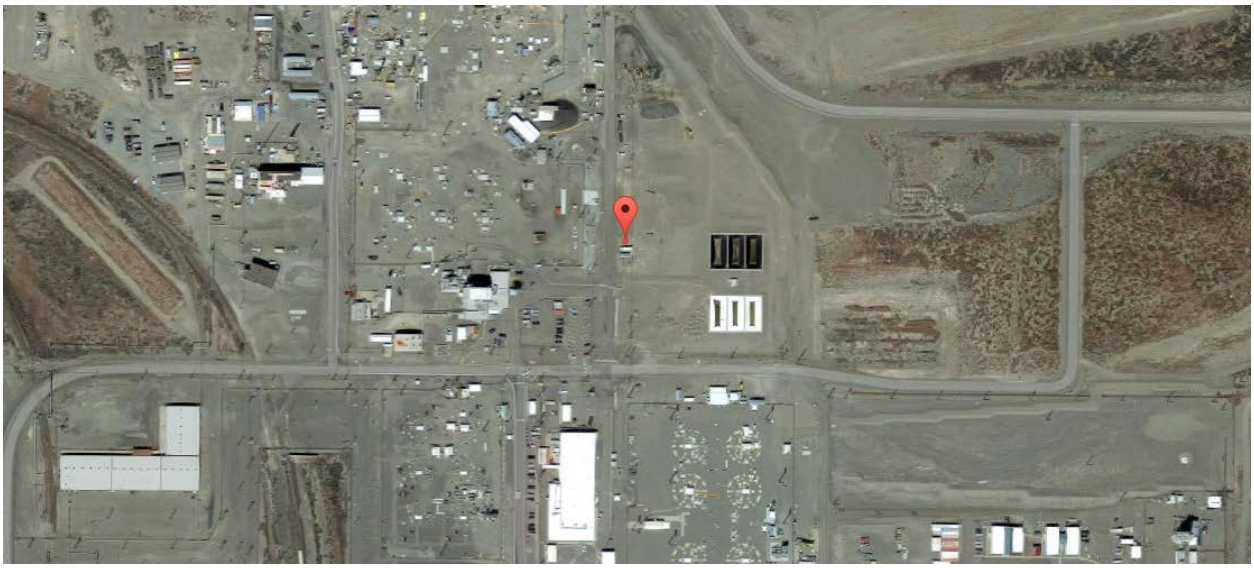


No CO_2 available on June 23rd. Plume 04b was observed at 7:02 AM on Canton E of A Farm and the 242A Evaporator. 67.0 °F and 1.01 bar, moderate winds blowing WSW. The plume consisted of elevated methanol. This methanol peak is the highest signal recorded for methanol on 6/23. No CO_2 data available for correlation.

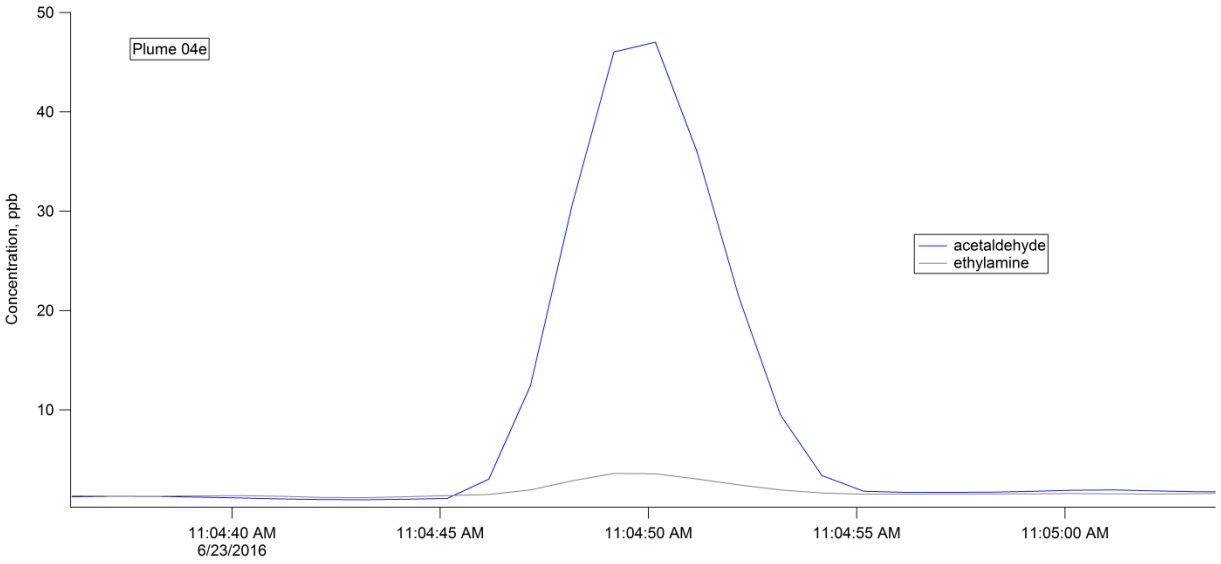


No CO_2 available on June 23rd. Plume 04c was observed at 7:11 AM in the parking lot by MO267. 67.1 °F and 1.01 bar, moderate winds blowing E. The plume consisted of elevated methanol, acetaldehyde, 1-butanol + butenes, and ethylamine signals, commonly associated with exhaust. No CO_2 data available for correlation.



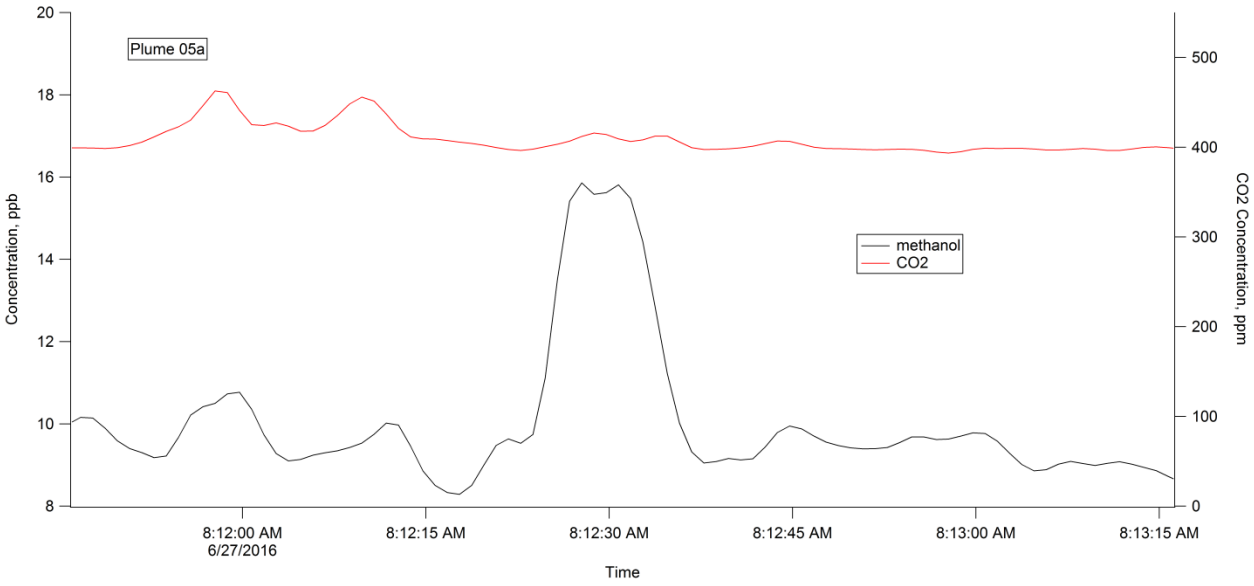


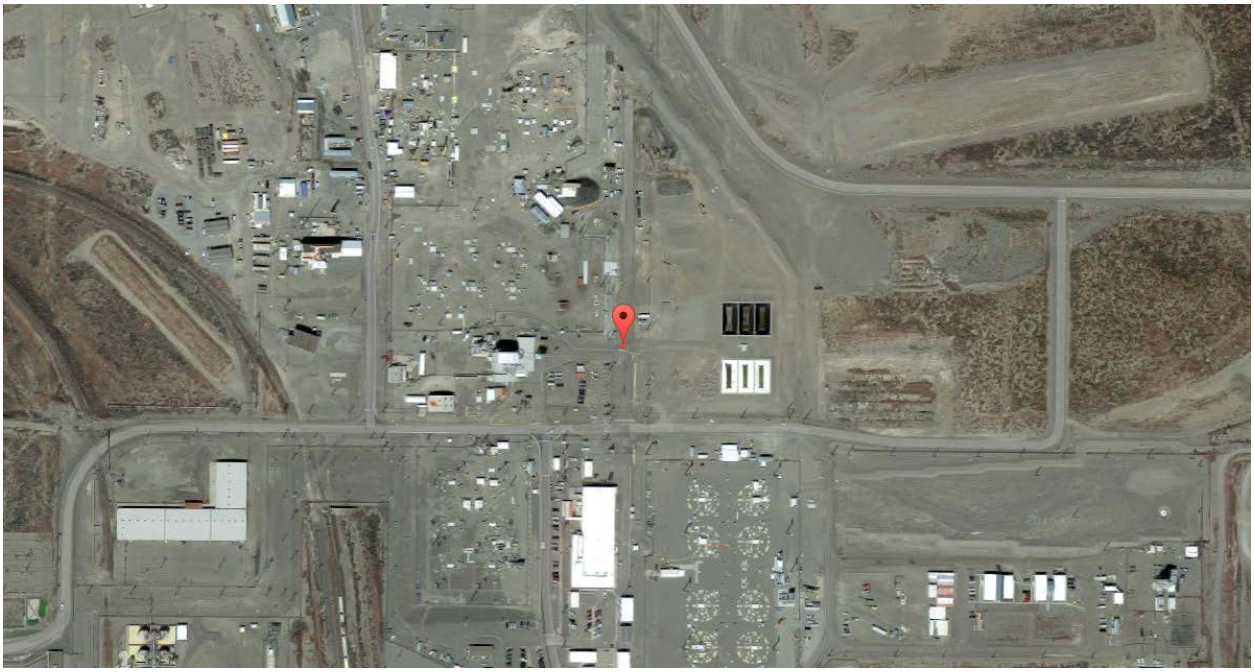
No CO_2 available on June 23rd. Plume 04d was observed at 7:49 AM at the Stationary Monitoring Site E of A Farm. 68.4 °F and 1.01 bar, moderate winds blowing S. The plume consisted of elevated methanol. No CO_2 data available for correlation.



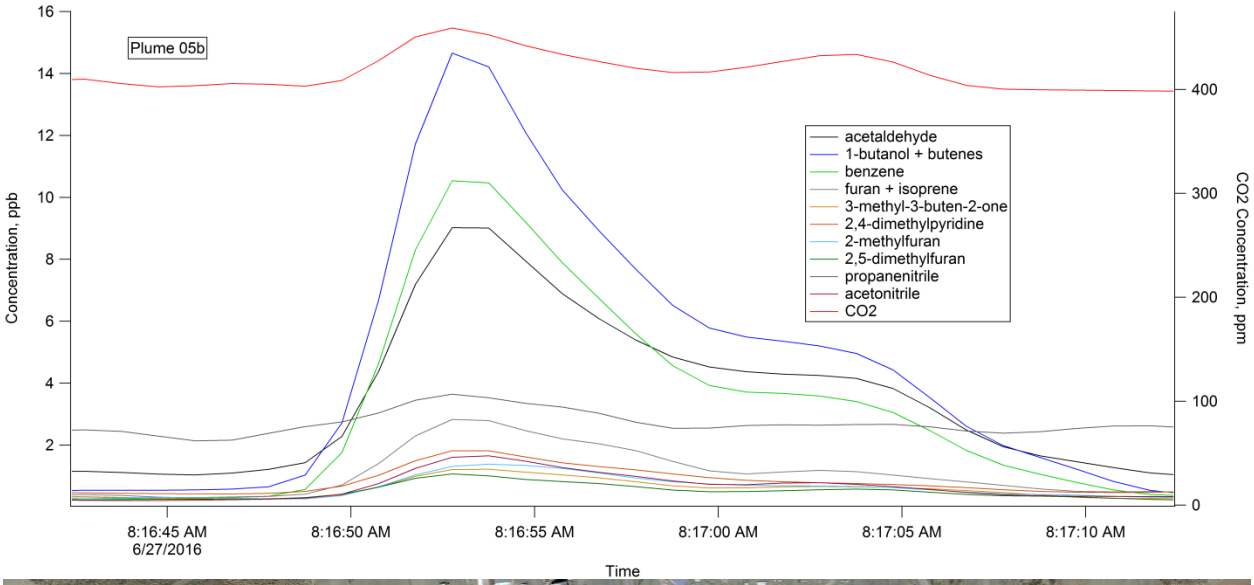
No CO_2 available on June 23rd. Plume 04e was observed at 11:04 AM on Canton E of AX Farm. 80.8 °F and 1.01 bar, light intermittent winds blowing S. The plume consisted of elevated acetaldehyde. No CO_2 data available for correlation.

9.2.5 June 27, 2016

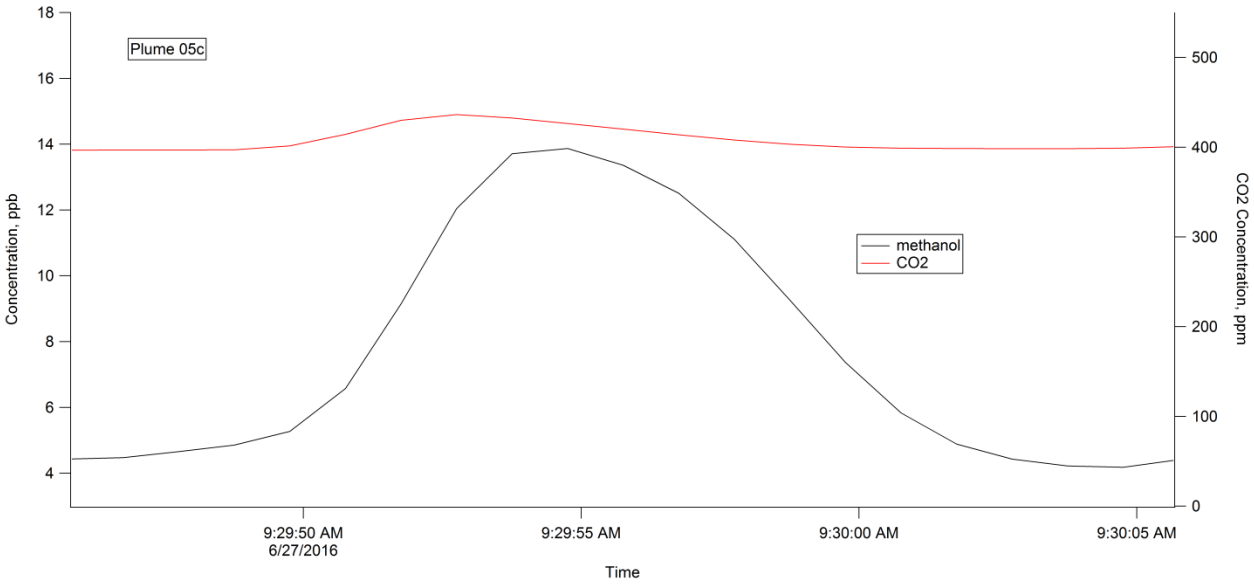




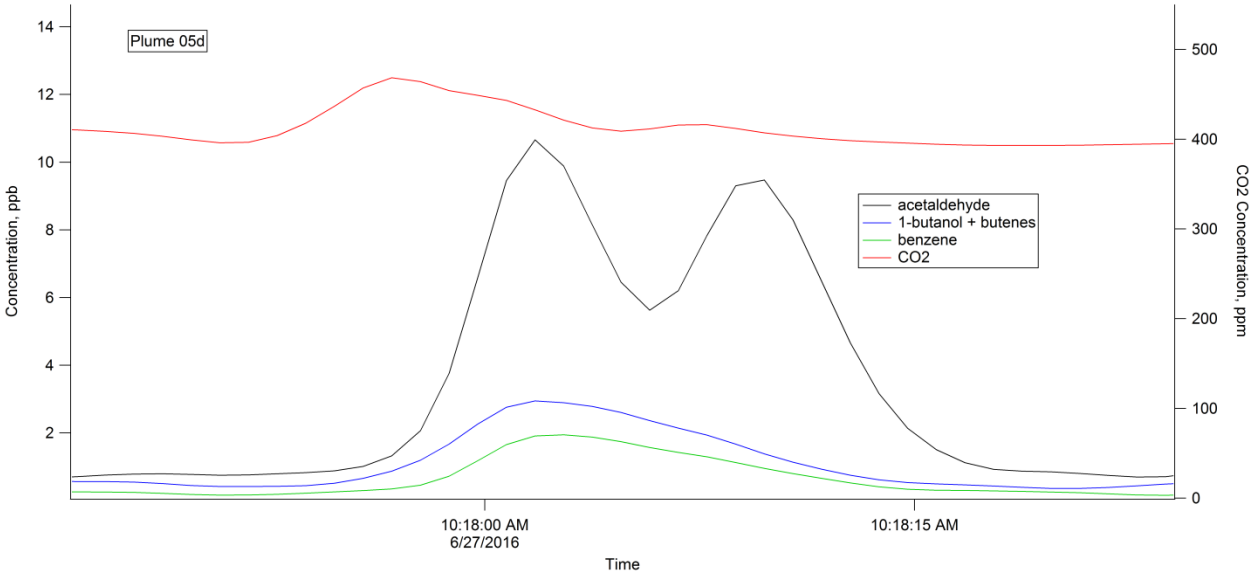
Plume 05a was observed at 8:12 AM on Canton E of A Farm and the 242A Evaporator. 81.1 °F and 1.02 bar, light winds blowing E. The plume consisted of slightly elevated methanol roughly 6 ppb above background with no other correlated COPCs. There is a slight elevation in CO_2 accompanying this plume.



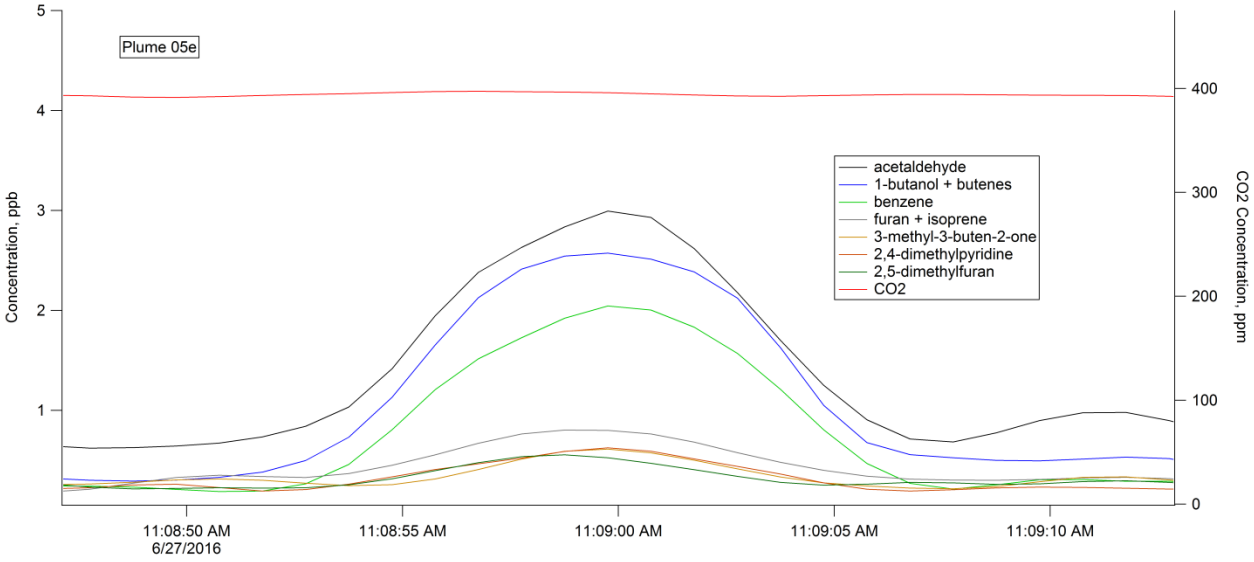
Plume 05b was observed at 8:16 AM at the Stationary Monitoring Site N of 244AR and W of A Farm. 81.7 °F and 1.02 bar, light winds blowing N. The plume consisted of many elevated signals, primarily acetaldehyde, 1-butanol + butenes, and benzene. This was the max peak for both 1-butanol + butenes and benzene for 6/27. There is an elevation in CO_2 accompanying this plume and is likely gasoline exhaust.



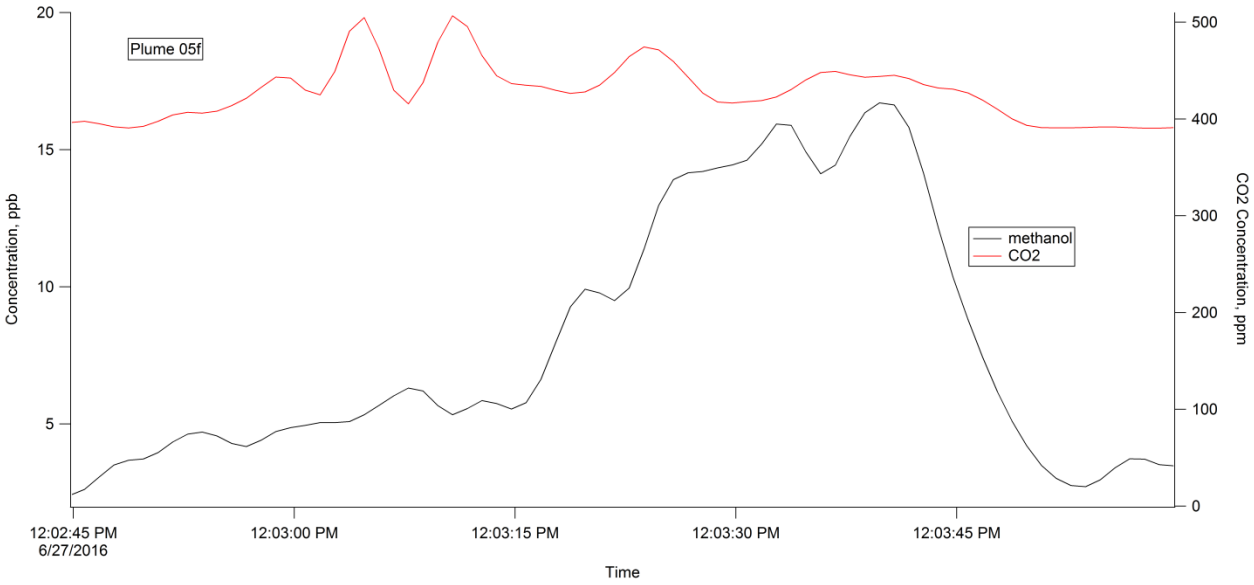
Plume 05c was observed at 9:29 AM at the Stationary Monitoring Site N of 244AR and W of A Farm. 88.3 °F and 1.02 bar, light winds blowing N. The plume consisted of elevated methanol with no other correlated COPCs. There is a slight elevation in CO_2 accompanying this plume, but is slightly offset which could be the result of a dilute or mixed plume.



Plume 05d was observed at 10:18 AM at the Stationary Monitoring Site N of 244AR and W of A Farm. 90.0 °F and 1.02 bar, moderate winds blowing N. The plume consisted of elevated acetaldehyde, 1-butanol + butenes, and benzene signals. This was the max peak for acetaldehyde for 6/27. There is a slight elevation in CO_2 accompanying this plume, so this plume is likely gasoline exhaust.

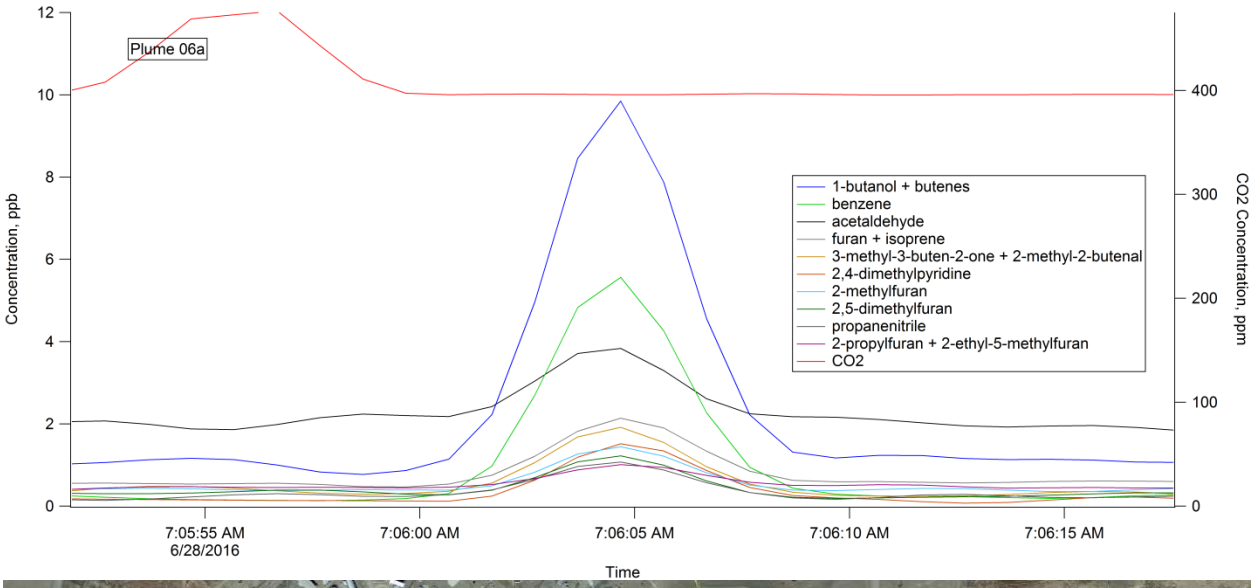


Plume 05e was observed at 11:09 AM at the Stationary Monitoring Site N of 244AR and W of A Farm. 92.0 °F and 1.02 bar, light winds blowing N. The plume consisted of several elevated COPC signals, primarily acetaldehyde, 1-butanol + butenes, and benzene signals. This was the max peak for acetaldehyde for 6/27. There is no correlated elevation in CO_2 accompanying this plume, so this plume is from an unknown source, potentially to the S of the Stationary Monitoring Site.

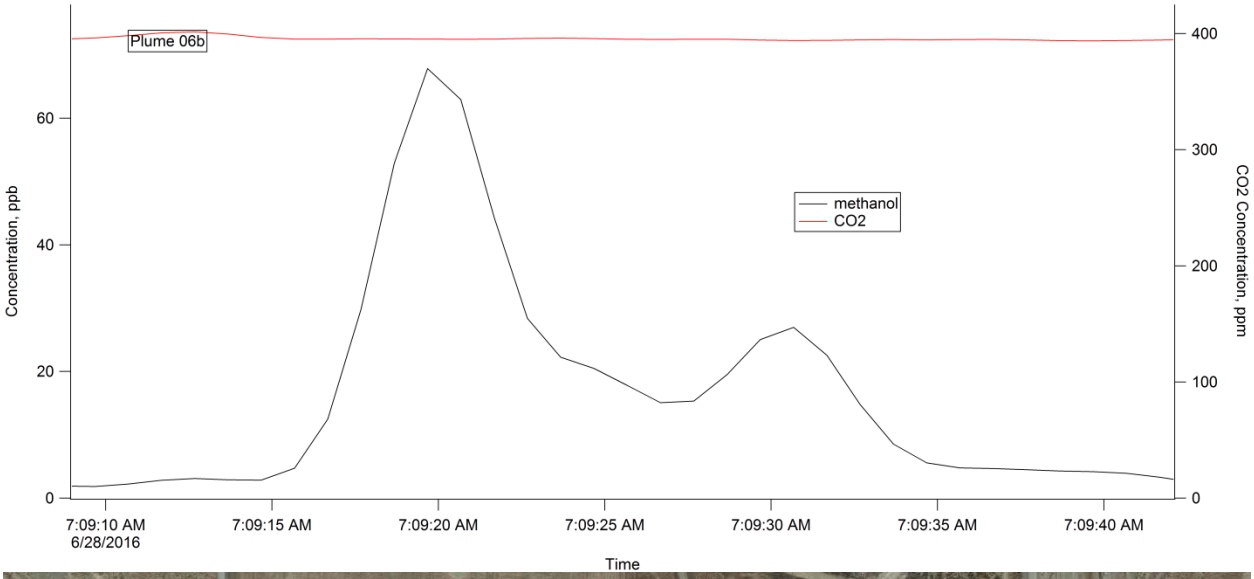


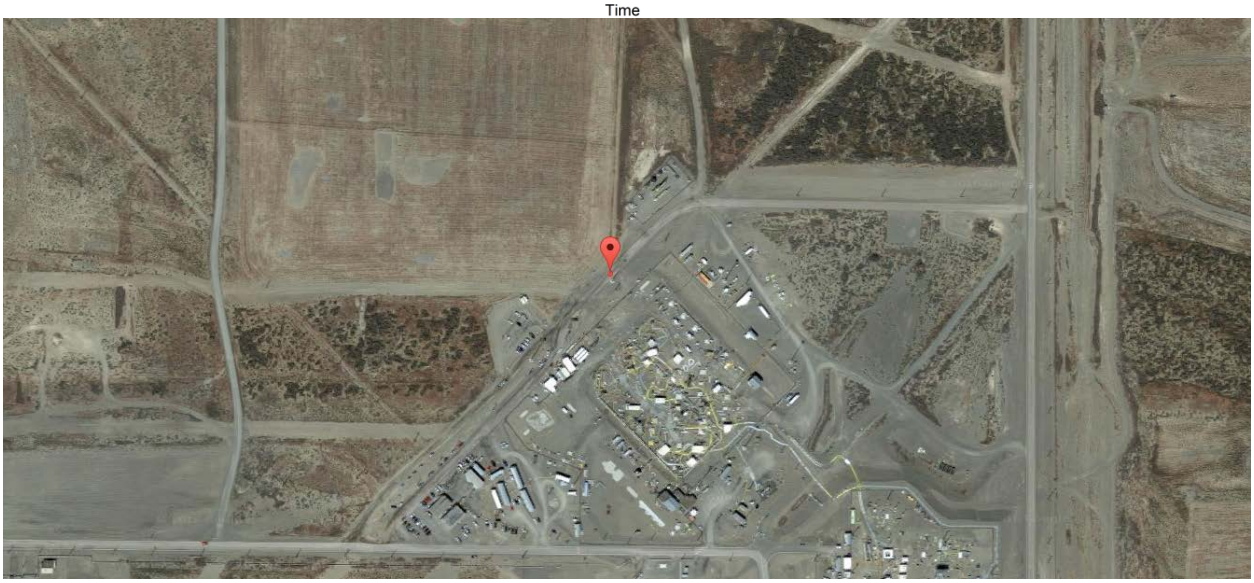
Plume 05f was observed at 12:03 PM at the Stationary Monitoring Site N of 244AR and W of A Farm. 95.2 °F and 1.02 bar, moderate winds blowing SW. The plume consisted of elevated methanol with no other correlated COPCs. There elevated CO_2 throughout this time period, but is slightly offset which could be the result of a dilute or mixed plume.

9.2.6 June 28, 2016

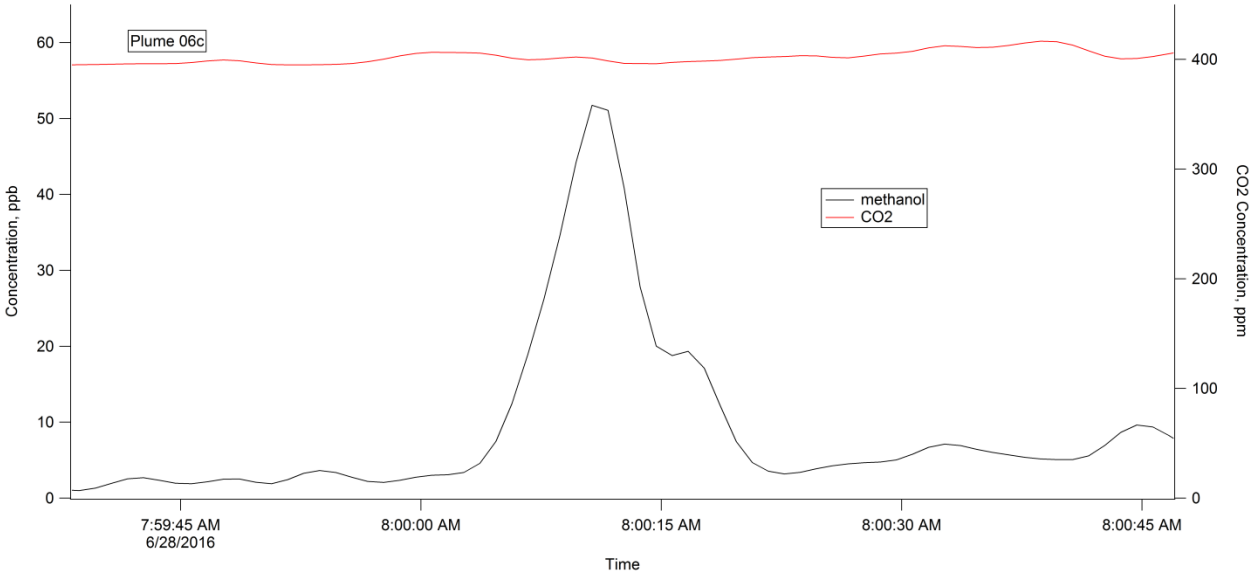


Plume 06a was observed at 7:06 AM while driving N on Buffalo W of AY and AZ Farms. 75.7 °F and 1.02 bar, moderate winds blowing ENE. The plume consisted of several elevated COPC signals, primarily 1-butanol + butenes, benzene, and acetaldehyde. This plume contains the max peak for 1-butanol + butenes and benzene for 6/28. 2-methylfuran, 2,5-dimethylfuran, and furan + isoprene signals exceeded OELs in this plume. There is no correlating elevation in CO_2 accompanying this plume, meaning this plume may come from an unknown source.

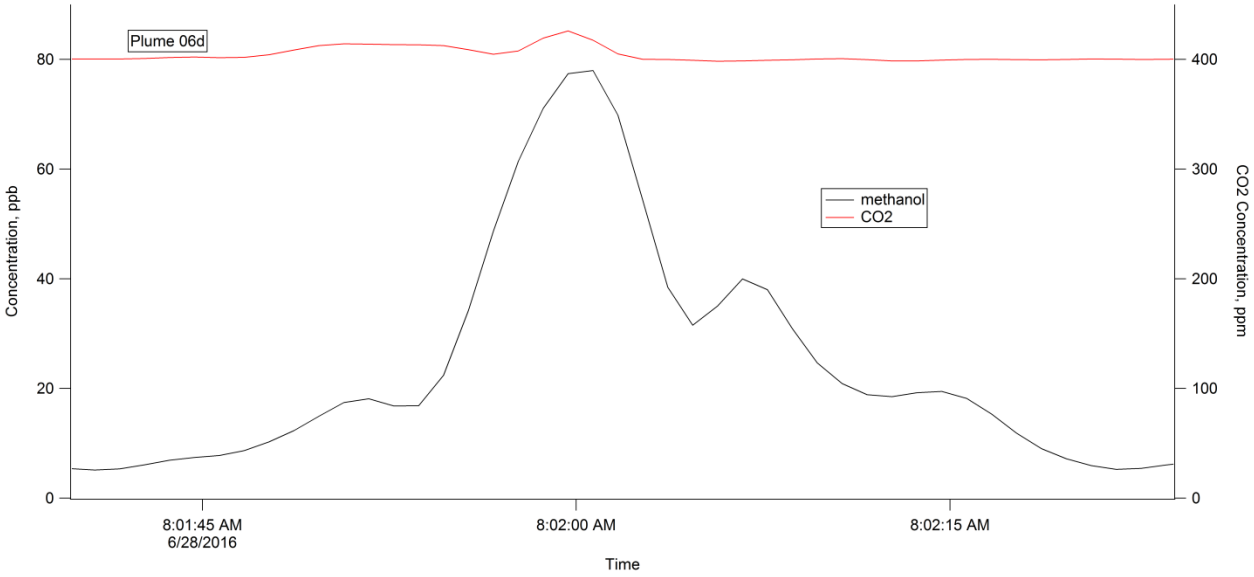


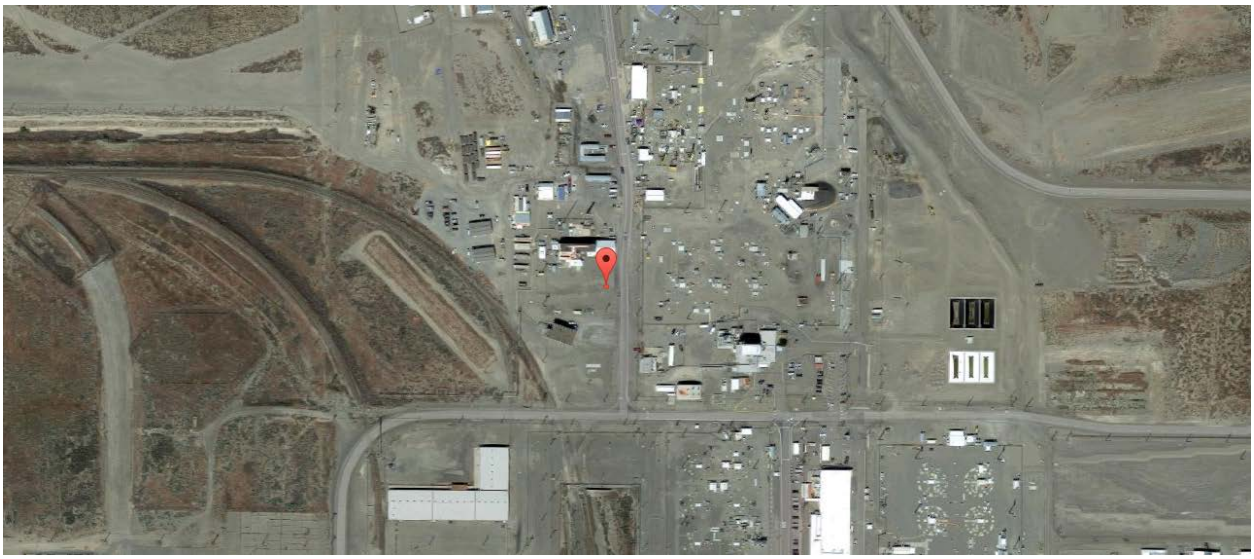


Plume 06b was observed at 7:09 AM N of C Farm. 75.6 °F and 1.02 bar, moderate winds blowing ESE. The plume consisted of moderately elevated methanol and no other COPCs of note. There is no correlating elevation in CO_2 accompanying this plume, meaning this plume may come from an unknown source near C Farm.



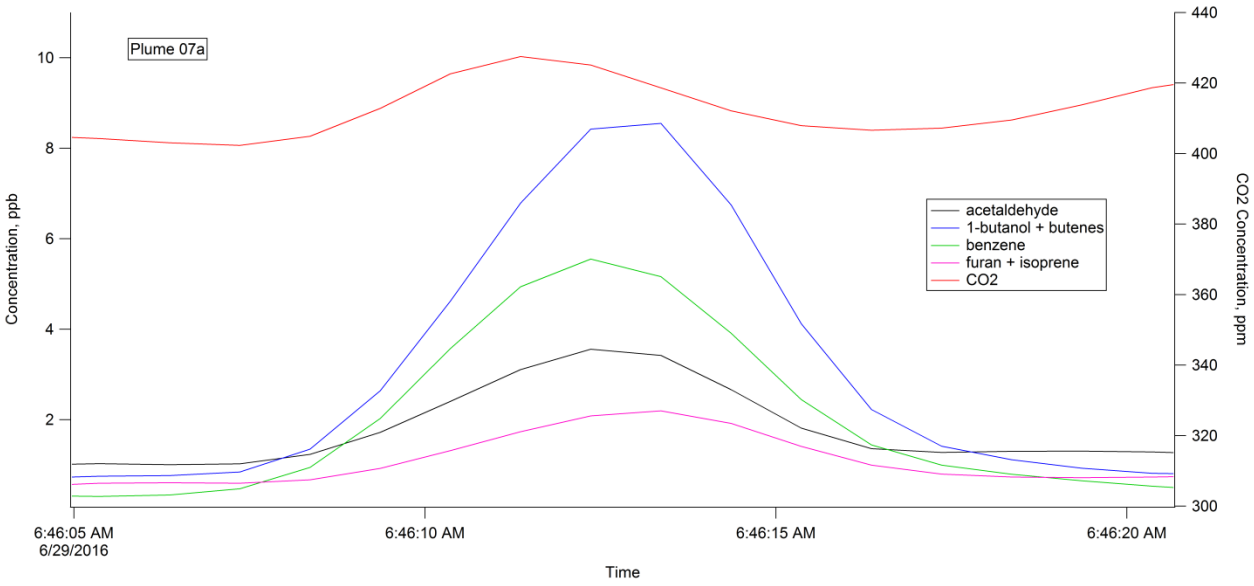
Plume 06c was observed at 8:00 AM at the Stationary Monitoring Site S of 244AR and W of A Farm. 87.6 °F and 1.02 bar, moderate winds blowing NNE. The plume consisted of moderately elevated methanol with no other COPCs of note. There is slightly elevated CO_2 accompanying this plume, meaning this plume may be a dilute or mixed plume.



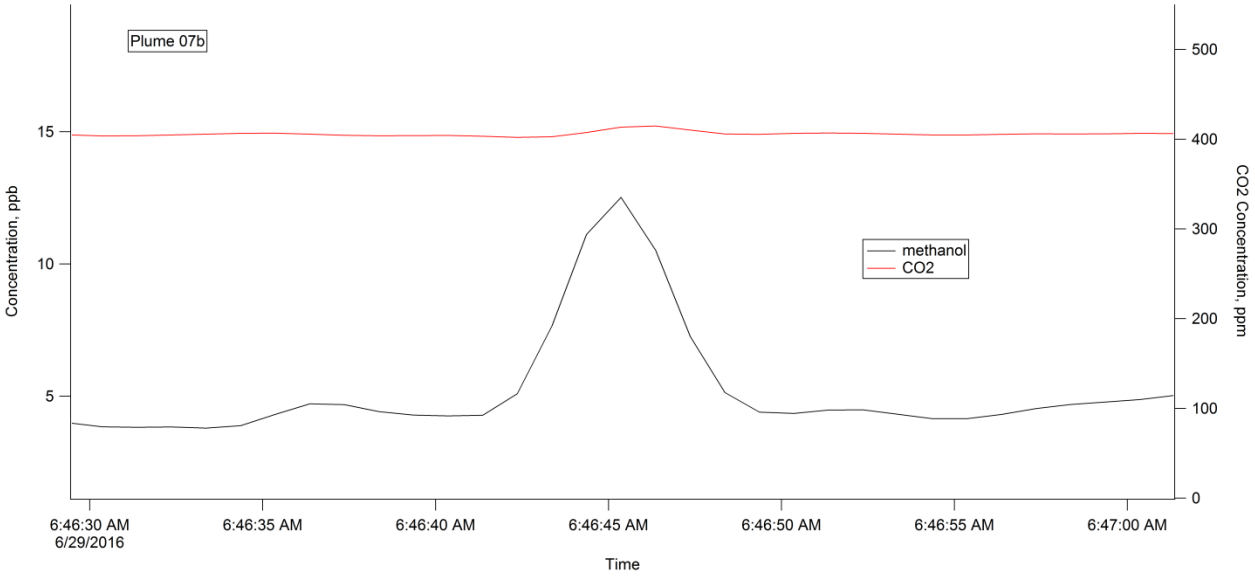


Plume 06d was observed at 8:02 AM at the Stationary Monitoring Site S of 244AR and W of A Farm. 86.4 °F and 1.02 bar, light winds blowing NNE. The plume consisted of moderately elevated methanol with no other COPCs of note. This was the max peak for methanol for 6/28. There is slightly elevated CO_2 accompanying this plume, meaning this plume may be a dilute or mixed exhaust plume.

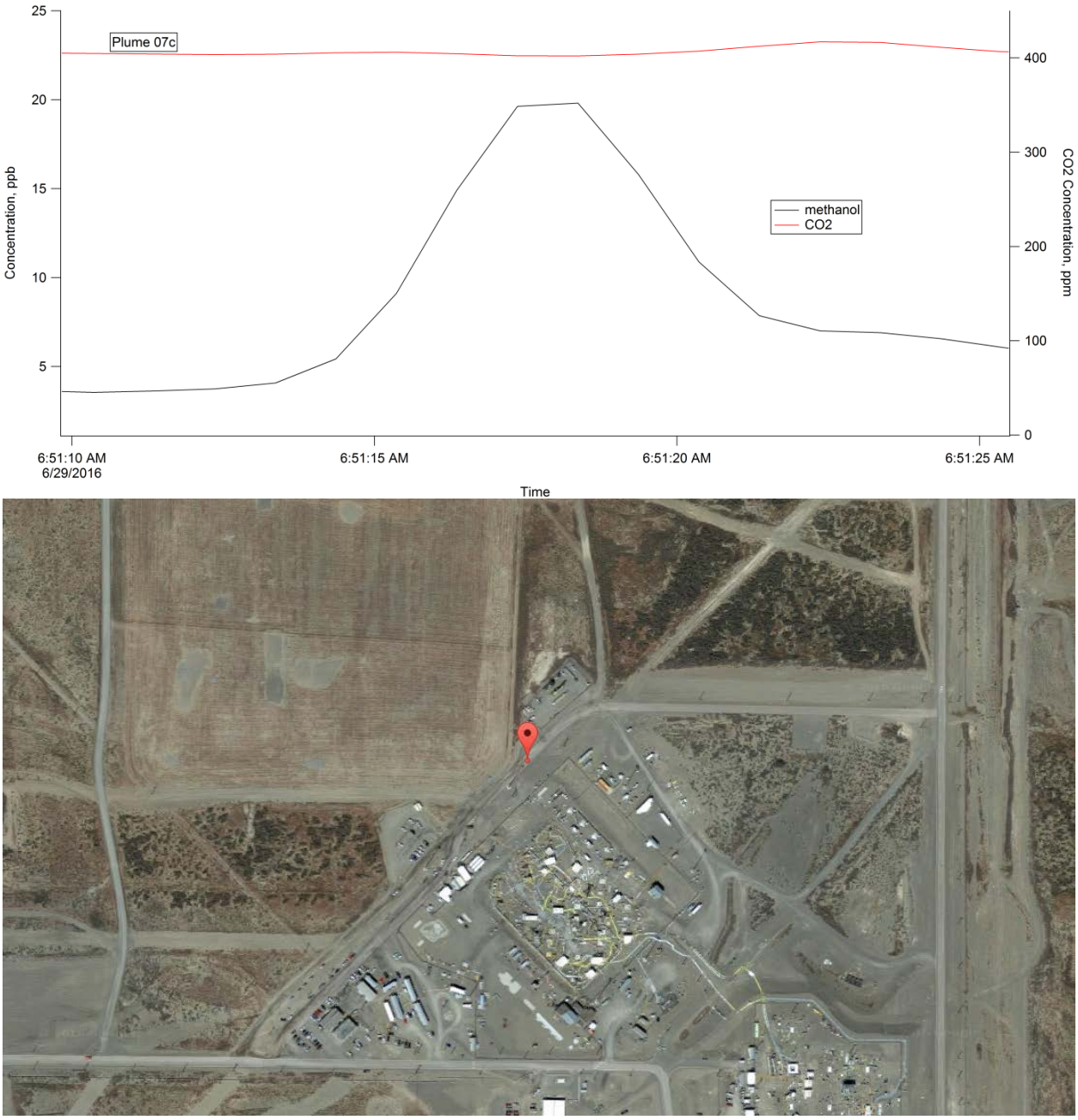
9.2.7 June 29, 2016



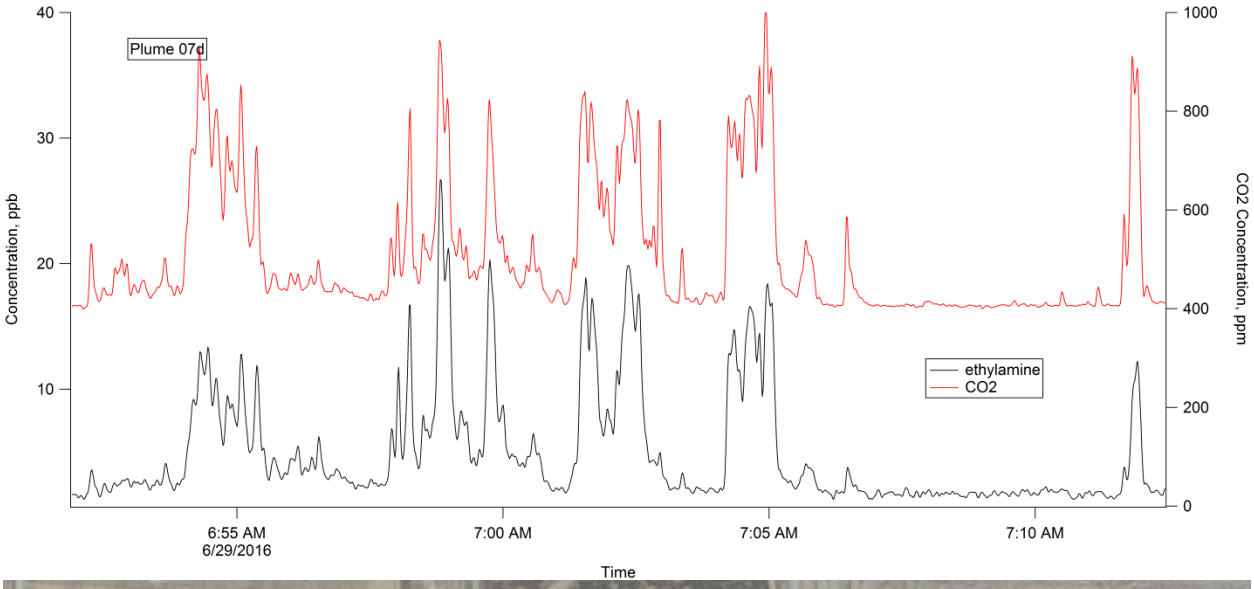
Plume 07a was observed at 6:46 AM while at the intersection of 4th and Buffalo. 72.7 °F and 1.01 bar, moderate winds blowing N. The plume consisted of several elevated COPC signals, primarily 1-butanol + butenes, benzene, and acetaldehyde. This plume contains the max peak for 1-butanol + butenes, acetaldehyde, and benzene for 6/29. The furan + isoprene signal exceeded OEL in this plume. There is a correlating elevation in CO_2 accompanying this plume, meaning this plume may come from gasoline exhaust.



No GPS available during this plume. Plume 07b was observed at 6:46 AM. GPS data was unavailable at this time, but it can be inferred that the vehicle was likely somewhere on Buffalo between 4th and C Farm. 72.8 °F and 1.01 bar, moderate winds blowing N. The plume consisted of slightly elevated methanol, around 8 ppb above background. There is a slight correlating elevation in CO_2 accompanying this plume, meaning this plume may be a dilute or mixed exhaust plume.



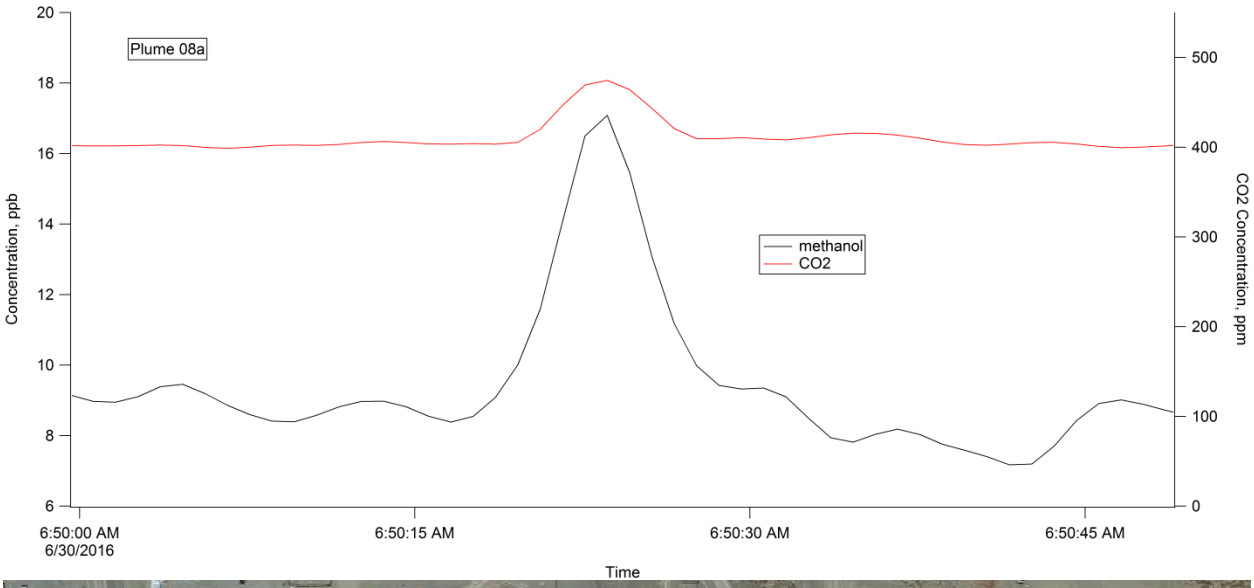
Plume 07c was observed at 6:51 AM N of C Farm. 72.7 °F and 1.01 bar, moderate winds blowing N. The plume consisted of several elevated COPC signals, primarily 1-butanol + butenes, benzene, and acetaldehyde. This plume contains the max peak for methanol for 6/29. There is no correlating elevation in CO_2 accompanying this plume, meaning this plume likely comes from an unknown source near C Farm.



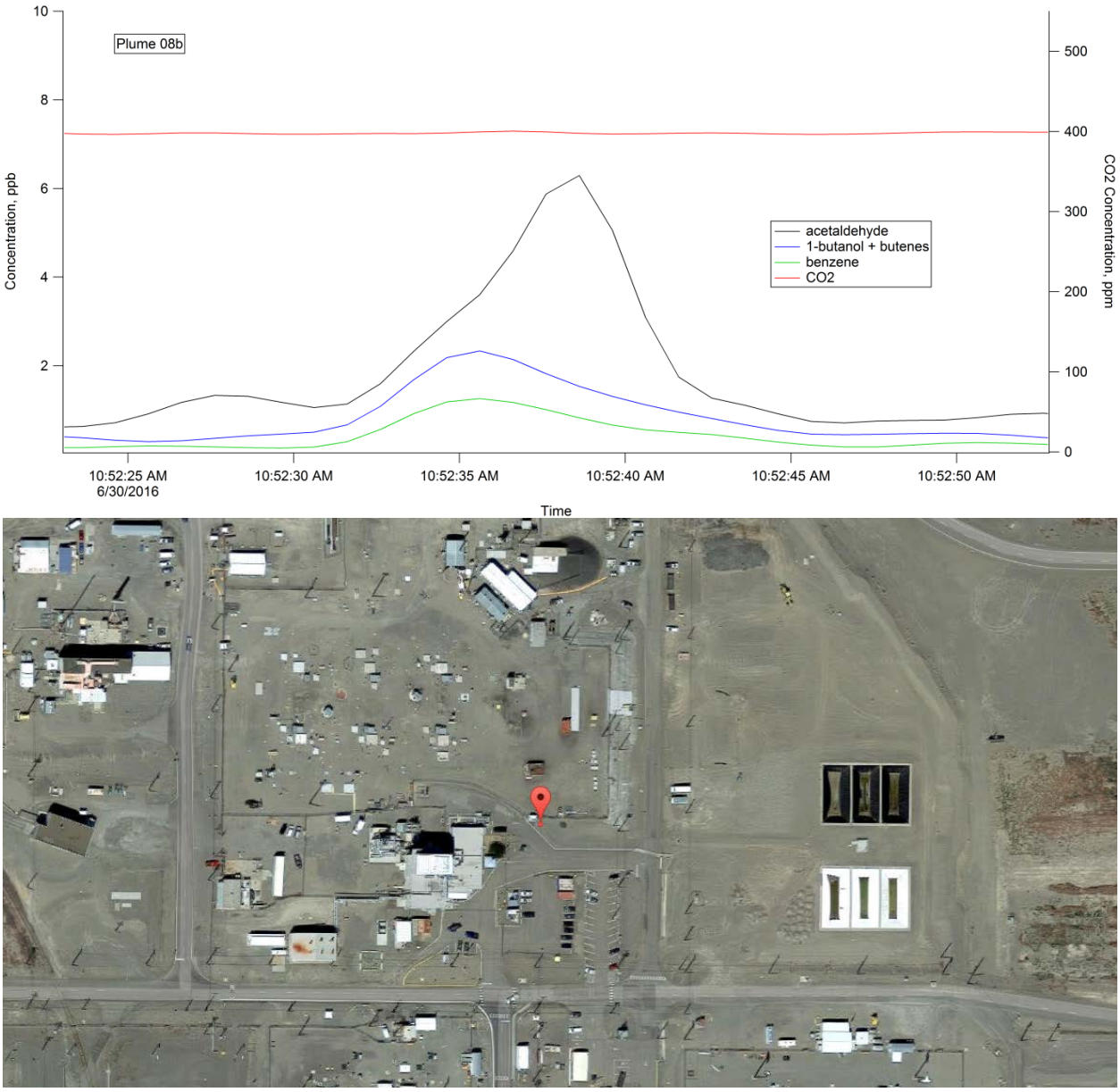
Plume 07d was observed between 6:52 AM and 7:13 AM while the Mobile Lab was making a trip around the perimeter of the 200E Tank Farms N of 4th. 75.9 °F and 1.01 bar, moderate variable winds. This is a series of elevated ethylamine signals that persisted throughout the time period shown. This plume contains the max peak for ethylamine for 6/29. There is a strong

correlation to CO_2 which means this is very likely exhaust, possibly from the Mobile Lab or its generator.

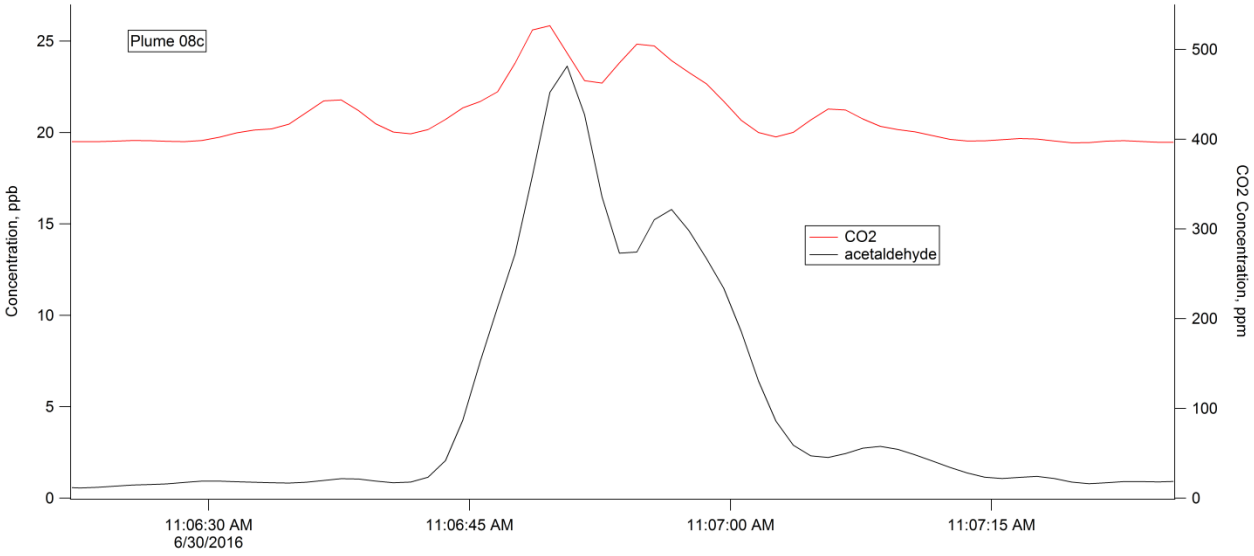
9.2.8 June 30, 2016

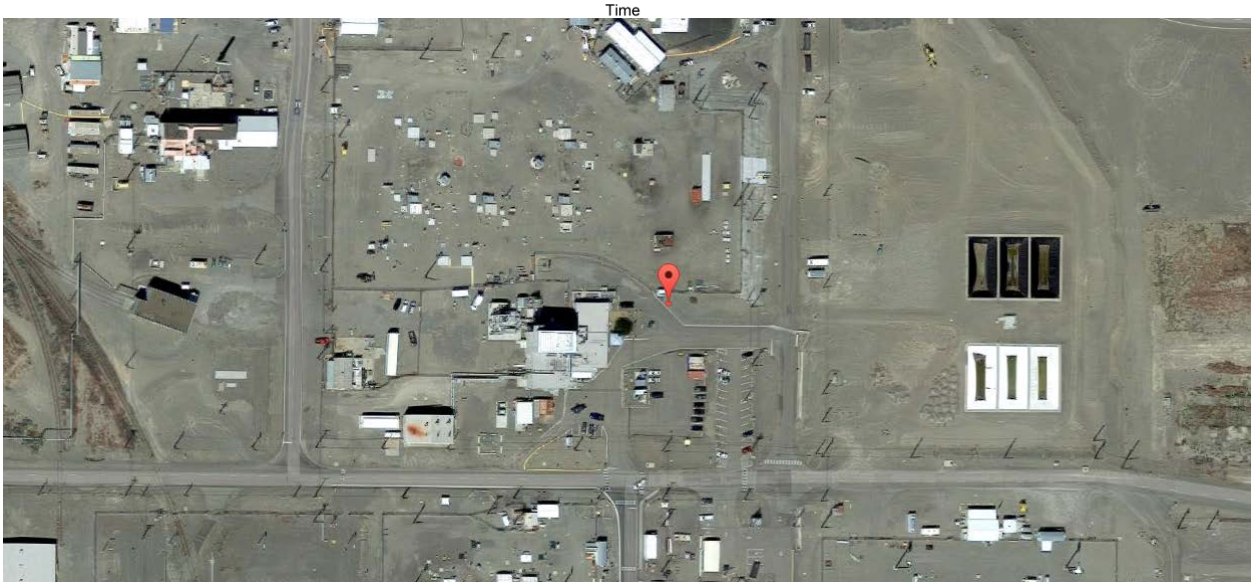


Plume 08a was observed at 6:50 AM while driving on Canton E of AX Farm. 72.5 °F and 1.02 bar, moderate winds blowing ENE. The plume consisted of elevated methanol with no other COPCs of note. This plume contains the max peak for methanol for 6/30. There is a strong correlating elevation in CO_2 accompanying this plume, meaning this plume may come from a dilute or mixed exhaust plume.



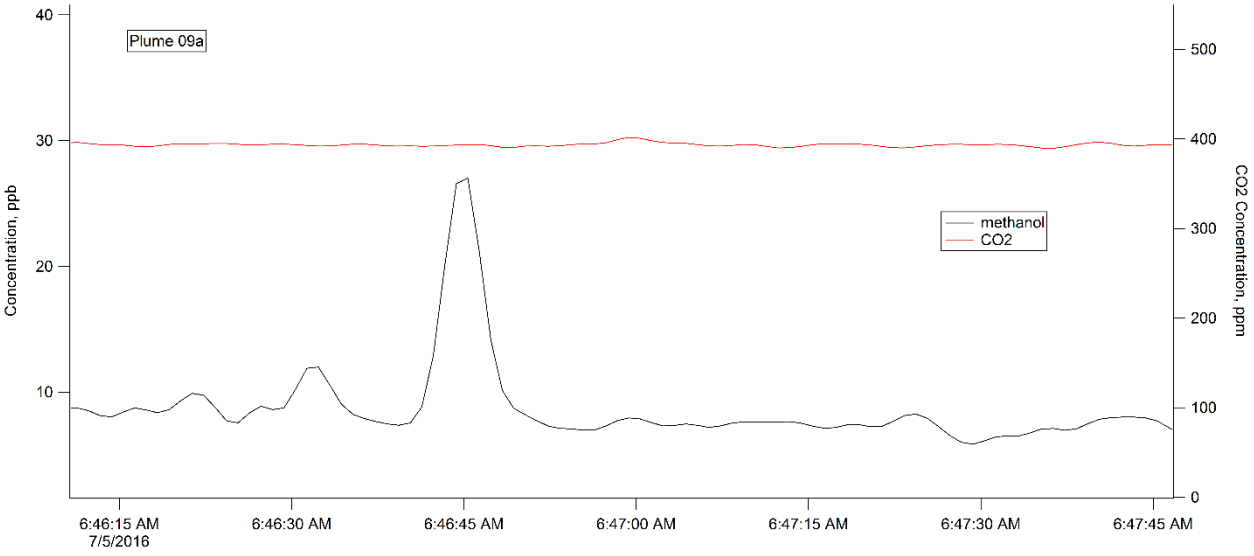
Plume 08b was observed at 10:52 AM at the Stationary Monitoring Site at 242A S of A-Farm. 87.8 °F and 1.02 bar, moderate winds blowing SW. The plume consisted of elevated 1-butanol + butenes, benzene, and acetaldehyde signals. There is no correlating elevation in CO_2 accompanying this plume, meaning this plume may come from an unknown source but could also indicate it is a very weak exhaust plume.



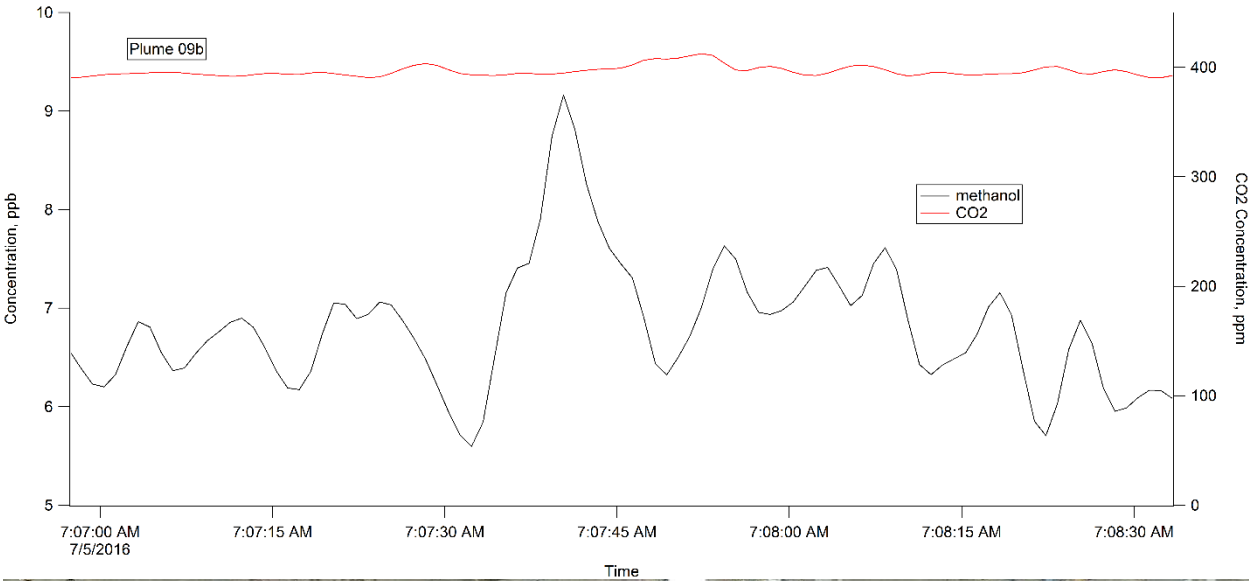


Plume 08c was observed at 11:06 AM while driving N on Buffalo W of AY and AZ Farms. 90.5 °F and 1.02 bar, moderate winds blowing NNW. The plume consisted elevated acetaldehyde. This plume contains the max peak for acetaldehyde for 6/30. There is a correlating elevation in CO_2 accompanying this plume, meaning this plume is likely exhaust.

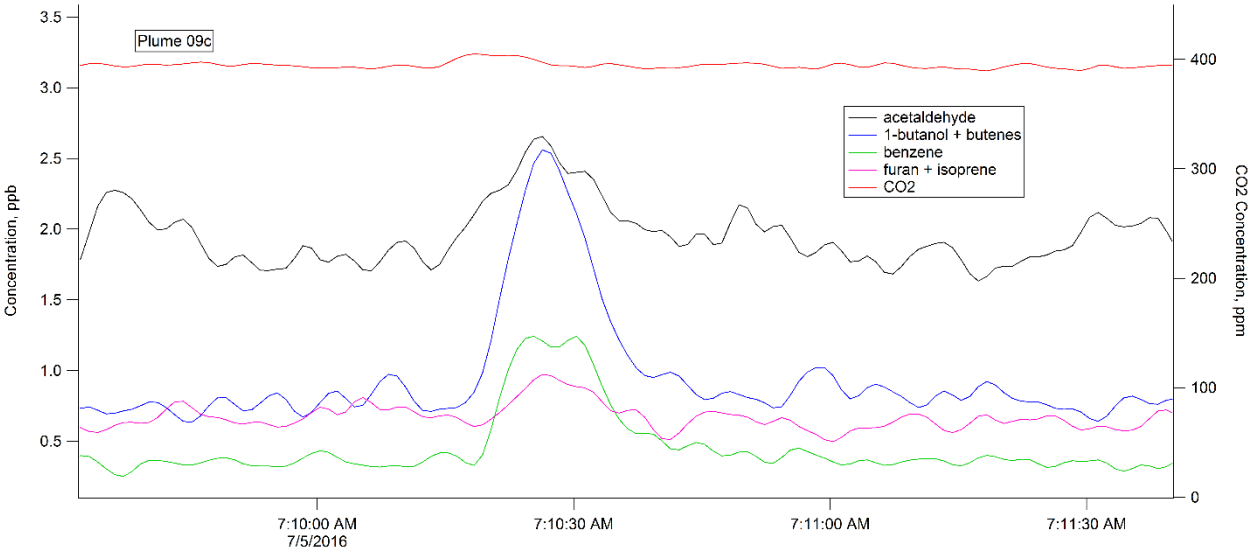
9.2.9 July 5, 2016



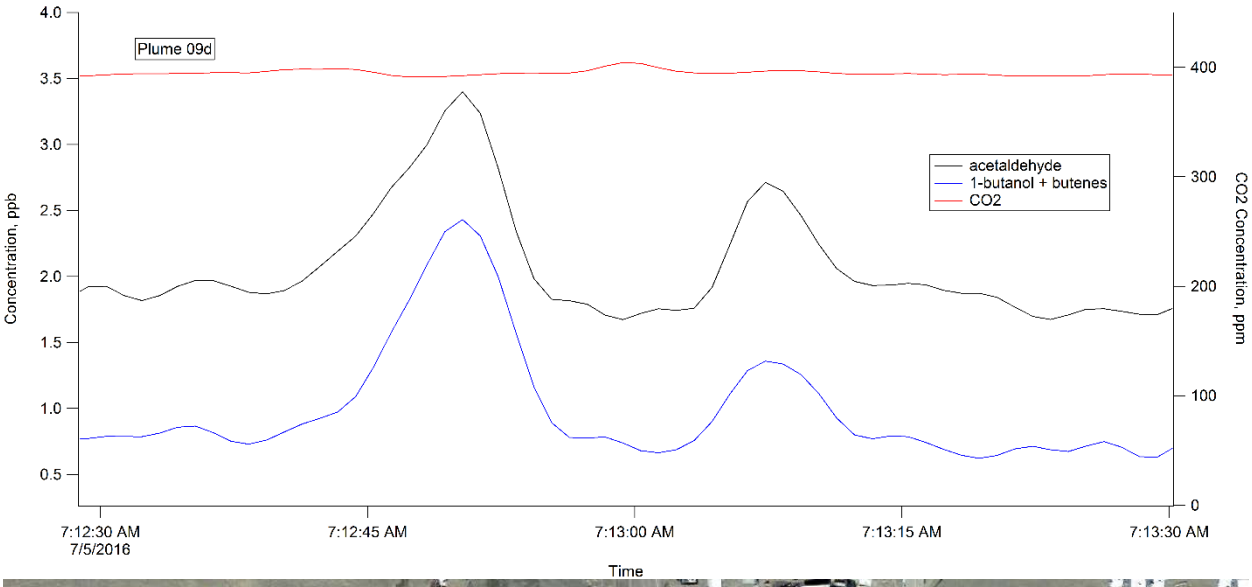
Plume 09a was observed at 6:46 AM while driving N on Buffalo W of the 242A Evaporator and A Farm. 62.4 °F and 1.02 bar, light winds blowing E. The plume consisted of elevated methanol with no other correlated COPCs. There is no correlating elevation in CO_2 accompanying this plume, meaning this plume may come from an unknown source W of A Farm.



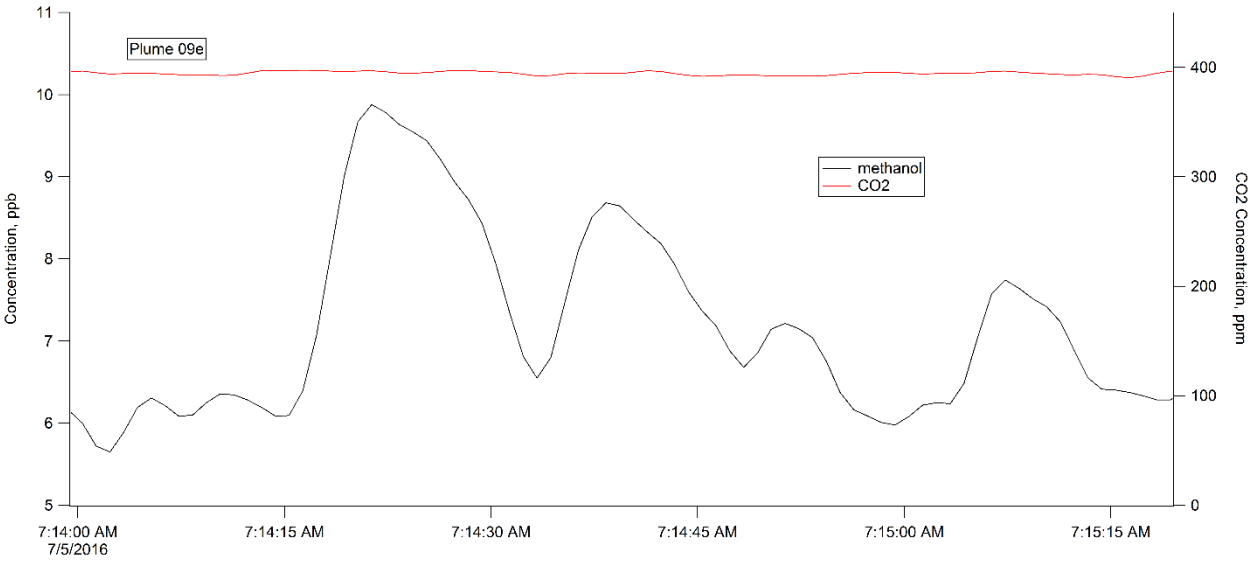
Plume 09b was observed at 7:07 AM at the Stationary Monitoring Site N of 244AR and W of A Farm. 62.2 °F and 1.01 bar, light winds blowing ENE. The plume consisted of slightly elevated methanol with no other correlated COPCs. There is slightly elevated CO_2 accompanying this plume, meaning this plume may be mixed or dilute or may come from an unknown source W of A Farm.



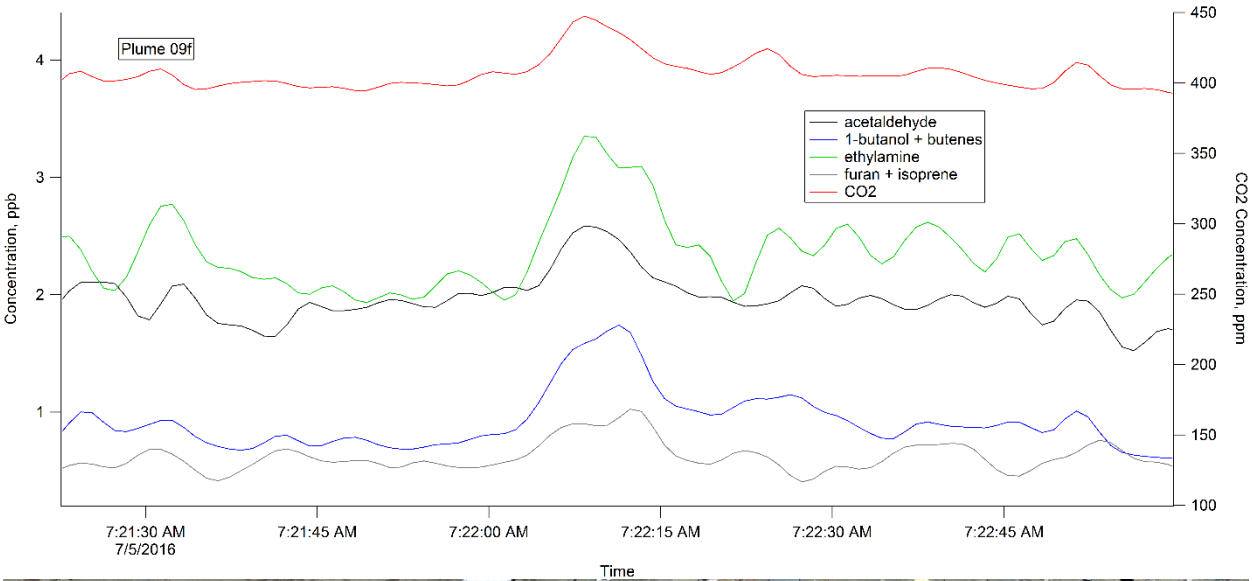
Plume 09c was observed at 7:10 AM at the Stationary Monitoring Site N of 244AR and W of A Farm. 63.2 °F and 1.02 bar, light winds blowing E. The plume consisted of several COPCs, primarily acetaldehyde, 1-butanol + butenes, and benzene signals. There is slightly elevated CO_2 accompanying this plume, meaning this plume may be mixed or dilute gasoline exhaust.



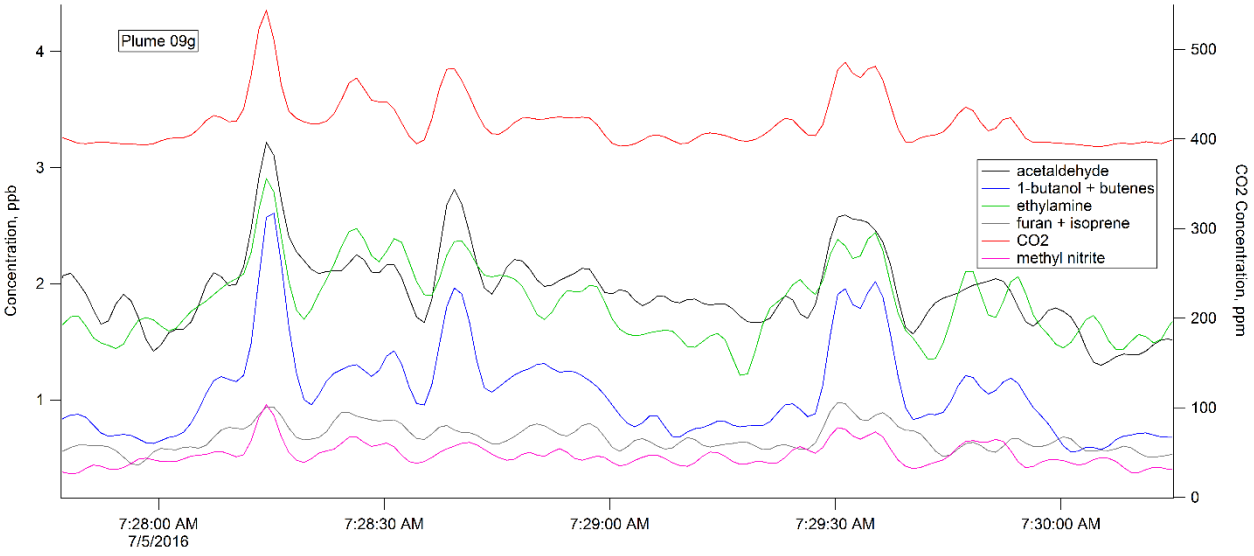
Plume 09d was observed at 7:12 AM at the Stationary Monitoring Site N of 244AR and W of A Farm. 63.5 °F and 1.02 bar, light winds blowing NE. The plume consisted of slightly elevated acetaldehyde and 1-butanol + butenes signals. There is slightly elevated CO_2 accompanying this plume but it is offset, meaning this plume may be mixed or dilute exhaust.



Plume 09e was observed at 7:14 AM at the Stationary Monitoring Site N of 244AR and W of A Farm. 64.2 °F and 1.02 bar, light winds blowing ENE. The plume consisted of several methanol peaks that diminish in intensity with time. There is no elevated CO_2 accompanying this plume meaning this plume may come from an unknown source W of A Farm.

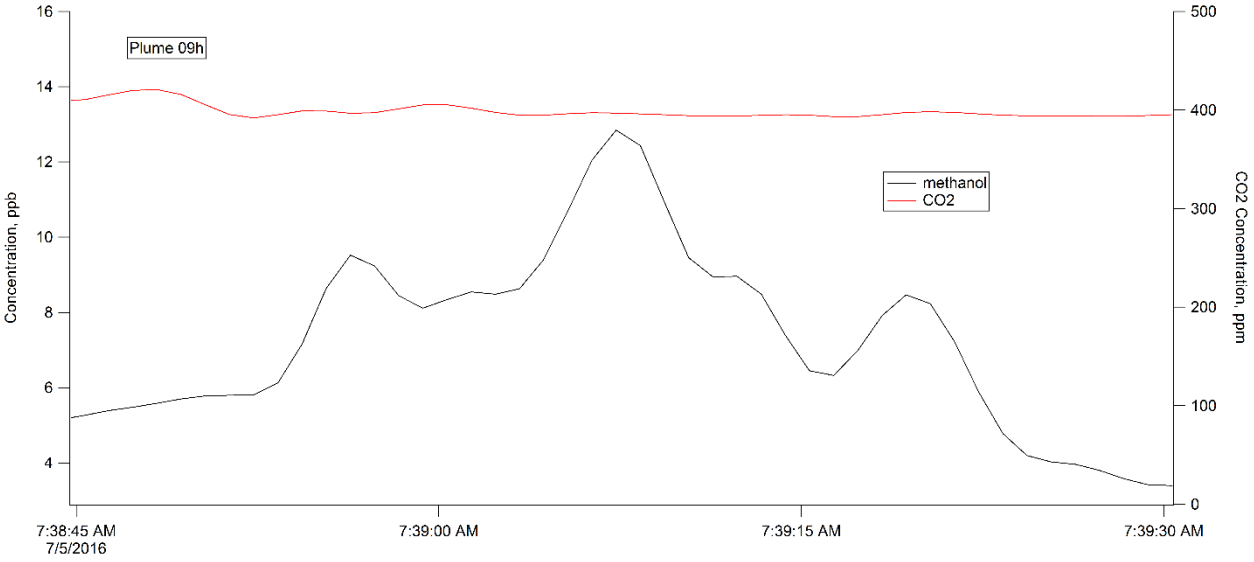


Plume 09f was observed at 7:22 AM at the Stationary Monitoring Site N of 244AR and W of A Farm. 67.3 °F and 1.02 bar, no wind. The plume consisted of elevated acetaldehyde, 1-butanol + butenes, ethylamine, and furan + isoprene signals. There is a correlating rise in CO_2 accompanying this plume meaning this plume is likely diesel exhaust.

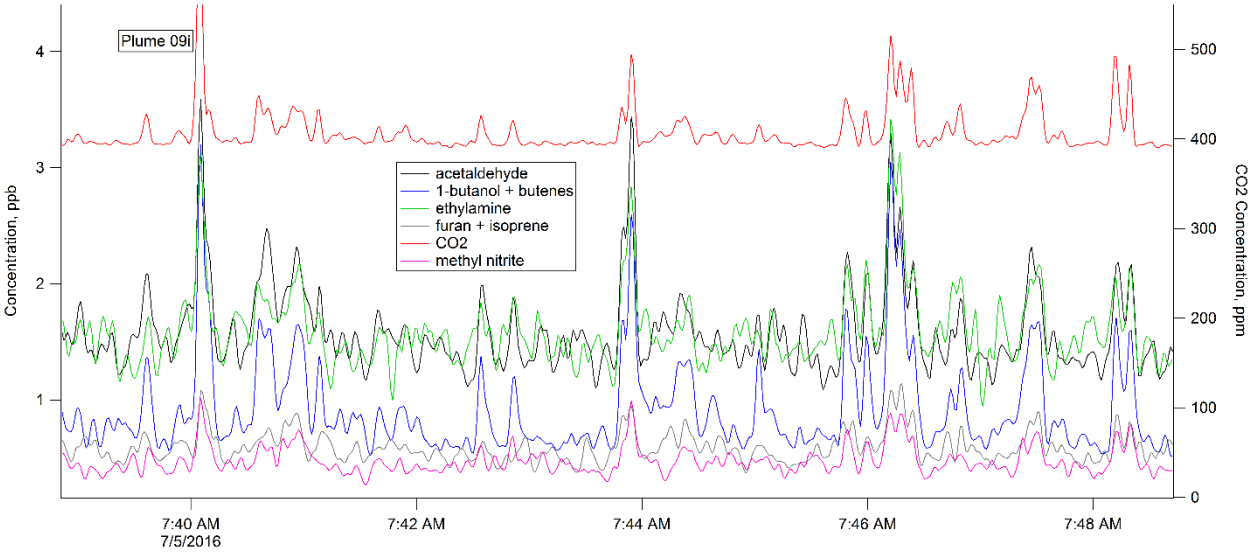


Plume 09g was observed between 7:28 AM and 7:30 AM at the Stationary Monitoring Site N of 244AR and W of A Farm. 68.4 °F and 1.02 bar, light winds blowing WNW. The plume consisted of several peaks that diminish in intensity with time. The peaks were primarily comprised of acetaldehyde, 1-butanol + butenes, and ethylamine. There is a strong correlation

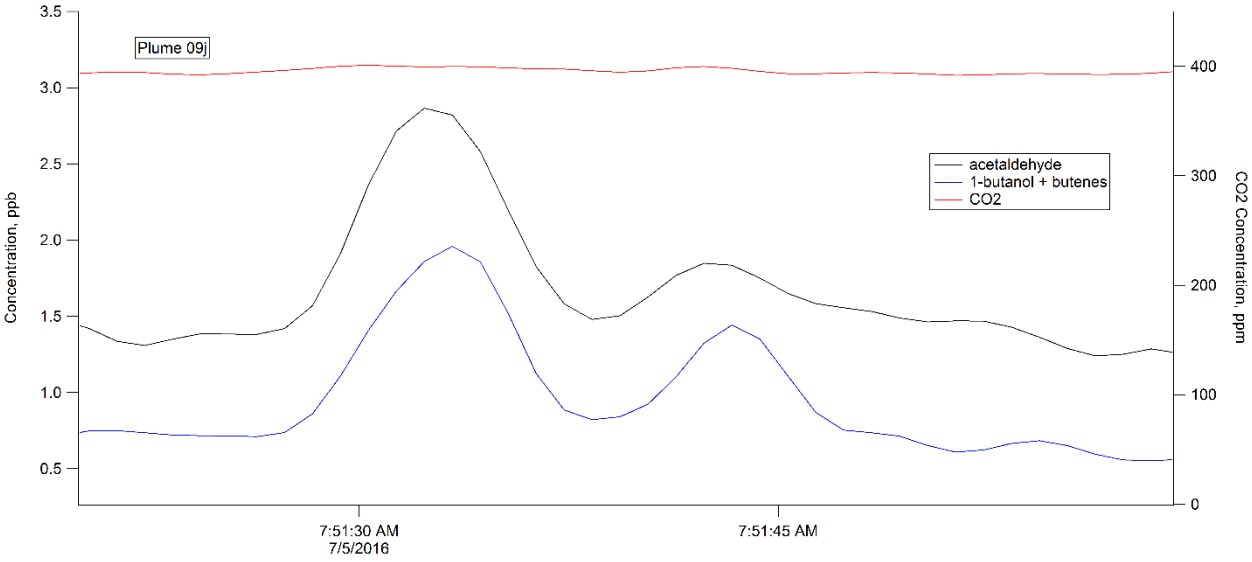
with elevated CO_2 accompanying this plume meaning this plume is very likely diesel exhaust.



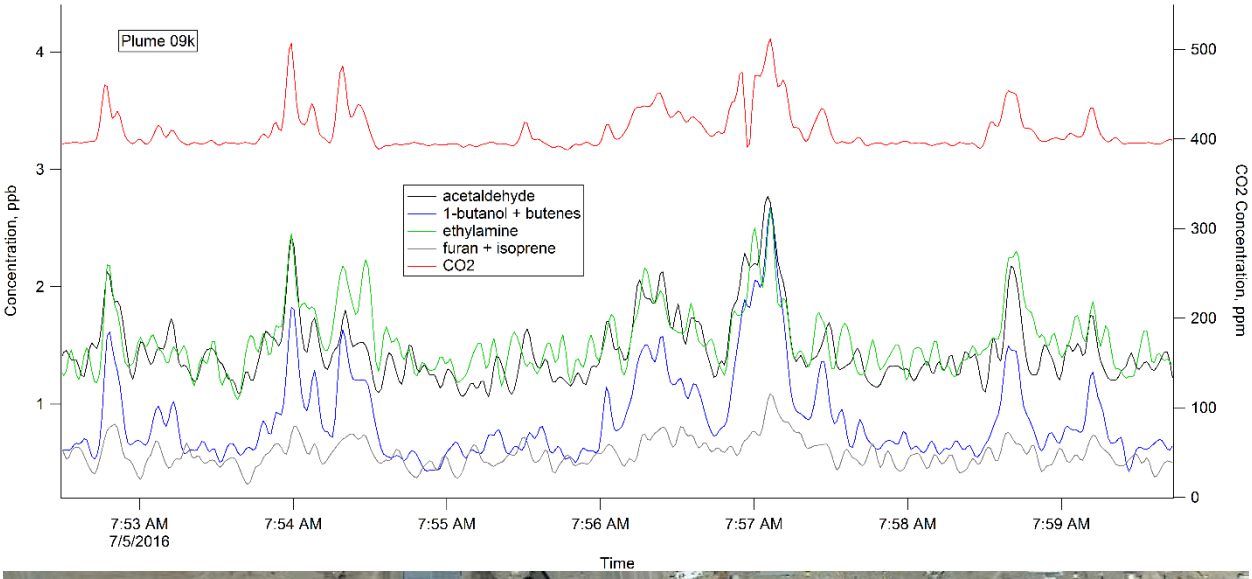
Plume 09h was observed at 7:39 AM at the Stationary Monitoring Site N of 244AR and W of A Farm. 67.6 °F and 1.02 bar, light winds blowing NNW. The plume consisted of several methanol peaks centered on 7:39:07 AM. There is no elevated CO_2 accompanying this plume meaning this plume may come from an unknown source W of A Farm.



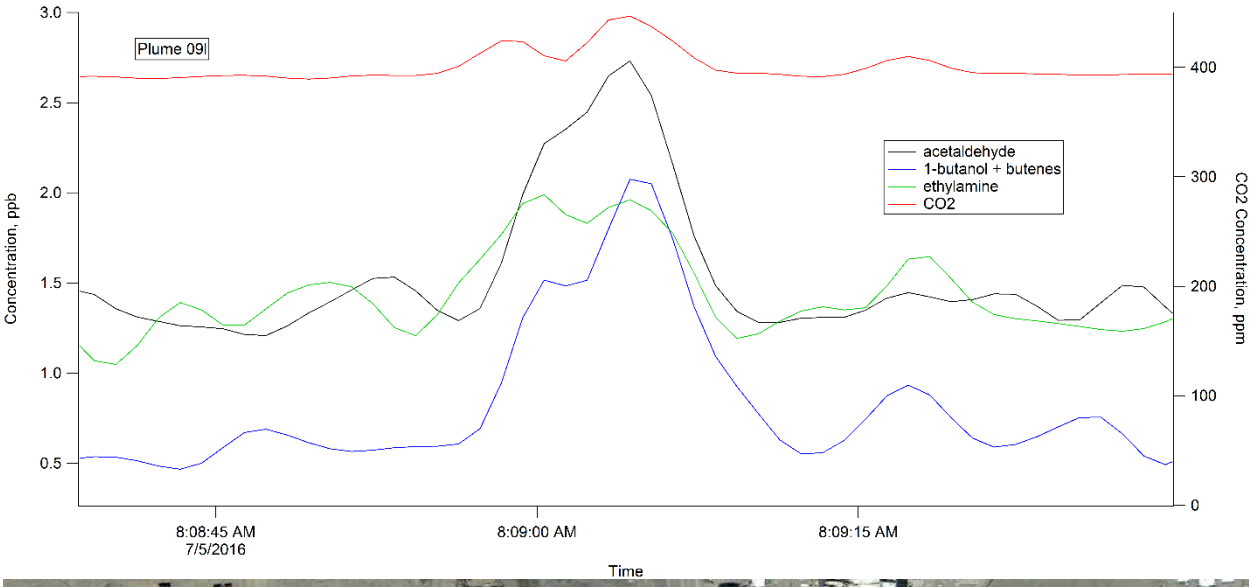
Plume 09i was observed between 7:39 AM and 7:48 AM at the Stationary Monitoring Site N of 244AR and W of A Farm. 70.3 °F and 1.02 bar, light winds blowing WNW. The plume consisted of several peaks, primarily comprised of acetaldehyde, 1-butanol + butenes, and ethylamine. The furan + isoprene signal exceeds OEL in this plume. There is a strong correlation with elevated CO_2 accompanying this plume meaning this plume is very likely diesel exhaust.



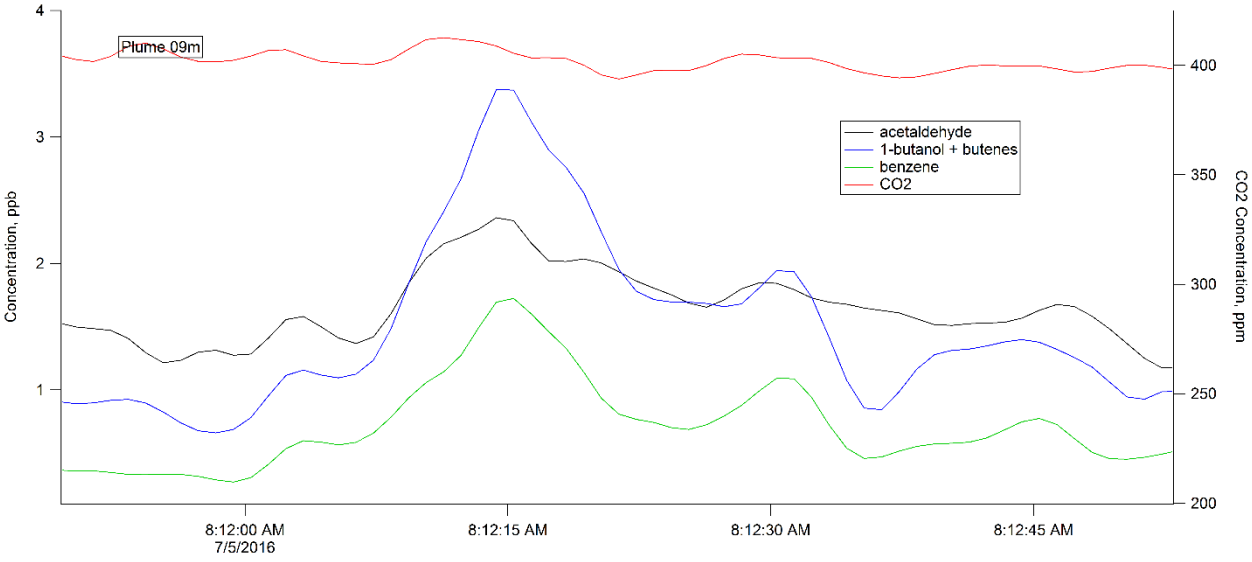
Plume 09j was observed at 7:51 AM at the Stationary Monitoring Site N of 244AR and W of A Farm. 72.9 °F and 1.02 bar, light winds blowing NE. The plume consisted of two peaks, comprised of slight acetaldehyde and 1-butanol + butenes signals. There is slightly elevated CO_2 accompanying this plume meaning this plume may come from dilute or mixed diesel exhaust.



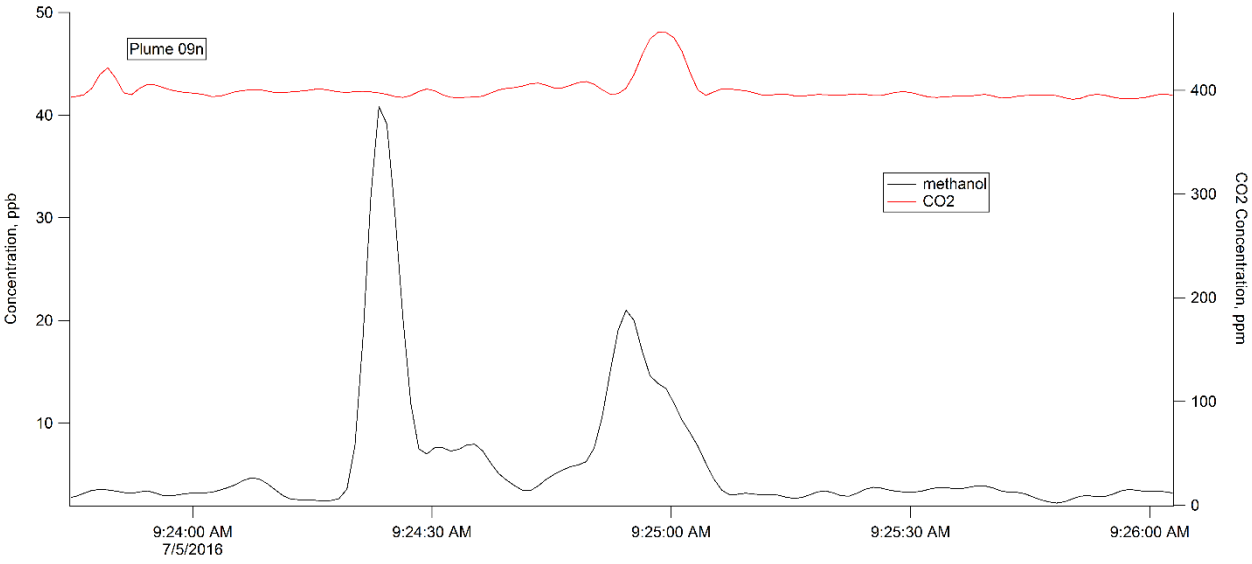
Plume 09k was observed between 7:53 AM and 7:59 AM at the Stationary Monitoring Site N of 244AR and W of A Farm. 73.6 °F and 1.02 bar, light winds blowing SW. The plume consisted of several peaks, primarily comprised of acetaldehyde, 1-butanol + butenes, and ethylamine. The furan + isoprene signal exceeds OEL in this plume. There is a strong correlation with elevated CO_2 accompanying this plume meaning this plume is very likely diesel exhaust.



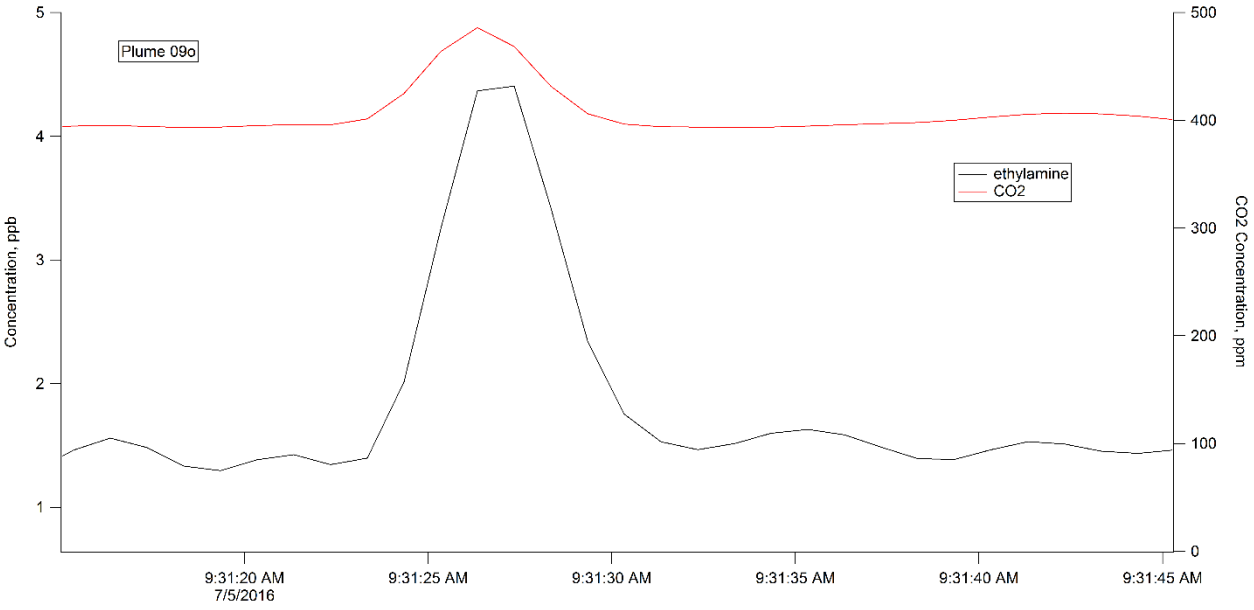
Plume 09l was observed at 8:09 AM at the Stationary Monitoring Site N of 244AR and W of A Farm. 75.2 °F and 1.02 bar, light winds blowing SW. The plume was primarily comprised of acetaldehyde, 1-butanol + butenes, and ethylamine. There is a strong correlation with elevated CO_2 accompanying this plume meaning this plume is very likely diesel exhaust.



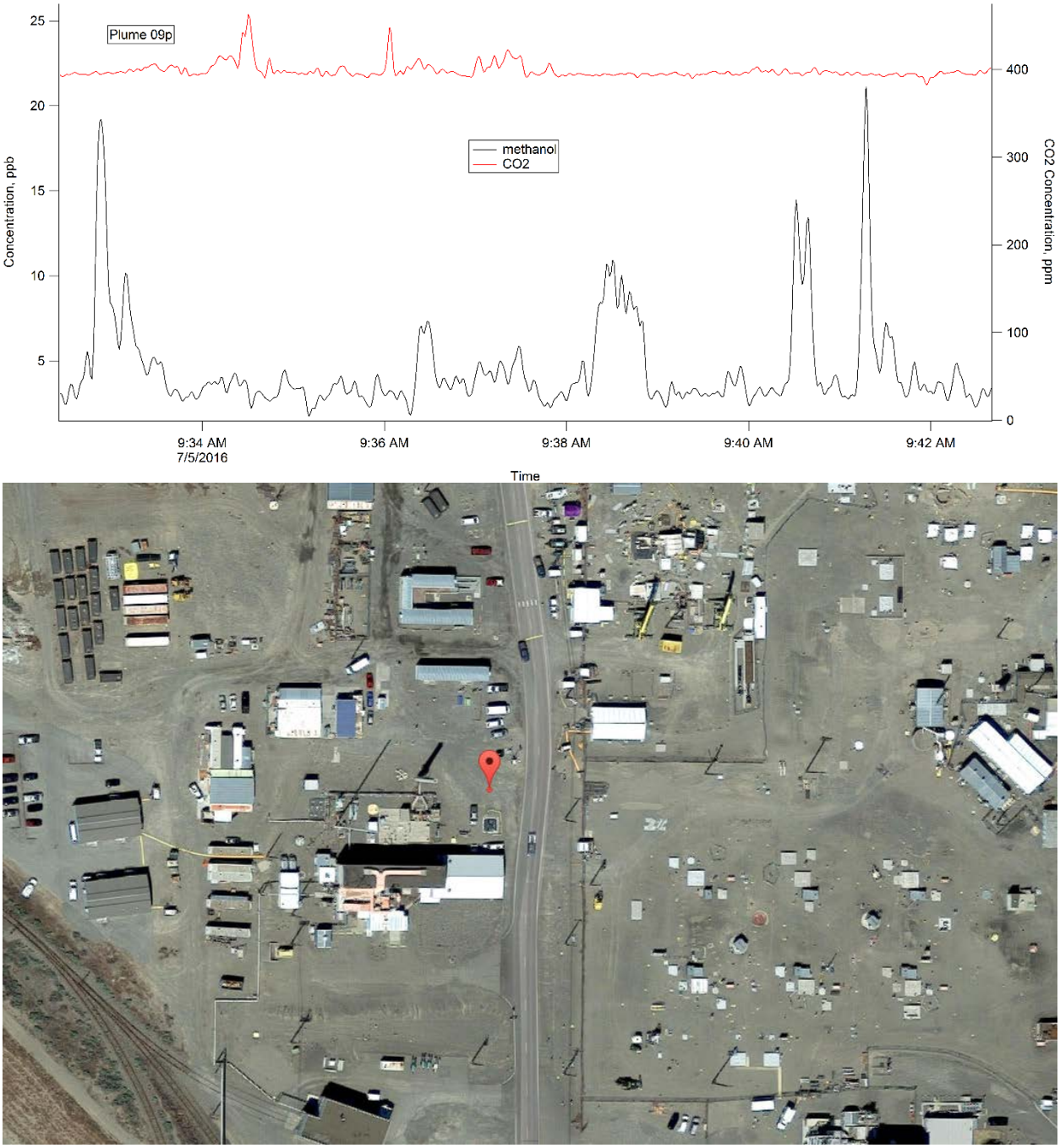
Plume 09m was observed at 8:12 AM at the Stationary Monitoring Site N of 244AR and W of A Farm. 75.7 °F and 1.02 bar, light winds blowing ESE. The plume was comprised of acetaldehyde, 1-butanol + butenes, and benzene. There is a correlation with elevated CO_2 accompanying this plume meaning this plume is likely gasoline exhaust.



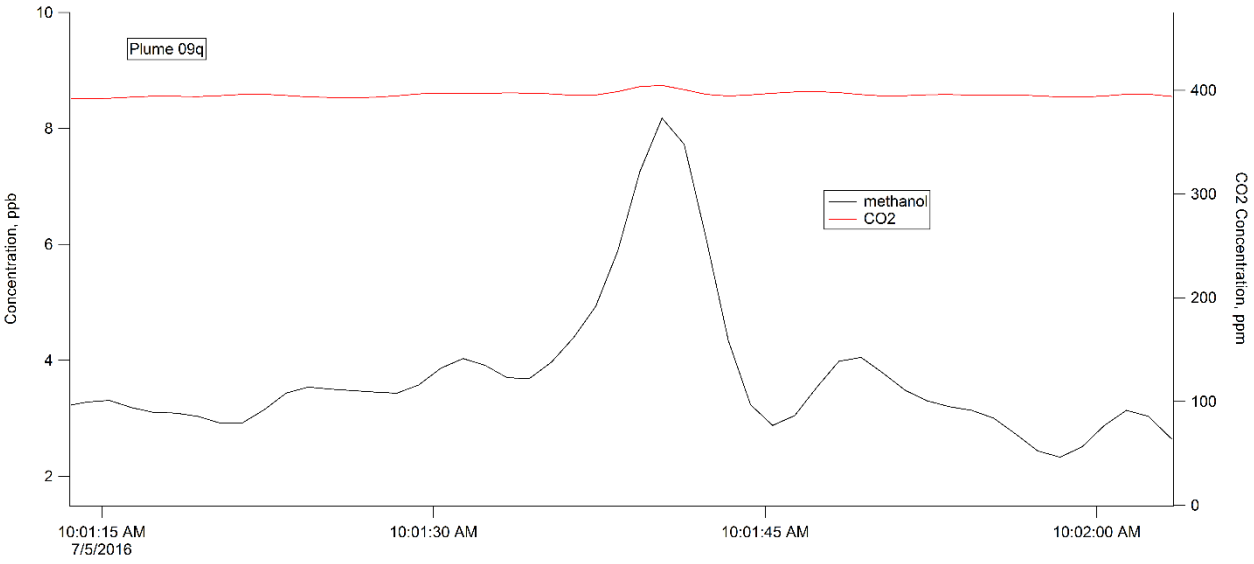
Plume 09n was observed between 9:24 AM and 9:25 AM at the Stationary Monitoring Site N of 244AR and W of A Farm. 75.6 °F and 1.02 bar, light winds blowing SE. The plume consisted of two peaks, comprised of methanol. There is a strong correlation with elevated CO_2 accompanying this plume meaning this plume is very likely diesel exhaust.



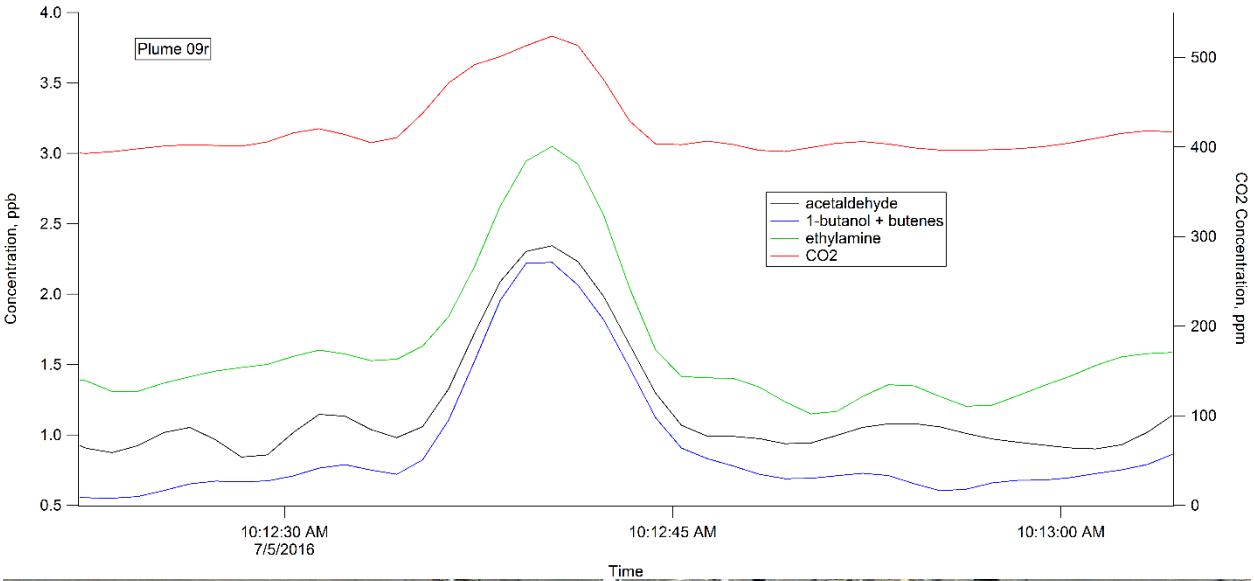
Plume 09o was observed at 9:31 AM at the Stationary Monitoring Site N of 244AR and W of A Farm. 76.6 °F and 1.02 bar, light winds blowing NW. The plume was comprised of ethylamine. There is a strong correlation with elevated CO_2 accompanying this plume meaning this plume is very likely exhaust.



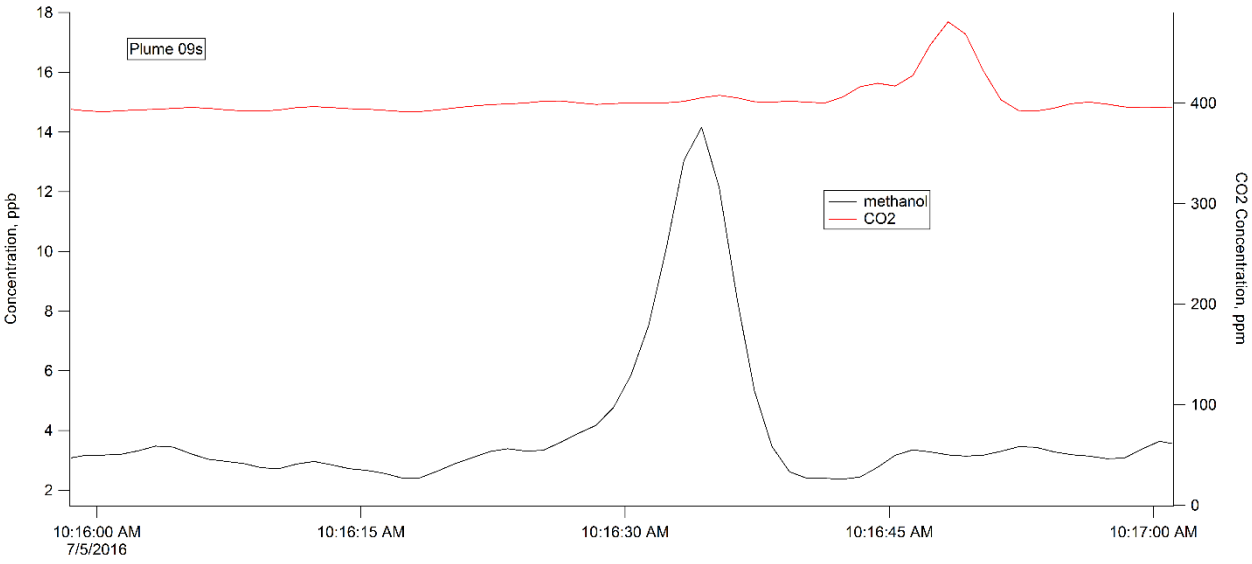
Plume 09p was observed between 9:33 AM and 9:42 AM at the Stationary Monitoring Site N of 244AR and W of A Farm. 77.7 °F and 1.02 bar, light winds blowing SE. The plume consisted of several methanol peaks. There is virtually no correlation with CO_2 despite its elevated levels meaning this plume is from an unknown source W of A Farm or a dilute or mixed plume.



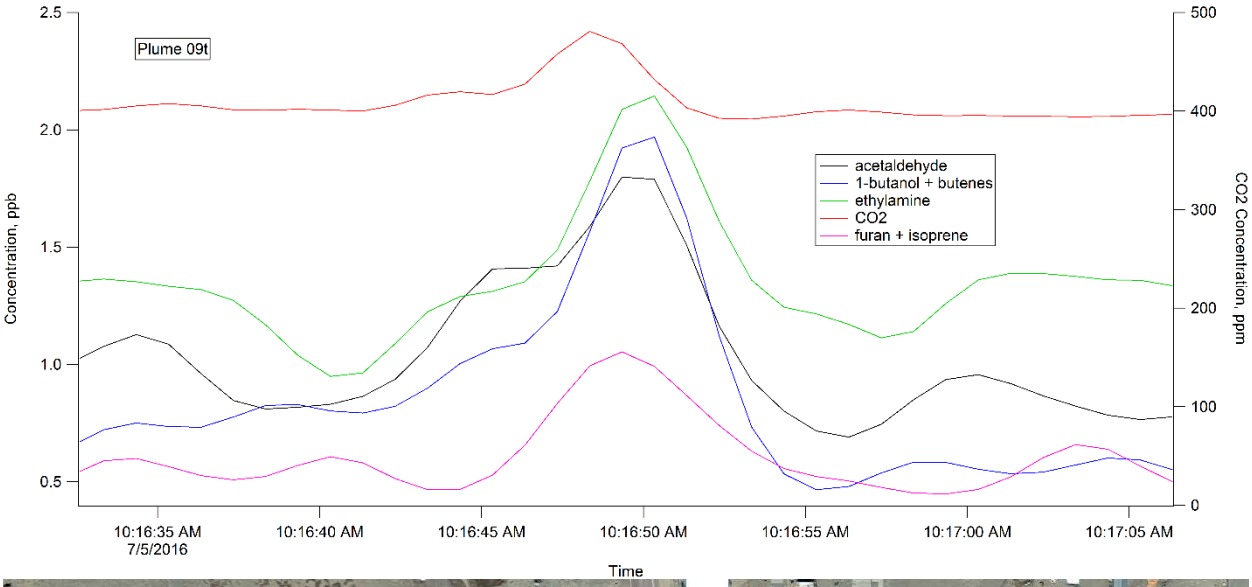
Plume 09q was observed at 10:01 AM at the Stationary Monitoring Site N of 244AR and W of A Farm. 77.0 °F and 1.02 bar, light winds blowing NE. The plume was marked by a slight rise in methanol. There is a weak correlation with elevated CO_2 accompanying this plume meaning this plume is possibly dilute or mixed.



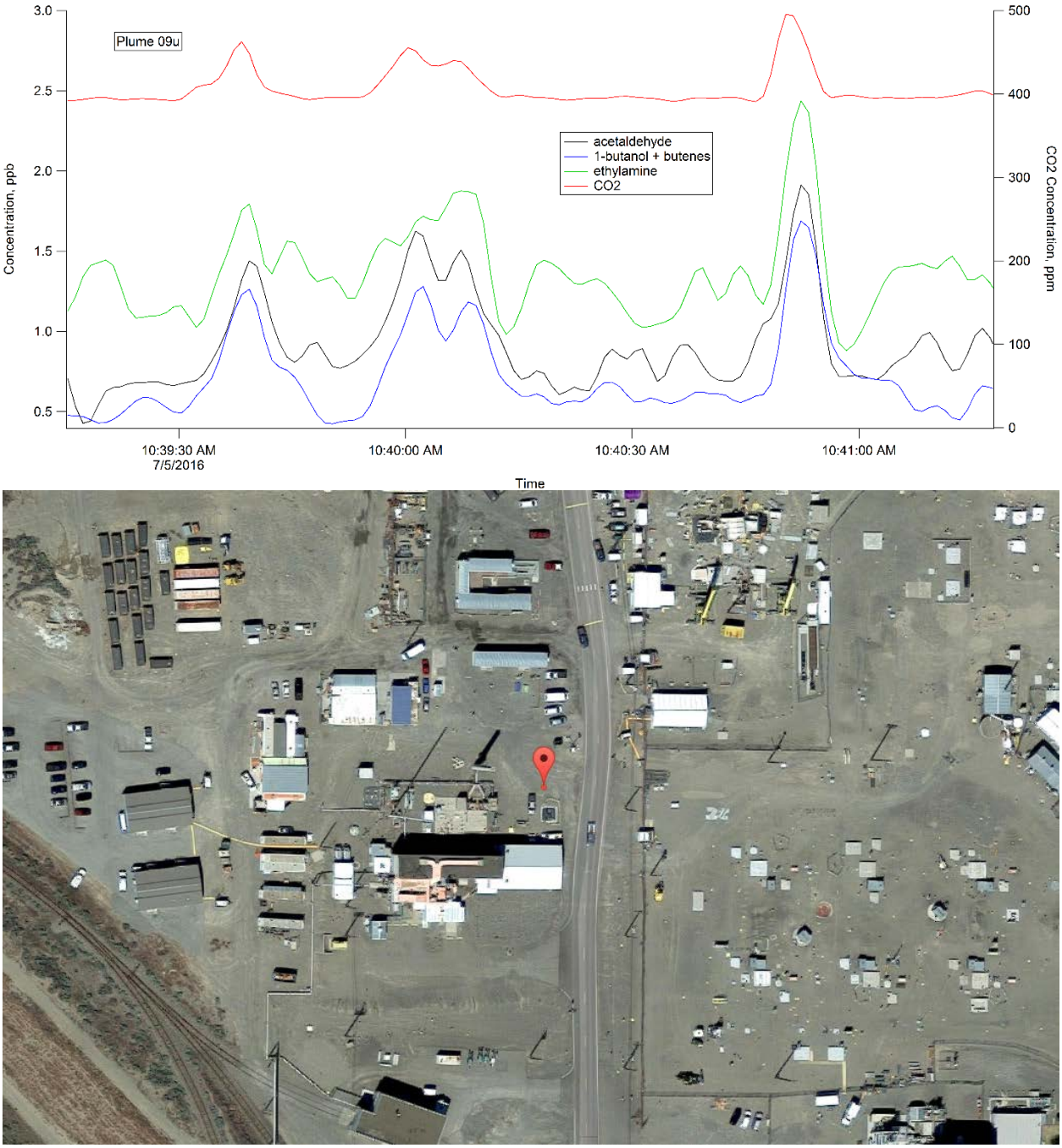
Plume 09r was observed at 10:12 AM at the Stationary Monitoring Site N of 244AR and W of A Farm. 79.0 °F and 1.02 bar, light winds blowing SSE. The plume was primarily comprised of acetaldehyde, 1-butanol + butenes, and ethylamine. There is a strong correlation with elevated CO_2 accompanying this plume meaning this plume is very likely diesel exhaust.



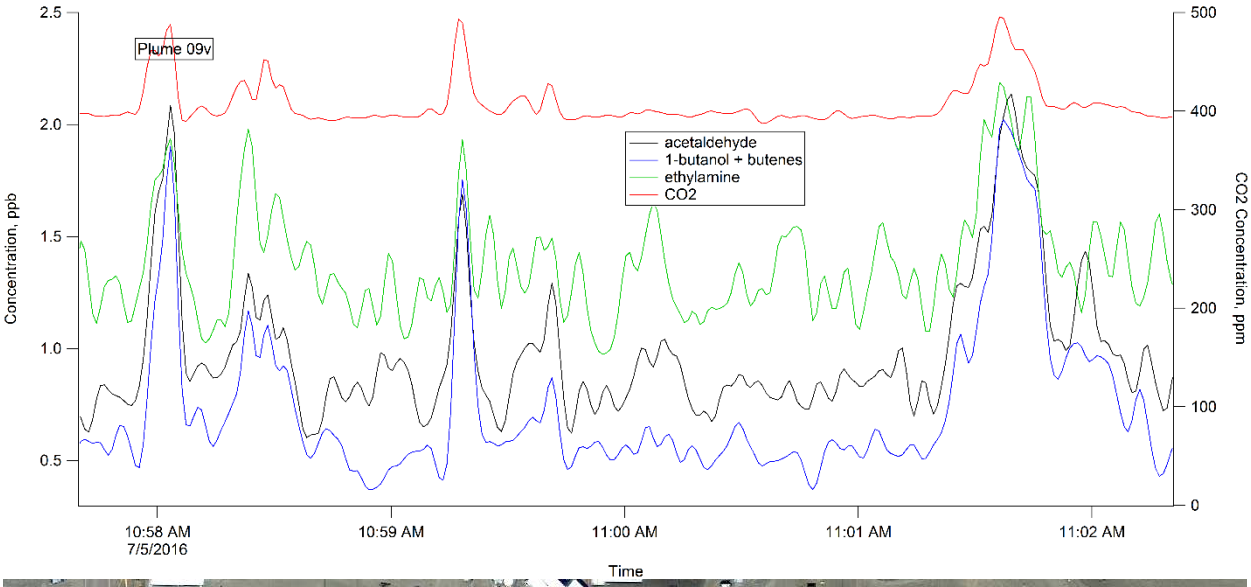
Plume 09s was observed at 10: 16 AM at the Stationary Monitoring Site N of 244AR and W of A Farm. 79.7 °F and 1.02 bar, light winds blowing NW. The plume was marked by a slight rise in methanol. There is no correlation with elevated CO_2 accompanying this plume meaning this plume is possibly from an unknown source W of A Farm.

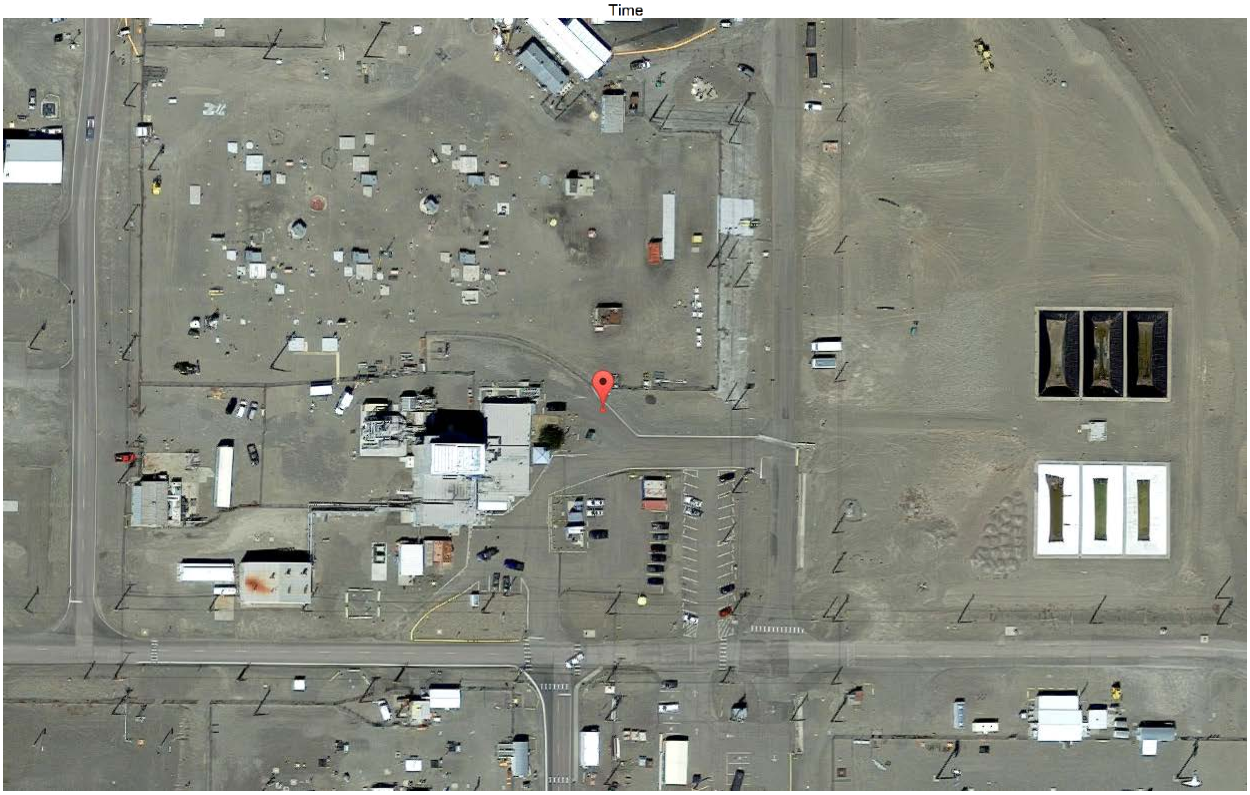


Plume 09t was observed at 10:16 AM at the Stationary Monitoring Site N of 244AR and W of A Farm. 79.9 °F and 1.02 bar, light winds blowing W. The plume was primarily comprised of acetaldehyde, 1-butanol + butenes, and ethylamine. The furan + isoprene signal exceeded OEL in this plume. There is a strong correlation with elevated CO_2 accompanying this plume meaning this plume is very likely diesel exhaust.

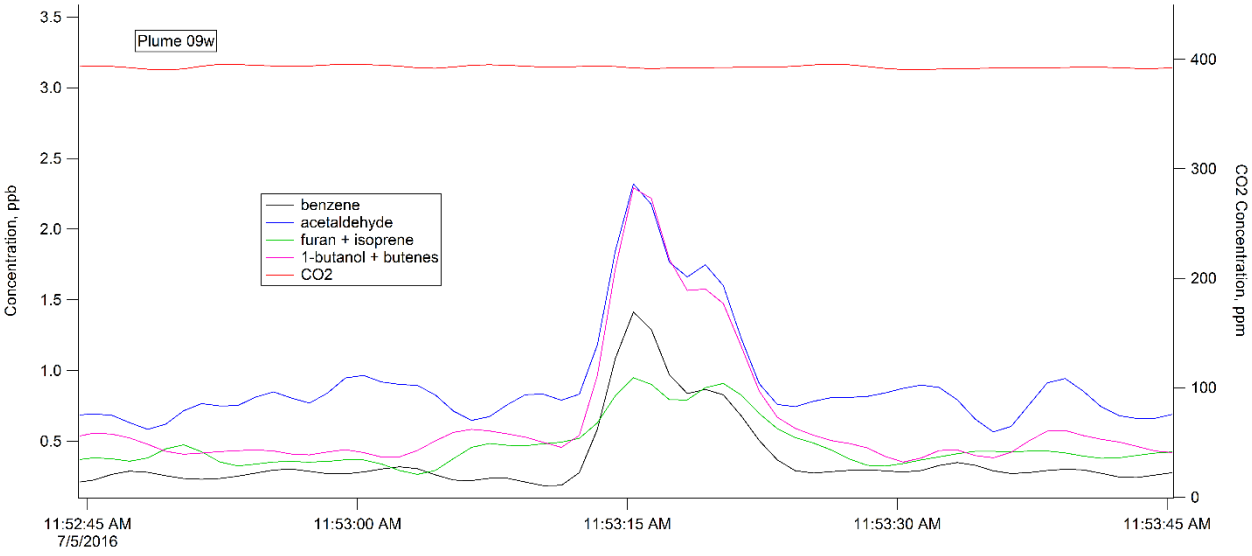


Plume 09u was observed between 10:39 AM and 10:42 AM at the Stationary Monitoring Site N of 244AR and W of A Farm. 80.1 °F and 1.01 bar, light winds blowing S. The plume contains several peaks which were primarily comprised of acetaldehyde, 1-butanol + butenes, and ethylamine. There is a strong correlation with elevated CO_2 accompanying this plume meaning this plume is very likely diesel exhaust.

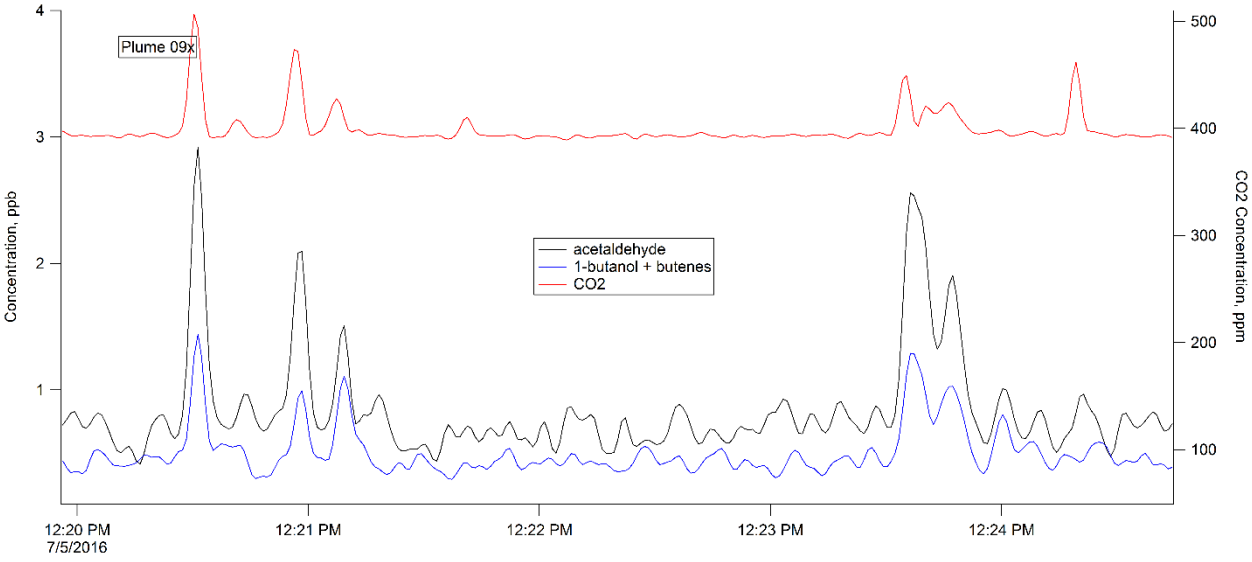


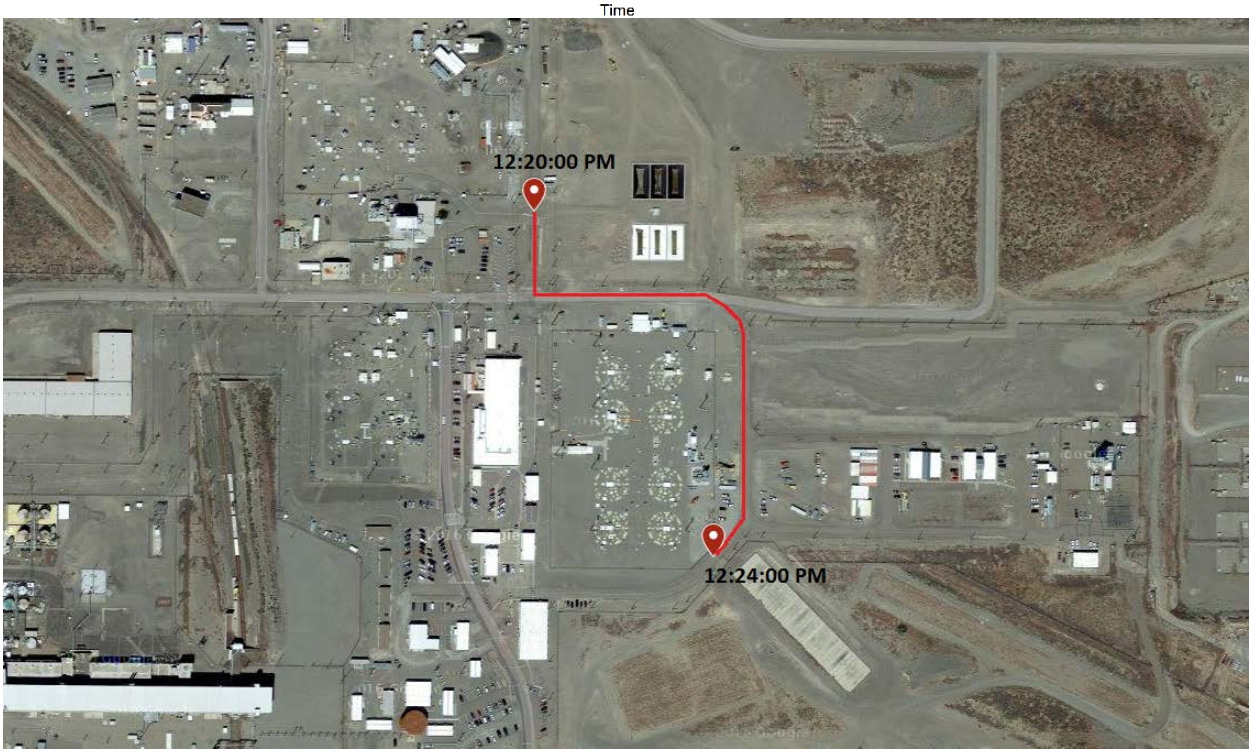


Plume 09v was observed between 10:39 AM and 10:42 AM at the Stationary Monitoring Site N of 244AR and W of A Farm. 77.9 °F and 1.02 bar, light winds blowing S. The plume contains several peaks which were primarily comprised of acetaldehyde, 1-butanol + butenes, and ethylamine. There is a strong correlation with elevated CO_2 accompanying this plume meaning this plume is very likely diesel exhaust.



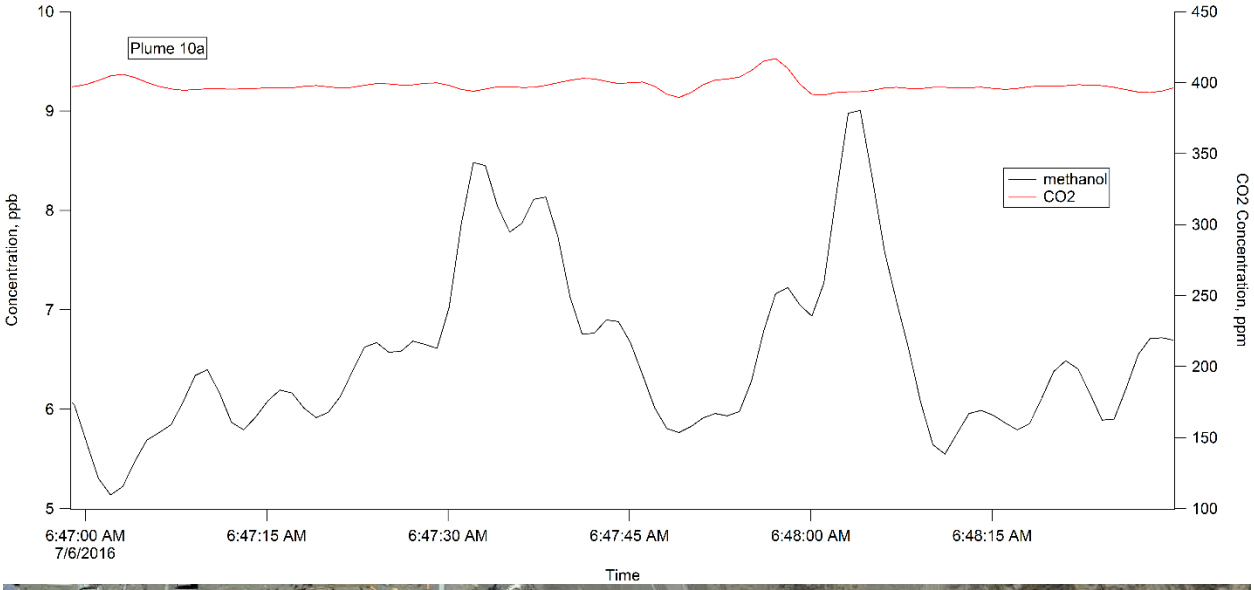
Plume 09w was observed at 11:53 AM while driving on 4th near AP Farm and 272AW. 79.3 °F and 1.01 bar, light winds blowing S. The plume was comprised of acetaldehyde, 1-butanol + butenes, ethylamine, and furan + isoprene signals. There is no correlation with elevated CO_2 accompanying this plume meaning this plume could be from an unknown source, despite its resemblance to gasoline exhaust.

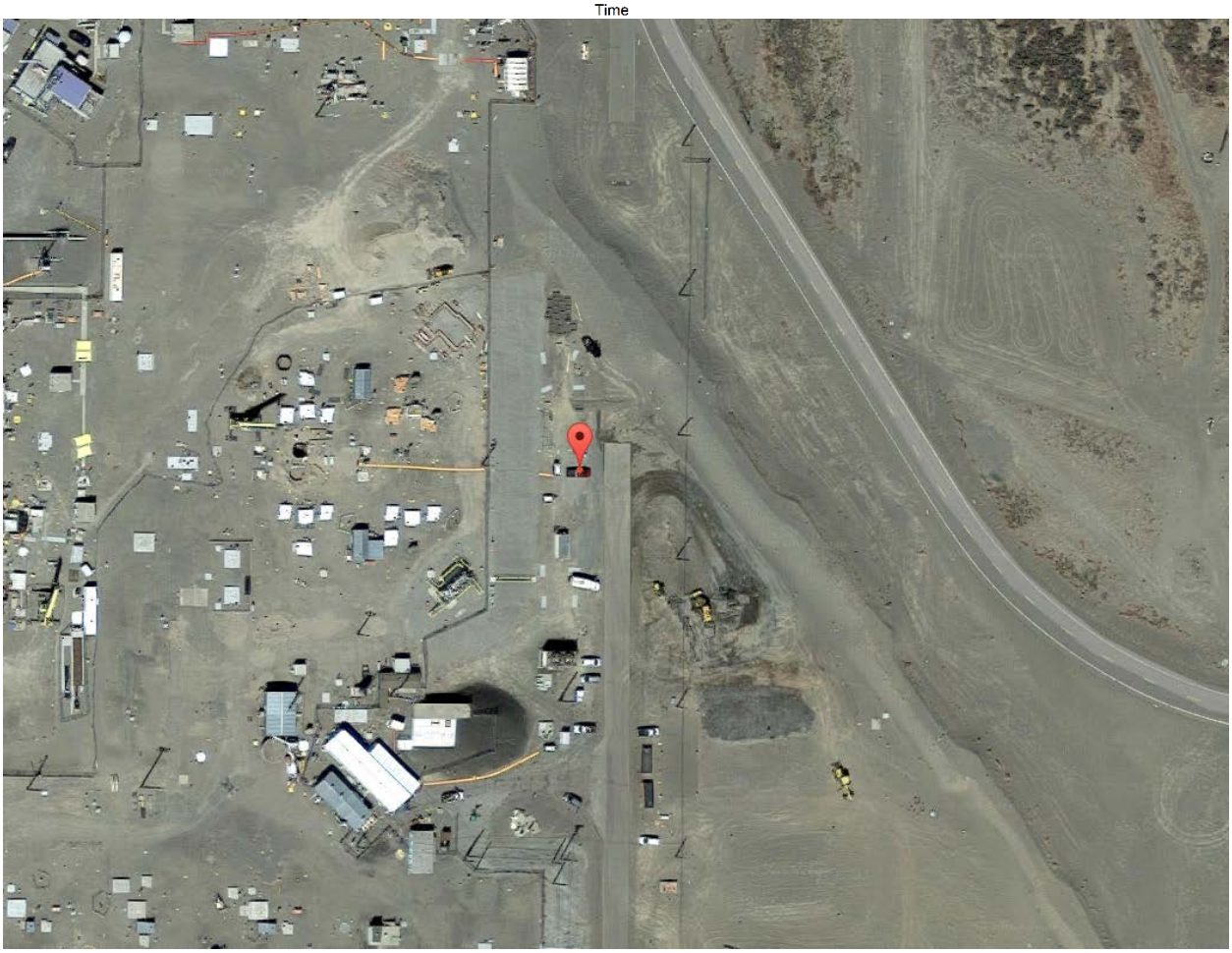




Plume 09x was observed between 12:20 PM and 12:24 PM while driving the perimeter of AP Farm. 80.3 °F and 1.02 bar, light winds blowing S. The plume contains several peaks which were comprised of acetaldehyde and 1-butanol + butenes. There is a strong correlation with elevated CO_2 accompanying this plume meaning this plume is very likely diesel exhaust.

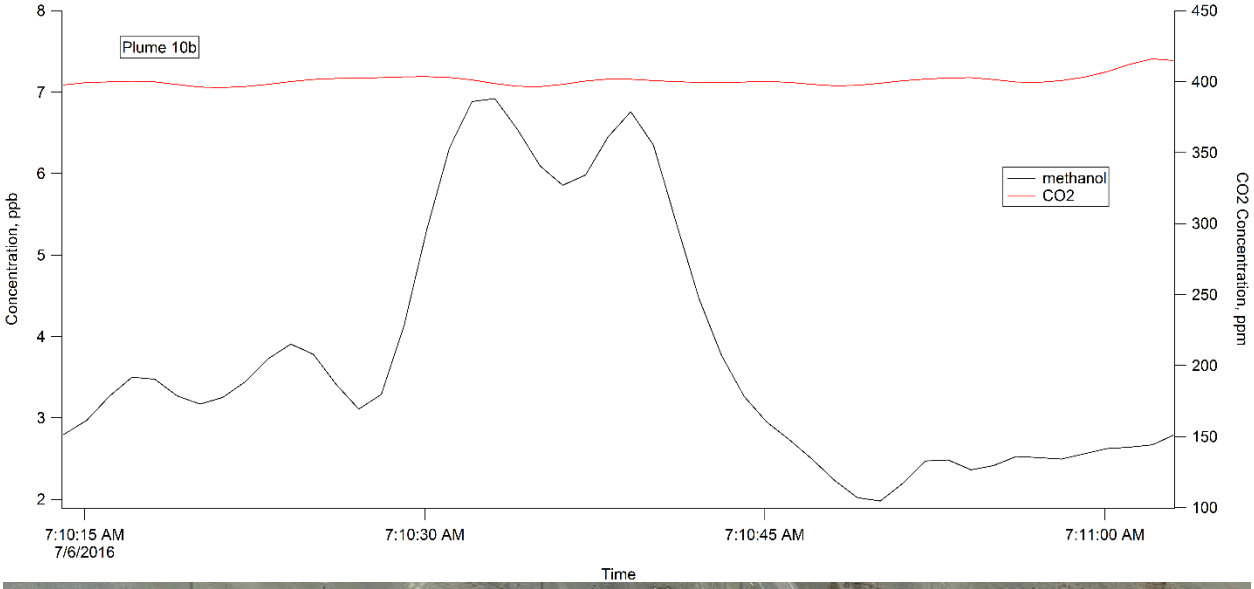
9.2.10 July 6, 2016



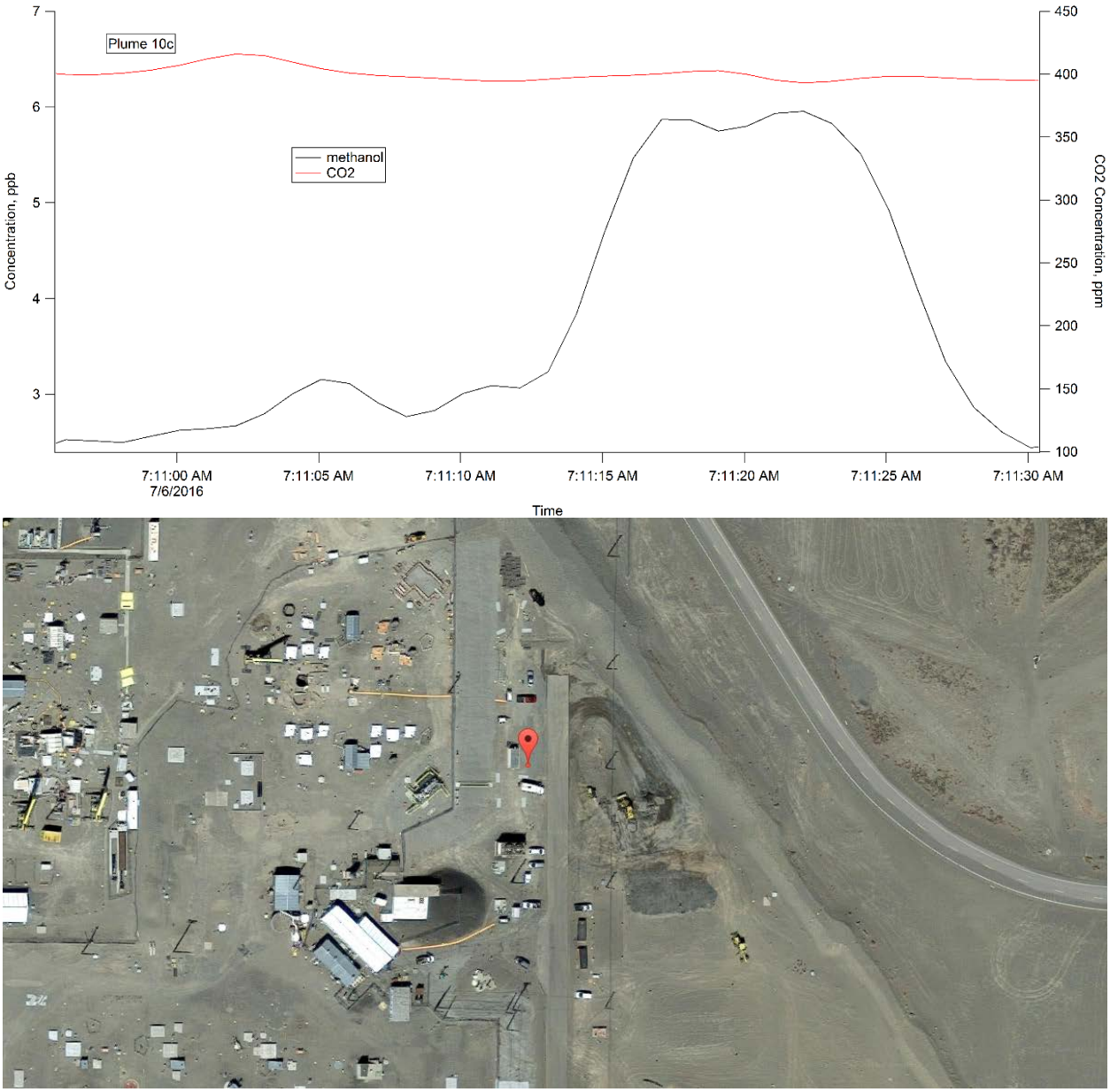


Plume 10a was observed at 6:47 AM at the Stationary Monitoring Site E of AX Farm. 62.9 °F and 1.02 bar, moderate winds blowing S. The plume consisted of several slightly elevated methanol peaks with no other COPCs of note. There is slightly elevated CO_2 accompanying this

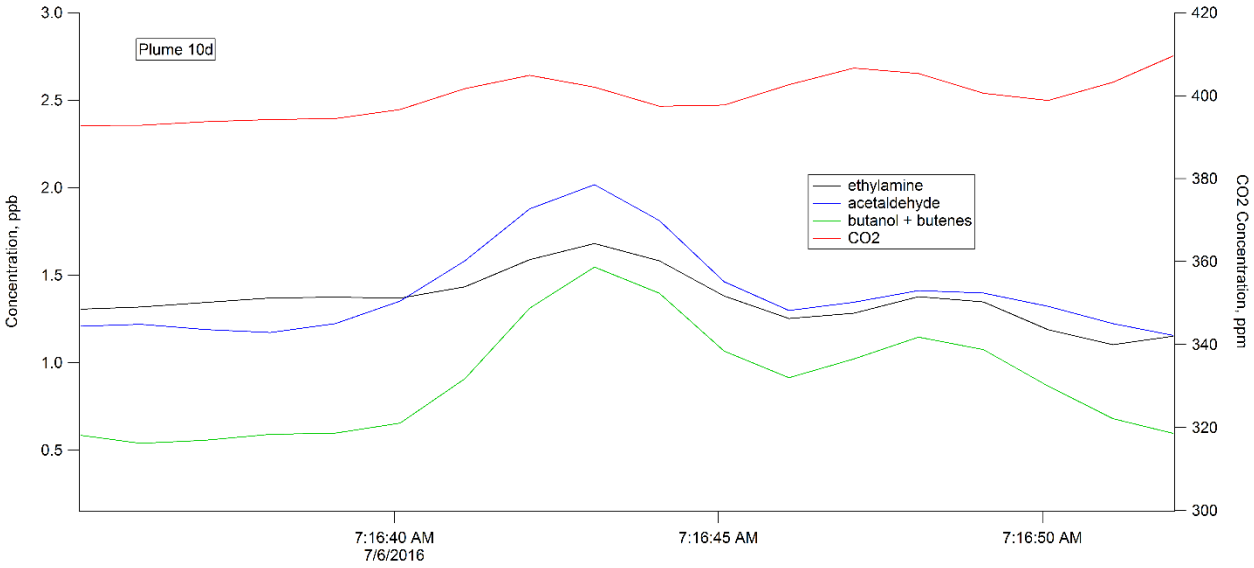
plume, but it does not seem to be perfectly correlated meaning this plume may be a dilute or mixed plume.

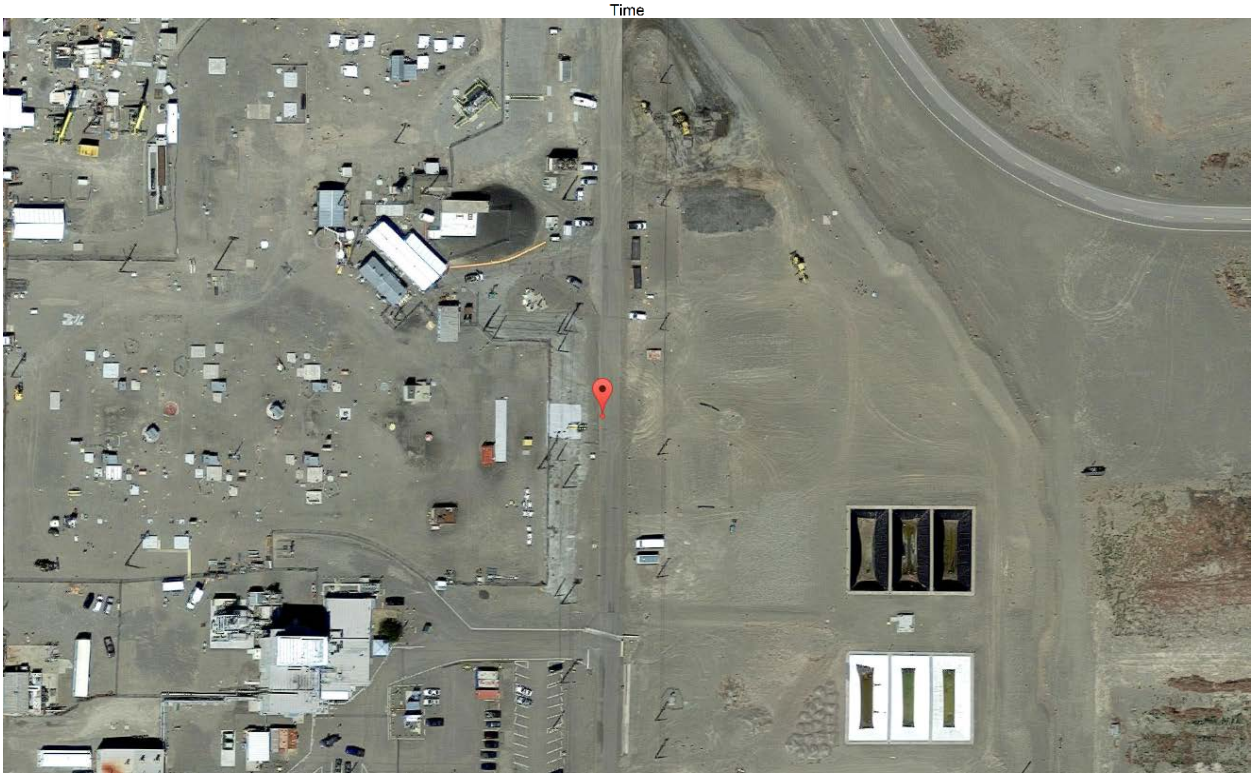


Plume 10b was observed at 7:10 AM at the Stationary Monitoring Site E of AX Farm. 65.1 °F and 1.02 bar, light winds blowing N. The plume consisted of a slightly elevated methanol signal with no other COPCs of note. There no elevated CO_2 accompanying this plume, meaning this plume may from an unknown source E of AX Farm.

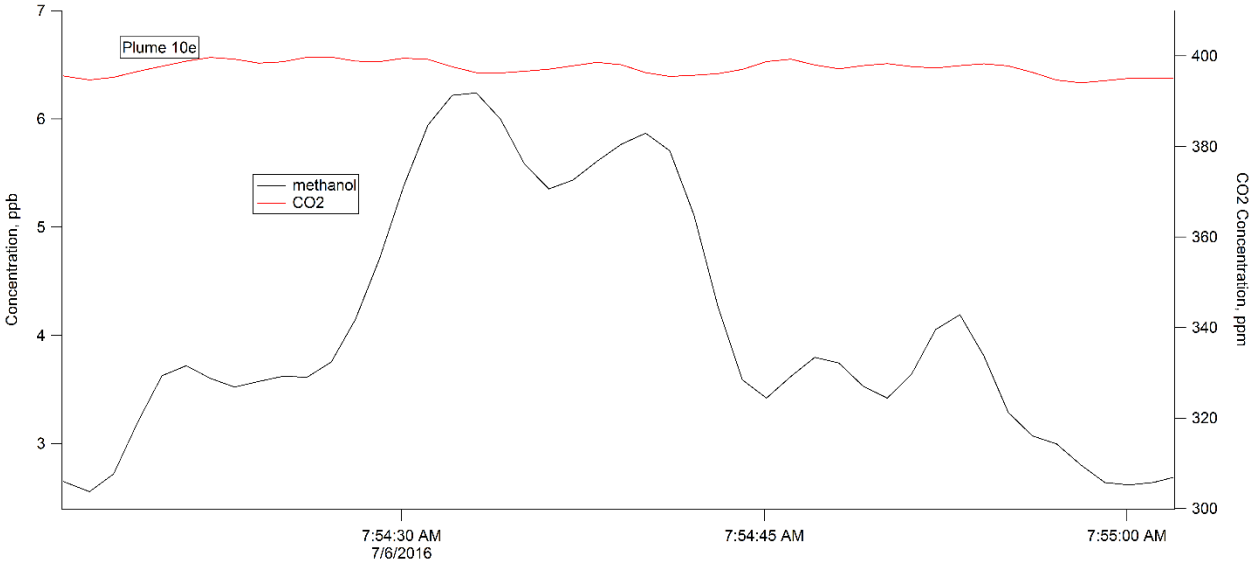


Plume 10c was observed at 7:11 AM at the Stationary Monitoring Site E of AX Farm. 65.1 °F and 1.02 bar, moderate winds blowing NW. The plume consisted of a slightly elevated methanol signal with no other COPCs of note. There no elevated CO_2 accompanying this plume, meaning this plume may from an unknown source E of AX Farm.

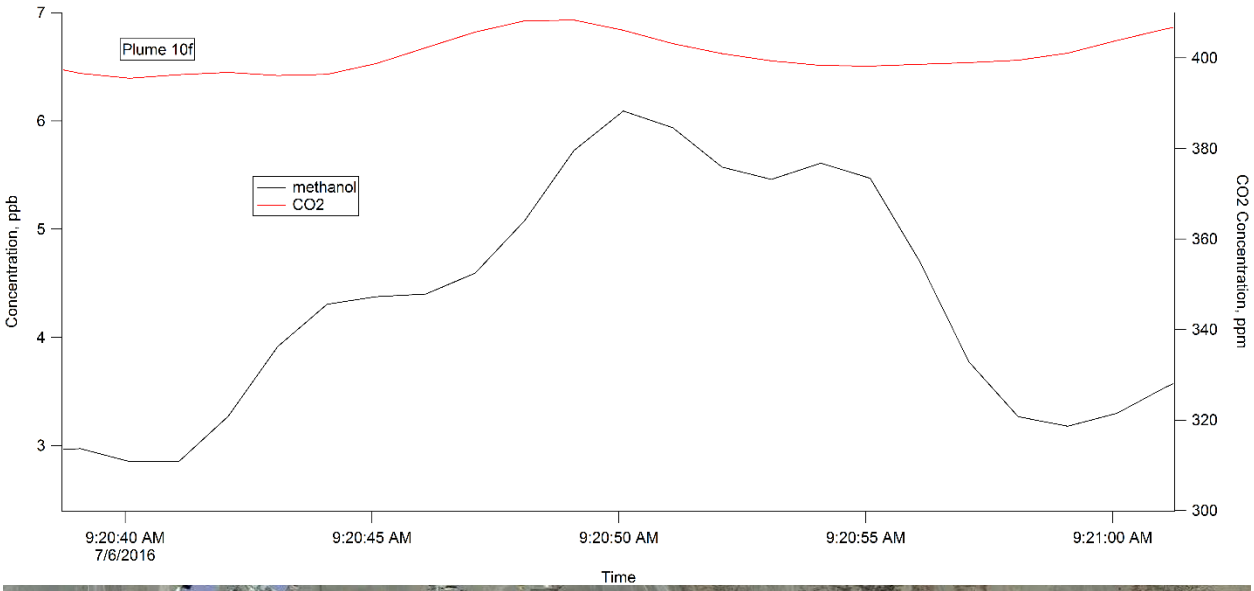




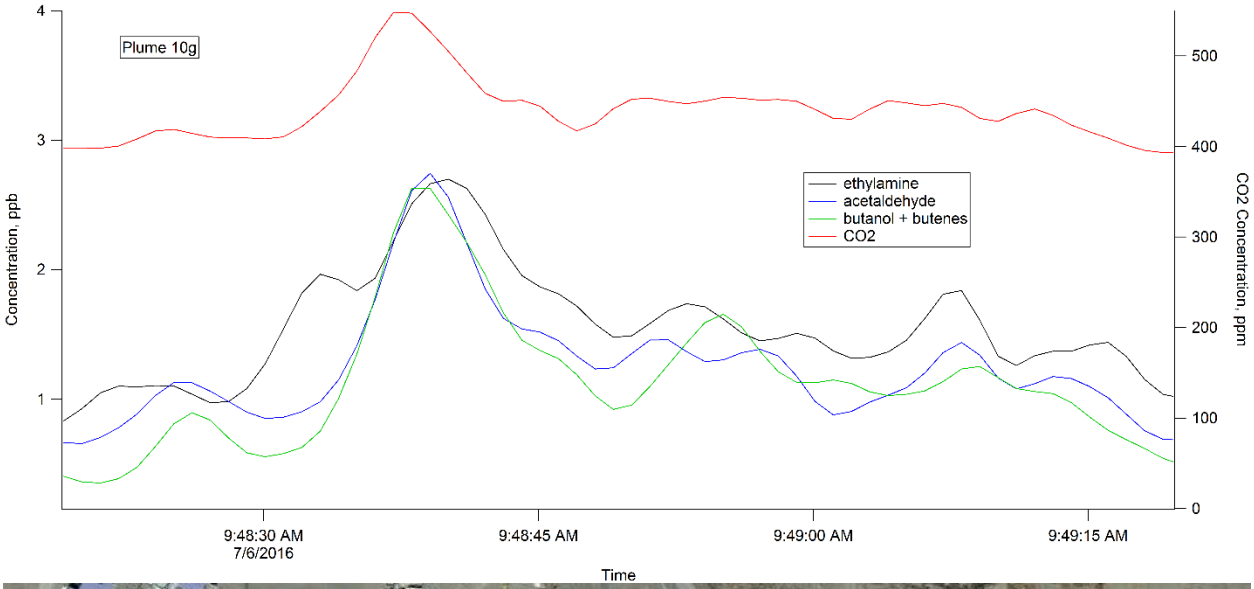
Plume 10d was observed at 7:16 AM while driving E of A Farm. 65.7 °F and 1.02 bar, moderate winds blowing WNW. The plume consisted of elevated ethylamine, acetaldehyde, and 1-butanol + butenes signals and strongly correlates with elevated CO_2, meaning it is likely a diesel exhaust plume.

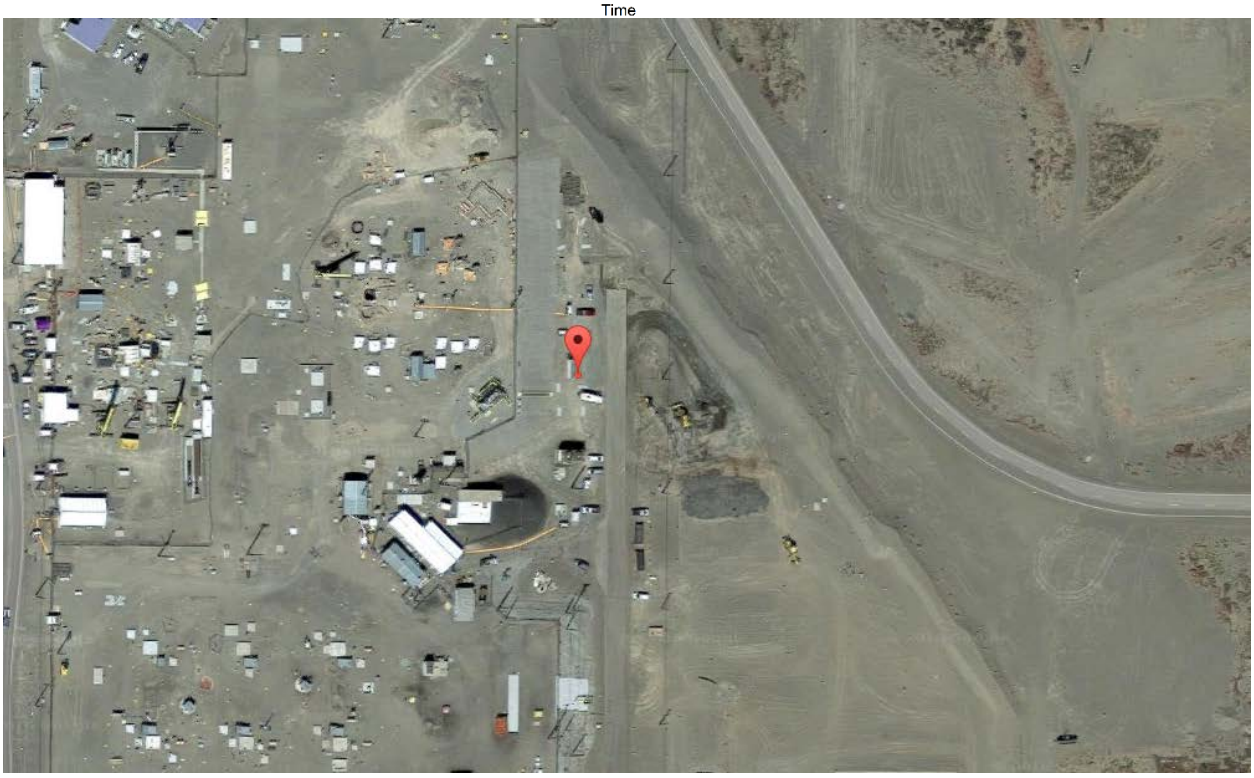


Plume 10e was observed between 7:54 AM and 7:55 AM while driving S on Canton between AN and AP Farms. 66.7 °F and 1.02 bar, moderate winds blowing SW. The plume consisted of a slightly elevated methanol signal with no other COPCs of note. There is elevated CO_2 accompanying this plume, but does not correlate well with this plume, meaning this it may from multiple dilute or mixed sources.

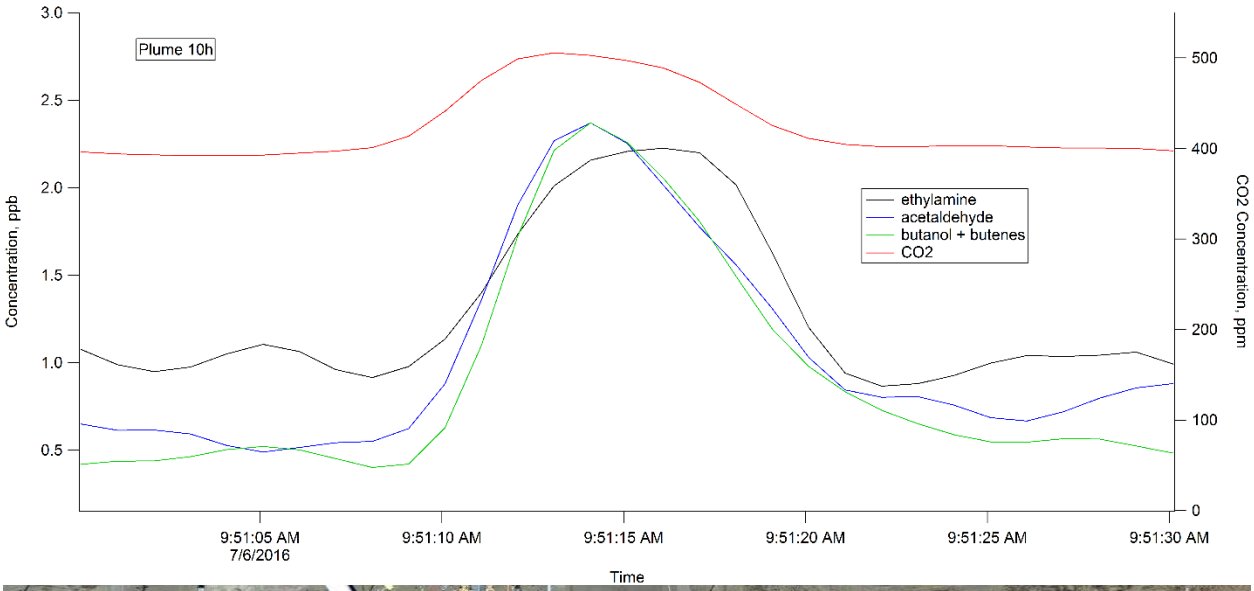


Plume 10f was observed at 9:20 AM at the Stationary Monitoring Site E of AX Farm. 74.1 °F and 1.02 bar, light winds blowing SSW. The plume consisted of a slightly elevated methanol signal with no other COPCs of note. There is a slight elevated CO_2 signal accompanying this plume, meaning this plume may be dilute exhaust.

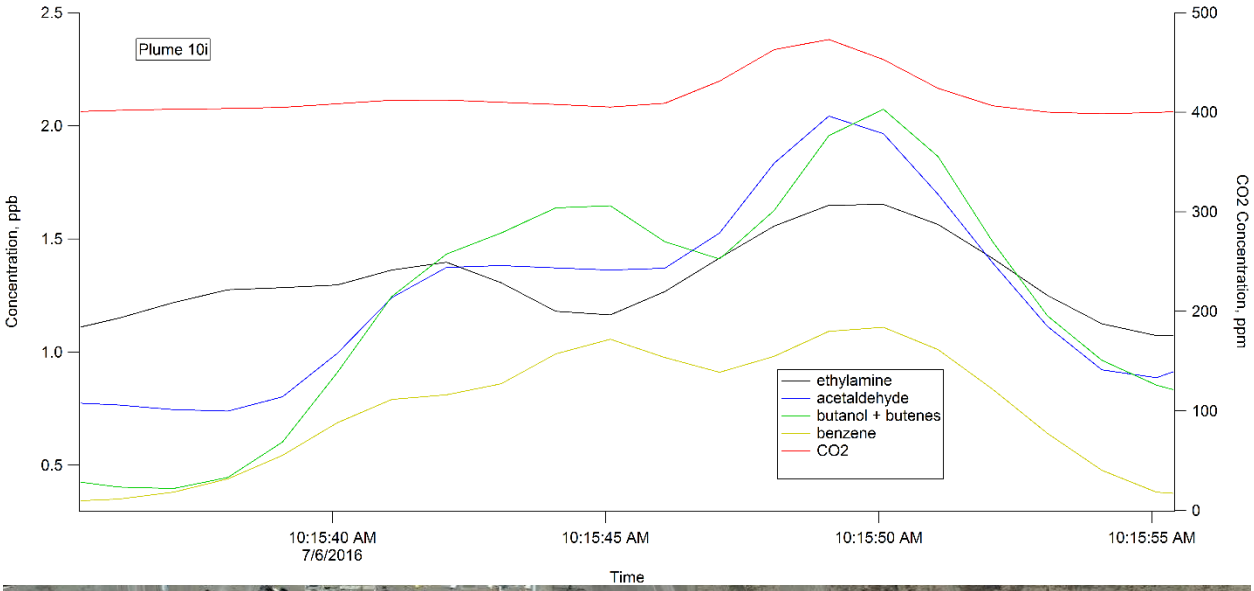


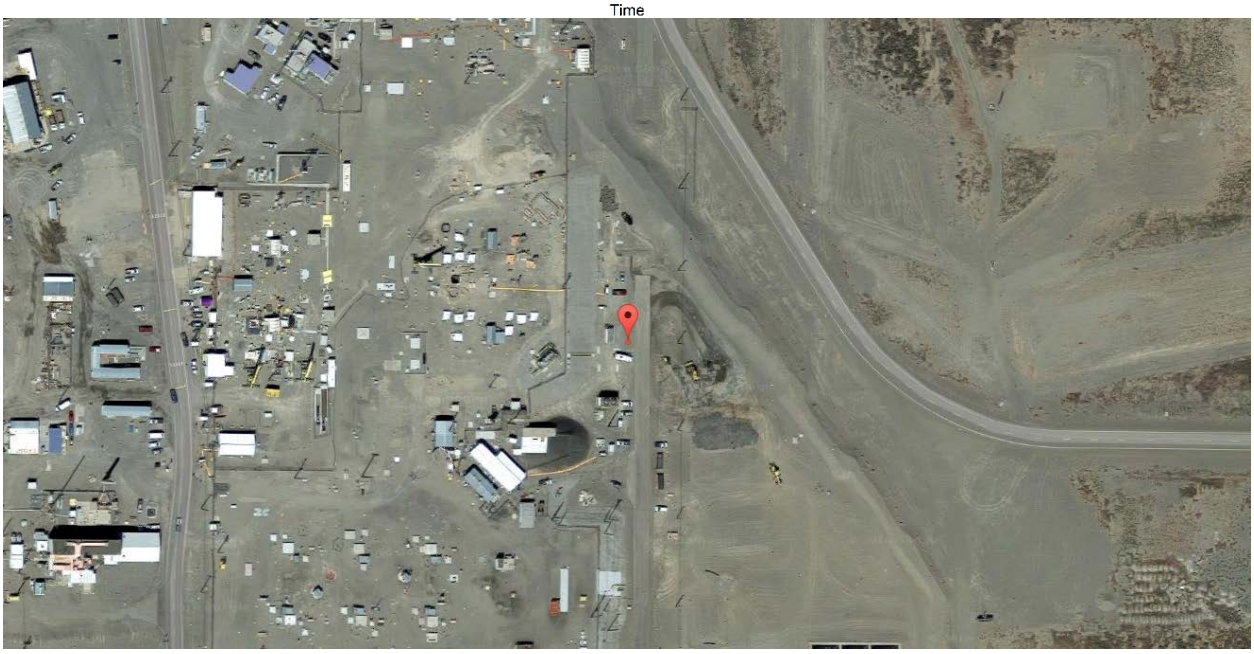


Plume 10g was observed at 9:48 AM at the Stationary Monitoring Site E of AX Farm. 77.0 °F and 1.02 bar, light winds blowing S. The plume consisted of elevated ethylamine, acetaldehyde, and 1-butanol + butenes signals and strongly correlates with elevated CO_2, meaning it is likely a diesel exhaust plume.

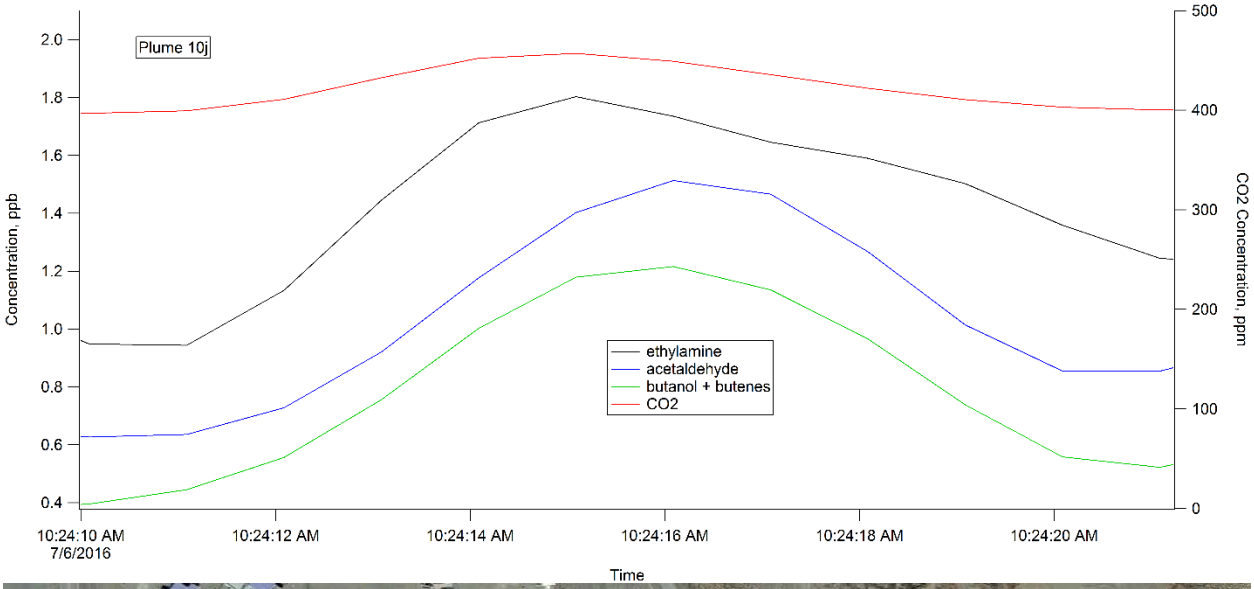


Plume 10h was observed at 9:51 AM at the Stationary Monitoring Site E of AX Farm. 76.6 °F and 1.02 bar, light winds blowing NE. The plume consisted of elevated ethylamine, acetaldehyde, and 1-butanol + butenes signals and strongly correlates with elevated CO_2, meaning it is likely a diesel exhaust plume.

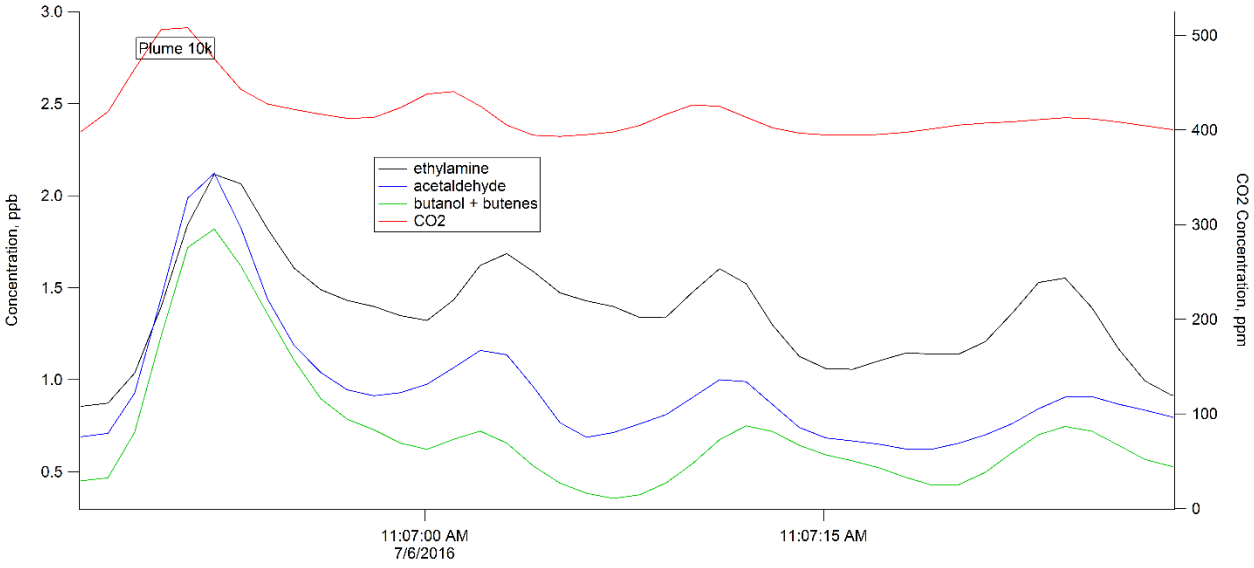


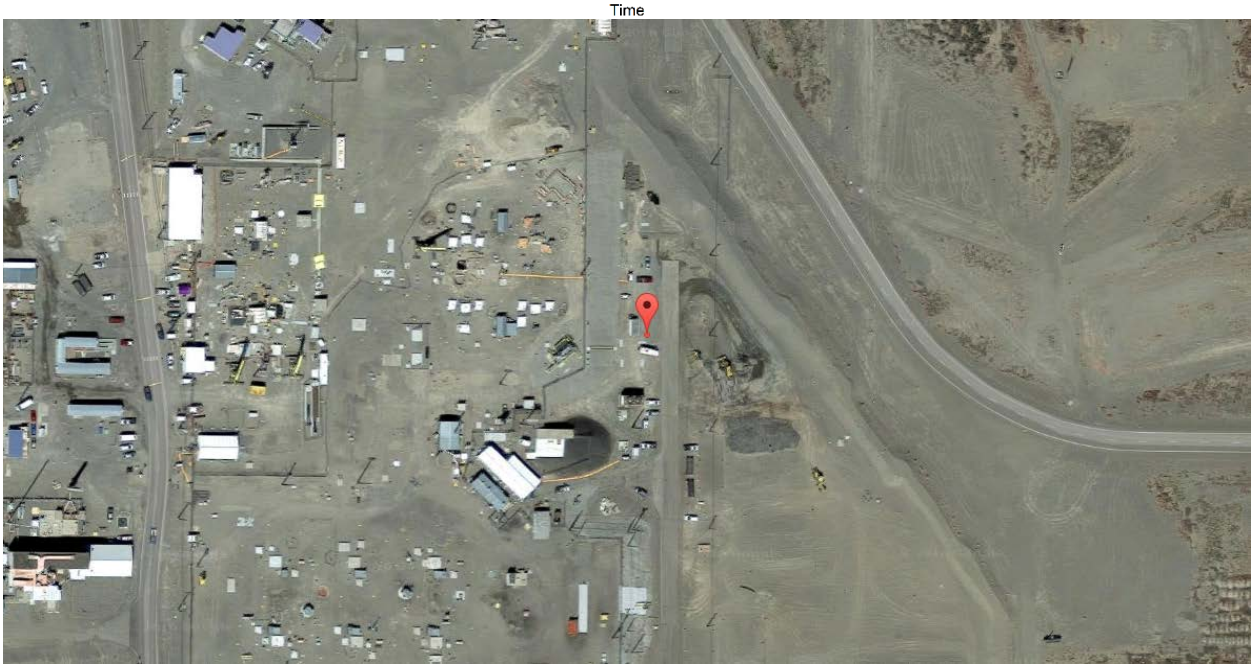


Plume 10h was observed at 10:15 AM at the Stationary Monitoring Site E of AX Farm. 78.1 °F and 1.02 bar, light winds blowing NNW. The plume consisted of elevated ethylamine, acetaldehyde, 1-butanol + butenes, and benzene signals and strongly correlates with elevated CO_2, meaning it is likely a gasoline exhaust plume.

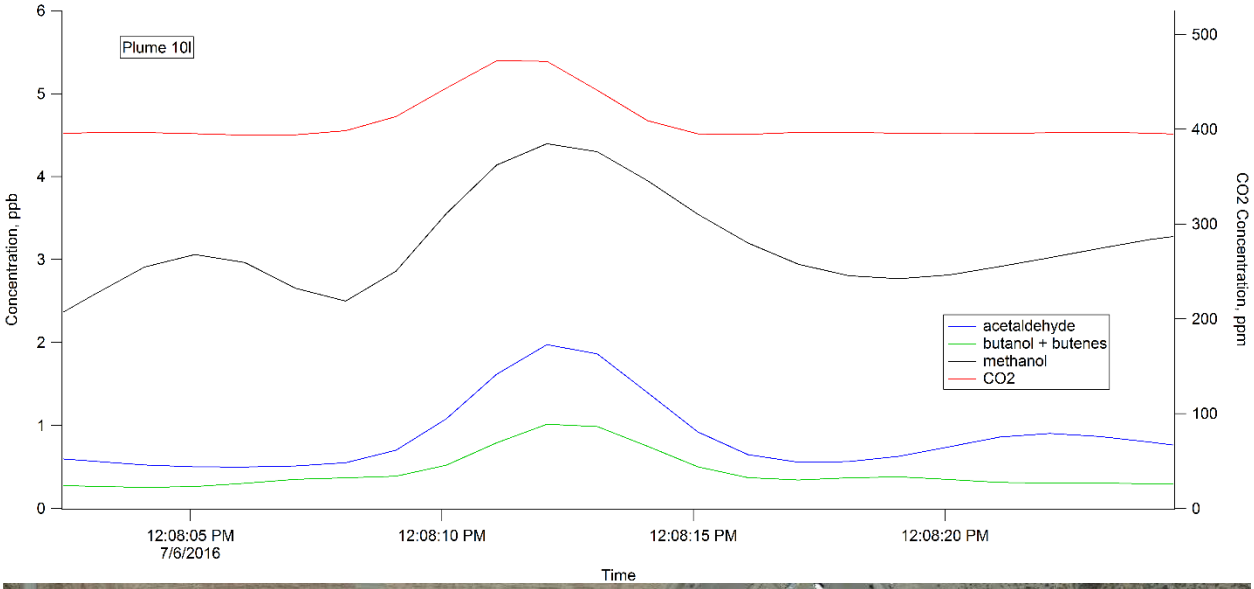


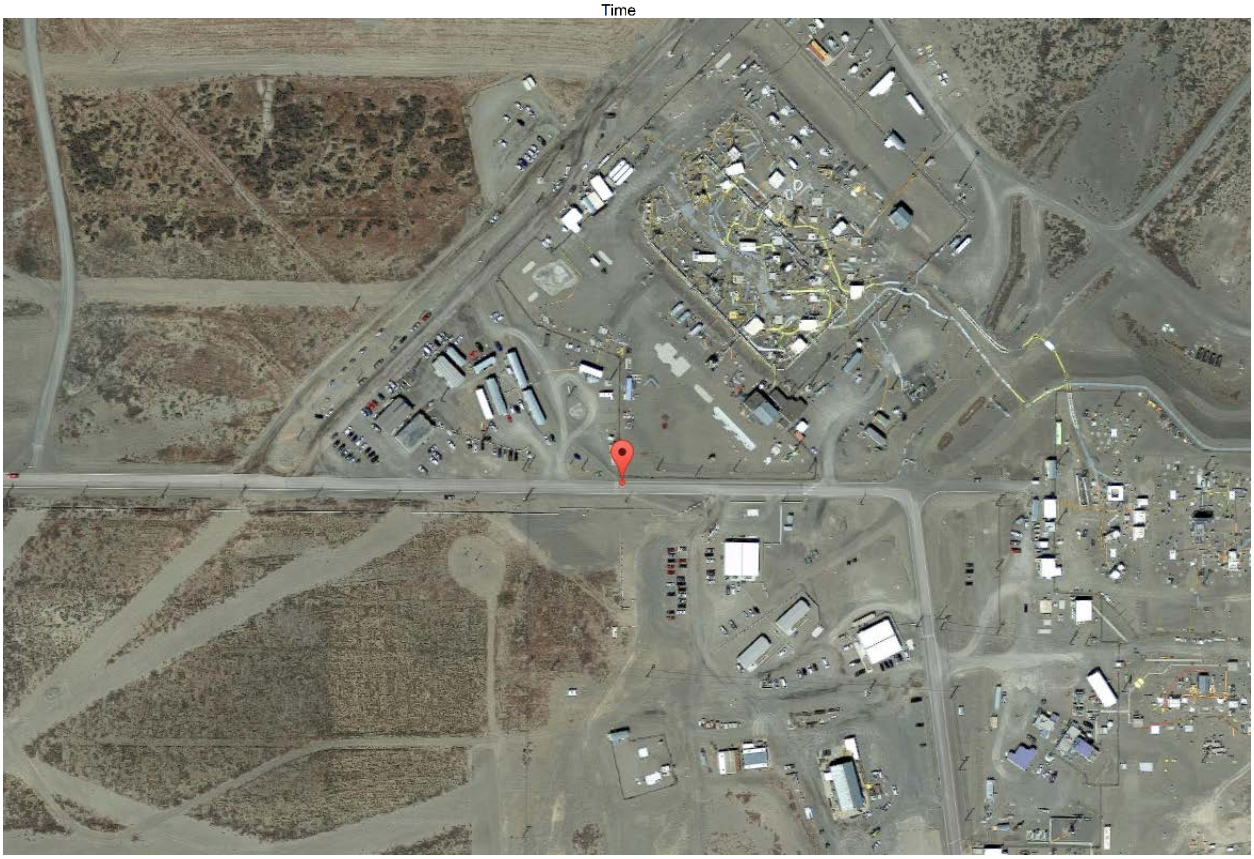
Plume 10j was observed at 10:24 AM at the Stationary Monitoring Site E of AX Farm. 79.0 °F and 1.02 bar, light winds blowing NW. The plume consisted of slightly elevated ethylamine, acetaldehyde, and 1-butanol + butenes signals and correlates with elevated CO_2, meaning it is likely a diesel exhaust plume.





Plume 10k was observed at 11:07 AM at the Stationary Monitoring Site E of AX Farm. 80.6 °F and 1.02 bar, light winds blowing WNW. The plume consisted of elevated ethylamine, acetaldehyde, and 1-butanol + butenes signals and strongly correlates with elevated CO_2, meaning it is likely a diesel exhaust plume.



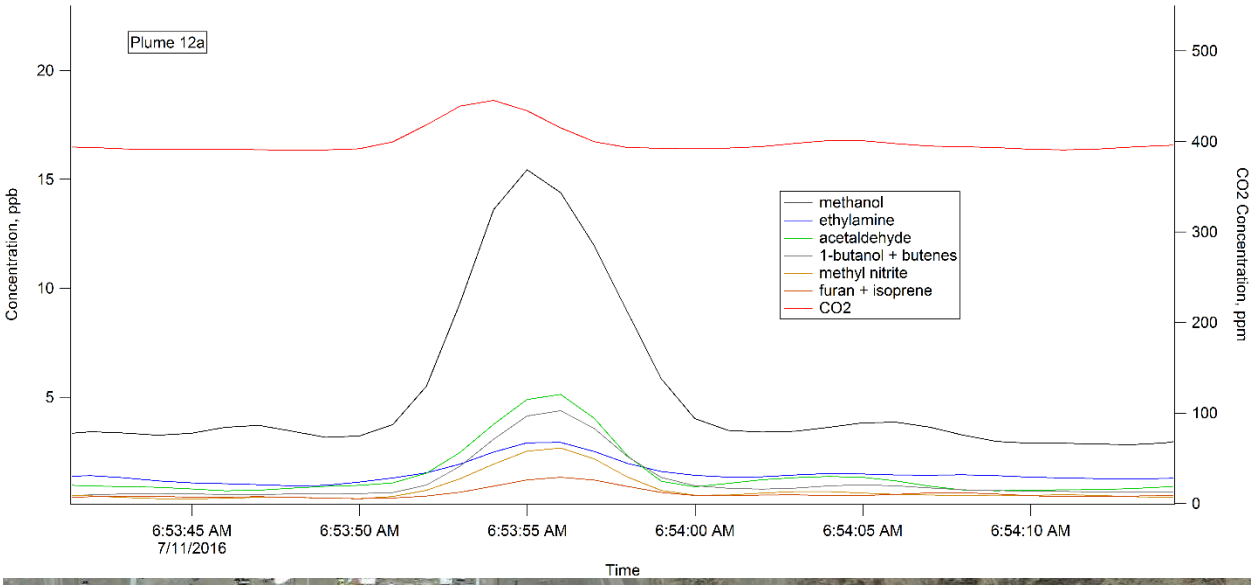


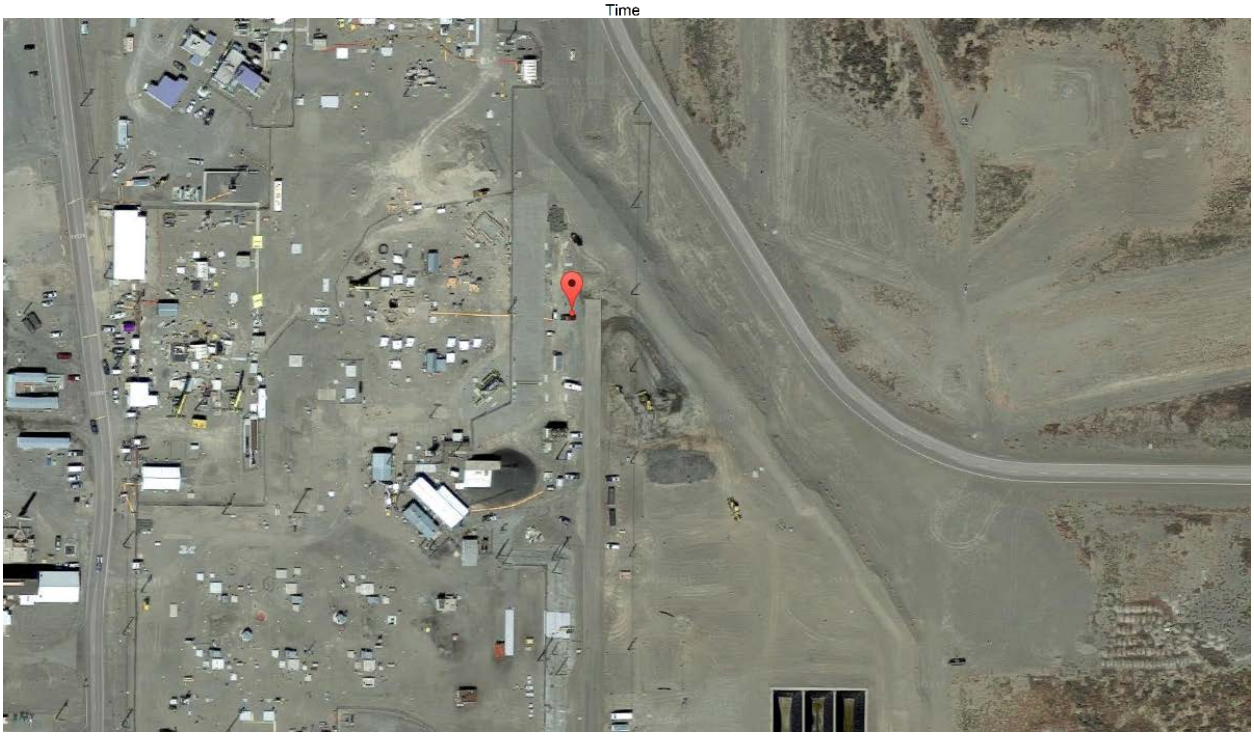
Plume 10l was observed at 12:08 PM while driving S of C Farm. 77.9 °F and 1.01 bar, moderate winds blowing NE. The plume consisted of elevated ethylamine, acetaldehyde, and 1-butanol + butenes signals and strongly correlates with elevated CO_2, meaning it is likely a diesel exhaust plume.

9.2.11 July 7, 2016

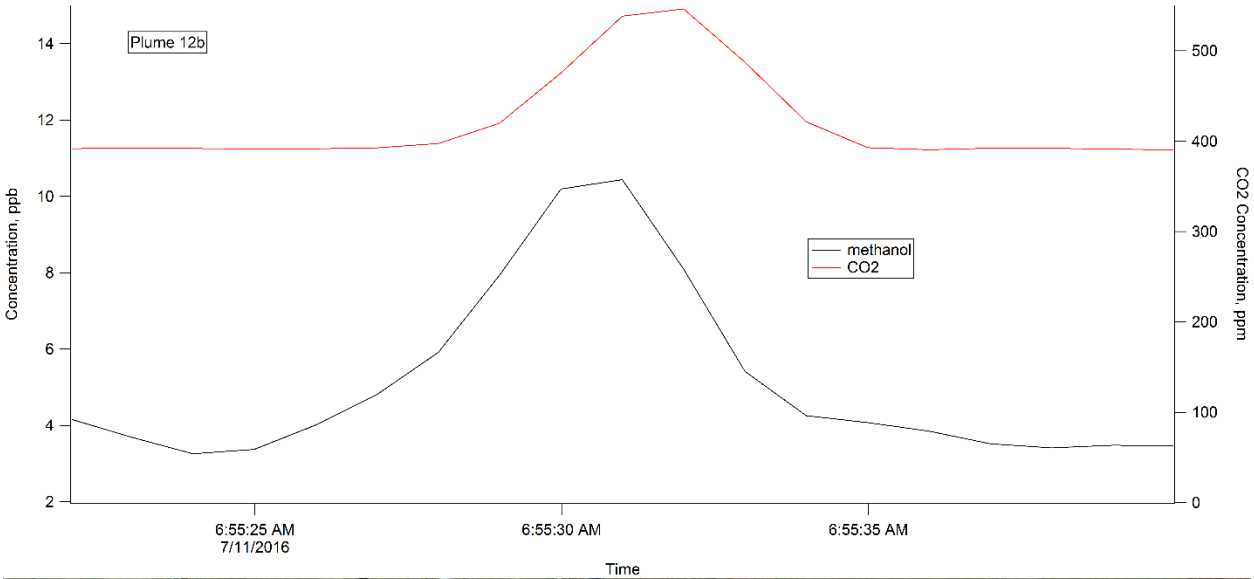
July 7 did not produce any usable data.

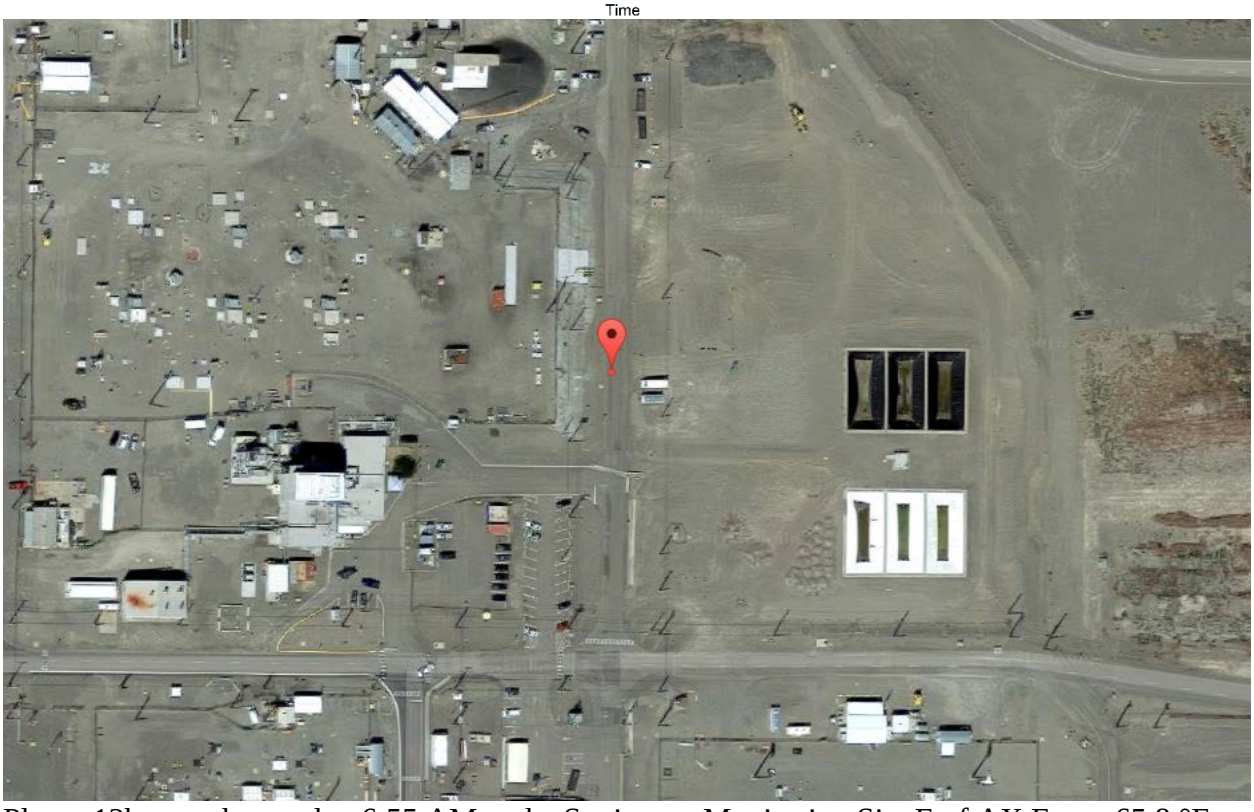
9.2.12 July 11, 2016



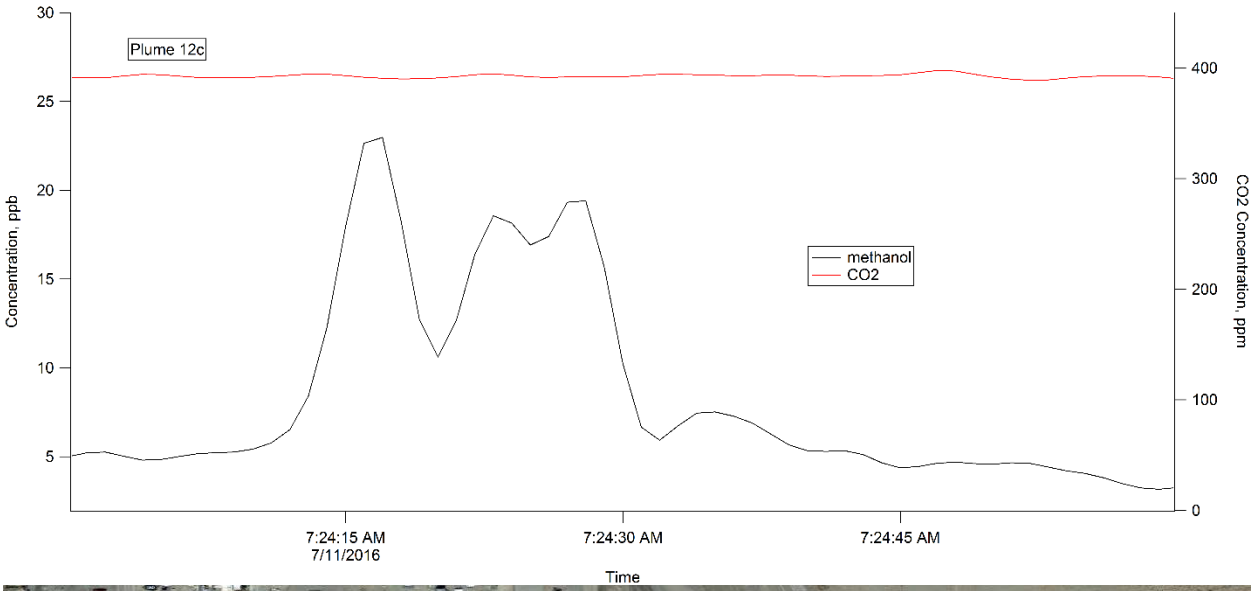


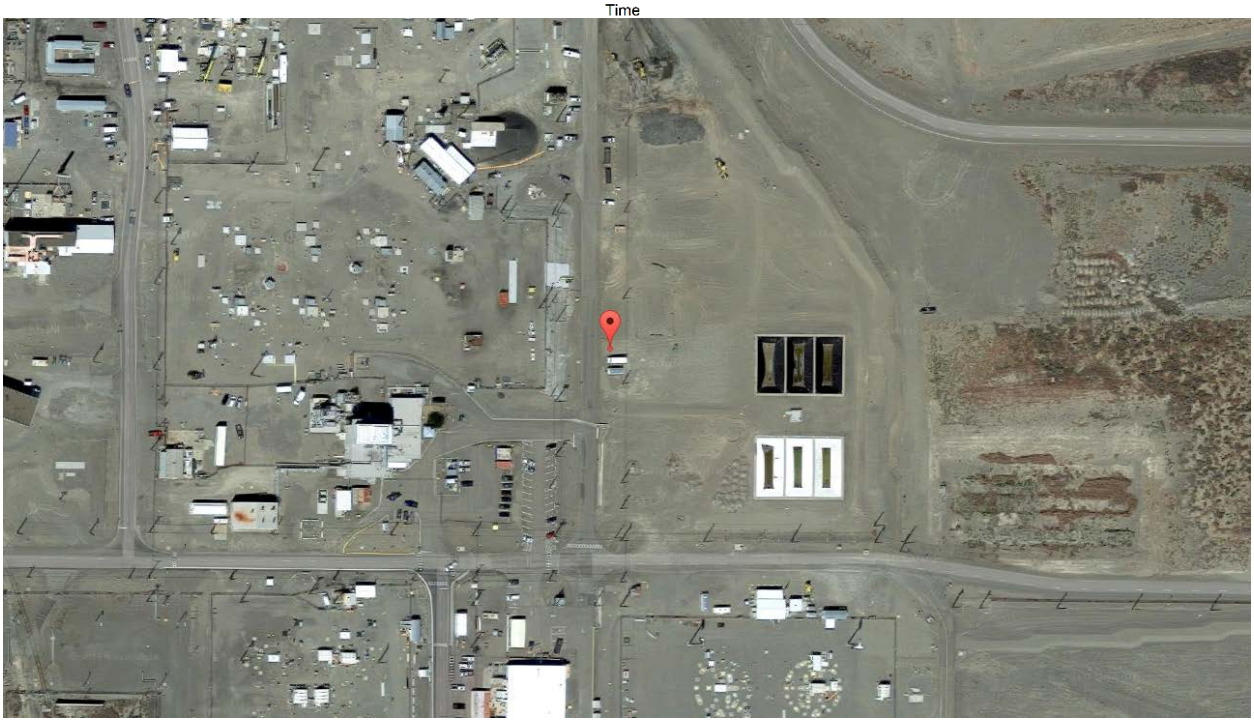
Plume 12a was observed at 6:53 AM while driving on Canton E of AX Farm. 65.7 °F and 1.01 bar, light winds blowing N. The plume consisted of elevated methanol, ethylamine, acetaldehyde, methyl nitrite, furan + isoprene, and 1-butanol + butenes signals and correlates with elevated CO_2 despite a slight time shift meaning it is likely a diesel exhaust plume. The furan + isoprene signal exceeded OEL in this plume.



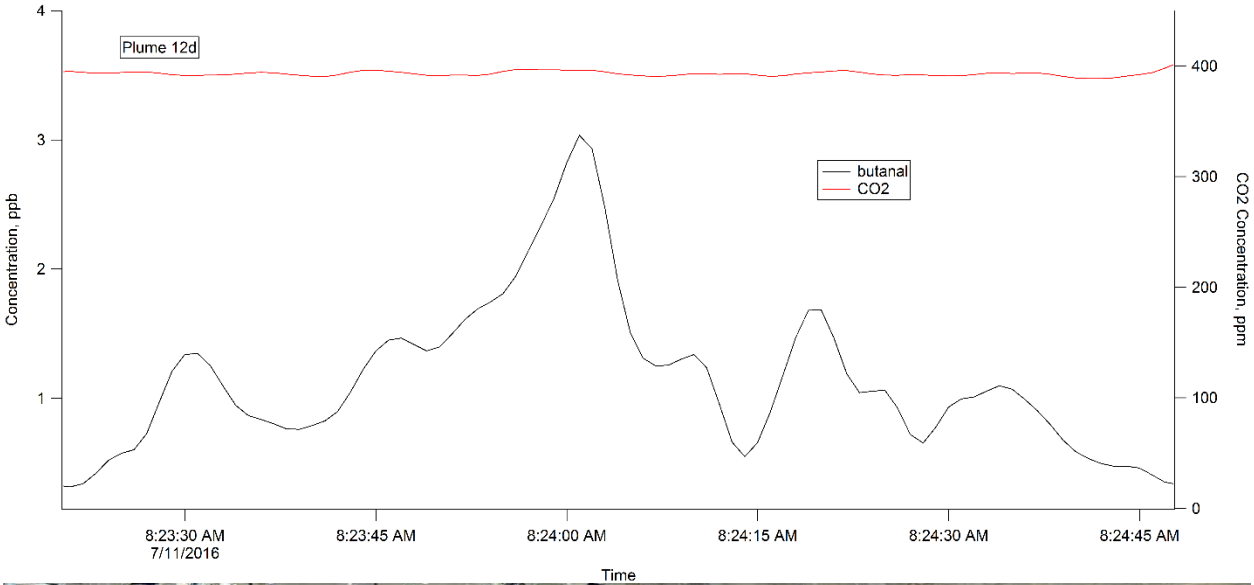


Plume 12b was observed at 6:55 AM at the Stationary Monitoring Site E of AX Farm. 65.8 °F and 1.02 bar, moderate winds blowing WNW. The plume consisted of an elevated methanol signal and somewhat correlates with elevated CO_2 with a slight time shift, meaning it may be a dilute or mixed exhaust plume.

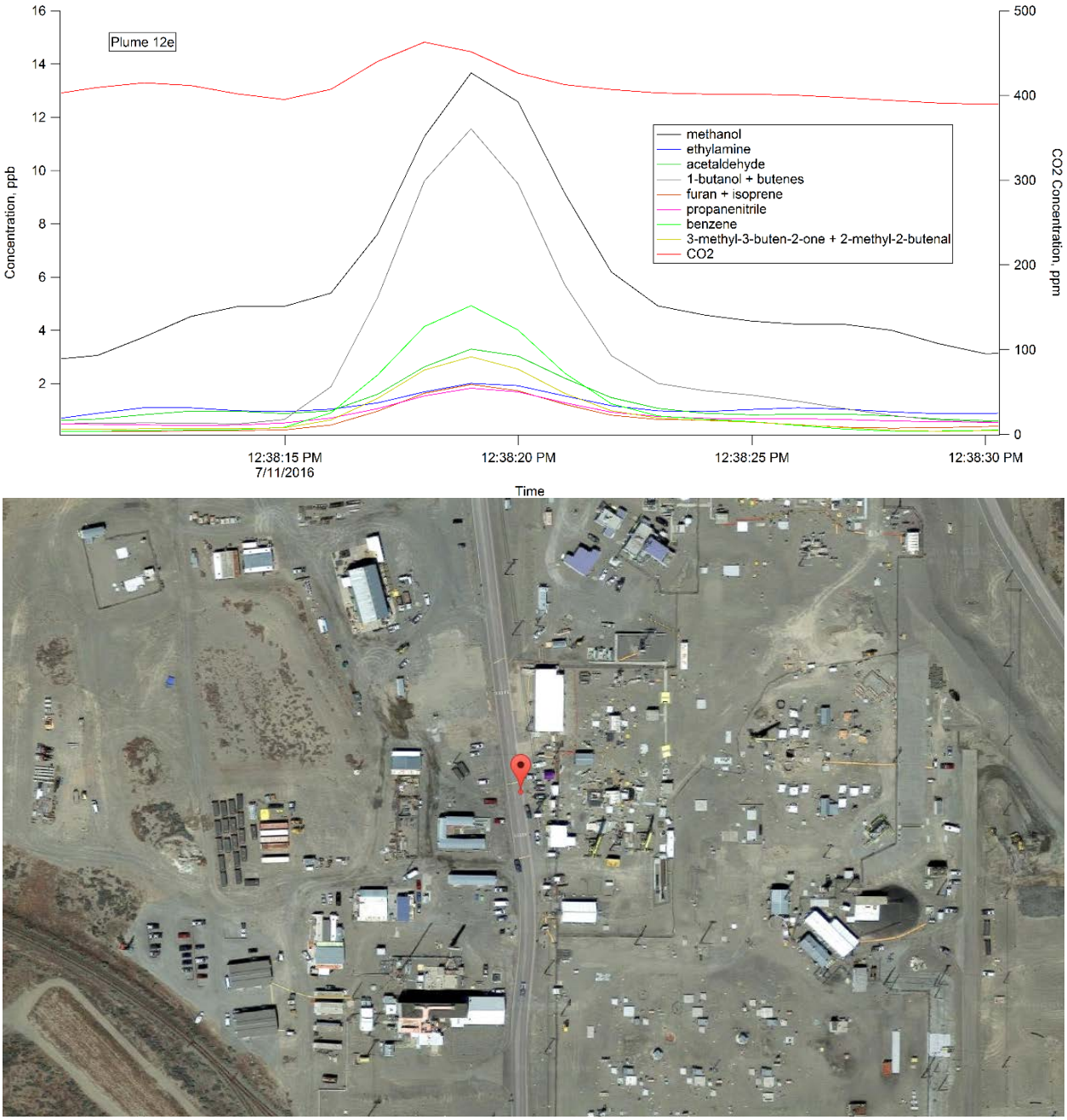




Plume 12c was observed at 7:24 AM at the Stationary Monitoring Site E of AX Farm. 67.6 °F and 1.02 bar, moderate winds blowing WNW. The plume consisted of an elevated methanol signal and does not correlate with CO_2, meaning it is potentially a plume from an unknown source.



Plume 12d was observed at 8:24 AM at the Stationary Monitoring Site E of AX Farm. 71.0 °F and 1.02 bar, moderate winds blowing W. The plume consisted of an elevated methanol signal and does not correlate with CO_2, meaning it is potentially a plume from an unknown source.

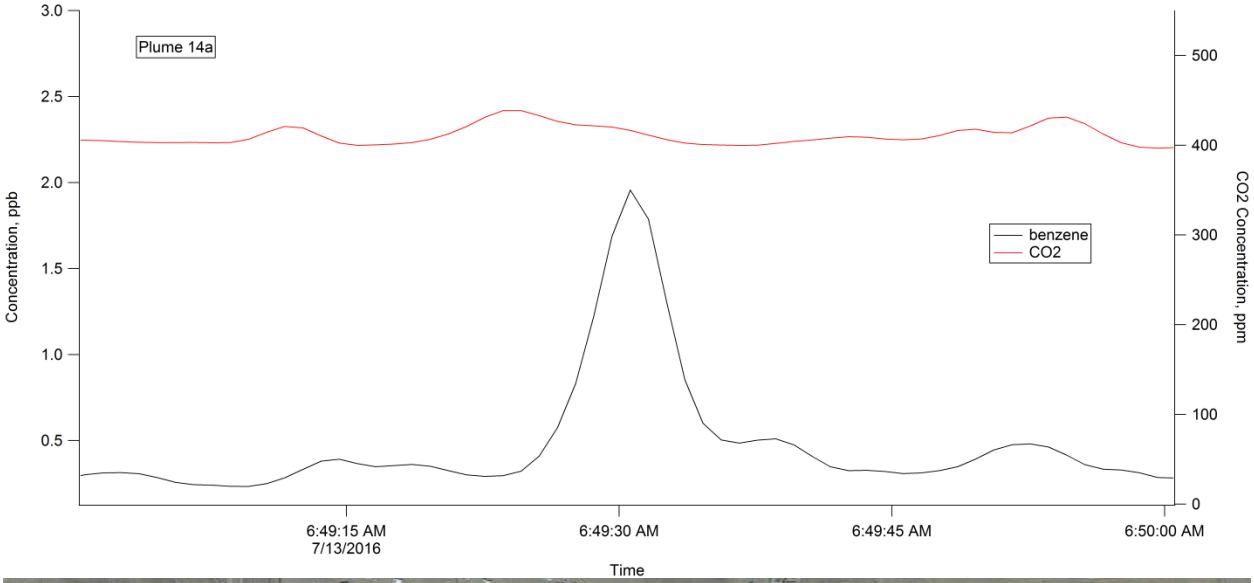


Plume 12e was observed at 12:38 PM while driving on Buffalo W of AY Farm. 80.0 °F and 1.01 bar, light winds blowing NW. The plume primarily consisted of elevated methanol, ethylamine, acetaldehyde, benzene, furan + isoprene, and 1-butanol + butenes signals and correlates with elevated CO_2 despite a slight time shift meaning it is likely a gasoline exhaust plume. The furan + isoprene signal exceeded OEL in this plume.

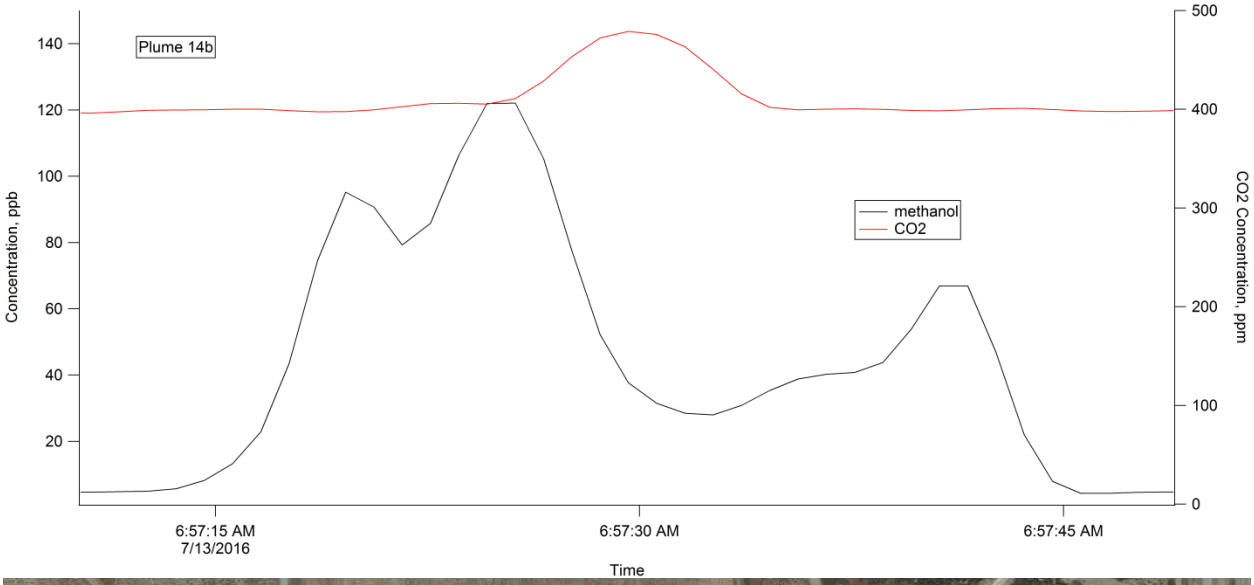
9.2.13 July 12, 2016

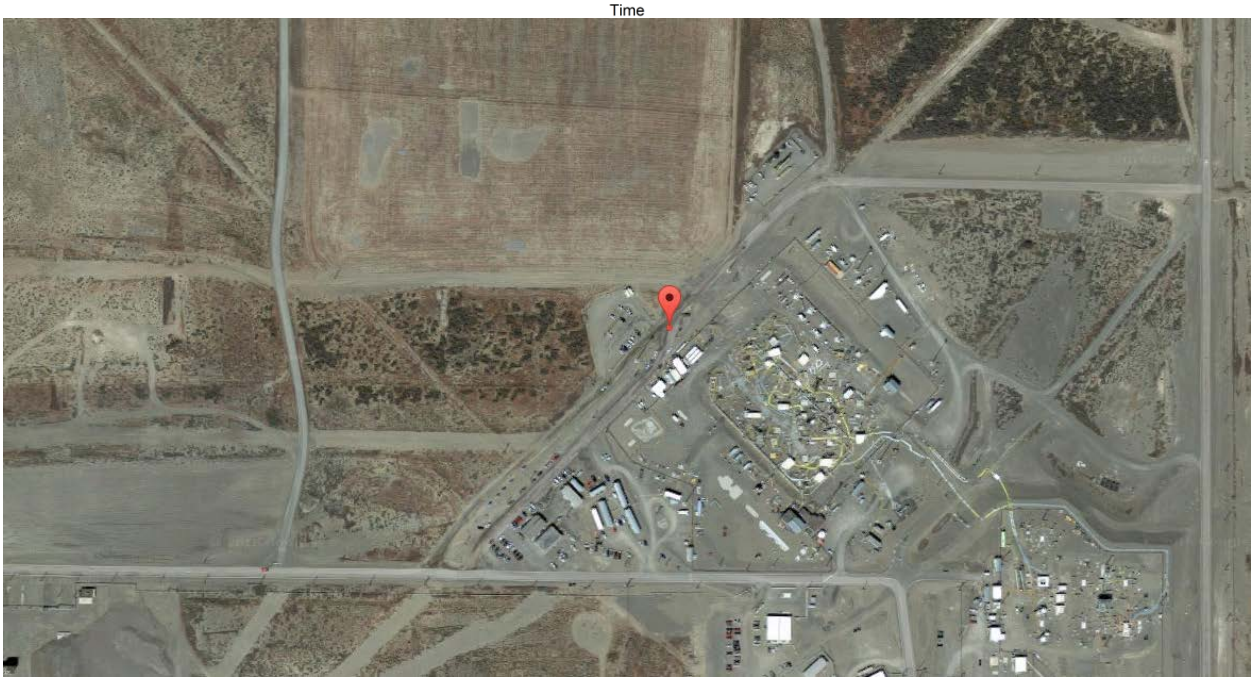
July 12 did not produce any usable data

9.2.14 July 13, 2016

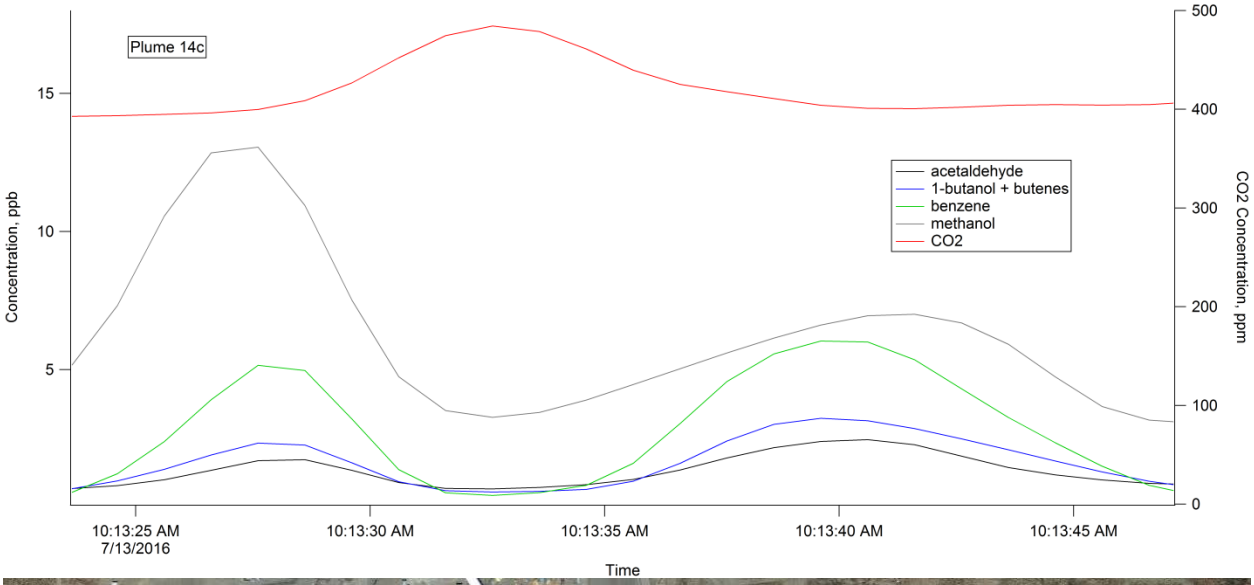


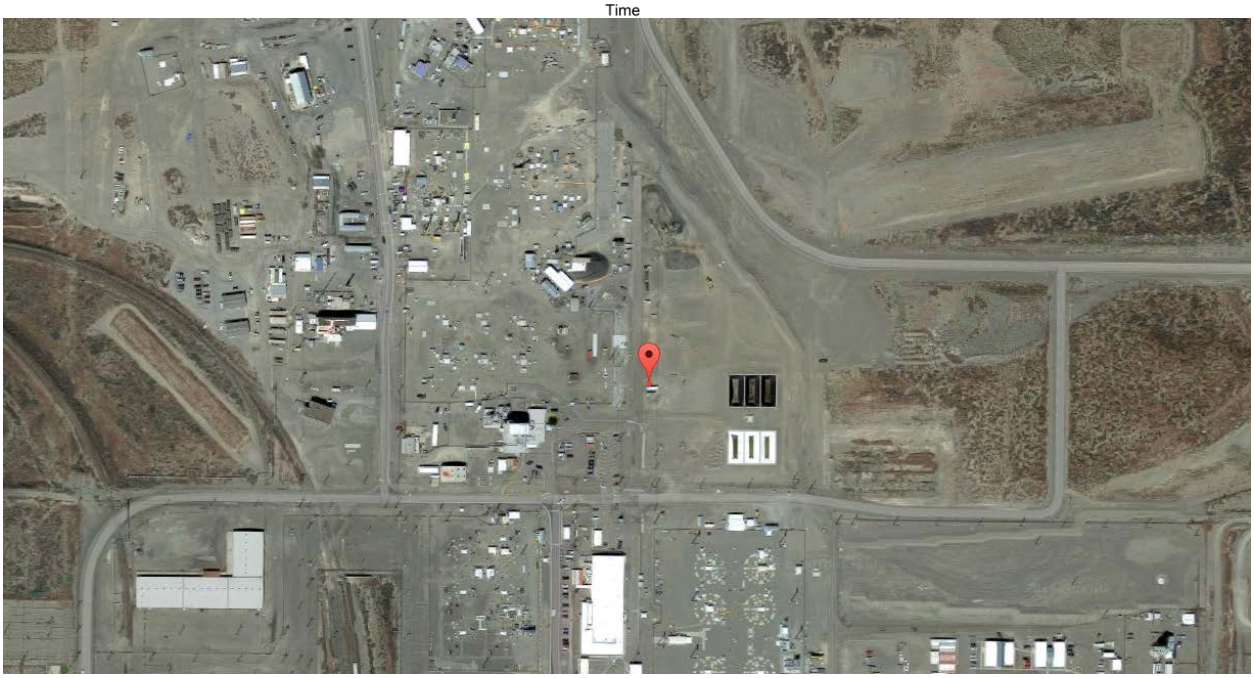
Plume 14a was observed at 6:49 AM while stopped at the intersection of Canton and 4th. 66.9 °F and 1.02 bar, light winds blowing NE. The plume consisted of elevated benzene and does not correlate with CO_2, meaning it could be from an unknown source.





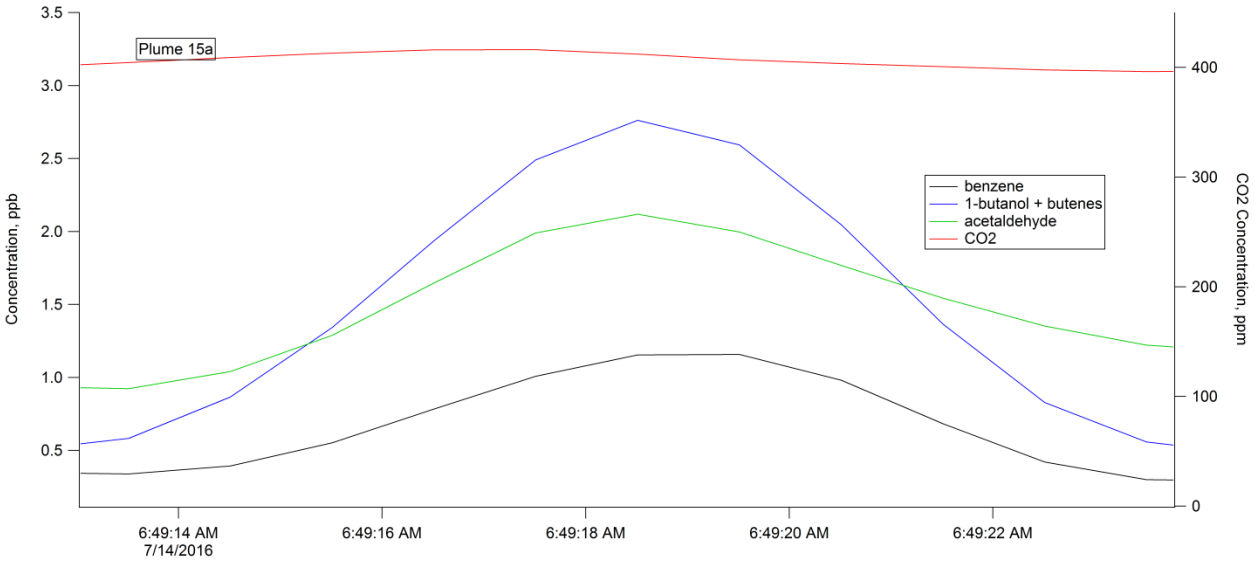
Plume 14b was observed at 6:57 AM while driving N of C Farm. 65.8 °F and 1.02 bar, light winds blowing W. The plume consisted of elevated methanol and does not correlate with CO_2, meaning it could be from an unknown source near C Farm.



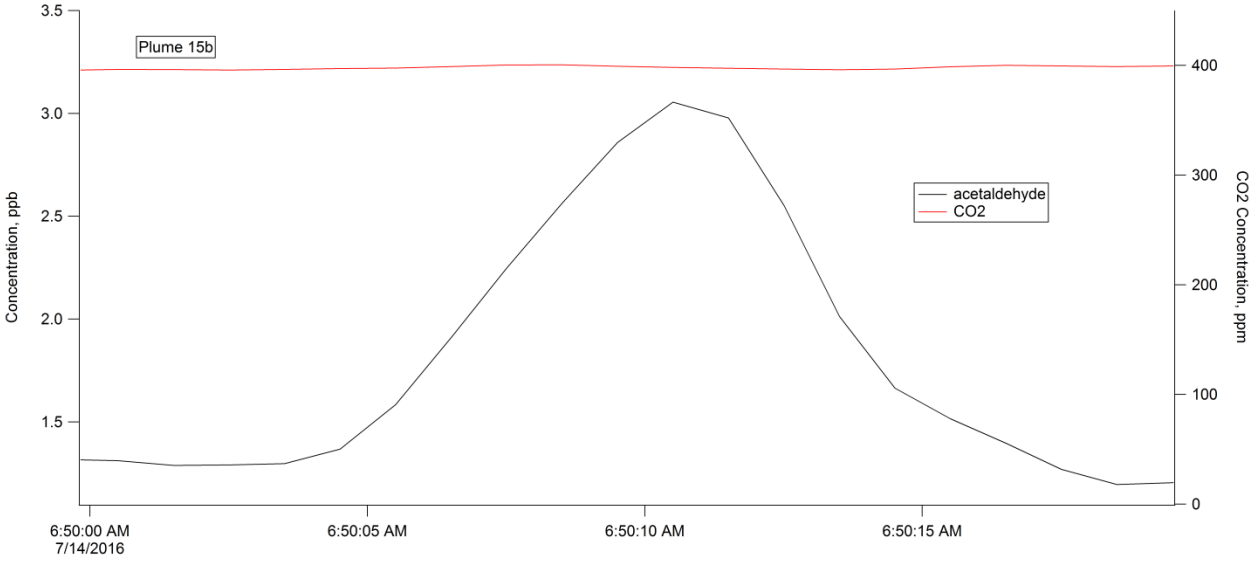


Plume 14c was observed at 10:13 AM while at the Stationary Monitoring Site. 80.0 °F and 1.02 bar, moderate winds blowing NE. The plume consisted of elevated acetaldehyde, 1-butanol + butenes, benzene, and methanol signals. This plume does not correlate with CO_2 despite elevated levels, which could mean this is a dilute or mixed exhaust plume.

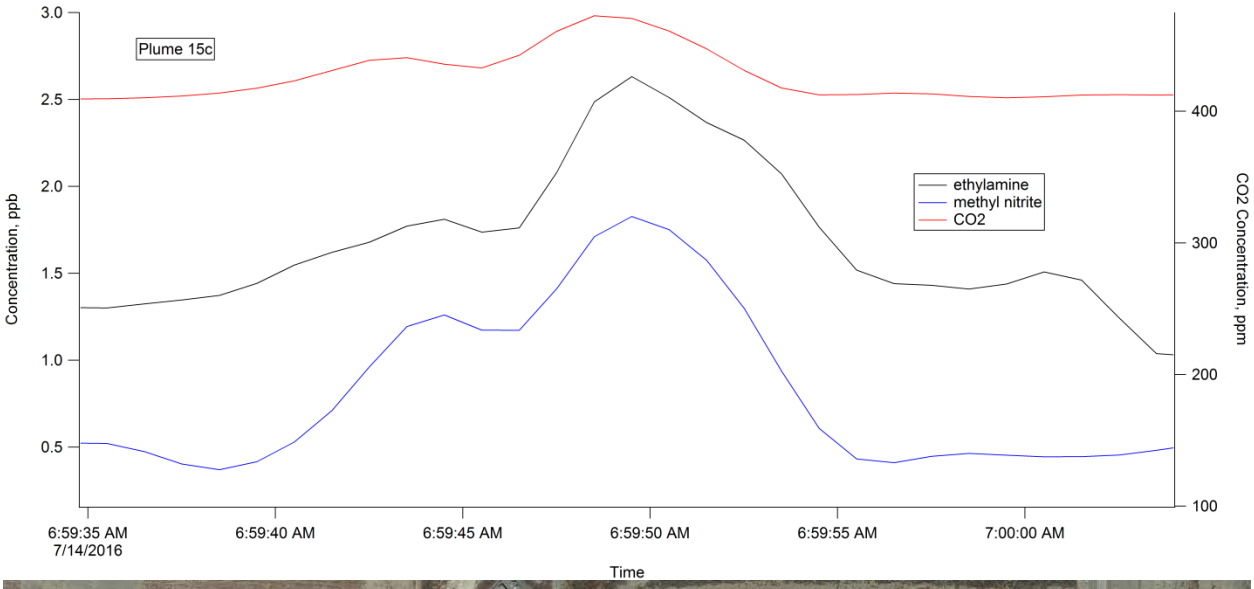
9.2.15 July 14, 2016



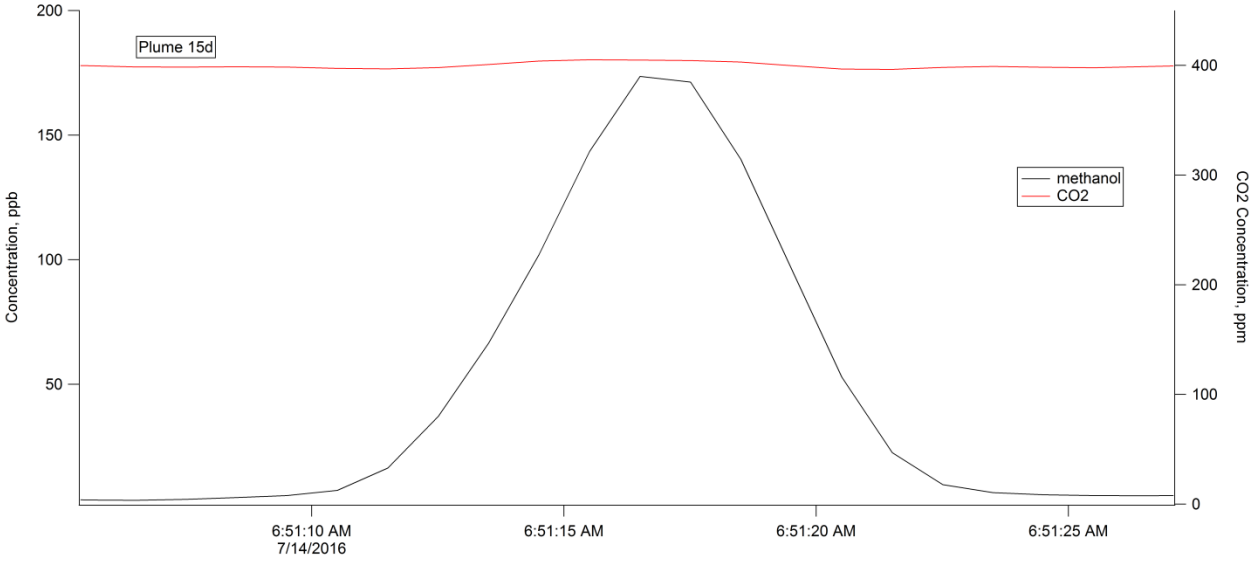
Plume 15a was observed at 6:49 AM while driving on Canton by 274AW. 66.0 °F and 1.02 bar, moderate winds blowing NNE. The plume consisted of elevated 1-butanol + butenes, benzene, and acetaldehyde signals. There is no correlating elevation in CO_2 accompanying this plume, meaning this plume may come from an unknown source but could also indicate it is a very weak exhaust plume.

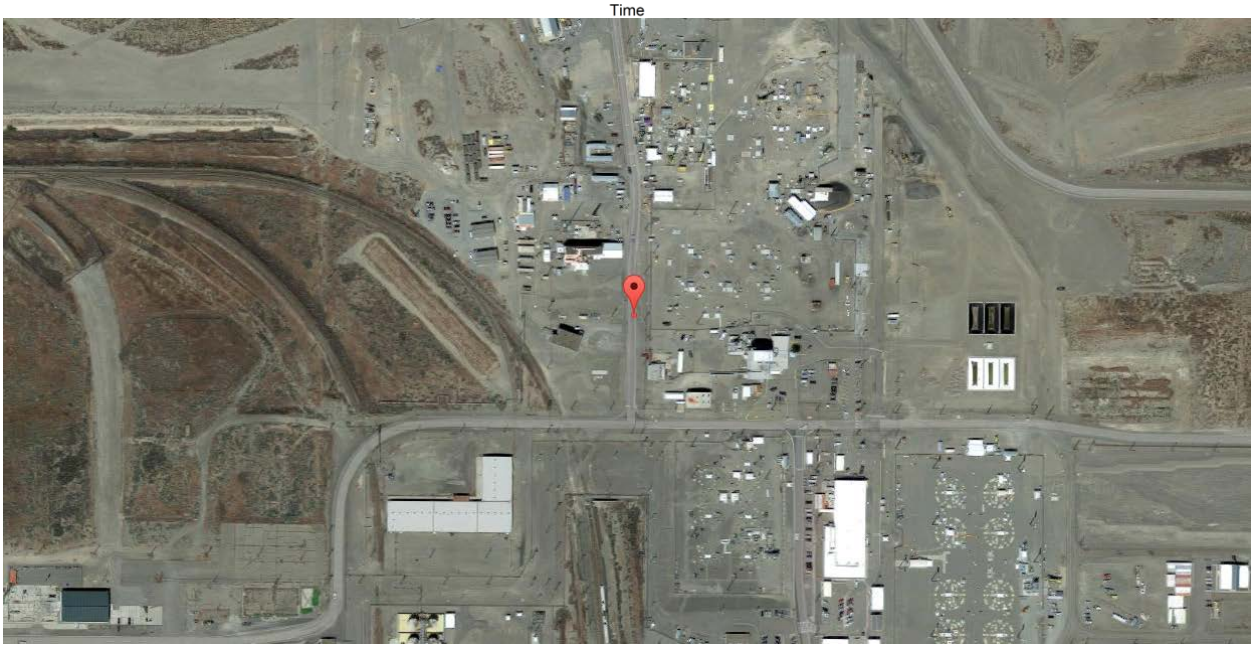


Plume 15b was observed at 6:50 AM at the intersection of Canton and 4th. 65.5 °F and 1.02 bar, light winds blowing NNE. The plume consisted of elevated acetaldehyde. There is no correlating elevation in CO_2 accompanying this plume, meaning this plume may come from an unknown source but could also indicate it is a very weak exhaust plume.

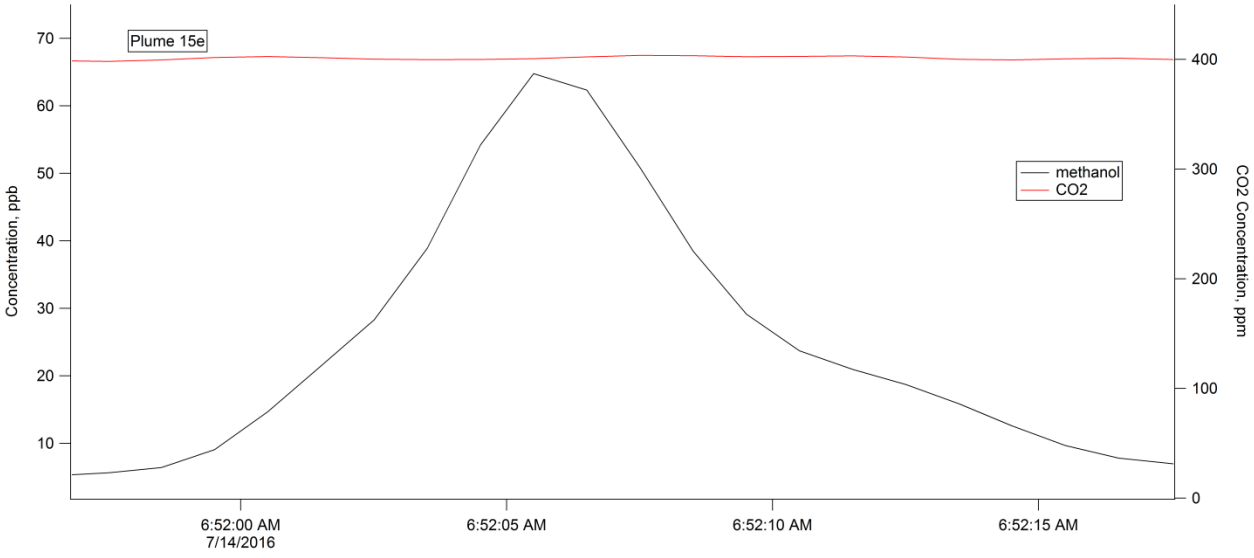


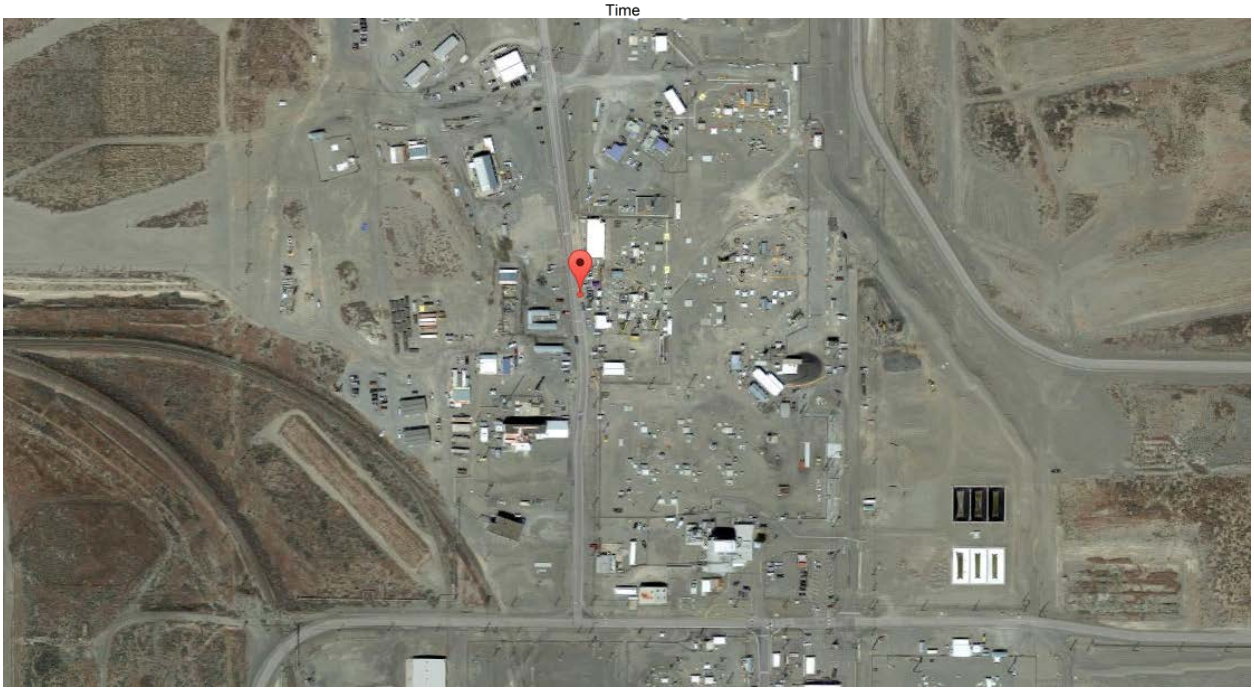
Plume 15c was observed at 6:59 AM along the N side of C Farm. 65.8 °F and 1.02 bar, light winds blowing NW. The plume consisted of elevated ethylamine and methyl nitrite signals. There is a correlated rise in CO_2 meaning this plume is probably exhaust.



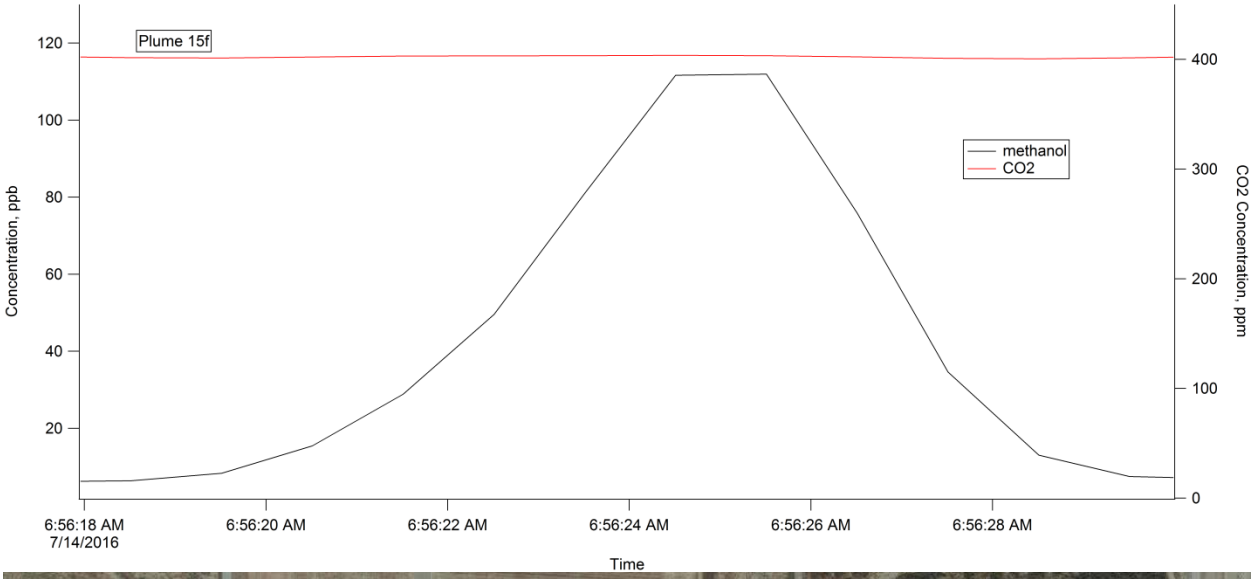


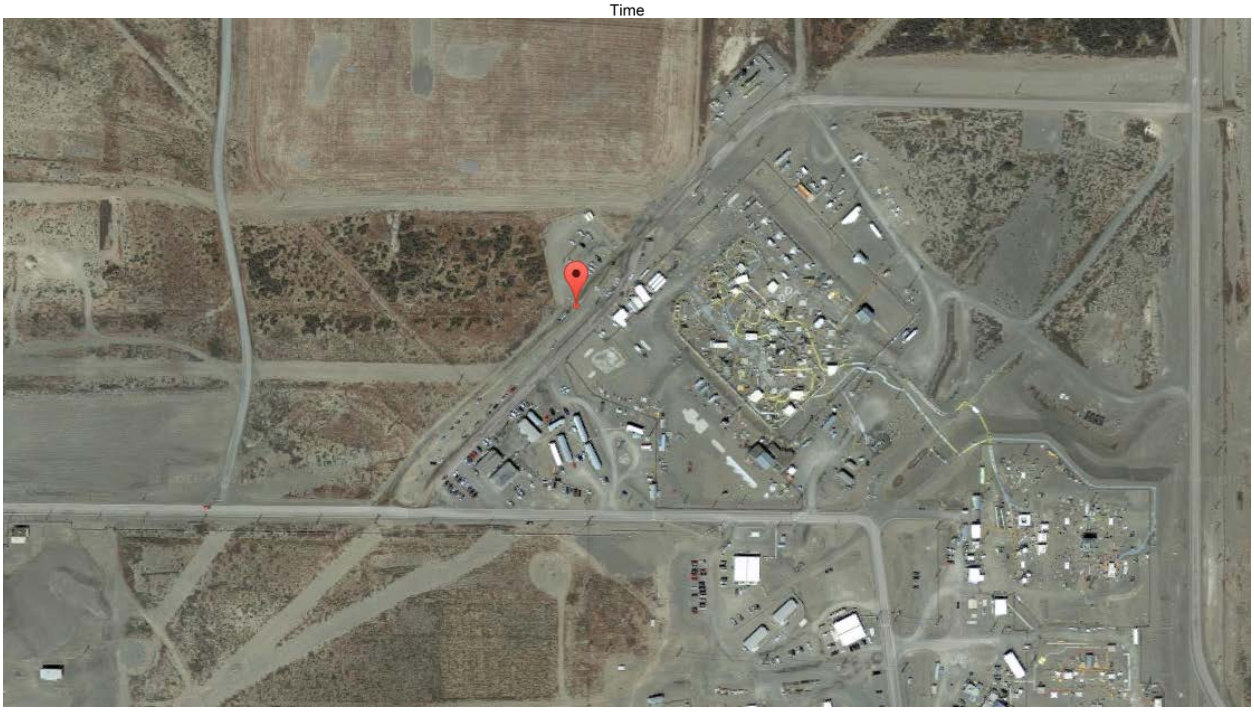
Plume 15d was observed at 6:51 AM while driving on Canton W of A Farm. 65.1 °F and 1.02 bar, moderate winds blowing NNE. The plume consisted of elevated methanol. There is no correlated rise in CO_2 meaning this plume may come from an unknown source.



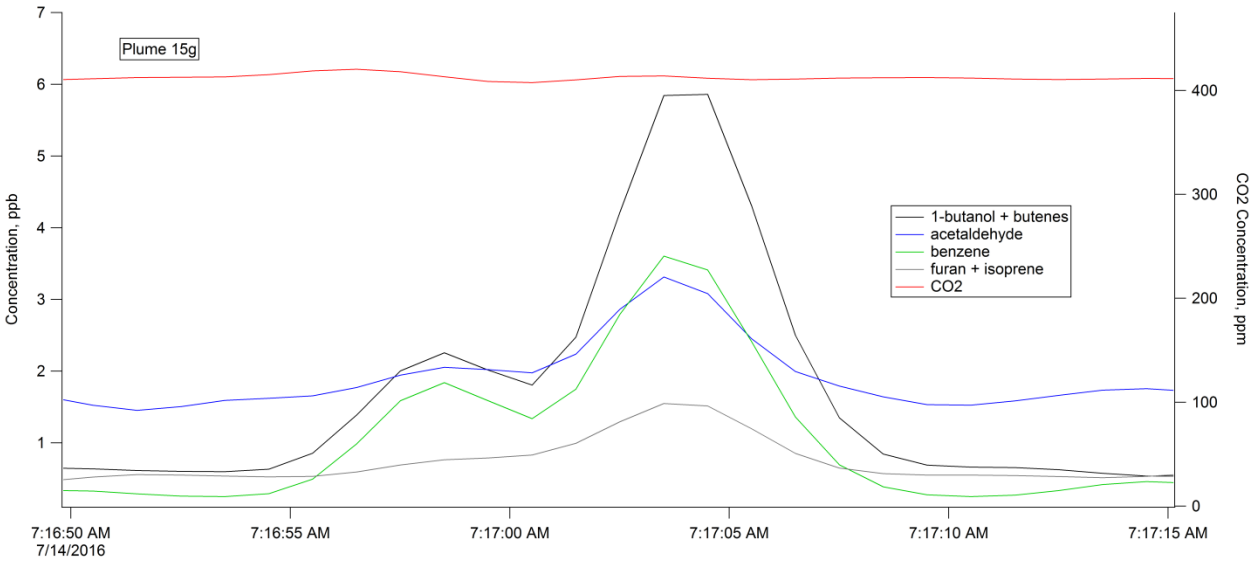


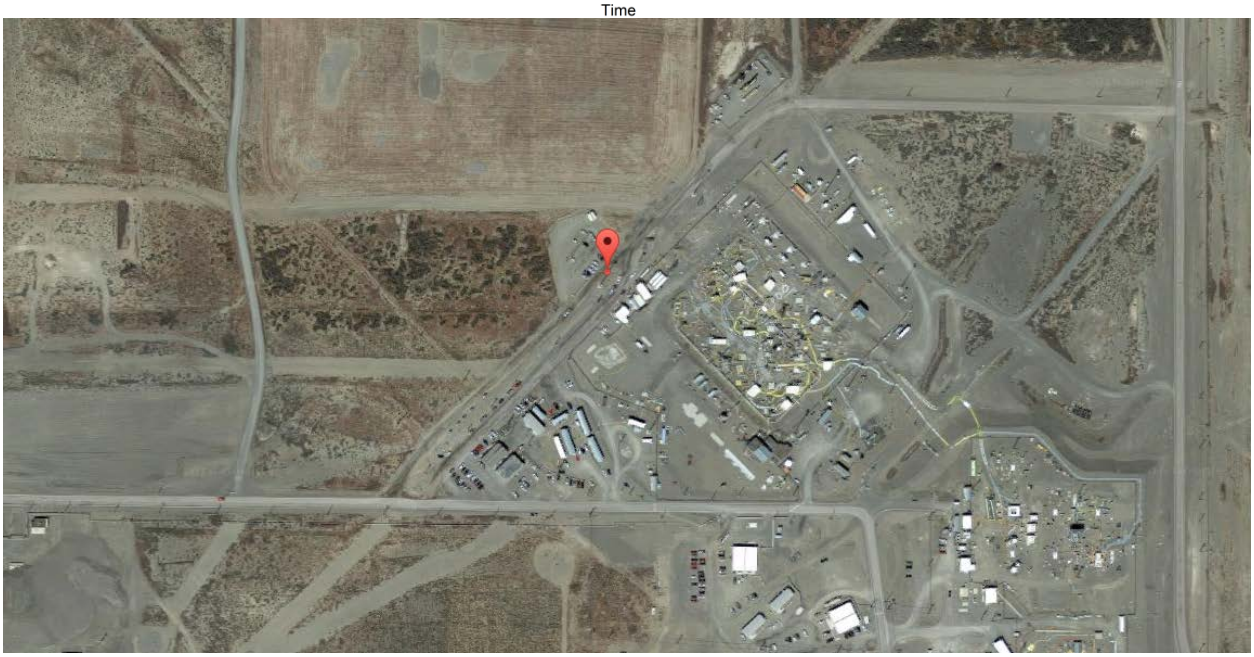
Plume 15e was observed at 6:52 AM while driving on Canton W of AY Farm. 64.9 °F and 1.02 bar, moderate winds blowing N. The plume consisted of elevated methanol. There is no correlated rise in CO_2 meaning this plume may come from an unknown source.



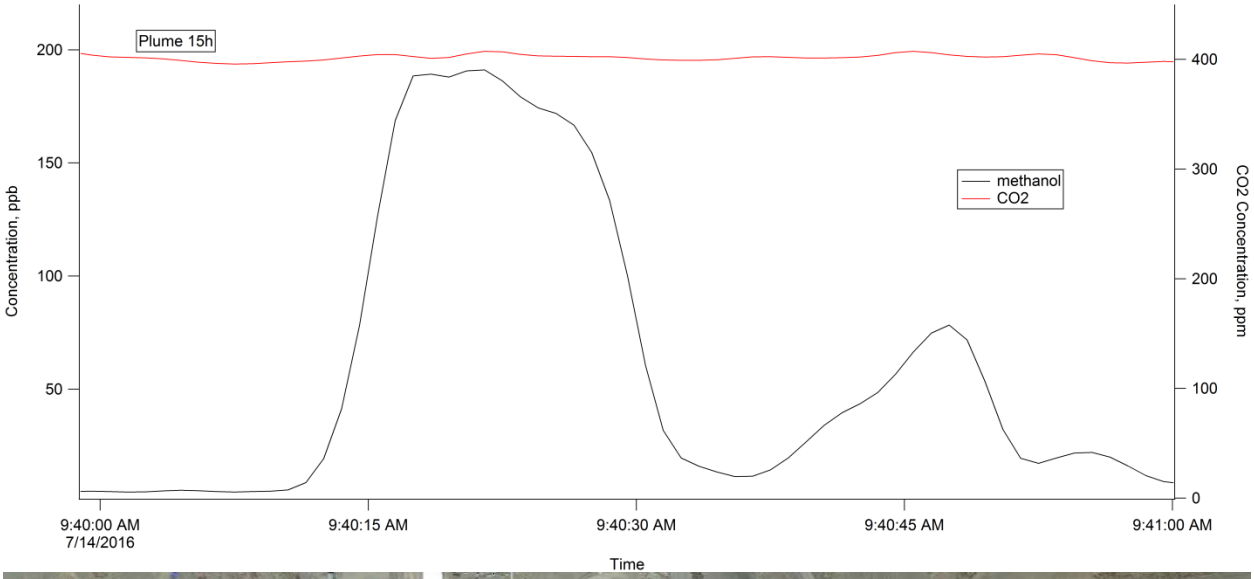


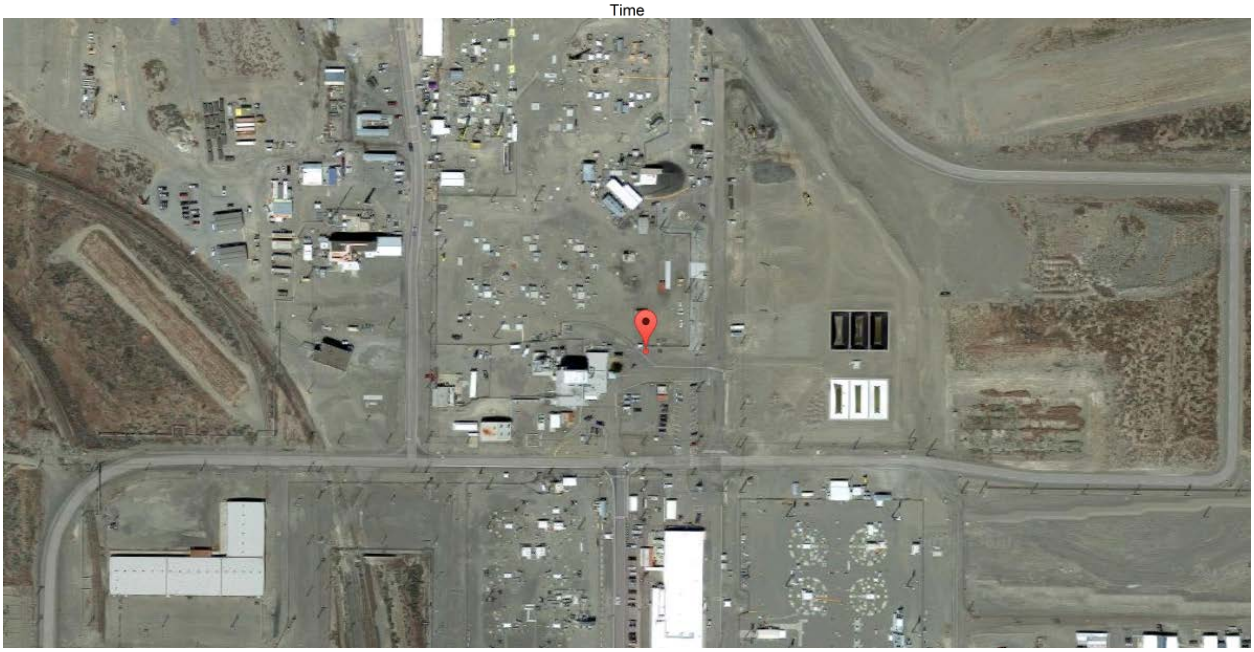
Plume 15f was observed at 6:56 AM while driving N of C Farm. 64.9 °F and 1.02 bar, moderate winds blowing NNE. The plume consisted of elevated methanol. There is no correlated rise in CO_2 meaning this plume may come from an unknown source.



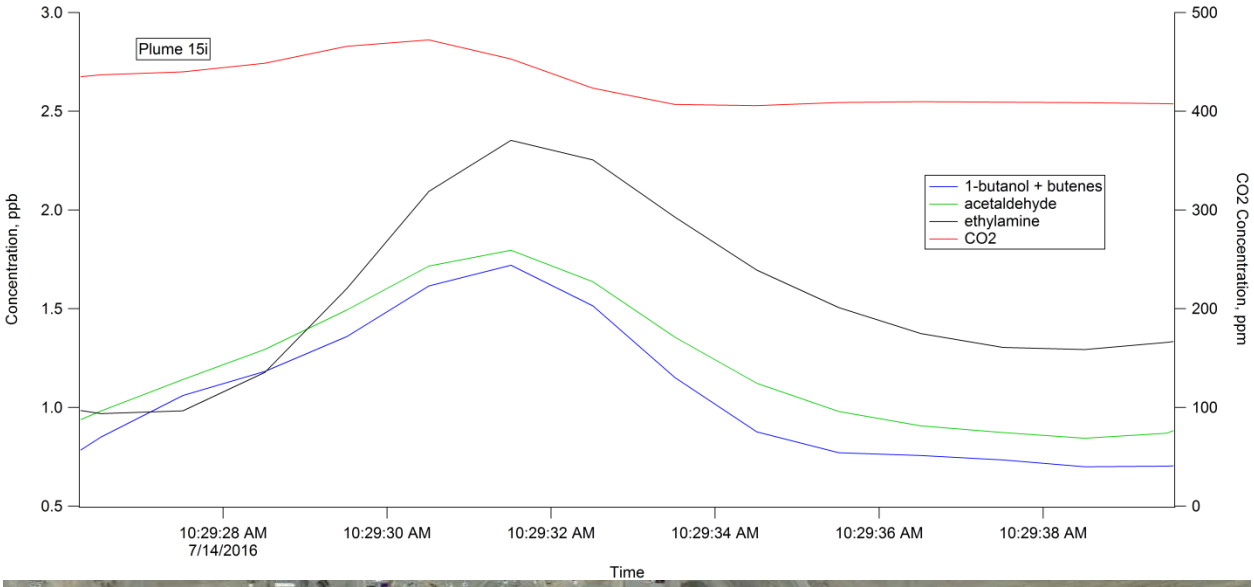


Plume 15g was observed at 7:17 AM while driving N of C Farm. 65.6 °F and 1.02 bar, moderate winds blowing ESE. The plume consisted of elevated 1-butanol + butenes, acetaldehyde, benzene, and furan + isoprene signals. There is no correlating elevation in CO_2 accompanying this plume, meaning this plume may come from an unknown source but could also indicate it is a very weak exhaust plume. The furan + isoprene signal exceeded OEL in this plume.

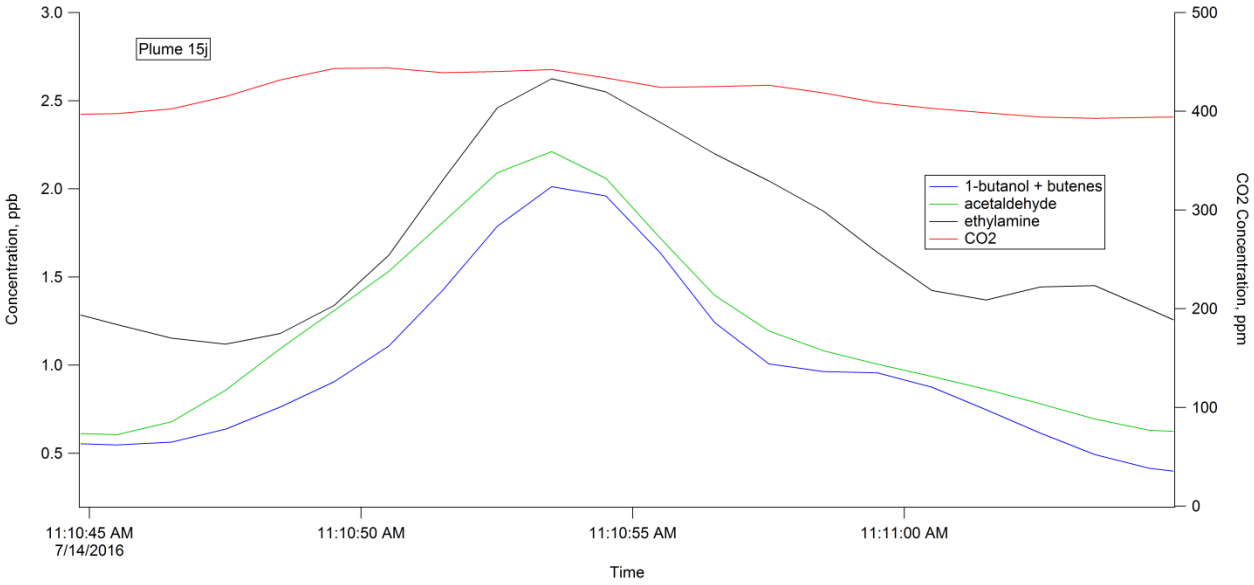


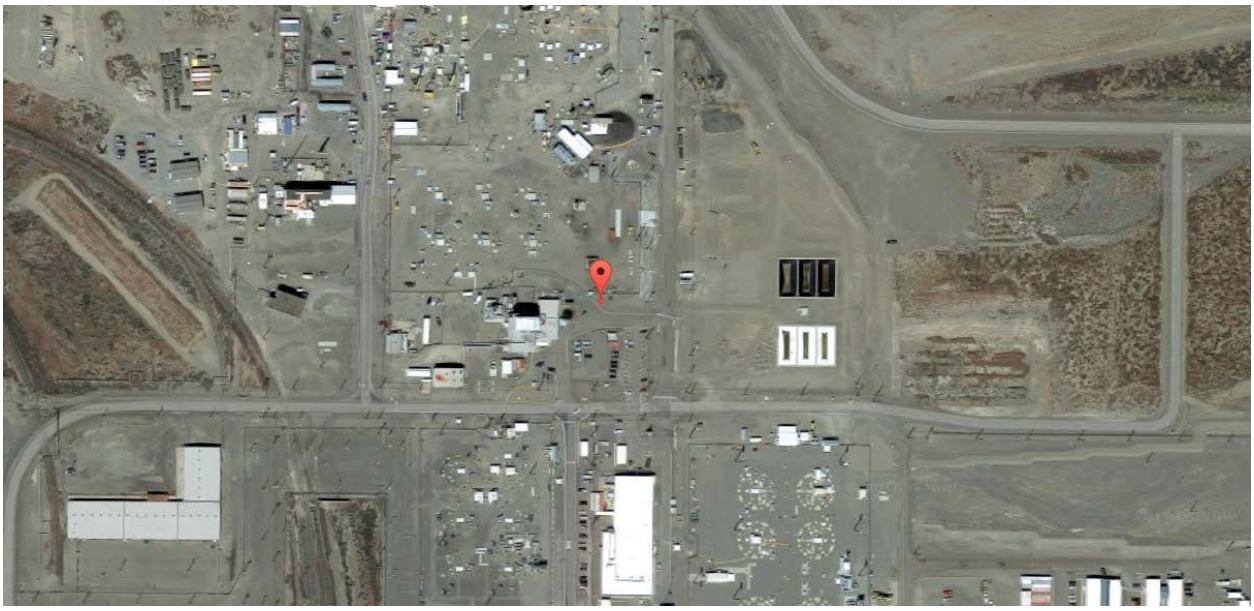


Plume 15h was observed at 9:40 AM at the Stationary Monitoring Site at the 242A Evaporator S of A Farm. 79.0 °F and 1.02 bar, light winds blowing NE. The plume consisted of elevated methanol. There is no correlated rise in CO_2 meaning this plume may come from an unknown source.



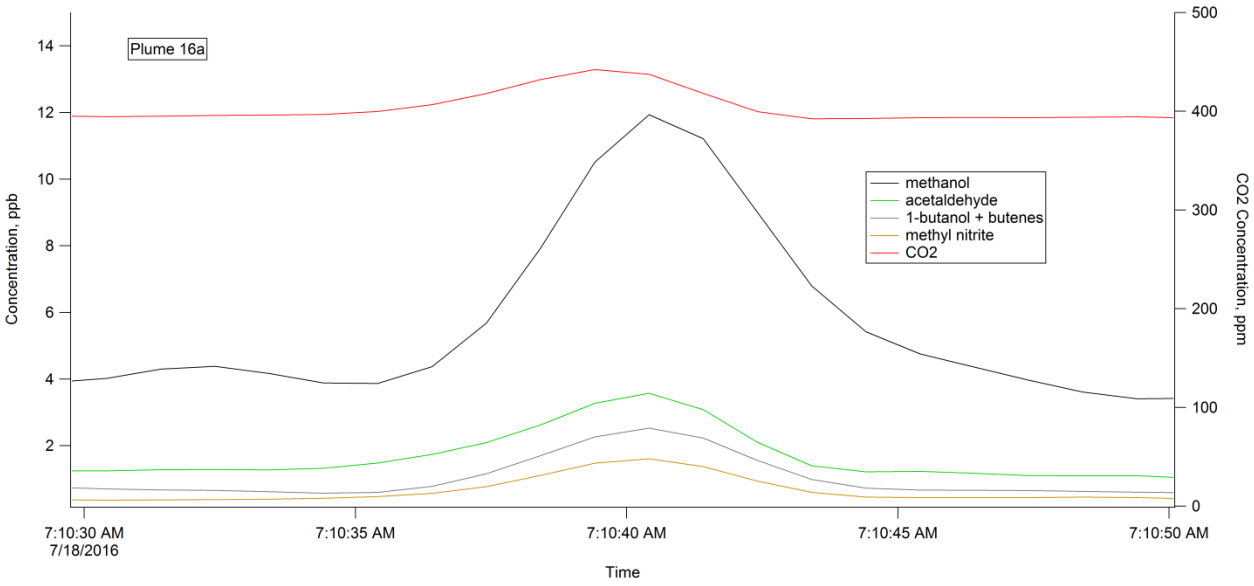
Plume 15i was observed at 10:29 AM at the Stationary Monitoring Site at the 242A Evaporator S of A Farm. 83.5 °F and 1.02 bar, light winds blowing SW. The plume consisted of elevated 1-butanol + butenes, acetaldehyde, and ethylamine signals. There is a slight rise in CO_2 accompanying this plume, meaning this plume is likely diesel exhaust.



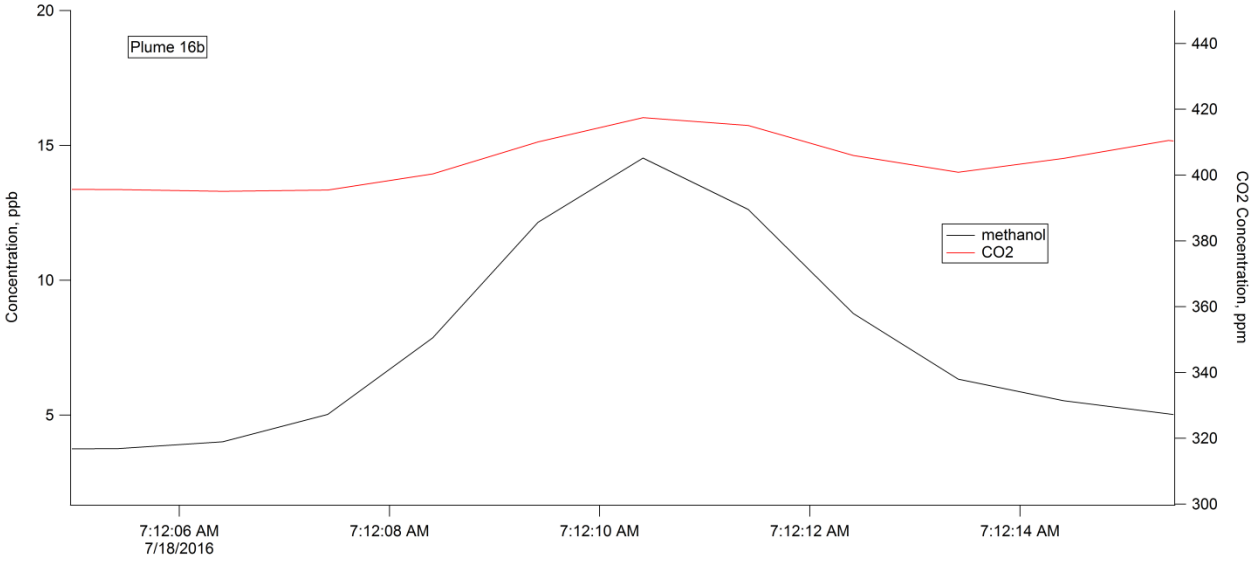


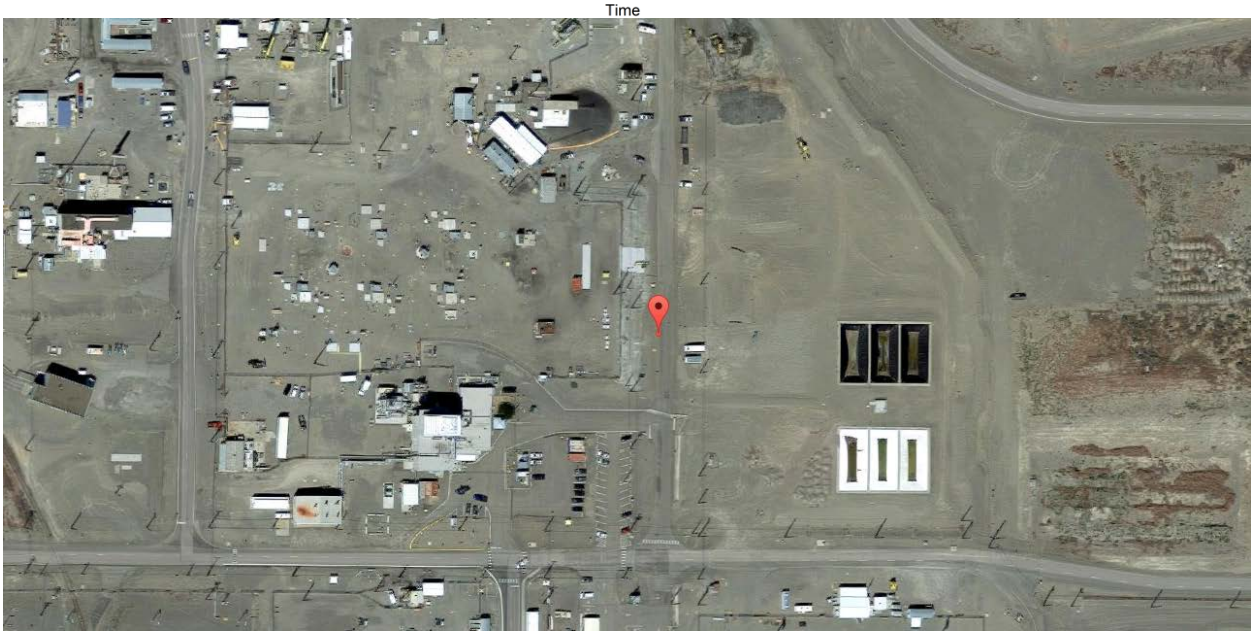
Plume 15j was observed at 11:10 AM at the Stationary Monitoring Site at the 242A Evaporator S of A Farm. 87.3 °F and 1.02 bar, light winds blowing NNW. The plume consisted of elevated 1-butanol + butenes, acetaldehyde, and ethylamine signals. There is a slight rise in CO_2 accompanying this plume, meaning this plume is likely diesel exhaust.

9.2.16 July 18, 2016

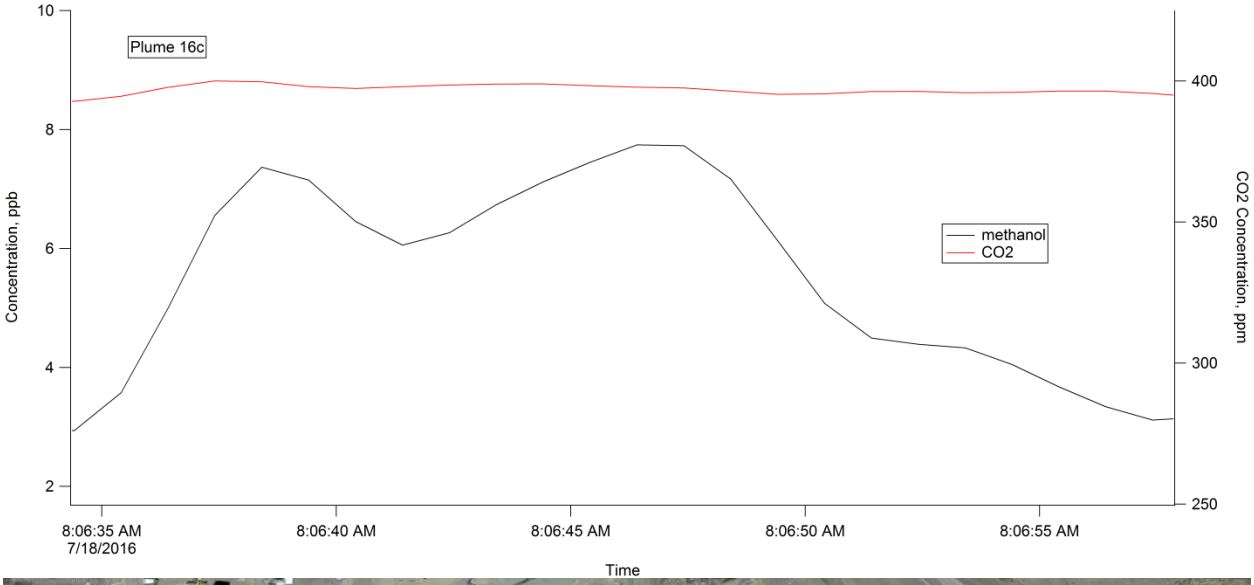


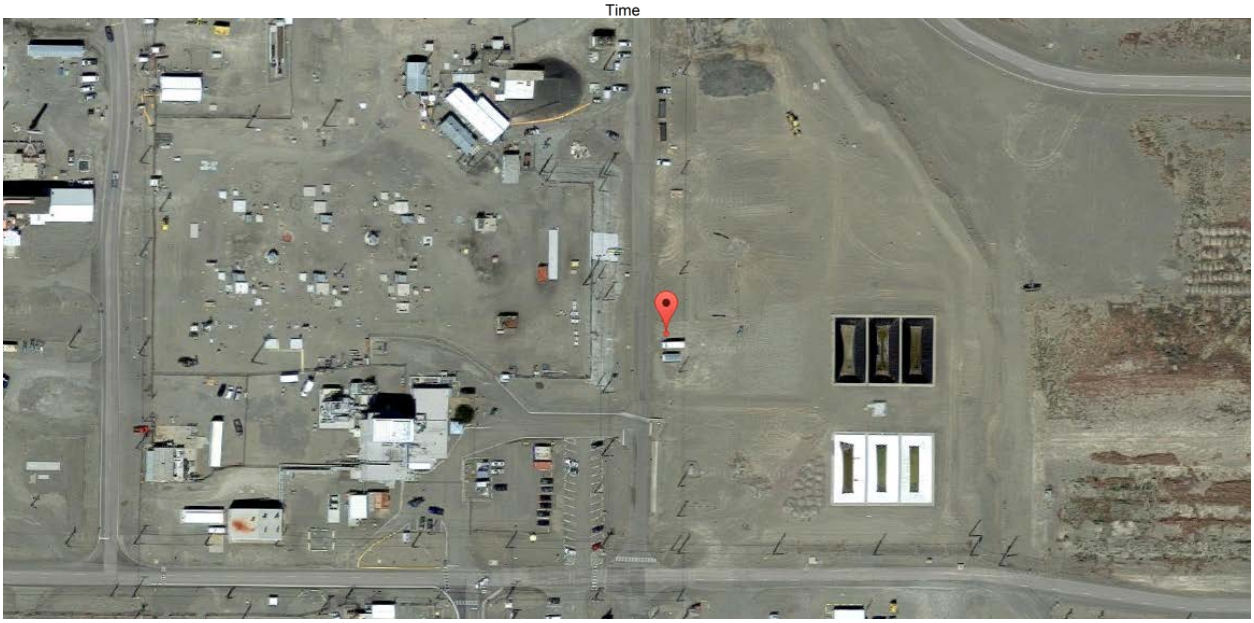
Plume 16a was observed at 7:10 AM while driving on Canton E of AX Farm. 68.7 °F and 1.01 bar, moderate winds blowing NNE. The plume consisted of elevated methanol, 1-butanol + butenes, methyl nitrite, and acetaldehyde signals. There is a correlating elevation in CO_2 accompanying this plume, meaning this plume is likely diesel exhaust.



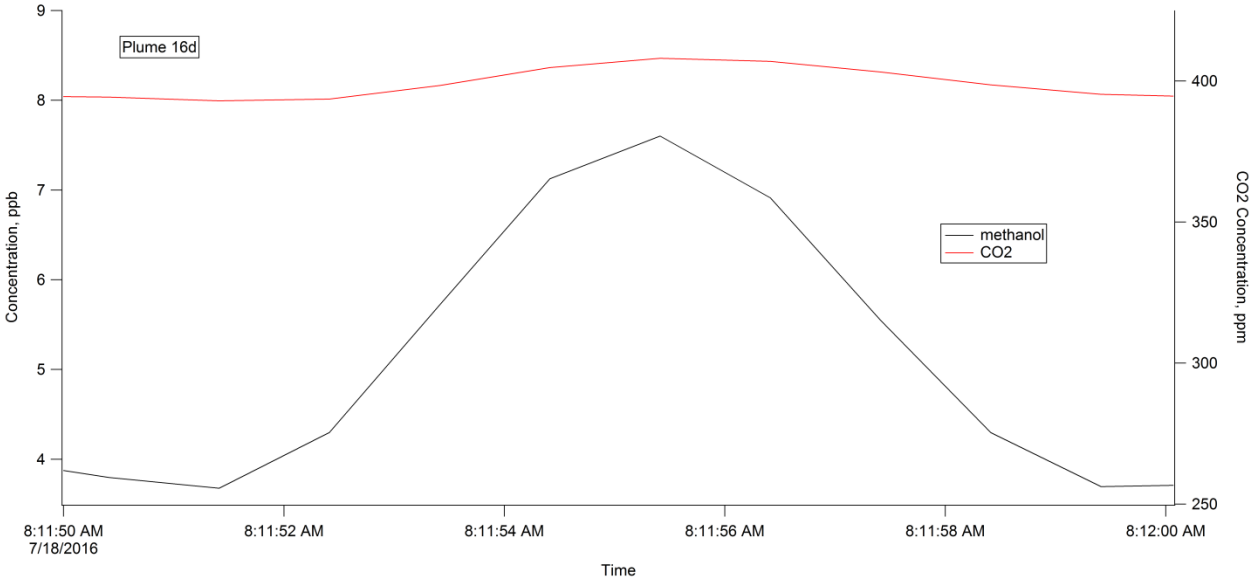


Plume 16b was observed at 7:12 AM while driving on Canton E of AX Farm. 69.3 °F and 1.01 bar, moderate winds blowing W. The plume consisted of elevated methanol. There is a correlating elevation in CO_2 accompanying this plume, meaning this plume is probably dilute or mixed exhaust.

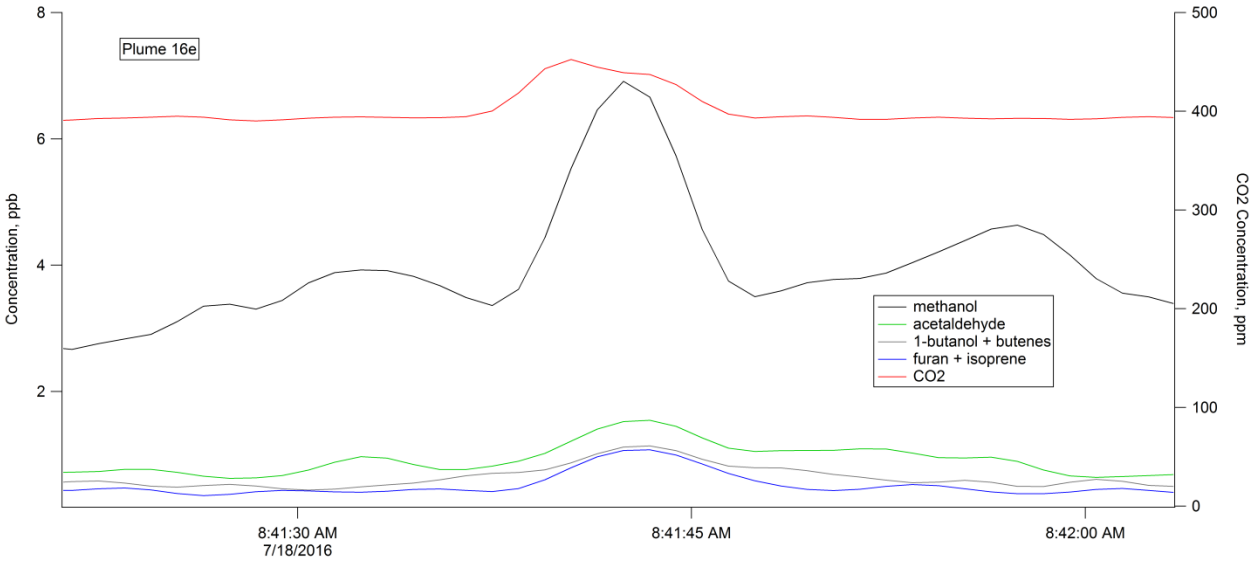




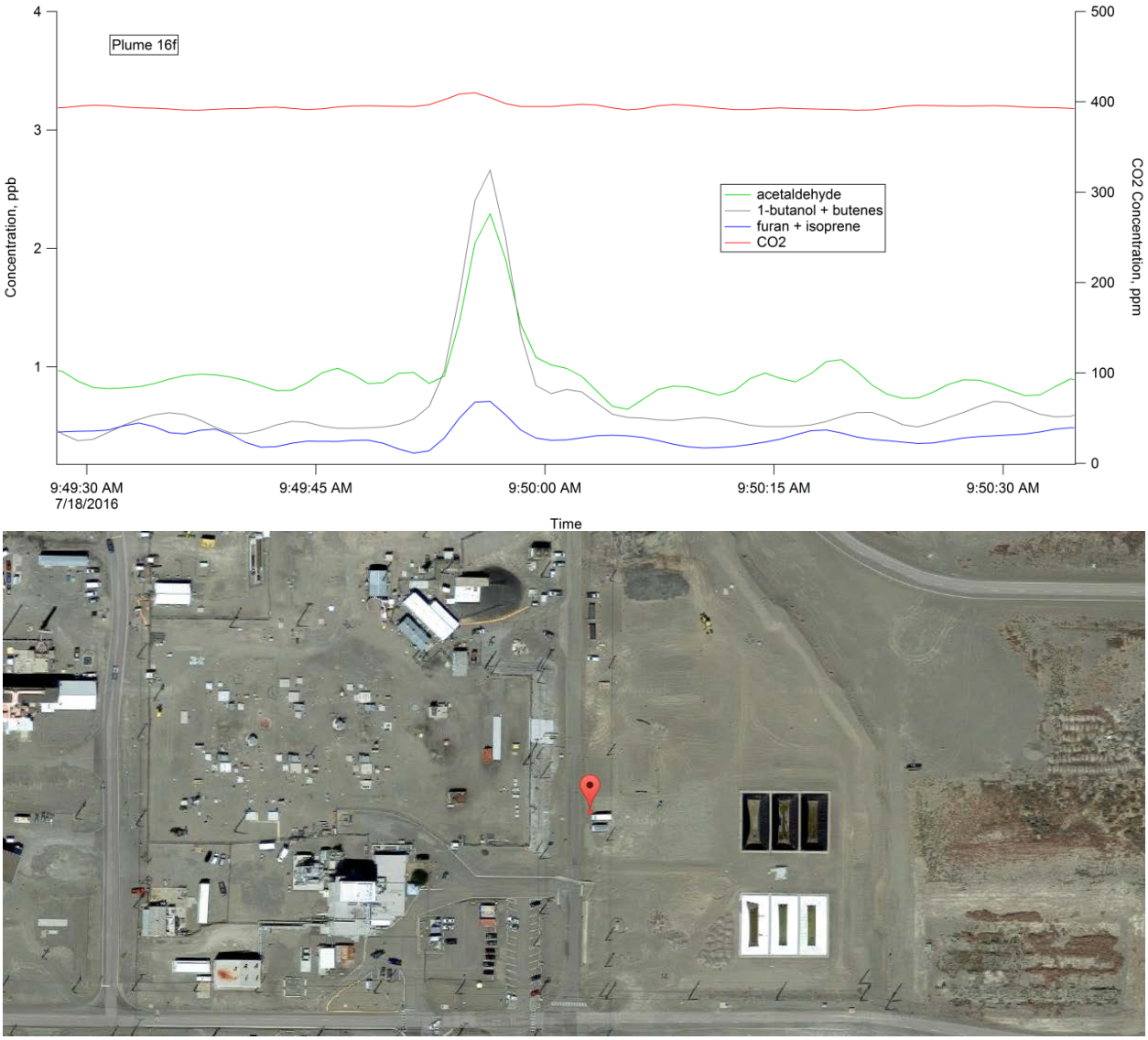
Plume 16c was observed at 8:06 AM at the stationary monitoring site E of A Farm. 72.1 °F and 1.01 bar, moderate winds blowing NNW. The plume consisted of elevated methanol. There is a slight correlating elevation in CO_2 accompanying this plume, meaning this plume is probably dilute or mixed exhaust.



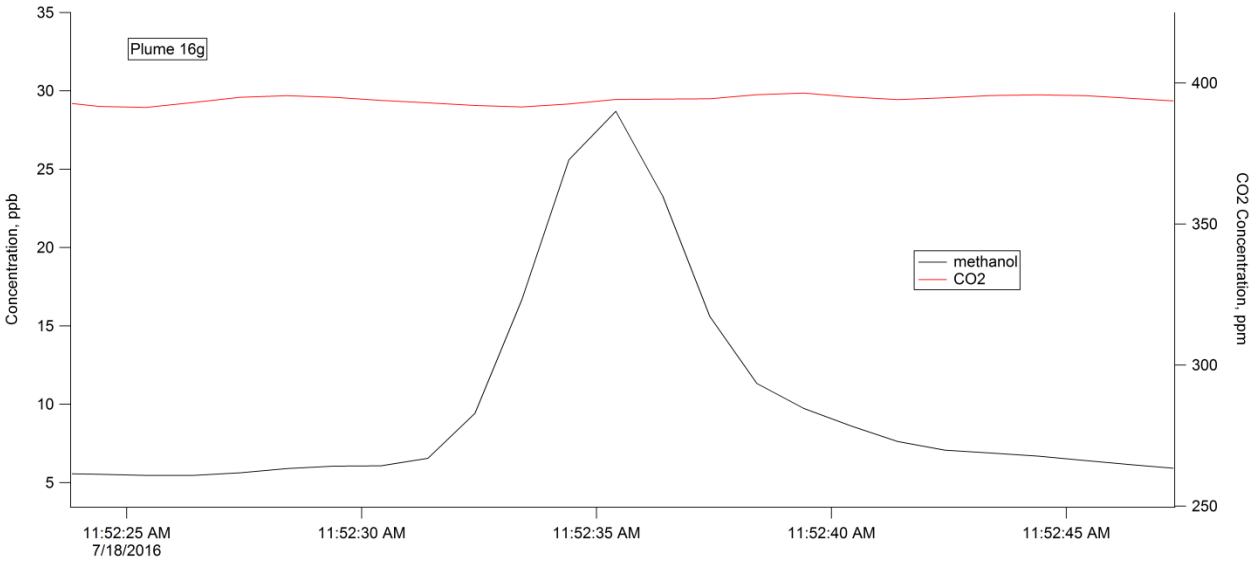
Plume 16d was observed at 8:11 AM. No GPS data was available at this time. 72.5 °F and 1.01 bar, moderate winds blowing NNW. The plume consisted of slightly elevated methanol. There is a slight correlating elevation in CO_2 accompanying this plume, meaning this plume is probably dilute or mixed exhaust.



Plume 16e was observed at 8:41 AM at the stationary monitoring site E of A Farm. 75.0 °F and 1.01 bar, moderate winds blowing NNW. The plume consisted of elevated methanol, 1-butanol + butenes, furan + isoprene, and acetaldehyde signals. There is a correlating elevation in CO_2 accompanying this plume, meaning this plume is likely diesel exhaust.



Plume 16f was observed at 9:49 AM at the stationary monitoring site E of A Farm. 75.0 °F and 1.01 bar, moderate winds blowing N. The plume consisted of elevated 1-butanol + butenes, furan + isoprene, and acetaldehyde signals. There is a slight correlating elevation in CO_2 accompanying this plume, meaning this plume is likely diesel exhaust.



Plume 16g was observed at 11:52 AM at the stationary monitoring site E of A Farm. 71.4 °F and 1.01 bar, moderate winds blowing WSW. The plume consisted of elevated methanol. There is no correlating elevation in CO_2 accompanying this plume, meaning this plume may be of an unknown source.

10.0 STATIONARY FINDINGS (AUGUST 29 AP-FARM AND SEPTEMBER 6, A FARM) INTENSIVE MONITORING AT STACKS AND PASSIVE BREATHER FILTERS

As mentioned in the section above, the data are currently in evaluation and will be provided in a later revision. The analyses have been performed, however, due to radiological limitations, no air canisters could be drawn in parallel. The only option was a continuous monitoring canister from the VMDS project which provides an averaged content, however, this data is not expected to be available from the on-site laboratory for several weeks. Quantification and comparison of the results between PTR-MS and GC-MS are significantly more labor intensive due to this arrangement.

11.0 AEROSOL SRNL STUDY FINDINGS FOR THE SRNL AEROSOL SUPPORT MAY 24-26 (TASK 4)

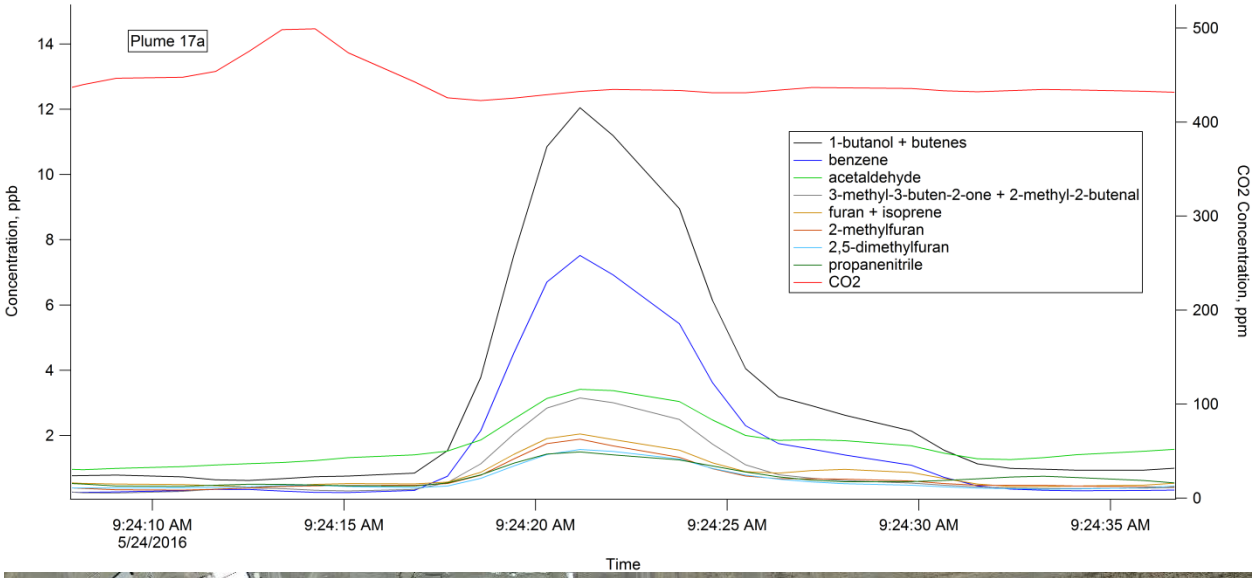
The setup of the study is described in Task 5; this description includes summaries on the results and implications. The results on the individual analyses for the three days of data are attached as Appendix C.

The mobile lab was deployed to support the SRNL aerosol study by searching for volatile organic plumes that may play a role in aerosol formation. The mobile lab drove the 200 East area looking for plumes but was also directed to sample downwind of electrostatic plate collection of aerosols by the SRNL team. In a similar fashion to data presentation for mobile/stationary data, the following sections will show the maximum and average of the 44 COPC ion signals and a closer look at the composition of any plumes of interest. Daily plots for all 44 ion signals are shown in Appendix C for review.

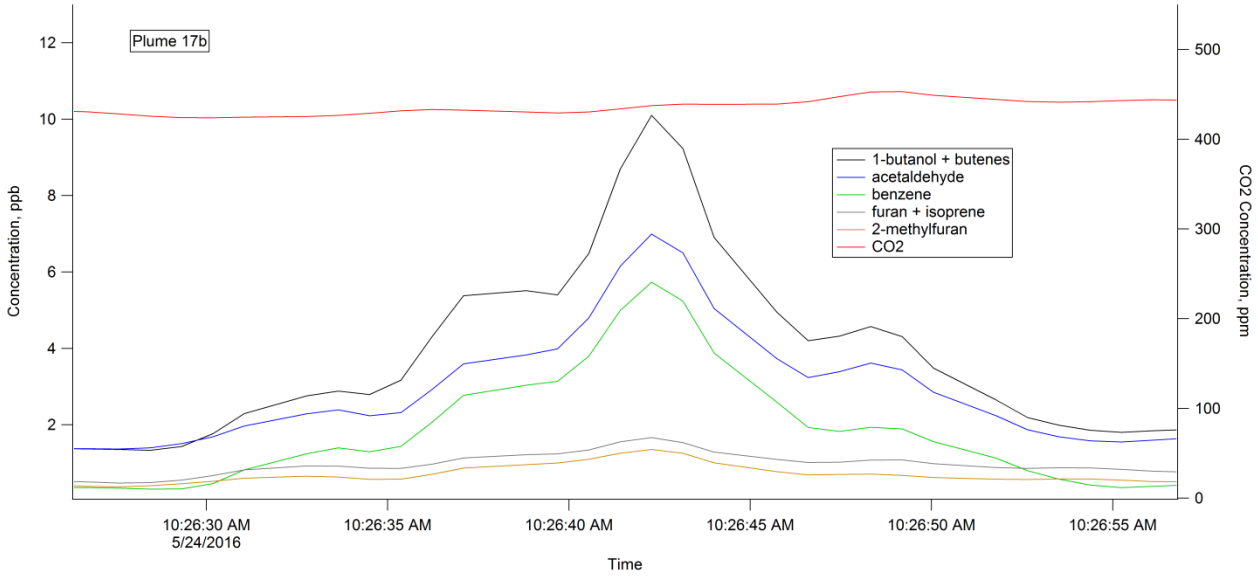
	May 24		May 25		May 26	
Compound	max	ave	max	ave	max	ave
formaldehyde	4.1	2.0	8.3	2.3	33.0	2.3
methanol	18.5	4.2	26.1	4.3	22.2	3.7
acetonitrile	1.5	0.2	1.2	0.3	1.4	0.2
acetaldehyde	7.0	1.2	17.5	1.4	94.8	1.9
ethylamine	3.1	1.4	5.0	1.7	6.0	1.4
1,3-butadiene	4.9	2.0	4.1	1.6	5.1	2.4
propanenitrile	1.5	0.5	1.4	0.4	0.9	0.5
1-butanol + butenes	12.0	0.8	5.7	0.6	5.3	0.6
methyl isocyanate	1.0	0.3	0.6	0.3	0.6	0.3
methyl nitrite	0.9	0.3	1.3	0.3	1.4	0.3
furan + isoprene	2.0	0.5	1.9	0.5	2.0	0.5
butanenitrile	0.9	0.2	0.7	0.2	0.4	0.2
methylvinylketone (MVK) + 2,3-dihydrofuran + 2,5-dihydrofuran	2.3	0.2	2.3	0.2	2.2	0.2

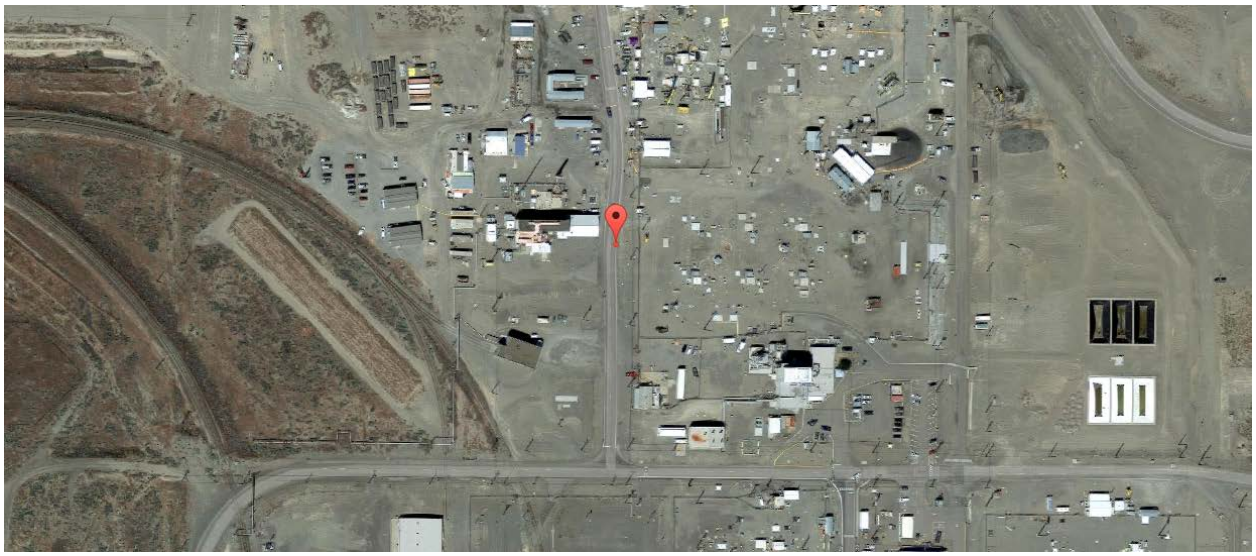
butanal	0.6	0.3	0.8	0.4	1.0	0.4
N-nitrosodimethylamine (NDMA)	0.8	0.4	0.9	0.4	0.8	0.4
benzene	15.2	0.3	2.4	0.3	2.3	0.3
pyridine + 2,4-pentadienenitrile	1.1	0.2	0.4	0.2	0.4	0.2
2-methylene butanenitrile	0.4	0.2	0.4	0.2	0.4	0.2
2-methylfuran	1.9	0.4	1.4	0.4	1.4	0.3
pentanenitrile	0.4	0.2	0.5	0.2	0.4	0.2
3-methyl-3-buten-2-one + 2-methyl-2-butenal	3.2	0.4	1.2	0.4	0.8	0.3
N-nitrosomethylethylamine (NEMA)	0.5	0.3	0.7	0.3	2.2	0.3
2,5-dimethylfuran	1.6	0.3	1.3	0.3	1.0	0.3
hexanenitrile	0.4	0.2	0.4	0.2	0.4	0.2
2-hexanone (MBK)	0.9	0.5	2.5	0.5	0.9	0.5
N-nitrosodiethylamine (NDEA)	0.7	0.3	1.5	0.3	0.7	0.3
butyl nitrite + 2-nitro-2-methylpropane	0.4	0.2	0.3	0.2	0.4	0.2
2,4-dimethylpyridine	1.2	0.2	0.9	0.2	0.8	0.2
2-propylfuran + 2-ethyl-5-methylfuran	0.7	0.3	0.9	0.2	0.6	0.3
heptanenitrile	0.3	0.2	0.3	0.2	0.3	0.2
4-methyl-2-hexanone	0.5	0.3	0.5	0.3	0.5	0.3
N-nitrosomorpholine (NMOR)	0.9	0.2	4.8	0.3	0.5	0.3
butyl nitrate	0.5	0.2	0.3	0.2	0.3	0.2
2-ethyl-2-hexenal + 4-(1-methylpropyl)-2,3-dihydrofuran + 3-(1,1-dimethylethyl)-2,3-dihydrofuran	0.4	0.2	0.5	0.2	0.4	0.2
6-methyl-2-heptanone	0.9	0.2	0.4	0.2	0.5	0.2
2-pentylfuran	0.3	0.2	0.3	0.2	0.3	0.2
biphenyl	0.3	0.1	0.3	0.1	0.2	0.1
2-heptylfuran	0.3	0.1	0.2	0.1	0.2	0.1
2-octylfuran + 1,4-butanediol dinitrate	0.2	0.1	0.2	0.1	0.2	0.1
1,2,3-propanetriol 1,3-dinitrate	0.2	0.1	0.2	0.1	0.2	0.1
PCB, one chlorine	0.2	0.1	0.2	0.1	0.2	0.1
6-(2-furanyl)-6-methyl-2-heptanone	0.2	0.1	0.2	0.1	0.2	0.1
furfural acetophenone	0.2	0.1	0.2	0.1	0.2	0.1
PCB, two chlorine	0.2	0.1	0.2	0.1	0.2	0.1

May 24th Plumes

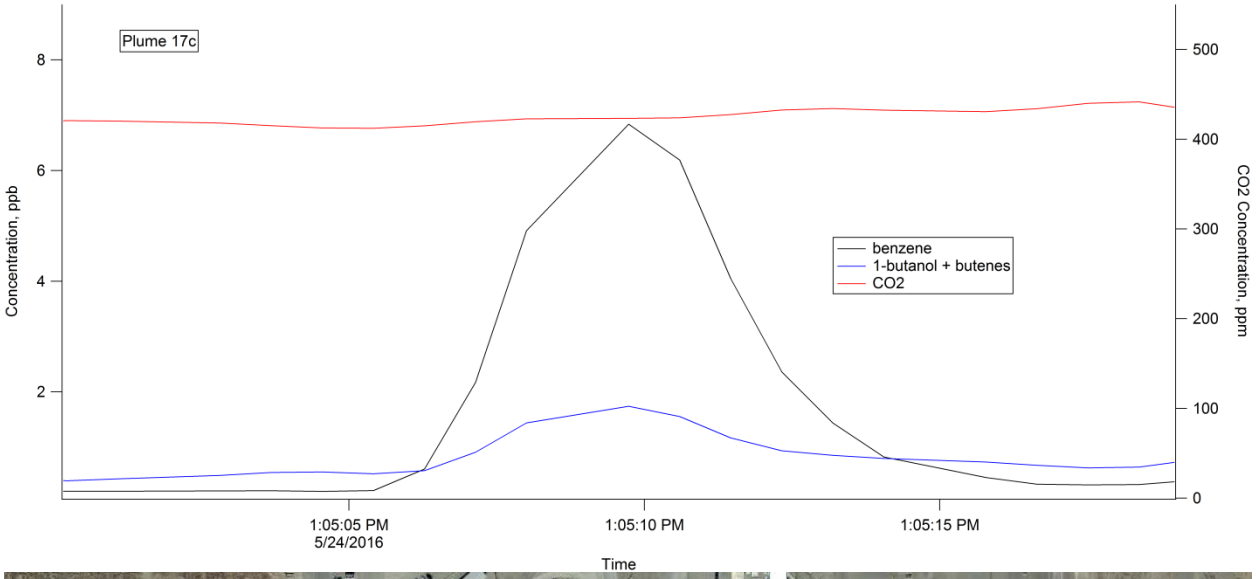


Plume 17a was observed at 9:24 AM while driving on Canton E of AX Farm. 67.4 °F and 1.01 bar, light winds blowing NNW. The plume primarily consisted of 1-butanol + butenes, benzene, and acetaldehyde signals. There is no correlating rise in CO_2 at this time, although the plume resembles a typical gasoline exhaust plume. The furan + isoprene, 2-methylfuran, and 2,5-dimethylfuran signals exceed OELs in this plume.

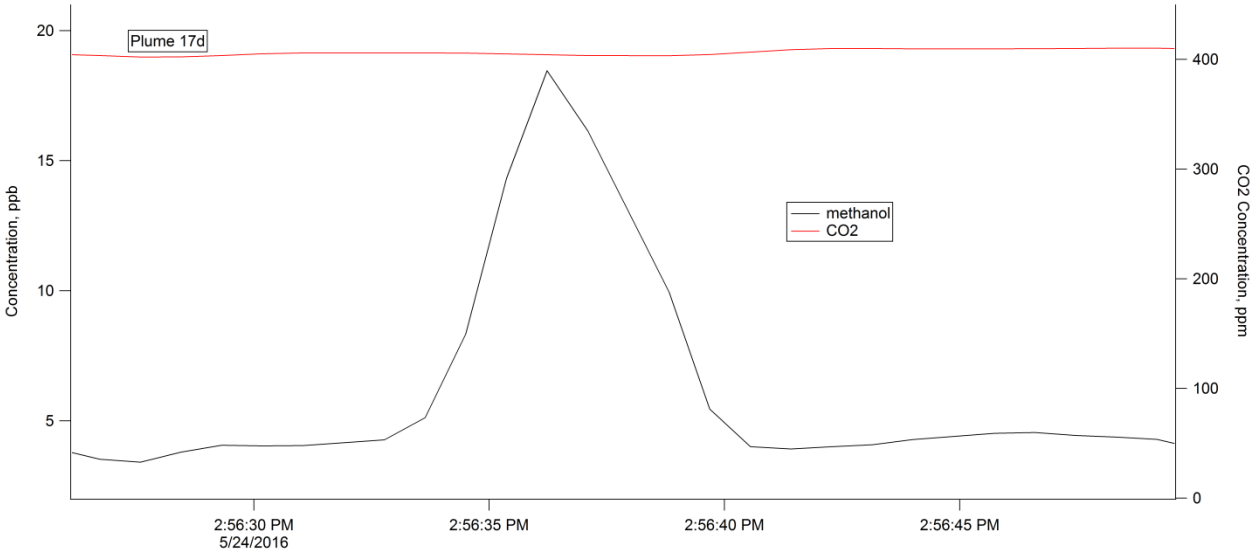




Plume 17b was observed at 10:26 AM while driving on Buffalo W of A Farm. 70.2 °F and 1.01 bar, light winds blowing NW. The plume primarily consisted of 1-butanol + butenes, benzene, and acetaldehyde signals. There is no correlating rise in CO_2 at this time, although the plume resembles a typical gasoline exhaust plume. The furan + isoprene and 2-methylfuran signals exceed OELs in this plume.

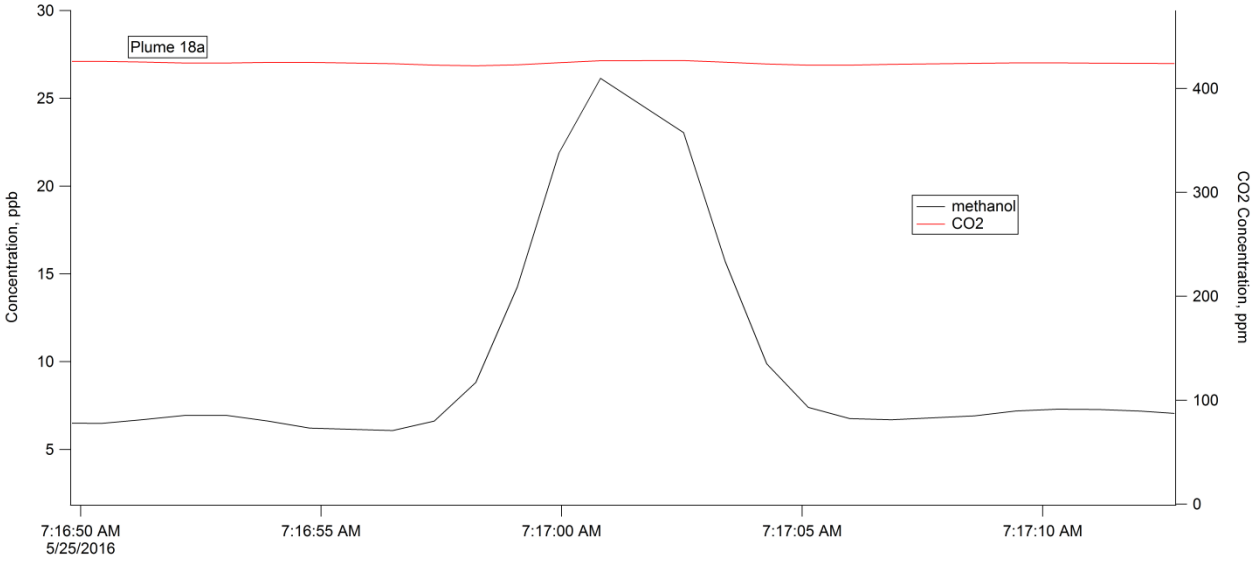


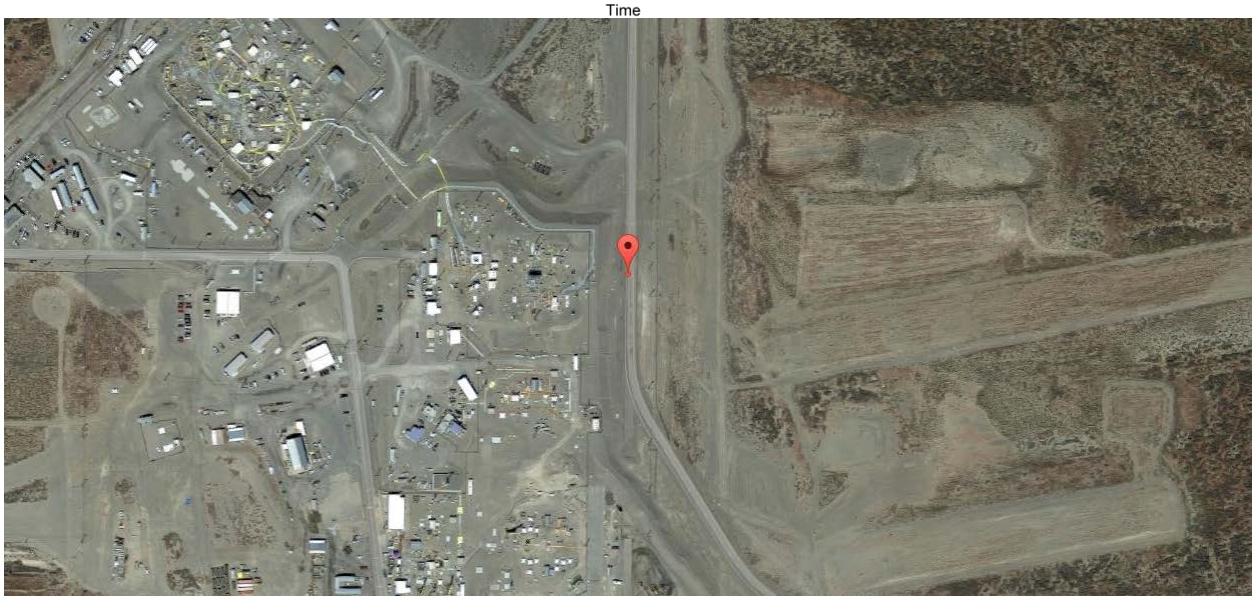
Plume 17c was observed at 1:05 PM at the stationary monitoring site W of AY Farm. 70.1 °F and 1.01 bar, light winds blowing E. The plume primarily consisted of 1-butanol + butenes and benzene. There is no correlating rise in CO_2 at this time, although the plume resembles a typical gasoline exhaust plume.



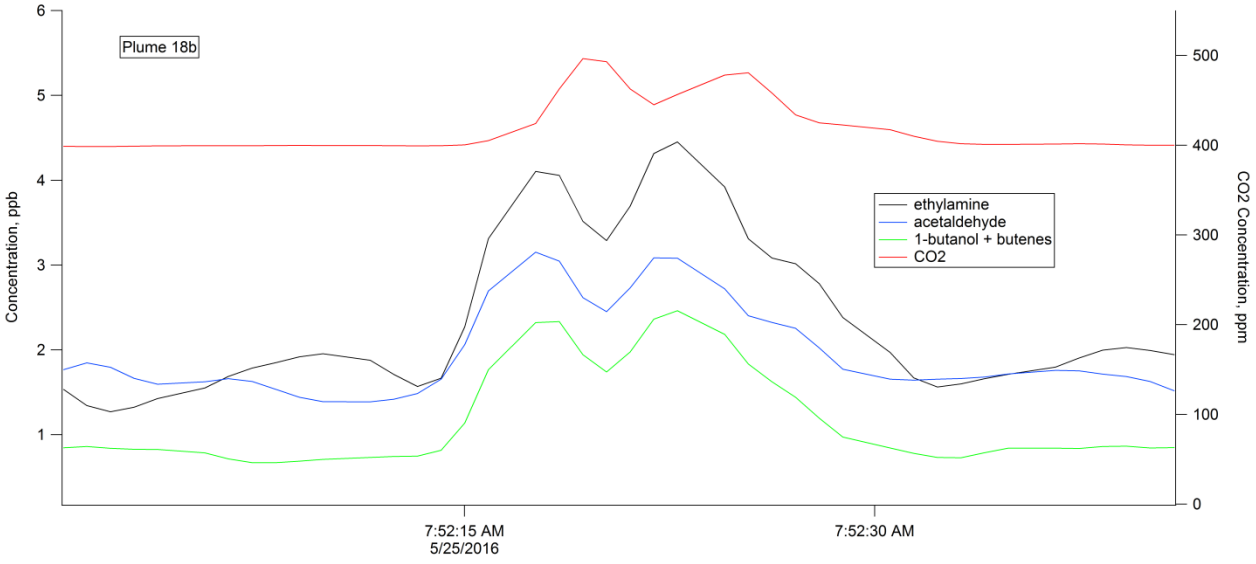
Plume 17d was observed at 2:56 AM while parked S of 272AW. 75.7 °F and 1.01 bar, moderate winds blowing ESE. The plume consisted of methanol. There is no correlating rise in CO_2 at this time, meaning this plume may be from an unknown source near AP or AN Farm.

May 25th Plumes

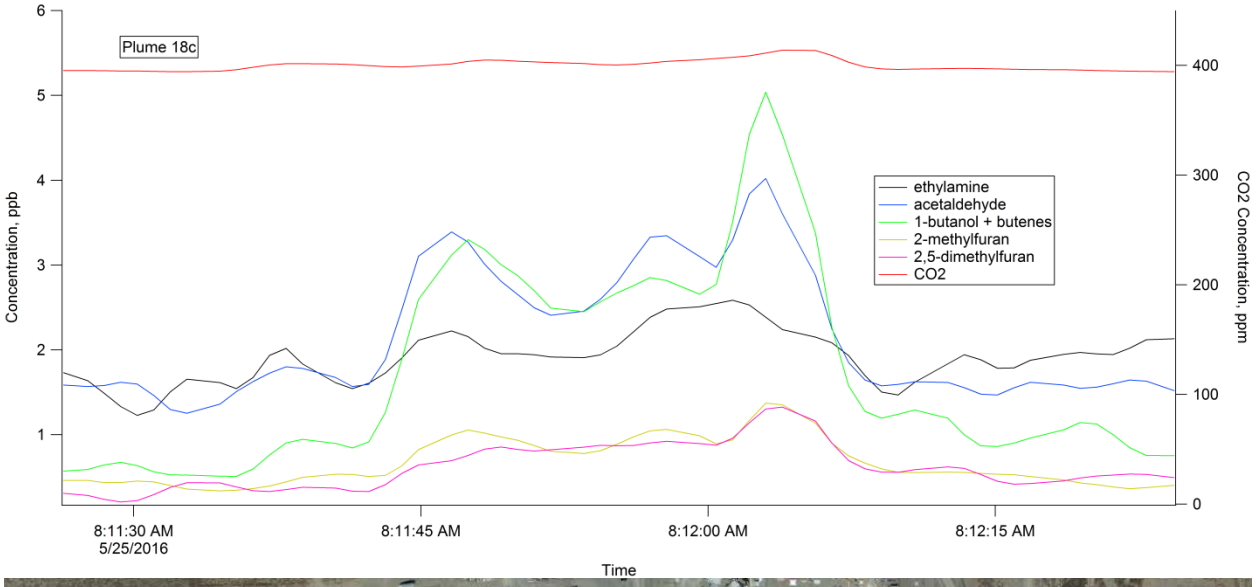




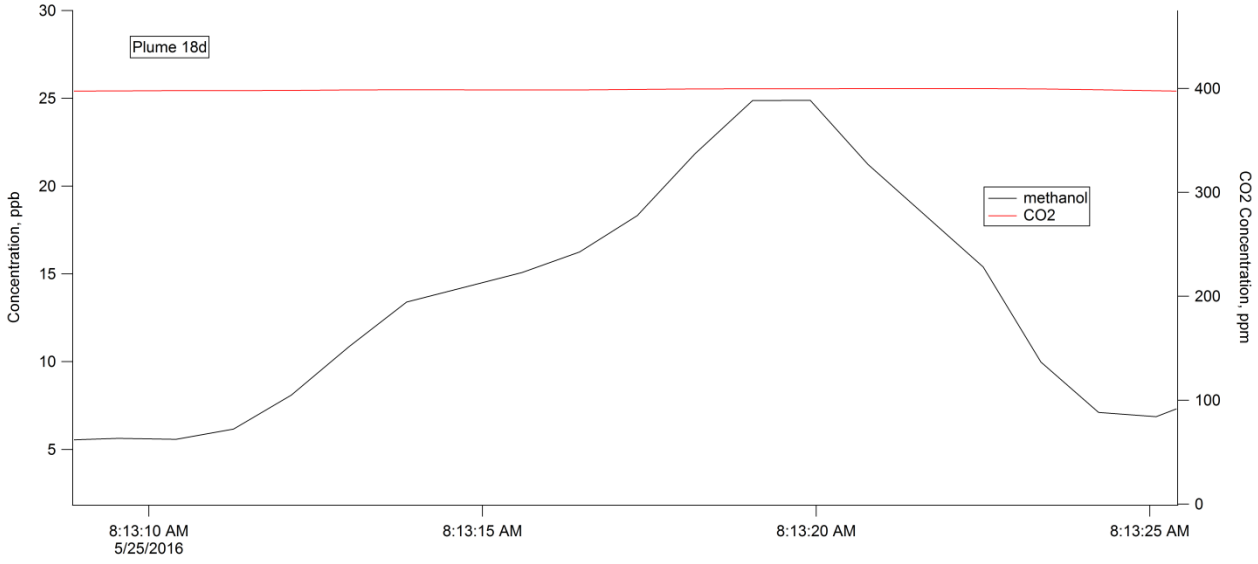
Plume 18a was observed at 7:17 AM while driving E of AZ Farm. 59.9 °F and 1.01 bar, moderate winds blowing NNW. The plume consisted of methanol. There is no correlating rise in CO_2 at this time, meaning this plume may be from an unknown source near AZ Farm.

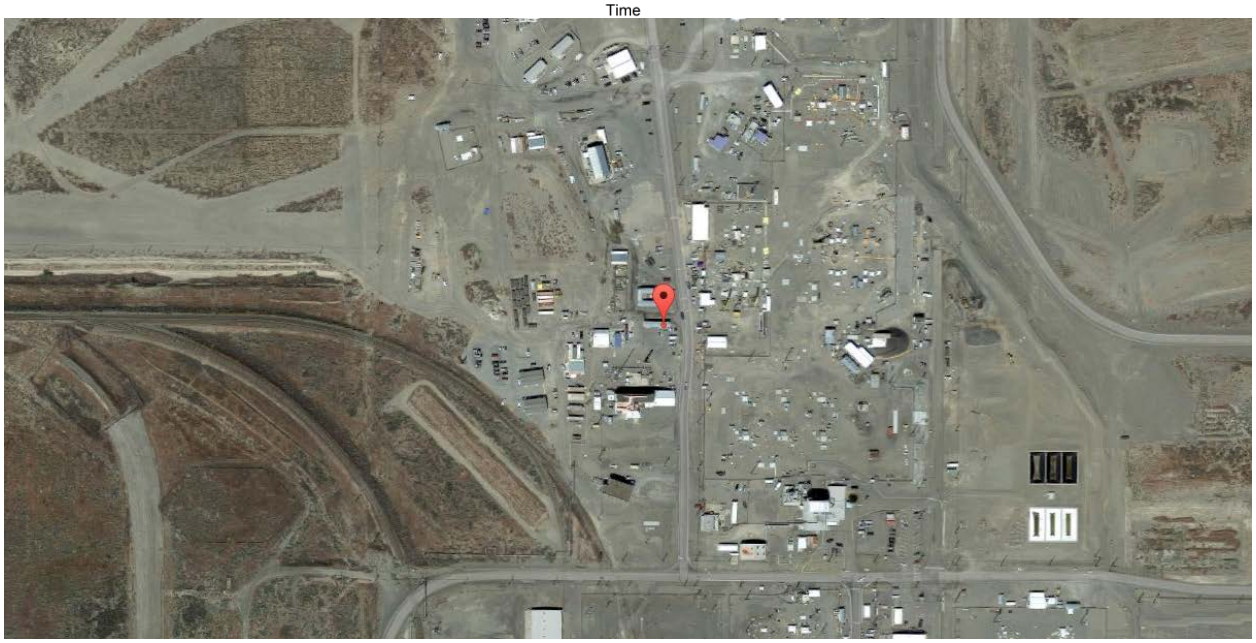


Plume 18b was observed at 7:52 AM at the Stationary Monitoring Site W of AY Farm. 68.4 °F and 1.01 bar, light winds blowing SW. The plume consisted of 1-butanol + butenes, ethylamine, and acetaldehyde signals. There is a correlating rise in CO_2 at this time, meaning this plume is likely diesel exhaust.

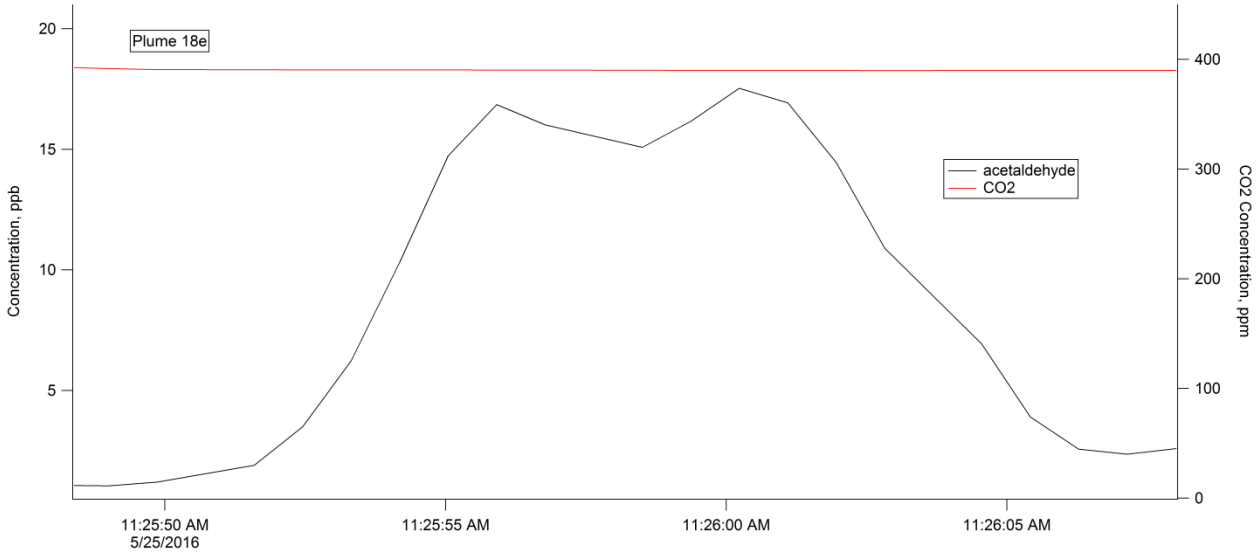


Plume 18c was observed at 8:11 AM at the Stationary Monitoring Site W of AY Farm. 70.0 °F and 1.01 bar, moderate winds blowing S. The plume primarily consisted of 1-butanol + butenes, ethylamine, and acetaldehyde signals. There is a very slight correlating rise in CO_2 at this time, meaning this plume is likely diesel exhaust. The 2-methylfuran and 2,5-dimethylfuran signals exceeded OELs in this plume.

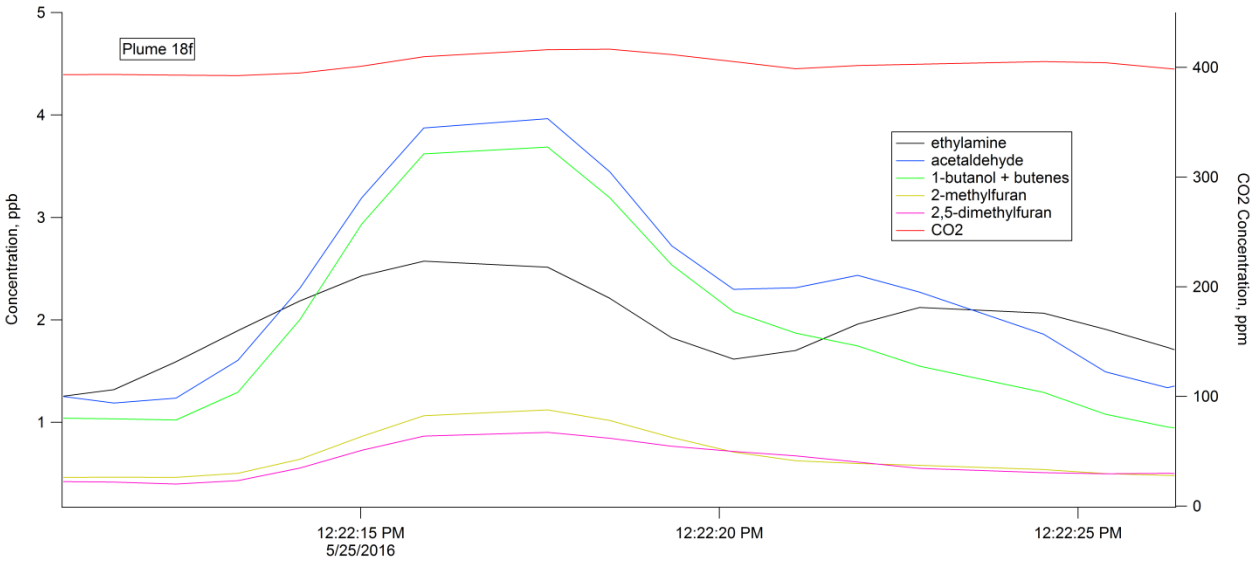


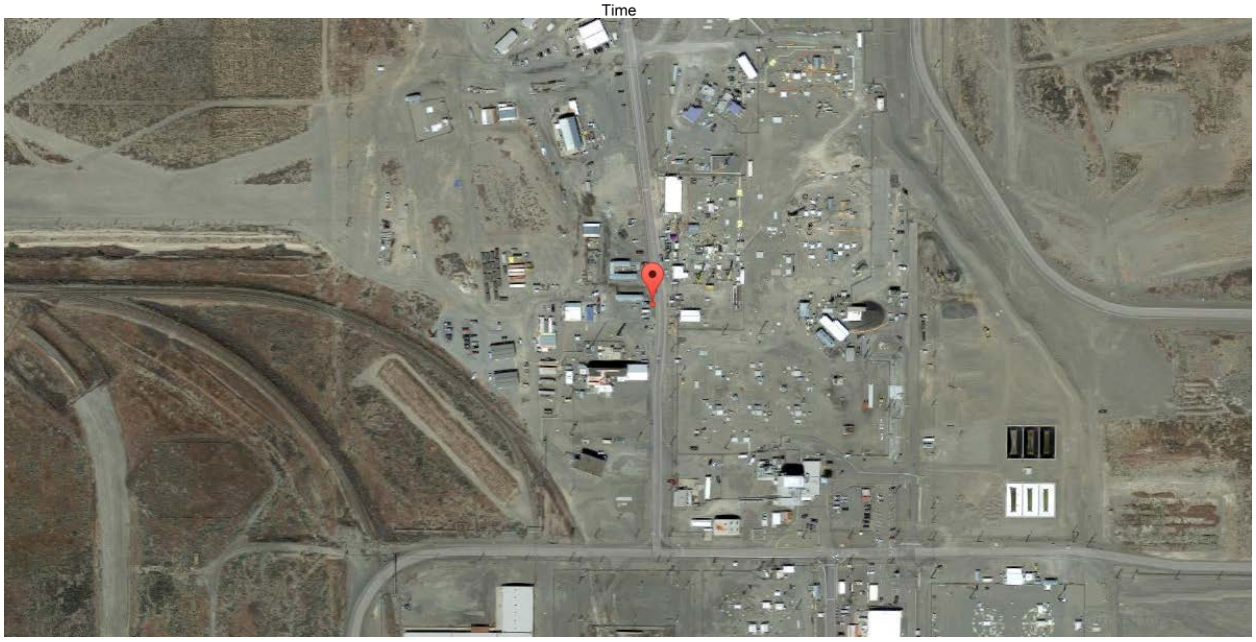


Plume 18d was observed at 8:13 AM at the Stationary Monitoring Site W of AY Farm. 70.0 °F and 1.01 bar, moderate winds blowing S. The plume consisted of methanol. There is no correlating rise in CO_2 at this time, meaning this plume may be from an unknown source.

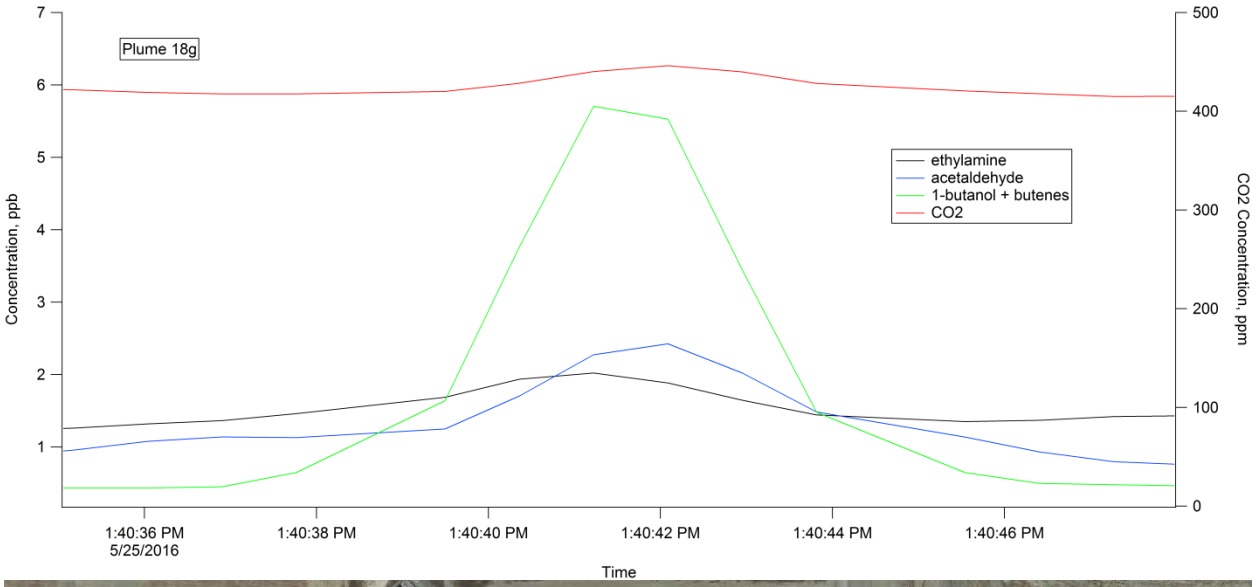


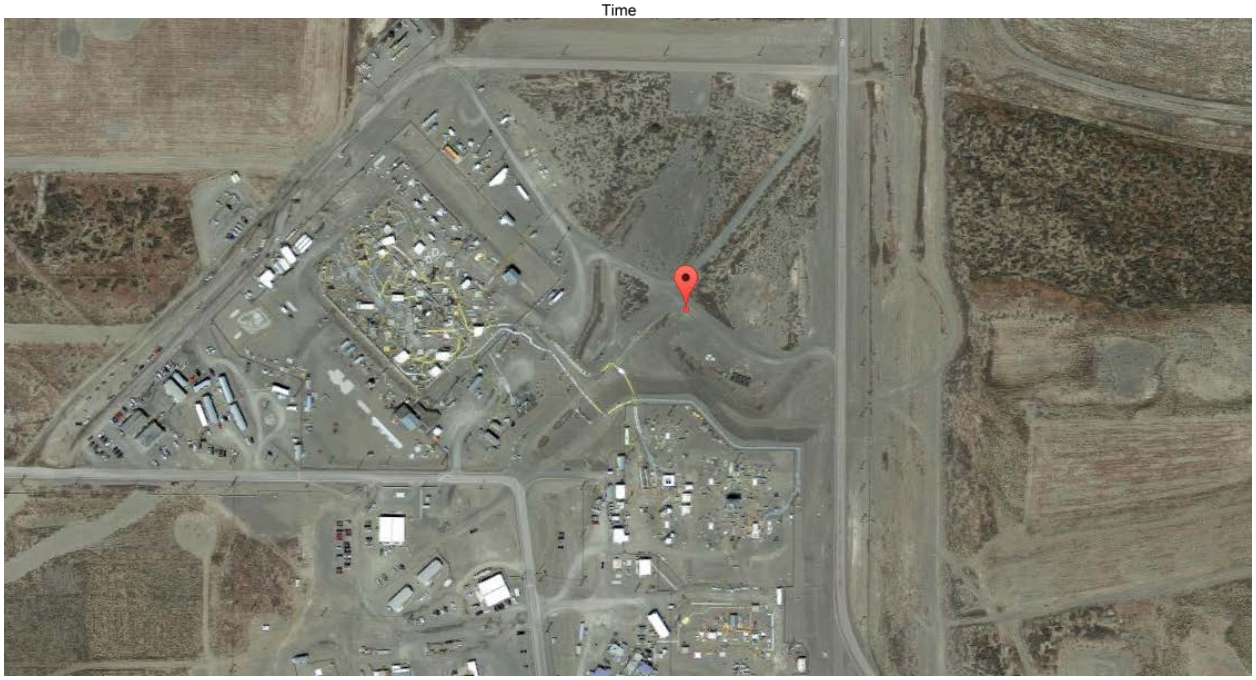
Plume 18e was observed at 11:25 AM at the Stationary Monitoring Site W of AY Farm. 77.0 °F and 1.01 bar, moderate winds blowing SE. The plume consisted of acetaldehyde. There is no correlating rise in CO_2 at this time, meaning this plume may be from an unknown source.



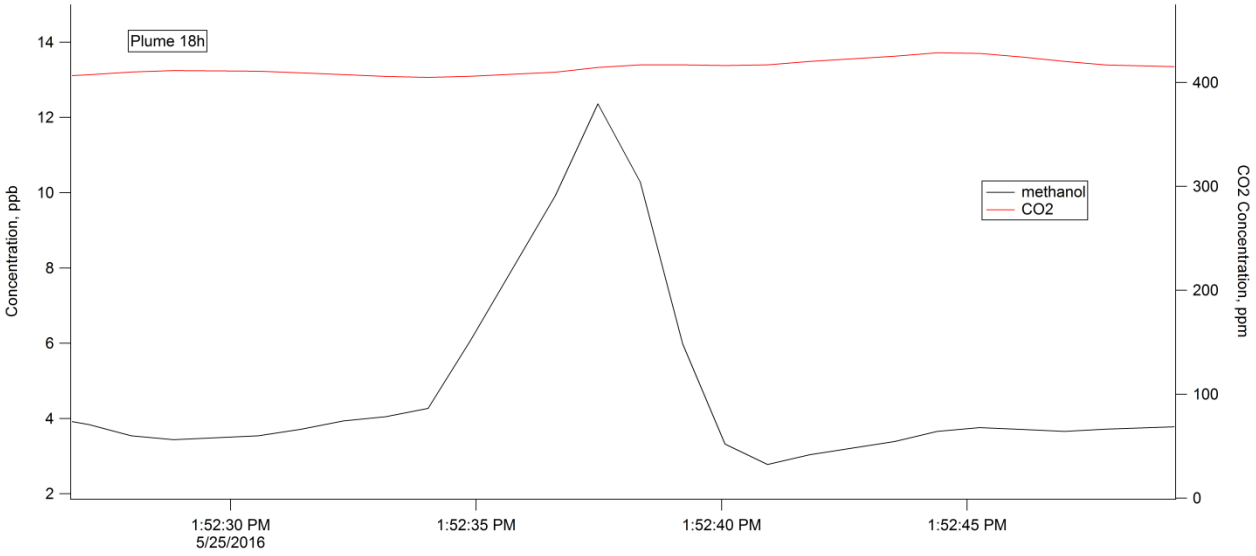


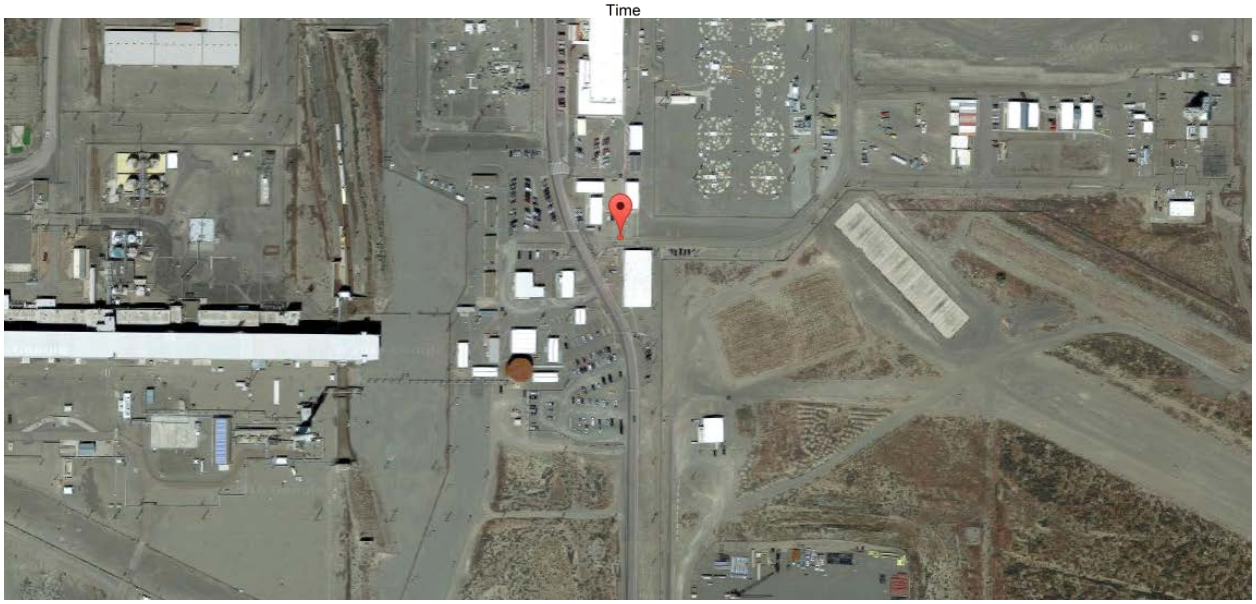
Plume 18f was observed at 12:22 PM at the Stationary Monitoring Site W of AY Farm. 80.4 °F and 1.01 bar, moderate winds blowing ESE. The plume primarily consisted of 1-butanol + butenes, ethylamine, and acetaldehyde signals. There is a very slight correlating rise in CO_2 at this time, meaning this plume is likely diesel exhaust. The 2-methylfuran signal exceeded OEL in this plume.





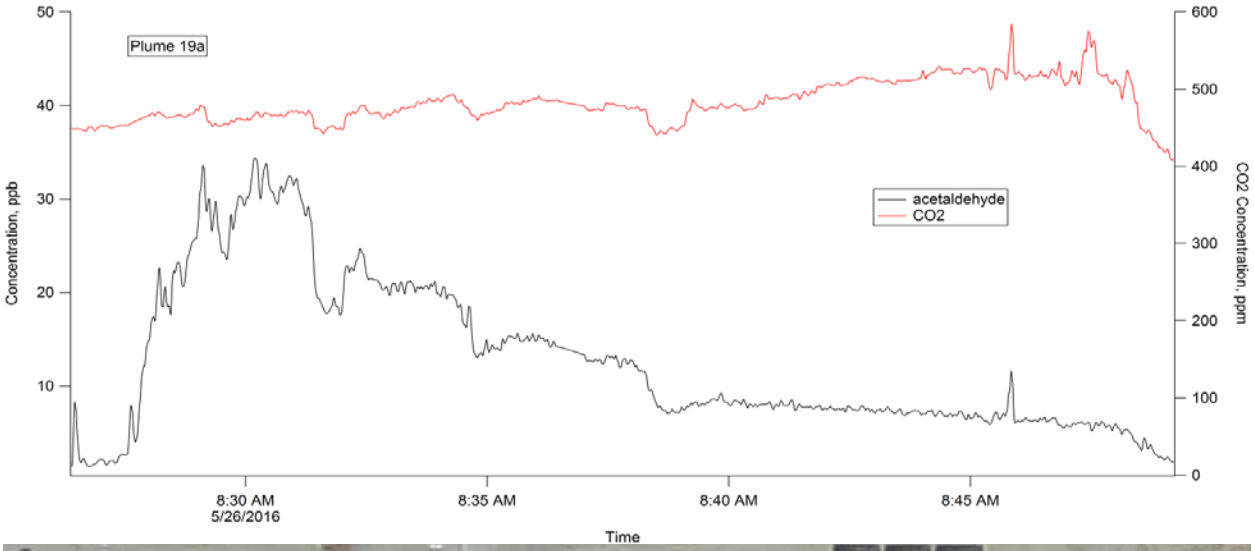
Plume 18g was observed at 1:40 PM at the Stationary Monitoring Site W of AY Farm. 79.3 °F and 1.01 bar, moderate winds blowing S. The plume consisted of 1-butanol + butenes, ethylamine, and acetaldehyde signals. There is a very slight correlating rise in CO_2 at this time, meaning this plume is likely diesel exhaust.



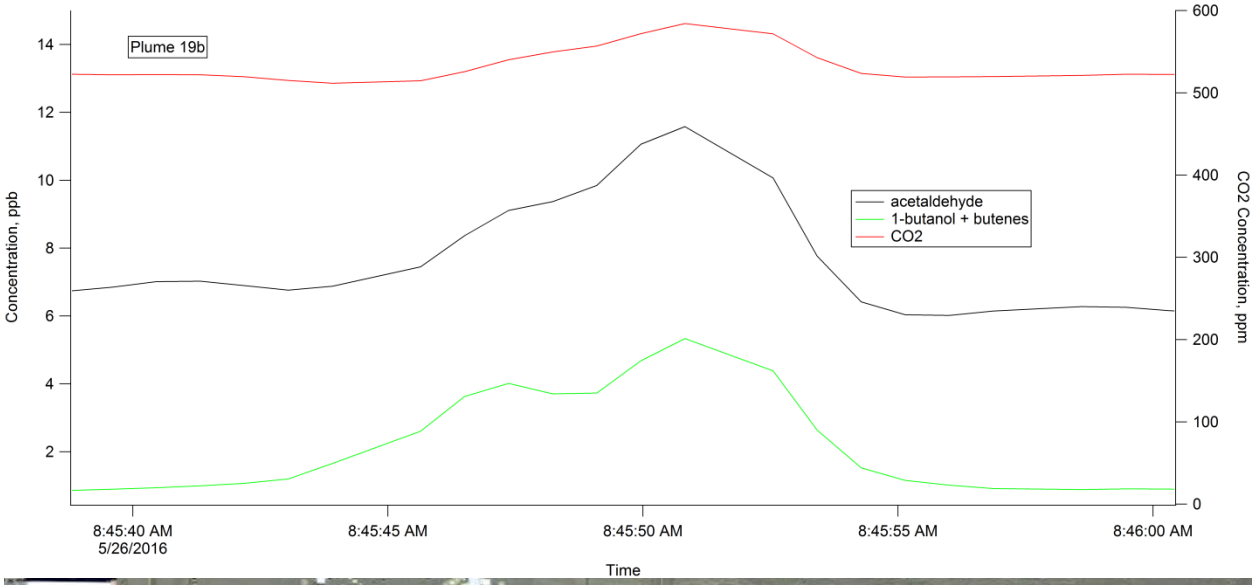


Plume 18h was observed at 1:52 PM while parked by MO266. 79.9 °F and 1.01 bar, strong winds blowing S. The plume consisted of methanol. There is no correlating rise in CO_2 at this time, meaning this plume may be from an unknown source.

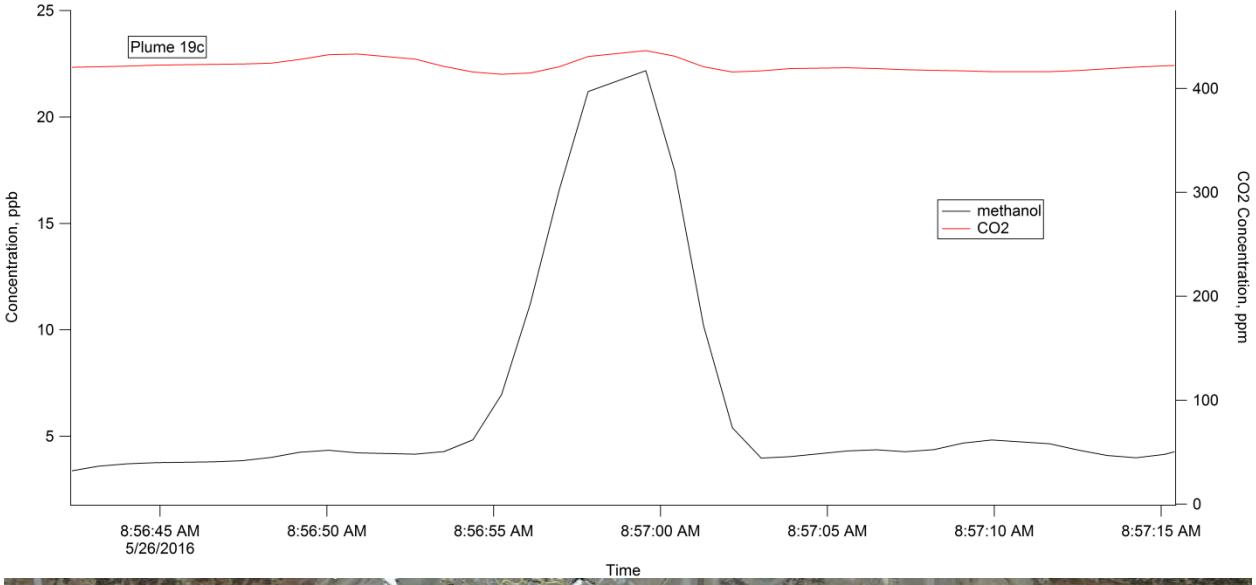
May 26th Plumes



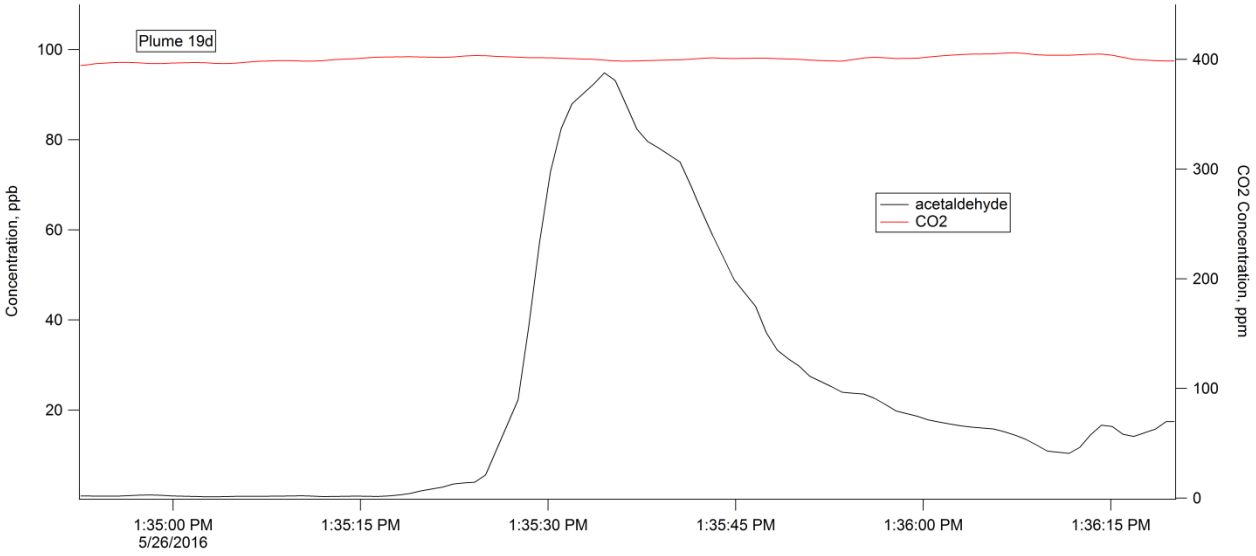
Plume 19a was observed between 8:27 AM and 8:47 AM while driving from the 242A Evaporator to the E side of AP Farm. 63.8 °F and 1.02 bar, moderate winds blowing WNW. This plume consisted of one large acetaldehyde peak that tapered off slowly over the next 20 minutes. CO_2 is also greatly elevated throughout. This, along with the fact that the Mobile Lab moved around extensively during this period, suggests that a true plume was likely observed while at 242A. In addition, the local meteorological conditions may have caused background concentrations to elevate during this time, or the van remained in the plume while driving, which would suggest a source near AP Farm or near the van.



Plume 19b was observed at 8:45 AM while parked on the E side of AP Farm. 64.8 °F and 1.02 bar, moderate winds blowing WNW. This plume consisted of acetaldehyde and 1-butanol + butenes. CO_2 is also elevated, which means this plume is likely exhaust.



Plume 19c was observed at 8:57 AM at the Stationary Monitoring Site W of AZ Farm. 64.2 °F and 1.02 bar, strong winds blowing W. This plume consisted of methanol. CO_2 is also elevated, which means this plume may be dilute or mixed.



Plume 19d was observed at 1:35 PM while parked E of AP Farm. 74.5 °F and 1.01 bar, strong winds blowing WNW. This plume consisted of acetaldehyde. No elevated CO_2 means this plume could be from an unknown source.

12.0 CONCLUSIONS AND RECOMMENDATIONS

After several weeks of performing volatile organic analysis using RJ Lee Group's mobile laboratory, the following conclusions can be drawn. The mobile laboratory has shown to be a highly valuable tool for real-time monitoring of vapors on site. The original setup needed some improvements, both in terms of sampling system design as well as in data processing to fulfill the needs of the customer. The following recommendations are the result of observations and diagnostic evaluation of potential issues for long term monitoring.

The recommendations are split into two categories based on data collection (i.e., sampling, analytical instruments) and data processing (i.e., aspects of speed of data deconvolution)

12.1 DATA COLLECTION RECOMMENDATIONS

Some improvements could be made for better and cleaner data collection with better accuracy. One of the main emissions on the Hanford site from the tank farms is ammonia; it is omnipresent in the tanks as a by-product of decades of radiolysis of nitrogen bearing material under caustic conditions.

The first recommendation involves an improvement for ammonia measurements to low part per billion (ppb) sensitivity with near real-time response. The direct correlation of VOC data to ammonia measurements is crucial to the assignment of monitored signals to tank farm emissions. Current field instruments in use (i.e., AreaRae™) do not have the necessary sensitivity for outside-the-fence monitoring of ammonia. Although the PTR-MS mobile laboratory currently can measure ammonia, its sensitivity can only identify extreme peaks in plumes rather than in a low ppb setting. Ideally, ammonia would be detectable in the same way the PTR-MS mobile lab collected data for multiple VOC compounds. Two possible options to pursue this aspect are to either incorporate a specific separate instrument into the mobile lab to collect data for ammonia only. There are several models on the market, primarily based on tunable infrared laser differential absorption spectroscopy (TILDAS) or Cavity Ring Down Spectroscopy; either technique has been used for such analysis in the field. An alternative approach would be to dedicate a second PTR-MS, such as the high-sensitivity quadrupole system, to measure ammonia with special settings (might also be used for the simultaneous measurement of mercury – evaluation needed). CBAL, due to its partnership with the Columbia Basin College, is in possession of such an instrument.

A second recommendation would be to use one of the high-end PTR-MS systems that has exceptional mass resolution and sensitivity. This instrument, PTR-Qi-TOF, is capable of mass resolving furan from isoprene and NDMA from methyl acetate or other compounds of different elemental compositions. It also has a factor of 10-20 times improvement in sensitivity over the TOF-1000 used in the measurements for this report. Such an instrument would greatly simplify data interpretation and help answer many of the questions that arose in the evaluation of the current data. An intermediate option is the TOF-1000 Ultra system rather than the basic TOF-1000. The difference between these two instruments is that the Ultra incorporates the Ionbooster funnel technology. This array of ring electrodes forms an ion-lens which results in a tenfold lower detection limit for most compounds. It is not clear if this instrument will provide the required mass resolution to resolve the isobaric overlaps that complicate the interpretation of the data. The Ultra was not available on the market at the time this project was initiated – it was presented as the latest

innovation by Ionicon in March of 2016. The PerMaSCal add-on is an option that has been found to be essential in the daily operation of the system. This is a permeation tube that 'leaks' a known reference compound into the drift tube. It ensures that every scan acquired has at a minimum, three reference points for mass scale verification.

A third recommendation involves the calibration routine. During the initial campaign of this project, it was observed that an improvement on the calibration routine to include automation with more compounds would be beneficial. This would allow for easier and more time efficient plume identification during data collection. The incorporation of the ability to automate background and calibration routines would save on both time and human interaction efforts.

A forth recommendation is the inclusion of other direct read instruments in the mobile laboratory such as NO_x and O_3 monitors or potentially a UV and/or IR DOAS system. These instruments can be interfaced to receive sample gas from the same sample line as the PTR-MS, thus ensuring direct correlation of results of a complimentary nature.

12.2 POINT SOURCES AND FUGITIVE EMISSIONS

Future VOC measurement activities should include an intensive effort locating, measuring and characterizing VOC emissions from the numerous known (and unknown) point sources on the Hanford Site. Many of these are contributors to the overall daily VOC inhalation burden and are likely responsible for many of the observed 'VOC Plumes' in the data sets. The significance of the burden can only be determined by measurement of the sources. The sources include generators, specialty vehicles (ATVs and cranes), sewage sumps, porta-potties, and normal shop activities (vehicle maintenance, machining, painting, etc.).

12.3 DATA PROCESSING RECOMMENDATIONS

Due to the nature of continuous monitoring using the PTR-MS, the amount of data collected over the course of a day in the field is very large. The evaluation process is further burdened by the introduction and correlation of data from other monitoring devices such and the carbon dioxide monitor, the weather station, or other direct read instruments. This has had a noticeable effect on the computer systems used for processing. To increase time efficiency, the use of specific workstations that are designed for such specific applications would be highly beneficial. As an example BOXX workstations are ideally designed for this purpose.

In addition, an automated processing routine should be established. Currently, the data volume is handled by one PTR-MS PhD expert and supported by two Chemical Engineers and a Chemist. The project has continuously evolved as has the data processing routines used for the deconvolution, visualization, and interpretation of the large data sets. In order to provide daily reports containing a large number of variables on a routine basis, the main functions of data deconvolution would need to be automated. Automation routines tend to be highly specific with respect to outcomes, therefore, for such routines to be effective they must be well defined by the expectations of the project. As in this project, it is anticipated that data processing development will continue to evolve to better meet the expectations of the customer and to relieve the burden of extensive manual assessment of the data.

APPENDIX A

TEST PLAN FOR OPERATION OF THE MOBILE LABORATORY AND ASSOCIATED INSTRUMENTATION.

RJ LEE GROUP
DELIVERING SCIENTIFIC RESOLUTION

Project Test Plan
Monitoring Hanford Tank Farm Vapors

Statement of Work

Proton Transfer Reaction-Mass Spectrometer Mobile Laboratory

Requisition #:283842

Revision History

Rev.	Date	Description
00	5/31/2016	Original
01	6/23/2013	Incorporation of Reviewer Comments; Re-formatted the document
02	07/18/16	Incorporation of reviewer comments.

Table of Contents

1.0 Purpose

The purpose of this test plan is to identify the testing requirements and data collection requirements for the use of a Mobile Laboratory to measure and quantify the chemical constituents associated with Hanford High Level Waste (HLW) tank vapors. This test plan lists the required tests and supporting documentation which verify system conformance to established systems used in similar field campaigns.

The Proton Transfer Reaction Mass Spectrometer (PTRMS), although not based on any regulatory methodology, has been widely utilized to monitor and elucidate a multitude of vapor related issues over the course of the past 20 years as evidenced by the hundreds of peer reviewed publications in the literature. This test plan will define how the instrument will be utilized for vapor monitoring support at the Hanford Tank Farms.

The objectives of the PTRMS measurements and the use of the Mobile Laboratory are to identify and quantify volatile chemical constituents in the air within the bounds of a Tank Farm and the surrounding areas outside the vapor control zones and to correlate that data with concurrent direct read instruments (DRIs) of various types. This work is being coordinated to support a broader Tank Farm Vapor Study, a Tank Farm stack aerosol emission study, and a 'Leading Indicator' study.

2.0 Scope

This test plan discusses the testing requirements and acceptance criteria for the Mobile Laboratory and associated instrumentation and how it will be used in the field to collect, analyze, and process data. The PTRMS/Mobile Laboratory will be used to support other vapor monitoring and detection systems as defined in document 241-TP-043; 241A Vapor Monitoring and Detection System Pilot-Scale Test Plan. Figure 2.1, Sampling areas for the Pilot-Scale testing of the vapor monitoring and detection system (VMDS), shows how the Mobile Laboratory interfaces to the overall scope of the vapor monitoring project. It is anticipated that the Mobile Laboratory will be coordinated with the pilot-scale test performed at the AP and A/AX tank farms in the 200 East Area of the Hanford Tank Farms.

Many aspects of the overall VMDS, the SOW governing this test plan, and the specifics of this test plan may be subject to change as the programs evolve. Communication among the respective project managers and plan authors is imperative to ensure that the requirements of the project are met. Any alterations of the SOW governing this test plan, and the specifics of this test plan will be documented and approved by the appropriate individual(s).

The Mobile Laboratory will be utilized in the following vapor monitoring studies;

- Fugitive Emissions; emissions of gases or vapors from equipment due to leaks and other unintended or irregular releases of gases from various activities. The data from the mobile laboratory will be utilized in conjunction with the DRIs, data from the autosampler systems, and the optical gas imaging equipment, to include ultraviolet/fourier transform infrared spectroscopy (UV/FTIR), open path differential optical absorption

spectroscopy (UV-DOAS and OP-FTIR), and the optical gas imaging infrared camera (OGI).

- Primary Source Emissions (Vapor Stacks and Passive Breather Filters); emissions from the ventilation sources on the waste storage tanks will be directly monitored by the mobile laboratory. These data will support the measurements from the optical gas imaging equipment, the DRIs, and samples collected by the autosampler systems.
- Tank Farm Area Monitoring; the general area within the defined tank farm fence may be monitored in an effort to better understand the dynamics of the vapor plume migration from the point source to the fence line. All data will be correlated to the DRIs optical instruments, and area samplers.
- Plume Chasing; an attempt will be made to 'chase' vapor plumes outside the recognized boundary of a vapor source in an effort to understand the temporal and spatial distribution of tank or fugitive emissions.
- Aerosol Studies; aerosol collection plates from a selected tank passive breather filter will be analyzed by the mobile laboratory to determine if there are any VOCs specifically associated with sub-micron aerosols.
- To meet the objectives listed above, this test plan will define how the mobile laboratory and the PTRMS will be operated in the field to ensure adherence to 'best practice' utilization of the instrumentation for sample collection, analysis, and data interpretation and correlation to other monitors.

3.0 Testing Equipment

The Mobile Laboratory consists of several instruments that can be used for routine monitoring of emissions from a source, support source apportionment by tracking specific vapor profiles, or aid in the identification of vapor components. The current laboratory configuration consists of the following instruments:

- Proton Transfer Reaction Mass Spectrometer (PTRMS)
- Gas Chromatograph / Mass Spectrometer (GC/MS)
- Carbon Dioxide Sensor
- Weather Station
- Video Camera
- Wi-Fi

Additional air monitoring instruments can be readily incorporated into the laboratory for specific field campaign activities, such as a cavity ring-down spectrometer (CRDS) tuned for specific gases (NOx, SOx, methane, ozone, CO, NH_3), a HazScanner instrument with various gas monitors, etc.

A gas sampling manifold, specific to this field operation, will be used to provide emissions transport from a point source (Stack and PBF) to the laboratory located outside the tank farm fence.

A detailed description of each device used in or in support of the mobile laboratory will be discussed in sections 3.1 through 3.8. Included are drawings to support the electrical and pneumatics layout of the laboratory.

3.1 Mobile Laboratory

The mobile laboratory is housed in a Mercedes Sprinter Van that has been retrofitted with the necessary power lines, gas plumbing, and communications wiring to support a variety of instruments used in the real time measurement of volatile constituents in air. The van is fully insulated, contains an on-board air conditioner/heater to manage internal temperatures for instrument operation and worker comfort, and has the option of utilizing either shore power (208V, 50A RV-type plug) or on-board diesel generator power for operation of the instruments. All power for the PTRMS and associated instrumentation is routed through a 3000VA uninterruptable power supply (UPS) which is a UL listed device. Two 1500VA UPS are available for supplying uninterruptable power to the GC/MS system and associated equipment. The mobile laboratory has been inspected and certified by an NRTL.

There are two sample collection lines in the laboratory. A gas sampling mast is located above the wind shear zone of the van for on-the-road, real time collection and analysis of emission plumes. The other sampling interface is used for stationary measurements where a sample line can be run to a building or other suspected source from a port on the side of the van.

The laboratory comes equipped with a server which incorporates interfaces to all test equipment and also supports a Wi-Fi system for remote operation of some of the equipment and/or data transfer to alternate locations for processing and review. The server consists of up to 6 2-GB solid state data storage drives for collection and storage of information from the various instruments. Figure 1 is a photo of the mobile laboratory.

Figure 1. The mobile laboratory used for the real time monitoring of vapor emissions.

3.2 Proton Transfer Reaction Mass Spectrometer

The PTRMS will be the most heavily used instrument in the mobile laboratory. Versions of the PTRMS has been commercially available since 1998 stemming from research efforts conducted at the University of Innsbruck, Innsbruck, Austria and collaborations from numerous individuals. The technology is partially based on the well understood gas phase ion-molecule reactions which are the foundation of modern chemical ionization mass spectrometry systems. The combination of the ion-molecule reactions in a drift field at reduced pressure with subsequent detection of the ions of interest by a mass spectrometer is the basis of the commercial systems.

The instrument of choice for the mobile laboratory and this application incorporates a time-of-flight mass spectrometer interfaced to a high sensitivity drift tube and ion optics interface. The instrument is designed to continuously measure volatile organic compounds (VOCs) in air. The measurement is performed in real time with no pre-concentration of the gas sample and no pre-separation of the VOCs of interest. Time resolutions of 100 milliseconds are possible with the instrument while maintaining detection sensitivities at approximately 10 parts per billion volume (ppbv). Detection limits are improved by increasing the signal integration time such that 5 part per trillion volume (pptv) is achievable with a 60 second integrated measurement. These are all features that are essential to the objectives of this project.

VOCs are measured by chemical ionization, whereby the regent ion H_3O^+ ionizes organics via a fast proton transfer reaction (R1).

$$R + H_3O^+ \rightarrow RH^+ + H_2O \qquad (R1)$$

These reactions are normally non-dissociative, although there are many compounds that fragment to smaller ions upon protonation. The reaction takes place in a drift tube where the sample air stream reacts with H_3O^+ ions produced by a hollow cathode ion source. The drift tube pressure (N), temperature, and electric field strength (E) are controlled. The drift tube is typically operated at an E/N ratio of 120 Td (1 Td = 1 x 10^{-17} V/cm^2). The protonated organics are mass analyzed by a TOF mass spectrometer and the ions counted by a secondary electron multiplier (SEM). The PTR-MS thus identifies compounds based on their molecular weight and cannot discriminate between geometric isomers. Compounds that have proton affinities greater than that of water (693 kJ/mol) can, in principle, be detected by this technique. Current instrument configurations are able to extend the range of compounds that can be detected (those with PA<H_2O) by using alternative reagent ions such as O_2^+, NO^+, Kr^+, and others. Each of these reagent ions find usefulness in various applications but come with higher energy reactions that may complicate the resulting spectrum. Figure 2 shows the general instrument and Figure 3 is an expanded view of the ion source and drift tube regions where the reagent ions are produced and the compounds of interests are ionized.

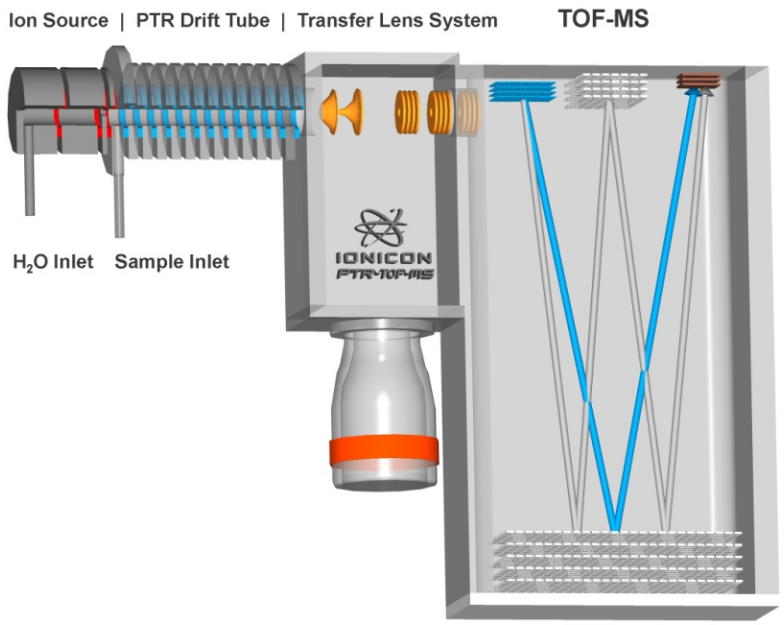


Figure 2. The PTRMS-TOF system showing the general configuration of the ion source, drift tube, sample inlet, and mass spectrometer.

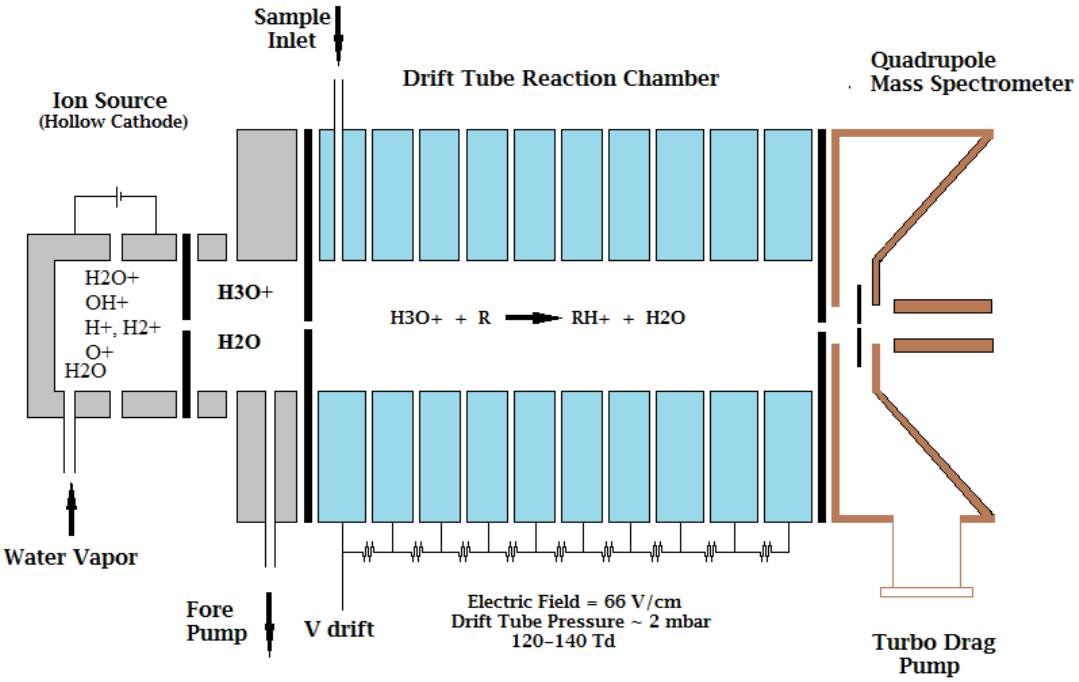


Figure 3. An expanded view of the ion source and drift tube.

The instrument is insensitive to the major constituents of air (N_2, O_2, or noble gases) and the dominate trace gases (CO_2, CH_4, N_2O, CO, O_3, SO_2, NO_x). It is also insensitive to alkanes < C_9, ethene, and acetylene. Atmospheric moisture, a problem for many air pre-concentration systems, does not influence the measurement process for the majority of compounds of interest.

In theory, the number concentration (molecules/cm^3) of the neutral R in the drift tube can be determined by the following equation:

$$[R] = \frac{1}{kt}\left(\frac{I_{RH^+}}{I_{H_3O^+}}\right)\frac{\varepsilon_{RH+}}{\varepsilon_{H3O+}} \qquad (1)$$

where k is the ion–molecule rate constant (molecules cm^{-3} s^{-1}), t is the reaction time (typically ~ 100 x 10^{-6} seconds), I_{RH+} and I_{H3O+} are the respective ion count rates, and ε_{RH+} and ε_{H3O+} are the ion transmission efficiencies through the TOF. The abundance of the H_3O^+ ion is monitored at m/z=21, corresponding to the ^{18}O isotope from the protonated water. This is done to prevent detector saturation from the measurement of normal ^{16}O isotope from protonated water.

The mixing ratio of the organic R in the sample air is then determined by:

$$\chi_R(ppbV) = \frac{[R]}{[AIR]_{drift}} * 1x10^9 \qquad (2)$$

Where [AIR] is the number concentration of air (molecules/cm^3) in the drift tube given the drift tube pressure (typically ~ 2 mbar) and temperature (typically ~ 50 °C).

In practice the sensitivity of the PTR-MS to various VOCs is determined by using multicomponent compressed gas standards to establish the ion count rate (RH^+) per ppbv of analyte per million reagent count rates. This is called the normalized sensitivity (normalized counts per second, or ncps). A theoretical normalized sensitivity value can be calculated from equation (1):

$$ncps = [R] I_{H3O+} kt \left(\frac{\varepsilon_{H3O+}}{e_{RH+}} \right) \qquad (3)$$

$$ncps = \left(4.57\text{x}10^7 \text{ molecules cm}^{-3}\right)\left(1\text{x}10^6 \text{ Hz}\right)\left(2.0x10^{-9} \text{molecule}^{-1}\text{cm}^3\text{s}^{-1}\right)\left(100\text{x}10^{-6} \text{ s}\right)\left(\frac{\varepsilon_{H3O+}}{e_{RH+}} \right)$$

$$ncps = 9 \text{ Hz}$$

The calculation shows a theoretical normalized sensitivity of 9 Hz / ppbV for a H_3O^+ count rate of 1 million Hz, given a reaction rate coefficient of 2 x 10^{-9} molecule^{-1} cm^3 s^{-1}, a reaction time of 100 μs, and a relative transmission efficiency of unity. In practice, due to differences in ion-molecule rate coefficients and relative transmission efficiencies, different species have different normalized sensitivities. To achieve the best quantitative result, calibration of the instrument to the specific VOC is required, however, very good semi-quantitative results may be obtained by using known or estimated reaction rate constants and ion transmission efficiencies.

The technology has been used in hundreds of applications around the world with hundreds of peer review publications appearing in the literature over the past 18 years. Even though the technology is widely used in the research arena and has proven to be indispensable for many applications, there remain no fully established and recognized methods among the United States regulatory agencies such as the EPA, ASTM, and NIOSH. The end user of the technology is expected to provide the 'best practice' in its use by adhering to established operational parameters governed by the scope of the project and the nature of the sample(s) to be measured.

3.3 Gas Chromatograph/Mass Spectrometer

The gas chromatograph/mass spectrometer (GC/MS) system consists of an Agilent 6890 GC coupled to an Agilent 5973 MS. A Perkin Elmer thermal desorption instrument is interfaced to the gas chromatograph. In addition, there is an interface that is used for the preparation of samples from air canisters or thermal desorption tubes. Cylinders of ultrahigh purity helium and nitrogen are carried in the van in support of the GC/MS. Standards for calibration and batch quality control are stored in stainless steel canisters for routine use. The GC/MS system has been set up to support the sampling and analysis

activities based on the recognized EPA Methods TO-15 (air canisters) and TO-17 (thermal desorption tubes). The instrument may also be used for other regulatory methods by reconfiguring the interfaces, installation of appropriate column, or other minor alterations to the system. For this project, the GC/MS and gas sampling procedures for canisters and thermal desorption tubes are used only to support and validate the PTRMS measurements.

3.4 Carbon Dioxide Sensor

The carbon dioxide sensor in the mobile lab is the Li-Cor model 840A. The LI-840A is an absolute, non-dispersive infrared (NDIR) gas analyzer based upon a single path, dual wavelength infrared detection system. It is a low-maintenance, high performance monitoring solution that gives accurate, stable readings over a wide range of environmental conditions. It has a range of 0-20,000 ppm (0-2%), low power consumption (4W after power-up), and fast 1 second signal averaging to allow for real time source apportionment (i.e., monitoring vehicle exhaust or other combustion sources on-the-fly). The instrument operates on a gas flow of less than 1 liter per minute.

3.5 Weather Station

The weather station in the mobile laboratory is an Airmar 150WX that has a control unit mounted in the server cabinet with the transducer mounted on the gas manifold mast located above the surface of the van. Real time display of the outputs is possible on the video monitor above the server. It is a stand-alone system that receives its power from the UPS via a 24VDC transformer. The output data is fed to the server with a clock time-stamp that is correlated to the other monitoring systems in the laboratory. The functions and outputs of the station include:

- Apparent wind speed and angle
- True wind speed and angle
- Air temperature
- Apparent wind chill temperature
- True wind chill temperature
- Barometric pressure
- 2D Magnetic compass heading
- Heading relative to true north
- Angle of pitch and roll
- Global positioning system (GPS)

3.6 Video Camera

A video system such as the GoPro model HERO4-Silver device is mounted in the mobile laboratory to provide synchronized capture of pertinent information related vapor emission and monitoring events. The video system features 1080p60 and 720p120 video,

12MP photos up to 30 frames per second, built-in Wi-Fi and Bluetooth, and Protune for photos and video. It is waterproof which enables the system to be mounted on the outside of the laboratory if required by the project or specific sampling campaigns.

3.7 WiFi

The WiFi system utilizes a standard wireless or USB interfaced aircard similar to the MiFi Liberate mobile hotspot device. It is used to provide remote login to both the PTRMS, GC/MS, CO2 monitor, and weather station in the mobile lab. It is also used for data transfer to a remote system and as an interface to the notebook systems for mobile operations.

3.8 Gas Sampling Manifold

The gas sampling manifold internal to the mobile laboratory consists entirely of PFA Teflon from the point of origin (sample mast or side port) to the PTRMS or auxiliary sampling stations. A return line provides a flow-through system with exhaust gases from the PTRMS and unused sample gases exiting a side port on the laboratory. The air sample delivery system is entirely sealed with no sample released to the interior of the laboratory. The air sample is pulled into the sampling system by an oil-free diaphragm pump located under the van. The pumping of the air sample is controlled by a needle valve located after a digital flow meter that is in series with the flow stream which are co-located after the analytical sampling stations. The 3/8" PFA tubing is generally pumped at a volumetric flow rate of approximately 20-25 liters per minute which corresponds to a linear velocity of approximately 5 meters per second. Alternate tube sizes are available for sampling activities and may include 1/2, 1/4, or 1/8 inch external diameters. Associated with the internal gas manifold is a 25 foot heated sample transfer line that can be connected between an external sampling station and the laboratory's pumped system. This transfer line is heated using heat trace tubing to reduce potential condensation effects when operating in colder temperatures. The heated line is operated at a nominal temperature of 50^{o}C and consists of a heated 3/8" PFA tube and an unheated 3/8" PFA tube. The constant power density tubing operates at a current draw of 0.10 amp per foot, whether at initial startup or at constant operation at its final temperature. The temperature is controlled by a SPDT UL listed line sensing thermostat. Power to the heat trace is provided by the mobile laboratory. The unheated tube is used to make sample dilutions at the point of an external gas manifold, as required.

An external sampling manifold was developed specifically for this project. It is used for the transport of a gas sample from either a tank ventilation stack or a tank passive breather filter. Two separate systems were constructed; one for each application. The external sampling manifolds will be left in place at the respective tank farms to provide support of continued tank farm sampling activities upon completion of the mobile laboratory project support. The external sampling manifolds are identical with the exception of the length of heat trace tubing. One system is 100 feet in length and the other is 130 feet. The length of tubing is defined by the distance from the respective ventilation source to the nearest fence line point where the mobile laboratory can be located. All but 6 inches of the 3/8" PFA tubing on both ends sampling system will be heated. The heating is by a commercially prepared constant power density electric trace tubing (Dekoron/Unitherm) with an aluminum Mylar thermal barrier which is a non-hydroscopic inorganic fibrous glass

thermal insulation. It is covered by a 105°C black flame retardant low temperature polyvinyl chloride jacket. The constant power density tubing operates at a current draw of 0.10 amp per foot, whether at initial startup or at constant operation at its final temperature. The temperature is controlled by a SPDT UL listed line sensing thermostat (NEMA 4x,7,9) which provides current flow to the heater based on a preset temperature. Power to the two heat trace lines for stack sampling will be provided by a local source.

The heat trace tube is connected to a manifold that permits the connection of various sampling devices. One of these devices will be the mobile laboratory. The air sampling side of manifold is constructed of PFA with the exception of a stainless steel bulkhead fitting and a stainless steel ball valve. Both of these items are Silonite treated to reduce reactivity to VOCs. The return gas side of the manifold is plumbed with a combination of stainless steel and PFA. The system is pumped by an oil-free diaphragm pump (110V, 4.8A) with all gas being returned to the source through a 1/2" line. The manifold components are enclosed in a protective NEMA shell.

4.0 Operation of the Laboratory Instruments

The Mobile Laboratory will be used in various configurations in support of the measurement of tank farm vapor emissions. Common to all configurations is the general operation of the instrumentation within the laboratory. Two types of testing configuration descriptions will be presented; one that deals with the operation of the instrumentation in the laboratory and one that deals with the operation of the laboratory at each VOC testing location. The Statement of Work (SOW) associated with the project (WRPS SOW# 283842, "Proton Transfer Reaction Mass Spectrometer Mobile Laboratory") is the basis for the testing program and includes both on-site (Hanford) and off-site components. This plan is in consideration of only the on-site Hanford related activities.

4.1 Operation of the PTRMS System

The PTRMS will be calibrated for several compounds of interest prior to bringing the laboratory onto the Hanford Site. Calibration is performed by operating the instrument under a fixed set of conditions while introducing a VOC standard of known concentrations. Calibration serves two functions. It provides data for the determination of the ion transmission efficiency over the mass range of interest and it provides response factors for specific compounds that are used for determining absolute quantification of those compounds. The ion transmission efficiency is required to allow the semi-quantitative determination of unknown VOCs using an average reaction rate coefficient. The response factors for individual compounds are determined by running a 4 point calibration curve at various concentrations, similar to typical GC/MS calibrations.

Calibration verifications and zero air analysis will be performed periodically in the field to ensure that the instrument is performing as expected and to provide corrections to the response factors from errors introduced by small drifts in the secondary electron multiplier response and the reagent ion production in the ion source. Zero air and continuing calibration verifications (CCVs) are generally performed at the beginning and end of daily operations or whenever there may be a significant change in physical

conditions, or as defined in a project statement of work. Zero air is produced by an on-board zero-air generator where laboratory air is passed through a heated catalysis tube containing palladium or supplied by a compressed gas cylinder. All VOCs are converted to CO_2 leaving VOC free air. CCVs are run from an air canister or compressed gas cylinder containing a known concentration of VOCs. The VOCs contained in the CCV gas standard are as follows:

Formaldehyde
Methanol
Acetonitrile
Acetaldehyde
Acetone
Isopropanol
Isoprene
Methyl vinyl ketone
Methyl ethyl ketone
Benzene
Toluene
Styrene
p-Xylene
1,3,5-Trimethylbenzene
Alpha-Pinene

The preparation and concentrations of the components in the gas mixture have been certified by the vendor. The documentation can be found in the materials and testing equipment section.

The entire process of performing a zero air background check and a CCV evaluation requires approximately 2-3 minutes.

Sample is introduced to the PTRMS via the laboratory's internal gas sampling manifold. This manifold may be connected to other external sampling systems or operated as a stand-alone sampling system. The PTRMS requires a flow of only 20-50 milliliters per minute, however, the internal manifold is capable of providing a gas flow of 20-30 liters per minute. The total flow through the manifold is determined by the individual testing requirements and is controlled by an in-line needle valve located prior to the pump but after all sampling ports. The manifold can accommodate multiple sampling ports which feed other monitors or sampling devices. Excess sample gas is fed to a return port located outside the laboratory. In this application, the excess gas will be returned to the source rather than being released to the surroundings.

4.2 Operation of the GC/MS System

The GC/MS system is only scheduled for use in conjunction with the aerosol emission study and as support to the PTRMS. The analyses performed on the GC/MS include those associated with EPA's Compendium Methods TO-15 and TO-17. The respective CBAL SOPs are LAP-013.03, Analysis of VOCs by EPA Compendium Method TO-15, and LAP-017.02, Determination of VOC and SVOC by EPA TO-17 Modified.

The GC/MS will be configured with an interface that will facilitate the thermal desorption of the VOCs associated with the aerosol collection plates. The desorption unit consists of a small chamber that can be opened and resealed to permit transfer of the aerosol sample plate. Two ports are attached to the chamber. One is for the inlet of ultrahigh purity helium and the other is the outlet for the desorbed VOCs. The outlet is connected to a CarboTrap 300 thermal desorption tube. The sample/desorption chamber is placed in the oven of the gas chromatograph which provides controlled heating of the sample. Once the

sample is collected, the thermal desorption tube undergoes analysis using the Perkin Elmer TD-50 instrument interfaced to the GC/MS.

The GC/MS system will be calibrated off-site for a large list of analytes. A listing of the compounds and the certification sheet from the vendor of the standard can be found in the materials and testing equipment section. The analytical protocol includes the analysis of a CCV to demonstrate continued system calibration for the aerosol/VOC study, the analysis of a laboratory control sample (LCS), and the analysis of a zero air sample (BLK) to demonstrate system cleanliness. The analysis of VOCs associated the aerosols is not intended to be a comprehensive analytical study, but rather, an exploratory study to determine if there are any associated VOCs. It is, therefore, not necessary to run a full quality control analytical batch with the sample; only sufficient quality control samples (CCV, LCS, BLK) to ensure proper instrument operation.

It is anticipated that there will be periodic collection of Summa and thermal desorption tube samples to support and validate the PTRMS measurements. It is important to note that there is no connection of these samples to any type of industrial hygiene or environmental monitoring activity.

4.3 Operation of the Carbon Dioxide Monitor

The carbon dioxide monitor is a direct read instrument that operates on a gas flow of approximately 0.5 – 2.0 liters per minute. It is interfaced to the laboratory's internal gas manifold just downstream of the PTRMS sampling port. The unit provides continuous 1 second integrated time responses from a non-dispersive infrared (NDIR) gas analyzer based upon a single path, dual wavelength infrared detection system. The data from the CO_2 monitor is for the correlation of CO_2 data to the VOC measurements from the PTRMS. It is a strong indicator of contribution of VOCs from combustion sources.

The CO_2 monitor has been factory calibrated. Periodic checks of the unit will be made with zero air and a known gas standard to ensure continued system operation. A sample gas flow of approximately 1 liter per minute is pulled from the main sampling line by a small pump. The gas line is plumbed near the port used for sample transfer to the PTRMS to ensure that both instruments are simultaneously sampling the same source. The system has a continuous direct readout which can be displayed on a computer monitor in real time. Data from a measurement process is periodically downloaded to the computer for permanent storage.

4.4 Operation of the Weather Station

The weather station in the mobile laboratory operates as a stand-alone system and requires no support other than power to the interface and transducer. Power will come from the UPS via a 24VDC transformer. Signal from the transducer will be accumulated and stored on the server. All data points are time-stamped with a clock that is correlated to the other instruments in the laboratory. If desired, the outputs of the station may be displayed in real time on the video monitor located above the server or on the notepads that are interfaced to the data systems. It is desirable to have wind direction displayed in real time when performing on-the-road measurements as this can provide guidance for the sampling process. Data generated by the weather station is stored on the server in the laboratory.

4.5 Operation of the Video Camera

The video camera is used to correlate position and activities that may influence the measurement of the VOCs, whether on the road or at a stationary source. At a stationary source, it is advantageous to direct the video camera toward the sample source. The importance of this record is to allow the end user of the data to determine if an unexpected event occurred that may influence the data. For example, if a measurement is being conducted at a source and a vehicle happens to drive past or stop at the upwind location from the source, the resulting emissions from the vehicle may result in an unusual VOC spike in the time frame of the measurement. The video data, time-stamped with the CO_2 and PTRMS data will enable the troubleshooting of unusual events. The video output can be linked to the laboratory server, and thus to the remote monitoring capability, with its built-in WiFi and or Bluetooth systems.

4.6 Interfacing to the External Gas Sampling Manifolds

Two external gas sampling manifolds have been constructed to transport vapor samples from a forced vented tank emission stack or a passive ventilated filter system. A general layout of the gas manifold/sampling lines is shown in Figure 4. A heat trace line will be run from the respective emission source to the gas manifold located outside the tank farm fence. Coupling of the sampling lines to the gas manifold is accomplished using 'quick connectors' for both the gas input and gas return. The Mobile Laboratory, or other gas sampling equipment, will couple to the manifold using appropriately sized and heated lines.

During operation with the mobile laboratory, the gas manifold will be operated with the pump associated with the internal sampling manifold in the mobile lab. When the mobile lab is away from the external manifold, the system will be pumped by a GAST 150WX vacuum pump located inside the manifold box.

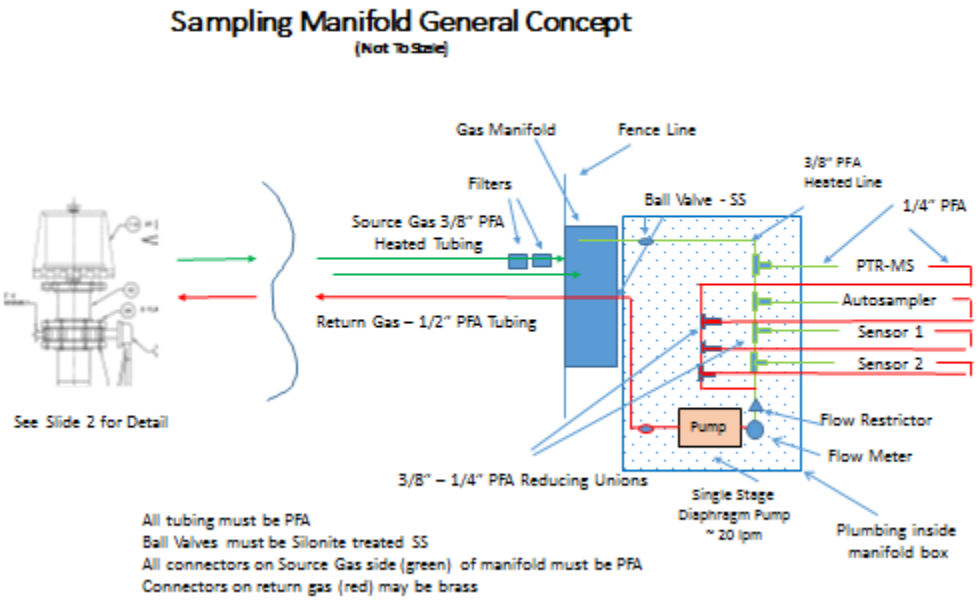


Figure 4. Schematic of the general concept for the external gas sampling manifold.

The heat trace line and the vacuum pump will be plugged into the gas manifold. Power to the manifold will be provided by a 110V, 20A circuit from the tank farm operations. It is anticipated that the heat trace will be operated at 60°C which is well above the exhaust temperature of the stacks. This will effectively eliminate moisture condensation on the walls of the transport tubing and also aid in the reduction of sample loss and sample retention effects of the tubing walls.

The sampling pump will pull a gas sample from the source (Figure 4 depicts a PFB line) to the manifold where it is distributed to the mobile lab. The pumped system then returns all unused gas and the sample exhaust from the mobile lab back to the area of the source in such a manner that the gas is not resampled.

The gas manifolds, in particular, the length of PFA tubing used in the manifolds, will be evaluated under laboratory conditions with respect to individual compound transport and retention under ambient and reduced temperature conditions. It is of importance to understand the compound transport characteristics through the sampling system and its influence on the interpretation of the data. A considerable amount of similar work was previously performed and reported to the IH group and the tank farm operations. The report is found in "Final Report of Phase II Activities; Proton Transfer Reaction Mass Spectrometry Monitoring: Hanford Tank Farm Real-Time Monitoring of Volatile Organic Compounds; WRPS 21065-41". This work will be repeated using as many of the 59 COPCs of interest that are commercially available. Figure 5 shows the general experimental setup for conducting the sample transport tube experiments. The syringe pump in the system may be replaced by a Liquid Calibration Unit from Ionicon or the used of compressed gas standards.

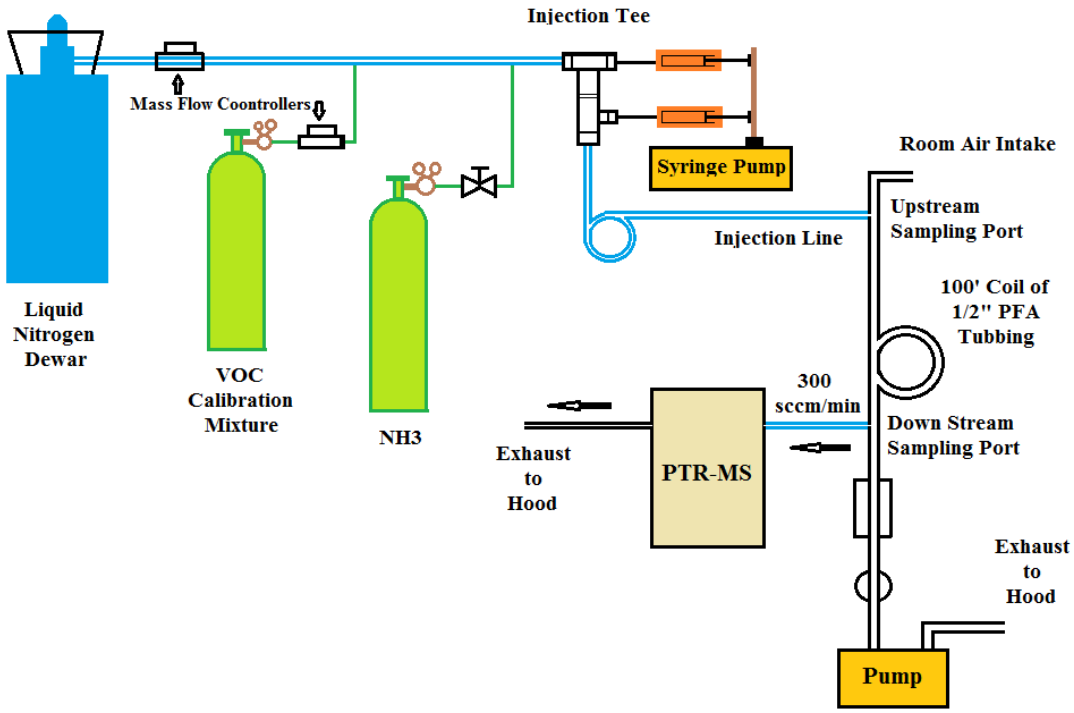


Figure 5. The experimental configuration of a typical system used to evaluate the compound transport characteristics through sampling tubes.

4.7 Direct Sampling System in the Mobile Laboratory

A significant portion of the mobile laboratory's support to the program will involve plume chasing and area surveys where the laboratory will be driven from one location to another. In this application, the laboratory will be utilizing its internal gas sampling manifold to bring an air sample to the various monitors inside the vehicle with exhaust back to the source environment. It will be using both the roof mount sampling mast and the side mount sampling port. In some instances, the personnel may elect to use the pumping system of the PTRMS to draw the air sample to the instrument, particularly if they choose to use the 1/4 or 1/8 inch sampling lines. Figure 6 shows the general layout of the internal gas sampling system.

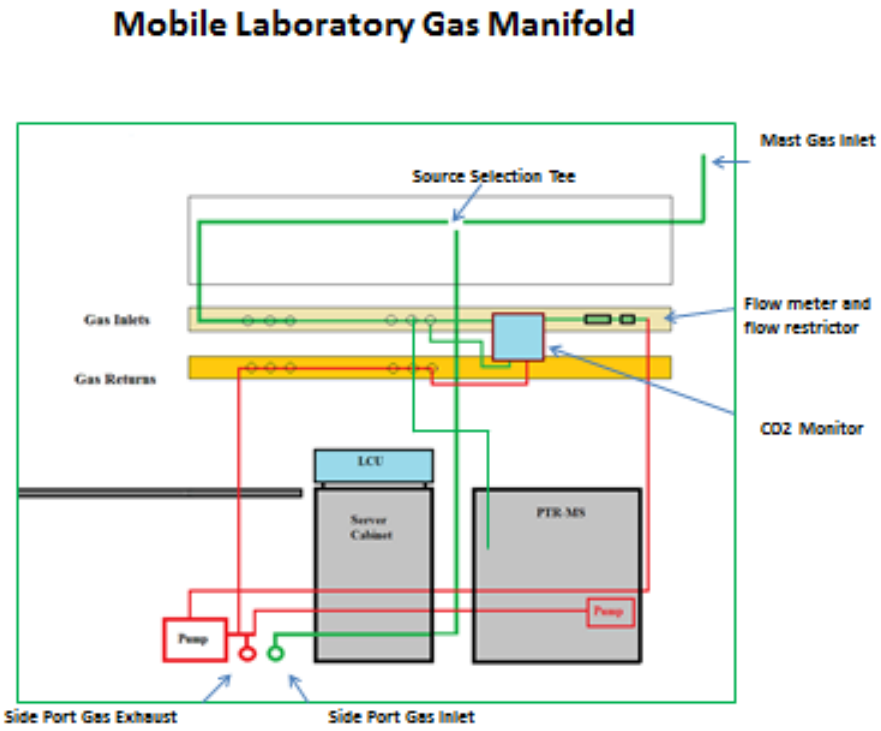


Figure 6. The Mobile Laboratory's internal gas sampling system.

5.0 Data Collection

5.1 PTRMS Evaluation of COPCs

Each COPC for which authentic standards can be readily obtained, will be measured by the PTRMS under varying conditions of drift tube voltage and static pressure. This allows the determination of quality of the response (the mass spectrum) under non-standard conditions and how those conditions may be used to elucidate and/or validate the identity of individual compounds. This experiment supports Task 3 of the Statement of Work.

5.2 Evaluation of Sampling Tube for Compound Measurement

Each compound will be evaluated under laboratory conditions with respect to individual compound transport and retention through the PFA sampling tubing under ambient and reduced temperature conditions. It is of importance to understand the compound transport characteristics through the sampling system and its influence on the interpretation of the data. A general experimental setup for this evaluation is shown in Figure 5.

The evaluation process involves the introduction of a constant concentration of a standard into the end of a transport tube of specific length (~ 100 feet) maintained at room temperature. The resulting signal is monitored to determine the time required to reach a steady state response. The source standard is removed and the time profile of clearing of the sampling tube (decay signal) is monitored. The experiment is repeated without the sampling tube but using the short sample introduction line at the PTRMS (~ 3 feet). A comparison of the resulting data provides information regarding sampling lag time, potential individual compound losses in the sampling system, and compound retention by the sampling system.

A considerable amount of similar work was previously performed and reported to the IH group and the tank farm operations. The report is found in "Final Report of Phase II Activities; Proton Transfer Reaction Mass Spectrometry Monitoring: Hanford Tank Farm Real-Time Monitoring of Volatile Organic Compounds; WRPS 21065-41".

This experiment satisfies Task 3 of the Statement of Work.

5.3 PTRMS – Stack & PFB Sampling

PTRMS stack sampling at the 241A and 241AP Farms is tentatively planned for a one week period at each location, to be determined by the 241-TP-043; 241A Vapor Monitoring and Detection System Pilot-Scale Test Plan. This schedule remains flexible with respect to the specific dates for monitoring as well as the specific number of days for monitoring activities at each location. These are anticipated to be an intensive monitoring and characterization campaigns to aid in the evaluation of tank vapor emissions correlated to atmospheric conditions such as daily temperature variations, wind velocity and direction, and barometric pressure. The PTRMS will be adjusted to collect samples at approximately the same rate as the DRI systems co-located within the tank farm and area (approximately 10-30 second time resolution). The data collection rate may be adjusted to shorter times if it is determined that bolus events are of a shorter duration. The PTRMS real time data will be validated with periodic grab samples either from the mobile laboratory (run on its internal GC/MS system) or from the project based autosampler systems.

PTRMS data will be processed from ion count vs. time domain to concentration vs. time domain. The data will be presented as a function of signal from individual protonated compounds with respect to the monitoring event. Generally, data files will be initiated and terminated approximately every 6 hours to enable effective management of the file size for processing. Individual files can be subsequently linked to provide a continuous data stream throughout the monitoring period or sliced into smaller time increments for enhanced detail.

5.4 PTRMS – Area Sampling

Area sampling, to include vapor plume chasing, will be conducted in the Hanford 200E and 200W tank farm areas. Generally, since the laboratory is in motion, sample collection times will be faster than the stationary experiments with data collection at 1 Hz.

An example of area monitoring routes for 200E and 200W tank farms is shown in Figures 7 and 8. The solid red dots in Figure 7 are possible locations for stationary monitoring assuming that ambient wind direction is from the southwest. Stationary monitoring locations are subject to change based on the given wind direction and velocity.

Figure 7. Map of typical plume chasing routes and stationary monitoring sites (Red) at 200E Tank Farms.

Figure 8. Map of typical plume chasing routes at 200W Tank Farms.

There are numerous compounds present in the vicinity of the tank farms that will be detected by the PTRMS system in addition to the 59 COPCs associated with the 241A Vapor Monitoring and Detection System Pilot-Scale Test Plan. Details of the contribution of these compounds to the tank farm VOC profile is lacking. Therefore, data processing is expected to require a significant time commitment by an experienced chemist to elucidate potential contributions from multiple point sources such as diesel and gasoline power generators and transient sources such as truck and automobile exhaust.

PTRMS data will be initially processed from ion count vs. time domain to concentration vs. time domain. The data will be presented as a function of signal from individual protonated compounds with respect to the monitoring event. Generally, data files will be initiated and terminated approximately every 6 hours to enable effective management of the file size for processing. Individual files can be subsequently linked to provide a continuous data stream throughout the monitoring period or sliced into smaller time increments for enhanced detail.

5.5 GC/MS Data Collection

Periodic collection of Summa and TDU grab samples will occur for the support and validation of the PTRMS sampling campaigns. These samples will be collected and analyzed according to the respective EPA TO-15 and TO-17 protocols and to CBAL internal SOPs or modifications thereof. The referenced CBAL SOPs are LAP-013.03; Analysis of Volatile Organic Compounds by EPA Compendium Method TO-15, and CBAL LAP-017; Determination of VOCs by EPA Method TO-17 modified. All analyses of the collected samples will be performed on the GC/MS in the mobile lab. See the reference section of this document for procedures and/or documentation of SOPs and EPA methods.

5.6 CO_2 Transducer

The CO_2 transducer will be used for continuous monitoring for the actively ventilated stack sampling, the passive breather filter sampling, and the area sampling campaigns.
The sampling line to the stack or PBF is essentially a direct connection to the vapor source and is not expected to be significantly influenced by outside sources under static conditions. However, ambient wind conditions may introduce VOCs from other nearby sources resulting in dilution and mixing of multiple sources. Variations of the CO_2 concentration will provide valuable data for the interpretation of the observed PTRMS signals. Although CO_2 is generally not a compound of potential concern, it is a compound whose change in concentration yields valuable insight to emission processes.

The CO_2 data is collected at a frequency of 1 Hz and will be presented in a concentration (ppm) vs. time domain. All data collected will be time stamped to the PTRMS data set.

5.7 Weather Station

The weather station data is continuously collected and stored for potential use during the data evaluation process. The data is streamed directly to the server located in the laboratory.

6.0 Acceptance Criteria and Quality Control

Quality control measures are governed by the RJ Lee Group, Inc., Columbia Basin Analytical Laboratory's Quality Assurance Manual, QAM.18, effective date of April 7, 2016. Additionally, sampling, analysis, and data reporting activities are addressed by numerous standard operating procedures within the laboratory's quality system. These documents will be referenced in the acceptance criteria and qualifications sections below and are listed in the reference section of this document.

A common data format/naming scheme will be used to help differentiate the data sets and to correlate data from one instrument to another. This format will start with YYMMDD_XXX, where YY is the year (20**16**), MM is the month (**06** = June), and DD is the current day of the month (**14** = 14th day of the month). The remaining file name (**XXX**) may be specific descriptors related to the data set or instrument. There is no need to include an instrument identifier in the data set name as this information is imbedded in each data set.

It is recognized that field sampling and analysis campaigns are designed to be flexible to allow sudden alterations in project activities due changes in local conditions or the occurrence of unexpected events. In many instances a shifts in focus is introduced by data from real-time measurements that would necessitate a variation from protocol to enable capture of data from an unexpected or unusual anomaly. All variations from standard SOPs or field sampling and analysis plans are recorded in appropriate notebooks or field data sheets (paper or electronic). Observations of field related activities that may influence data quality or reported results are similarly recorded.

These documents are part of the quality system. Control of these documents is addressed in the CBAL QAM.

6.1 PTRMS – Data Acceptance Criteria & Qualification

The PTRMS is typically used for real-time continuous measurement activities where the primary objective is to observe temporal variations of compound concentration vs. time, location, or both. To achieve this measurement objective, it is generally less critical to have absolute compound quantification vs. volume of air sample and more important to ensure long term instrument response or response factors of each component.

The general operation of the PTRMS system is discussed in CBAL LAP-150. The appendix of this document contains forms used to document the daily operation of the instrument. These forms are 1) PTRMS Start-up Record, and 2) PTRMS Daily Record for Continuous Measurements. The forms contain information pertinent to the tracking of daily instrument operation and data collection.

Compound 'quantification', particularly in the absence of an authentic gas phase standard, is conveniently performed by using average kinetic reaction coefficients to provide

estimated concentrations. The majority of gas phase ion/molecule reaction rate coefficients range from 1 x 10^{-9} molecule^{-1} cm^3 s^{-1} to 4 x 10^{-9} molecule^{-1} cm^3 s^{-1}. Use of average kinetic data, coupled with other instrumental variations will generally result in estimated absolute compound concentrations within the range of +/-30% of the true value. For many measurements, such as those encountered in this project, this range of precision is adequate, assuming that they are consistent over the long term. Other experiments may require a higher level of precision necessitating the use of authentic standards of known concentrations to prepare calibration curves over a concentration range of interest. For this measurement campaign, it is impractical to secure gas phase standards for every compound that may be encountered.

A Time-of-Flight mass spectrometry system will be used to ensure long term measurement stability to enable the comparison of the relative concentration of each component. In addition to providing response data for every mass at high temporal resolution, the system incorporates an internal reference standard that is measured with each data cycle. This standard is introduced to the gas phase from a permeation tube that is maintained at a constant temperature for all experiments, thus ensuring that there is a constant leak rate into the instrument at all times. The primary purpose of the internal standard is to provide mass scale correction in each data cycle to account for minute variations in instrument parameters such as power supply voltages and temperature changes (may change effective flight path of the ions). The intent is to use this internal standard in a similar fashion that an internal standard is used in GC/MS data; to provide a fixed reference to account for instrument signal variations due to ion source tuning, overall ion transmission variations, and multiplier response variations.

In addition to the instrument's internal standard, daily tune checks will be performed using a multicomponent standard and a zero air or nitrogen source. The multicomponent standard is maintained at a constant concentration over the entire period of the project. It will be introduced at the beginning and end of each data set (estimated at 6 hour blocks). This ensures that all data is properly corrected for minor absolute response variations in the short and long term.

It is expected that long term data variations, after internal and external standard corrections, to vary by no more than +/-5%. A more precise determination of the variation will be provided as part of the final report as data is obtained on the evaluation of the external standard's response vs. the internal standard over the course of the project.

6.2 GC/MS Data Acceptance Criteria & Qualification

The GC/MS data will qualified on a per batch basis by running the BFB tune check, a CCV, an LCS, and method blank with each data set, as specified in the CBAL standard operating procedure LAP-013.03. This level of qualification differs somewhat from normal laboratory protocol but will satisfy the quality control criteria for the project which is to ensure relative comparison of data collected throughout of the project rather than absolute quantification of each measured component.

Acceptance criteria for the qualifying data from the GC/MS sample analysis batches can be found in CBAL LAP-013.03 and is summarized below. Any deviations of data beyond the range of acceptance will be appropriately qualified in the report using descriptive flags.

6.2.1 BFB Tune Check. Meet the criteria specified in Table 3 of EPA Compendium Method TO-15.

Mass	Ion Abundance Criteria
50	8.0 to 40.0 Percent of m/e 95
75	30.0 to 66.0 Percent of m/e 95
95	Base Peak, 100 Percent Relative Abundance
96	5.0 to 9.0 Percent of m/e 95 (See note)
173	Less than 2.0 Percent of m/e 174
174	50.0 to 120.0 Percent of m/e 95
175	4.0 to 9.0 Percent of m/e 174
176	93.0 to 101.0 Percent of m/e 174
177	5.0 to 9.0 Percent of m/e 176

6.2.2 Continuing Calibration Verification. The recovery of each analyte in the CCV should be within +/-30% of the expected value.

6.2.3 Laboratory Control Sample. The recovery of each analyte in the LCS should be within +/-30% of the expected value.

6.2.4 Method Blank. Target analytes from the project based objectives should not be present in the MBLK that exceeds 50% of the reporting limit of the project.

6.3 CO_2 Monitor – Data Acceptance Criteria & Qualification

The absolute CO_2 concentration is of less importance that the ability to measure concentration variations over time. We rely upon the specifications of the instrument from the vendor as the source of data qualification, both absolute and long term. To ensure that the instrument is performing within acceptable limits, an ambient air sample free from a combustion source will be monitored on a weekly basis to track reproducibility. We expect the measured value to be at the currently observed CO_2 atmospheric background of ~380 ppm.

The instrument vendor quotes an accuracy of 1.5% of the true measured value with an RMS noise at 370 ppm with 1 second filtering at less than 1 ppm. The calibration drift is specified as the following; zero drift < 0.15 ppm/^{o}C and span drift < 0.03%/^{o}C.

6.4 Data Storage

The data collected from the various instruments used in this project will initially be stored on the computers that are used to control the individual instruments in the mobile laboratory. Raw data will be subsequently processed on those computer systems or transferred to other systems for offline processing. The transfer process will utilize USB flash drives containing data storage capacity relevant to the data files of interest. All data,

raw and processed will ultimately be transferred and stored on to CBAL's server at their Pasco, WA location. This data is backed up daily according to GEN-067, Rev 4; Computer Backup and Protection. Data is controlled by GEN-059, Rev 04; Data Retention, Disposal, and Archiving and GEN-074, Rev 01; Records Handling.

The physical location of the sampling performed by the mobile laboratory is documented by the GPS system that is part of the weather station. All computer clocks in the ML used for real time data collection are referenced to the same time standard, the 'time-nw.nist.gov' clock. This enables time synchronization of data from multiple computer systems.

Automatic data logging of position is augmented by human observations while monitoring real time responses. The visual observations are recorded into a bound laboratory notebook which becomes part of the permanent record. This data may include descriptors of the physical location, notations of current localized weather conditions and traffic patterns, and observations of various events that may result in vapor emissions or that may influence the instrument response.

6.5 Data Reporting

Data reporting is controlled by SOP GEN-006, Rev 02; Data Preparation, Review, Reporting, and Validation.

GC/MS data will be reported based on concentration of individual components verses the sample collection time. Samples collected in support of the PTRMS measurements will be directly correlated to the specific cycle time of the PTRMS and/or clock time of its data system. Other GC/MS data, such as the supporting data for the aerosol collection campaign, will be reported with identifiers determined by the associated chain-of-custody. The GC/MS data originating from this project is intended only as support and validation of associated project activities such as the PTRMS and aerosol measurement campaigns. The data is not intended for support of any routine ongoing Hanford Site industrial hygiene or environmental sampling and analysis activities.

PTRMS data will generally be reported on the basis of a compound concentration or measured intensity vs. time at a specific geographic location (static source monitoring). In some instances, data may be reported on the basis of a compound concentration vs. geographic location (plume mapping).

CO2 data will be reported on the basis of concentration vs. time at a specific geographic location (static source monitoring). In some instances, data may be reported on the basis of concentration vs. geographic location (plume mapping). All data will be correlated to the PTRMS instrument cycle time or internal clock (data is collected on the same controller used for the PTRMS).

6.6 Personnel Training

Training of personnel on the use of the various instruments in the mobile laboratory is performed by one of three mechanisms; training by individuals with prior experience, direct on-the-job training, and self-guided training by reading operation manuals and hands on experience. Personnel training at CBAL is governed by GEN-072, Rev 03; Initial and Ongoing Training.

7.0 References

Columbia Basin Analytical Laboratory Draft of ASTM procedure for vapor monitoring.

Determination Of Volatile Organic Compounds (VOCs) In Air Collected In Specially-Prepared Canisters And Analyzed By Gas Chromatography/Mass Spectrometry (GC/MS). Compendium of Methods for the Determination of Toxic Organic Compounds in Ambient Air: Method T015, Second Edition, U. S. Environmental Protection Agency, Research Triangle Park, NC, EPA 600/625/R-96/010b, January 1999.

CBAL SOP: LAP-013.03; Analysis of Volatile Organic Compounds by EPA Compendium Method TO-15.

Determination of Volatile Organic Compounds in Ambient Air Using Active Sampling Onto Sorbent Tubes. Compendium of Methods for the Determination of Toxic Organic Compounds in Ambient Air: Method T017, Second Edition, U. S. Environmental Protection Agency, Research Triangle Park, NC, EPA 600/625/R-96/010b, January 1999.

CBAL SOP: LAP-017.02; Determination of VOCs by EPA Method TO-17 Modified.

Ionicon Analytik web site with application of PTRMS; http://www.ionicon.com/information/ptr-ms-applications

Ionicon Analytik web site with publications of PTRMS projects; http://www.ionicon.com/publications

CBAL SOP: LAP-149, Rev 00; Whole air active soil sampling by PTR-MS.

CBAL SOP: LAP-150, Rev 00; Quantification of Volatile Organic Compounds using the Proton Transfer Reaction Mass Spectrometer.

CBAL SOP: GEN-006, Rev 02; Data Preparation, Review, Reporting, and Validation

CBAL SOP: GEN-067, Rev 4; Computer Backup and Protection.

CBAL SOP: GEN-059, Rev 04; Data Retention, Disposal, and Archiving

CBAL SOP: GEN-074, Rev 01; Records Handling.

CBAL SOP: GEN-072, Rev 03; Initial and Ongoing Training.

Final Report of Phase II Activities; Proton Transfer Reaction Mass Spectrometry Monitoring: Hanford Tank Farm Real-Time Monitoring of Volatile Organic Compounds. WRPS 21065-41.

8.0 Materials & Testing Equipment

8.1 Instrument Calibration Standards

Two gas calibration standards may be used in the routine operation of the PTR-MS and GC/MS instruments. Copies of the vendor certification sheets for both standards are provided below:

PTR-MS Calibration and CCV Standard

AIR LIQUIDE Air Liquide America Specialty Gases LLC Scott

CERTIFIED WORKING CLASS

Single-Certified Calibration Standard

6141 EASTON ROAD, BLDG 1, PLUMSTEADVILLE, PA 18949-0310 Phone: 800-331-4953 Fax: 215-766-7226

CERTIFICATE OF ACCURACY: Certified Working Class Calibration Standard

Product Information
Document # : 46583111-001
Item No.: MAF00199-T-30AL
P.O. No.: WO1168

Cylinder Number: ALM048609
Cylinder Size: 30AL
Certification Date: 29Jun2012
Expiration Date: 29Jun2014
Lot Number: PLU0111040

Customer

R J LEE GROUP INC
2715 ST. ANDREWS LOOP
SUITE F
PASCO, WA 99301
US

COPY

CERTIFIED CONCENTRATION

Component Name	Concentration (Moles)		Accuracy (+/-%)
METHANOL	2.09	PPM	5
ACETONITRILE	2.10	PPM	5
ACETONE	2.10	PPM	5
VINYL CHLORIDE	2.10	PPM	5
2-METHYL-1,3-BUTADIENE	2.11	PPM	5
METHYL VINYL KETONE	2.11	PPM	5
2-BUTANONE	2.11	PPM	5
TRICHLOROETHYLENE	2.10	PPM	5
BENZENE	2.11	PPM	5
TOLUENE	2.10	PPM	5
STYRENE	2.11	PPM	5
P-XYLENE	2.12	PPM	5
1,3,5-TRIMETHYLBENZENE	2.10	PPM	5
1,2,3,5-TETRAMETHYLBENZENE	2.10	PPM	5
1,2-DICHLOROETHYLENE (MIXED)	2.10	PPM	5
TETRACHLOROETHYLENE	2.10	PPM	5
NITROGEN		BALANCE	

TRACEABILITY

Traceable To

Scott Reference Standard

APPROVED BY: Walter Sabitus
WALTER SABITUS

DATE: 6/29/12

GC/MS Calibration and CCV Standard

Scott™

Shipped From:
6141 Easton Road
Plumsteadville, PA 18949
Phone: 215-766-8860
Fax: 215-766-7226

CERTIFICATE OF ANALYSIS

R J LEE GROUP INC
R J LEE GROUP INC
2710 N 20th Ave
Pasco, WA 99301-3398
US

Sales Order # : 3798917
P.O. #.: W02622
Item No.: A0909185
Date: 12Jul2016

Cylinder #: ST0000166462
Fill Pressure: 1800 PSIG
CGA: 180

Product Expiration: 13Jul2017
Lot #: 403-474931

Blend Type: CERTIFIED SCOTTY

Component Name	Requested Gas Conc (Moles)	Analysis (Mole)	Accuracy (+ / - %)
1,1,1-TRICHLOROETHANE	1.00 PPM	1.04 PPM	5
1,1,2,2-TETRACHLOROETHANE	1.00 PPM	1.01 PPM	5
1,1,2-TRICHLOROETHANE	1.00 PPM	1.05 PPM	5
1,1,2-TRICHLOROTRIFLUOROETHANE	1.00 PPM	1.07 PPM	5
1,1-DICHLOROETHANE	1.00 PPM	1.03 PPM	5
1,1-DICHLOROETHYLENE	1.00 PPM	1.06 PPM	5
1,2,4-TRICHLOROBENZENE	1.00 PPM	1.05 PPM	5
1,2,4-TRIMETHYLBENZENE	1.00 PPM	1.06 PPM	5
1,2-DIBROMOETHANE	1.00 PPM	1.04 PPM	5
1,2-DICHLOROBENZENE	1.00 PPM	1.05 PPM	5
1,2-DICHLOROETHANE	1.00 PPM	1.04 PPM	5
1,2-DICHLOROPROPANE	1.00 PPM	1.04 PPM	5
1,2-DICHLOROTETRAFLUOROETHANE	1.00 PPM	1.04 PPM	5
1,3,5-TRIMETHYLBENZENE	1.00 PPM	1.04 PPM	5
1,3-BUTADIENE	1.00 PPM	0.96 PPM	5
1,3-DICHLOROBENZENE	1.00 PPM	1.05 PPM	5
1,4-DICHLOROBENZENE	1.00 PPM	1.04 PPM	5
2-PROPANOL	1.00 PPM	1.02 PPM	5
3-CHLORO-1-PROPENE	1.00 PPM	1.02 PPM	5
4-ETHYL TOLUENE	1.00 PPM	0.99 PPM	5
ACETONE	1.00 PPM	0.99 PPM	5
ACROLEIN	1.00 PPM	1.02 PPM	5
BENZENE	1.00 PPM	1.03 PPM	5
BENZYL CHLORIDE	1.00 PPM	1.04 PPM	5
BROMODICHLOROMETHANE	1.00 PPM	1.04 PPM	5
BROMOETHENE	1.00 PPM	1.00 PPM	5
CARBON DISULFIDE	1.00 PPM	1.03 PPM	5
CARBON TETRACHLORIDE	1.00 PPM	1.05 PPM	5
CHLOROBENZENE	1.00 PPM	1.02 PPM	5
CHLORODIBROMOMETHANE	1.00 PPM	1.05 PPM	5
CHLOROFORM	1.00 PPM	1.03 PPM	5
CIS-1,2-DICHLOROETHYLENE	1.00 PPM	1.04 PPM	5
CIS-1,3-DICHLOROPROPENE	1.00 PPM	1.04 PPM	5
CYCLOHEXANE	1.00 PPM	1.03 PPM	5
DICHLORODIFLUOROMETHANE	1.00 PPM	1.01 PPM	5
ETHANOL	1.00 PPM	1.02 PPM	5

AIR LIQUIDE

ETHYL ACETATE	1.00 PPM		1.04 PPM	5
ETHYL CHLORIDE	1.00 PPM		1.02 PPM	5
ETHYLBENZENE	1.00 PPM		1.01 PPM	5
ETHYLENE 1,2 DICHLORO (TRANS)	1.00 PPM		1.04 PPM	5
HEXACHLORO-1,3-BUTADIENE	1.00 PPM		1.06 PPM	5
ISOOCTANE	1.00 PPM		1.03 PPM	5
ISOPROPYL BENZENE	1.00 PPM		1.04 PPM	5
METHACRYLIC ACID METHYL ESTER	1.00 PPM		1.03 PPM	5
METHYL BROMIDE	1.00 PPM		1.00 PPM	5
METHYL CHLORIDE	1.00 PPM		1.02 PPM	5
METHYL ETHYL KETONE	1.00 PPM		1.02 PPM	5
METHYL ISOBUTYL KETONE	1.00 PPM		1.01 PPM	5
METHYL N-BUTYL KETONE	1.00 PPM		1.01 PPM	5
METHYL TRIBROMIDE	1.00 PPM		1.01 PPM	5
METHYLENE CHLORIDE	1.00 PPM		1.04 PPM	5
M-XYLENE	1.00 PPM		1.00 PPM	5
N-BUTANE	1.00 PPM		1.02 PPM	5
N-HEPTANE	1.00 PPM		1.03 PPM	5
N-HEXANE	1.00 PPM		1.01 PPM	5
N-NONANE	1.00 PPM		1.02 PPM	5
N-PENTANE	1.00 PPM		1.00 PPM	5
O-CHLOROTOLUENE	1.00 PPM		1.03 PPM	5
O-XYLENE	1.00 PPM		1.03 PPM	5
P-DIOXANE	1.00 PPM		1.05 PPM	5
PROPYL BENZENE	1.00 PPM		1.03 PPM	5
PROPYLENE	1.00 PPM		1.01 PPM	5
P-XYLENE	1.00 PPM		1.00 PPM	5
STYRENE	1.00 PPM		1.04 PPM	5
TERT-BUTYL METHYL ETHER	1.00 PPM		1.05 PPM	5
TERTIARY BUTANOL	1.00 PPM		1.03 PPM	5
TETRACHLOROETHYLENE	1.00 PPM		1.04 PPM	5
TETRAHYDROFURAN	1.00 PPM		1.05 PPM	5
TOLUENE	1.00 PPM		1.02 PPM	5
TRANS-1,3-DICHLOROPROPENE	1.00 PPM		1.04 PPM	5
TRICHLOROETHYLENE	1.00 PPM		1.03 PPM	5
TRICHLOROFLUOROMETHANE	1.00 PPM		1.02 PPM	5
VINYL ACETATE	1.00 PPM		0.97 PPM	5
VINYL CHLORIDE	1.00 PPM		1.02 PPM	5
NITROGEN	BALANCE		BALANCE	

SPECIFICATIONS

Component Name	Requested Concentration (Mole)	Gravimetric Concentration (Mole)	Analyzed Concentration (Mole)	Blend Tolerance Result (+/- %)	Blend Process Accuracy Result (+/- %)	Analytical Accuracy Result (+/- %)	Interlocking Result (+/- %)
1,1,1-TRICHLOROETHANE	1.000 PPM	N/A PPM	1.04 PPM	4.00	N/A	5.00	N/A
1,1,2,2-TETRACHLOROETHANE	1.000 PPM	N/A PPM	1.01 PPM	1.00	N/A	5.00	N/A
1,1,2-TRICHLOROETHANE	1.000 PPM	N/A PPM	1.05 PPM	5.00	N/A	5.00	N/A
1,1,2-TRICHLOROTRIFLUOROETHANE	1.000 PPM	N/A PPM	1.07 PPM	7.00	N/A	5.00	N/A
1,1-DICHLOROETHANE	1.000 PPM	N/A PPM	1.03 PPM	3.00	N/A	5.00	N/A
1,1-DICHLOROETHYLENE	1.000 PPM	N/A PPM	1.06 PPM	6.00	N/A	5.00	N/A
1,2,4-TRICHLOROBENZENE	1.000 PPM	N/A PPM	1.05 PPM	5.00	N/A	5.00	N/A
1,2,4-TRIMETHYLBENZENE	1.000 PPM	N/A PPM	1.06 PPM	6.00	N/A	5.00	N/A
1,2-DIBROMOETHANE	1.000 PPM	N/A PPM	1.04 PPM	4.00	N/A	5.00	N/A
1,2-DICHLOROBENZENE	1.000 PPM	N/A PPM	1.05 PPM	5.00	N/A	5.00	N/A

1,2-DICHLOROETHANE	1.000 PPM	N/A PPM	1.04 PPM	4.00	N/A	5.00	N/A
1,2-DICHLOROPROPANE	1.000 PPM	N/A PPM	1.04 PPM	4.00	N/A	5.00	N/A
1,2-DICHLOROTETRAFLUOROETHANE	1.000 PPM	N/A PPM	1.04 PPM	4.00	N/A	5.00	N/A
1,3,5-TRIMETHYLBENZENE	1.000 PPM	N/A PPM	1.04 PPM	4.00	N/A	5.00	N/A
1,3-BUTADIENE	1.000 PPM	N/A PPM	0.96 PPM	4.00	N/A	5.00	N/A
1,3-DICHLOROBENZENE	1.000 PPM	N/A PPM	1.05 PPM	5.00	N/A	5.00	N/A
1,4-DICHLOROBENZENE	1.000 PPM	N/A PPM	1.04 PPM	4.00	N/A	5.00	N/A
2-PROPANOL	1.000 PPM	N/A PPM	1.02 PPM	2.00	N/A	5.00	N/A
3-CHLORO-1-PROPENE	1.000 PPM	N/A PPM	1.02 PPM	2.00	N/A	5.00	N/A
4-ETHYL TOLUENE	1.000 PPM	N/A PPM	0.99 PPM	1.00	N/A	5.00	N/A
ACETONE	1.000 PPM	N/A PPM	0.99 PPM	1.00	N/A	5.00	N/A
ACROLEIN	1.000 PPM	N/A PPM	1.02 PPM	2.00	N/A	5.00	N/A
BENZENE	1.000 PPM	N/A PPM	1.03 PPM	3.00	N/A	5.00	N/A
BENZYL CHLORIDE	1.000 PPM	N/A PPM	1.04 PPM	4.00	N/A	5.00	N/A
BROMODICHLOROMETHANE	1.000 PPM	N/A PPM	1.04 PPM	4.00	N/A	5.00	N/A
BROMOETHENE	1.000 PPM	N/A PPM	1.00 PPM	0.00	N/A	5.00	N/A
CARBON DISULFIDE	1.000 PPM	N/A PPM	1.03 PPM	3.00	N/A	5.00	N/A
CARBON TETRACHLORIDE	1.000 PPM	N/A PPM	1.05 PPM	5.00	N/A	5.00	N/A
CHLOROBENZENE	1.000 PPM	N/A PPM	1.02 PPM	2.00	N/A	5.00	N/A
CHLORODIBROMOMETHANE	1.000 PPM	N/A PPM	1.05 PPM	5.00	N/A	5.00	N/A
CHLOROFORM	1.000 PPM	N/A PPM	1.03 PPM	3.00	N/A	5.00	N/A
CIS-1,2-DICHLOROETHYLENE	1.000 PPM	N/A PPM	1.04 PPM	4.00	N/A	5.00	N/A
CIS-1,3-DICHLOROPROPENE	1.000 PPM	N/A PPM	1.04 PPM	4.00	N/A	5.00	N/A
CYCLOHEXANE	1.000 PPM	N/A PPM	1.03 PPM	3.00	N/A	5.00	N/A
DICHLORODIFLUOROMETHANE	1.000 PPM	N/A PPM	1.01 PPM	1.00	N/A	5.00	N/A
ETHANOL	1.000 PPM	N/A PPM	1.02 PPM	2.00	N/A	5.00	N/A
ETHYL ACETATE	1.000 PPM	N/A PPM	1.04 PPM	4.00	N/A	5.00	N/A
ETHYL CHLORIDE	1.000 PPM	N/A PPM	1.02 PPM	2.00	N/A	5.00	N/A
ETHYLBENZENE	1.000 PPM	N/A PPM	1.01 PPM	1.00	N/A	5.00	N/A
ETHYLENE 1,2 DICHLORO (TRANS)	1.000 PPM	N/A PPM	1.04 PPM	4.00	N/A	5.00	N/A
HEXACHLORO-1,3-BUTADIENE	1.000 PPM	N/A PPM	1.06 PPM	6.00	N/A	5.00	N/A
ISOOCTANE	1.000 PPM	N/A PPM	1.03 PPM	3.00	N/A	5.00	N/A
ISOPROPYL BENZENE	1.000 PPM	N/A PPM	1.04 PPM	4.00	N/A	5.00	N/A
METHACRYLIC ACID METHYL ESTER	1.000 PPM	N/A PPM	1.03 PPM	3.00	N/A	5.00	N/A
METHYL BROMIDE	1.000 PPM	N/A PPM	1.00 PPM	0.00	N/A	5.00	N/A
METHYL CHLORIDE	1.000 PPM	N/A PPM	1.02 PPM	2.00	N/A	5.00	N/A
METHYL ETHYL KETONE	1.000 PPM	N/A PPM	1.02 PPM	2.00	N/A	5.00	N/A
METHYL ISOBUTYL KETONE	1.000 PPM	N/A PPM	1.01 PPM	1.00	N/A	5.00	N/A
METHYL N-BUTYL KETONE	1.000 PPM	N/A PPM	1.01 PPM	1.00	N/A	5.00	N/A
METHYL TRIBROMIDE	1.000 PPM	N/A PPM	1.01 PPM	1.00	N/A	5.00	N/A
METHYLENE CHLORIDE	1.000 PPM	N/A PPM	1.04 PPM	4.00	N/A	5.00	N/A
M-XYLENE	1.000 PPM	N/A PPM	1.00 PPM	0.00	N/A	5.00	N/A
N-BUTANE	1.000 PPM	N/A PPM	1.02 PPM	2.00	N/A	5.00	N/A
N-HEPTANE	1.000 PPM	N/A PPM	1.03 PPM	3.00	N/A	5.00	N/A
N-HEXANE	1.000 PPM	N/A PPM	1.01 PPM	1.00	N/A	5.00	N/A
N-NONANE	1.000 PPM	N/A PPM	1.02 PPM	2.00	N/A	5.00	N/A
N-PENTANE	1.000 PPM	N/A PPM	1.00 PPM	0.00	N/A	5.00	N/A
O-CHLOROTOLUENE	1.000 PPM	N/A PPM	1.03 PPM	3.00	N/A	5.00	N/A
O-XYLENE	1.000 PPM	N/A PPM	1.03 PPM	3.00	N/A	5.00	N/A
P-DIOXANE	1.000 PPM	N/A PPM	1.05 PPM	5.00	N/A	5.00	N/A
PROPYL BENZENE	1.000 PPM	N/A PPM	1.03 PPM	3.00	N/A	5.00	N/A
PROPYLENE	1.000 PPM	N/A PPM	1.01 PPM	1.00	N/A	5.00	N/A

P-XYLENE	1.000 PPM	N/A PPM	1.00 PPM	0.00	N/A	5.00	N/A
STYRENE	1.000 PPM	N/A PPM	1.04 PPM	4.00	N/A	5.00	N/A
TERT-BUTYL METHYL ETHER	1.000 PPM	N/A PPM	1.05 PPM	5.00	N/A	5.00	N/A
TERTIARY BUTANOL	1.000 PPM	N/A PPM	1.03 PPM	3.00	N/A	5.00	N/A
TETRACHLOROETHYLENE	1.000 PPM	N/A PPM	1.04 PPM	4.00	N/A	5.00	N/A
TETRAHYDROFURAN	1.000 PPM	N/A PPM	1.05 PPM	5.00	N/A	5.00	N/A
TOLUENE	1.000 PPM	N/A PPM	1.02 PPM	2.00	N/A	5.00	N/A
TRANS-1,3-DICHLOROPROPENE	1.000 PPM	N/A PPM	1.04 PPM	4.00	N/A	5.00	N/A
TRICHLOROETHYLENE	1.000 PPM	N/A PPM	1.03 PPM	3.00	N/A	5.00	N/A
TRICHLOROFLUOROMETHANE	1.000 PPM	N/A PPM	1.02 PPM	2.00	N/A	5.00	N/A
VINYL ACETATE	1.000 PPM	N/A PPM	0.97 PPM	3.00	N/A	5.00	N/A
VINYL CHLORIDE	1.000 PPM	N/A PPM	1.02 PPM	2.00	N/A	5.00	N/A

Instrumentation

Instrument/Model/Serial#	Last Date Calibrated	Analytical Principle
AGILENT 7890A GC-MS -- S/N CN10813101	07/11/2016	GC-MS

APPROVED BY: COLIN MCCARTY

DATE: 12Jul2016

8.2 Liquid Calibration Unit

A liquid calibration unit, manufactured by Ionicon, is used for the routine calibration and continuing calibration verifications of the PTR-MS system. It is used for both liquid and gas standards. Details of the certification of this device are shown below:

IONICON

Inspection and Quality Certificate

IONICON Analytik GmbH

Type: LCU-a
S/N: 16-A03-La-029

Date: 3/31/2016

IONICON ANALYTIK
Gesellschaft mbH
Eduard-Bodem-Gasse 3
6020 Innsbruck, Austria
Tel.: +43 (0) 512 214 800
Fax: +43 (0) 512 214 800-099
office@ionicon.com
www.IONICON.com

Customer: RJ Lee
With PTR-MS: -

LIQUID CALIBRATION UNIT

IONICON

LCU Tests

Software	Installed	Tested
Software	ok	ok

Inlet Leaktest	Passed
Gas Inlet 1	ok
Gas Inlet 2	ok

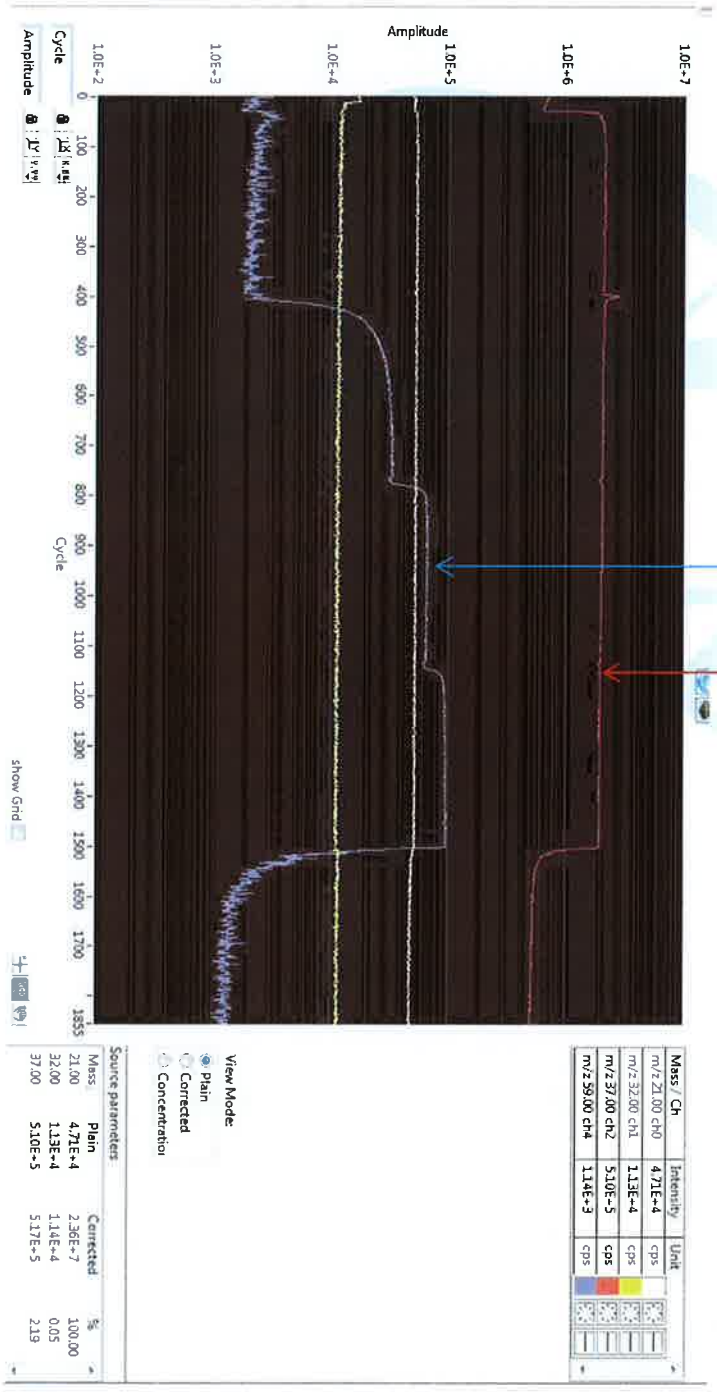
Heating	Set (°C)	Reached
Spray Chamber	110	ok
Hose	100	ok

MFC Test	Set (sccm)	Act. MFC (sccm)	Measured DryCal (sccm)	Meas. error	Acceptance Range (sccm)
Gas Flow Nebulizer	500	500	505	±10	494 ... 506
SN: M15214005U	250	250	251	±2.5	247 ... 253
Gas Flow Std. Gas	100	100	99,8	±1	99.4 ... 100.6
SN: M15213940C	20	20	20,0	±0.2	19.8 ... 20.2

aLFC Test	Serial Number	Checked	Emptied (pump air)
aLFC 1	16-05(050)		ok
aLFC 2	16-06(051)		ok
Spare pump	---	ok	ok

IONICON

Calibration test



Test	Passed
Humidity	ok
VOC	ok

- Calibration sequence with aqueous acetone standard
- LCU-a only: maintain constant humidity

IONICON

aLFC 1
Test Report

IONICON Analytik GmbH

Type: aLFC-50
S/N: 16-05(050)

Set (µl/min)	Measured (µl/min)	Meas. error	Acceptance range (µl/min)	Power <60%
50	51,3	±1.5	49.0 ... 51.0	43%
10	10,2	±0.5	9.8 ... 10.2	--

IONICON

aLFC 2
Test Report

IONICON Analytik GmbH

Type: aLFC-50
S/N: 16-06(051)

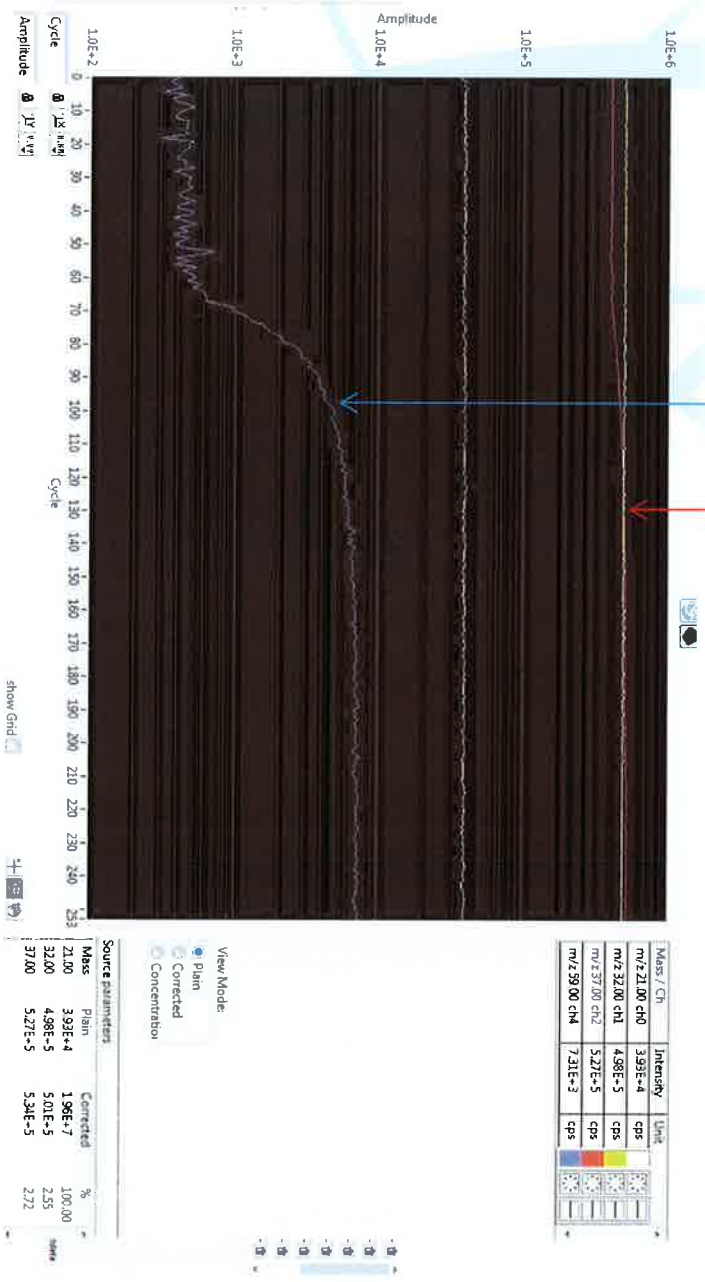
Set (µl/min)	Measured (µl/min)	Meas. error	Acceptance range (µl/min)	Power <60%
50	50,8	±1.5	49.0 ... 51.0	44%
10	10,1	±0.5	9.8 ... 10.2	--

3/31/2016 5

IONICON

HPZAG Test Report

Type: HPZAG
S/N: 16-A03-ZAG-008



Test	Passed
Humidity	ok
VOC	ok

Compare:

- HPZAG zero-air
  - VOC low
  - Humidity constant
- Room-air
  - VOC high

8.3 Flow Meters and Pressure Transducers

A variety of flow meters and pressure transducers may be used in the operation of the mobile laboratory. Some of these devices may be critical for system's operation where an accurate value of a measurement is required. Others may only be needed for the determination of a relative value. Certification data is provided below for all devices used in measurements where an accurate result is required for a parameter that is important for final data evaluation.

MesaLab Defender 520 Digital Flow Meter.

MesaLabs

NVLAP Lab Code 200661-0

Calibration Certificate

CertificateNo.	88679	**Sold To:**	RJ Lee Group
Product	200-520M Defender 520 Medium Flow		2710 North 20th Avenue
Serial No.	134085		Pasco, WA 99301
Cal. Date	15-Apr-2016		US

All calibrations are performed at Mesa Laboratories, Inc., 10 Park Place, Butler, NJ, 07405, an ISO 17025:2005 accredited laboratory through NVLAP of NIST. This report shall not be reproduced except in full without the written approval of the laboratory. Results only relate to the items calibrated. This report must not be used to claim product certification, approval, or endorsement by NVLAP, NIST, or any agency of the Federal Government.

As Received Calibration Data

Technician Sonia Otero

Lab. Pressure 762 mmHg
Lab. Temperature 21.6 °C

Instrument Reading	Lab Standard Reading	Deviation	Allowable Deviation	As Received
4507.4 ccm	4506.5 ccm	0.02%	1.00%	In Tolerance
1009.5 ccm	1009.15 ccm	0.03%	1.00%	In Tolerance
251.67 ccm	251.335 ccm	0.13%	1.00%	In tolerance
20.8 °C	21.3 °C	-	± 0.8°C	In Tolerance
762 mmHg	762 mmHg	-	± 3.5 mmHg	In Tolerance

Mesa Laboratories Standards Used

Description	Standard Serial Number	Calibration Date	Calibration Due Date
ML 500-24	113774	16-Apr-2015	15-Apr-2016
Percision Thermometer	305460	22-Sep-2015	21-Sep-2016
Precision Barometer	431/98-07	03-Jun-2015	02-Jun-2016

MesaLabs

NVLAP

NVLAP Lab Code 200661-0

As Shipped Calibration Data

Certificate No	88679	**Lab. Pressure**	762 mmHg
Technician	Sonia Otero	**Lab. Temperature**	21.6 °C

Instrument Reading	Lab Standard Reading	Deviation	Allowable Deviation	As Shipped
4509.1 ccm	4504.95 ccm	0.09%	1.00%	In Tolerance
1005.2 ccm	1007.5 ccm	-0.23%	1.00%	In Tolerance
250.45 ccm	250.82 ccm	-0.15%	1.00%	In Tolerance
21.5 °C	21.5 °C	-	± 0.8°C	In Tolerance
762 mmHg	762 mmHg	-	± 3.5 mmHg	In Tolerance

Mesa Laboratories Standards Used

Description	Standard Serial Number	Calibration Date	Calibration Due Date
ML-500-24	113774	16-Apr-2015	15-Apr-2016
Percision Thermometer	305460	22-Sep-2015	21-Sep-2016
Precision Barometer	431/98-07	03-Jun-2015	02-Jun-2016

Calibration Notes

The expanded uncertainty of flow, temperature, and pressure measurements all have a coverage factor of k = 2 for a confidence interval of approximately 95%.

Flow testing is in accordance with our test number PR18-13 with an expanded uncertainty of 0.27% using high-purity nitrogen or filtered laboratory air.

Pressure testing is in accordance with our test number PR18-11 with an expanded uncertainty of 0.16 mmHg.

Temperature testing is in accordance with our test number PR18-12 with an expanded uncertainty of 0.04 °C.

Traceability to the International System of Units (SI) is verified by accreditation to ISO/IEC 17025 by NVLAP under NVLAP Code 200661-0.

Technician Notes:

Louis Guido, Chief Metrologist

APPENDIX B

INITIAL FOUR PBI WEEKS

This appendix displays all the data via graphs of each COPC compound of the vapor data collecting campaign involved in the first four weeks of the PBI, structured to be shown by each day per week. These weeks include the following:

- Section B.1 – Week 1
  - Section B.1.1 – May 18th 2016 Data Collection
  - Section B.1.2 – May 20st 2016 Data Collection
  - Section B.1.3 – May 22nd 2016 Data Collection
  - Section B.1.4 – May 23rd 2016 Data Collection

- Section B.2 – Week 2
  - Section B.2.1 – June 27th 2016 Data Collection
  - Section B.2.2 – June 28th 2016 Data Collection
  - Section B.2.3 – June 29th 2016 Data Collection
  - Section B.2.4 – June 30th 2016 Data Collection

- Section B.3 – Week 3
  - Section B.3.1 – July 5th 2016 Data Collection
  - Section B.3.2 – July 6th 2016 Data Collection
  - Section B.3.3 – July 7th 2016 Data Collection
  - Section B.3.4 – July 11th 2016 Data Collection

- Section B.4 – Week 4
  - Section B.4.1 – July 12th 2016 Data Collection
  - Section B.4.2 – July 13th 2016 Data Collection
  - Section B.4.3 – July 14th 2016 Data Collection
  - Section B.4.4 – July 18th 2016 Data Collection

B.1 WEEK 1

Week 1 started the data collection campaign. As stated above, each day has its own section within this appendix.

B.1.1 May 18th Data Collection

May 18th data collection started at 8:16 AM and ended at 12:53 PM. Data collection methods included both mobile and stationary lab techniques. Below are the graphs presented in order based on the Chemicals of Potential Concern (COPC) list.

Figure B.1.1-1. May 18th - Formaldehyde (TOP), Methanol (MIDDLE), Acetonitrile (BOTTOM)

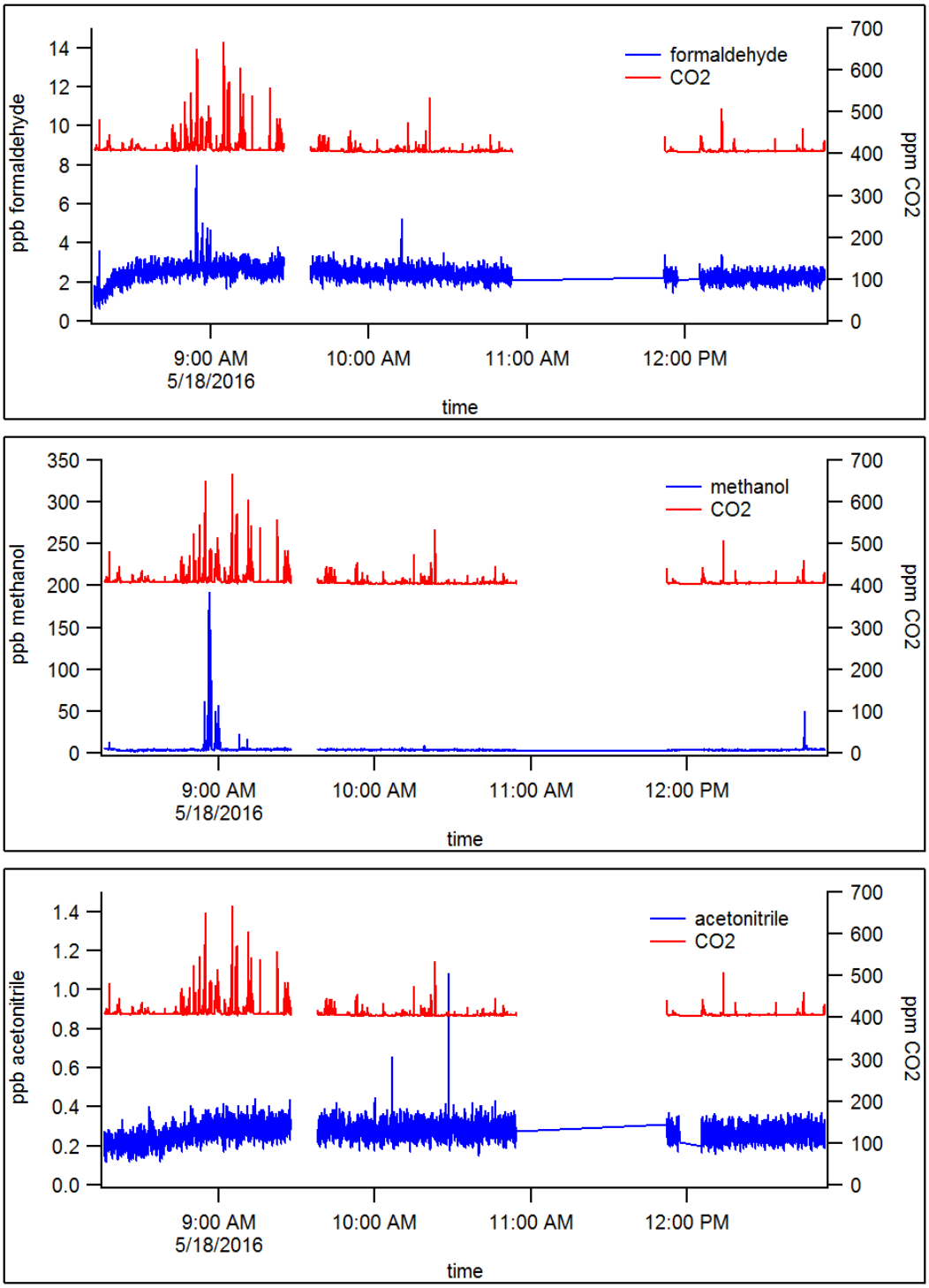


Figure B.1.1-2. May 18th – Acetaldehyde (TOP), Ethylamine (MIDDLE), 1,3-Butadiene (BOTTOM)

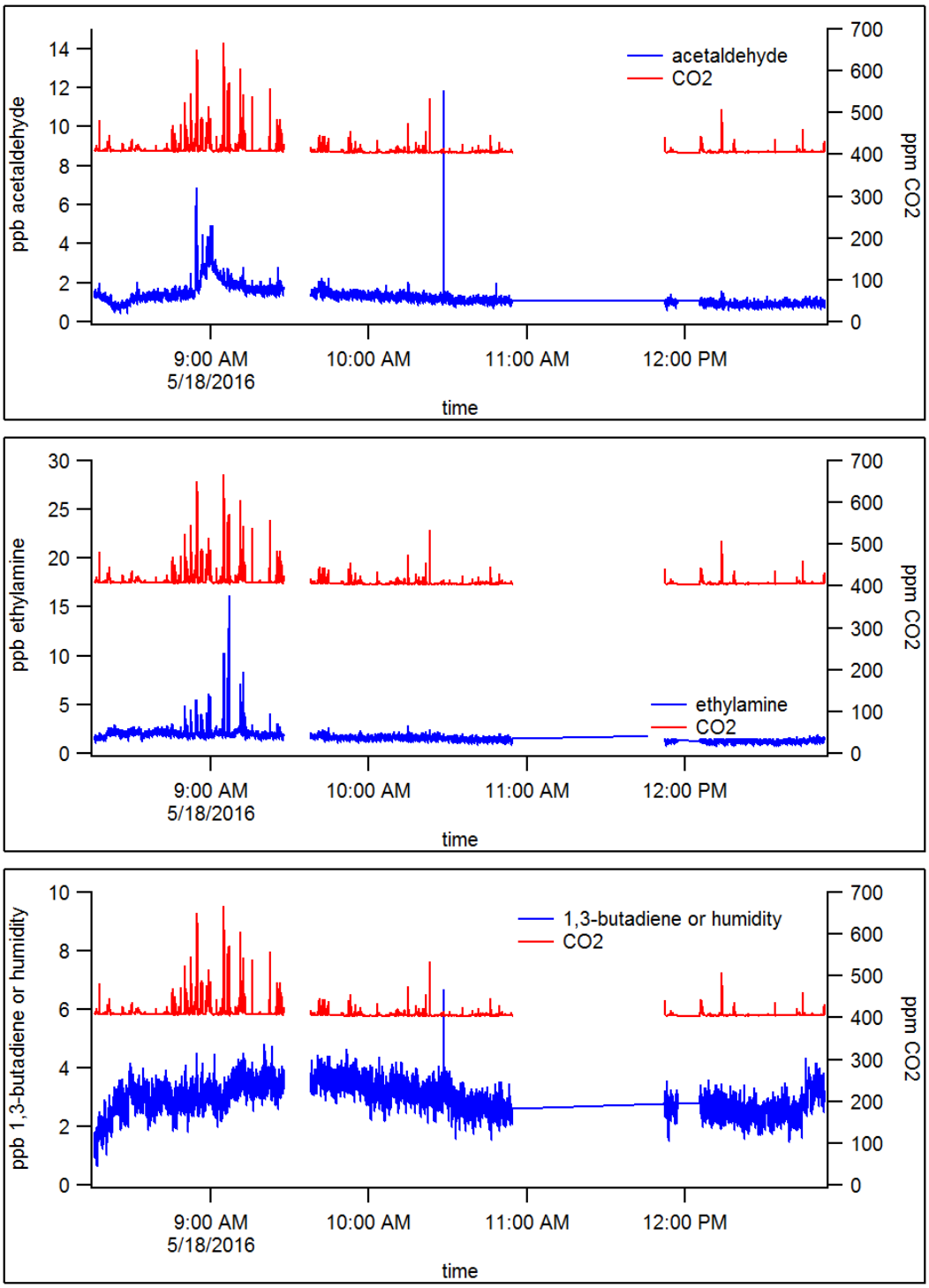


Figure B.1.1-3. May 18th - Propanenitrile (TOP), 1-Butanol; Butenes (MIDDLE), Methyl Isocyanate (BOTTOM)

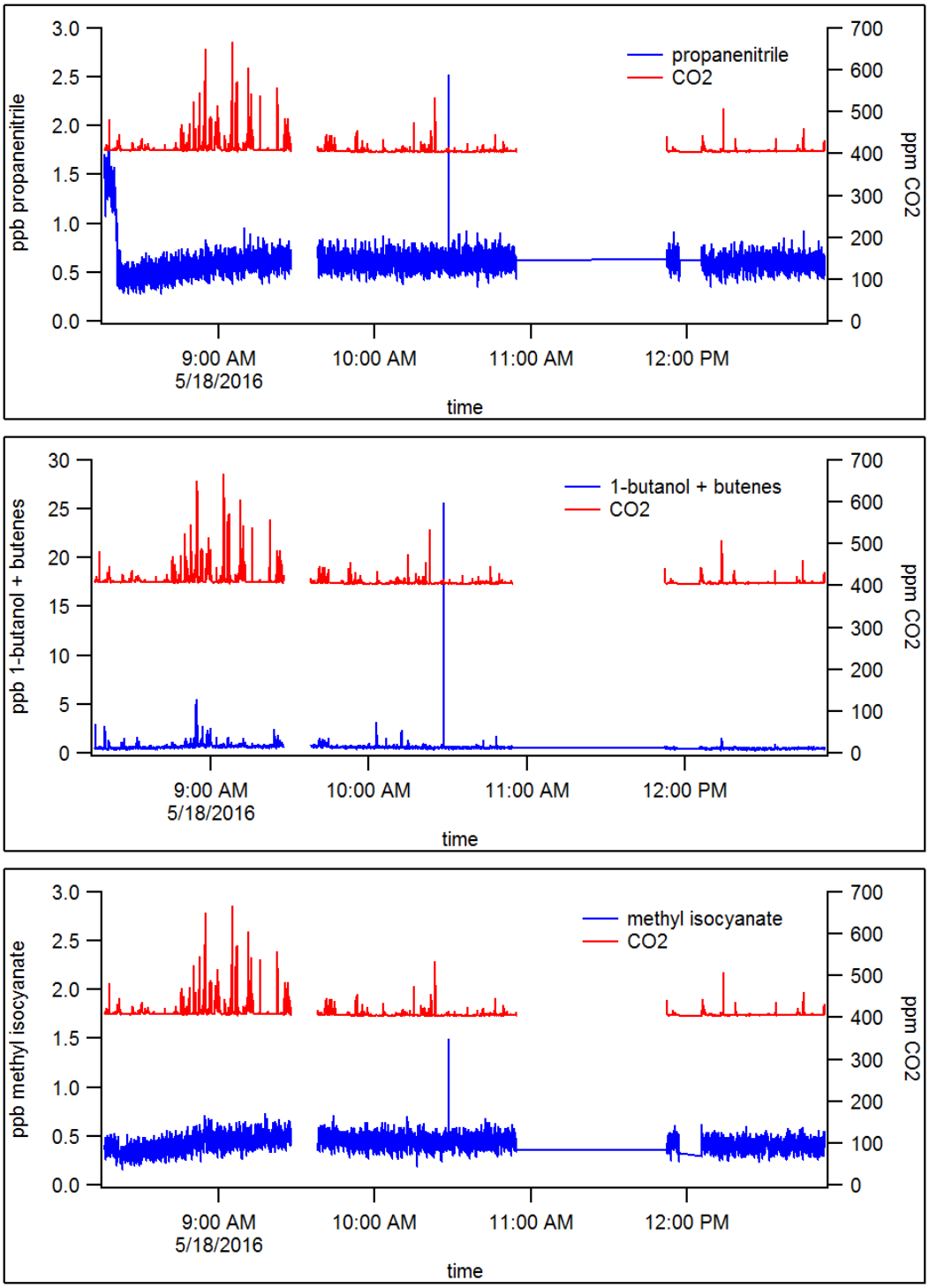


Figure B.1.1-4. May 18th - Methyl Nitrite (TOP), Furan; Isoprene (MIDDLE), Butanenitrile (BOTTOM)

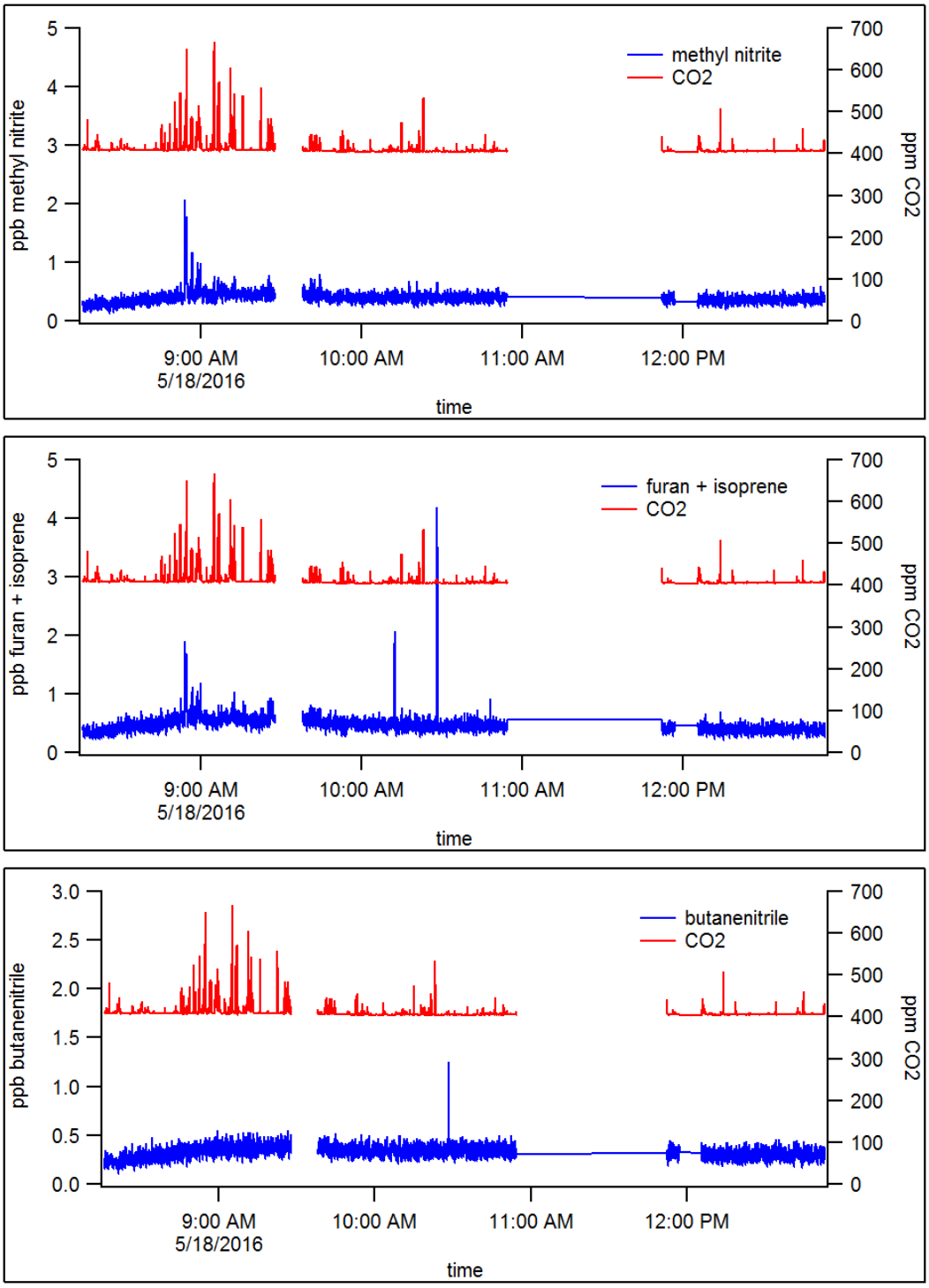


Figure B.1.1-5. May 18th - MVK + Dihydrofurans(TOP), Butanal (MIDDLE), N-nitrosodimethylamine [NDMA] (BOTTOM)

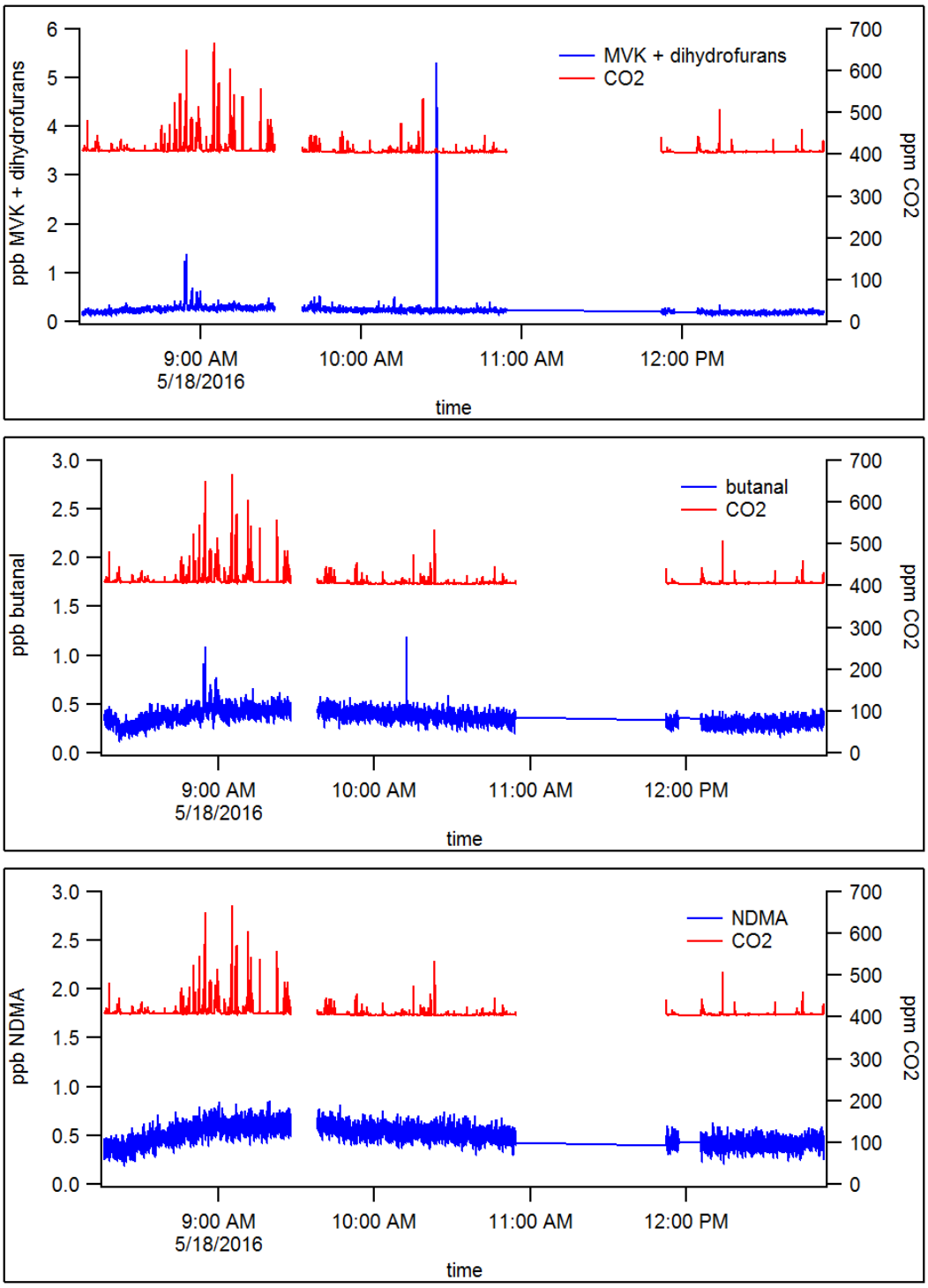


Figure B.1.1-6. May 18th - Benzene (TOP), 2,4-Pentadienenitrile; Pyridine (MIDDLE), 2-methylene Butanenitrile (BOTTOM)

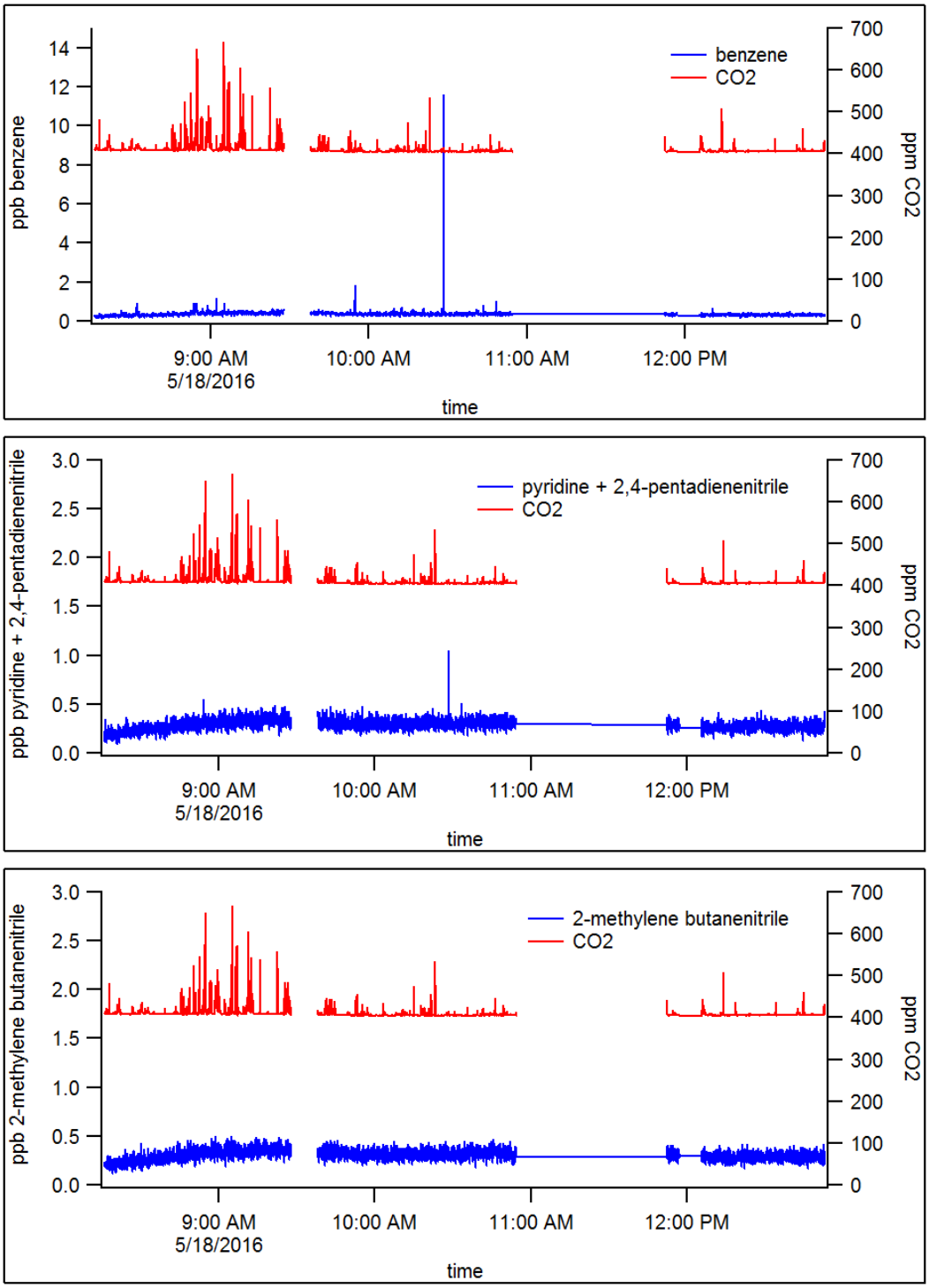


Figure B.1.1-7. May 18th - 2-methylfuran (TOP), Pentanenitrile (MIDDLE), 3-methyl-3-buten-2-one; 2-methyl-2-butenal (BOTTOM)

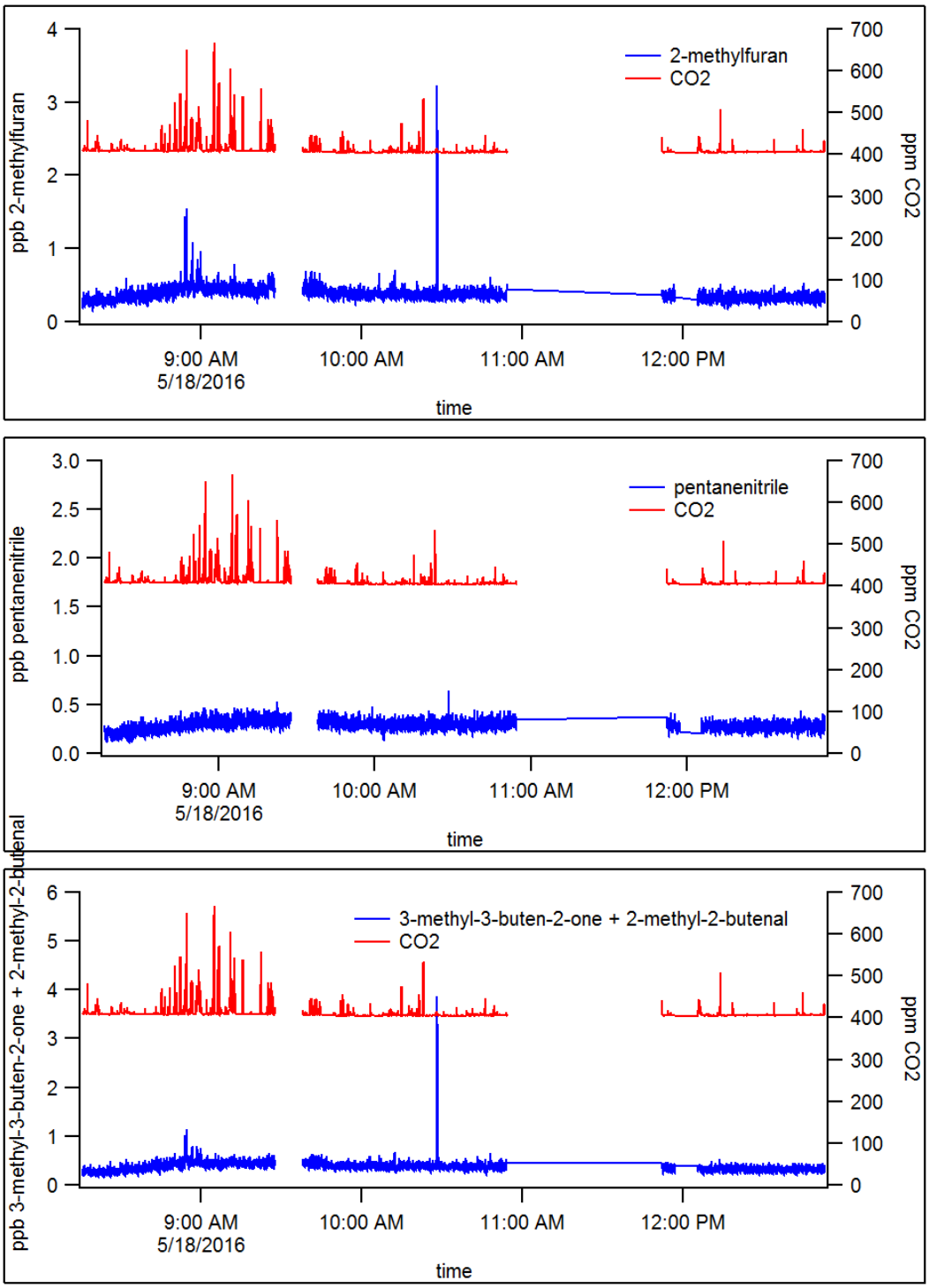


Figure B.1.1-8. May 18th - N-nitrosomethylethylamine [NEMA] (TOP), 2,5-dimethylfuran (MIDDLE), Hexanenitrile (BOTTOM)

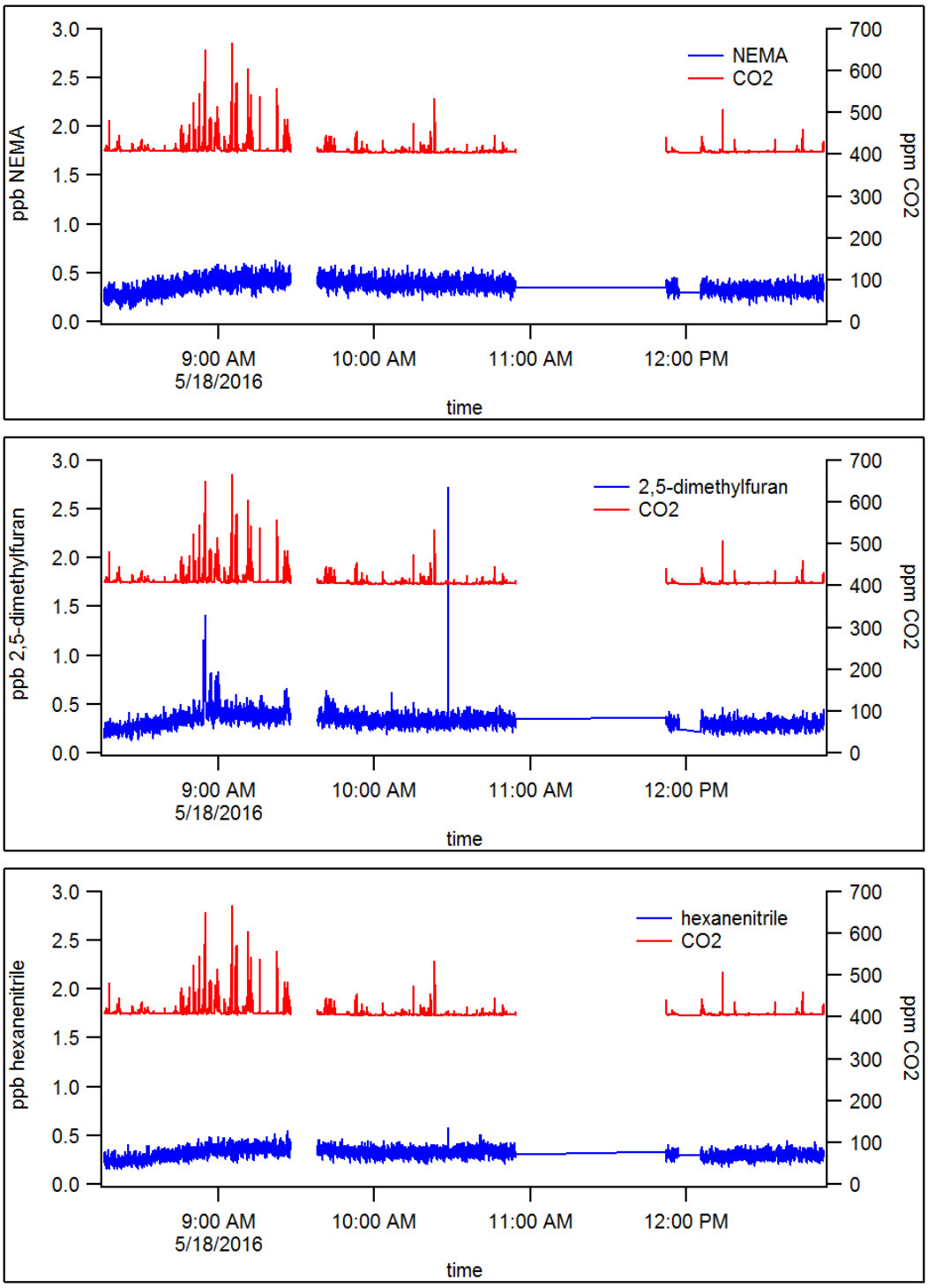


Figure B.1.1-9. May 18th - 2-hexanone [MBK] (TOP), N-nitrosodiethylamine [NDEA] (MIDDLE), Butyl Nitrite; 2-nitro-2-methylpropane (BOTTOM)

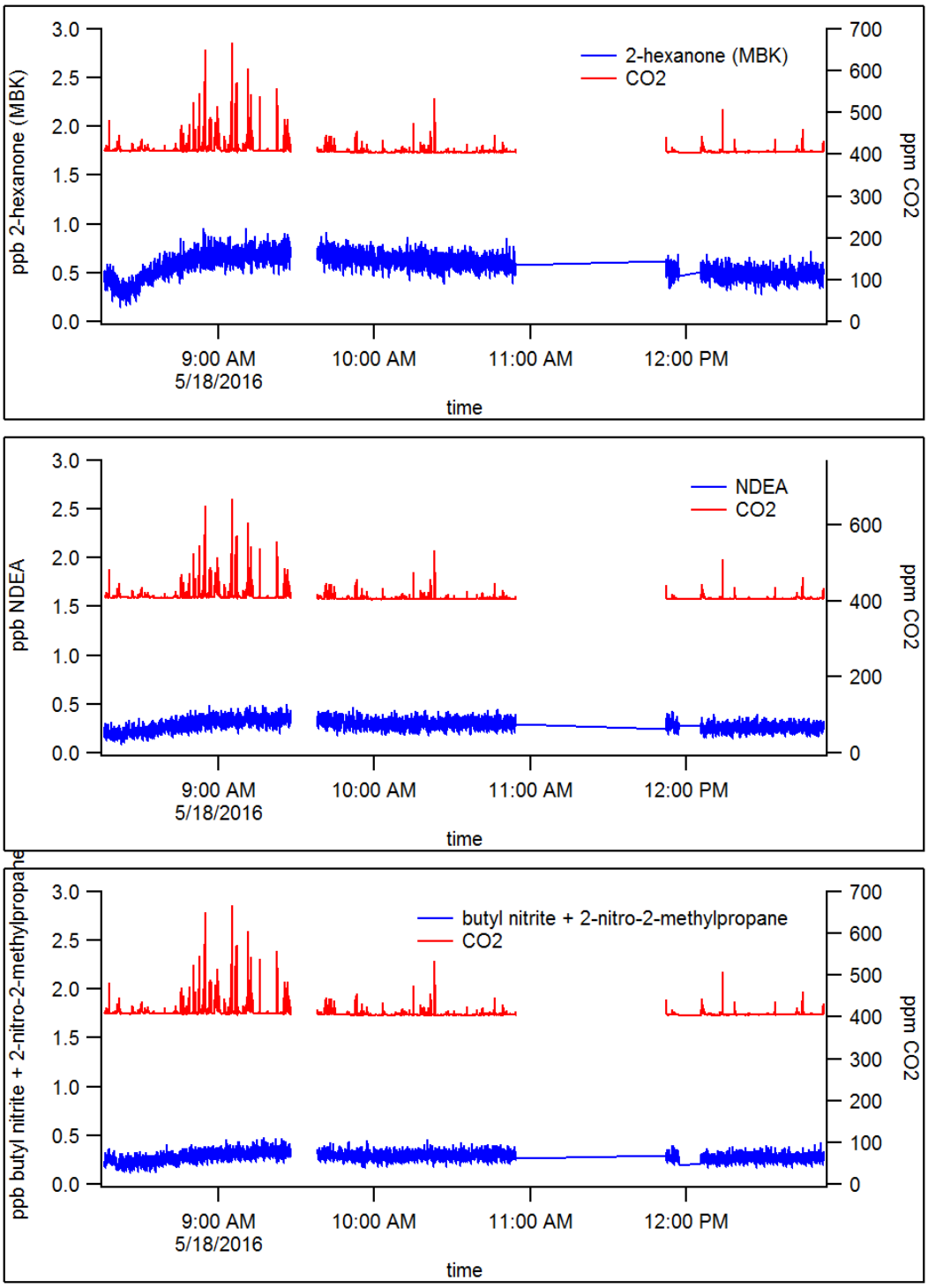


Figure B.1.1-10. May 18th - 2,4-dimethylpyridine (TOP), 2-ethyl-5-methylfuran (MIDDLE), Heptanenitrile (BOTTOM)

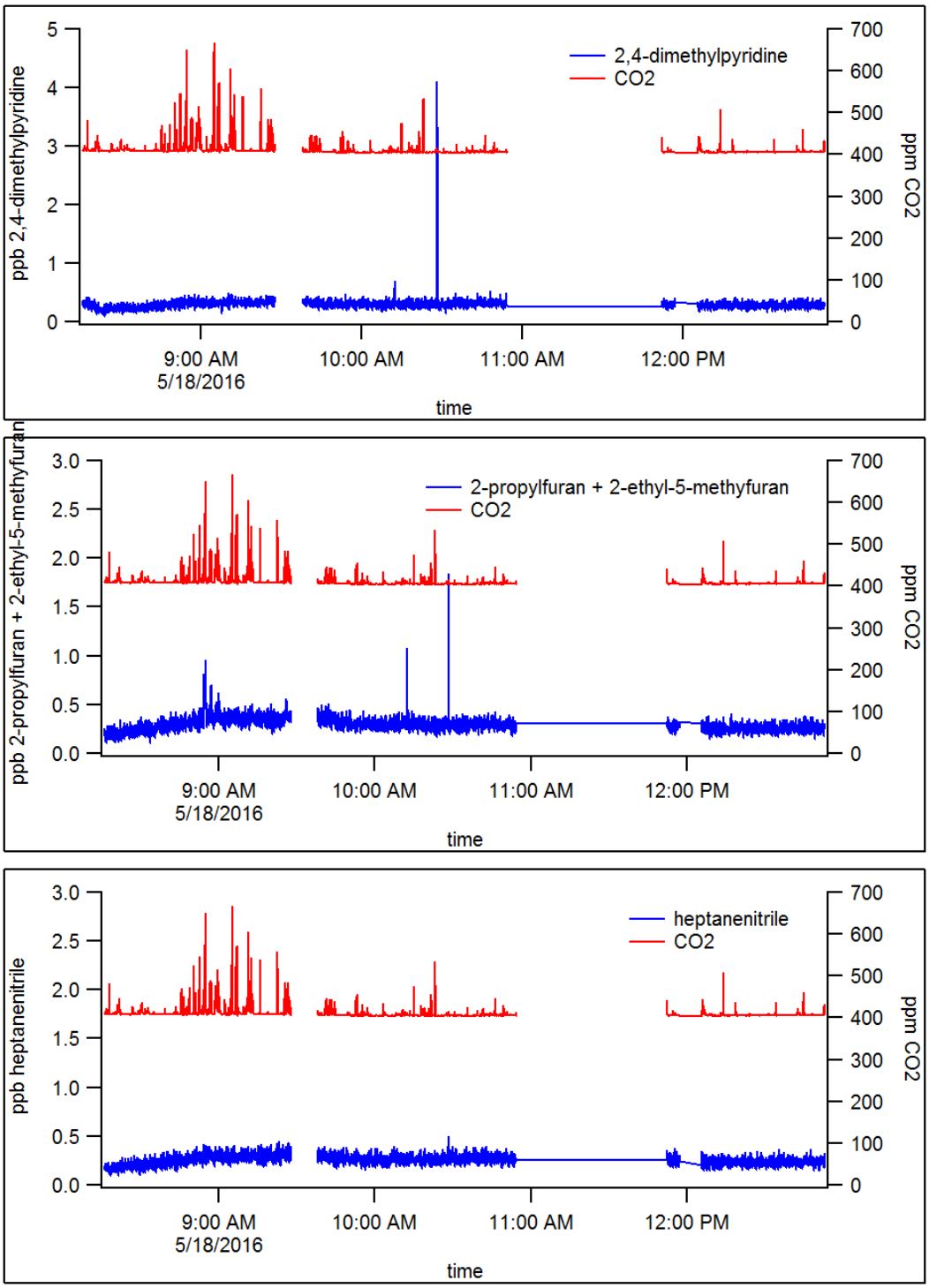


Figure B.1.1-11. May 18th - 4-methyl-2-hexanone (TOP), N-nitrosomorpholine [NMOR] (MIDDLE), Butyl Nitrate (BOTTOM)

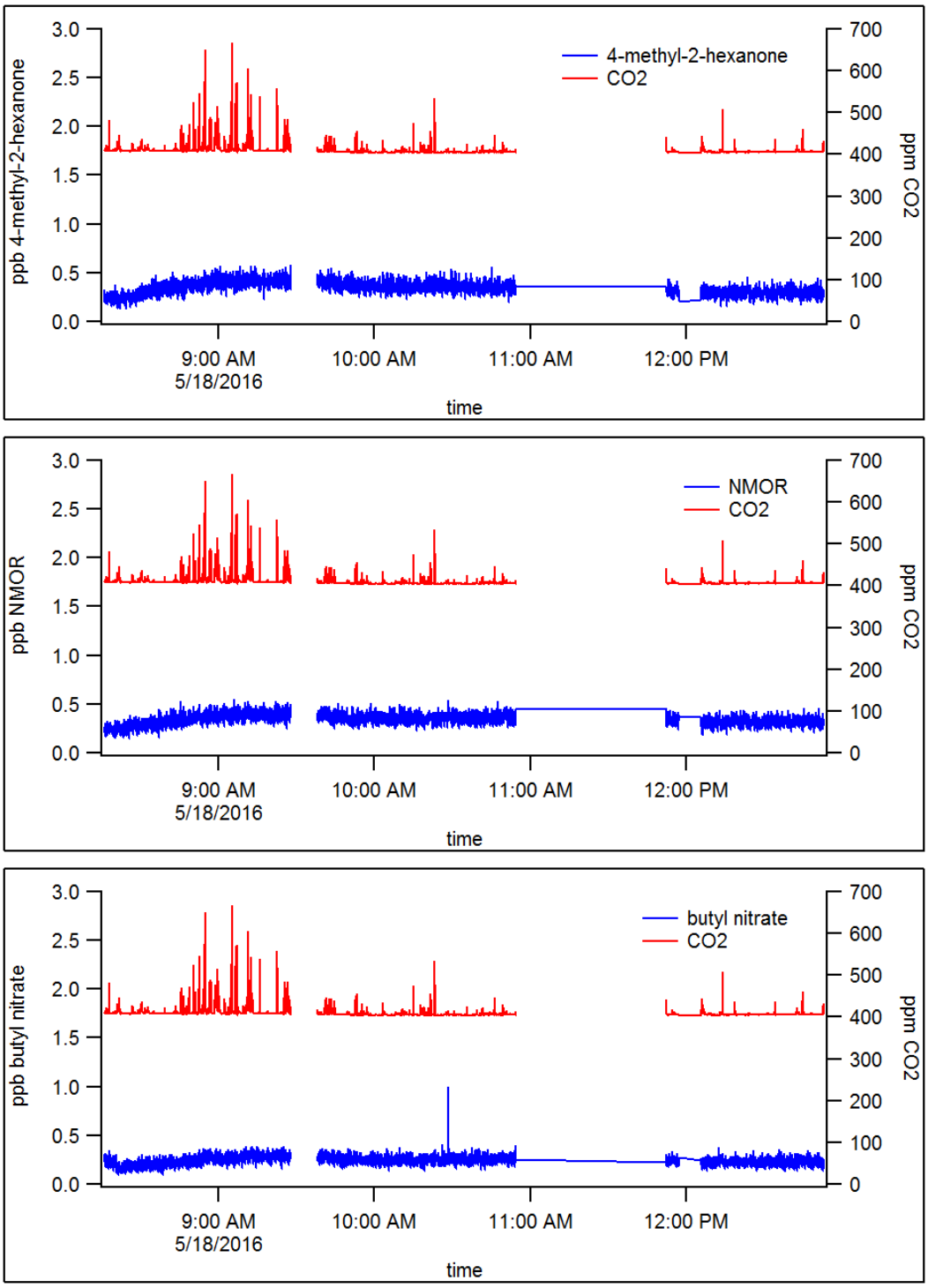


Figure B.1.1-12. May 18th - Multiple Furans [m/z 127] (TOP), 6-methyl-2-heptanone (MIDDLE), 2-pentylfuran (BOTTOM)

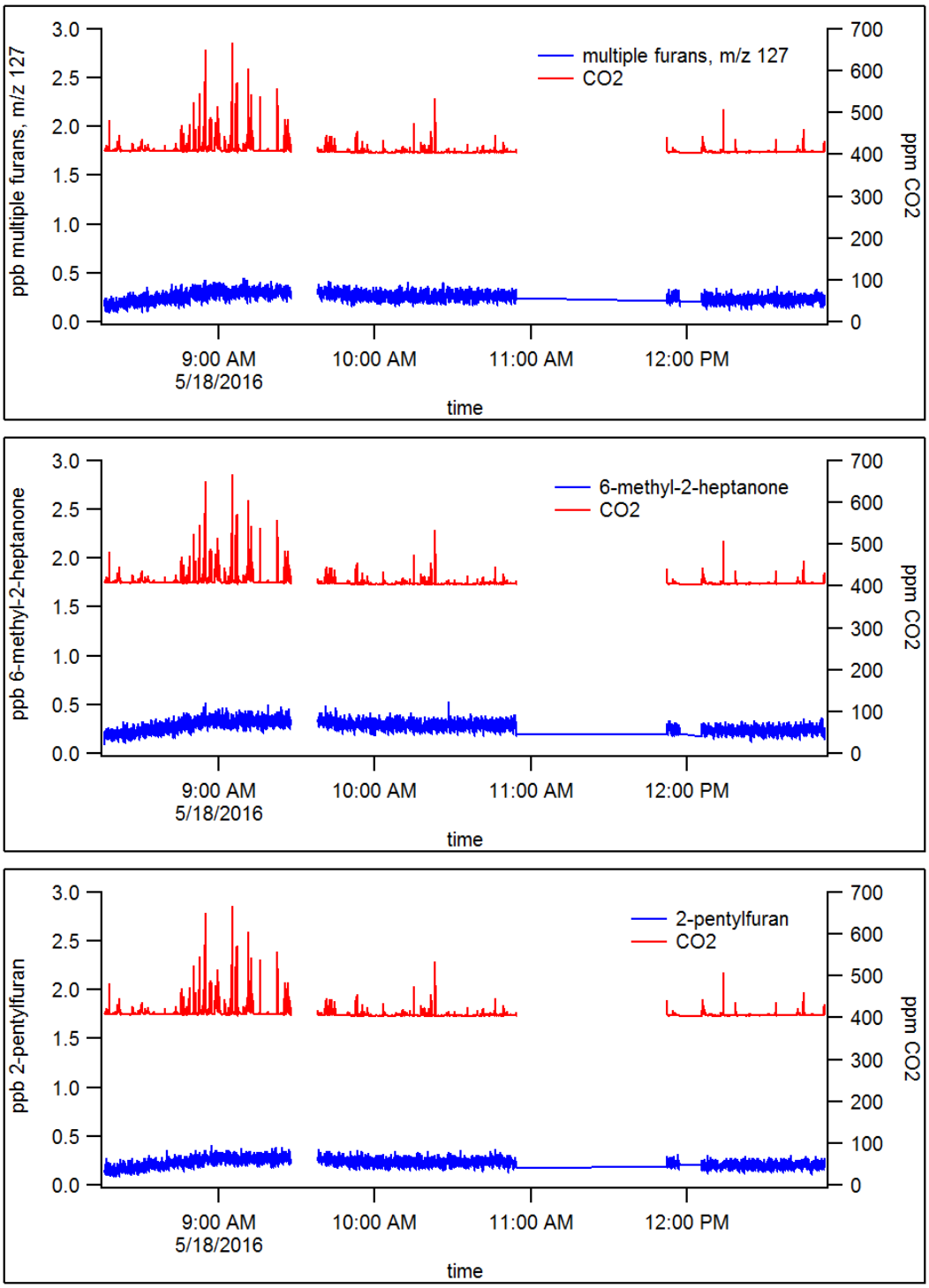


Figure B.1.1-13. May 18th - Biphenyl (TOP), 2-heptylfuran (MIDDLE), 2-octylfuran; 1,4-butanediol, dinitrate (BOTTOM)

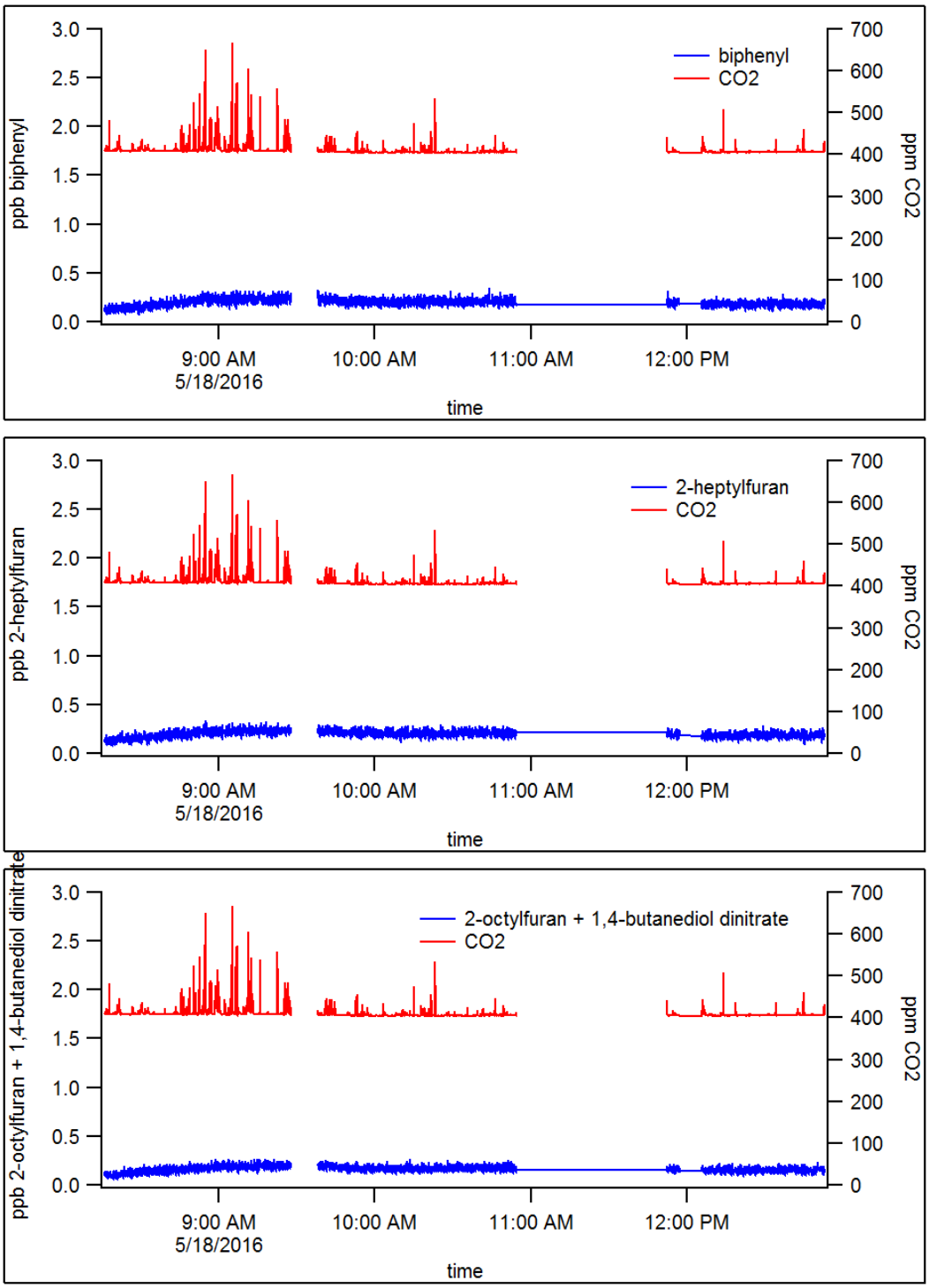


Figure B.1.1-14. May 18th - 1,2,3-propanetriol, 1,3-dinitrate (TOP), PCB (MIDDLE), 6-(2-furanyl)-6-methyl-2-heptanone (BOTTOM)

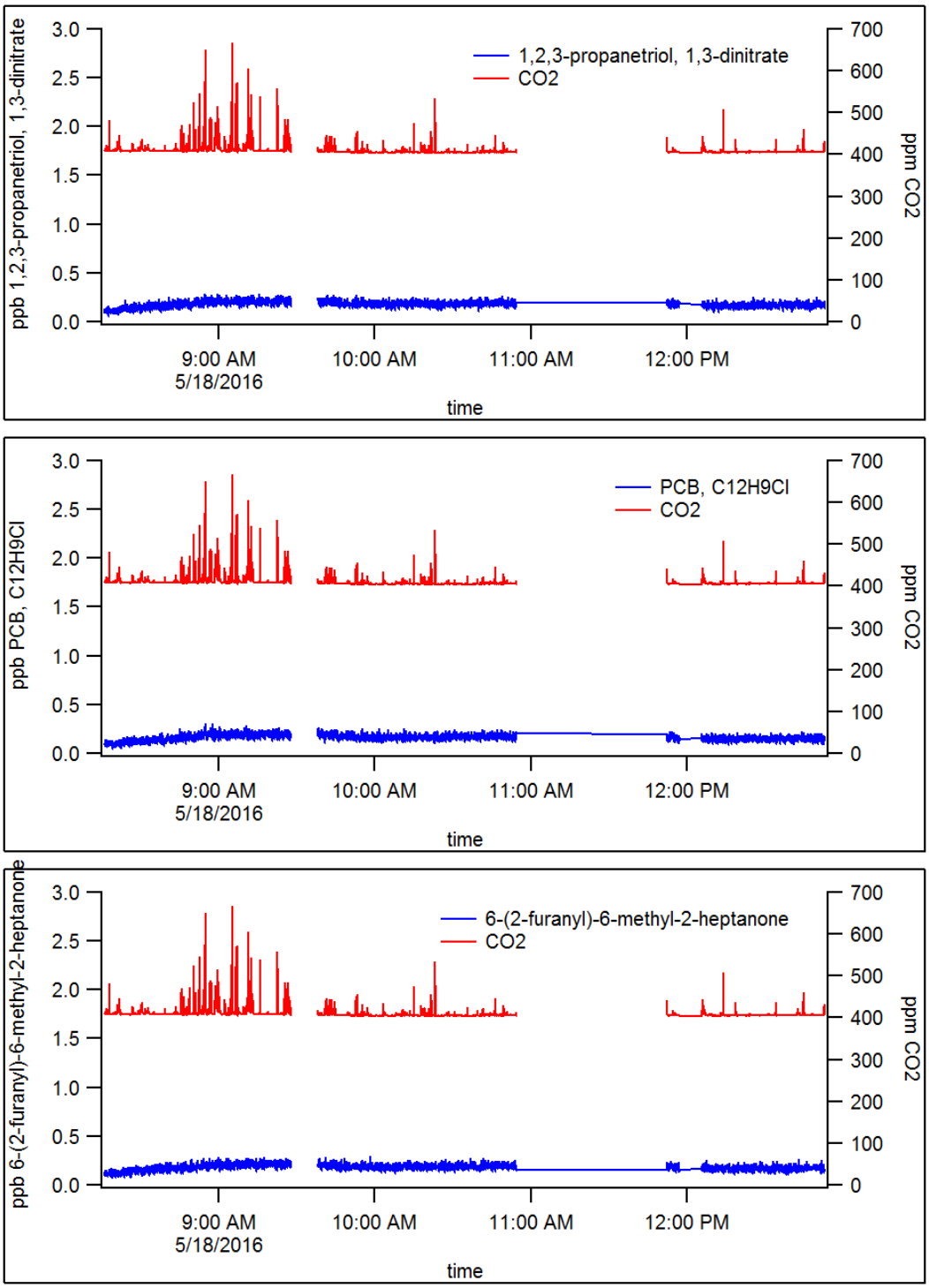
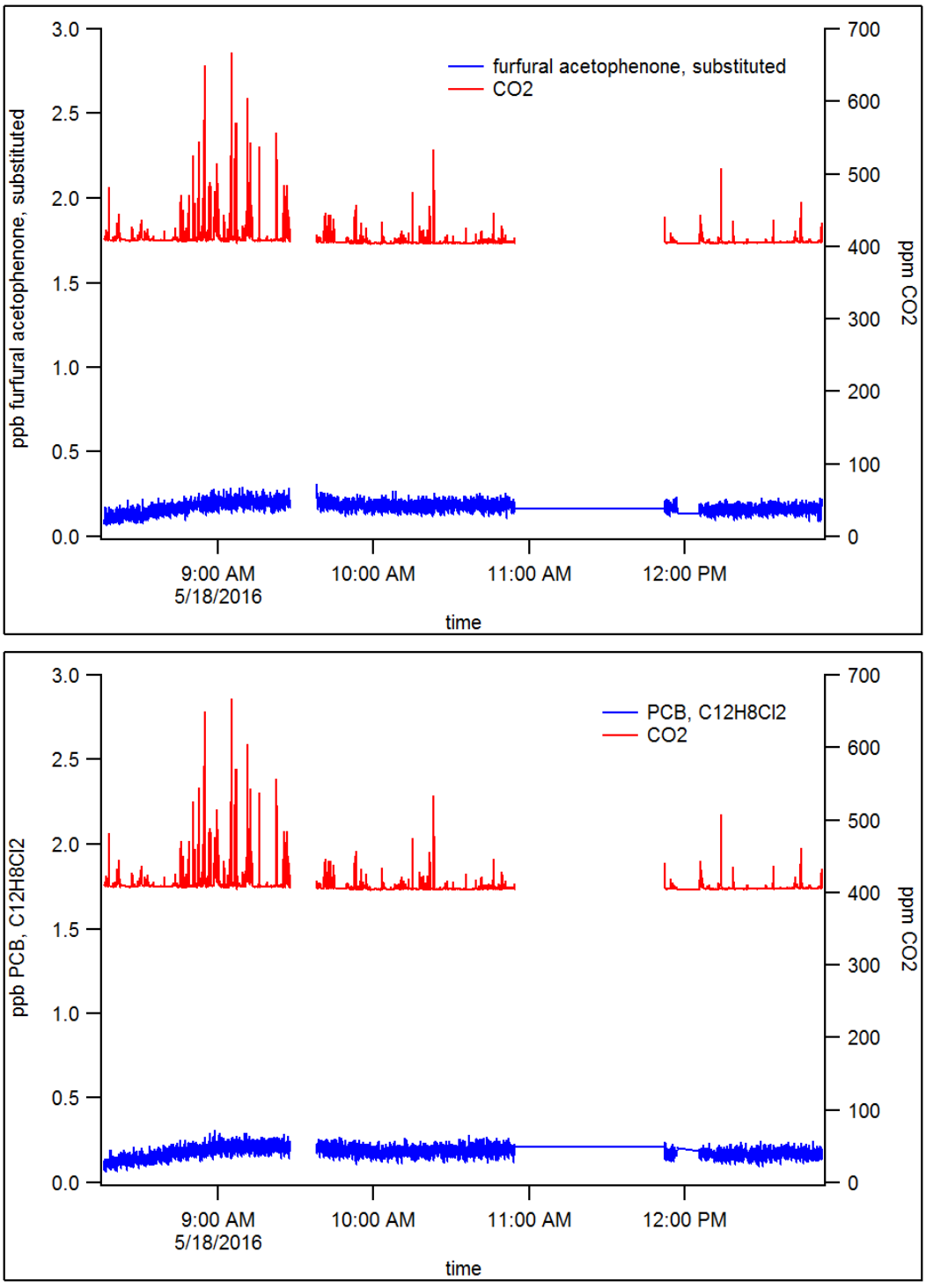


Figure B.1.1-15. May 18th - Furfural Acetophenone [3-(2-furanyl)-1-pheynyl-2-propen-1-one] (TOP), PCB [2] (BOTTOM)



B.1.2 June 20th Data Collection

June 20th data collection started at 7:16 AM and ended at 11:15 AM. Data collection methods included both mobile and stationary lab techniques. Below are the graphs presented in order based on the Chemicals of Potential Concern (COPC) list. Note that with this date's data, there is no Carbon Dioxide (CO_2) data to correlate with the PTR-Mass data, as there were technical difficulties with the mobile and stationary lab techniques.

Figure B.1.2-1. June 20th - Formaldehyde (TOP), Methanol (MIDDLE), Acetonitrile (BOTTOM)

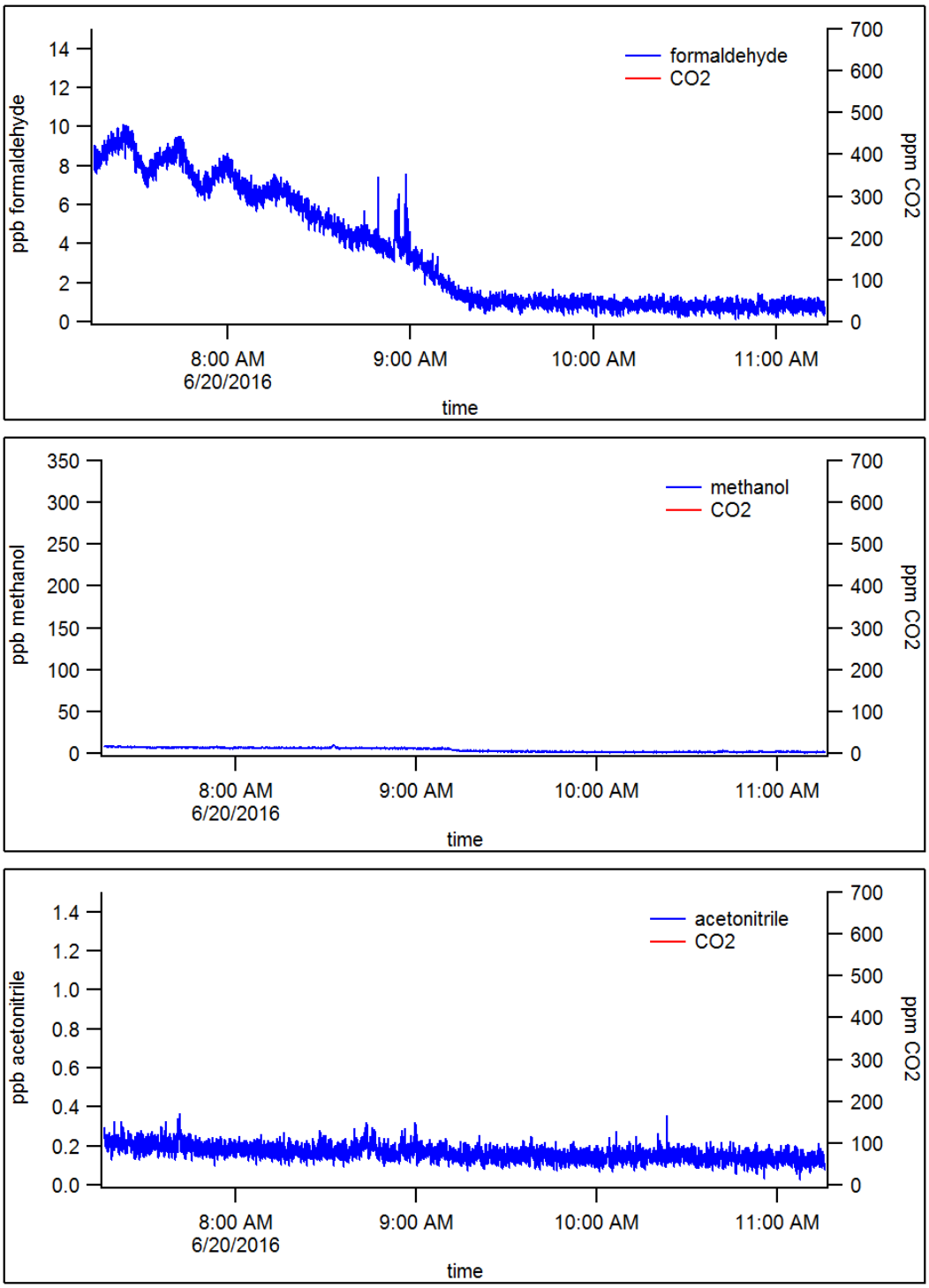


Figure B.1.2-2. June 20th - Acetaldehyde (TOP), Ethylamine (MIDDLE), 1,3-Butadiene (BOTTOM)

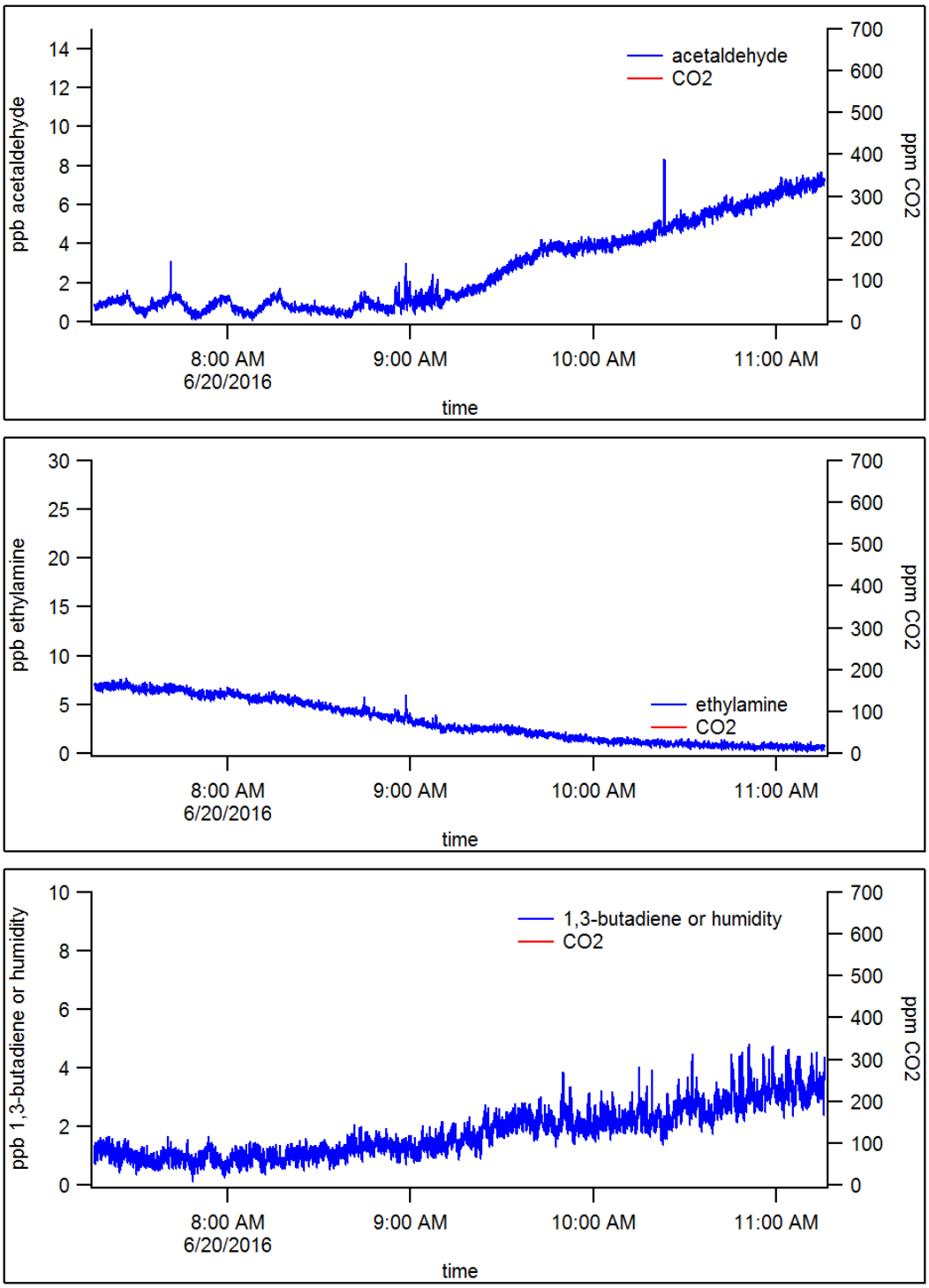


Figure B.1.2-3. June 20th - Propanenitrile (TOP), 1-Butanol; Butenes (MIDDLE), Methyl Isocyanate (BOTTOM)

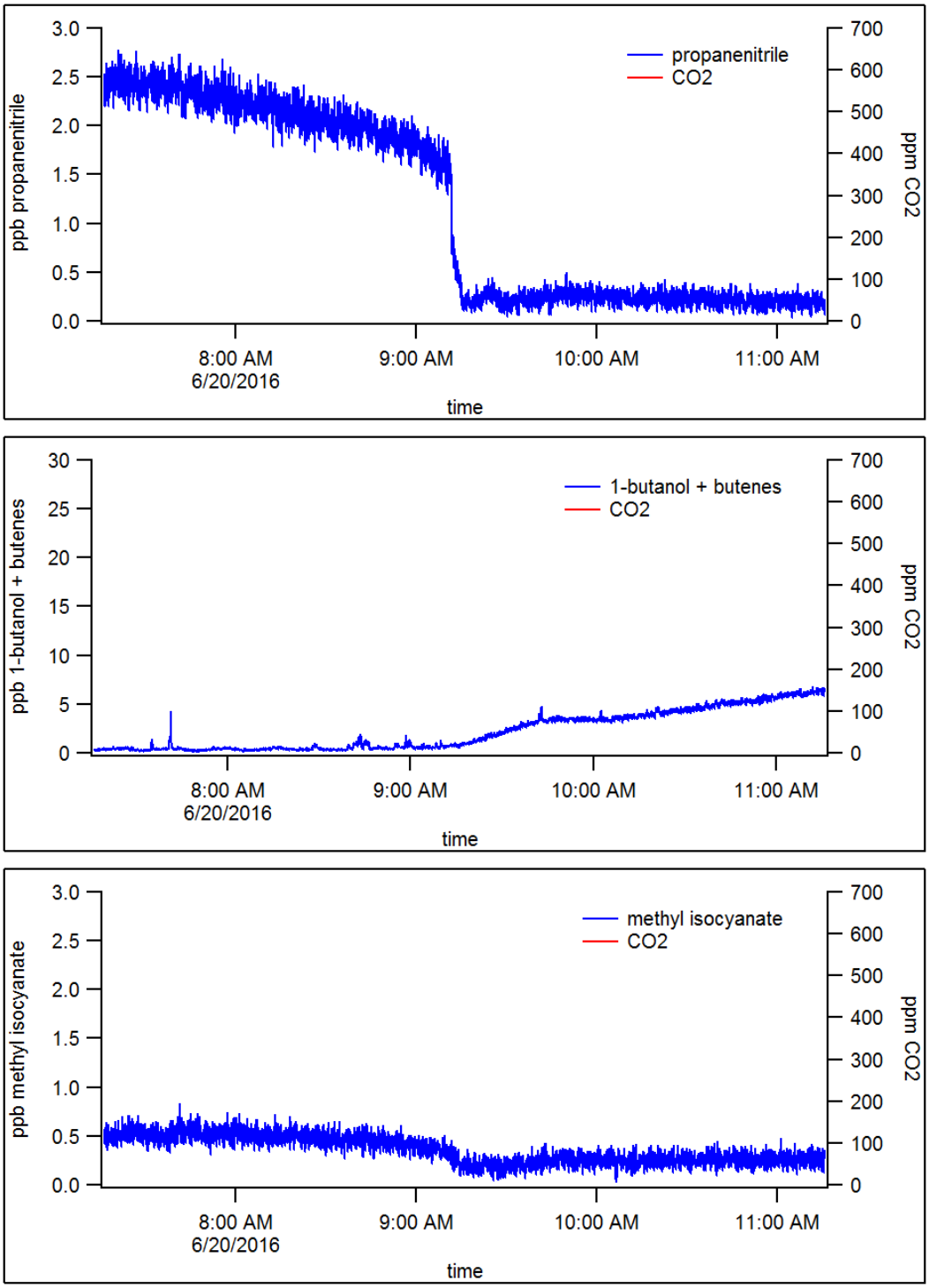


Figure B.1.2-4. June 20th - Methyl Nitrite (TOP), Furan; Isoprene (MIDDLE), Butanenitrile (BOTTOM)

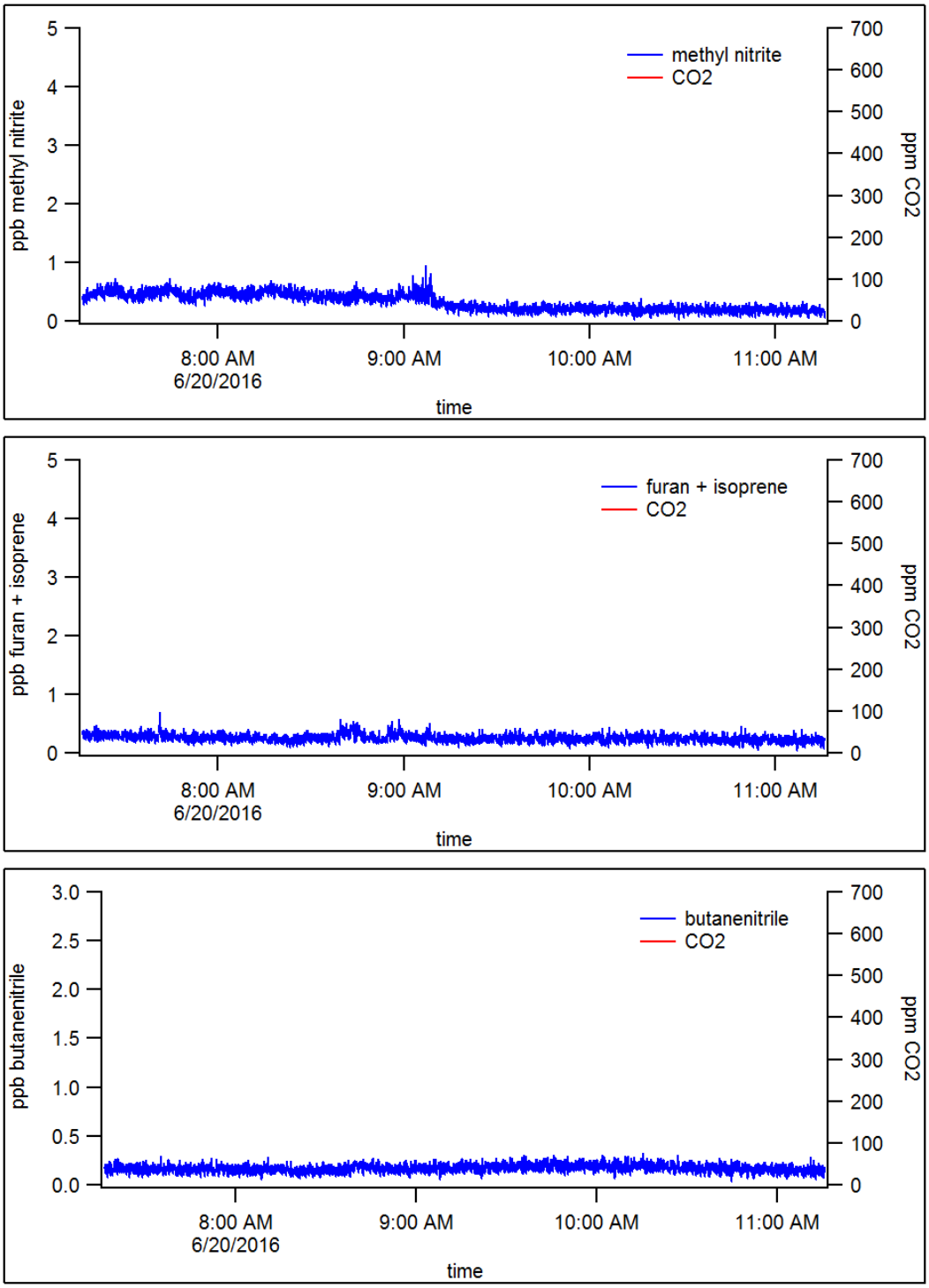


Figure B.1.2-5. June 20th - MVK + Dihydrofurans (TOP), Butanal (MIDDLE), N-nitrosodimethylamine [NDMA] (BOTTOM)

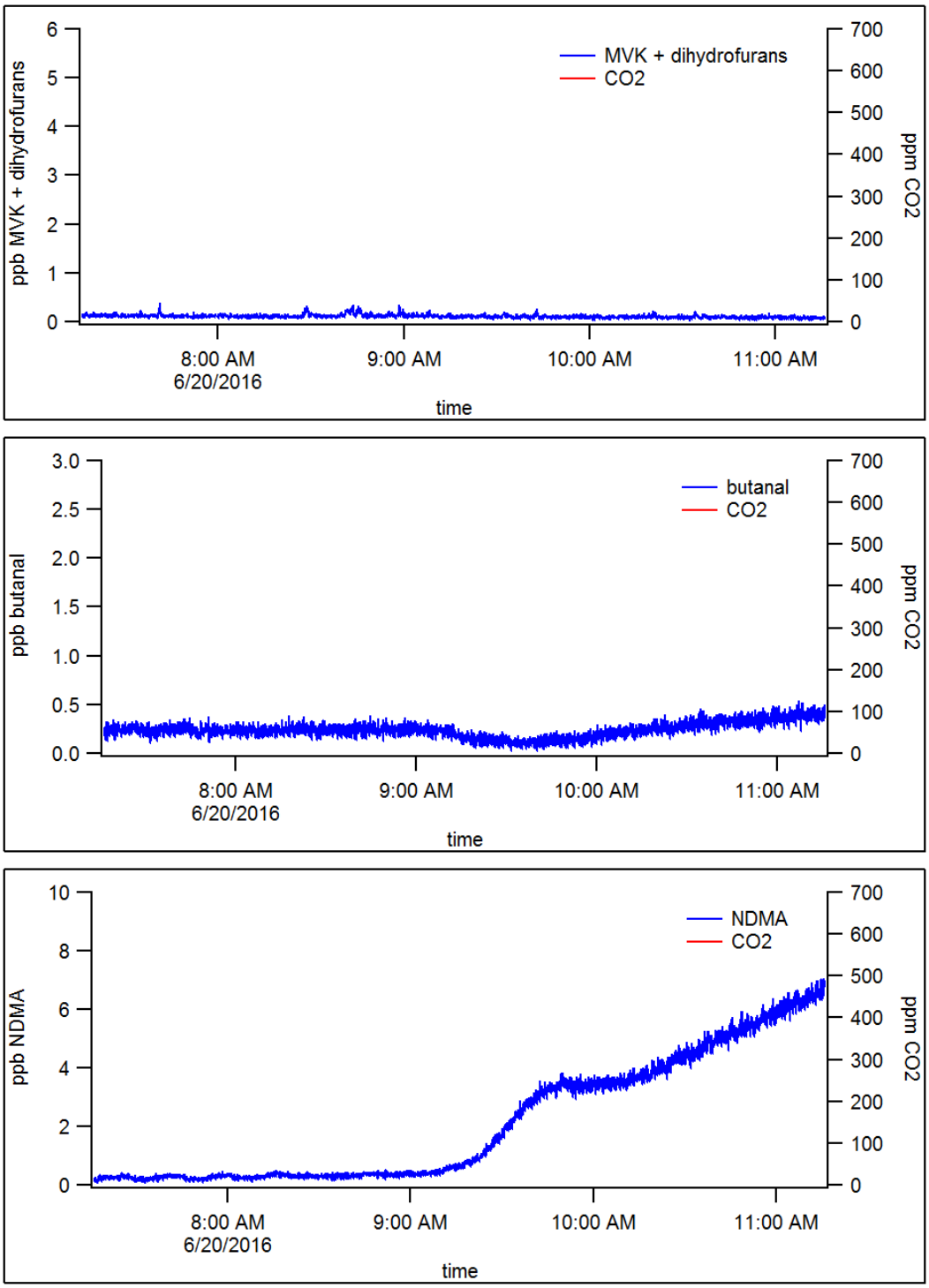


Figure B.1.2-6. June 20th - Benzene (TOP), 2,4-Pentadienenitrile; Pyridine (MIDDLE), 2-methylene Butanenitrile (BOTTOM)

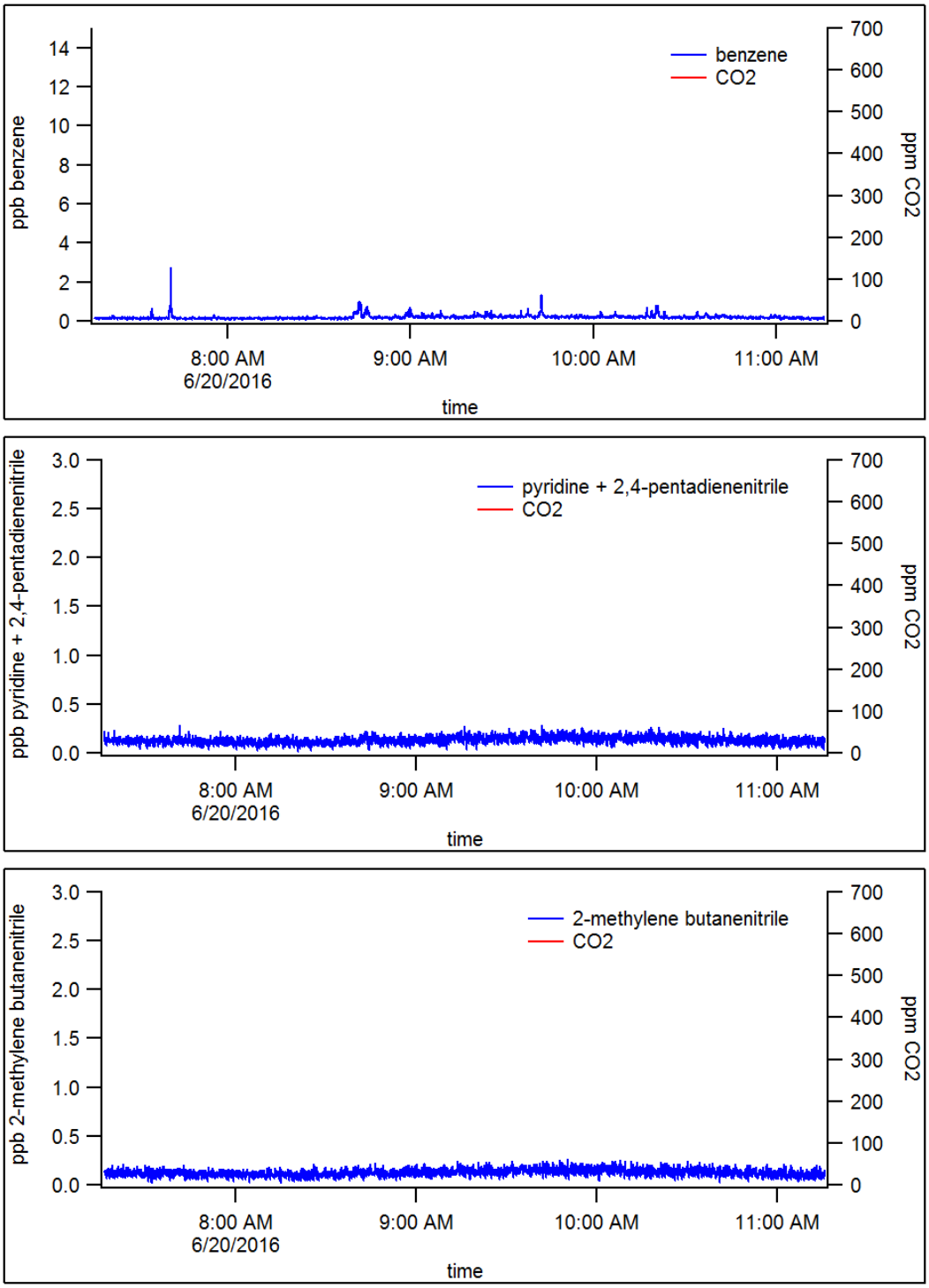


Figure B.1.2-7. June 20th - 2-methylfuran (TOP), Pentanenitrile (MIDDLE), 3-methyl-3-buten-2-one; 2-methyl-2-butenal (BOTTOM)

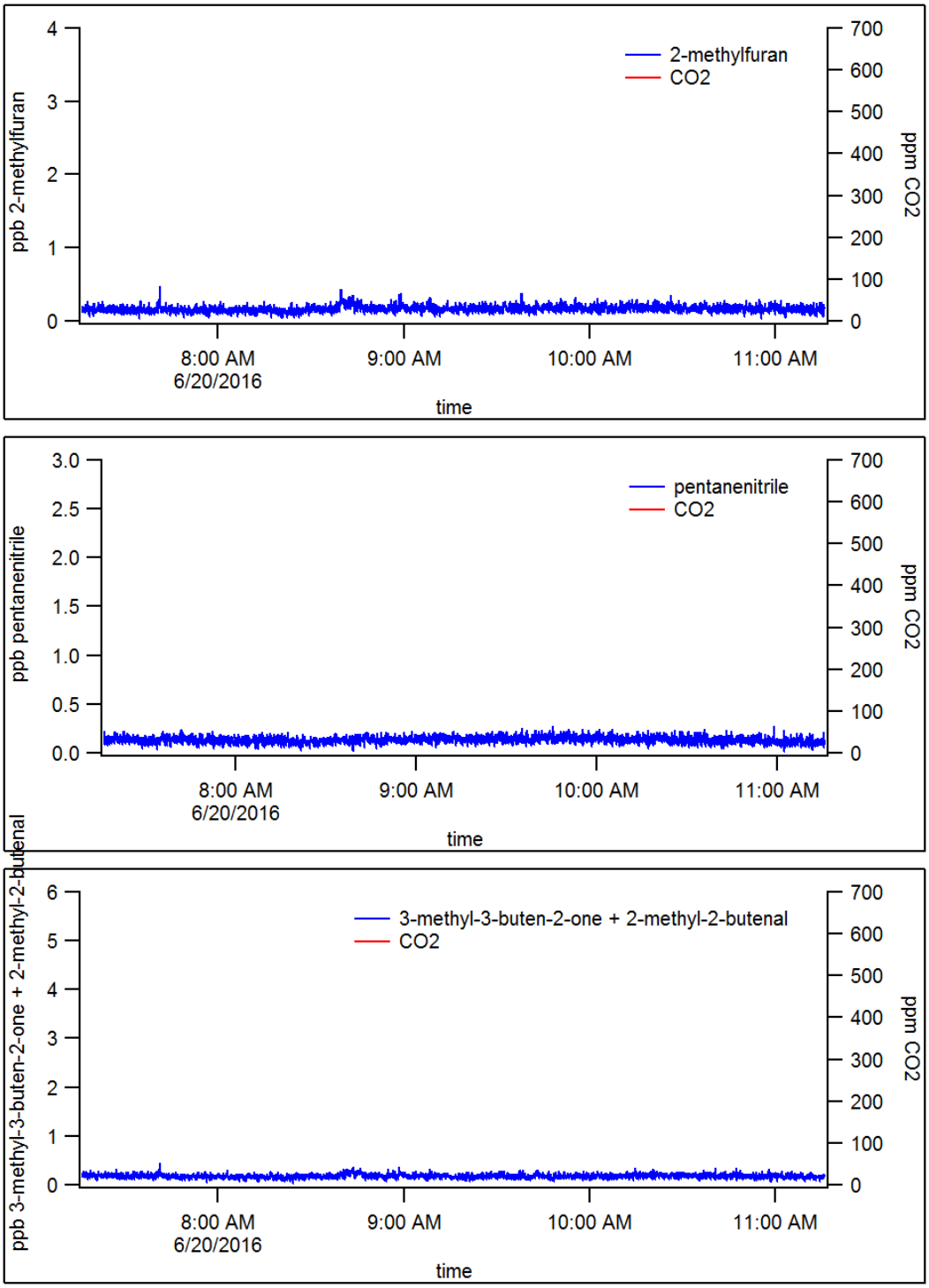


Figure B.1.2-8. June 20th - N-nitrosomethylethylamine [NEMA] (TOP), 2,5-dimethylfuran (MIDDLE), Hexanenitrile (BOTTOM)

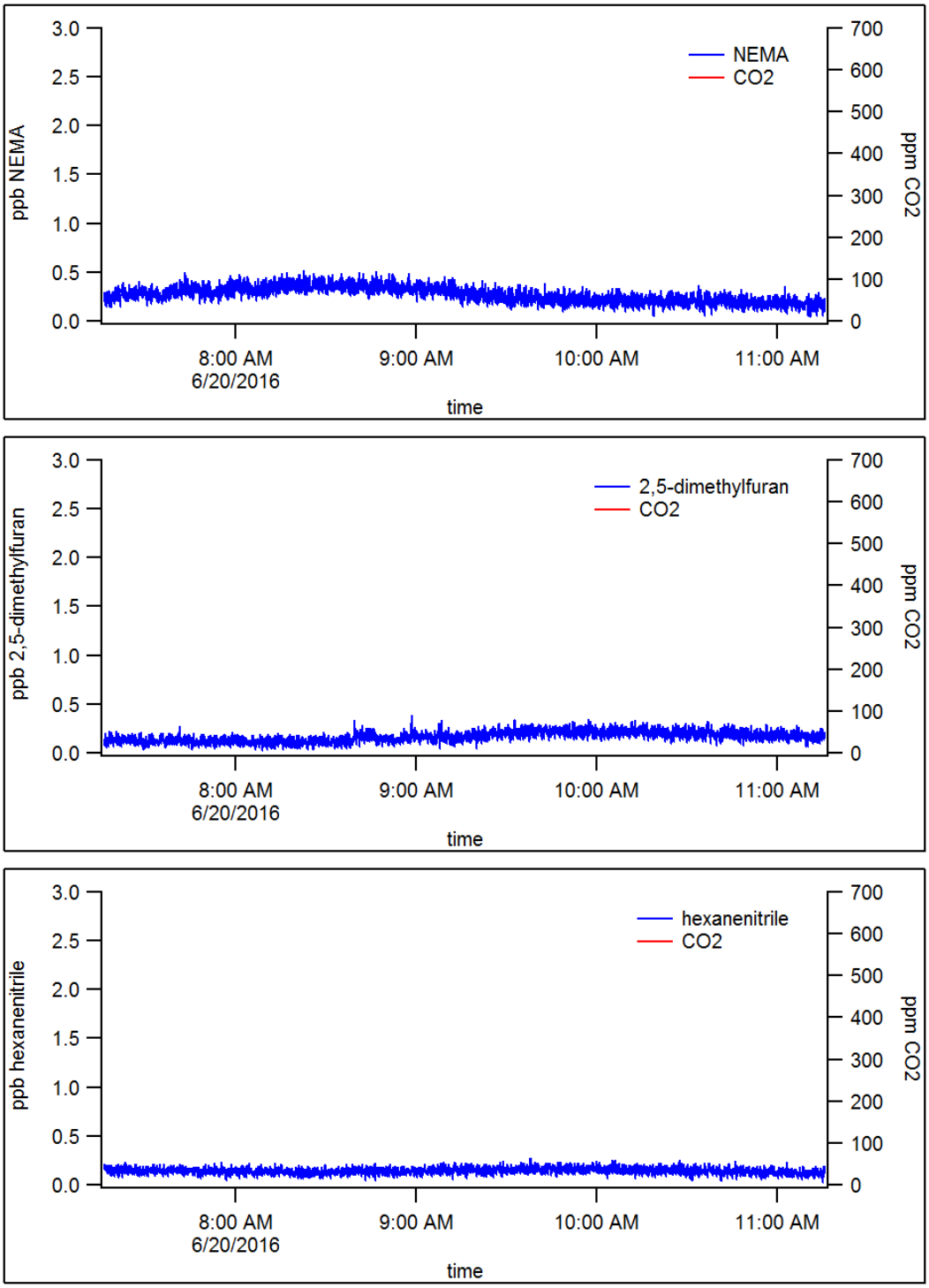


Figure B.1.2-9. June 20th - 2-hexanone [MBK] (TOP), N-nitrosodiethylamine [NDEA] (MIDDLE), Butyl Nitrite; 2-nitro-2-methylpropane (BOTTOM)

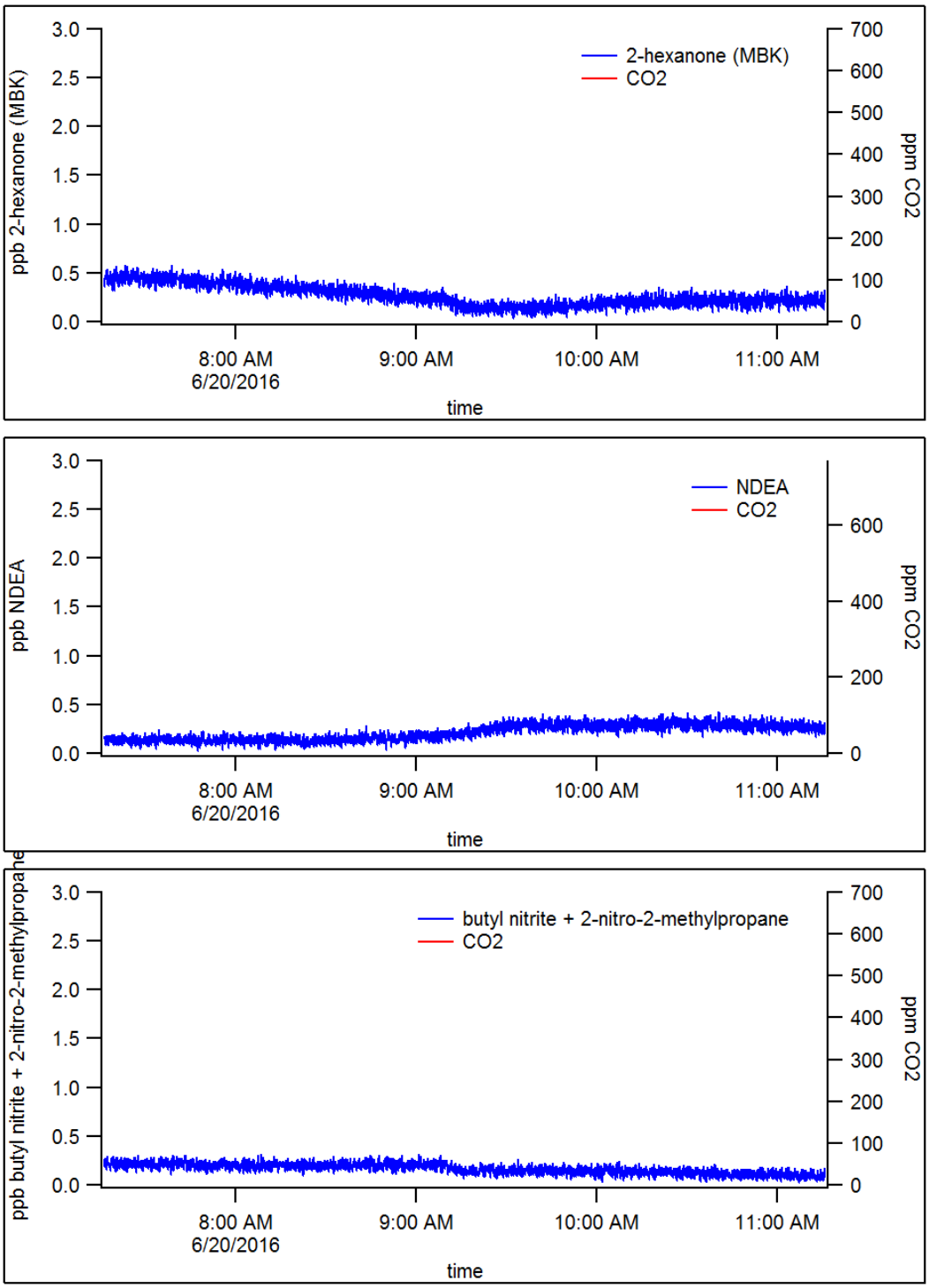


Figure B.1.2-10. June 20th - 2,4-dimethylpyridine (TOP), 2-ethyl-5-methylfuran (MIDDLE), Heptanenitrile (BOTTOM)

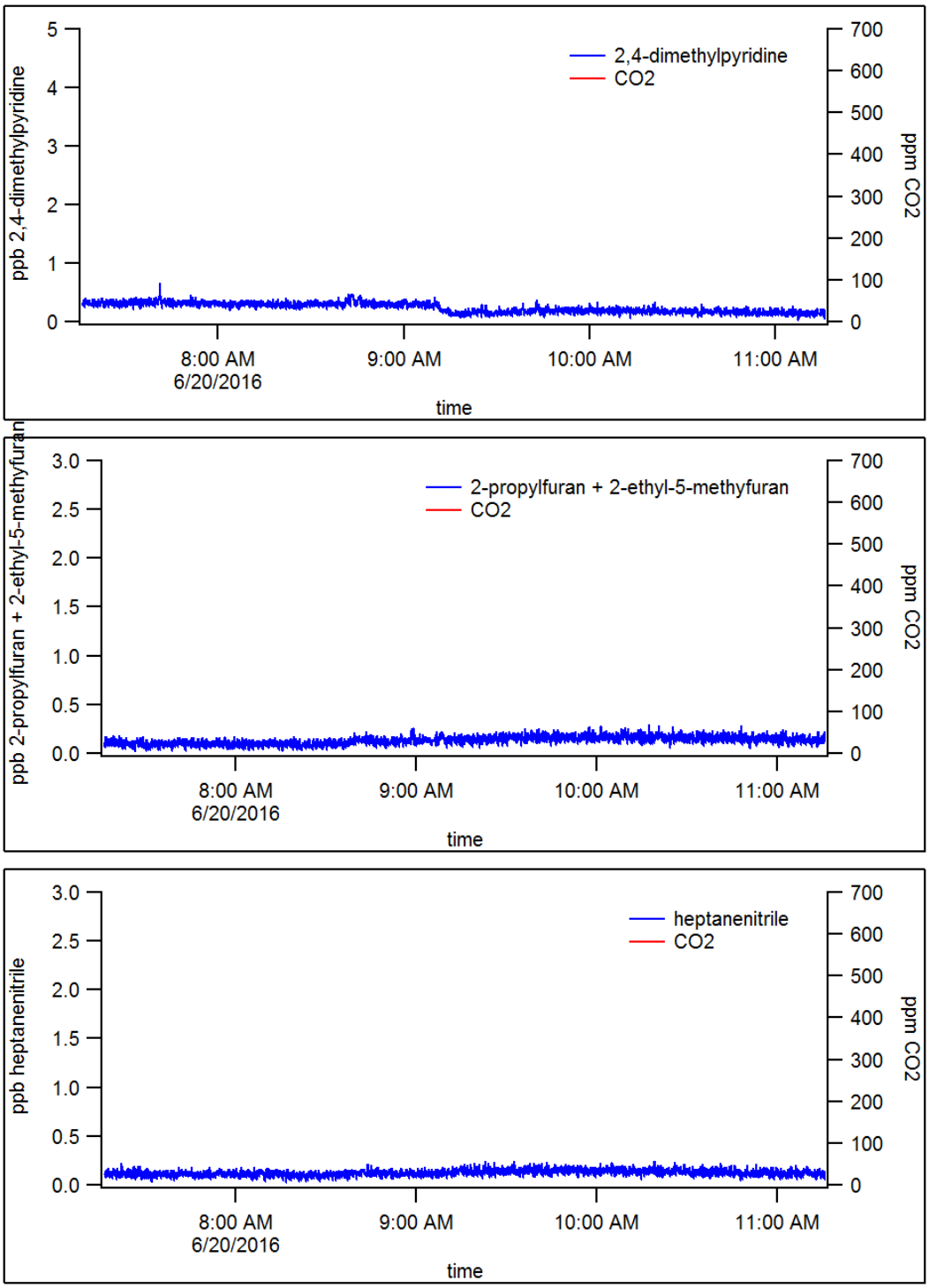


Figure B.1.2-11. June 20th - 4-methyl-2-hexanone (TOP), N-nitrosomorpholine [NMOR] (MIDDLE), Butyl Nitrate (BOTTOM)

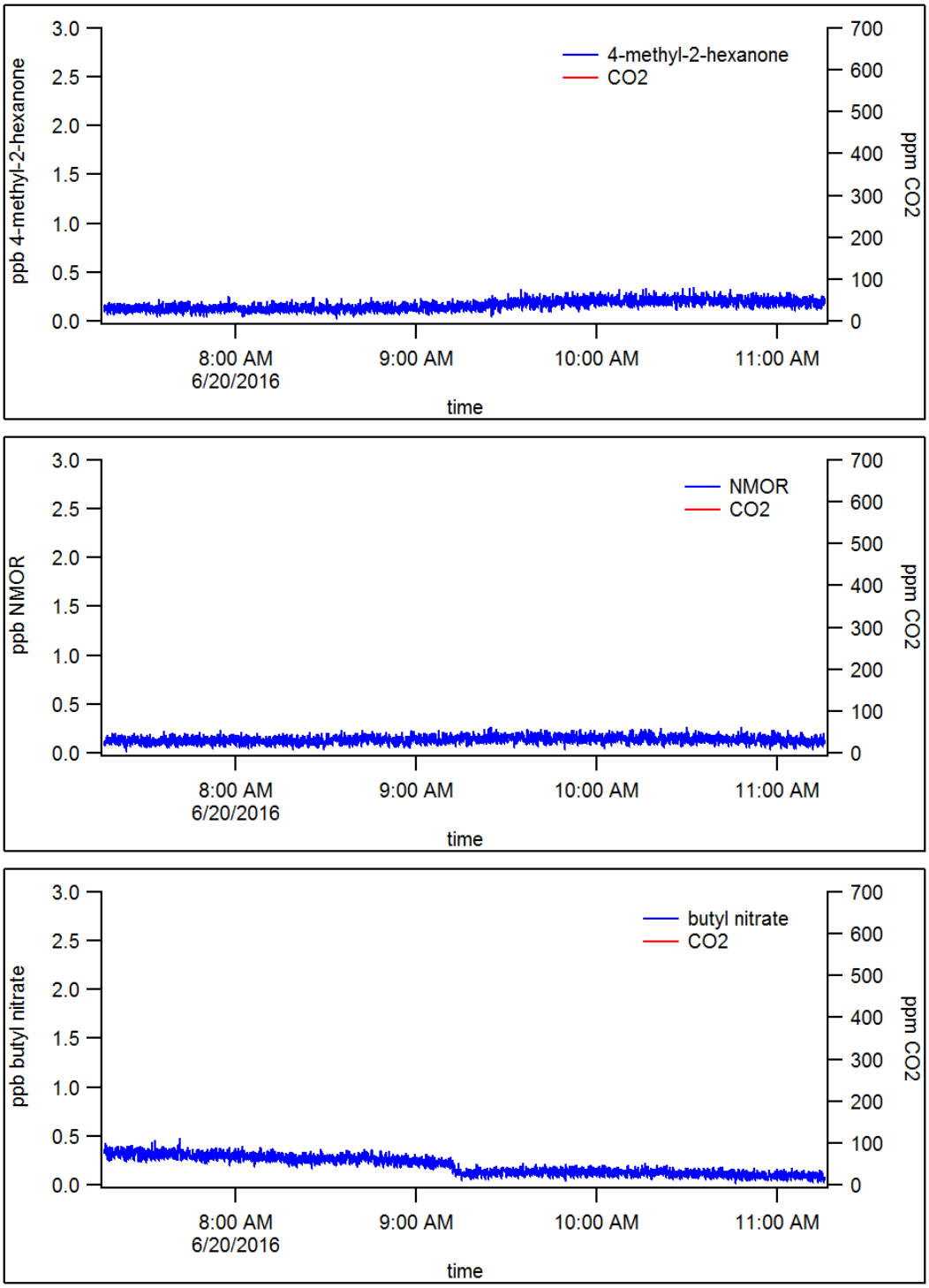


Figure B.1.2-12. June 20th - Multiple Furans [m/z 127] (TOP), 6-methyl-2-heptanone (MIDDLE), 2-pentylfuran (BOTTOM)

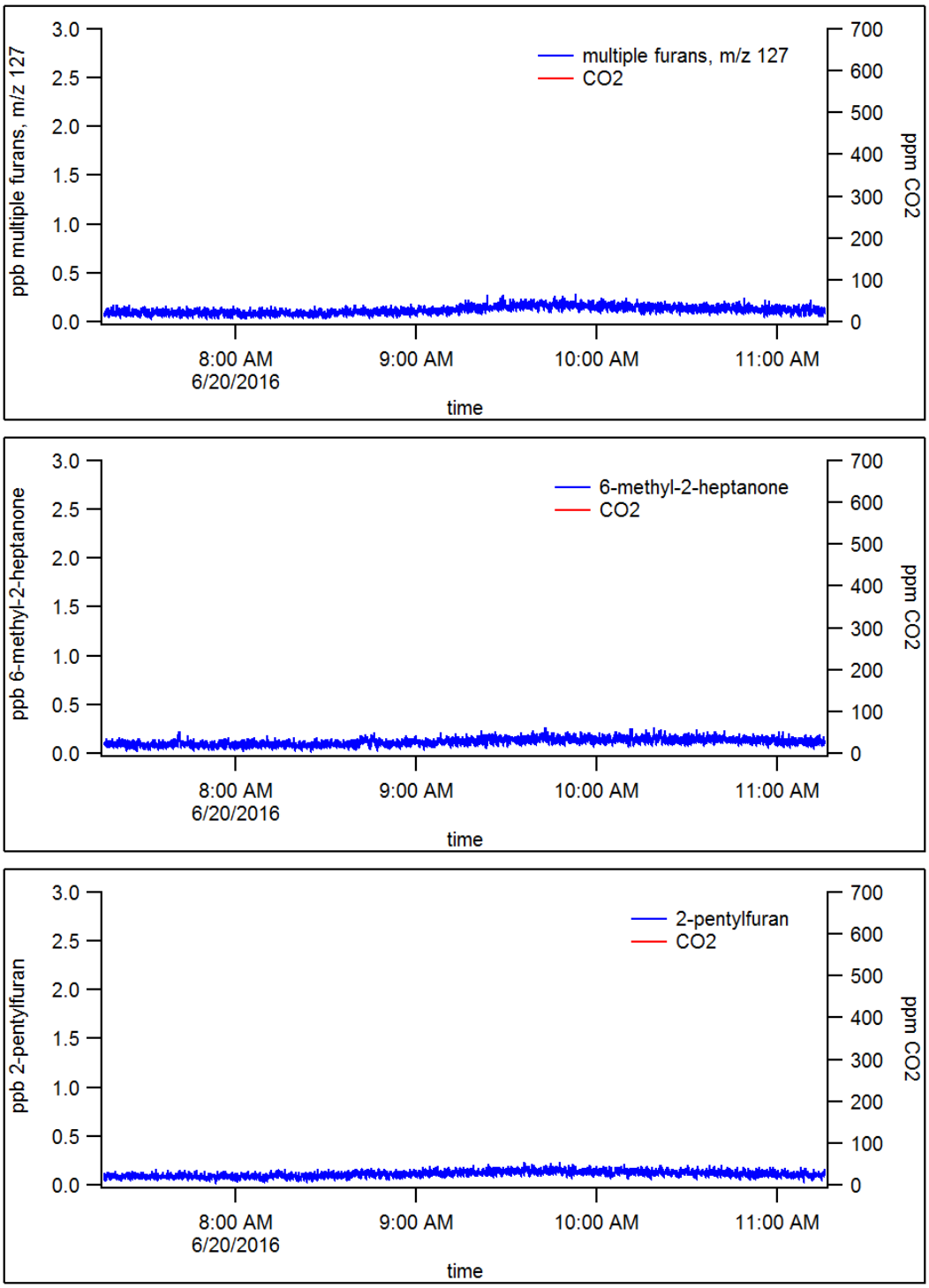


Figure B.1.2-13. June 20th - Biphenyl (TOP), 2-heptylfuran (MIDDLE), 2-octylfuran; 1,4-butanediol, Dinitrate (BOTTOM)

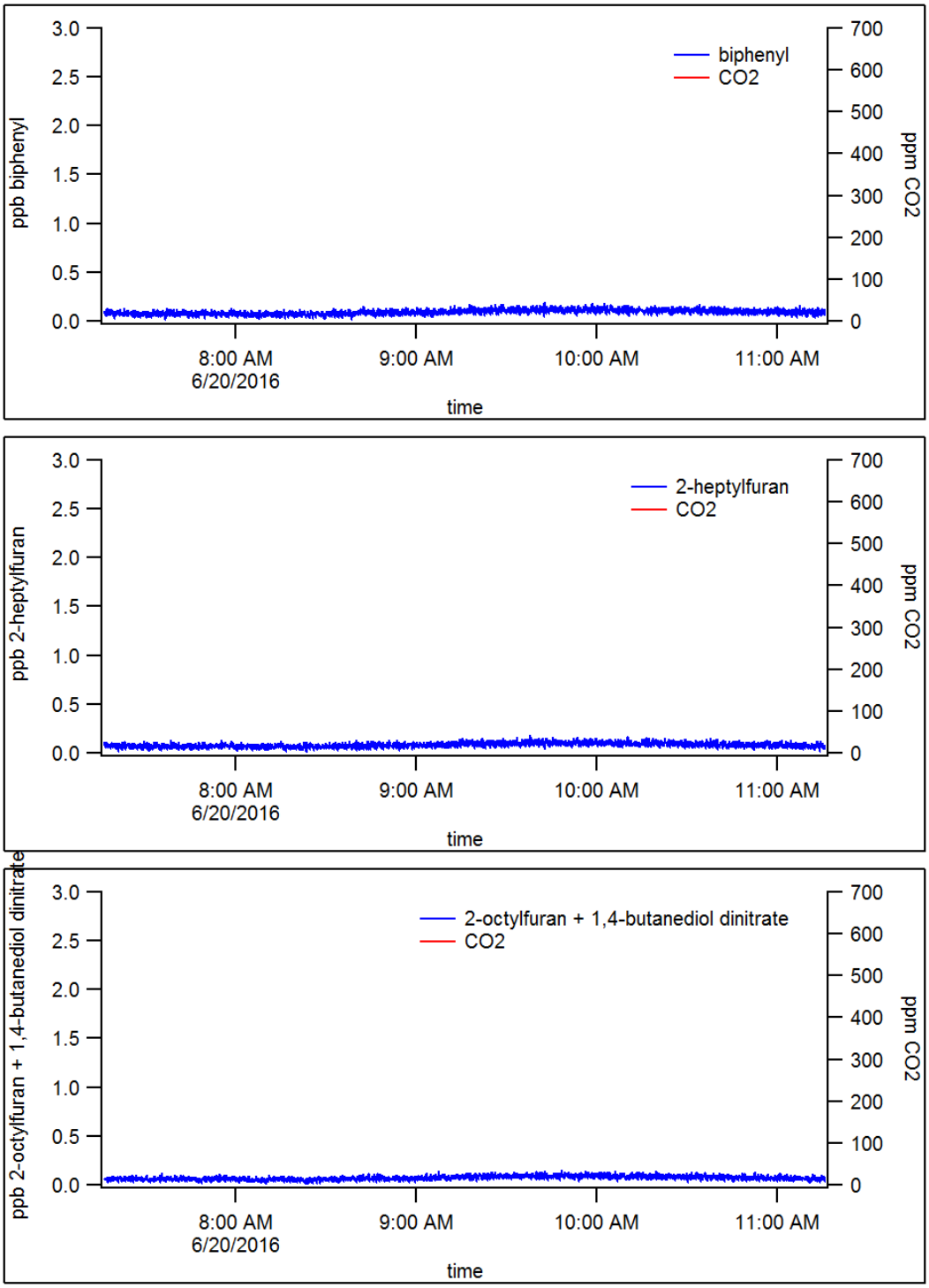


Figure B.1.2-14. June 20th - 1,2,3-propanetriol, 1,3-dinitrate (TOP), PCB (MIDDLE), 6-(2-furanyl)-6-methyl-2-heptanone (BOTTOM)

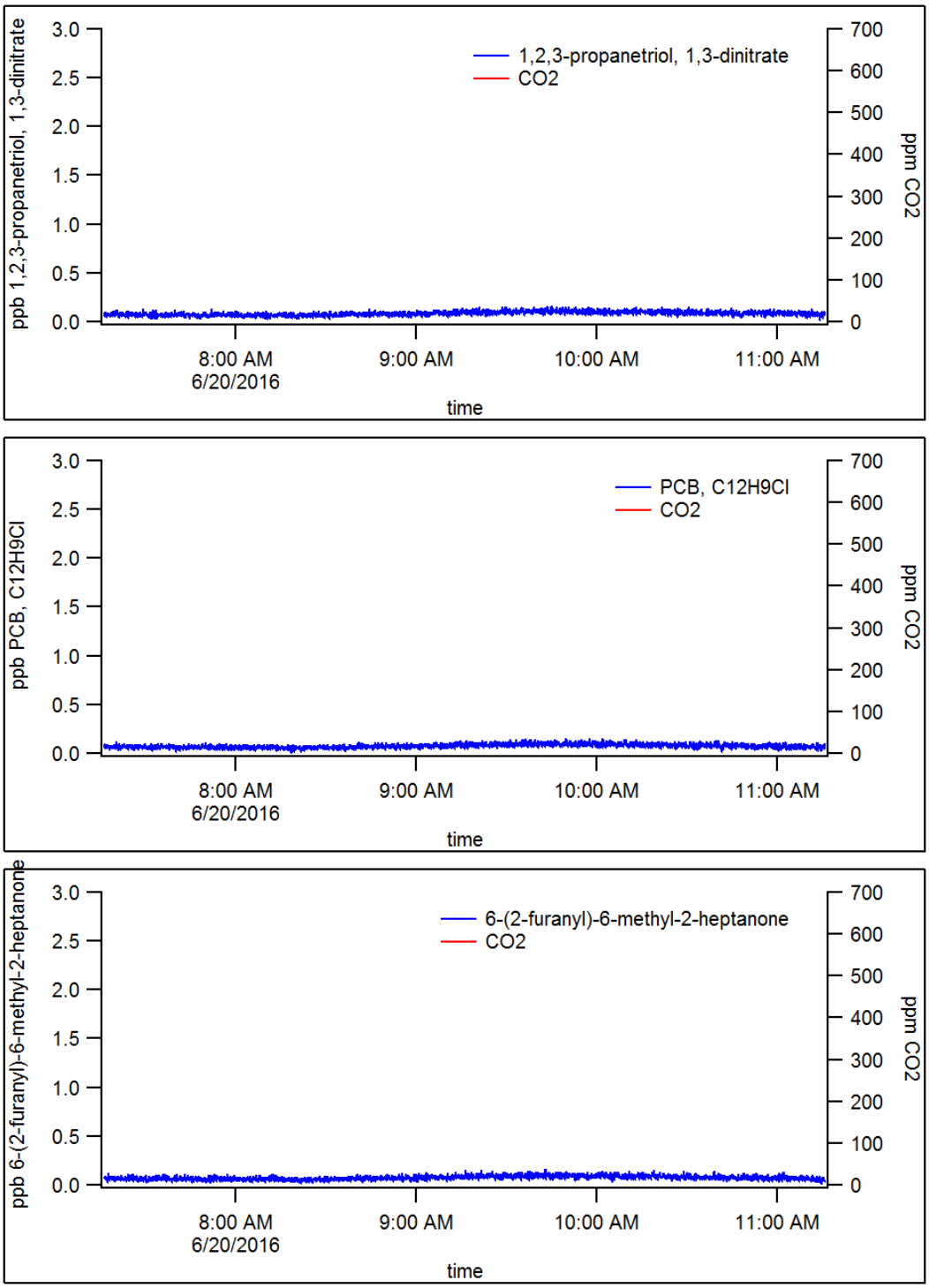
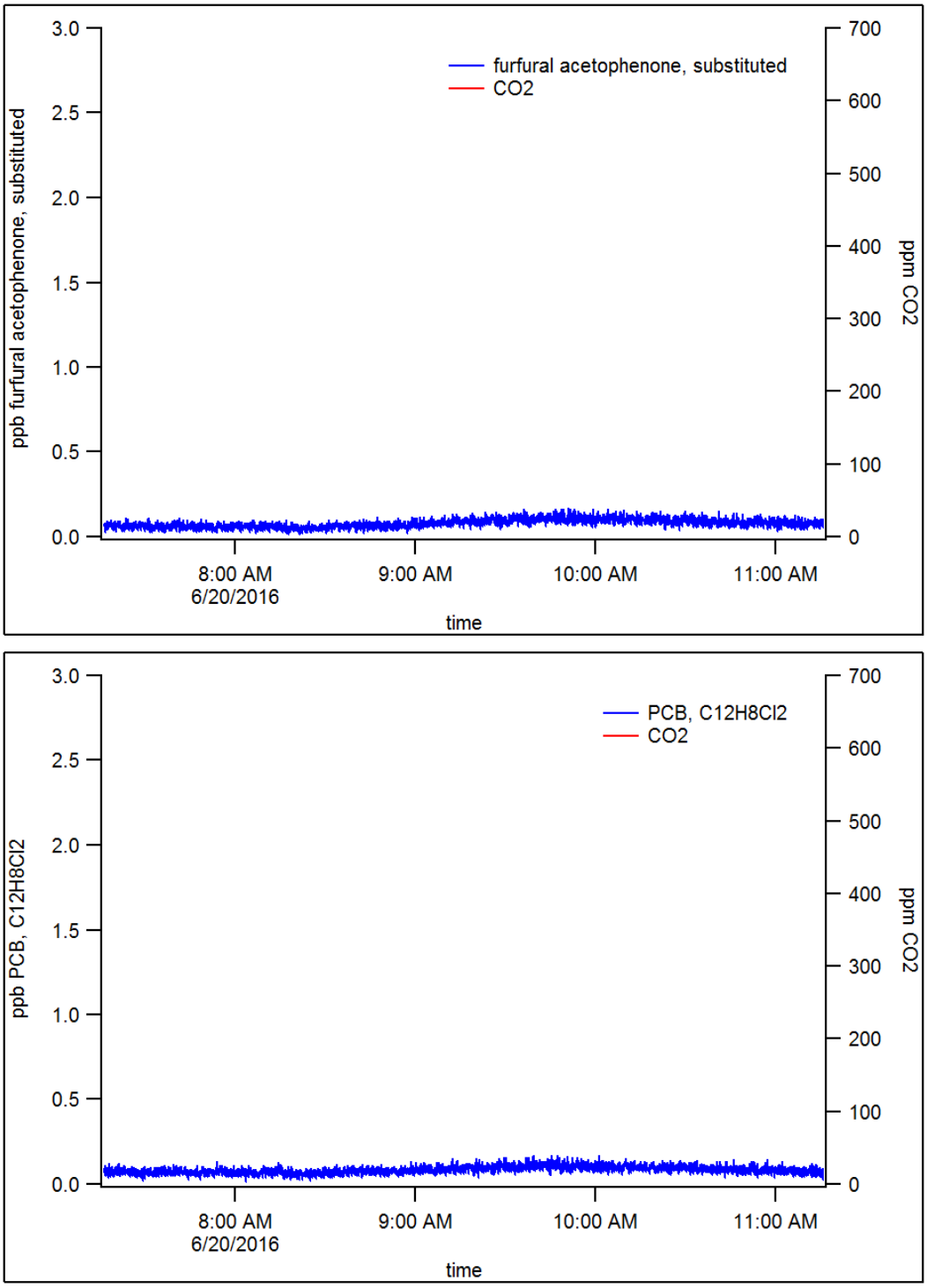


Figure B.1.2-15. June 20th - Furfural Acetophenone [3-(2-furanyl)-1-pheynyl-2-propen-1-one] (TOP), PCB [2] (BOTTOM)



B.1.3 June 22th Data Collection

June 22th data collection started at 7:30 AM and ended at 1:30 PM. Data collection methods included both mobile and stationary lab techniques. Below are the graphs presented in order based on the Chemicals of Potential Concern (COPC) list. Note that with this date's data, there is no Carbon Dioxide (CO_2) data to correlate with the PTR-Mass data, as there were technical difficulties with the mobile and stationary lab techniques.

Figure B.1.3-1. June 22th - Formaldehyde (TOP), Methanol (MIDDLE), Acetonitrile (BOTTOM)

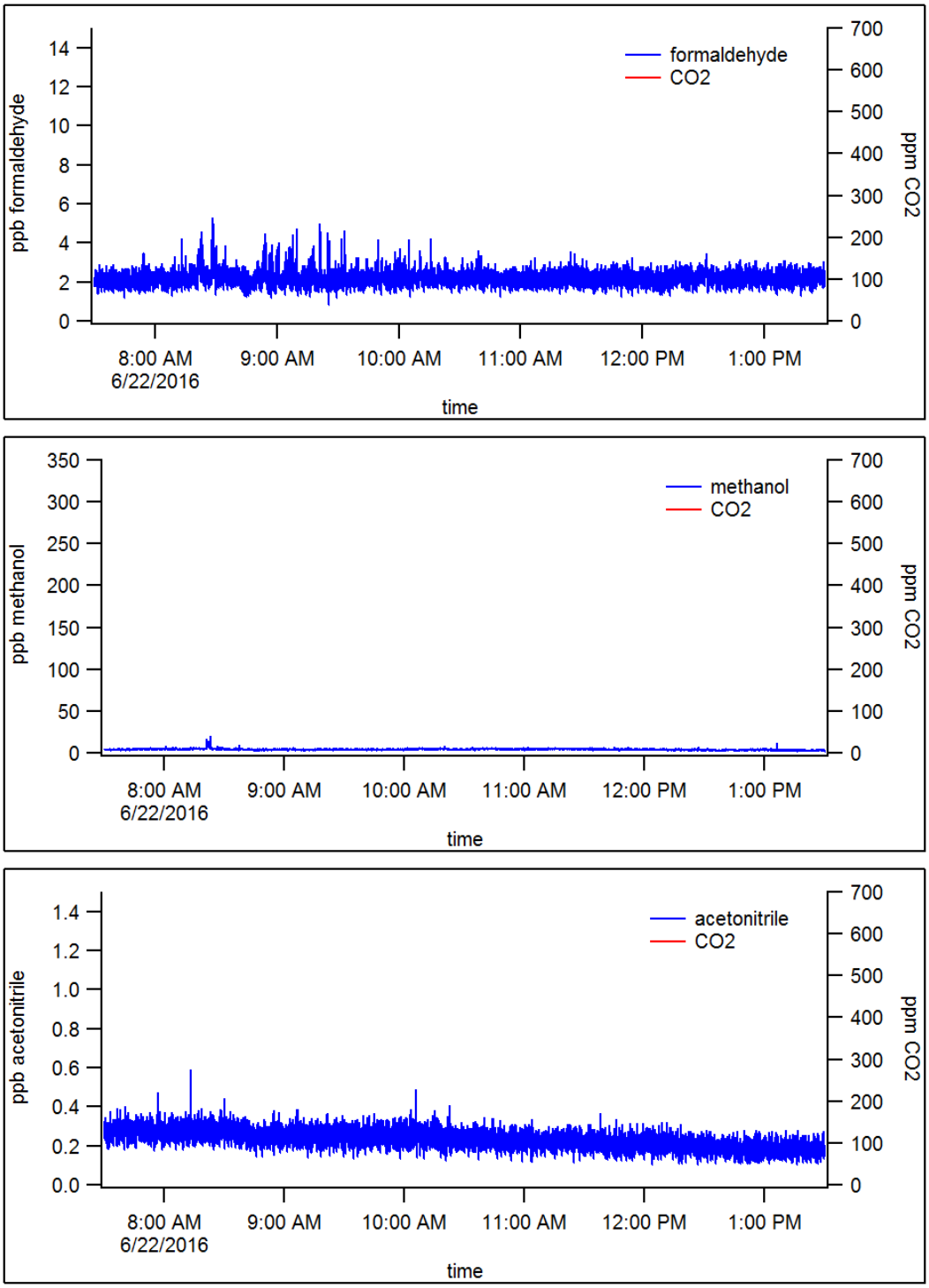


Figure B.1.3-2. June 22th - Acetaldehyde (TOP), Ethylamine (MIDDLE), 1,3-Butadiene (BOTTOM)

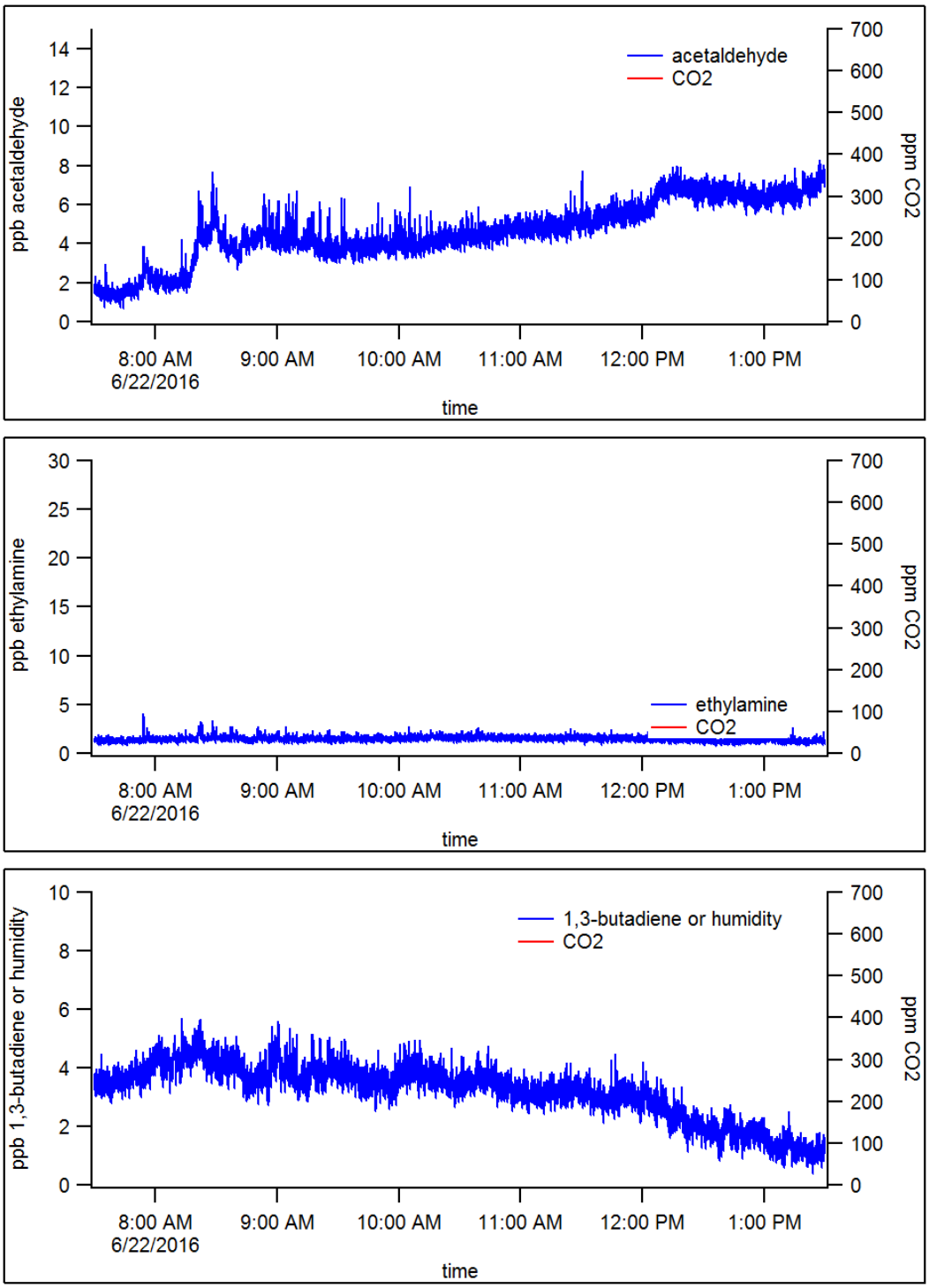


Figure B.1.3-3. June 22th - Propanenitrile (TOP), 1-Butanol; Butenes (MIDDLE), Methyl Isocyanate (BOTTOM)

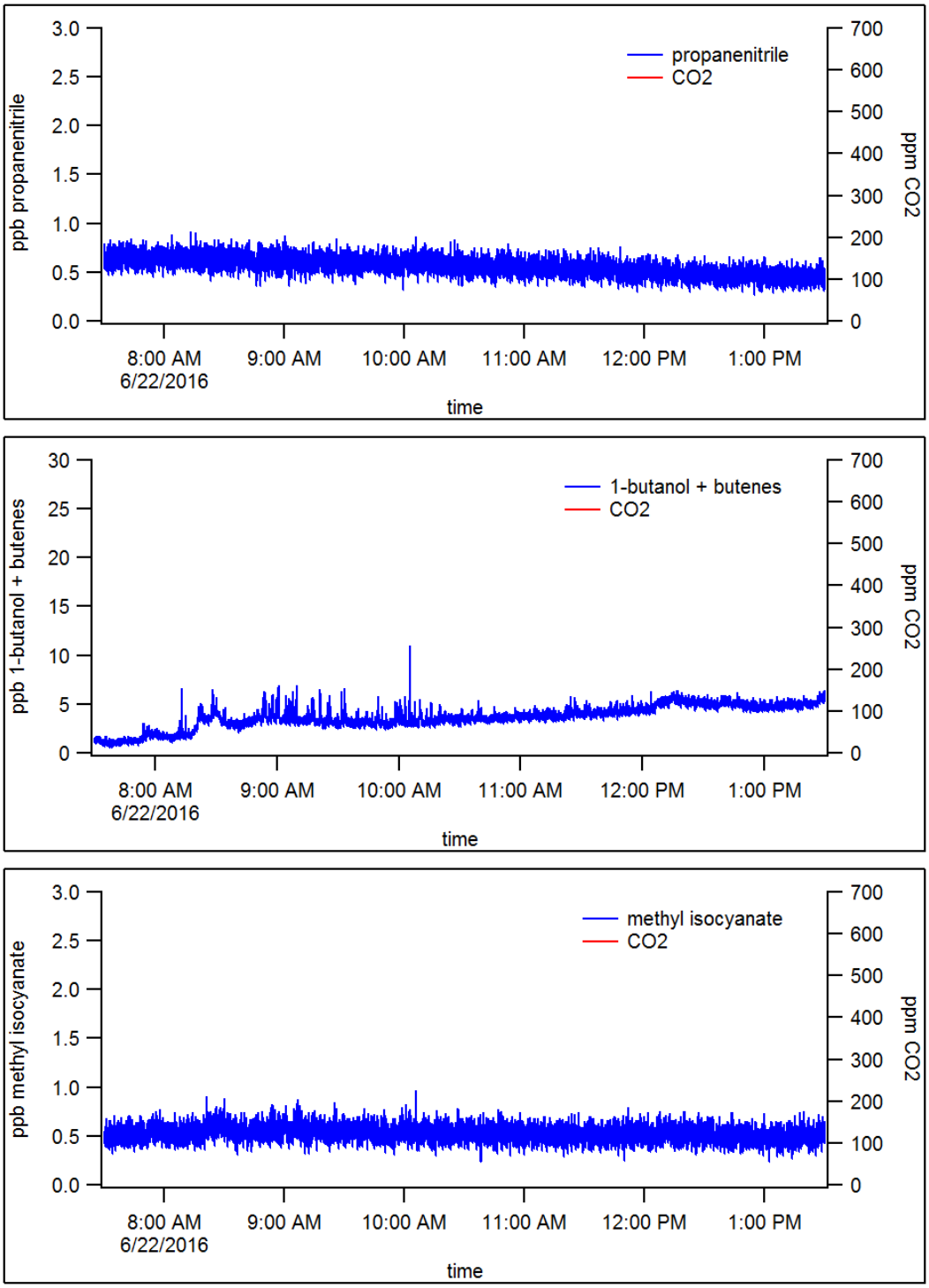


Figure B.1.3-4. June 22th - Methyl Nitrite (TOP), Furan; Isoprene (MIDDLE), Butanenitrile (BOTTOM)

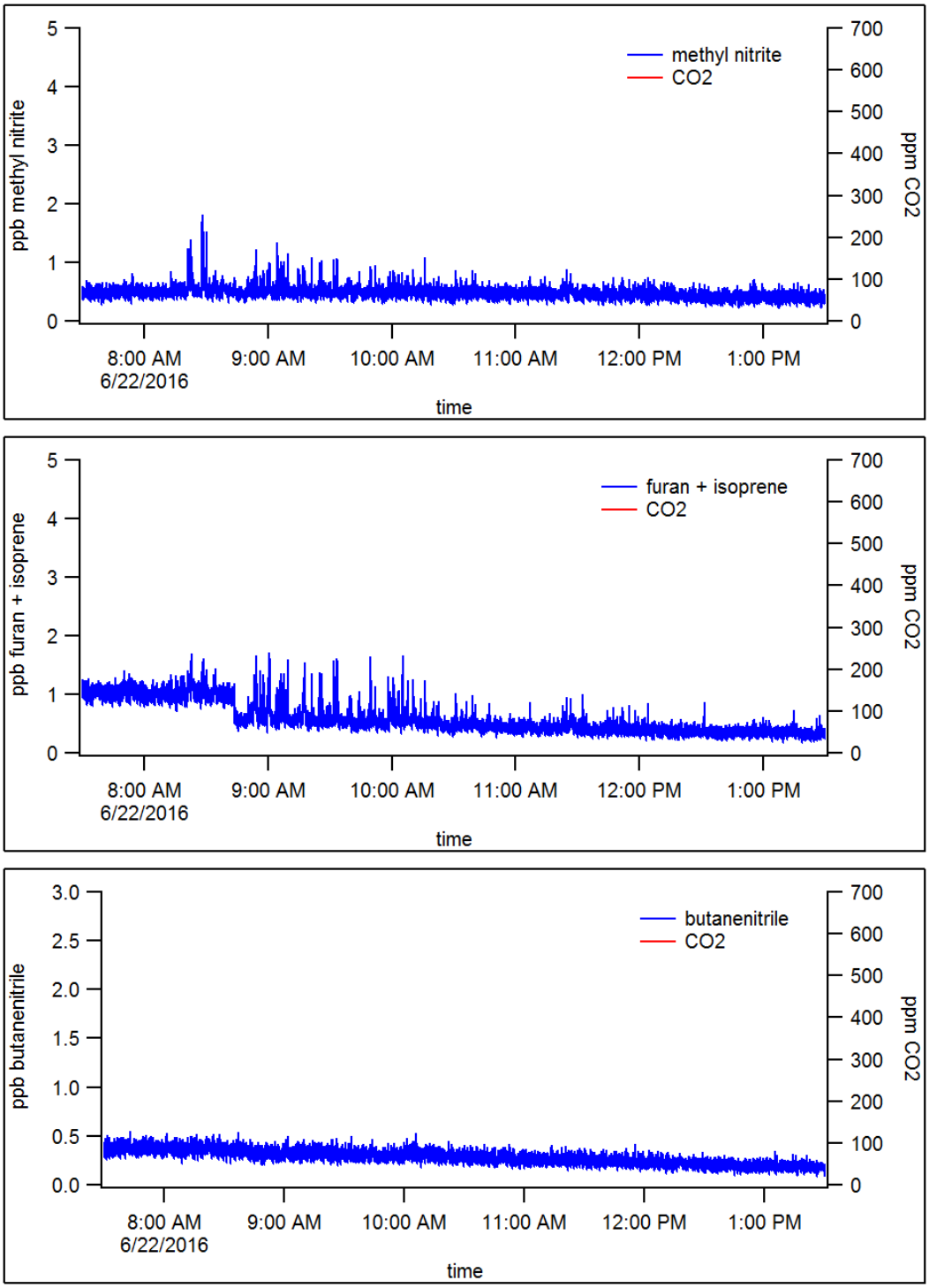


Figure B.1.3-5. June 22th - MVK + Dihydrofurans (TOP), Butanal (MIDDLE), N-nitrosodimethylamine [NDMA] (BOTTOM)

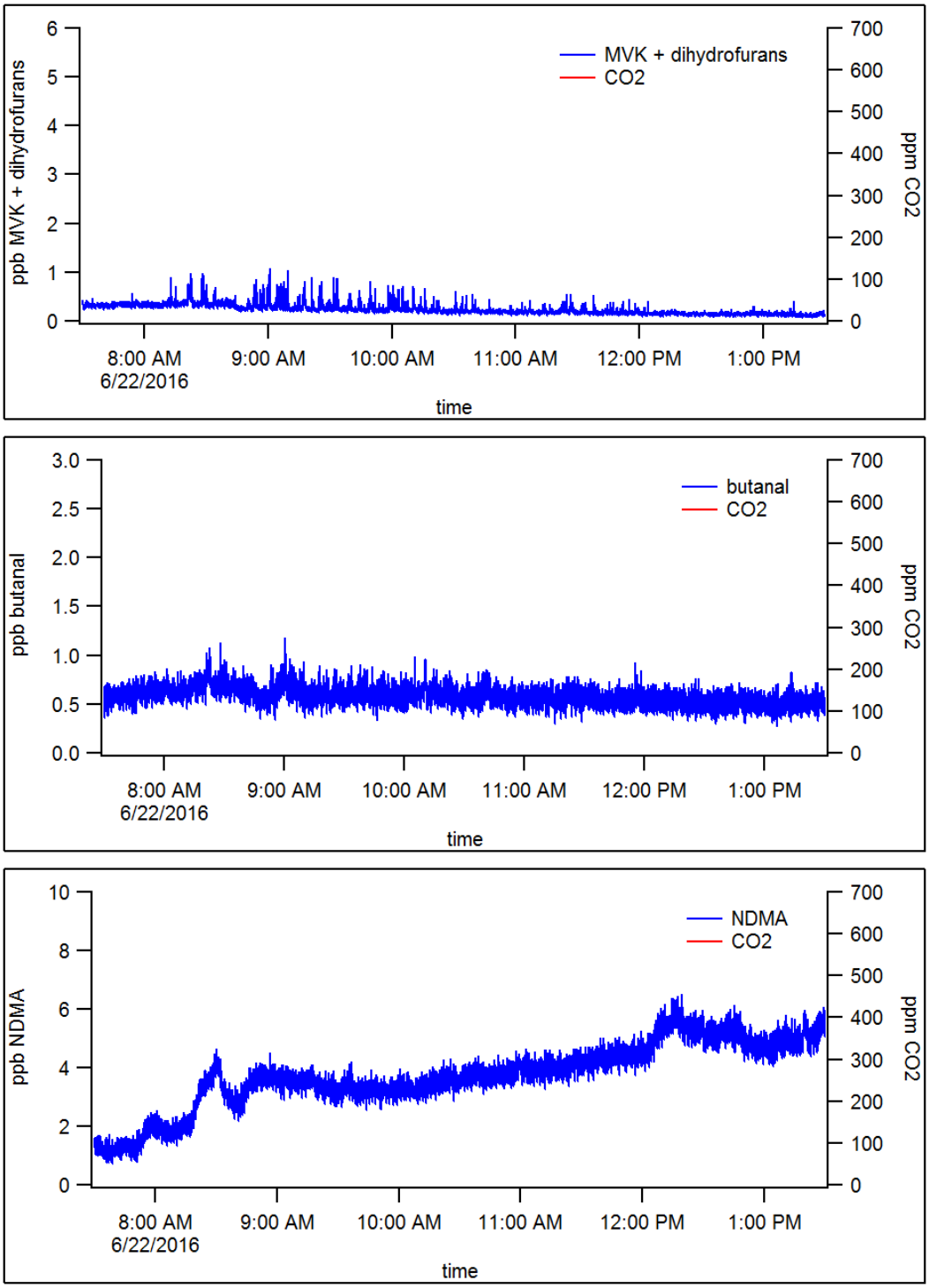


Figure B.1.3-6. June 22th - Benzene (TOP), 2,4-Pentadienenitrile; Pyridine (MIDDLE), 2-methylene Butanenitrile (BOTTOM)

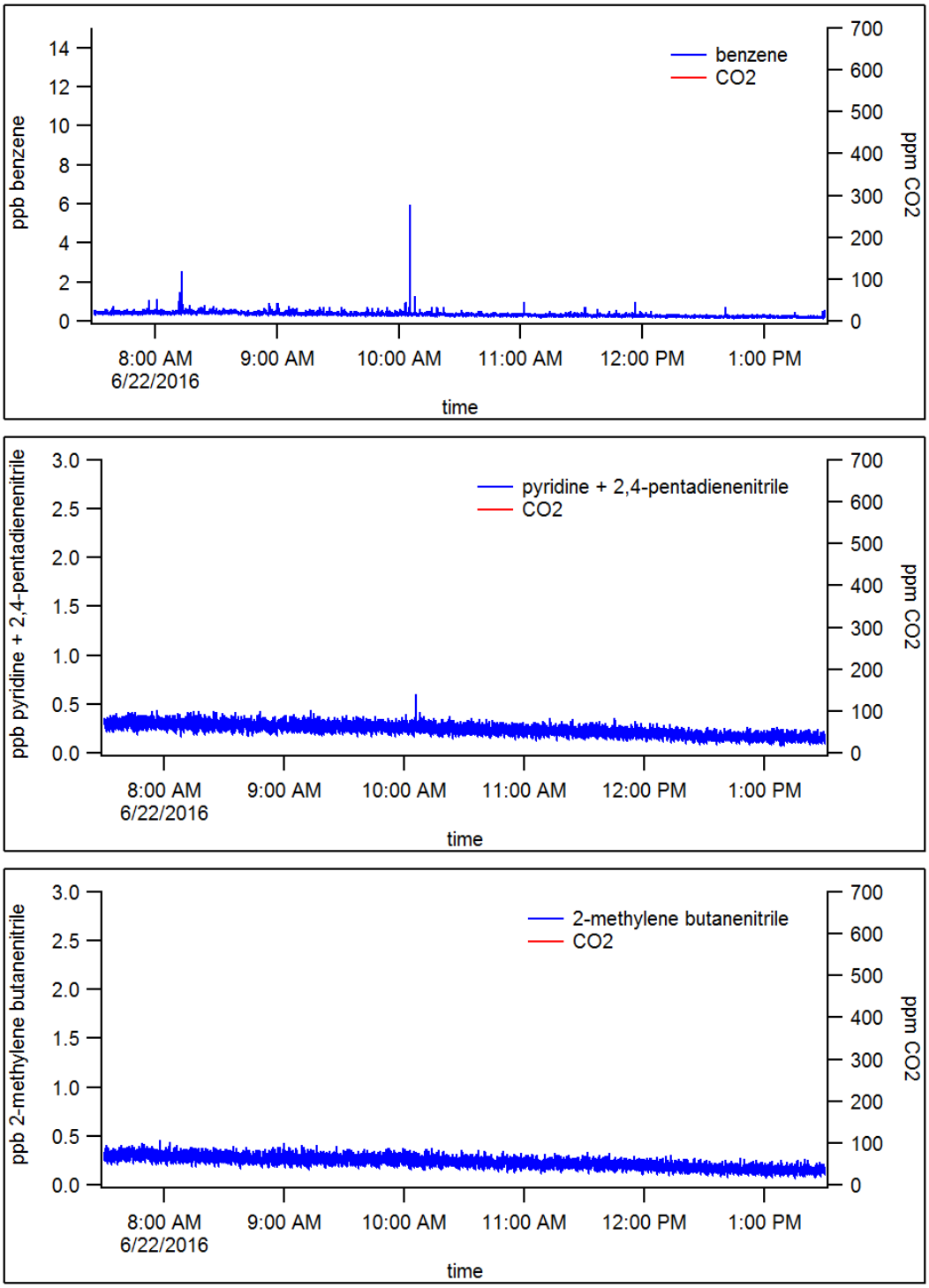


Figure B.1.3-7. June 22th - 2-methylfuran (TOP), Pentanenitrile (MIDDLE), 3-methyl-3-buten-2-one; 2-methyl-2-butenal (BOTTOM)

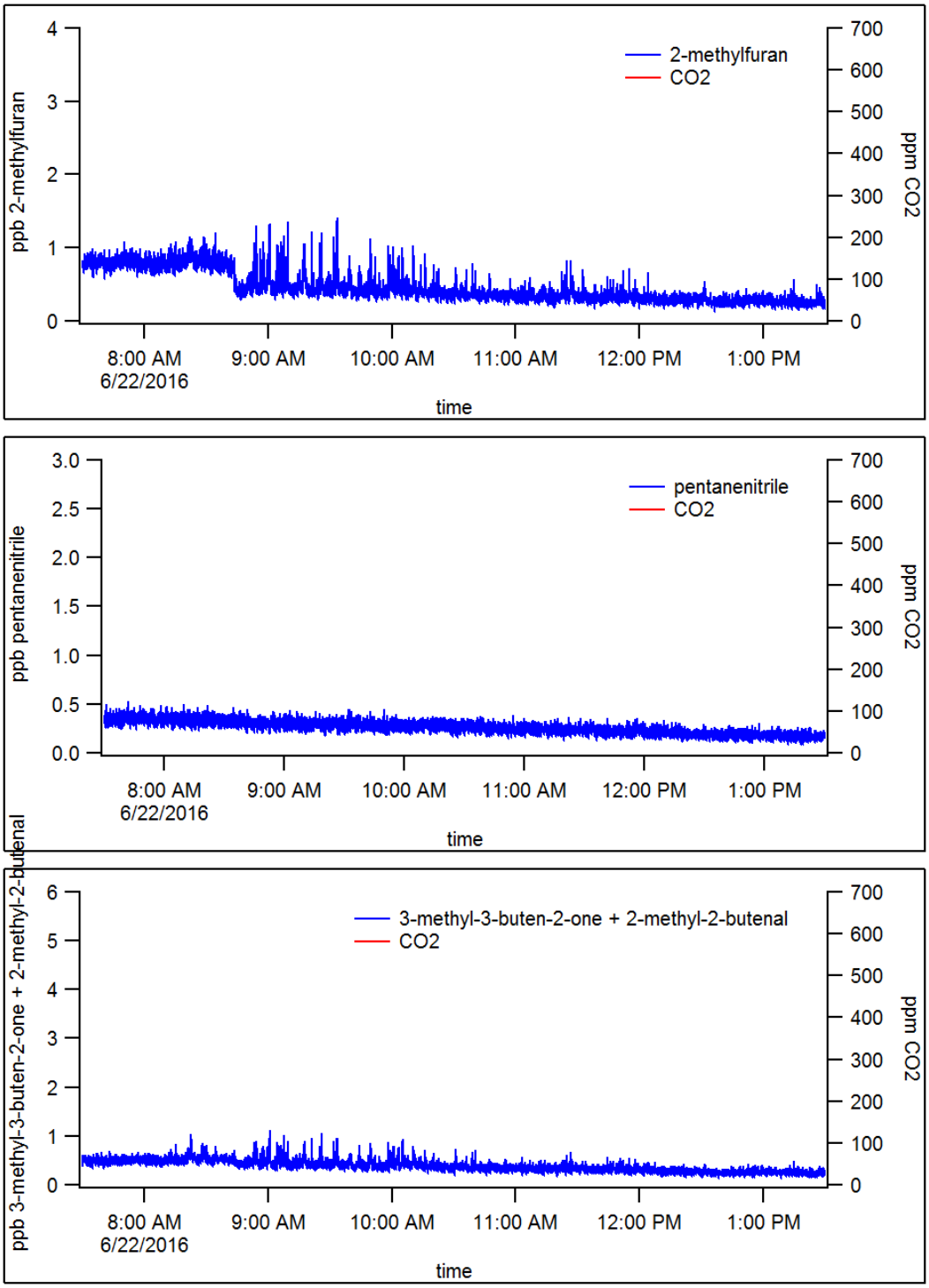


Figure B.1.3-8. June 22th - N-nitrosomethylethylamine [NEMA] (TOP), 2,5-dimethylfuran (MIDDLE), Hexanenitrile (BOTTOM)

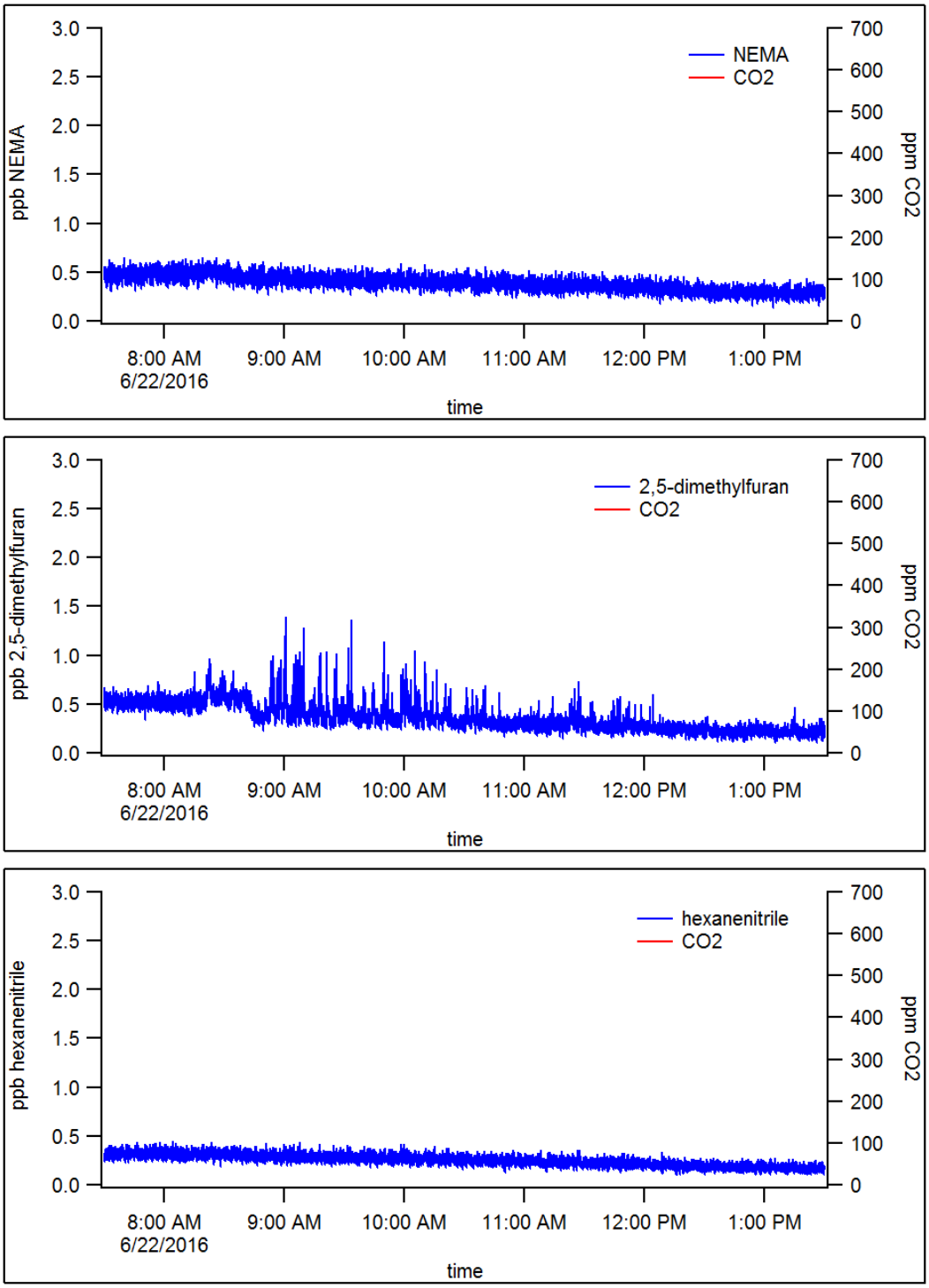


Figure B.1.3-9. June 22th - 2-hexanone [MBK] (TOP), N-nitrosodiethylamine [NDEA] (MIDDLE), Butyl Nitrite; 2-nitro-2-methylpropane (BOTTOM)

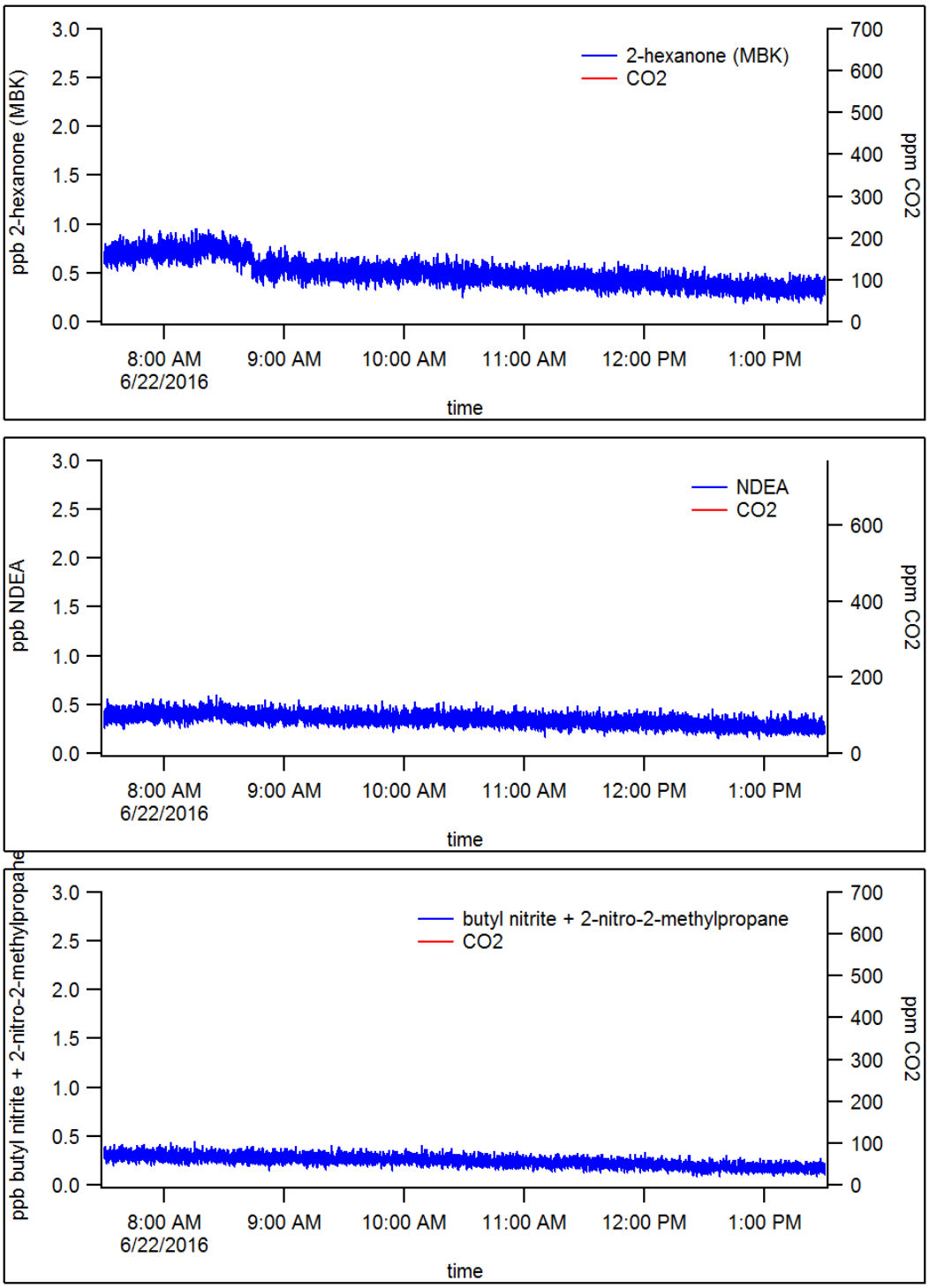


Figure B.1.3-10. June 22th - 2,4-dimethylpyridine (TOP), 2-ethyl-5-methylfuran (MIDDLE), Heptanenitrile (BOTTOM)

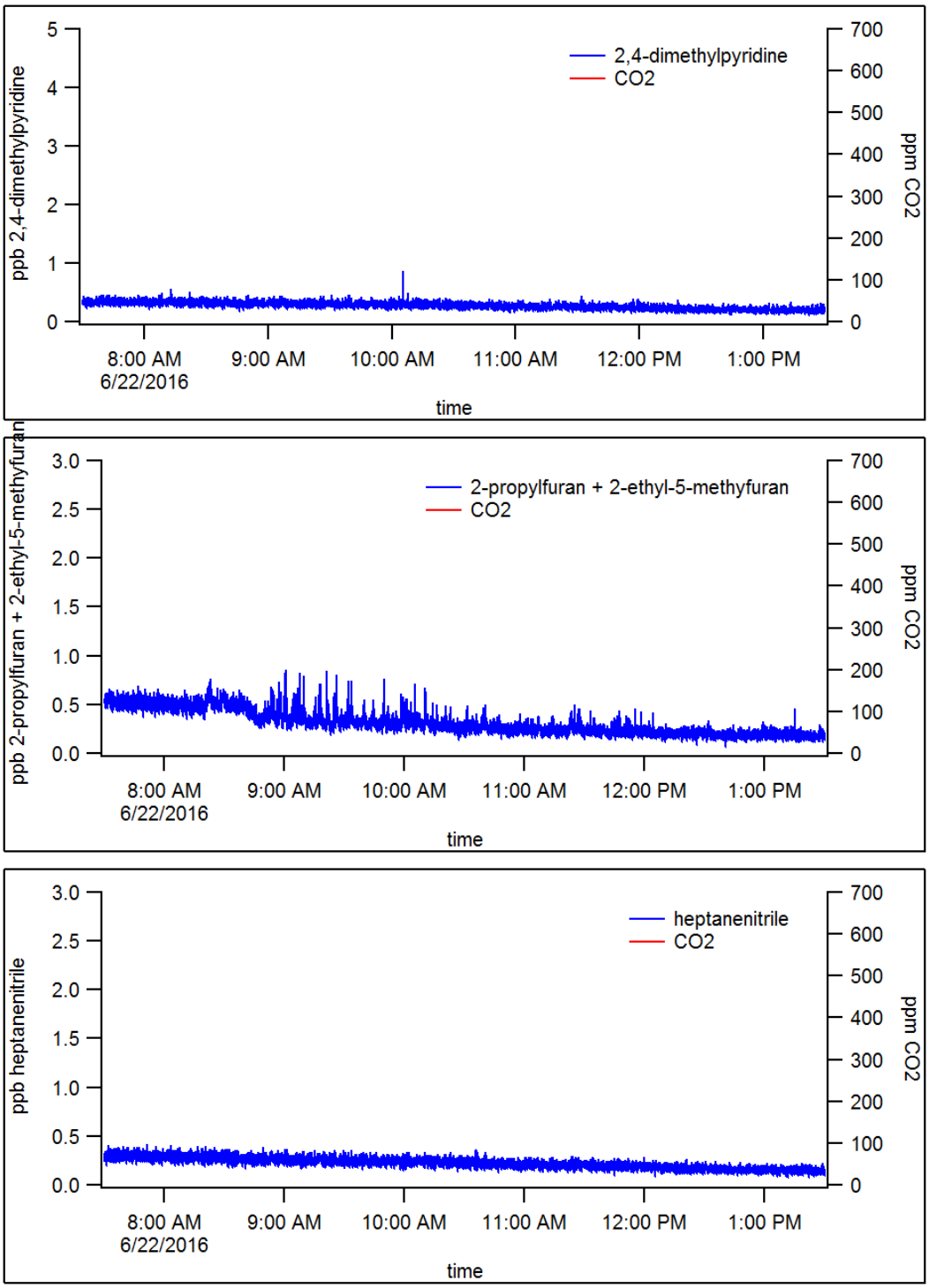


Figure B.1.3-11. June 22th - 4-methyl-2-hexanone (TOP), N-nitrosomorpholine [NMOR] (MIDDLE), Butyl Nitrate (BOTTOM)

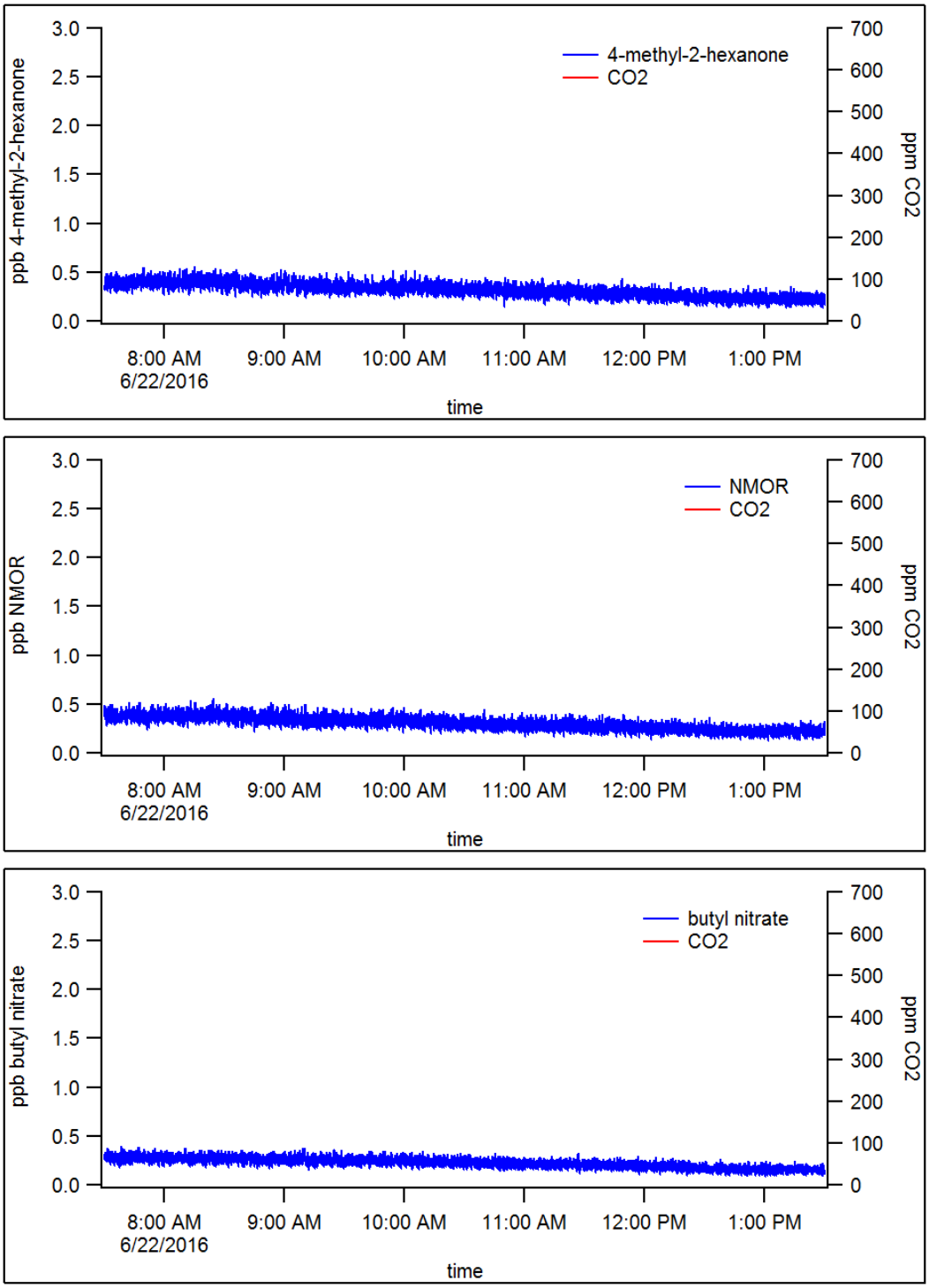


Figure B.1.3-12. June 22th - Multiple Furans [m/z 127] (TOP), 6-methyl-2-heptanone (MIDDLE), 2-pentylfuran (BOTTOM)

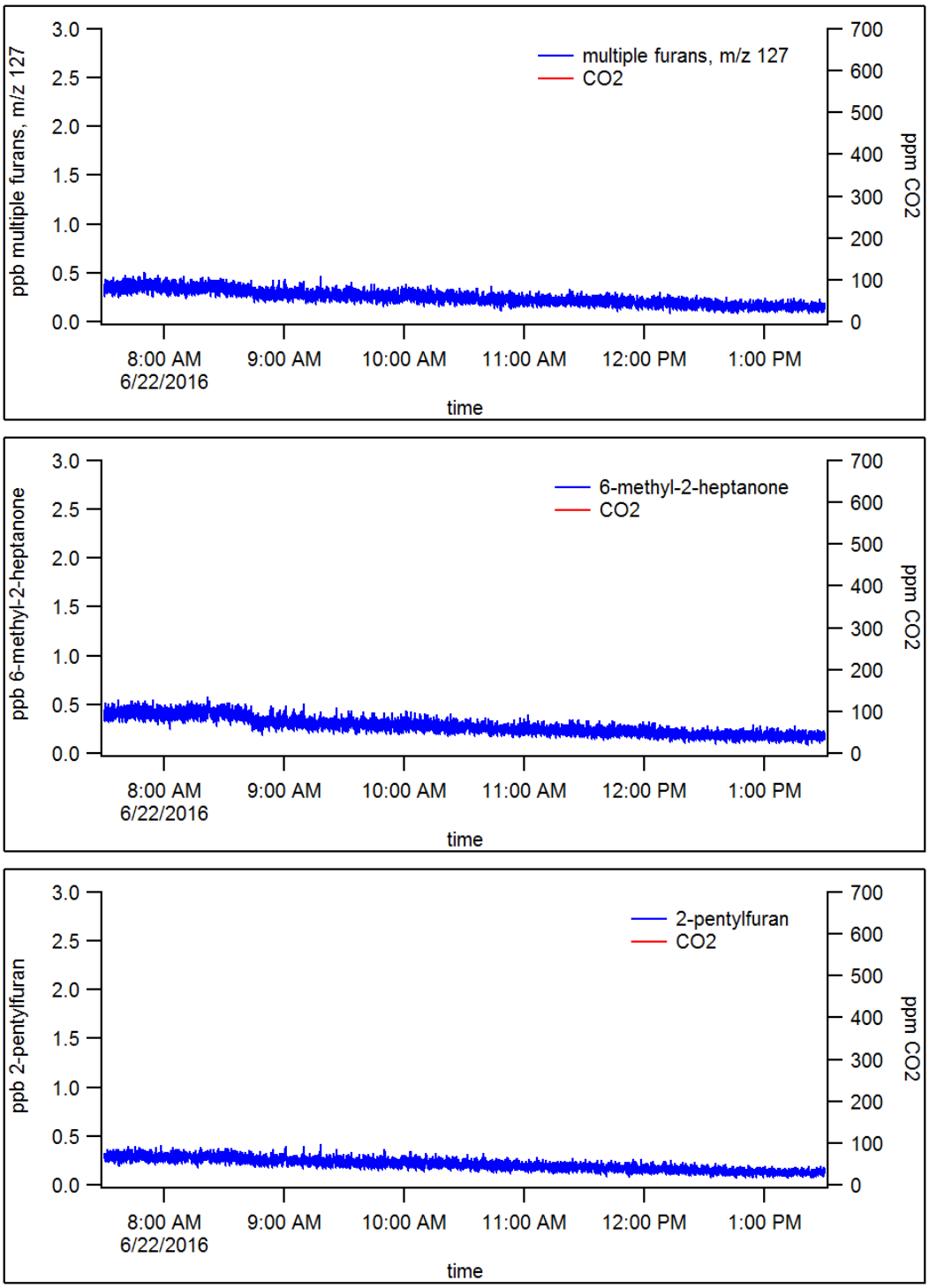


Figure B.1.3-13. June 22th - Biphenyl (TOP), 2-heptylfuran (MIDDLE), 2-octylfuran; 1,4-butanediol, Dinitrate (BOTTOM)

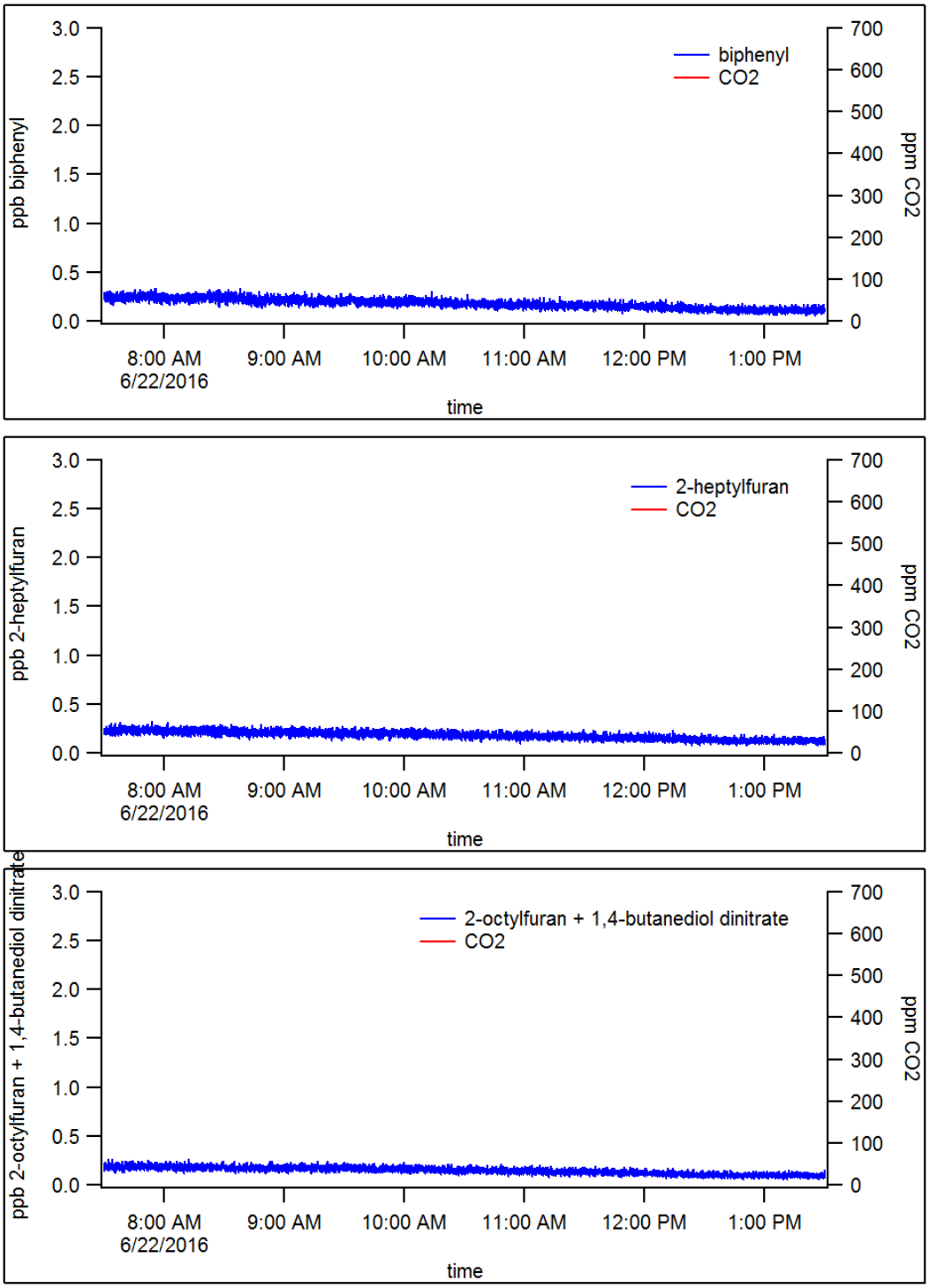


Figure B.1.3-14. June 22th - 1,2,3-propanetriol, 1,3-dinitrate (TOP), PCB (MIDDLE), 6-(2-furanyl)-6-methyl-2-heptanone (BOTTOM)

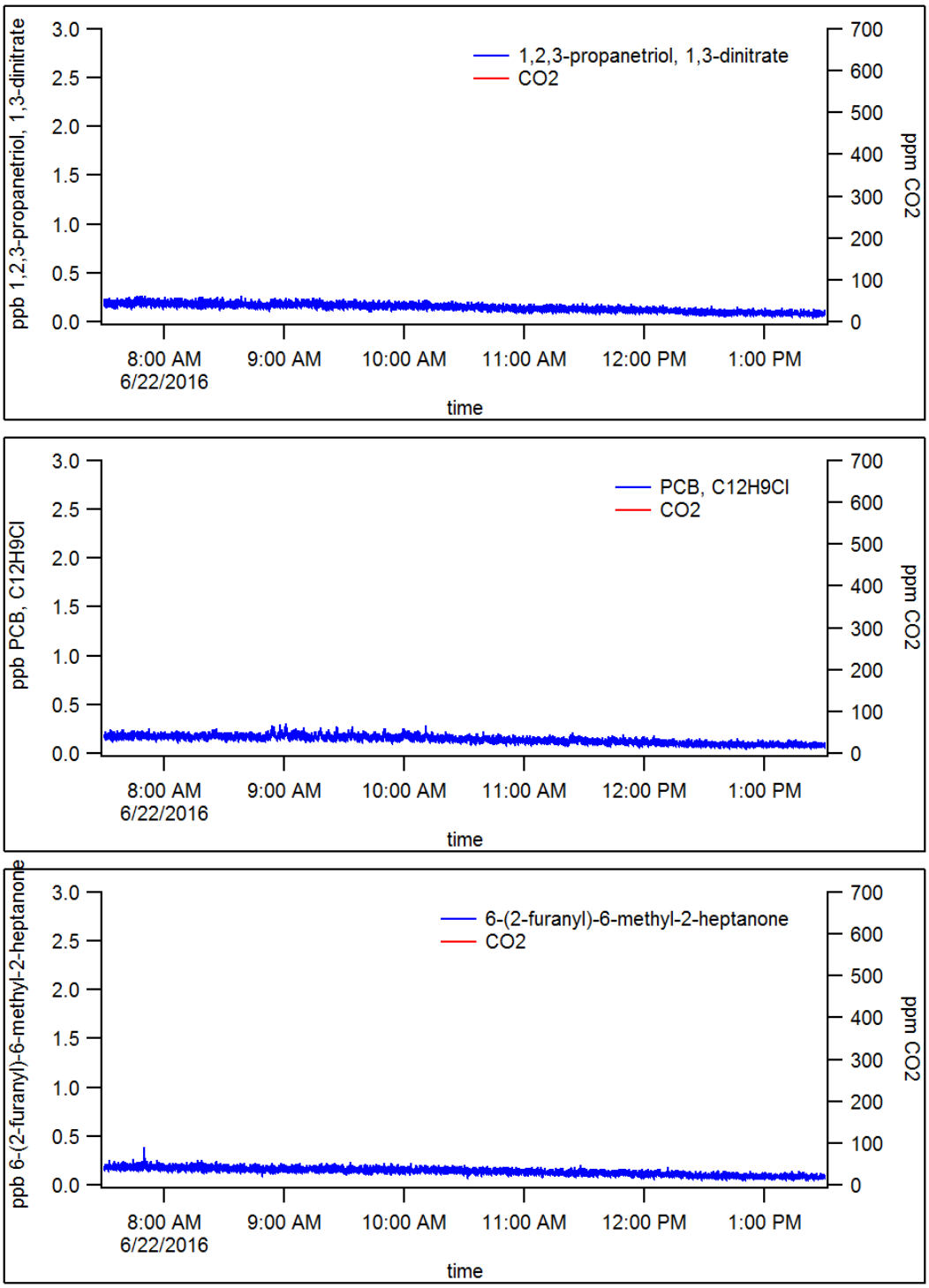
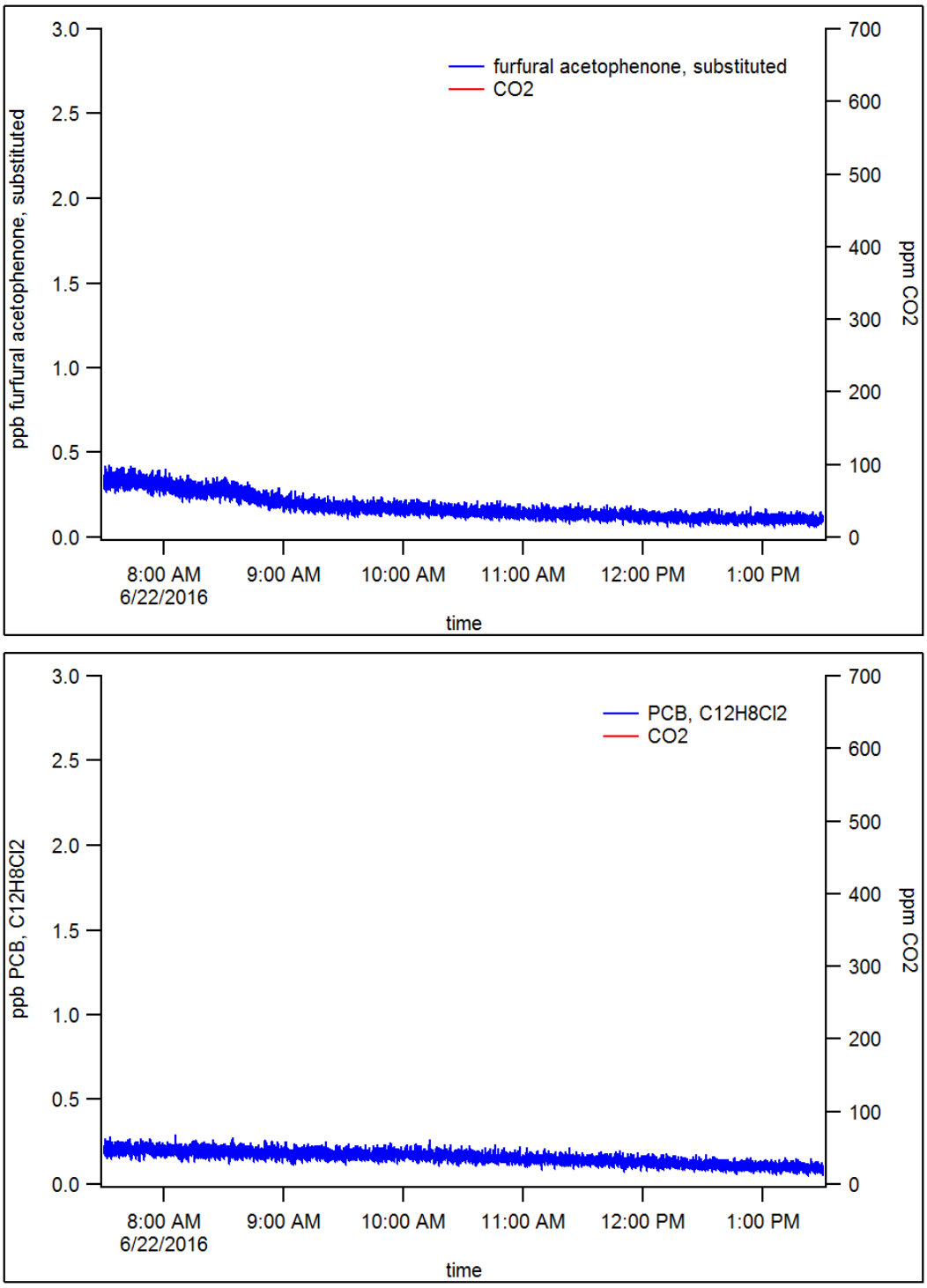


Figure B.1.3-15. June 22th - Furfural Acetophenone [3-(2-furanyl)-1-pheynyl-2-propen-1-one] (TOP), PCB [2] (BOTTOM)



B.1.4 June 23rd Data Collection

June 23rd data collection started at 6:40 AM and ended at 12:15 PM. Data collection methods included both mobile and stationary lab techniques. Below are the graphs presented in order based on the Chemicals of Potential Concern (COPC) list. Note that with this date's data, there is no Carbon Dioxide (CO_2) data to correlate with the PTR-Mass data, as there were technical difficulties with the mobile and stationary lab techniques.

Figure B.1.4-1. June 23rd - Formaldehyde (TOP), Methanol (MIDDLE), Acetonitrile (BOTTOM)

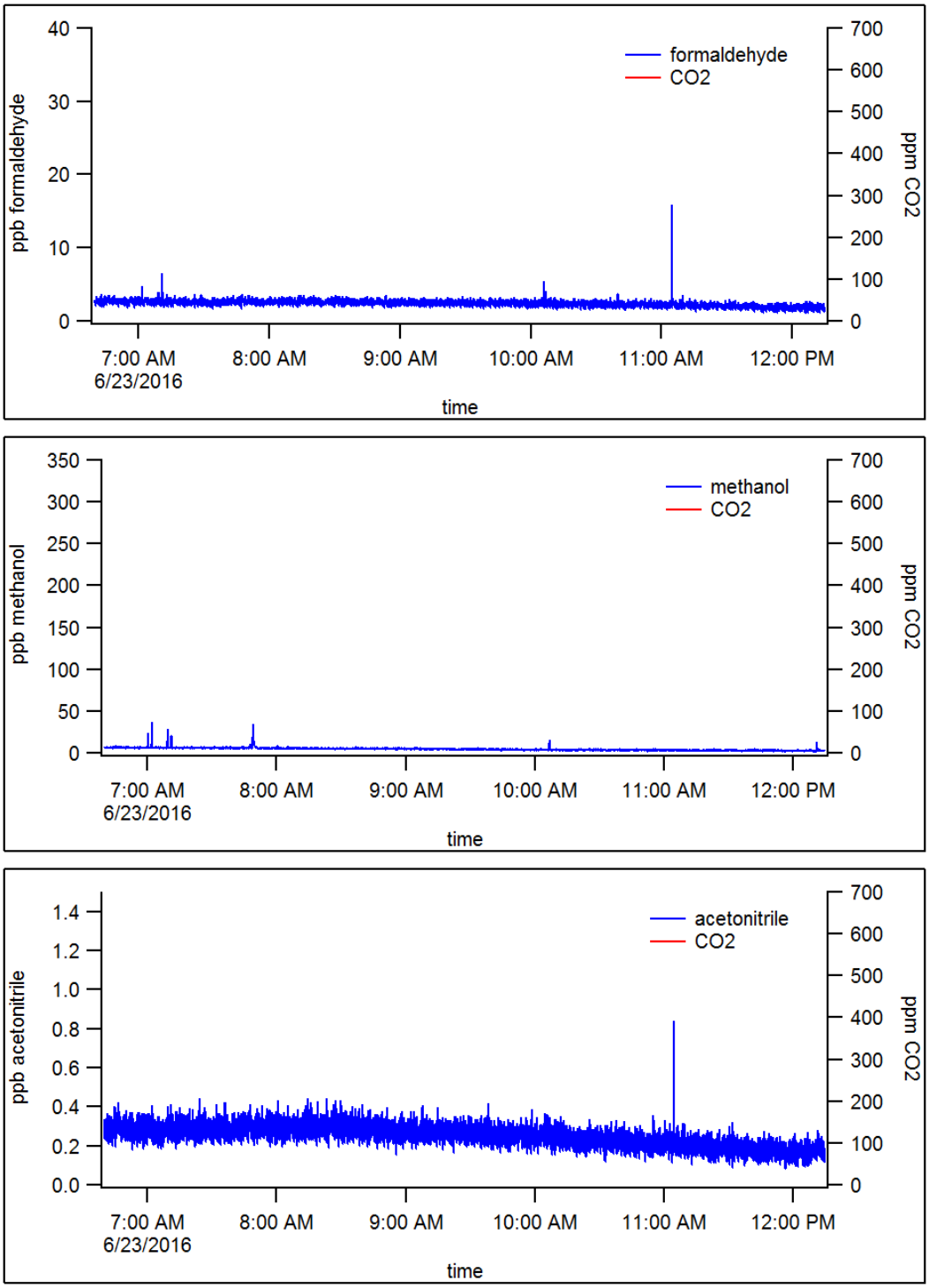


Figure B.1.4-2. June 23rd - Acetaldehyde (TOP), Ethylamine (MIDDLE), 1,3-Butadiene (BOTTOM)

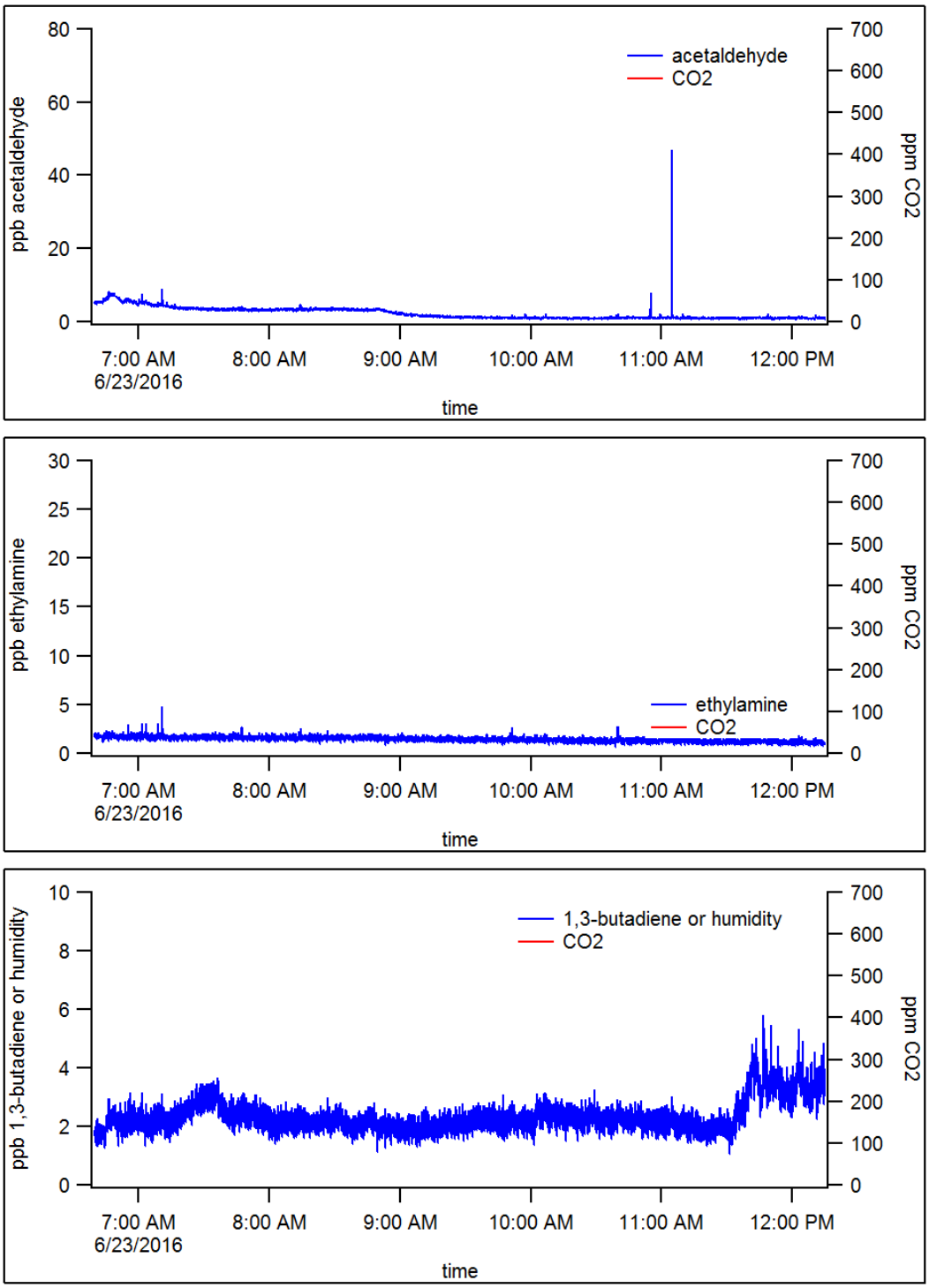


Figure B.1.4-3. June 23rd - Propanenitrile (TOP), 1-Butanol; Butenes (MIDDLE), Methyl Isocyanate (BOTTOM)

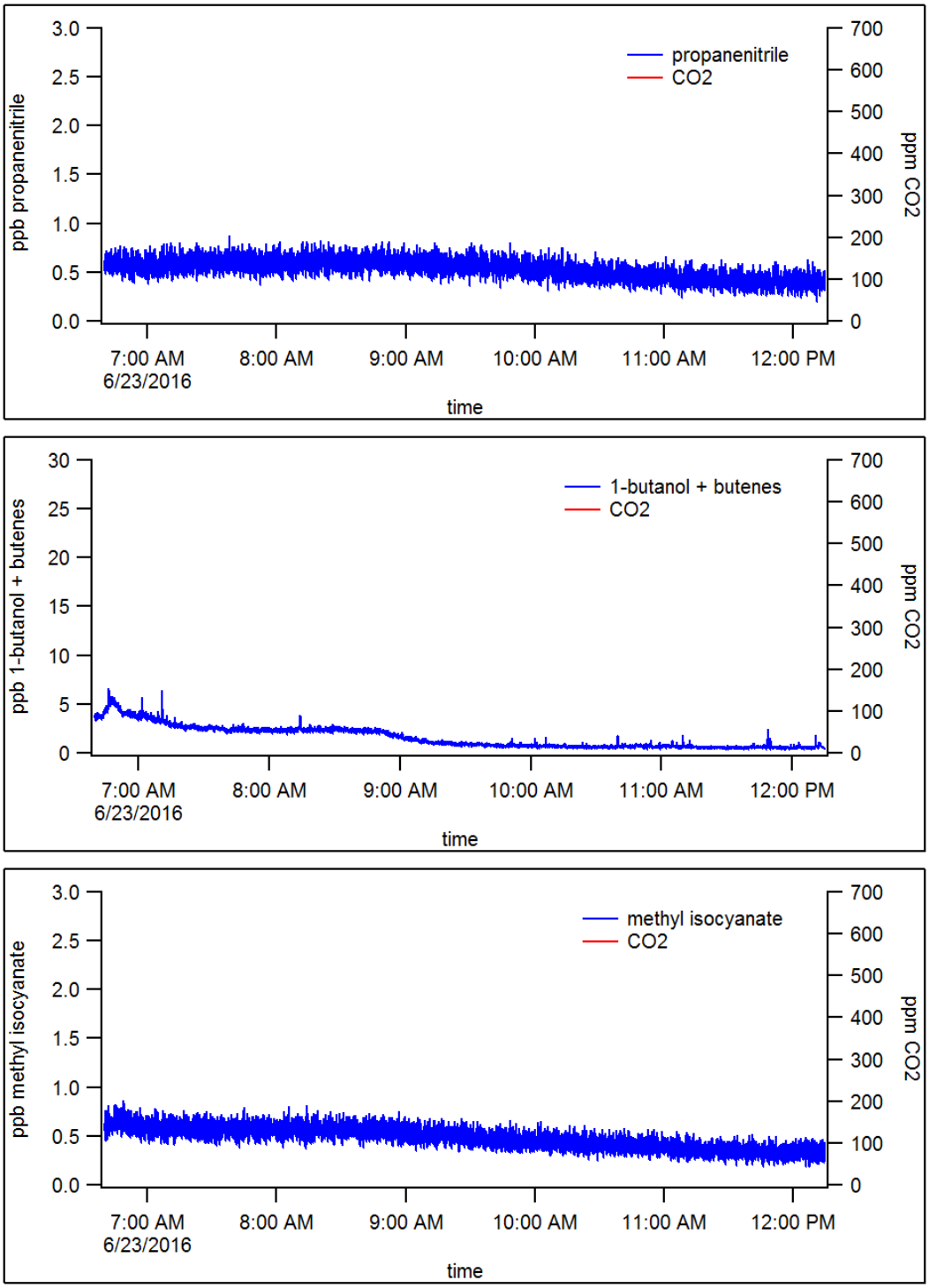


Figure B.1.4-4. June 23rd - Methyl Nitrite (TOP), Furan; Isoprene (MIDDLE), Butanenitrile (BOTTOM)

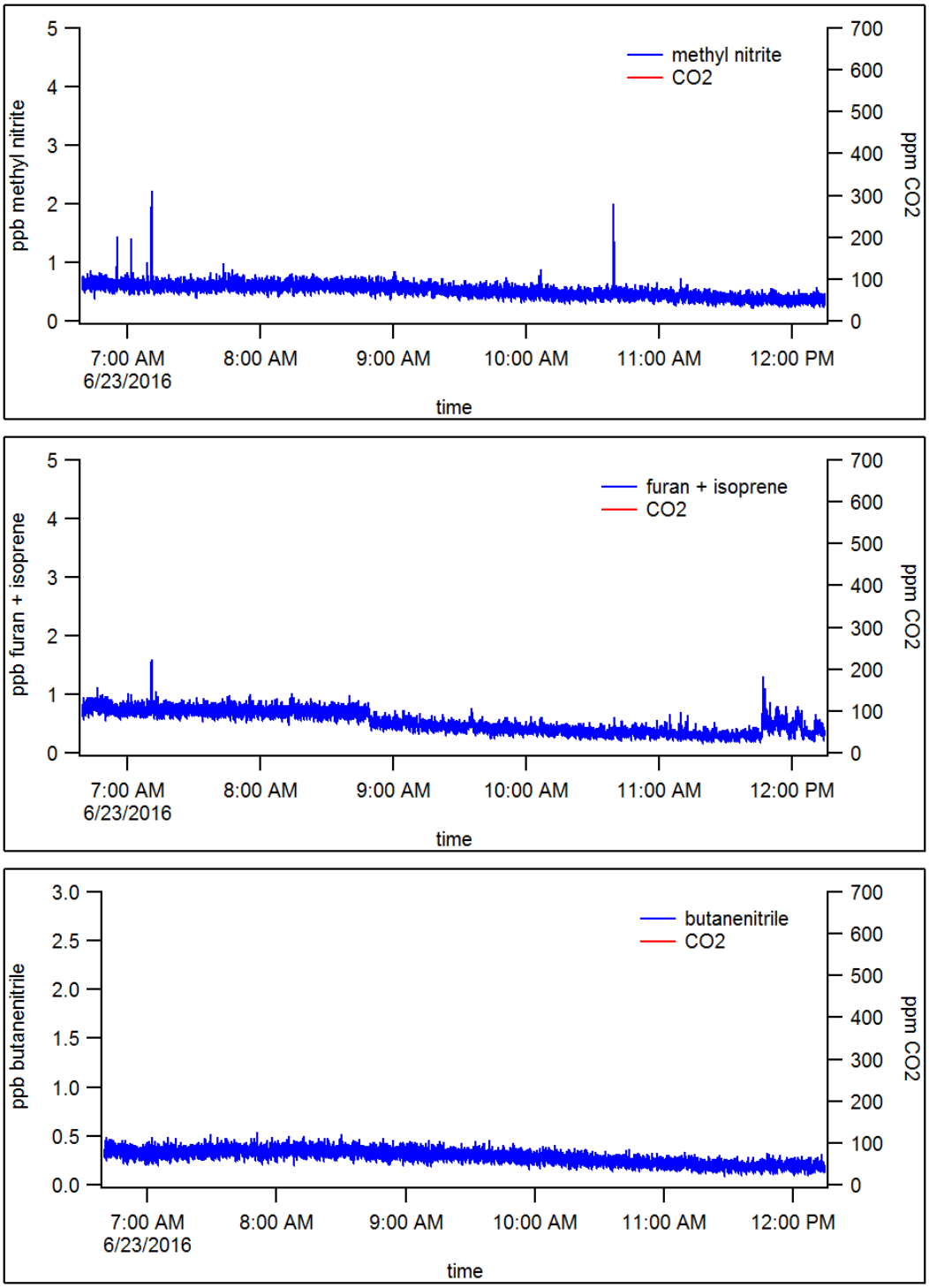


Figure B.1.4-5. June 23rd - MVK + Dihydrofurans(TOP), Butanal (MIDDLE), N-nitrosodimethylamine [NDMA] (BOTTOM)

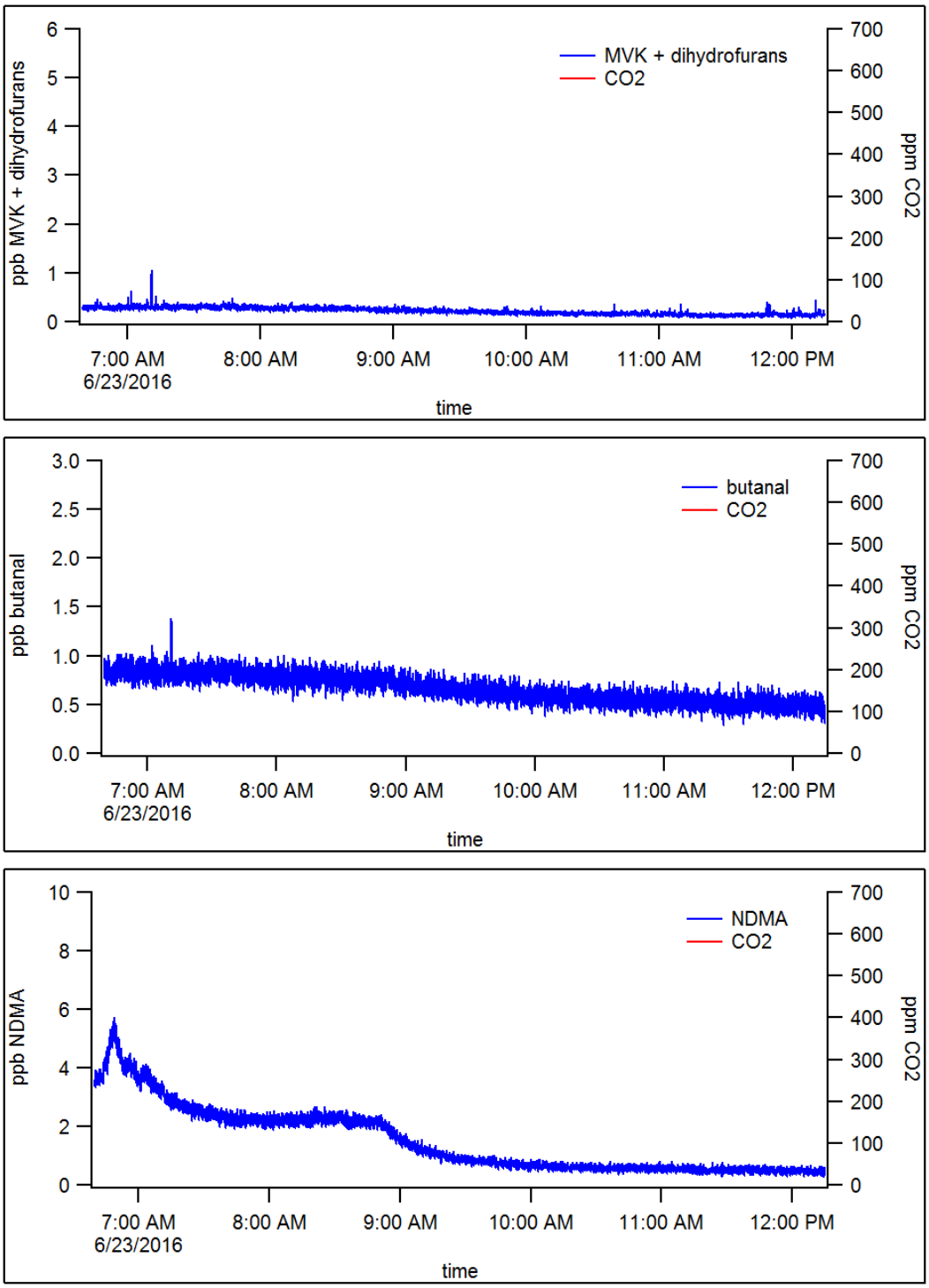


Figure B.1.4-6. June 23rd - Benzene (TOP), 2,4-Pentadienenitrile; Pyridine (MIDDLE), 2-methylene Butanenitrile (BOTTOM)

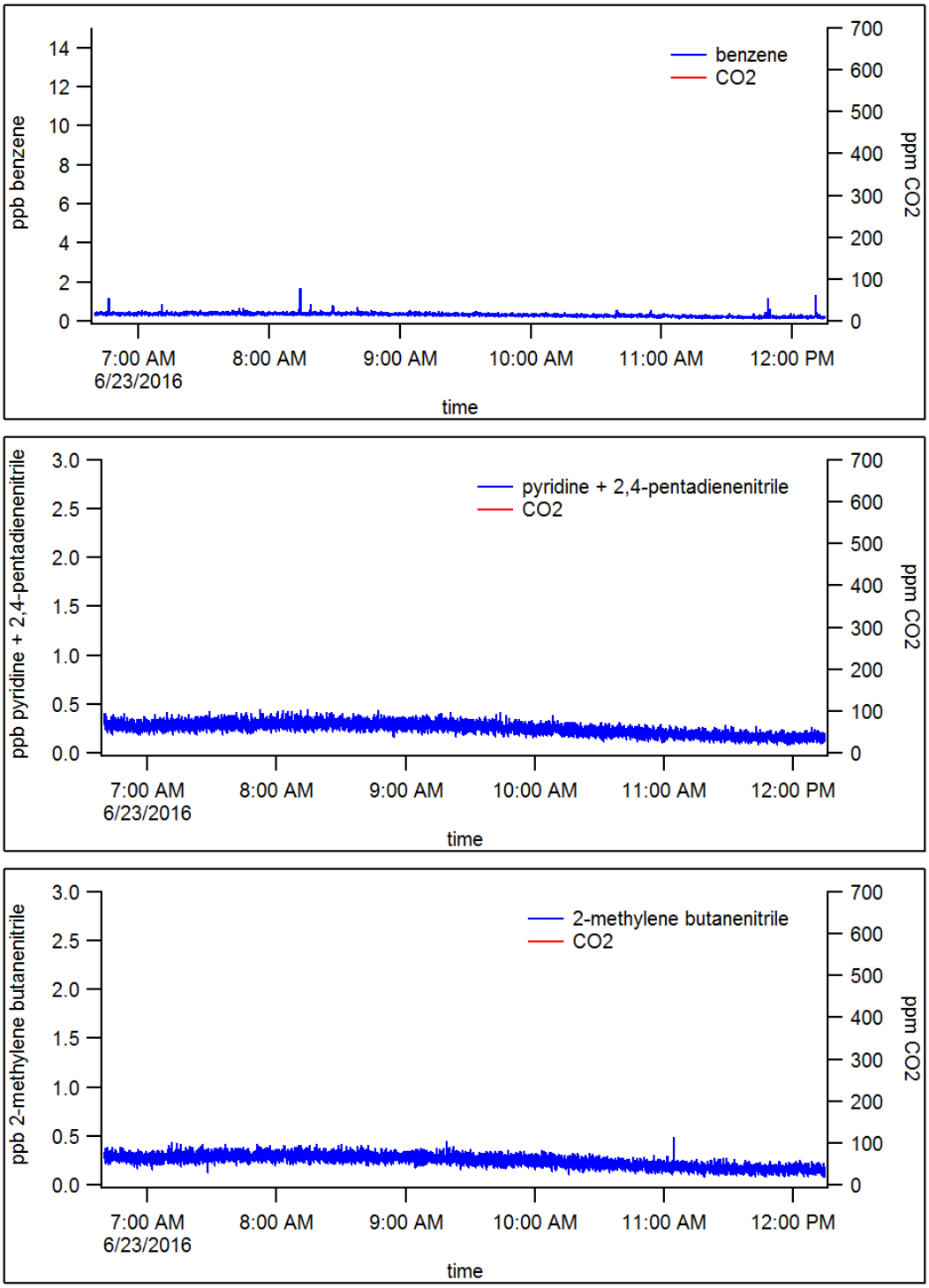


Figure B.1.4-7. June 23rd - 2-methylfuran (TOP), Pentanenitrile (MIDDLE), 3-methyl-3-buten-2-one; 2-methyl-2-butenal (BOTTOM)

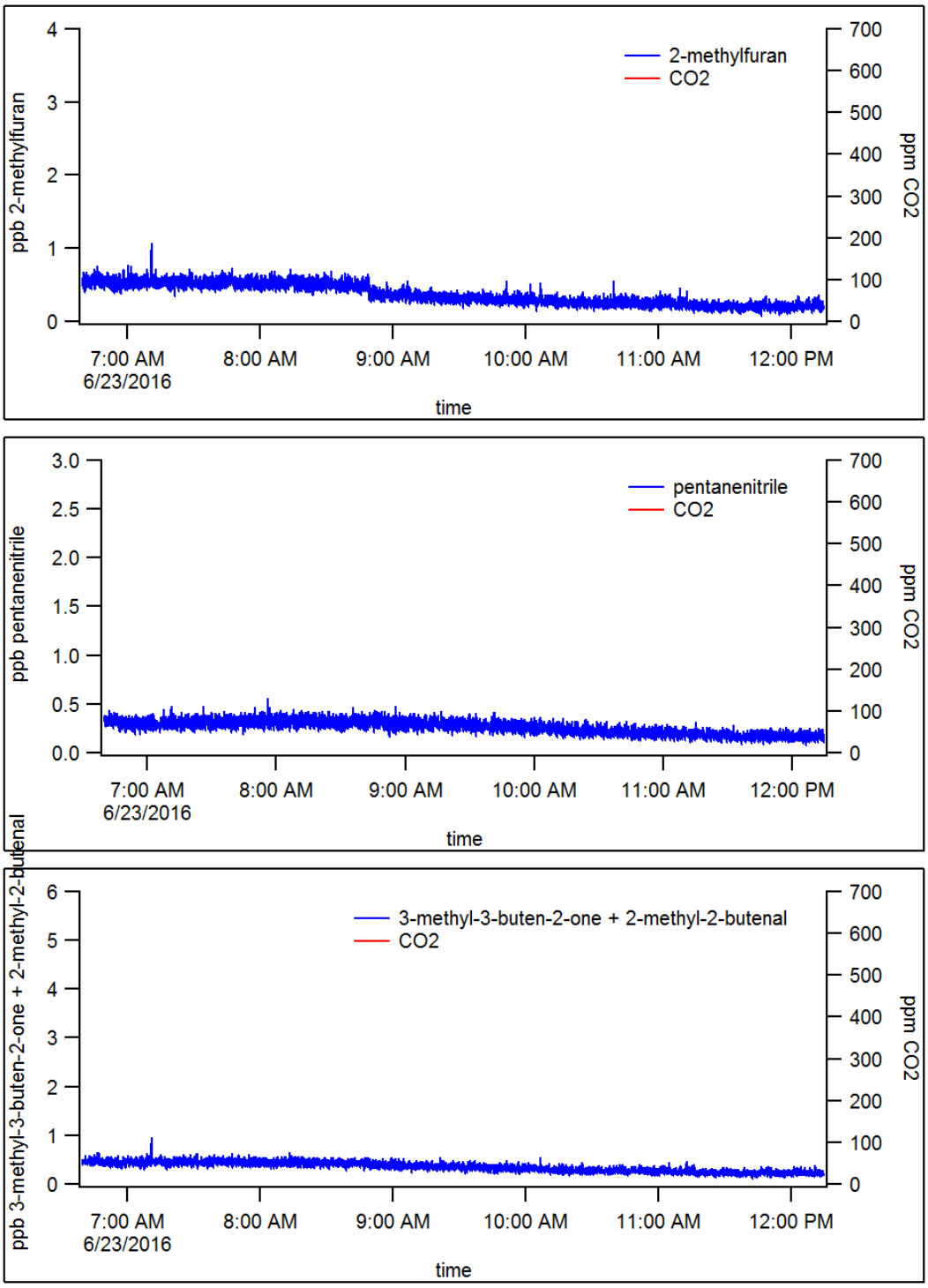


Figure B.1.4-8. June 23rd - N-nitrosomethylethylamine [NEMA] (TOP), 2,5-dimethylfuran (MIDDLE), Hexanenitrile (BOTTOM)

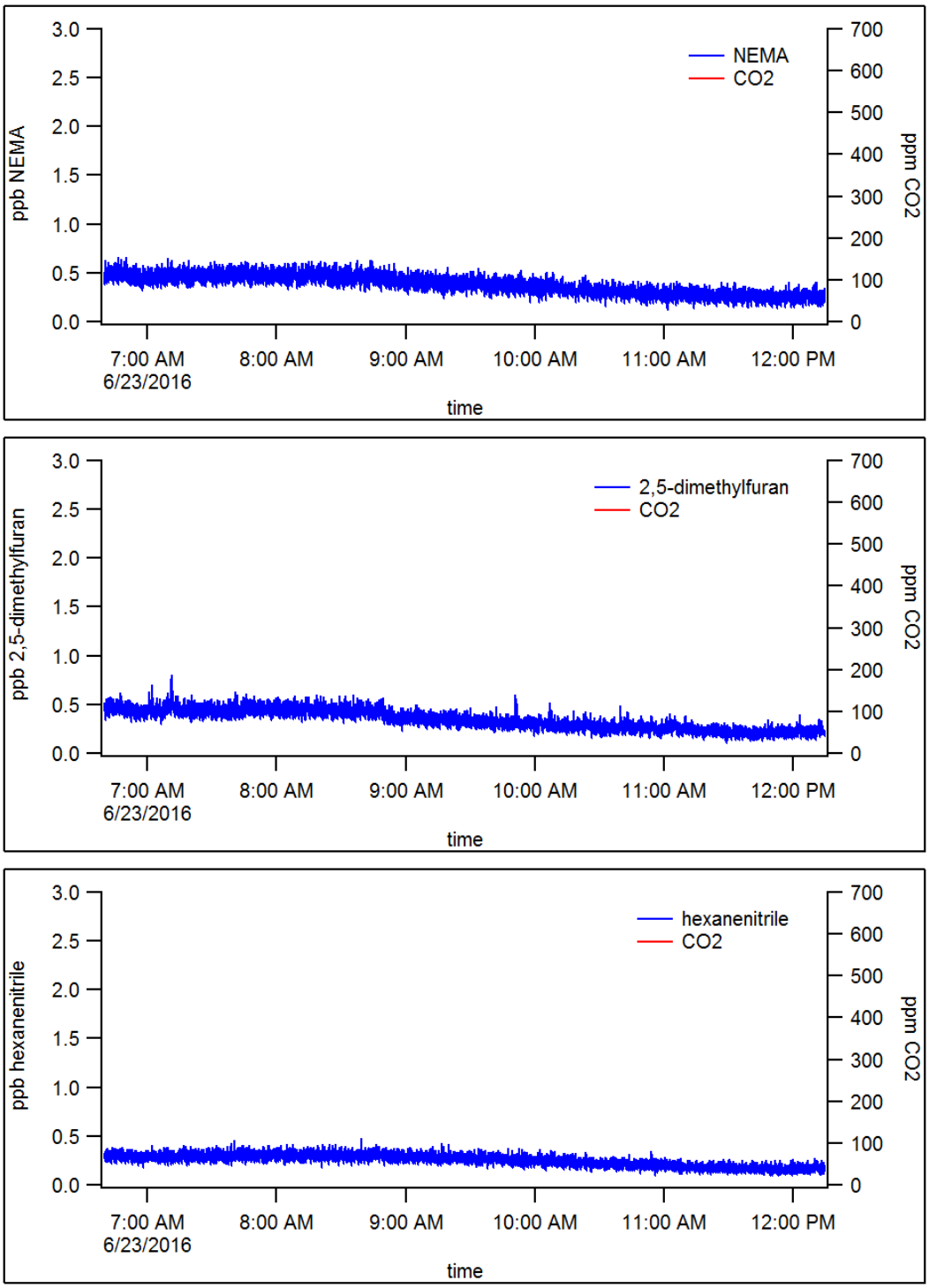


Figure B.1.4-9. June 23rd - 2-hexanone [MBK] (TOP), N-nitrosodiethylamine [NDEA] (MIDDLE), Butyl Nitrite; 2-nitro-2-methylpropane (BOTTOM)

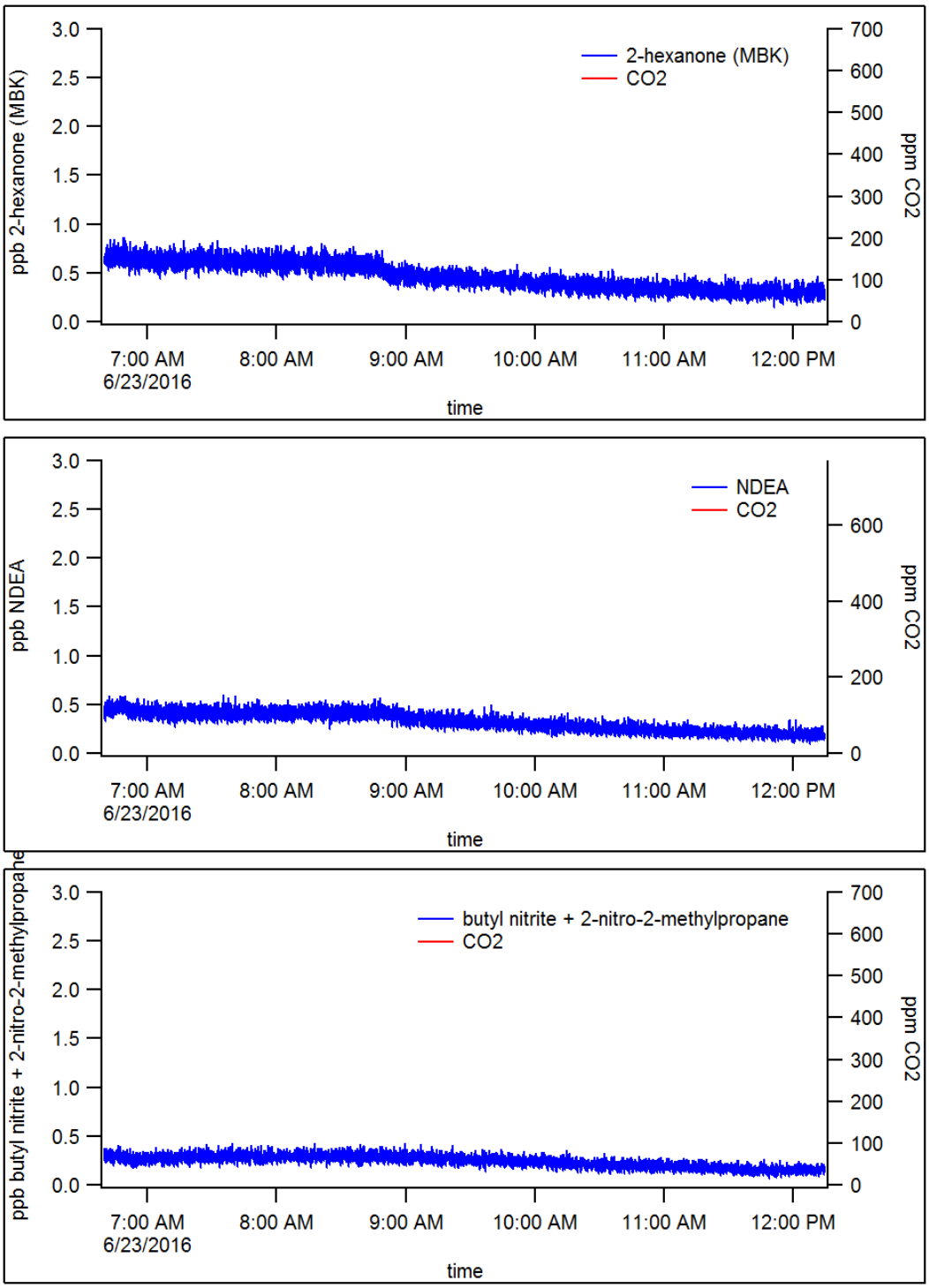


Figure B.1.4-10. June 23rd - 2,4-dimethylpyridine (TOP), 2-ethyl-5-methylfuran (MIDDLE), Heptanenitrile (BOTTOM)

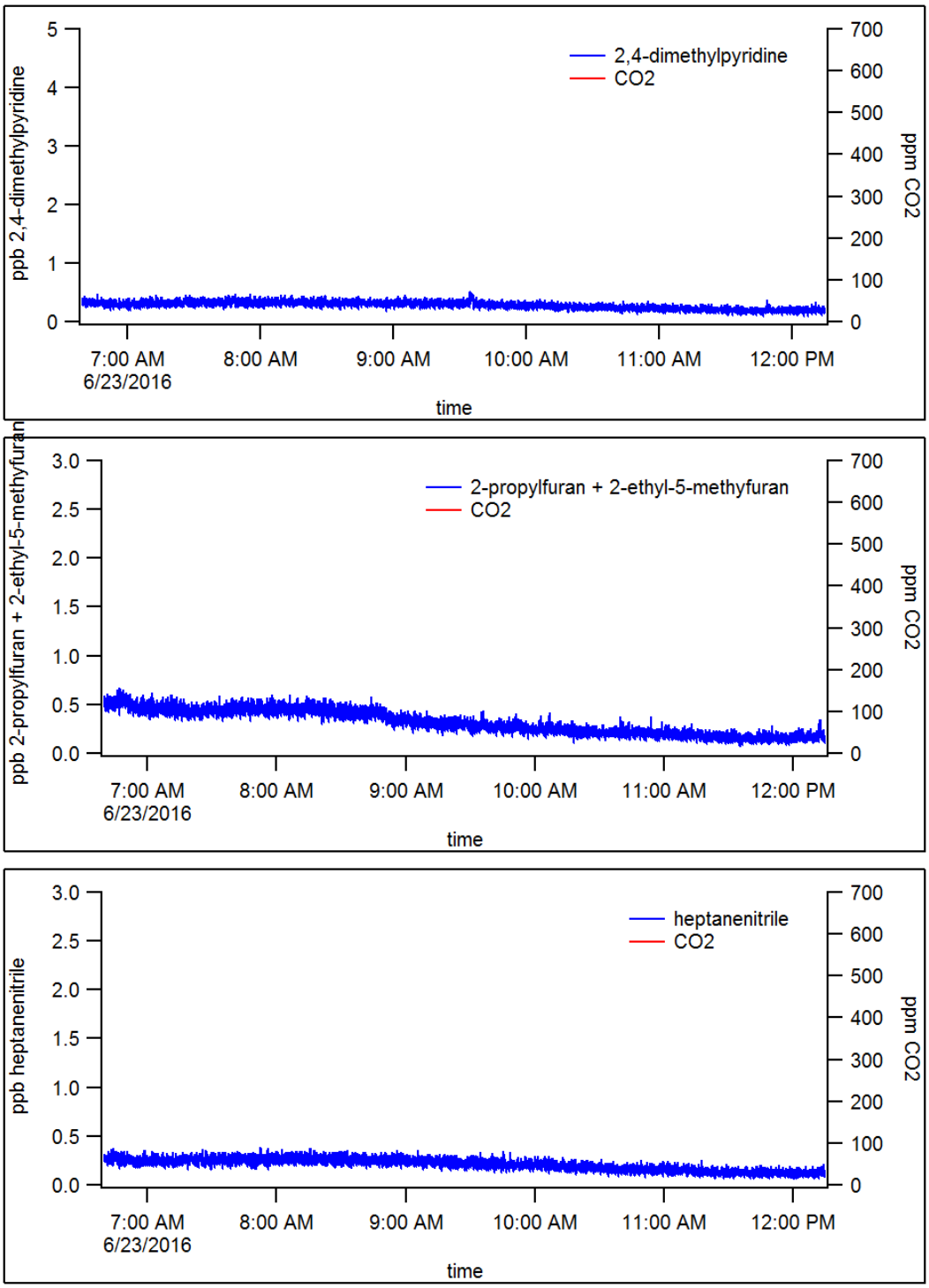


Figure B.1.4-11. June 23rd - 4-methyl-2-hexanone (TOP), N-nitrosomorpholine [NMOR] (MIDDLE), Butyl Nitrate (BOTTOM)

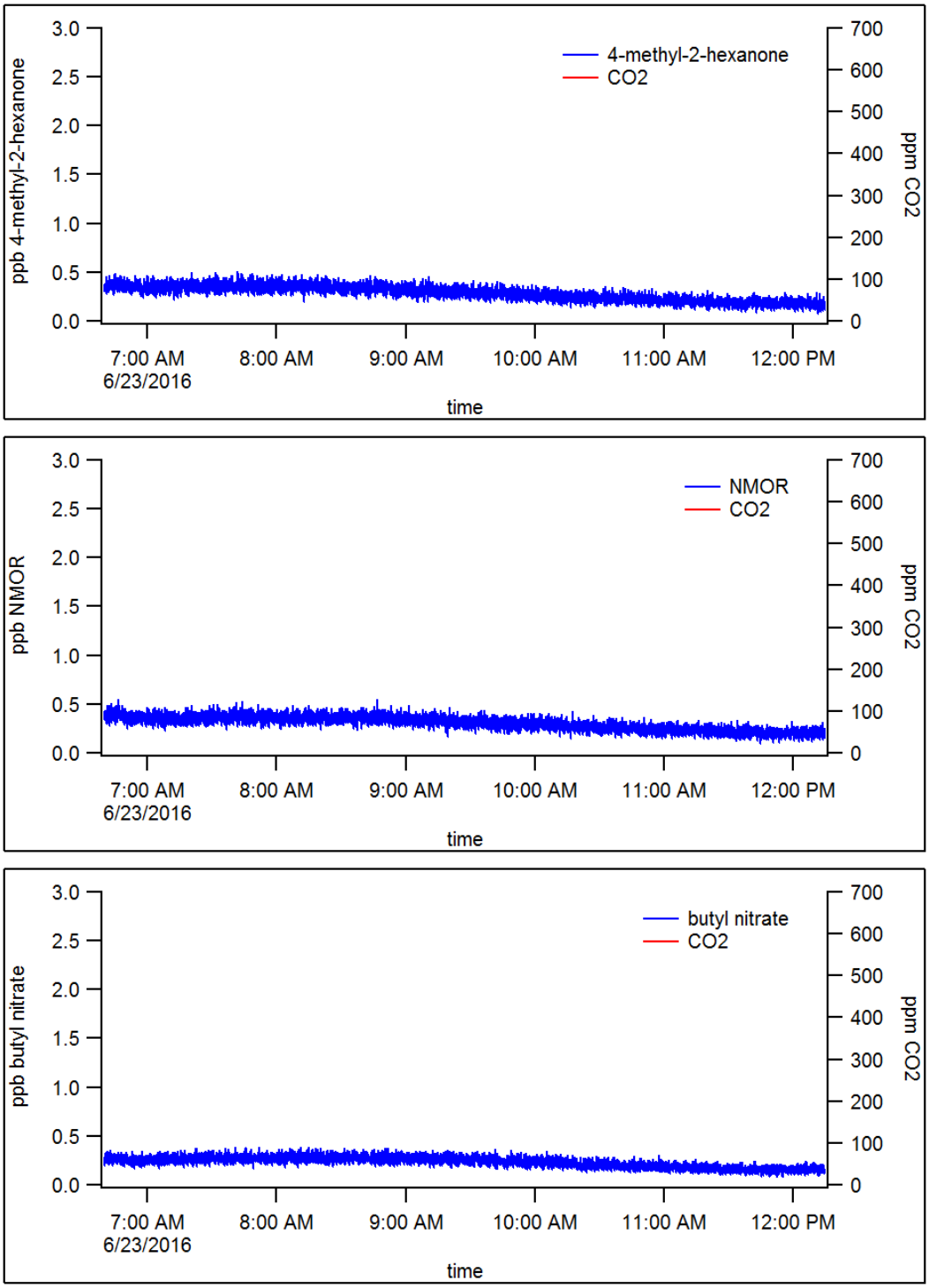


Figure B.1.4-12. June 23rd - Multiple Furans [m/z 127] (TOP), 6-methyl-2-heptanone (MIDDLE), 2-pentylfuran (BOTTOM)

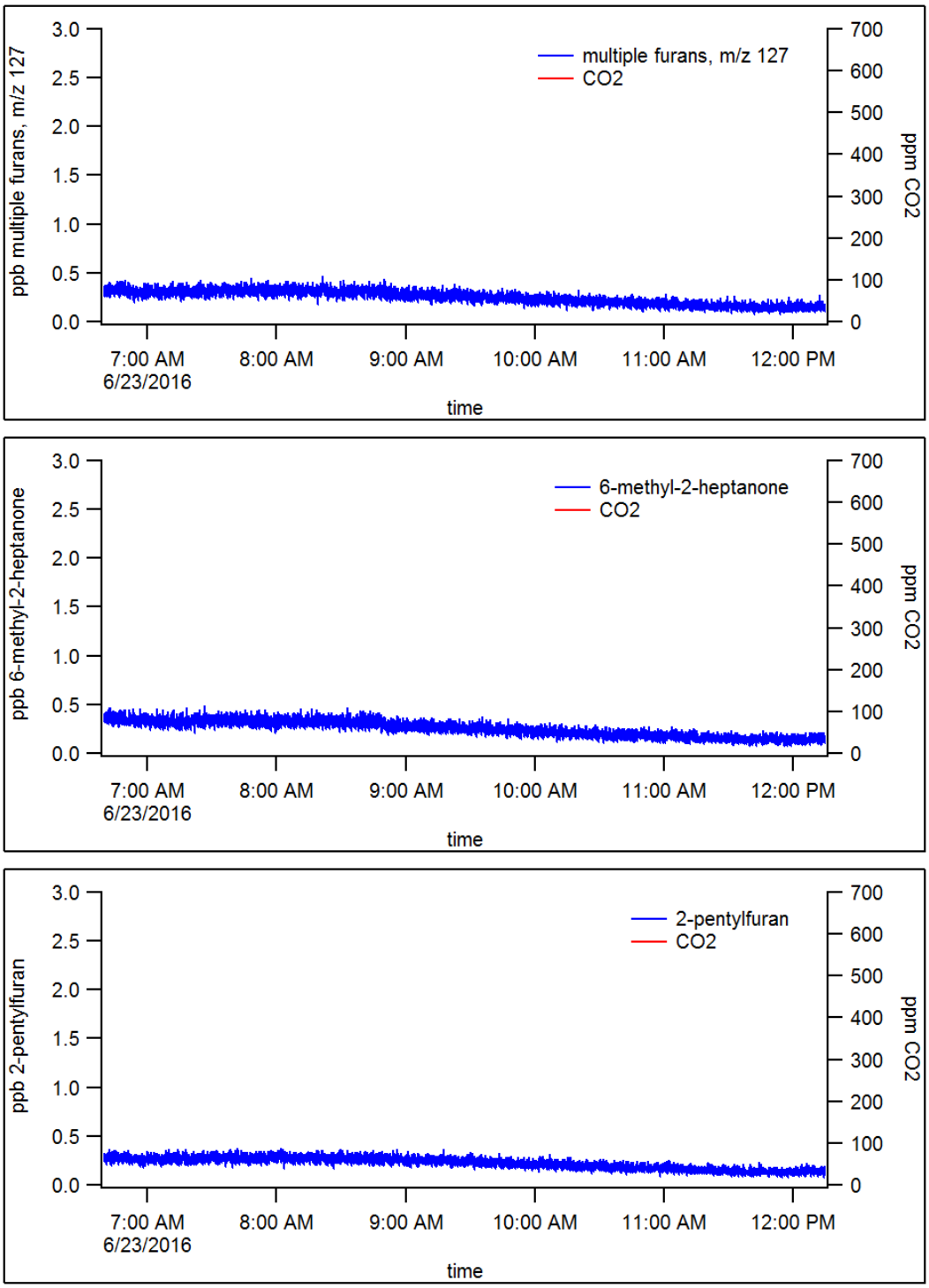


Figure B.1.4-13. June 23rd - Biphenyl (TOP), 2-heptylfuran (MIDDLE), 2-octylfuran; 1,4-butanediol, Dinitrate (BOTTOM)

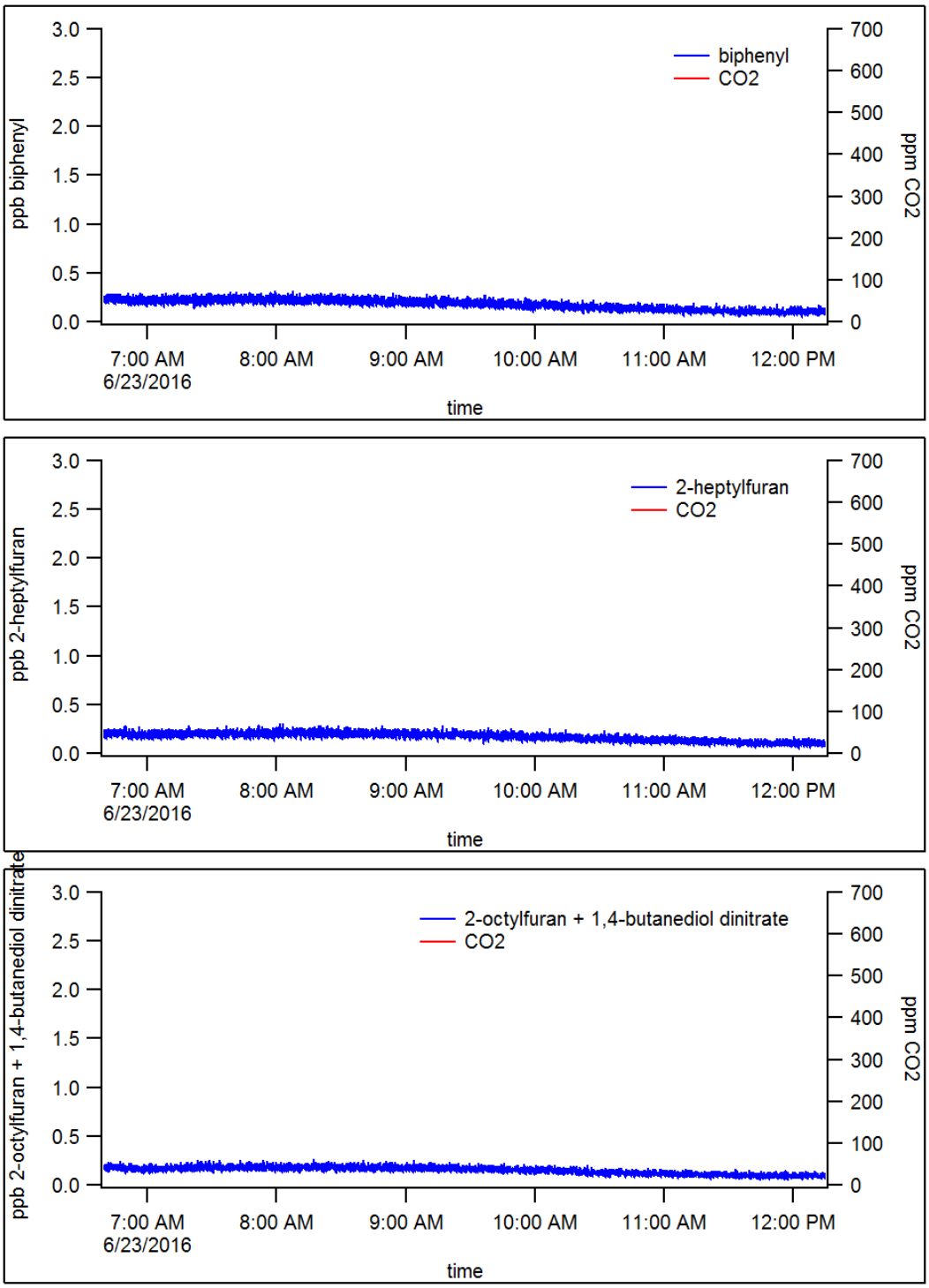


Figure B.1.4-14. June 23rd - 1,2,3-propanetriol, 1,3-dinitrate (TOP), PCB (MIDDLE), 6-(2-furanyl)-6-methyl-2-heptanone (BOTTOM)

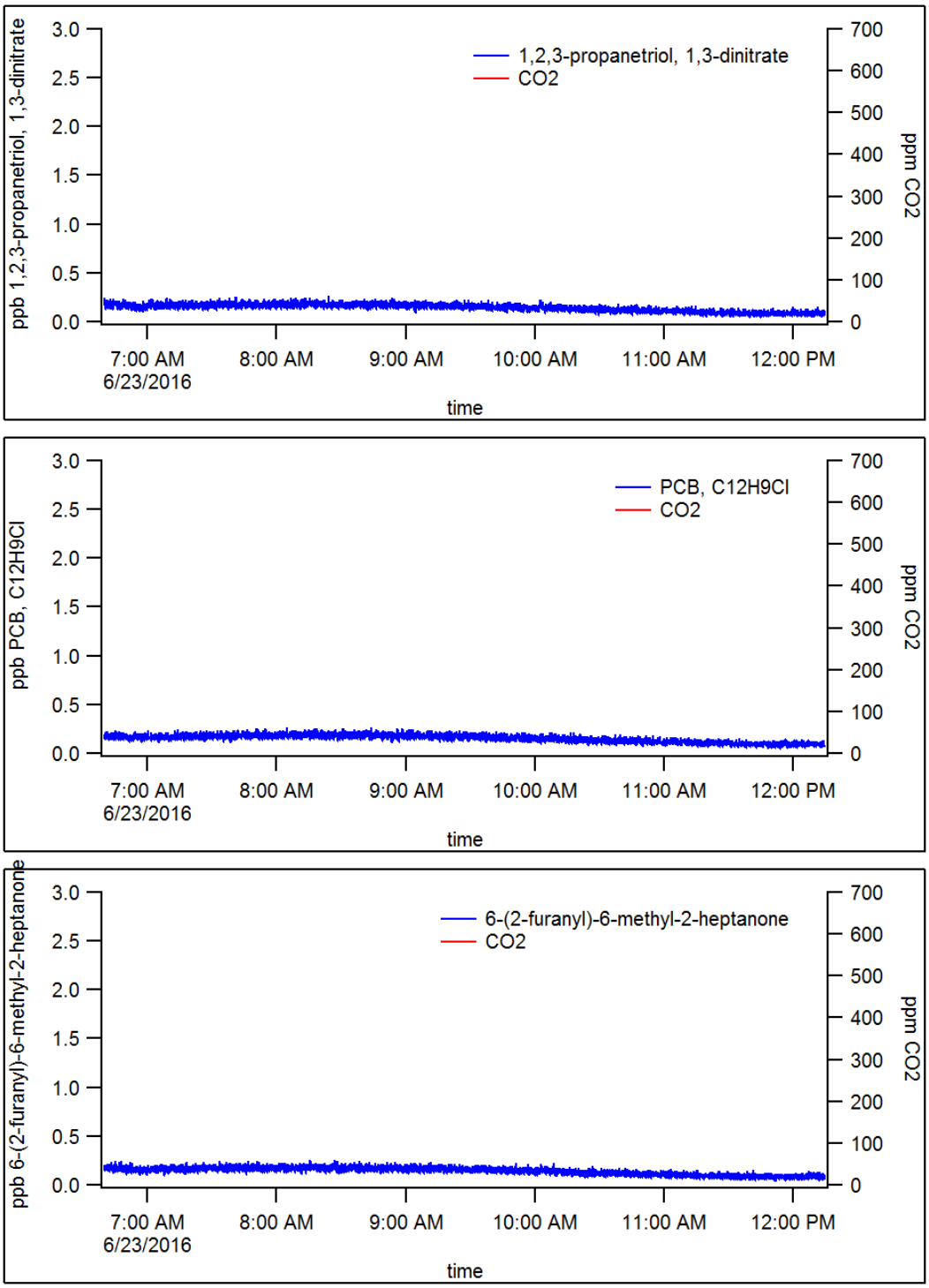
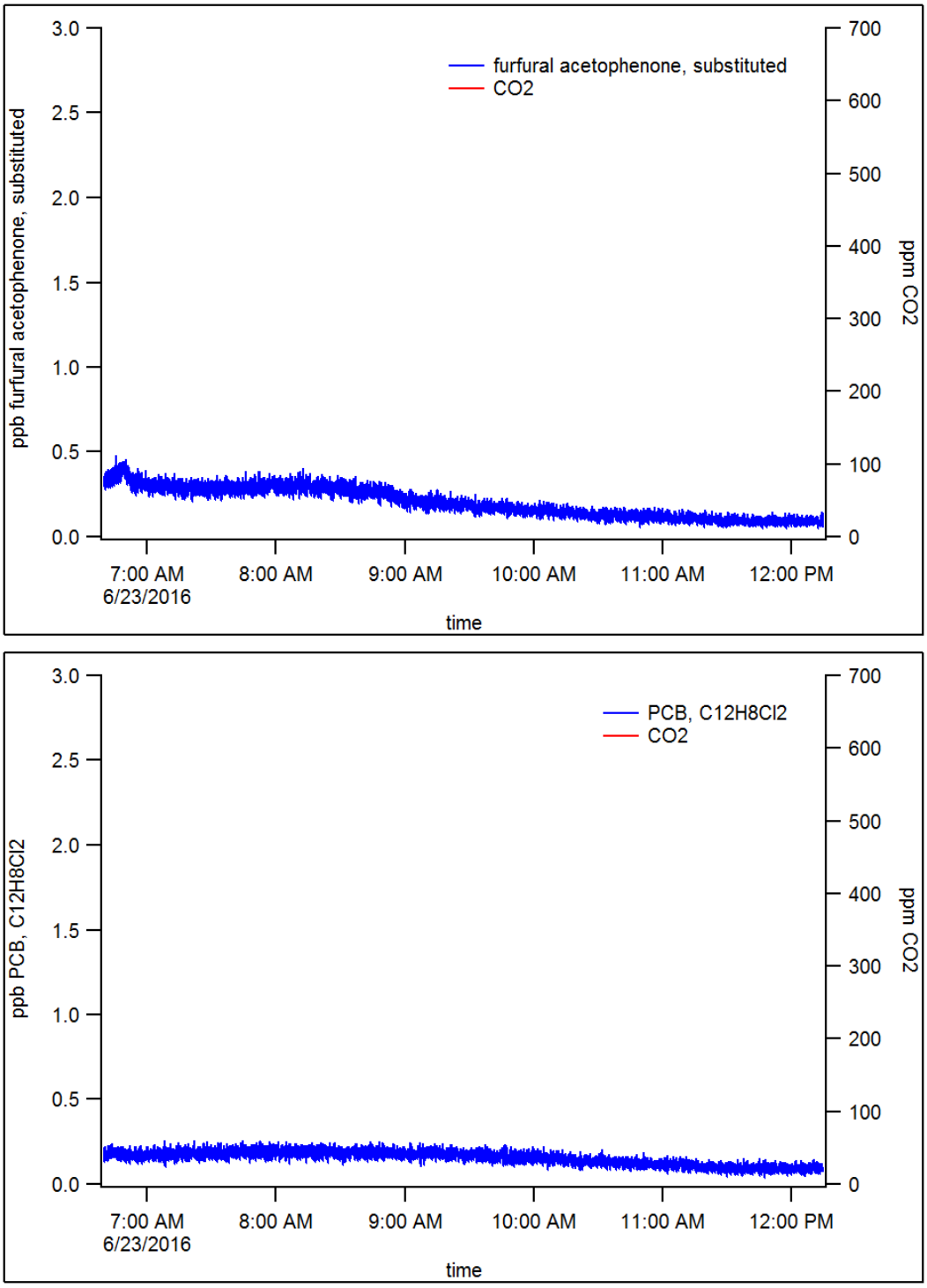


Figure B.1.4-15. June 23rd - Furfural Acetophenone (3-(2-furanyl)-1-pheynyl-2-propen-1-one (TOP), PCB [2] (BOTTOM)



B.2 WEEK 2

Week 2 refers to the second week of the initial data collection campaign. As stated above, each day has its own section within this appendix.

B.2.1 June 27th Data Collection

June 27th data collection started at 7:30 AM and ended at 12:20 PM. Data collection methods included both mobile and stationary lab techniques. Below are the graphs presented in order based on the Chemicals of Potential Concern (COPC) list.

Figure B.2.1-1. June 27th - Formaldehyde (TOP), Methanol (MIDDLE), Acetonitrile (BOTTOM)

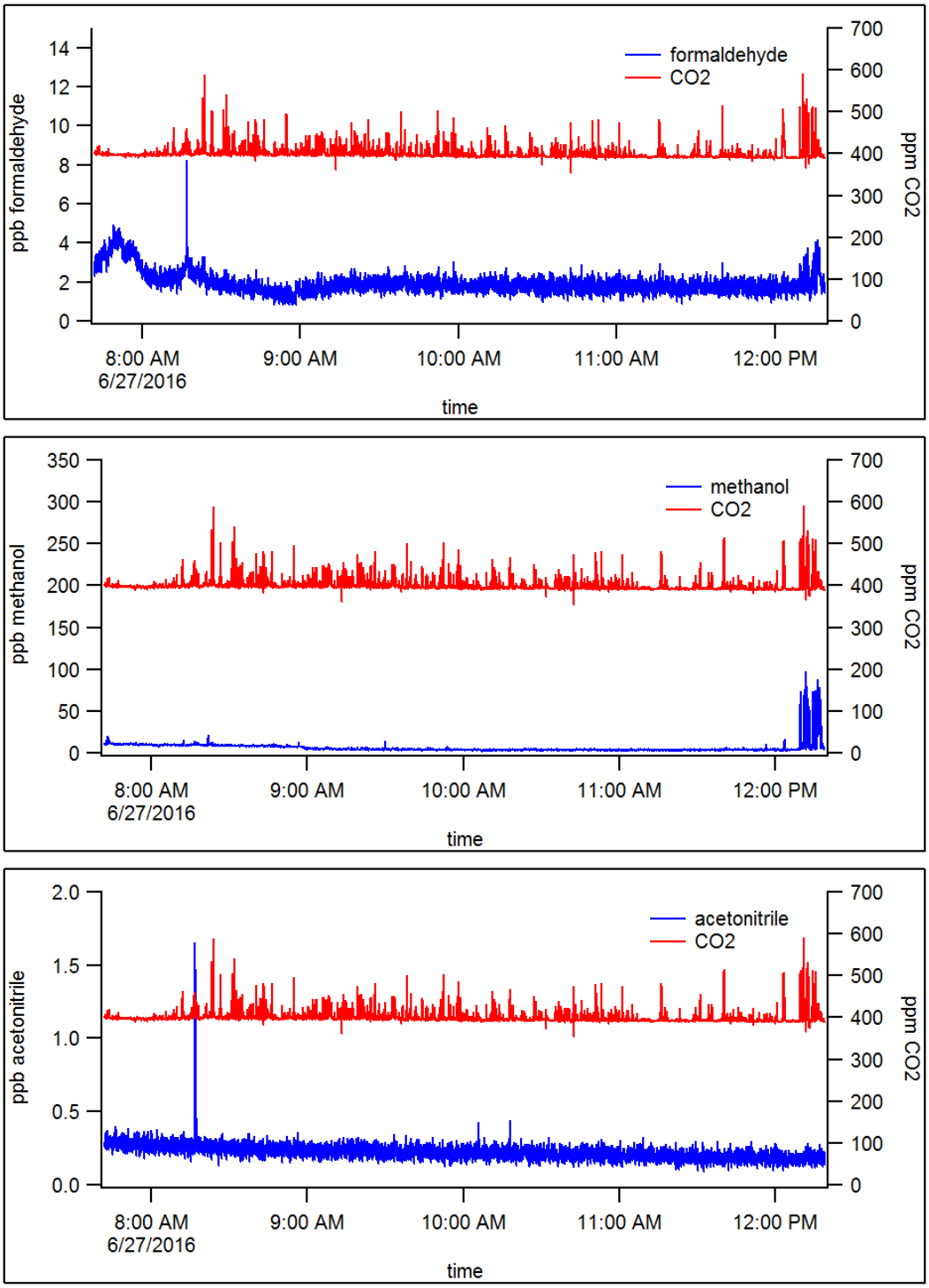


Figure B.2.1-2. June 27th - Acetaldehyde (TOP), Ethylamine (MIDDLE), 1,3-Butadiene (BOTTOM)

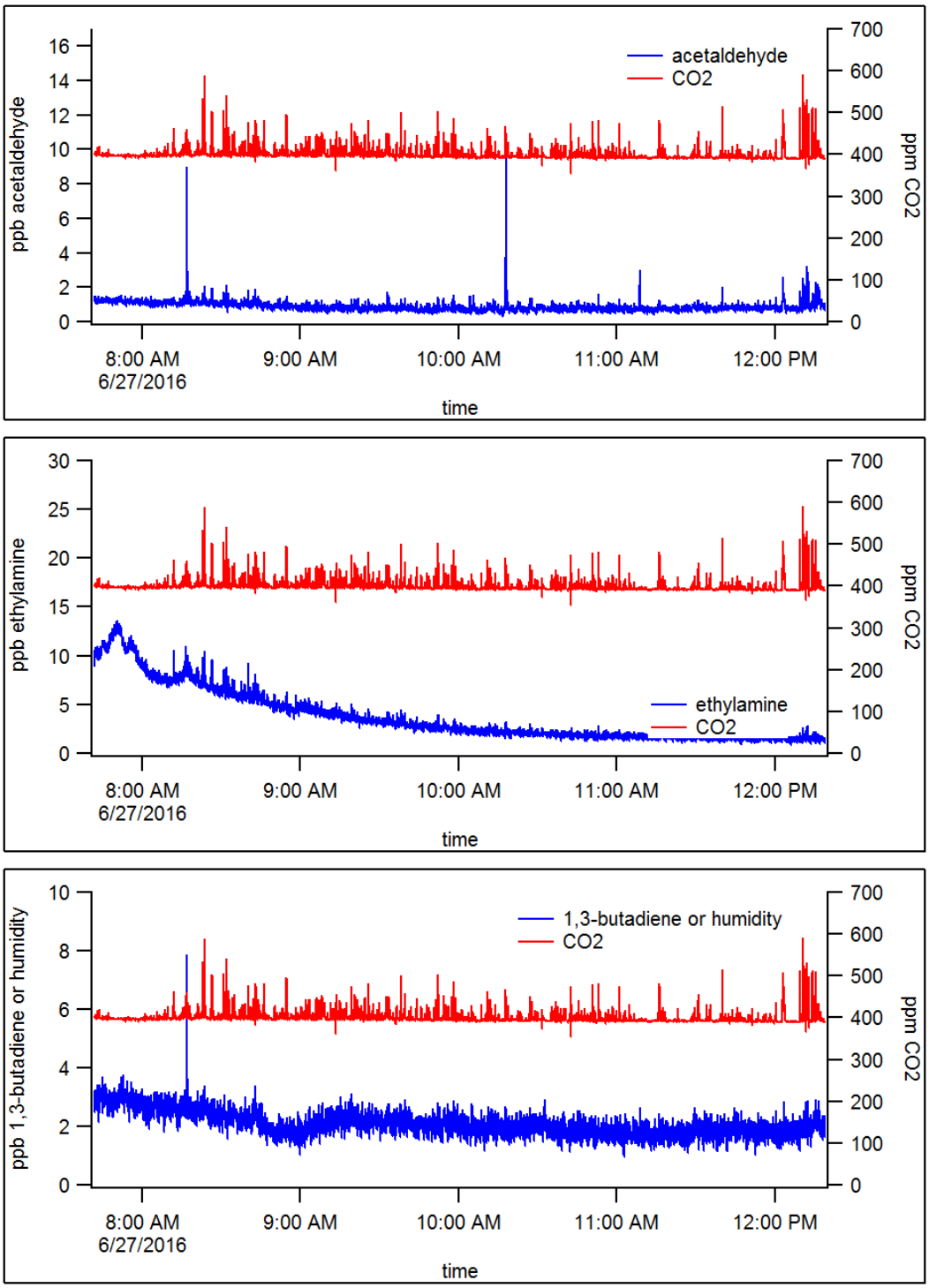


Figure B.2.1-3. June 27th - Propanenitrile (TOP), 1-Butanol; Butenes (MIDDLE), Methyl Isocyanate (BOTTOM)

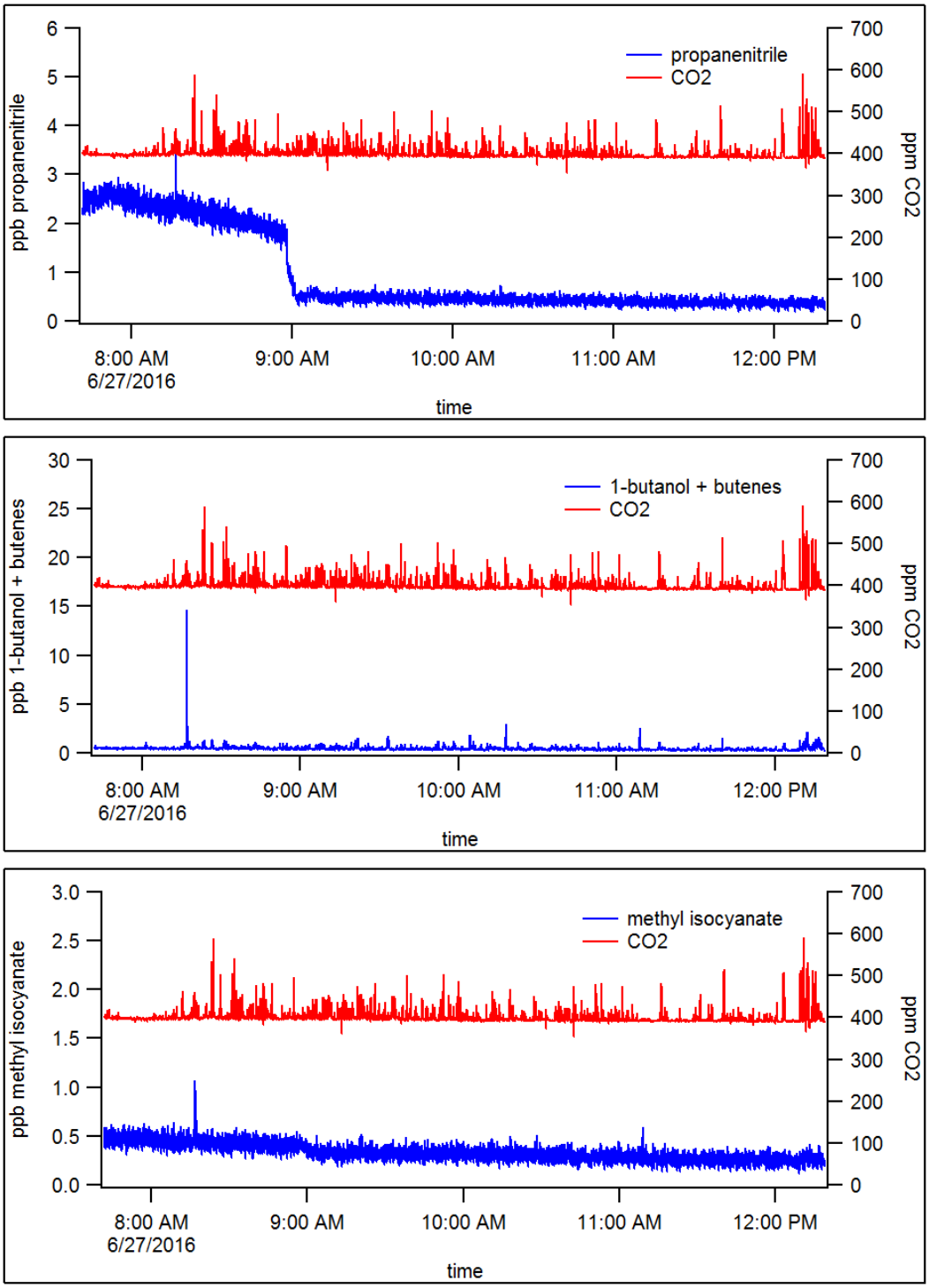


Figure B.2.1-4. June 27th - Methyl Nitrite (TOP), Furan; Isoprene (MIDDLE), Butanenitrile (BOTTOM)

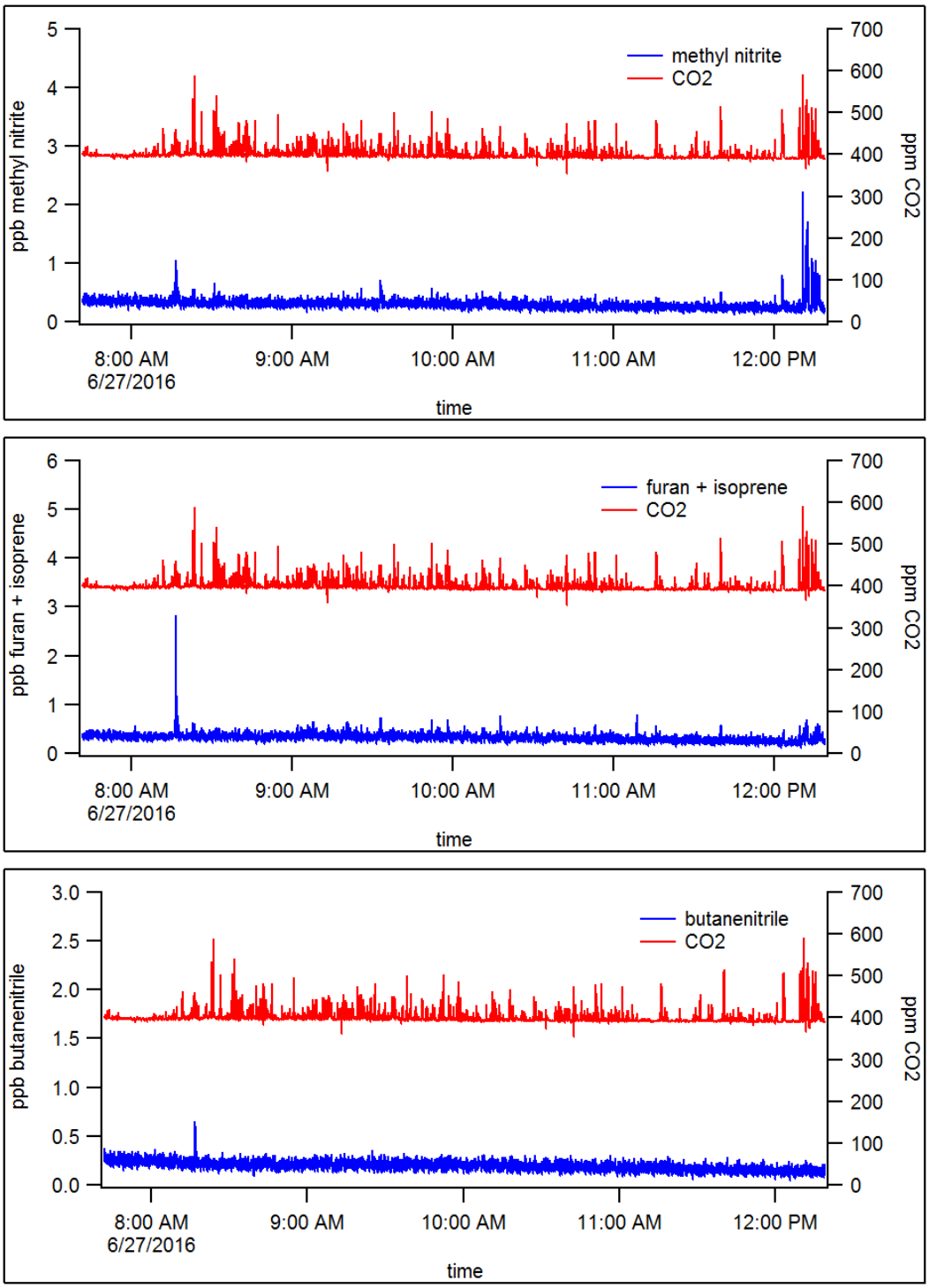


Figure B.2.1-5. June 27th - MVK + Dihydrofurans(TOP), Butanal (MIDDLE), N-nitrosodimethylamine [NDMA] (BOTTOM)

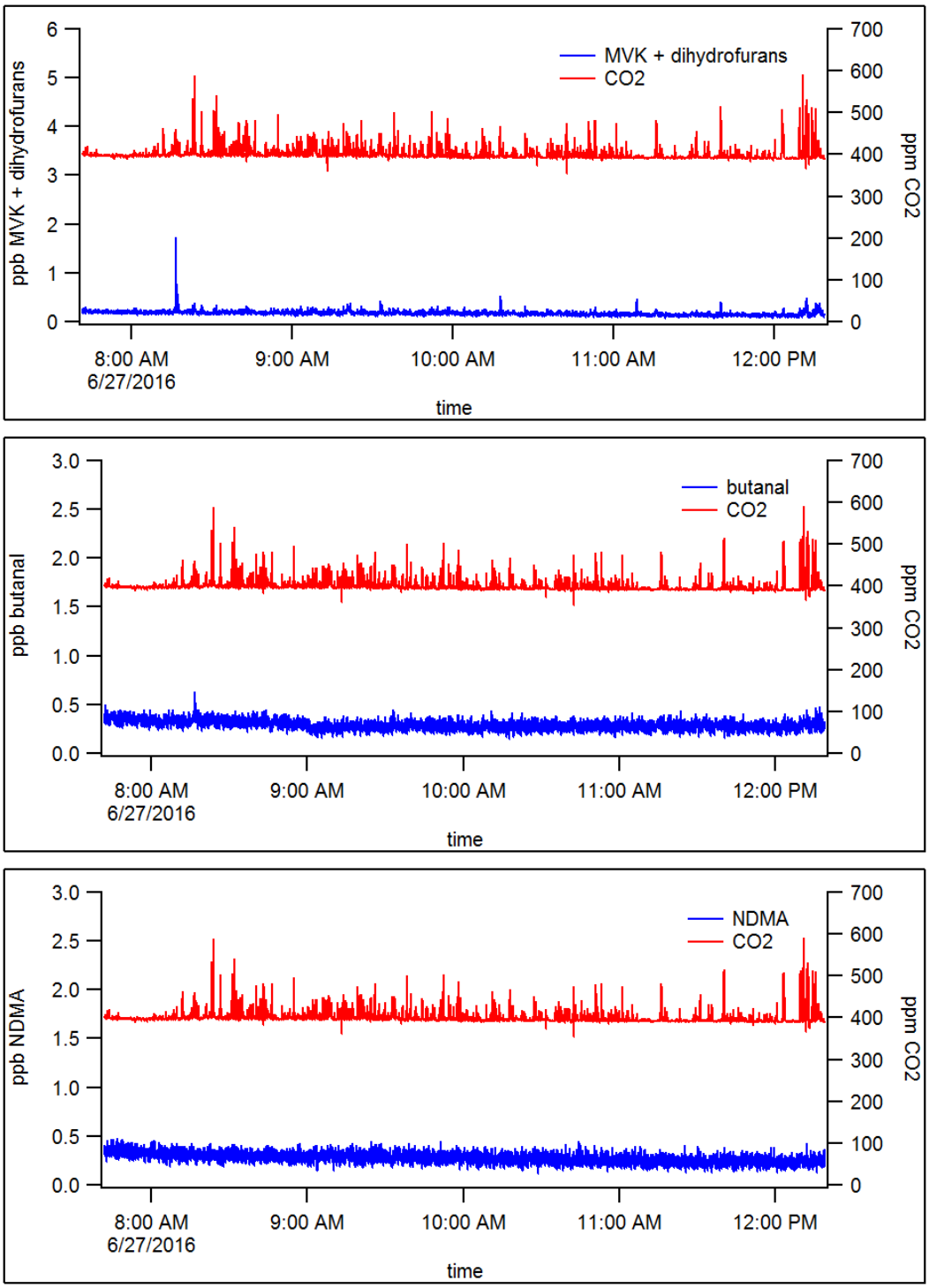


Figure B.2.1-6. June 27th - Benzene (TOP), 2,4-Pentadienenitrile; Pyridine (MIDDLE), 2-methylene Butanenitrile (BOTTOM)

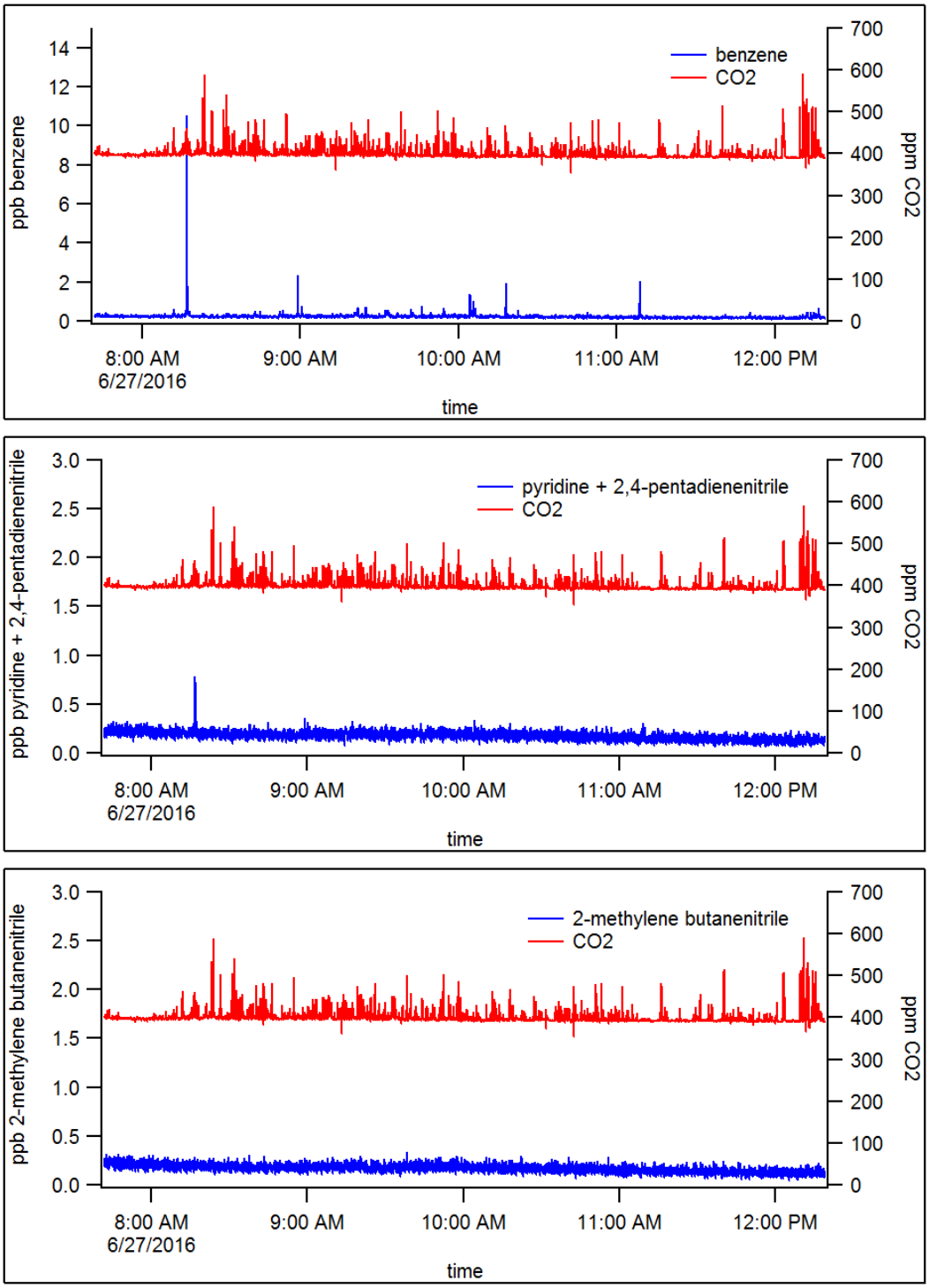


Figure B.2.1-7. June 27th - 2-methylfuran (TOP), Pentanenitrile (MIDDLE), 3-methyl-3-buten-2-one; 2-methyl-2-butenal (BOTTOM)

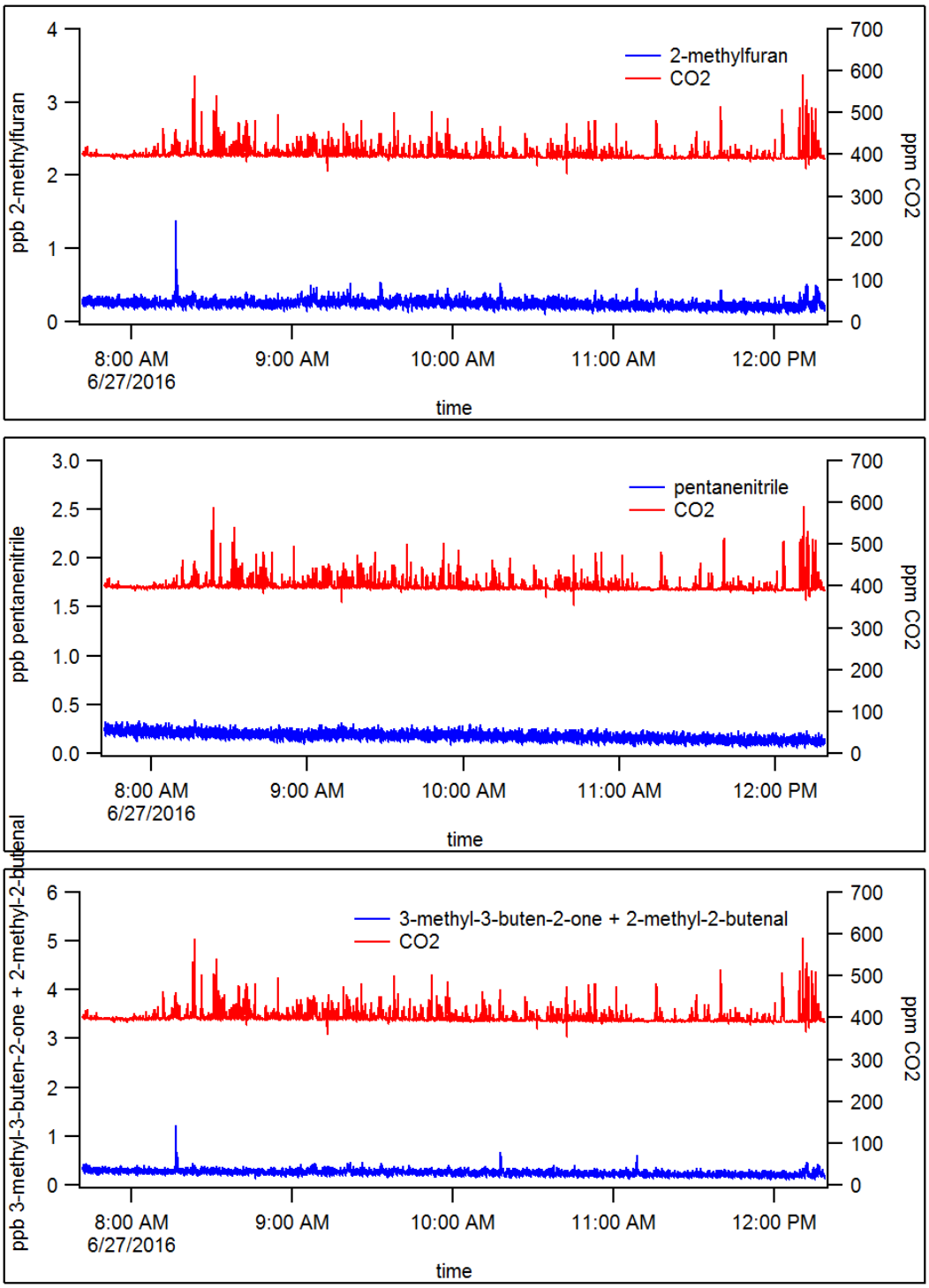


Figure B.2.1-8. June 27th - N-nitrosomethylethylamine [NEMA] (TOP), 2,5-dimethylfuran (MIDDLE), Hexanenitrile (BOTTOM)

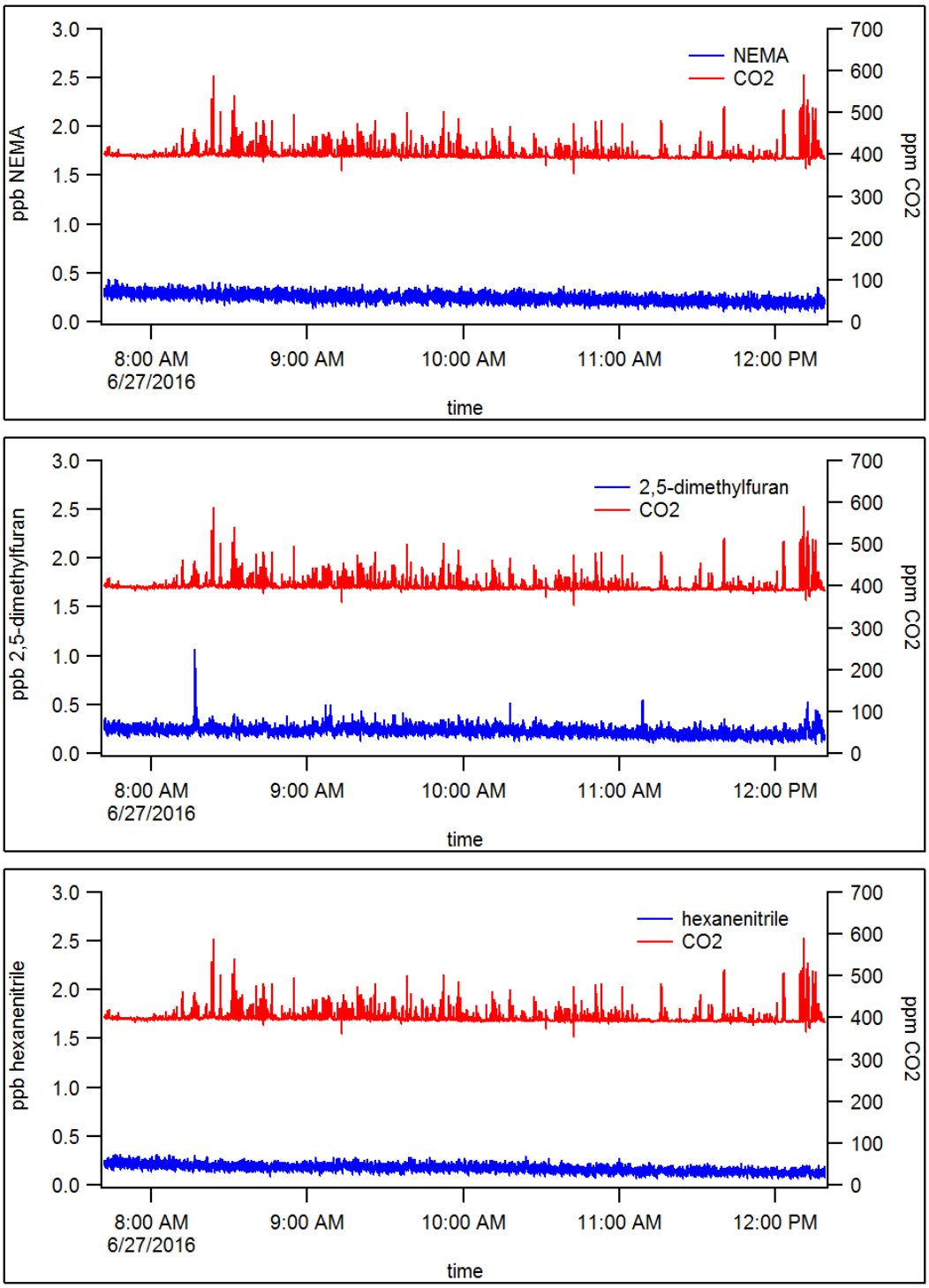


Figure B.2.1-9. June 27th - 2-hexanone [MBK] (TOP), N-nitrosodiethylamine [NDEA] (MIDDLE), Butyl Nitrite; 2-nitro-2-methylpropane (BOTTOM)

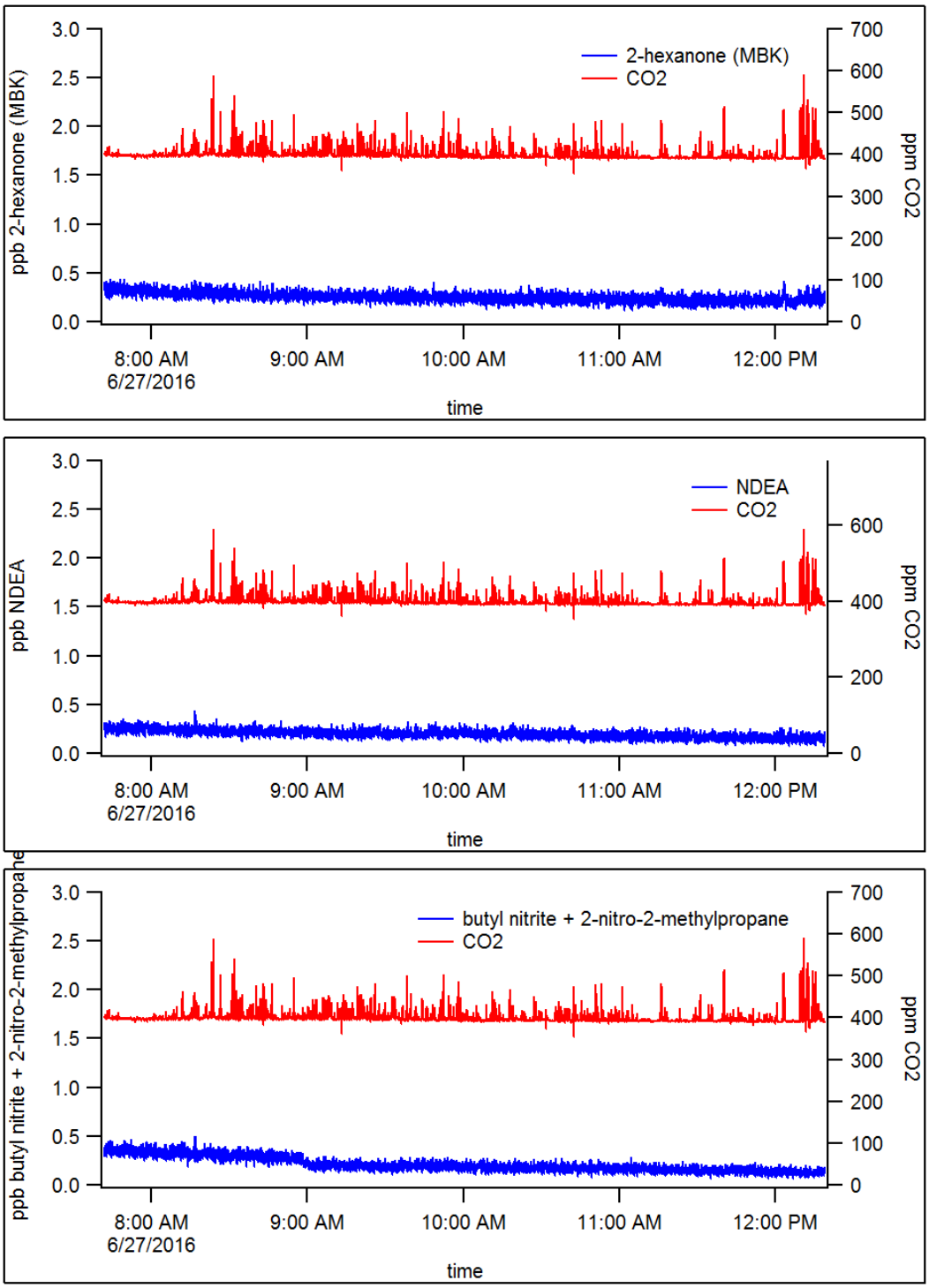


Figure B.2.1-10. June 27th - 2,4-dimethylpyridine (TOP), 2-ethyl-5-methylfuran (MIDDLE), Heptanenitrile (BOTTOM)

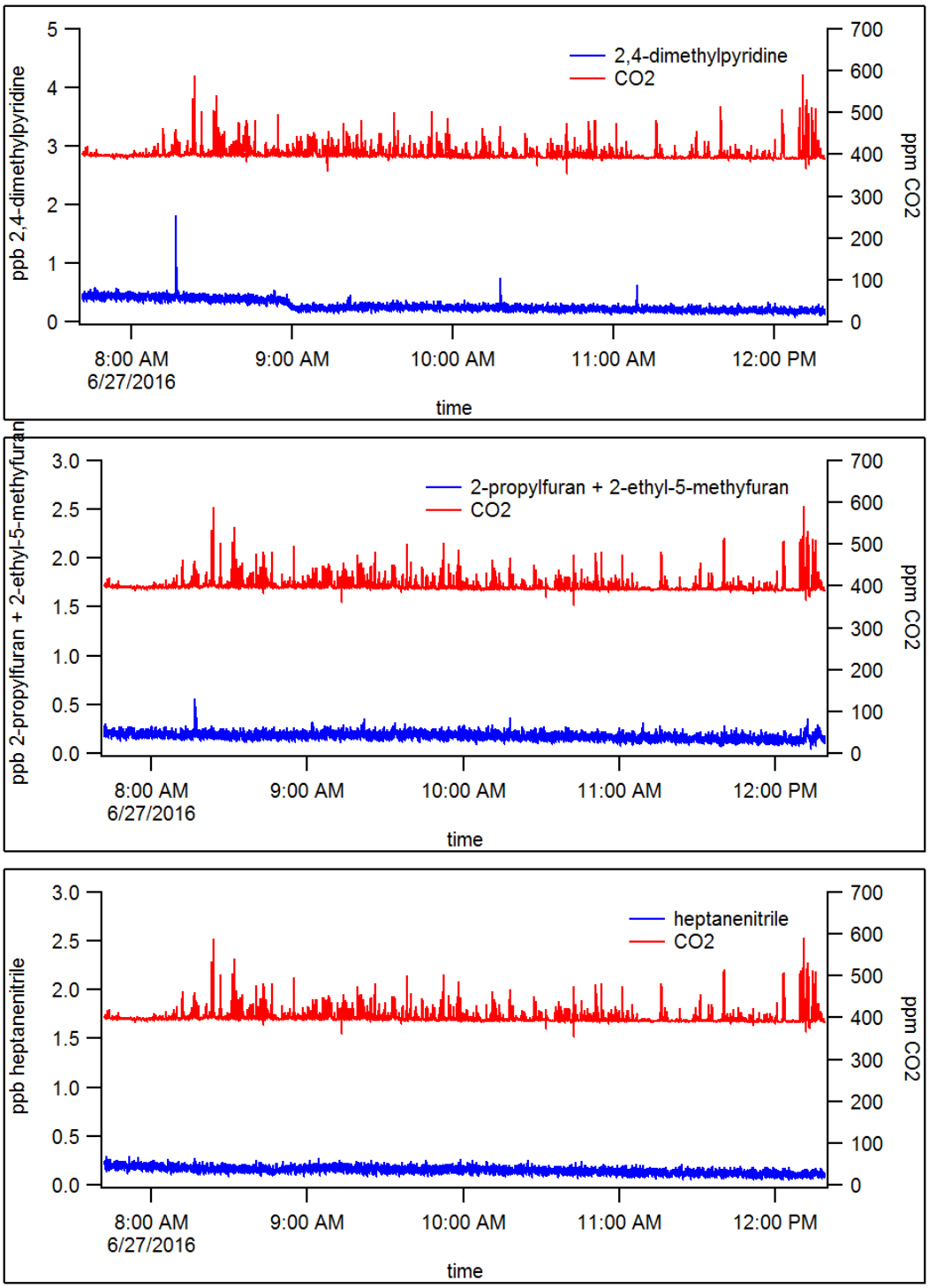


Figure B.2.1-11. June 27th - 4-methyl-2-hexanone (TOP), N-nitrosomorpholine [NMOR] (MIDDLE), Butyl Nitrate (BOTTOM)

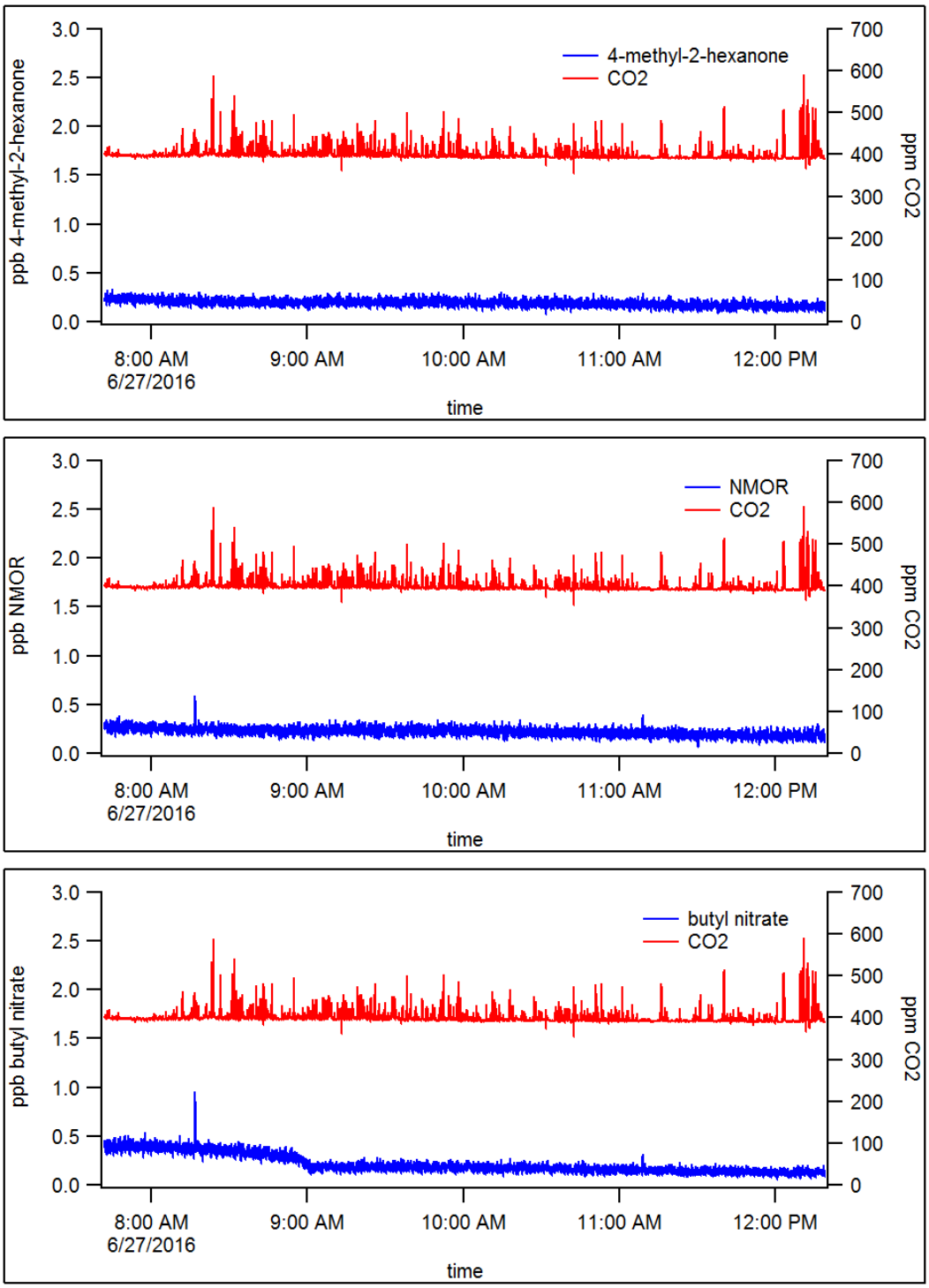


Figure B.2.1-12. June 27th - Multiple Furans [m/z 127] (TOP), 6-methyl-2-heptanone (MIDDLE), 2-pentylfuran (BOTTOM)

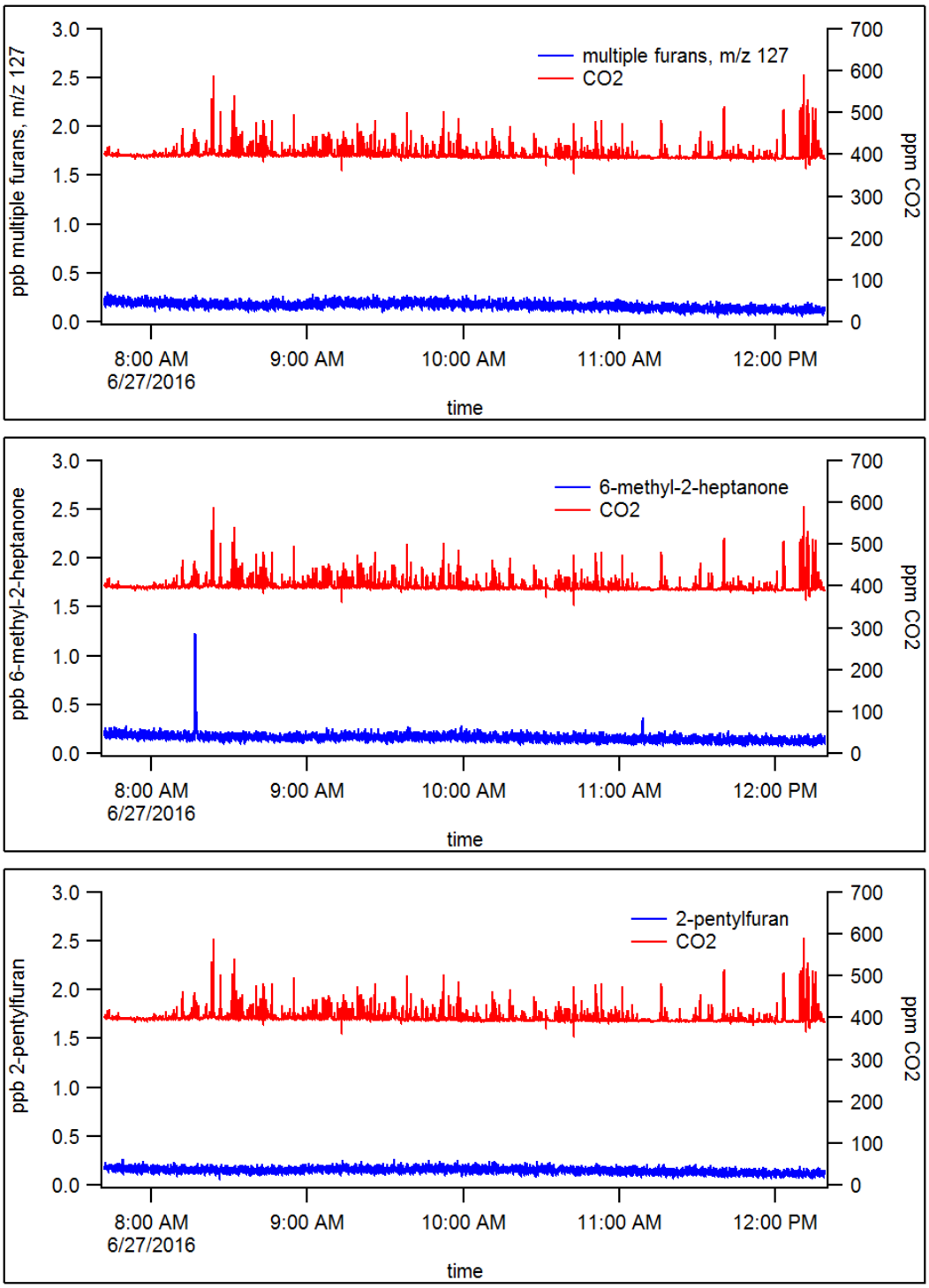


Figure B.2.1-13. June 27th - Biphenyl (TOP), 2-heptylfuran (MIDDLE), 2-octylfuran; 1,4-butanediol, Dinitrate (BOTTOM)

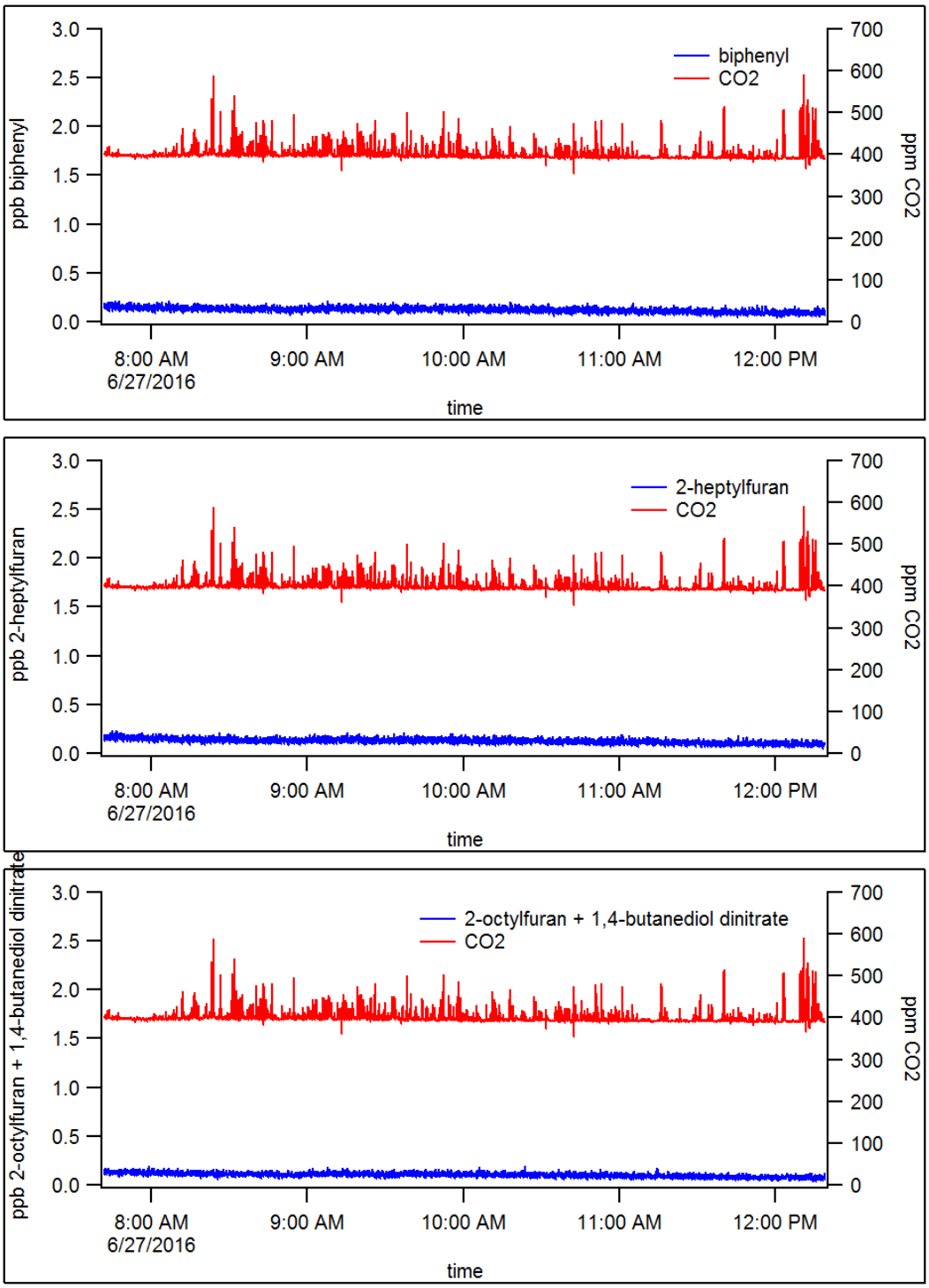


Figure B.2.1-14. June 27th - 1,2,3-propanetriol, 1,3-dinitrate (TOP), PCB (MIDDLE), 6-(2-furanyl)-6-methyl-2-heptanone (BOTTOM)

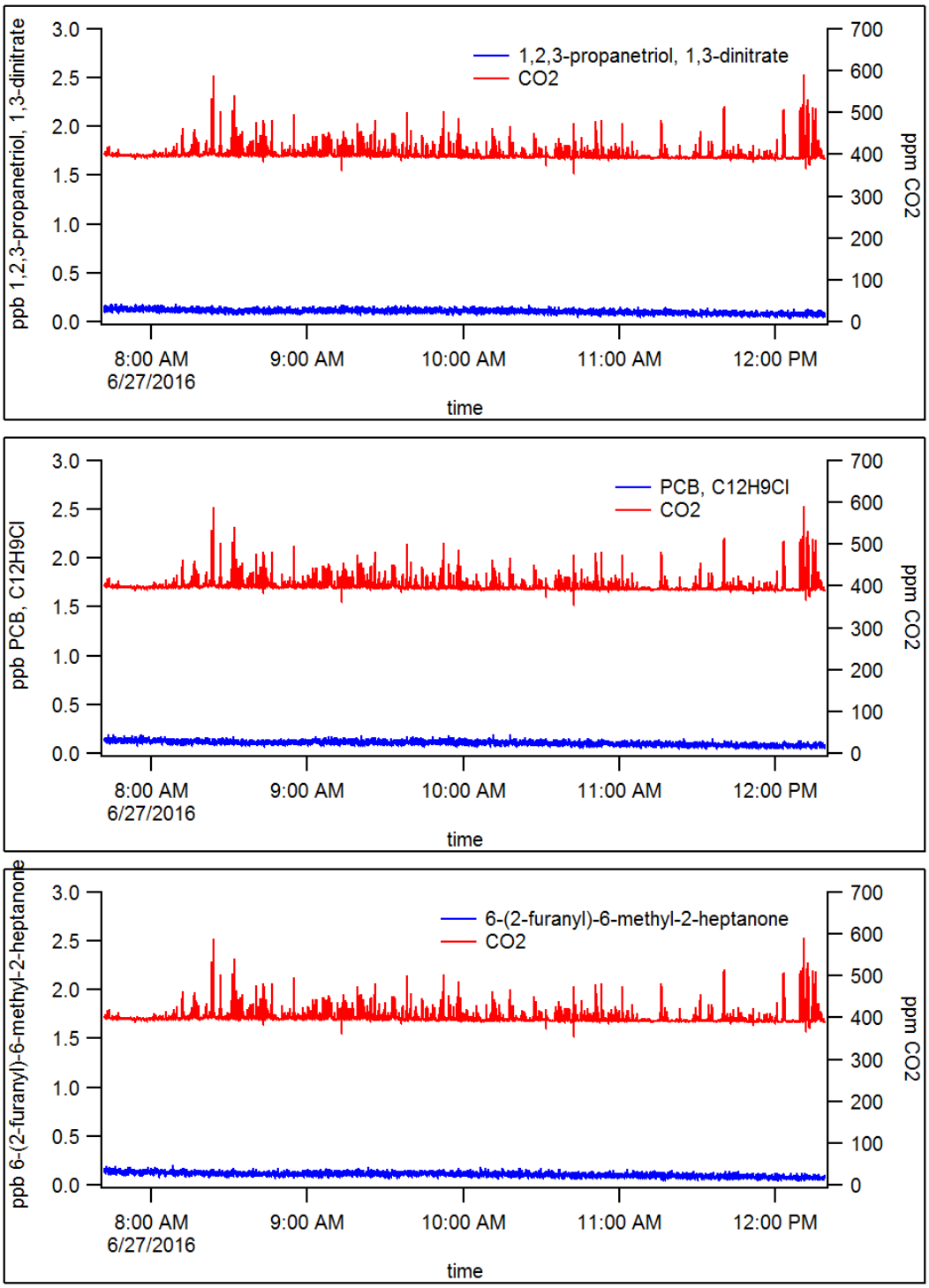
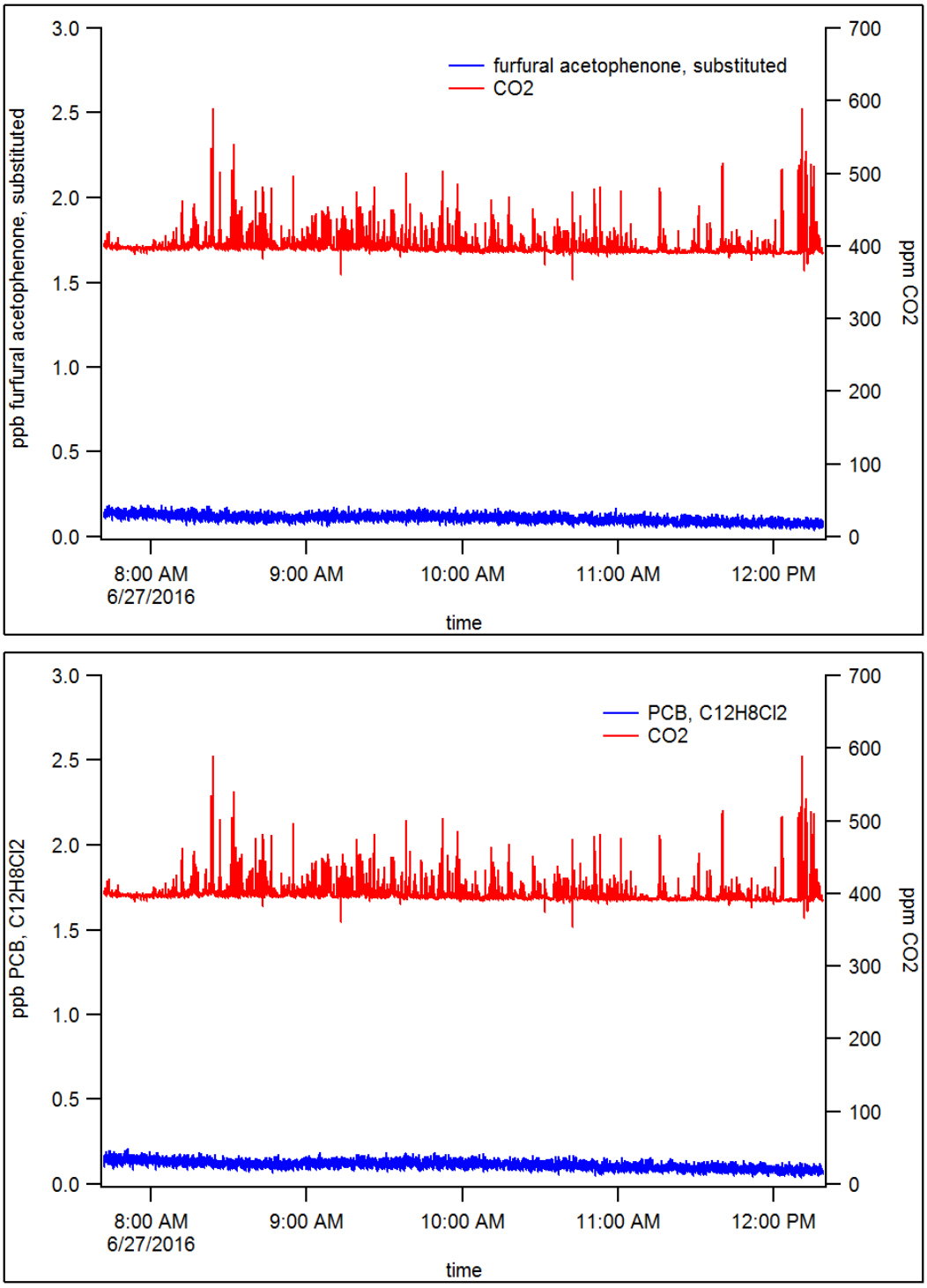


Figure B.2.1-15. June 27th - Furfural Acetophenone [3-(2-furanyl)-1-pheynyl-2-propen-1-one] (TOP), PCB [2] (BOTTOM)



B.2.2 June 28th Data Collection

June 28th data collection started at 6:55 AM and ended at 12:15 PM. Data collection methods included both mobile and stationary lab techniques. Below are the graphs presented in order based on the Chemicals of Potential Concern (COPC) list.

Figure B.2.2-1. June 28th - Formaldehyde (TOP), Methanol (MIDDLE), Acetonitrile (BOTTOM)

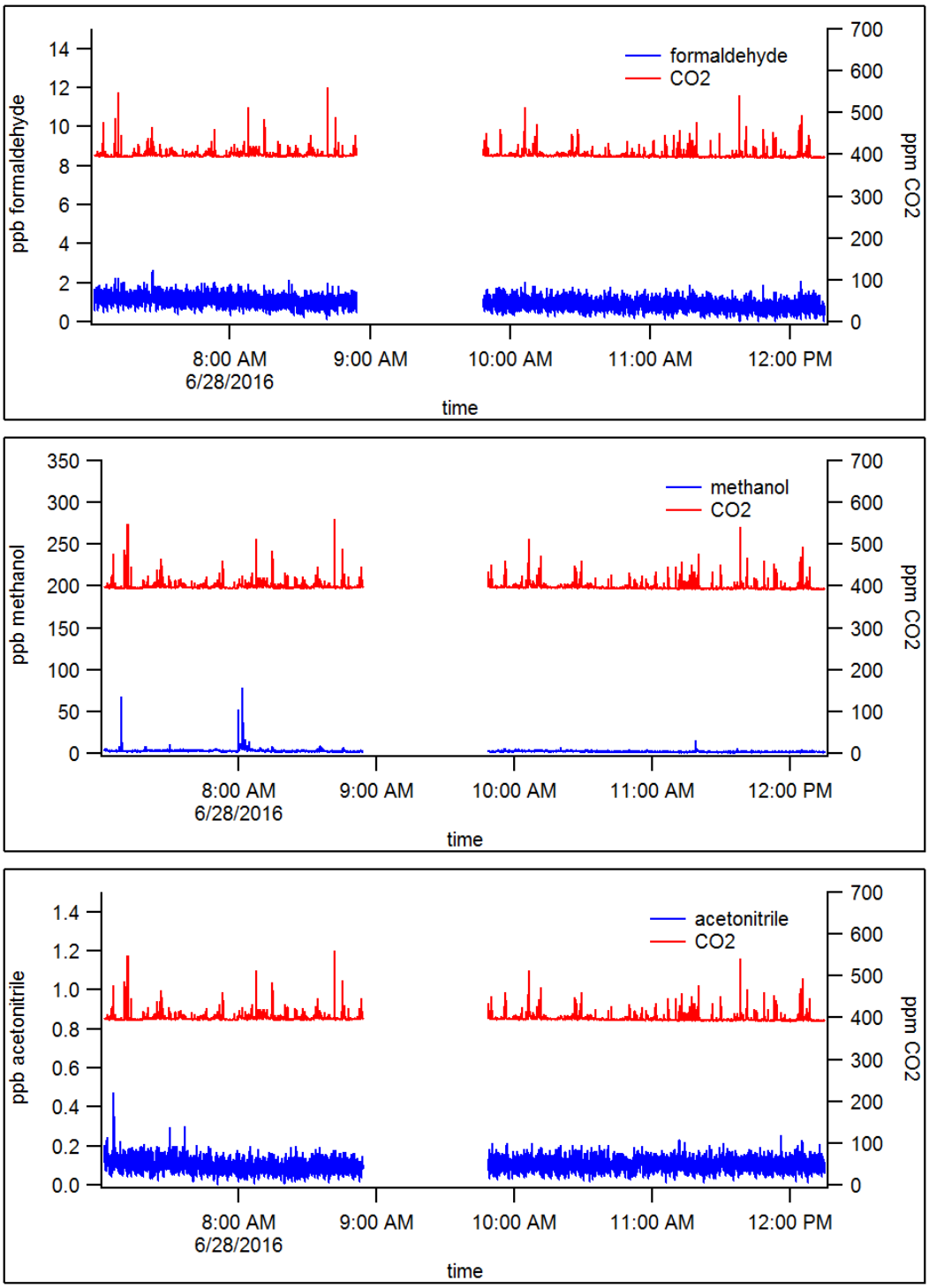


Figure B.2.2-2. June 28th - Acetaldehyde (TOP), Ethylamine (MIDDLE), 1,3-Butadiene (BOTTOM)

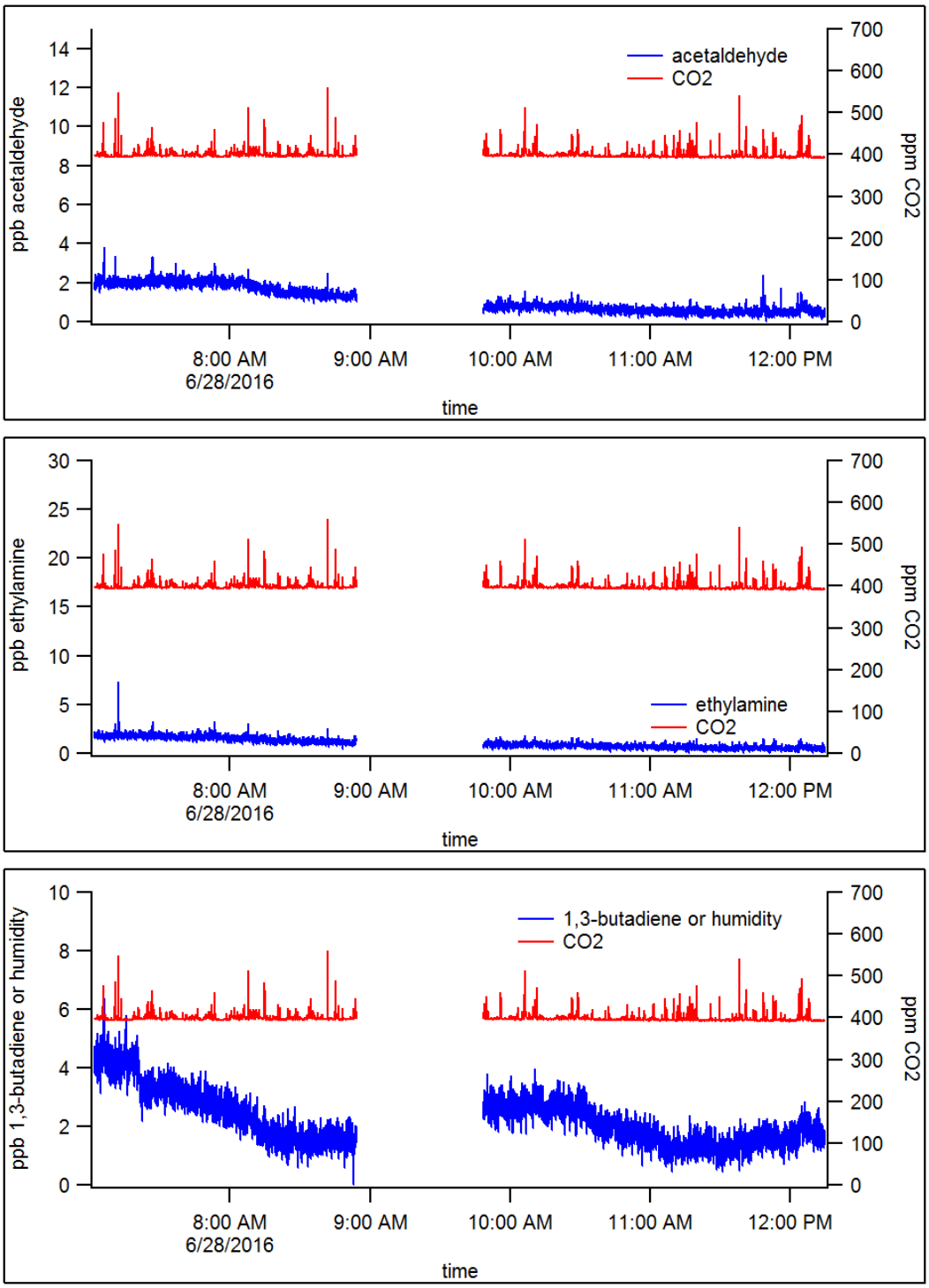


Figure B.2.2-3. June 28th - Propanenitrile (TOP), 1-Butanol; Butenes (MIDDLE), Methyl Isocyanate (BOTTOM)

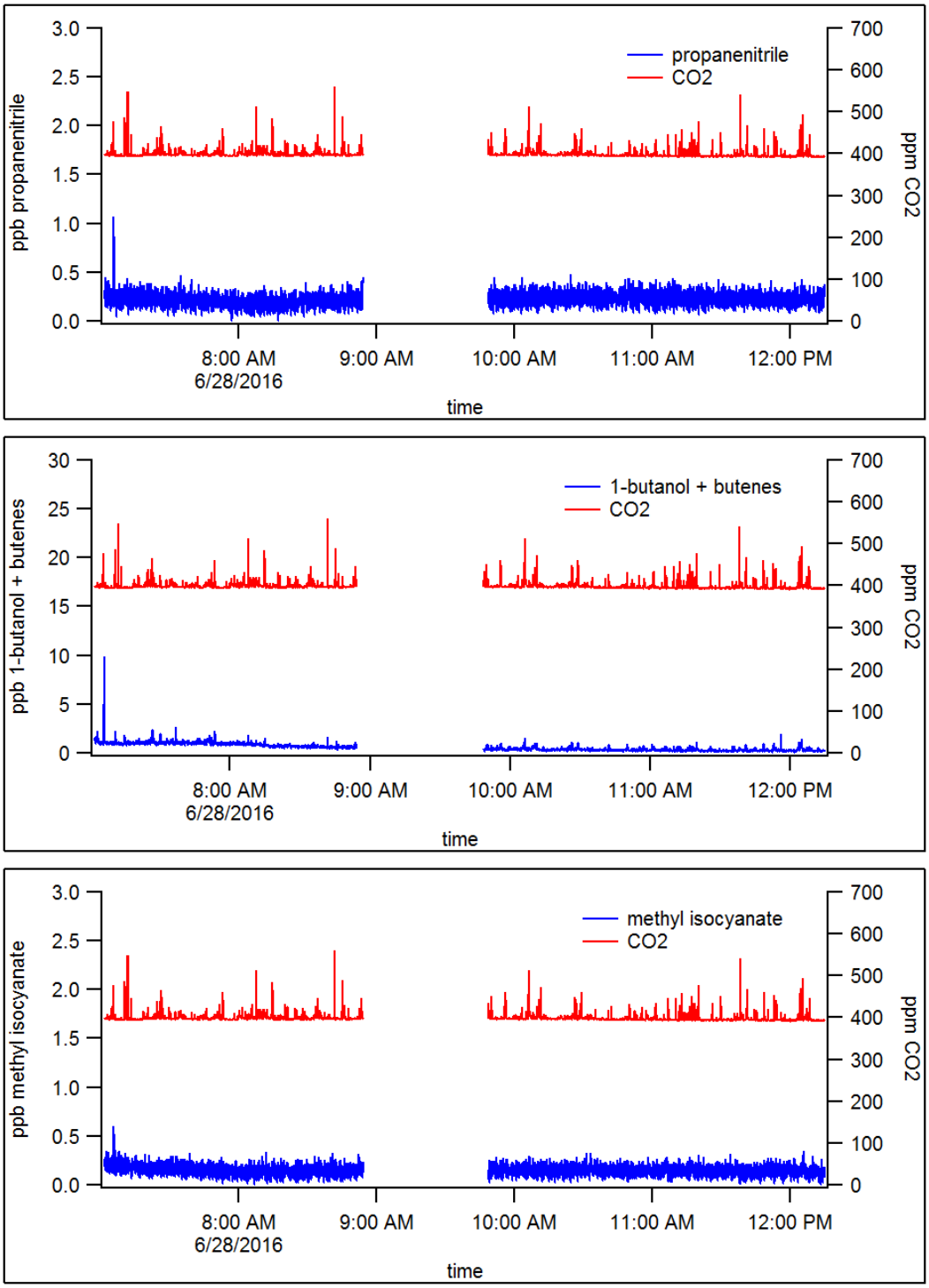


Figure B.2.2-4. June 28th - Methyl Nitrite (TOP), Furan; Isoprene (MIDDLE), Butanenitrile (BOTTOM)

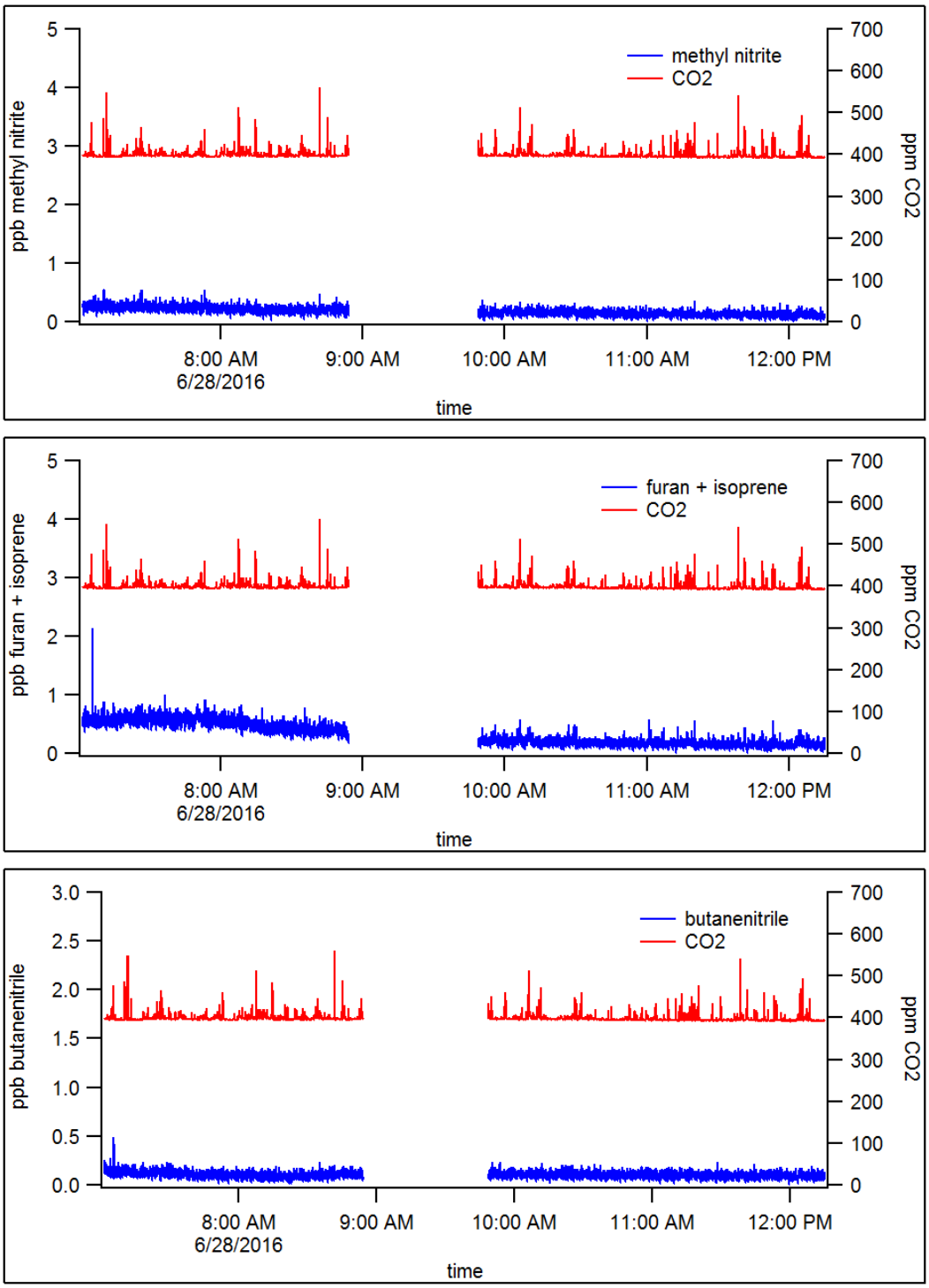


Figure B.2.2-5. June 28th - MVK + Dihydrofurans(TOP), Butanal (MIDDLE), N-nitrosodimethylamine [NDMA] (BOTTOM)

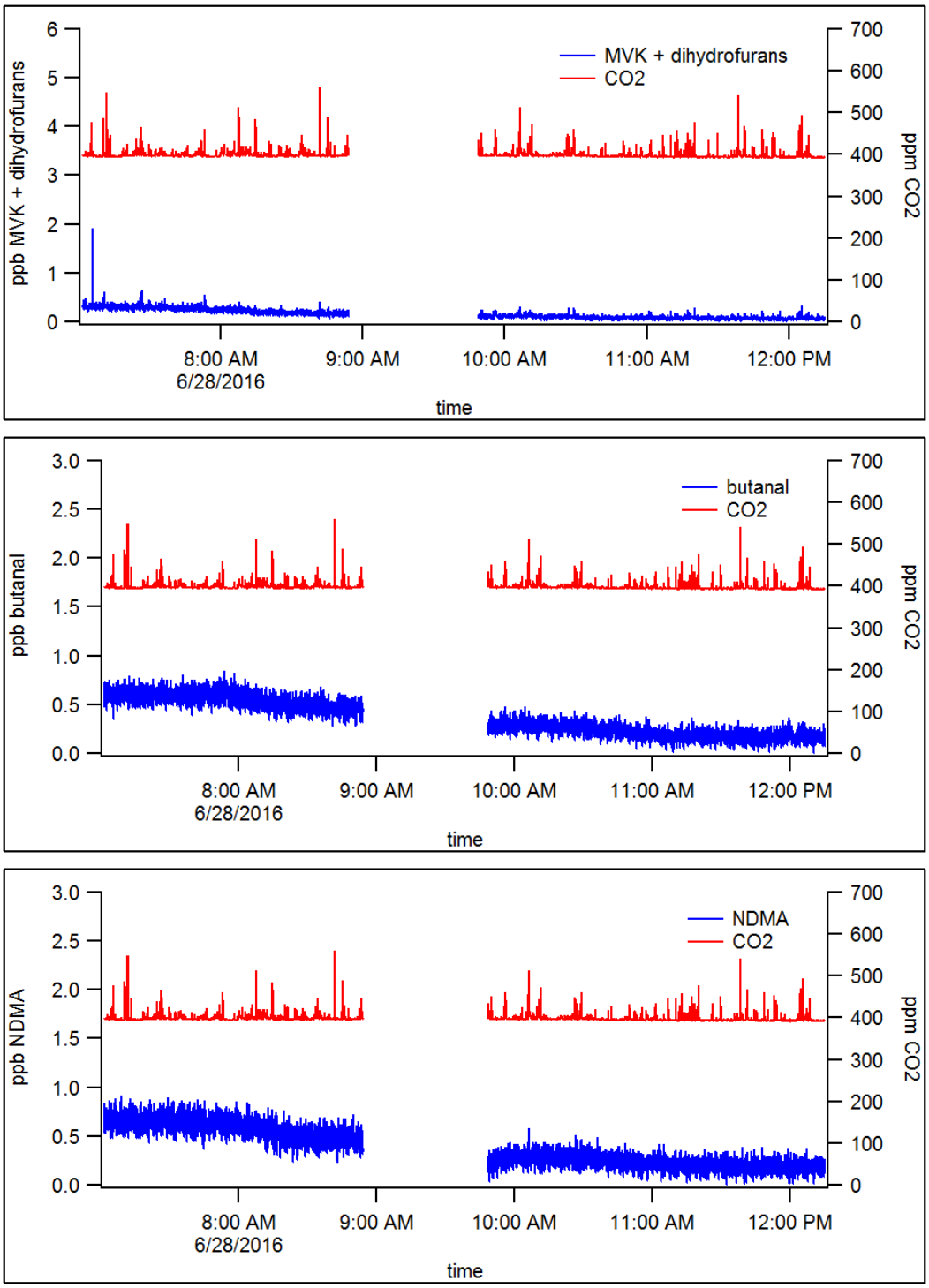


Figure B.2.2-6. June 28th - Benzene (TOP), 2,4-Pentadienenitrile; Pyridine (MIDDLE), 2-methylene Butanenitrile (BOTTOM)

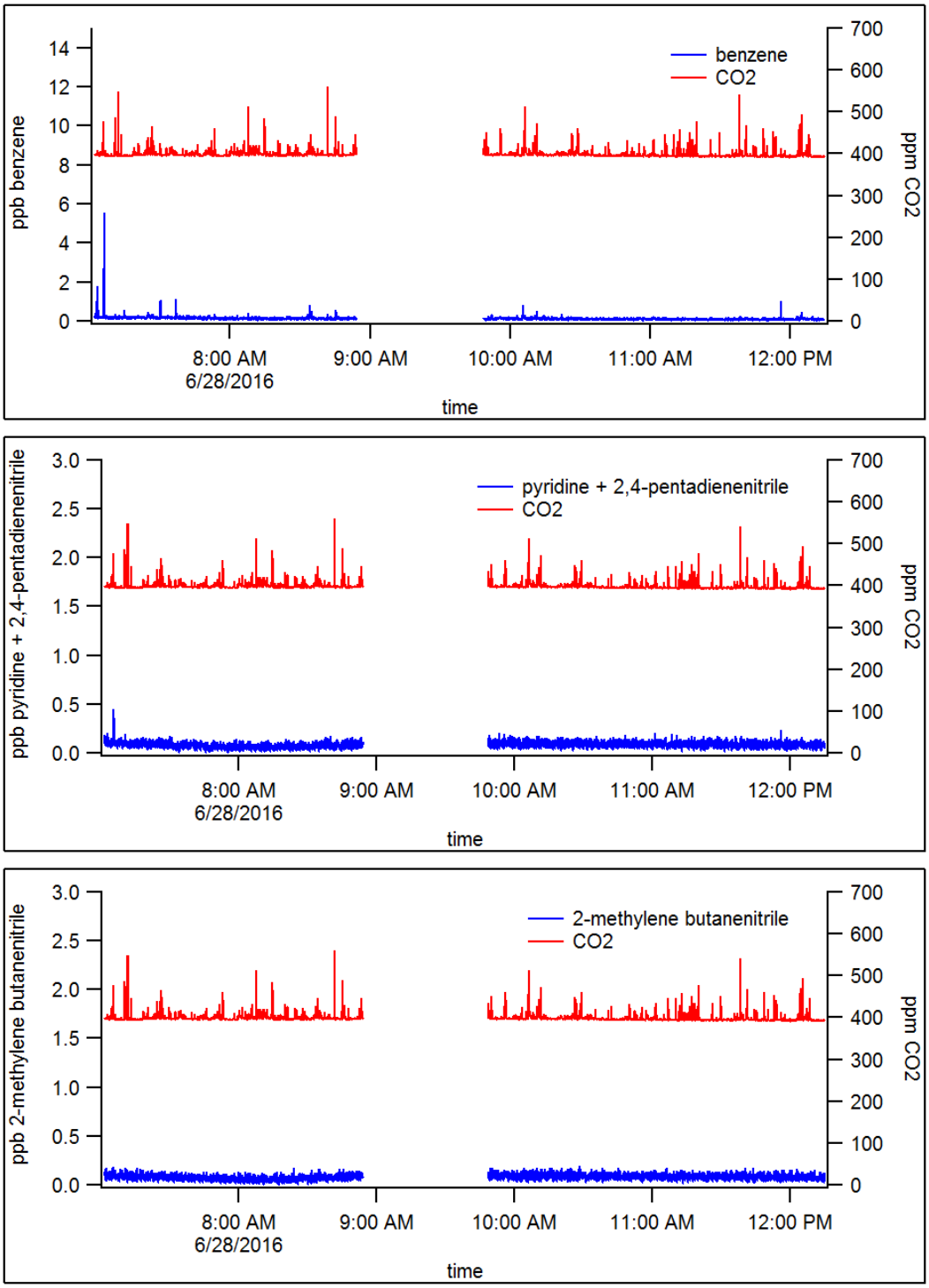


Figure B.2.2-7. June 28th - 2-methylfuran (TOP), Pentanenitrile (MIDDLE), 3-methyl-3-buten-2-one; 2-methyl-2-butenal (BOTTOM)

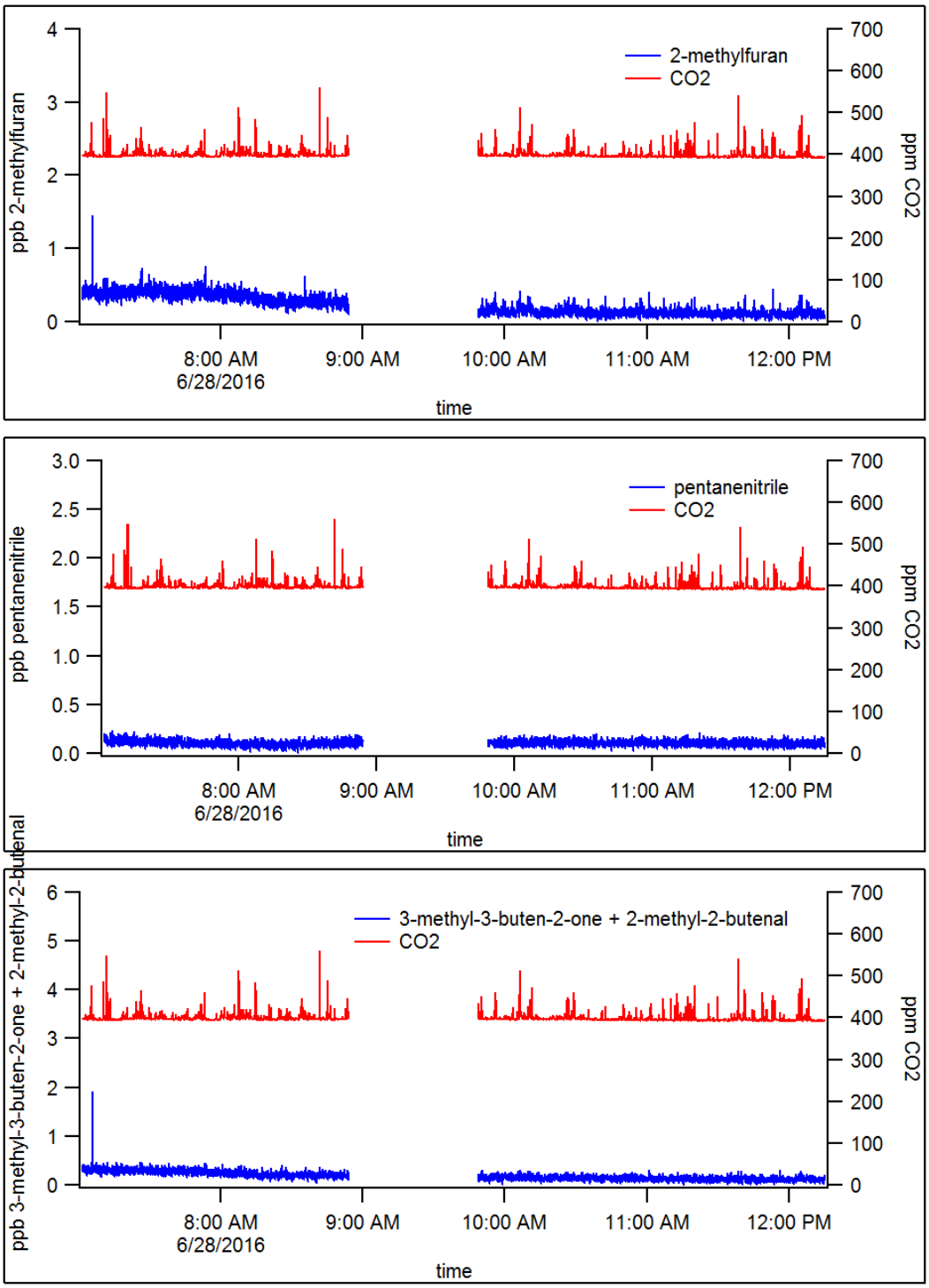


Figure B.2.2-8. June 28th - N-nitrosomethylethylamine [NEMA] (TOP), 2,5-dimethylfuran (MIDDLE), Hexanenitrile (BOTTOM)

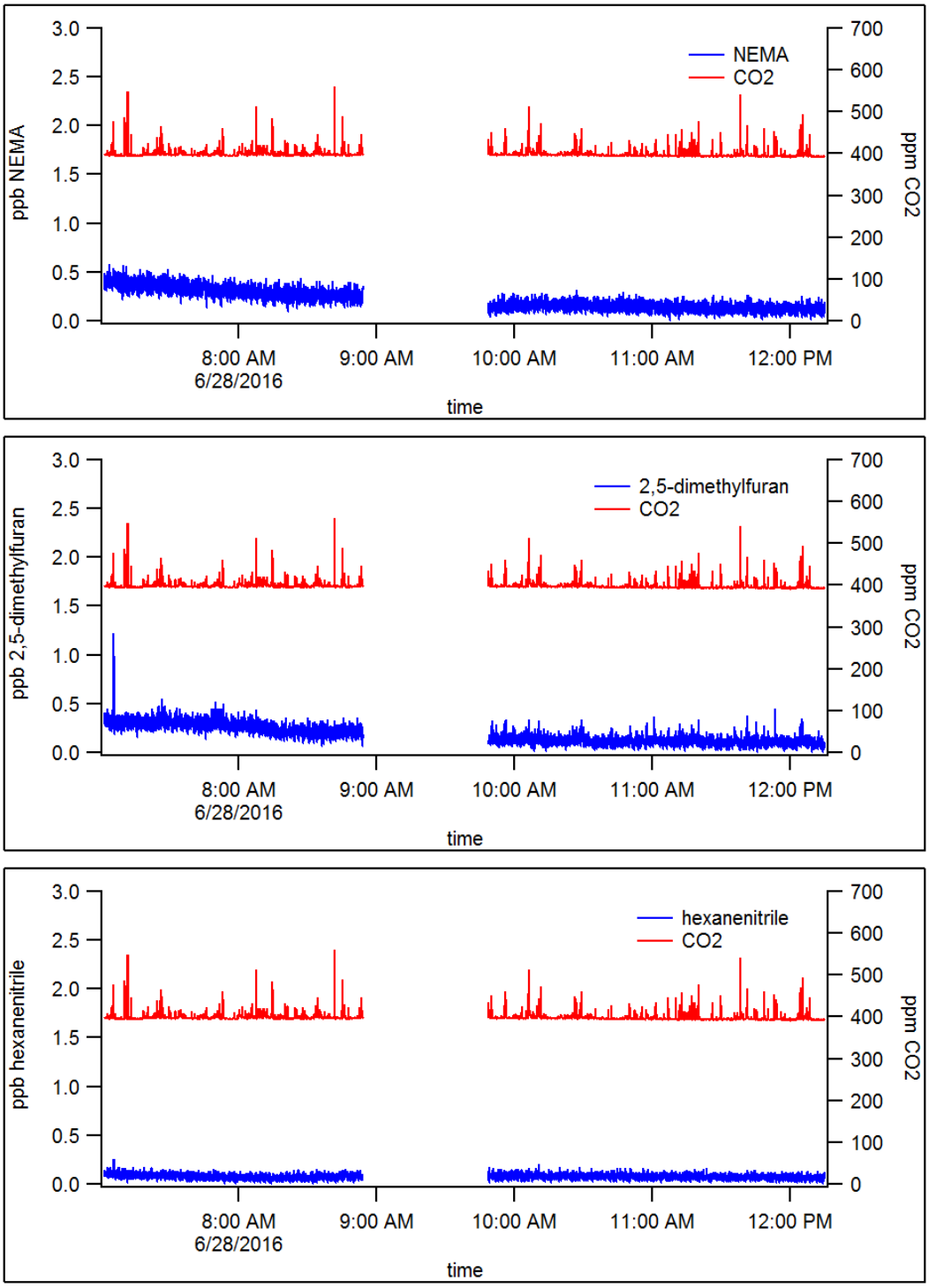


Figure B.2.2-9. June 28th - 2-hexanone [MBK] (TOP), N-nitrosodiethylamine [NDEA] (MIDDLE), Butyl Nitrite; 2-nitro-2-methylpropane (BOTTOM)

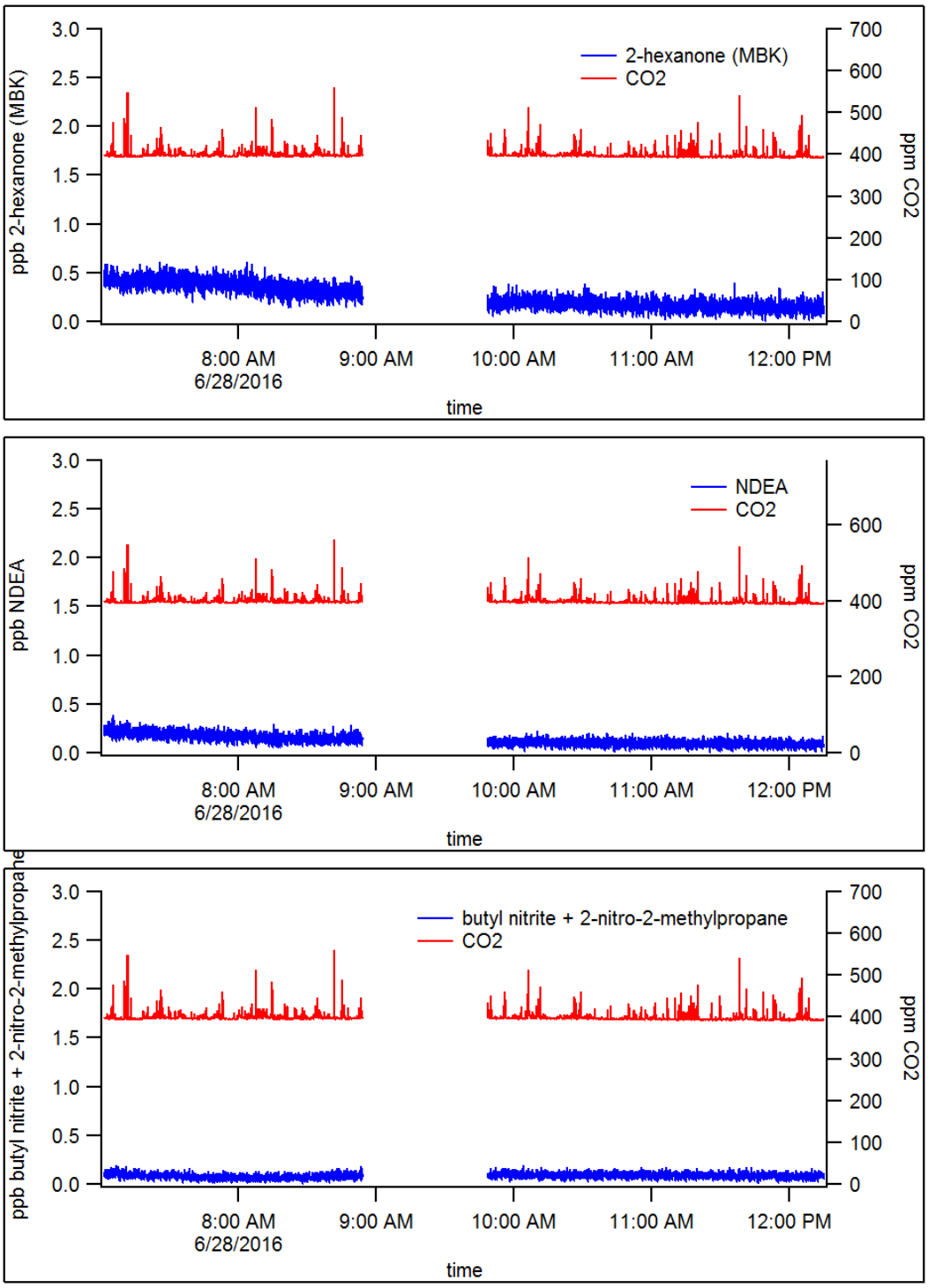


Figure B.2.2-10. June 28th - 2,4-dimethylpyridine (TOP), 2-ethyl-5-methylfuran (MIDDLE), Heptanenitrile (BOTTOM)

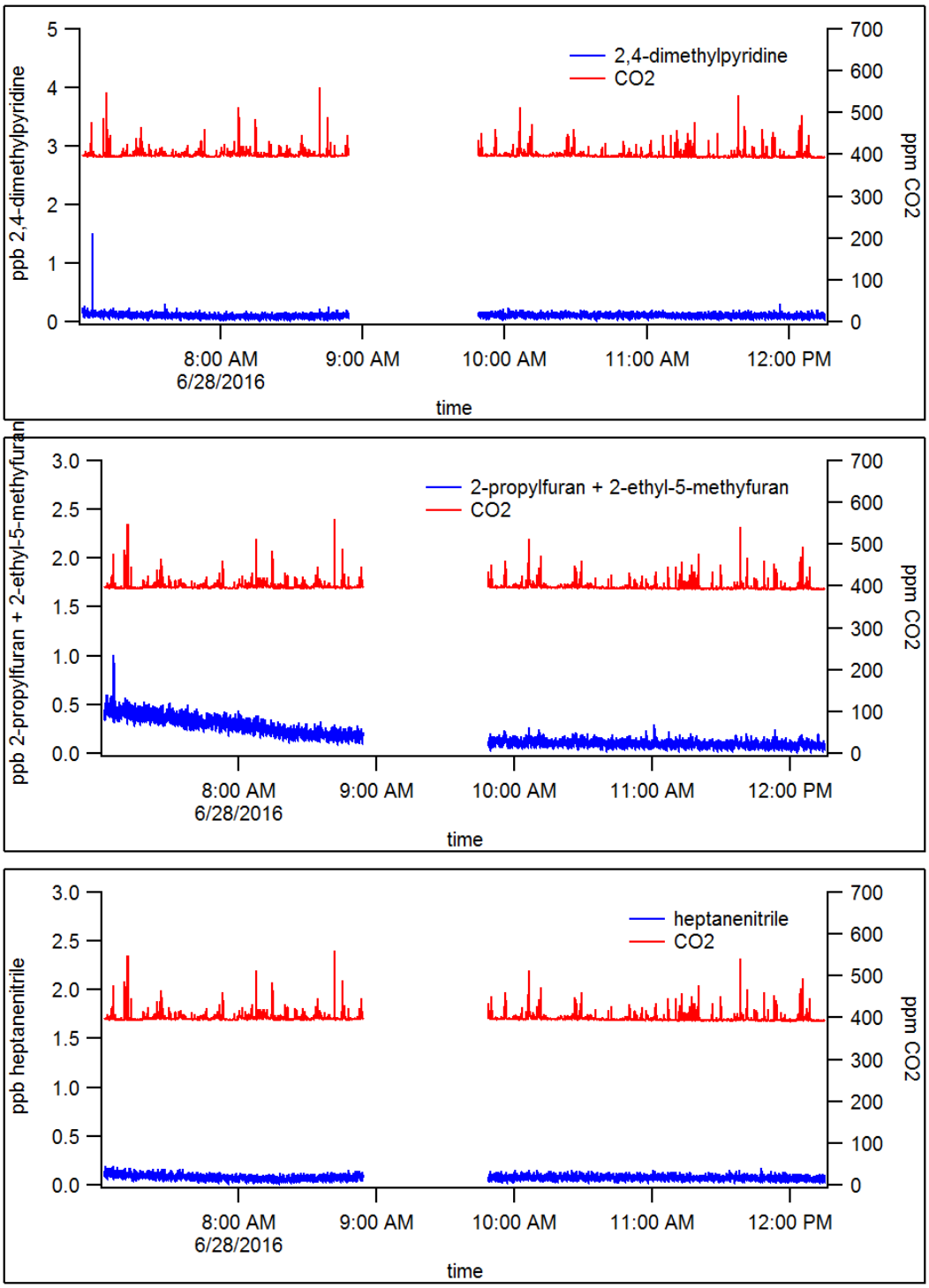


Figure B.2.2-11. June 28th - 4-methyl-2-hexanone (TOP), N-nitrosomorpholine [NMOR] (MIDDLE), Butyl Nitrate (BOTTOM)

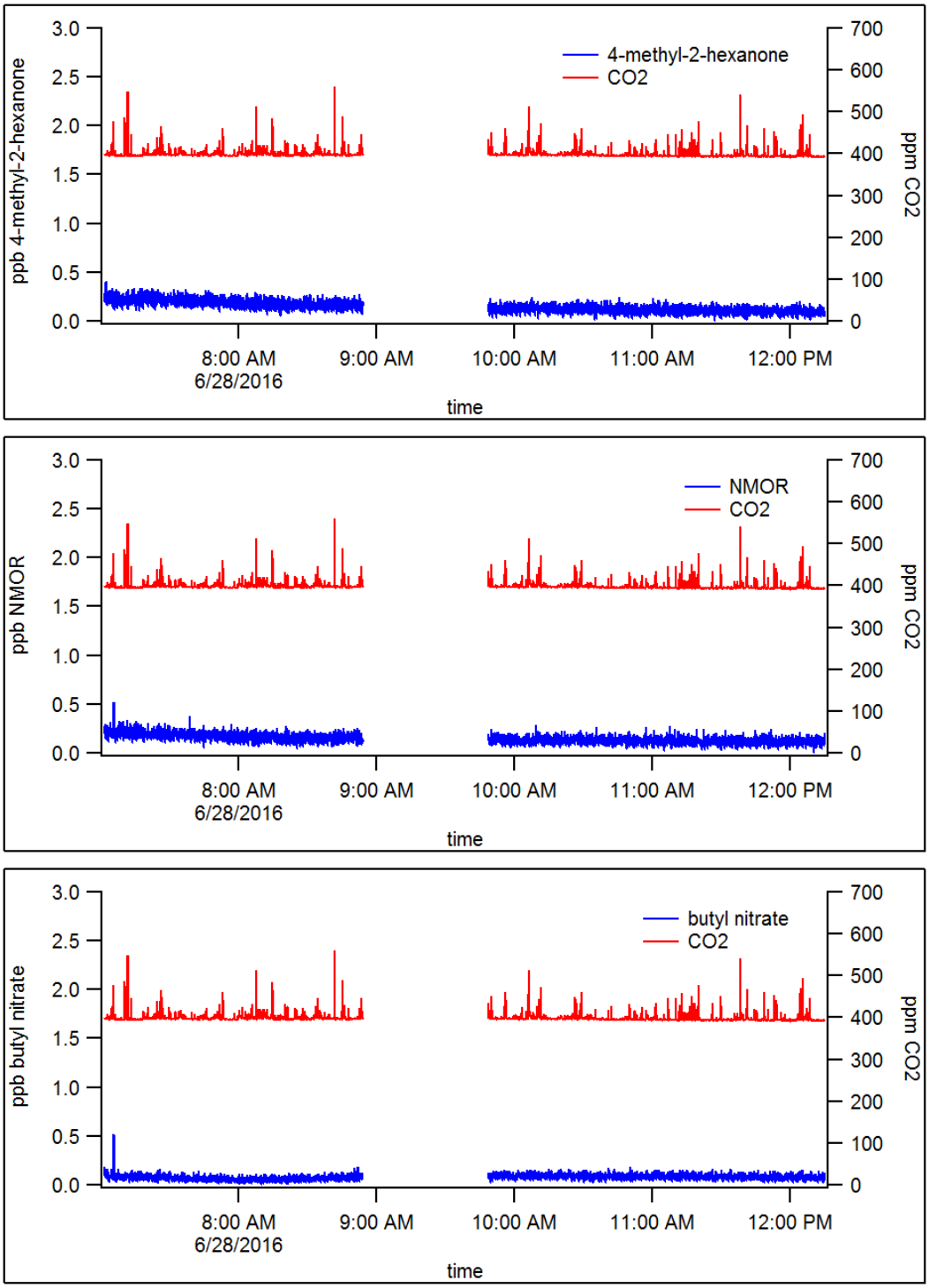


Figure B.2.2-12. June 28th - Multiple Furans [m/z 127] (TOP), 6-methyl-2-heptanone (MIDDLE), 2-pentylfuran (BOTTOM)

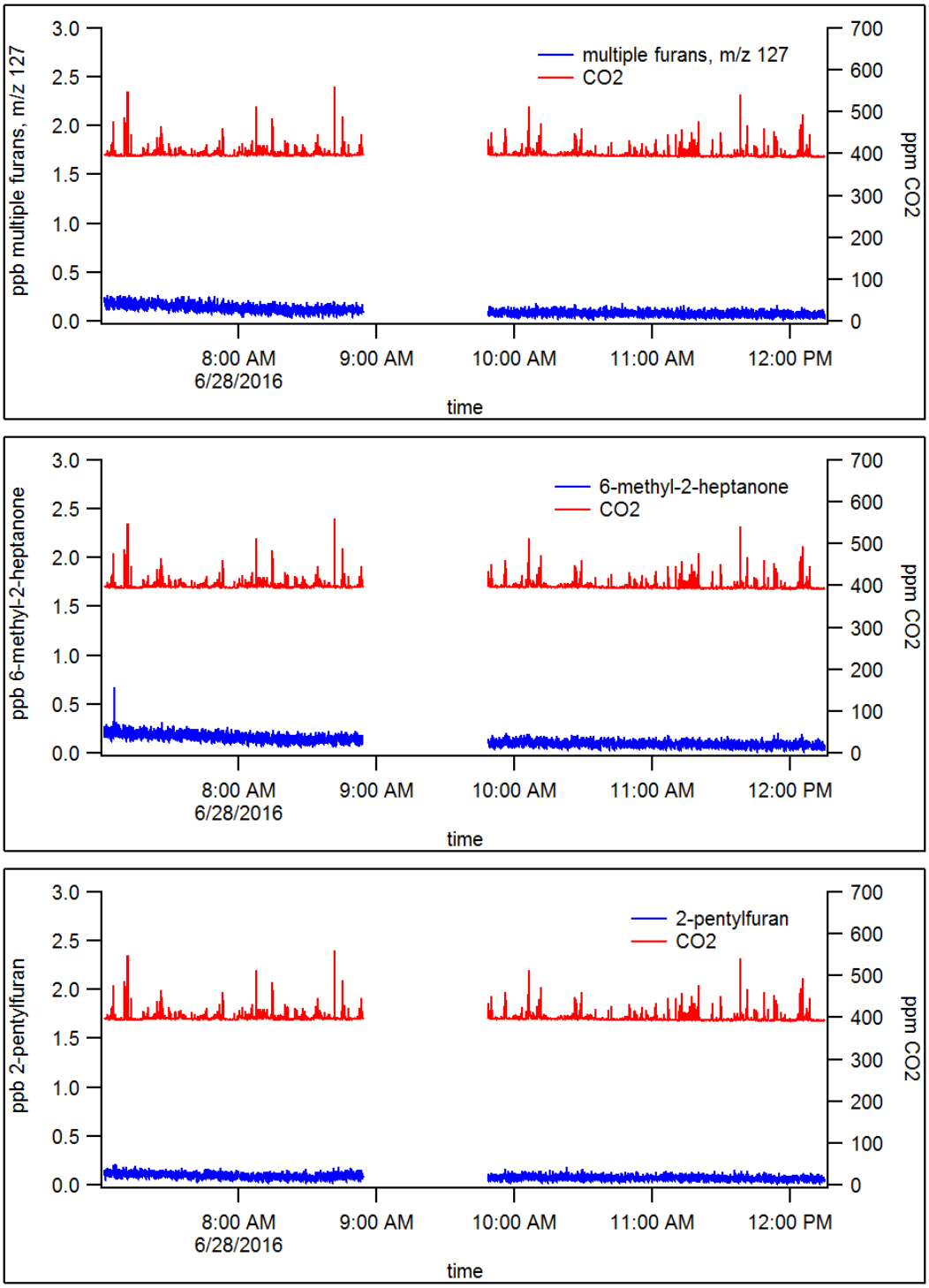


Figure B.2.2-13. June 28th - Biphenyl (TOP), 2-heptylfuran (MIDDLE), 2-octylfuran; 1,4-butanediol, Dinitrate (BOTTOM)

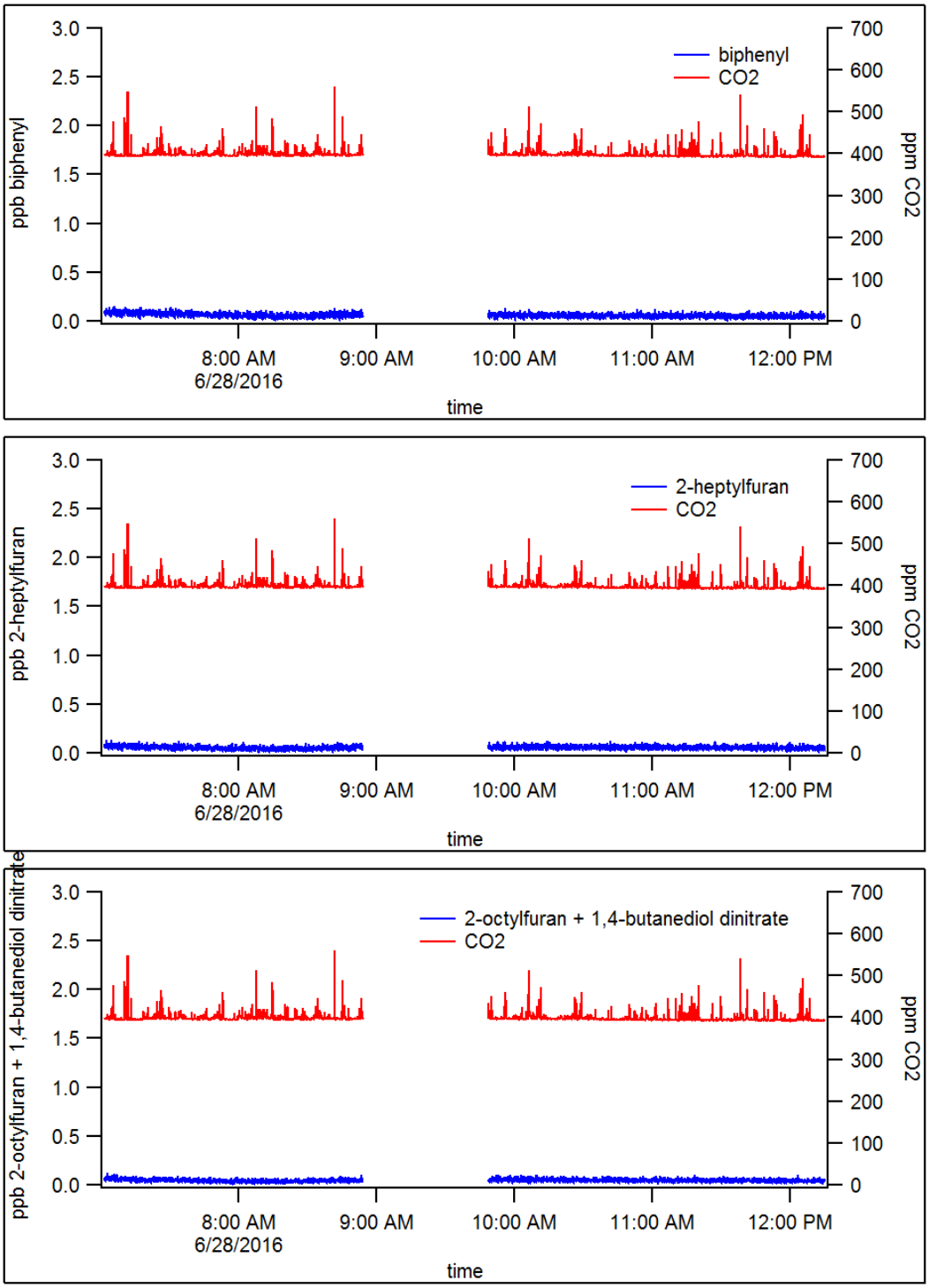


Figure B.2.2-14. June 28th - 1,2,3-propanetriol, 1,3-dinitrate (TOP), PCB (MIDDLE), 6-(2-furanyl)-6-methyl-2-heptanone (BOTTOM)

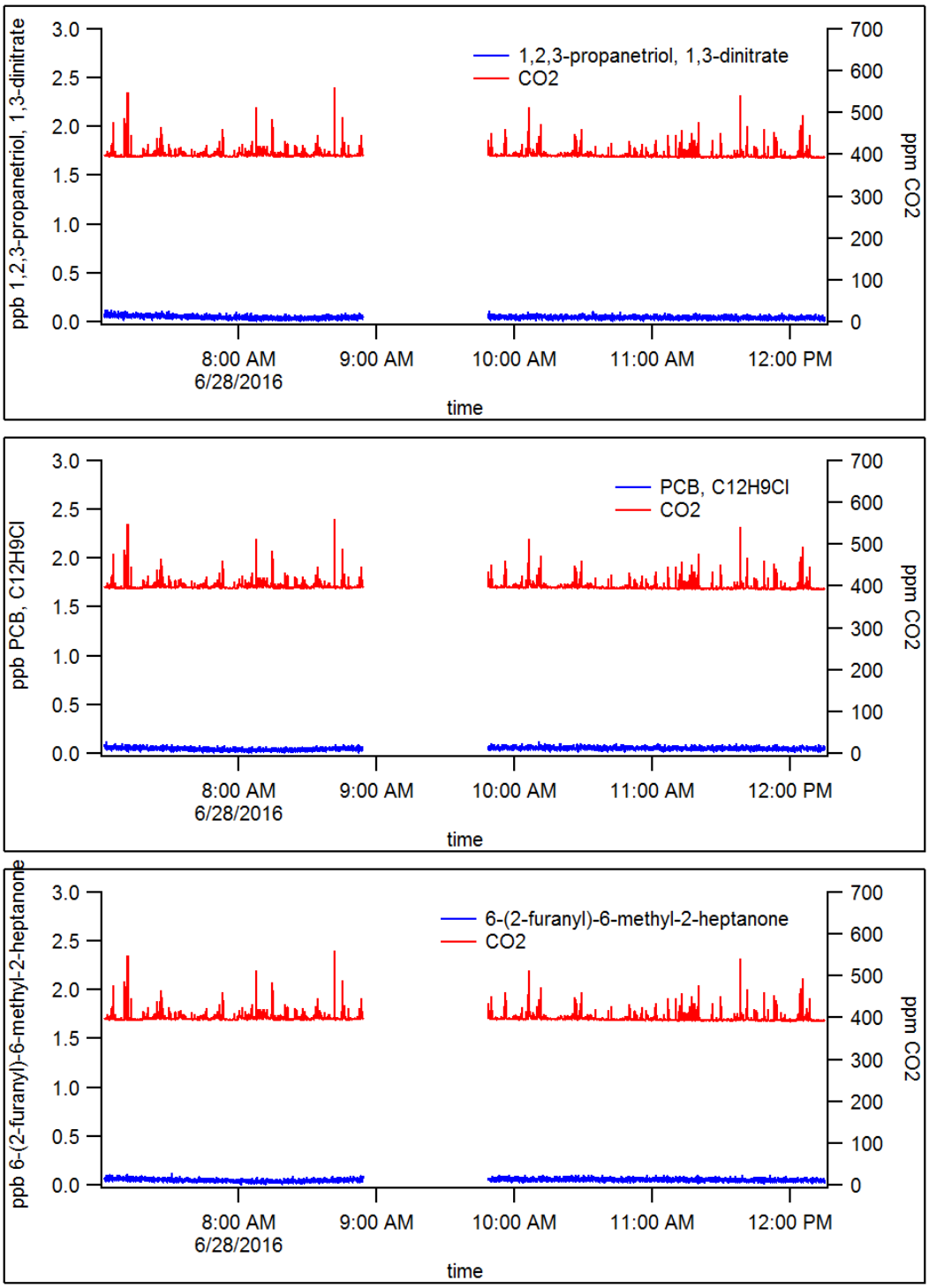
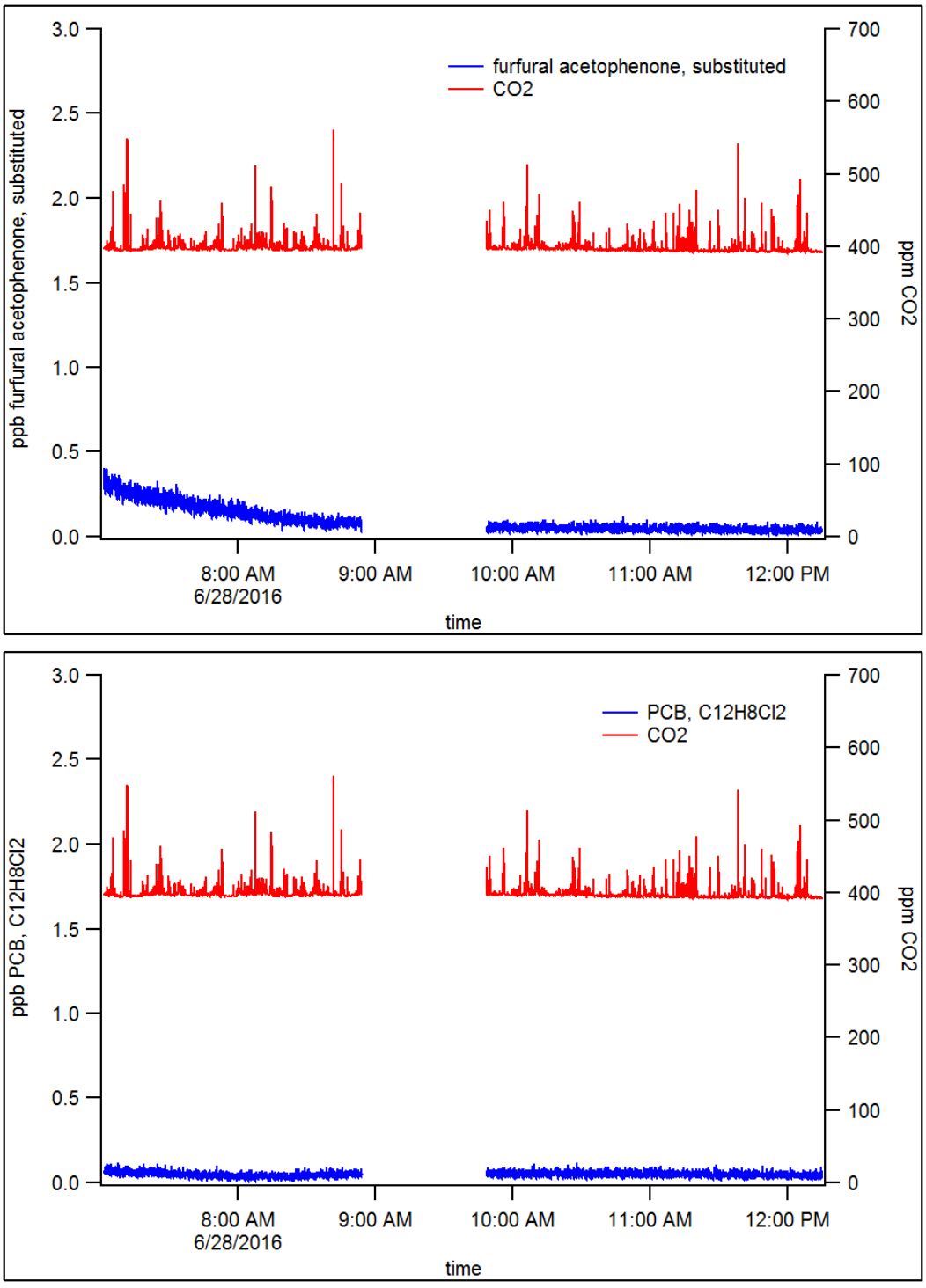


Figure B.2.2-15. June 28th - Furfural Acetophenone [3-(2-furanyl)-1-pheynyl-2-propen-1-one] (TOP), PCB [2] (BOTTOM)



B.2.3 June 29th Data Collection

June 29th data collection started at 6:35 AM and ended at 11:45 AM. Data collection methods included both mobile and stationary lab techniques. Below are the graphs presented in order based on the Chemicals of Potential Concern (COPC) list.

Figure B.2.3-1. June 29th - Formaldehyde (TOP), Methanol (MIDDLE), Acetonitrile (BOTTOM)

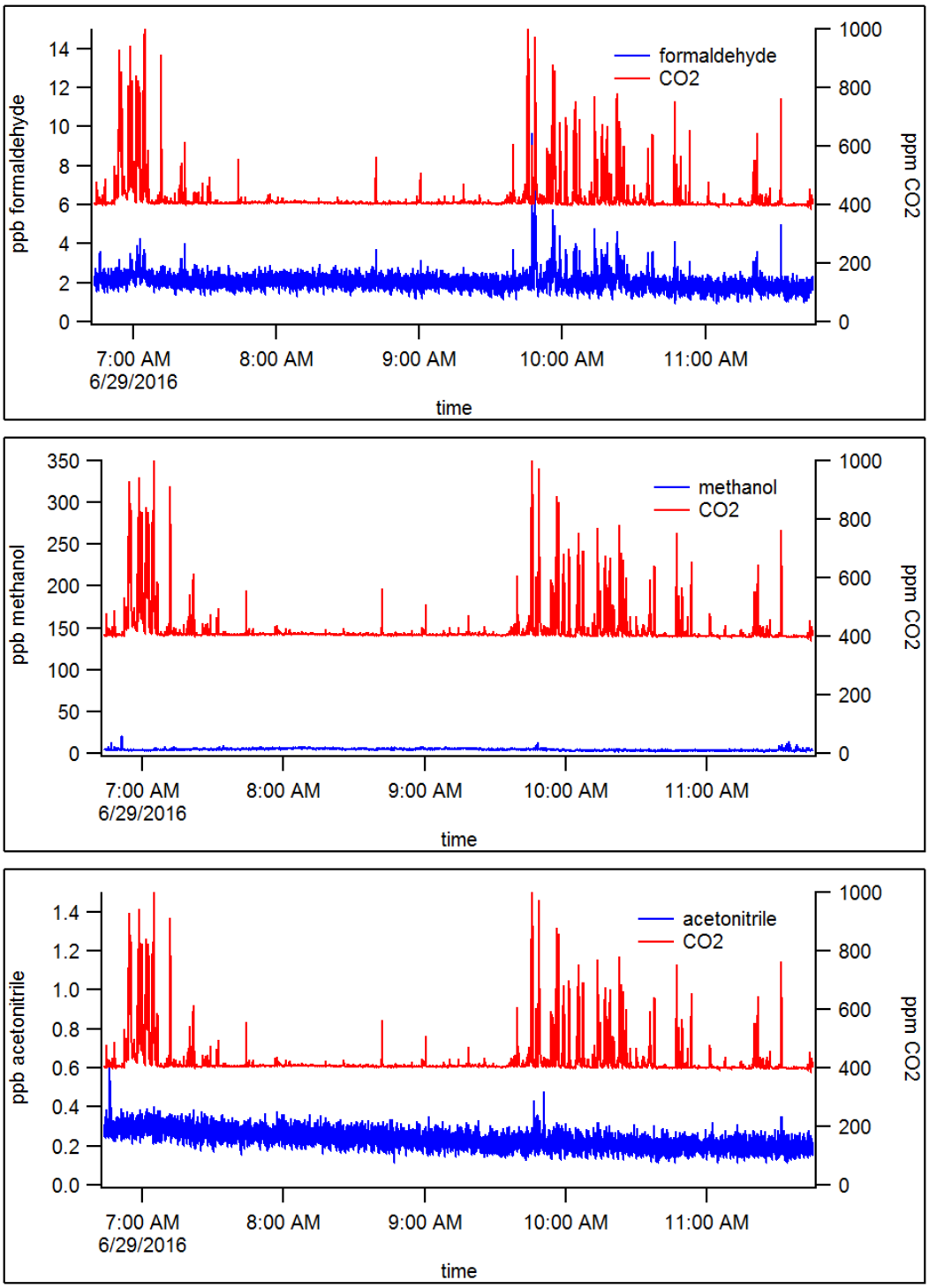


Figure B.2.3-2. June 29th - Acetaldehyde (TOP), Ethylamine (MIDDLE), 1,3-Butadiene (BOTTOM)

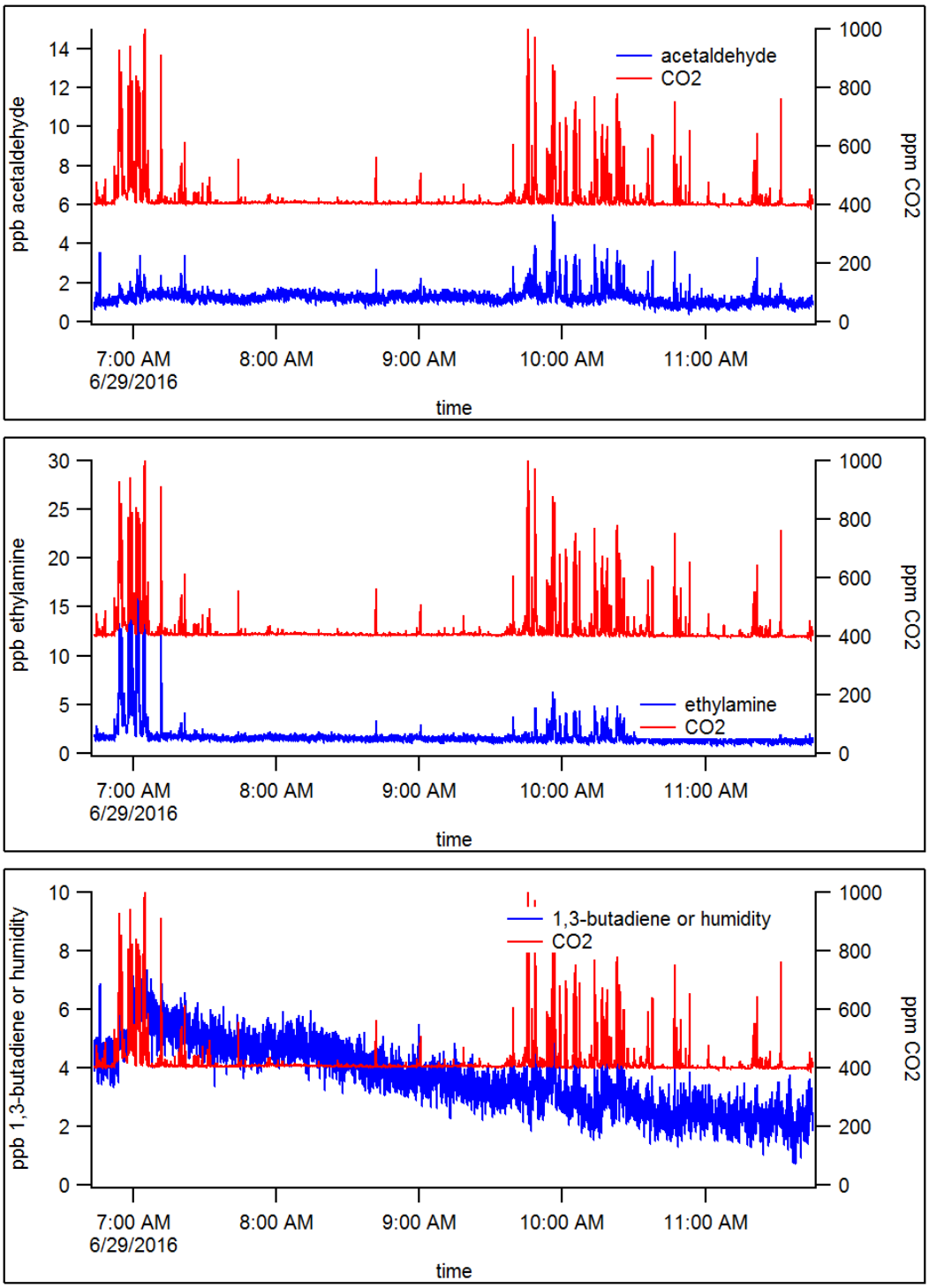


Figure B.2.3-3. June 29th - Propanenitrile (TOP), 1-Butanol; Butenes (MIDDLE), Methyl Isocyanate (BOTTOM)

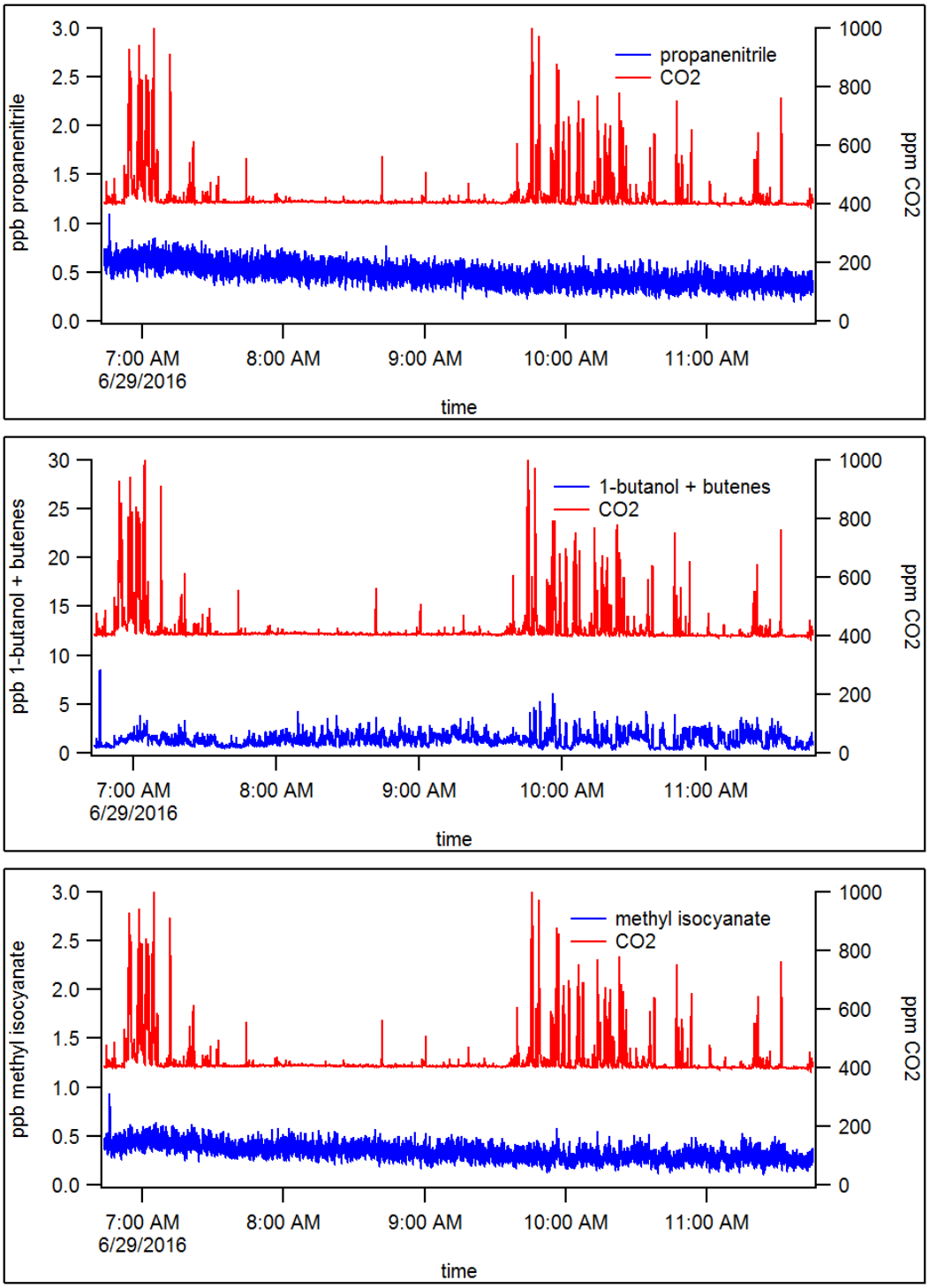


Figure B.2.3-4. June 29th - Methyl Nitrite (TOP), Furan; Isoprene (MIDDLE), Butanenitrile (BOTTOM)

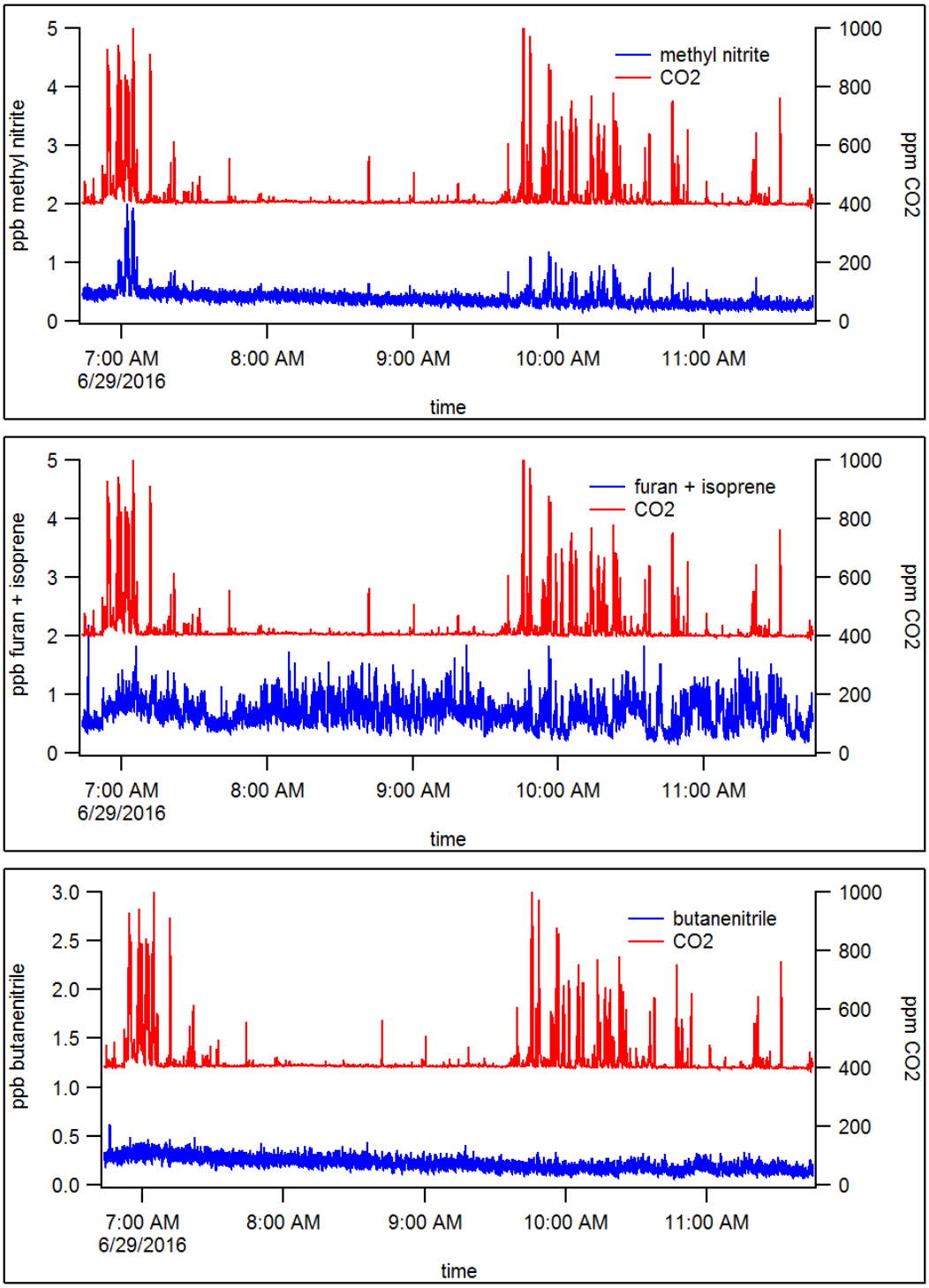


Figure B.2.3-5. June 29th - MVK + Dihydrofurans(TOP), Butanal (MIDDLE), N-nitrosodimethylamine [NDMA] (BOTTOM)

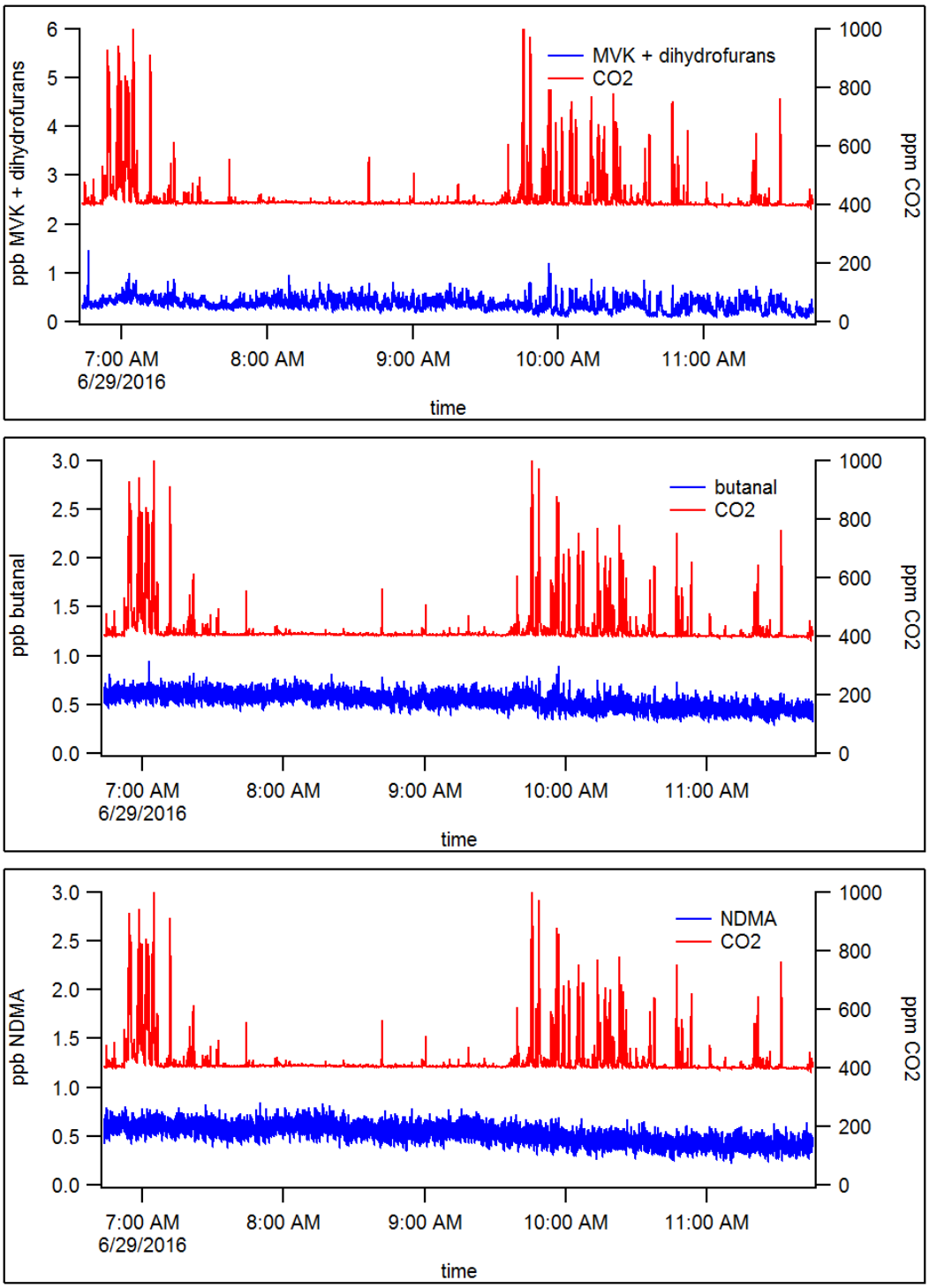


Figure B.2.3-6. June 29th - Benzene (TOP), 2,4-Pentadienenitrile; Pyridine (MIDDLE), 2-methylene Butanenitrile (BOTTOM)

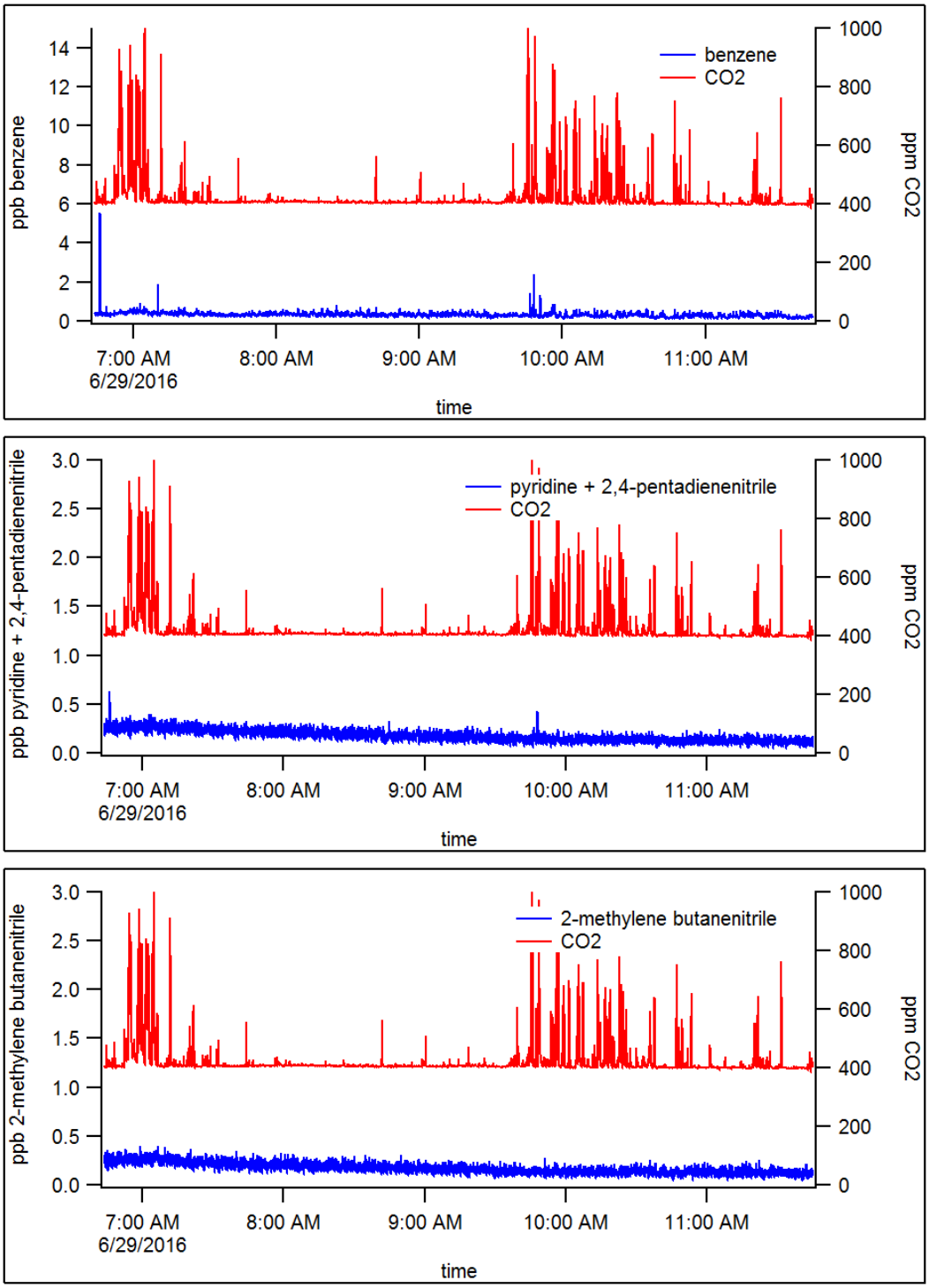


Figure B.2.3-7. June 29th - 2-methylfuran (TOP), Pentanenitrile (MIDDLE), 3-methyl-3-buten-2-one; 2-methyl-2-butenal (BOTTOM)

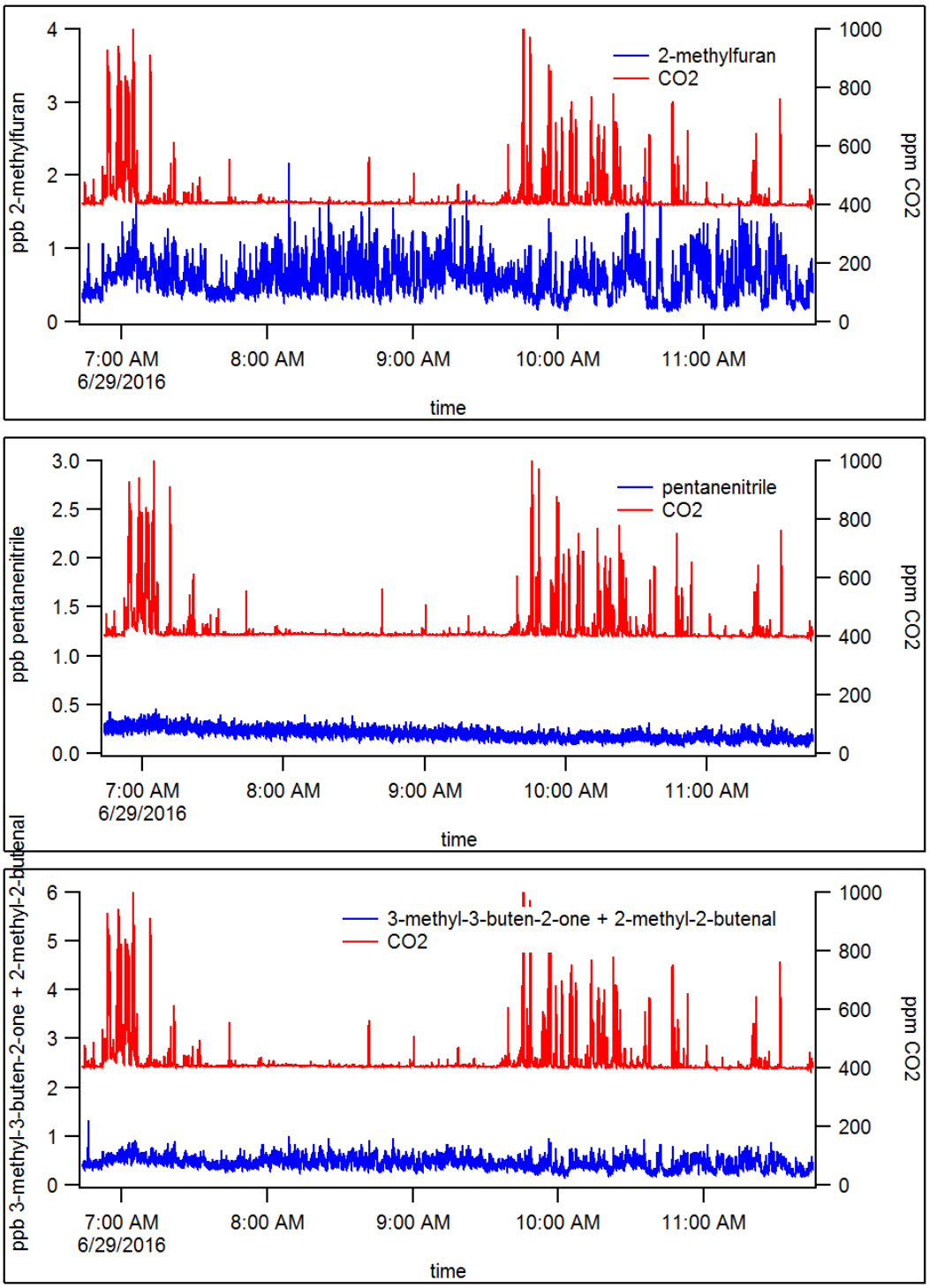


Figure B.2.3-8. June 29th - N-nitrosomethylethylamine [NEMA] (TOP), 2,5-dimethylfuran (MIDDLE), Hexanenitrile (BOTTOM)

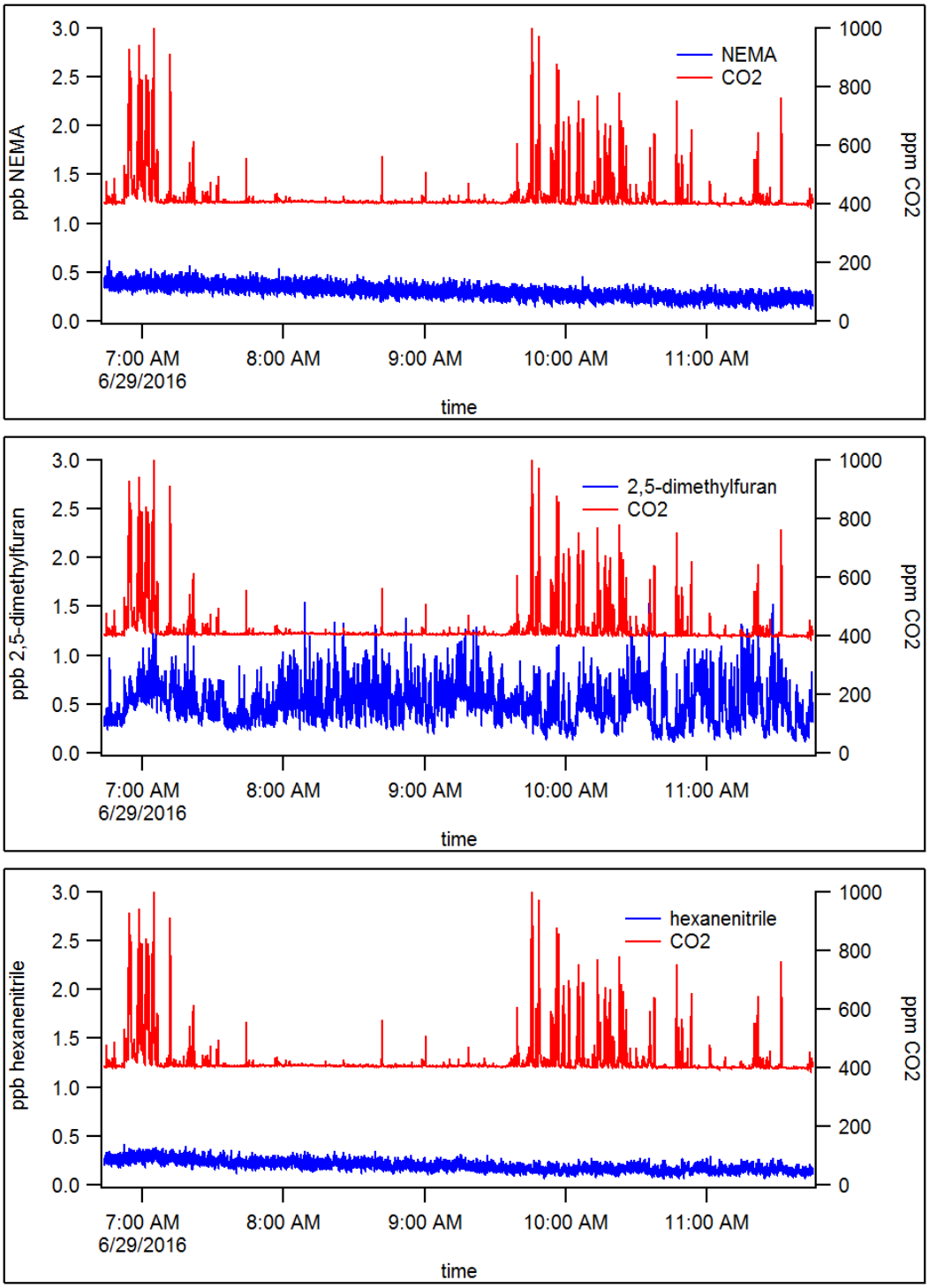


Figure B.2.3-9. June 29th - 2-hexanone [MBK] (TOP), N-nitrosodiethylamine [NDEA] (MIDDLE), Butyl Nitrite; 2-nitro-2-methylpropane (BOTTOM)

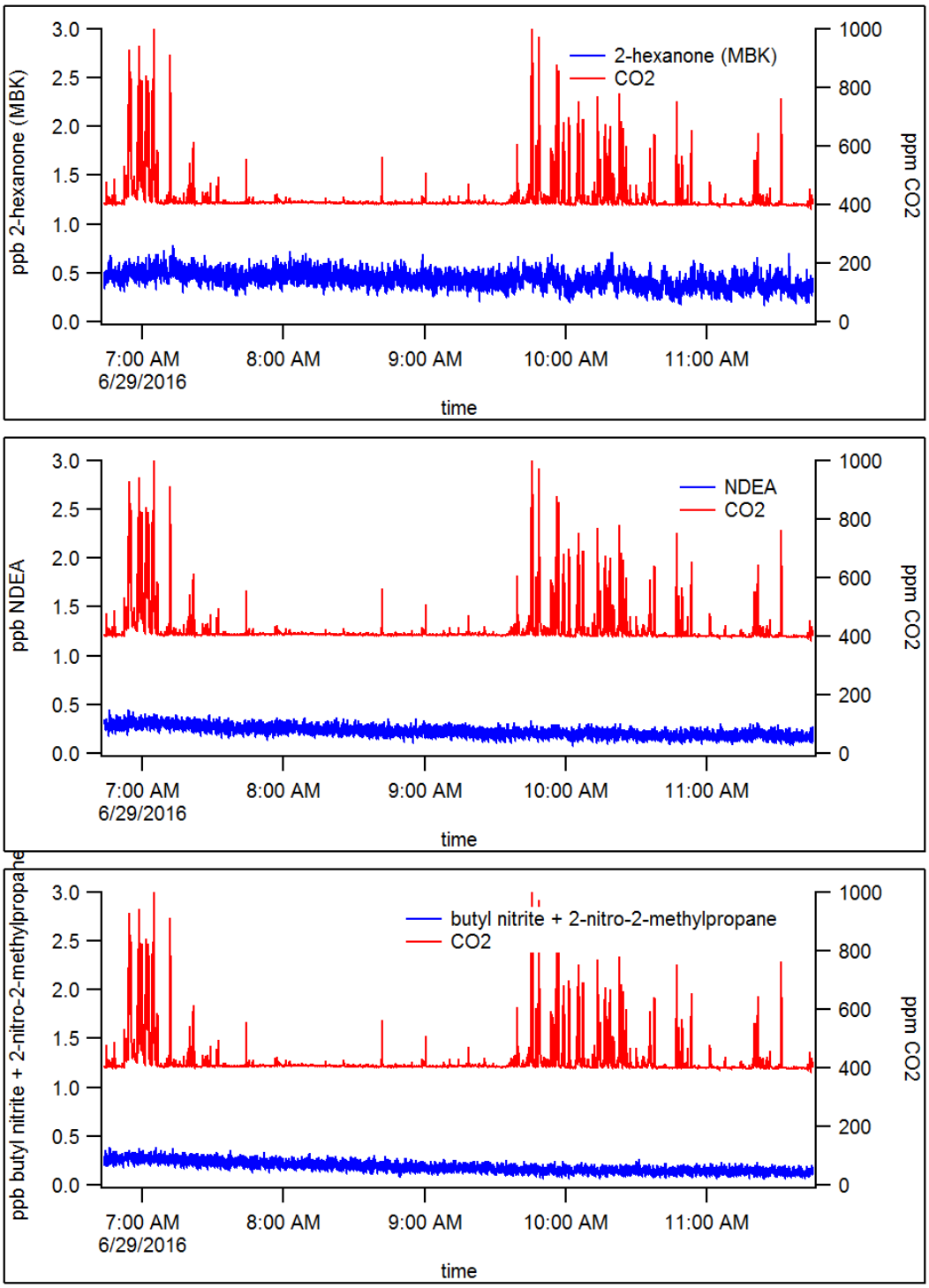


Figure B.2.3-10. June 29th - 2,4-dimethylpyridine (TOP), 2-ethyl-5-methylfuran (MIDDLE), Heptanenitrile (BOTTOM)

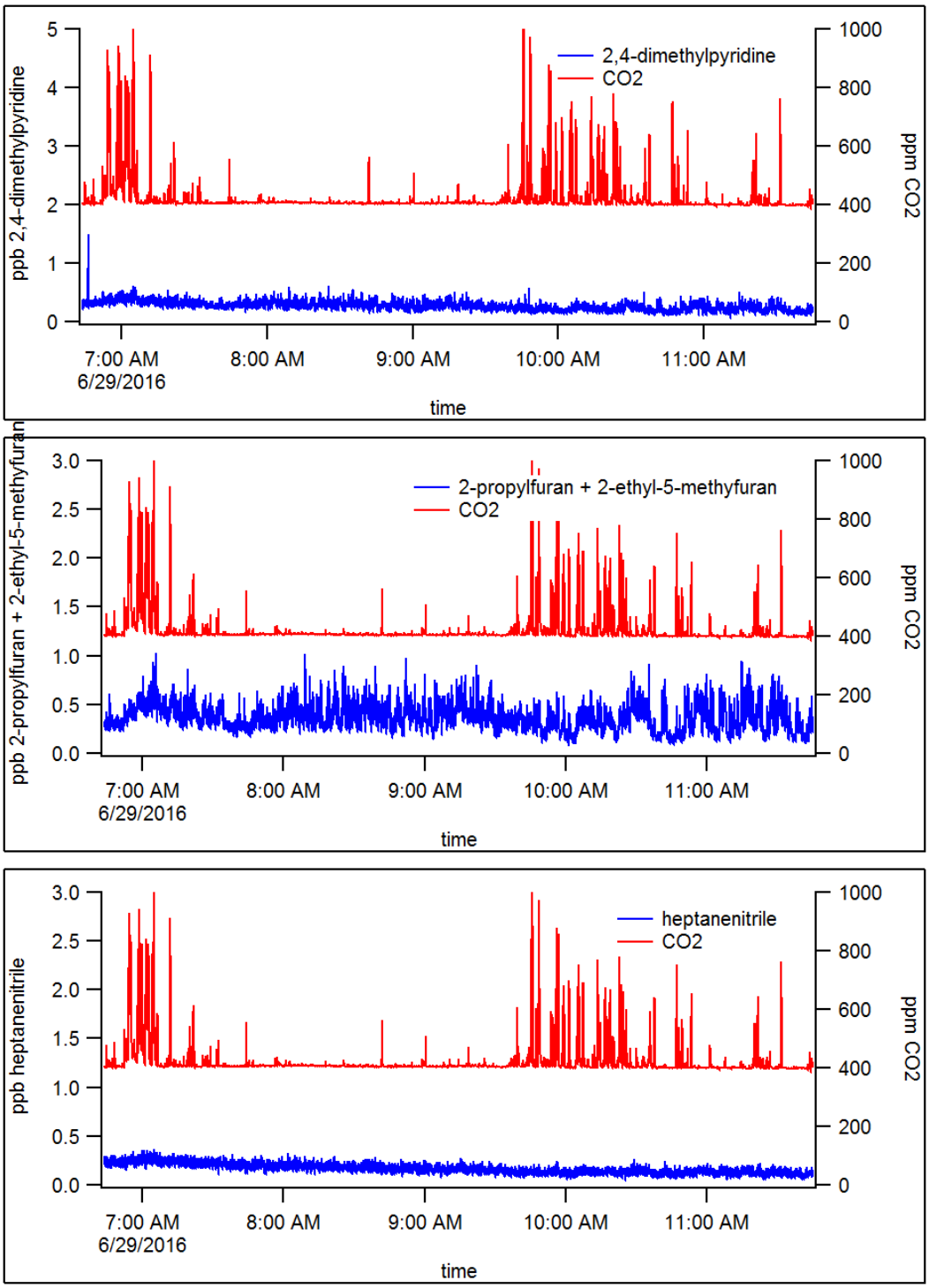


Figure B.2.3-11. June 29th - 4-methyl-2-hexanone (TOP), N-nitrosomorpholine [NMOR] (MIDDLE), Butyl Nitrate (BOTTOM)

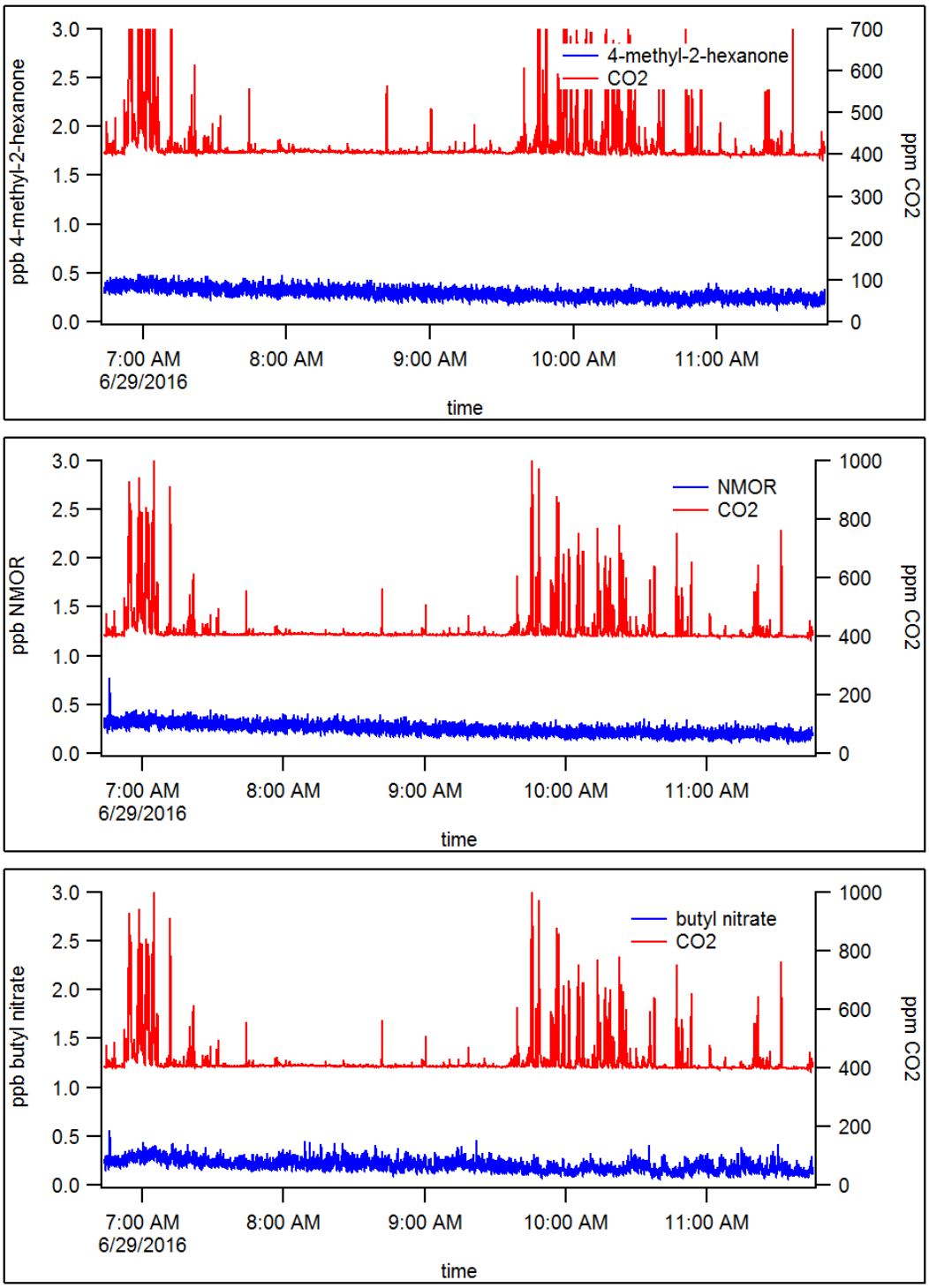


Figure B.2.3-12. June 29th - Multiple Furans [m/z 127] (TOP), 6-methyl-2-heptanone (MIDDLE), 2-pentylfuran (BOTTOM)

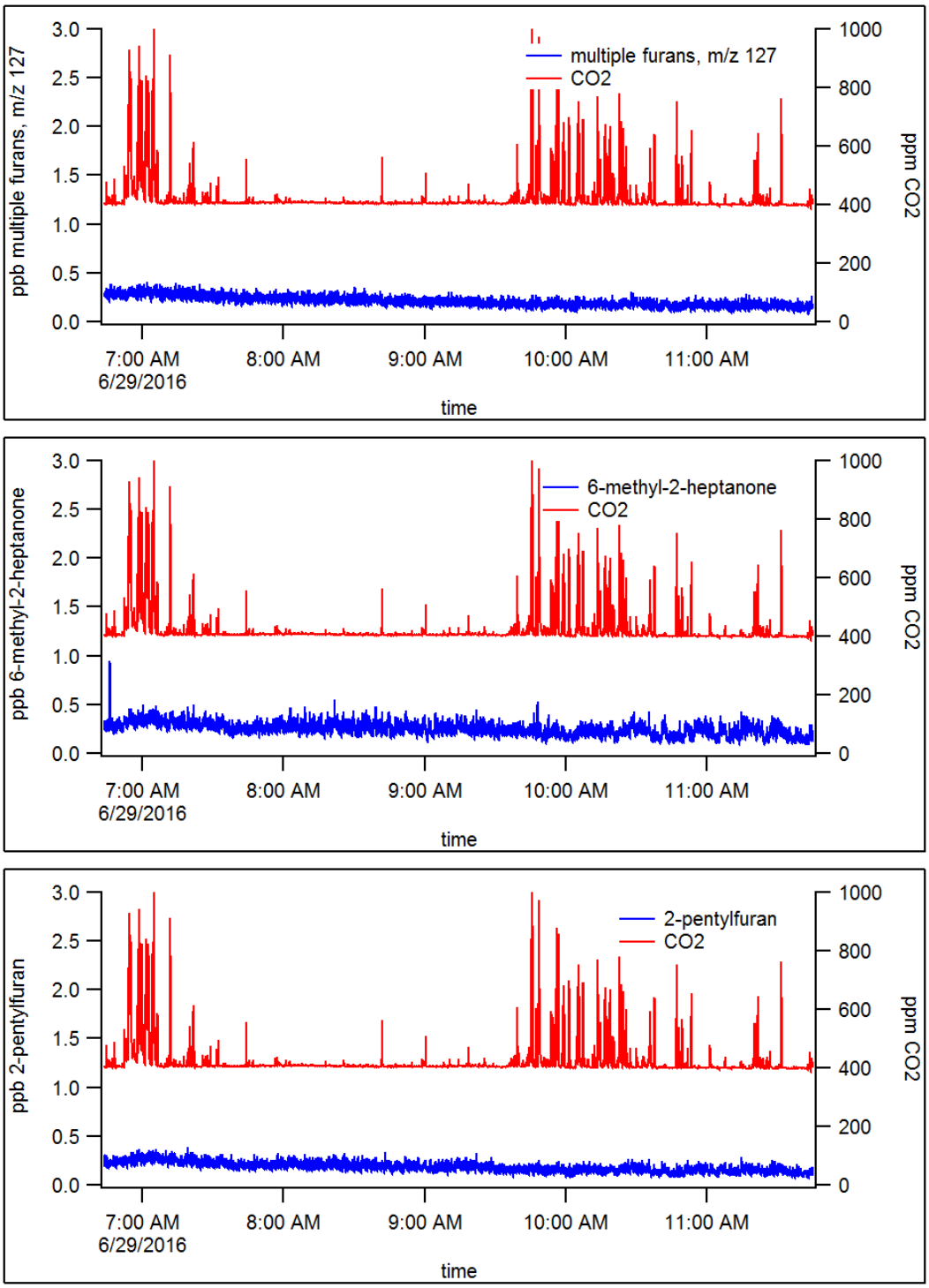


Figure B.2.3-13. June 29th - Biphenyl (TOP), 2-heptylfuran (MIDDLE), 2-octylfuran; 1,4-butanediol, Dinitrate (BOTTOM)

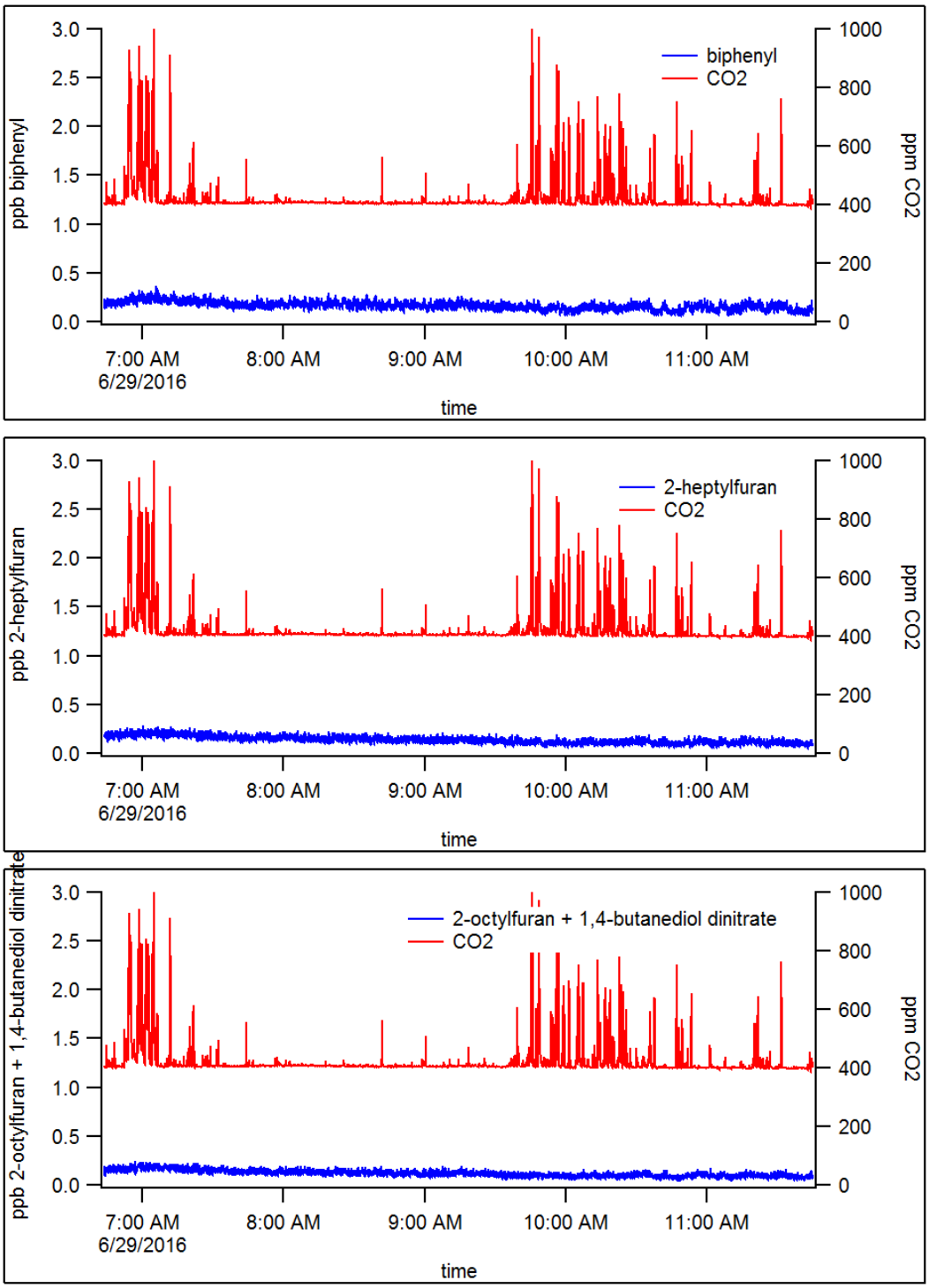


Figure B.2.3-14. June 29th - 1,2,3-propanetriol, 1,3-dinitrate (TOP), PCB (MIDDLE), 6-(2-furanyl)-6-methyl-2-heptanone (BOTTOM)

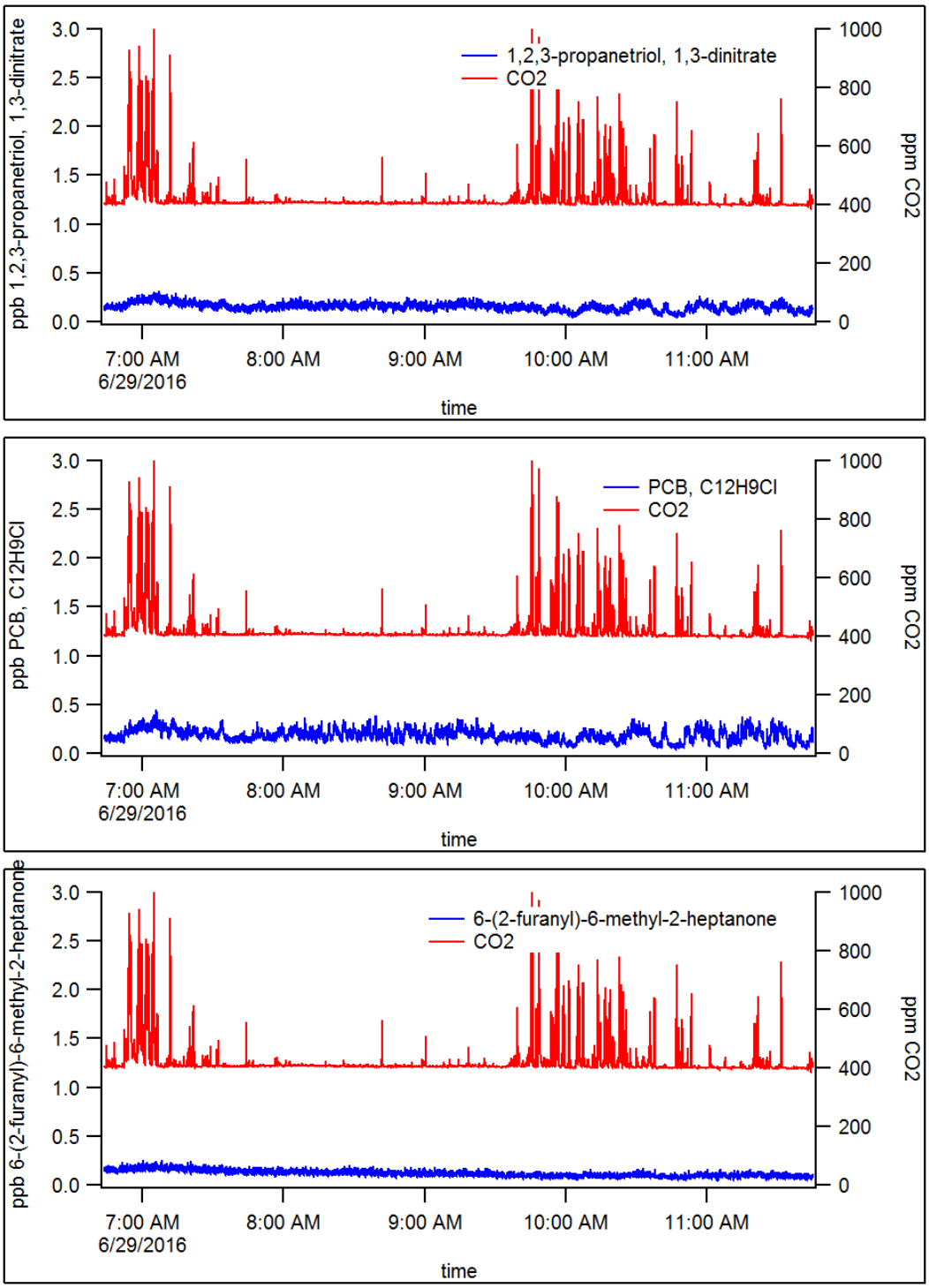
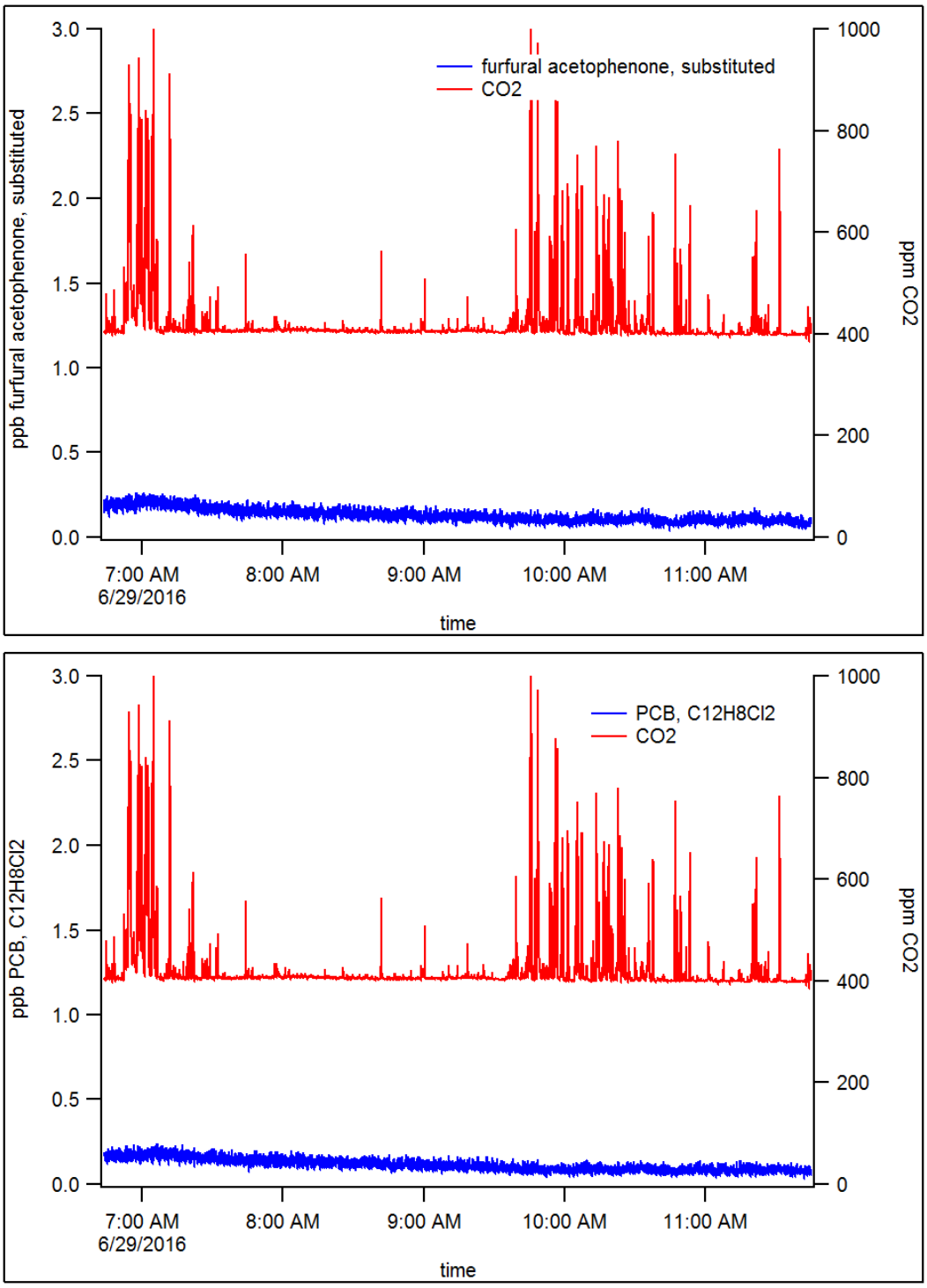


Figure B.2.3-15. June 29th - Furfural Acetophenone [3-(2-furanyl)-1-pheynyl-2-propen-1-one] (TOP), PCB [2] (BOTTOM)



B.2.4 June 30th Data Collection

June 30th data collection started at 6:30 AM and ended at 12:30 PM. Data collection methods included both mobile and stationary lab techniques. Below are the graphs presented in order based on the Chemicals of Potential Concern (COPC) list.

Figure B.2.4-1. June 30th - Formaldehyde (TOP), Methanol (MIDDLE), Acetonitrile (BOTTOM)

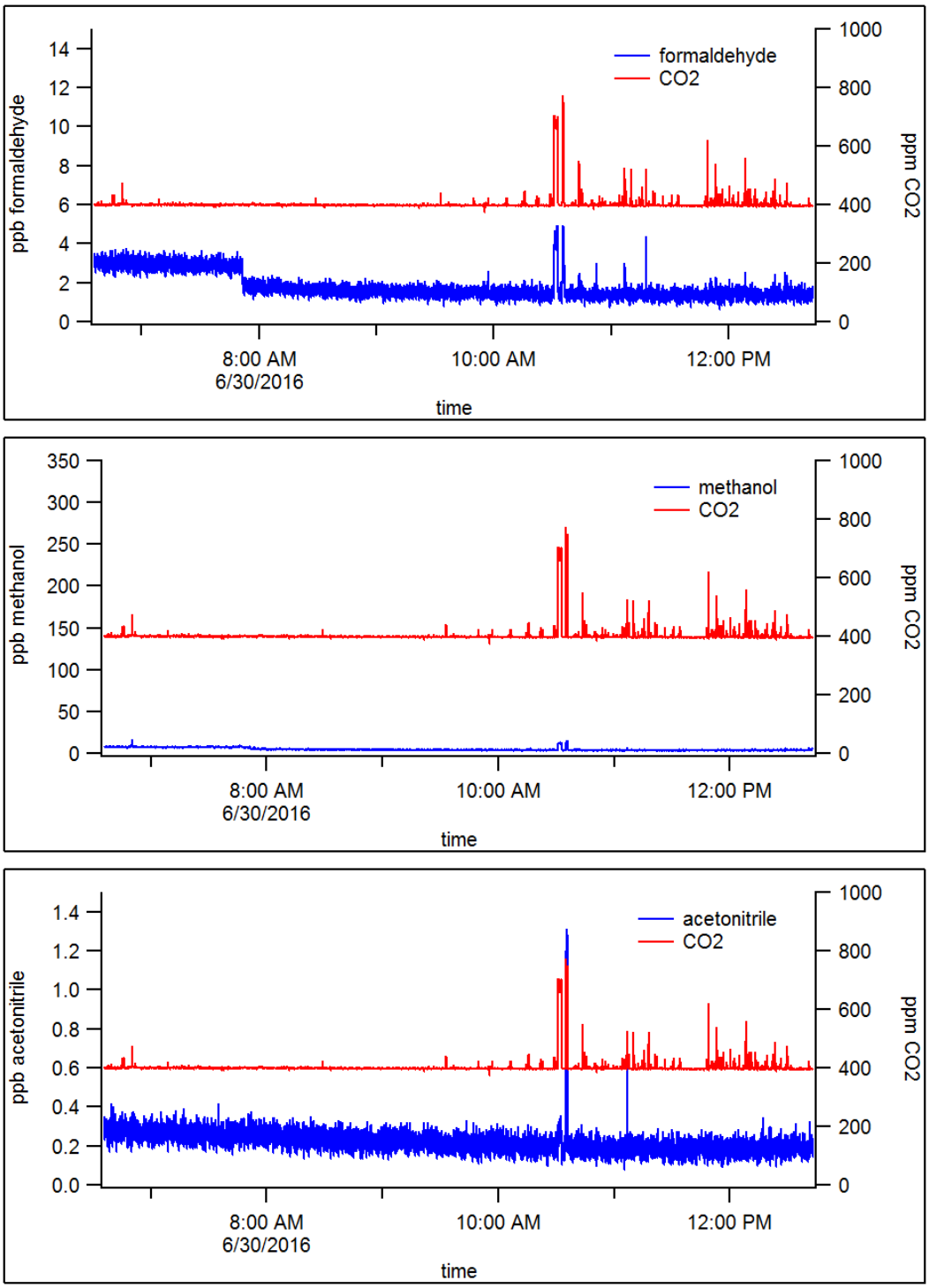


Figure B.2.4-2. June 30th - Acetaldehyde (TOP), Ethylamine (MIDDLE), 1,3-Butadiene (BOTTOM)

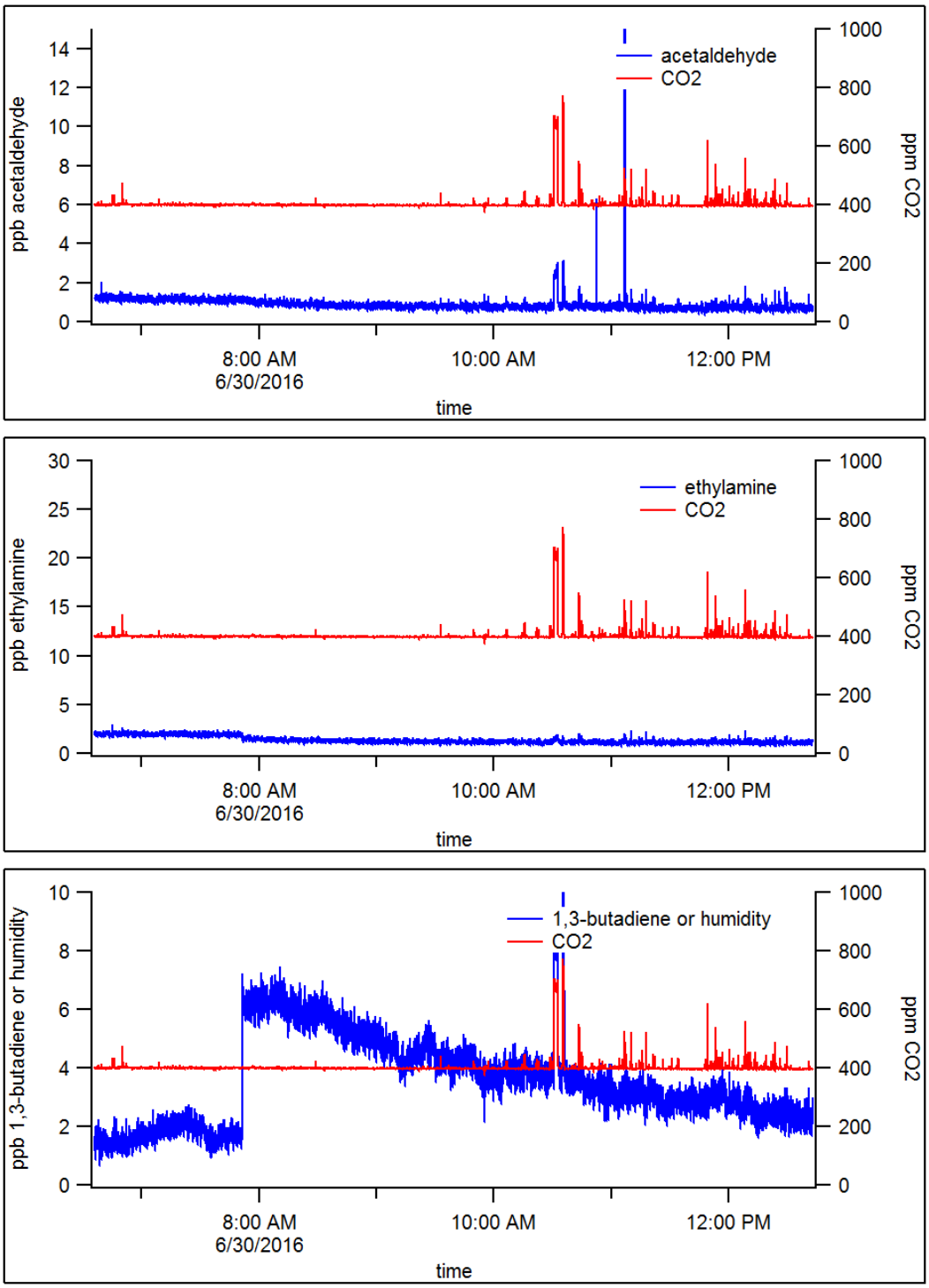


Figure B.2.4-3. June 30th - Propanenitrile (TOP), 1-Butanol; Butenes (MIDDLE), Methyl Isocyanate (BOTTOM)

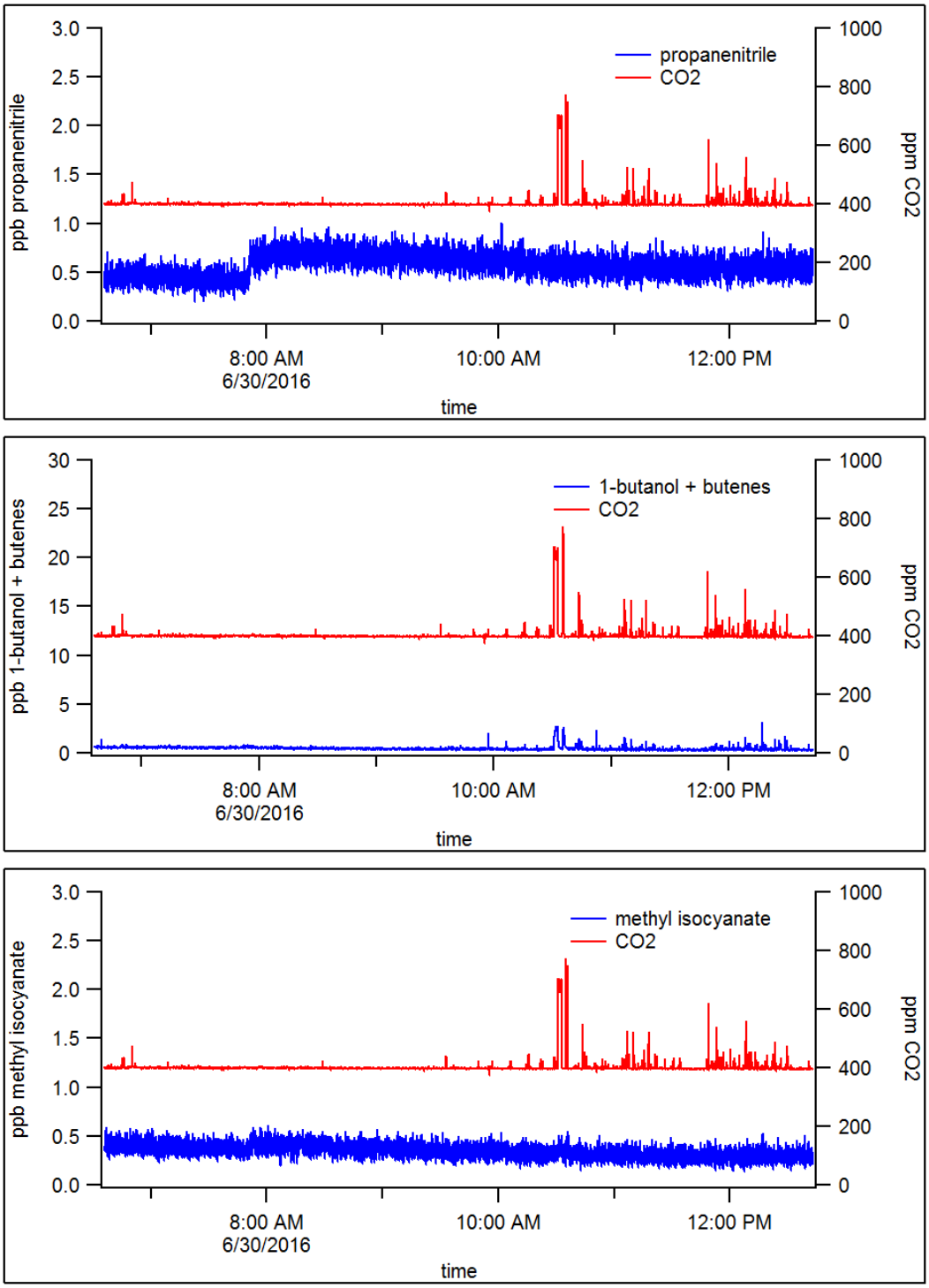


Figure B.2.4-4. June 30th - Methyl Nitrite (TOP), Furan; Isoprene (MIDDLE), Butanenitrile (BOTTOM)

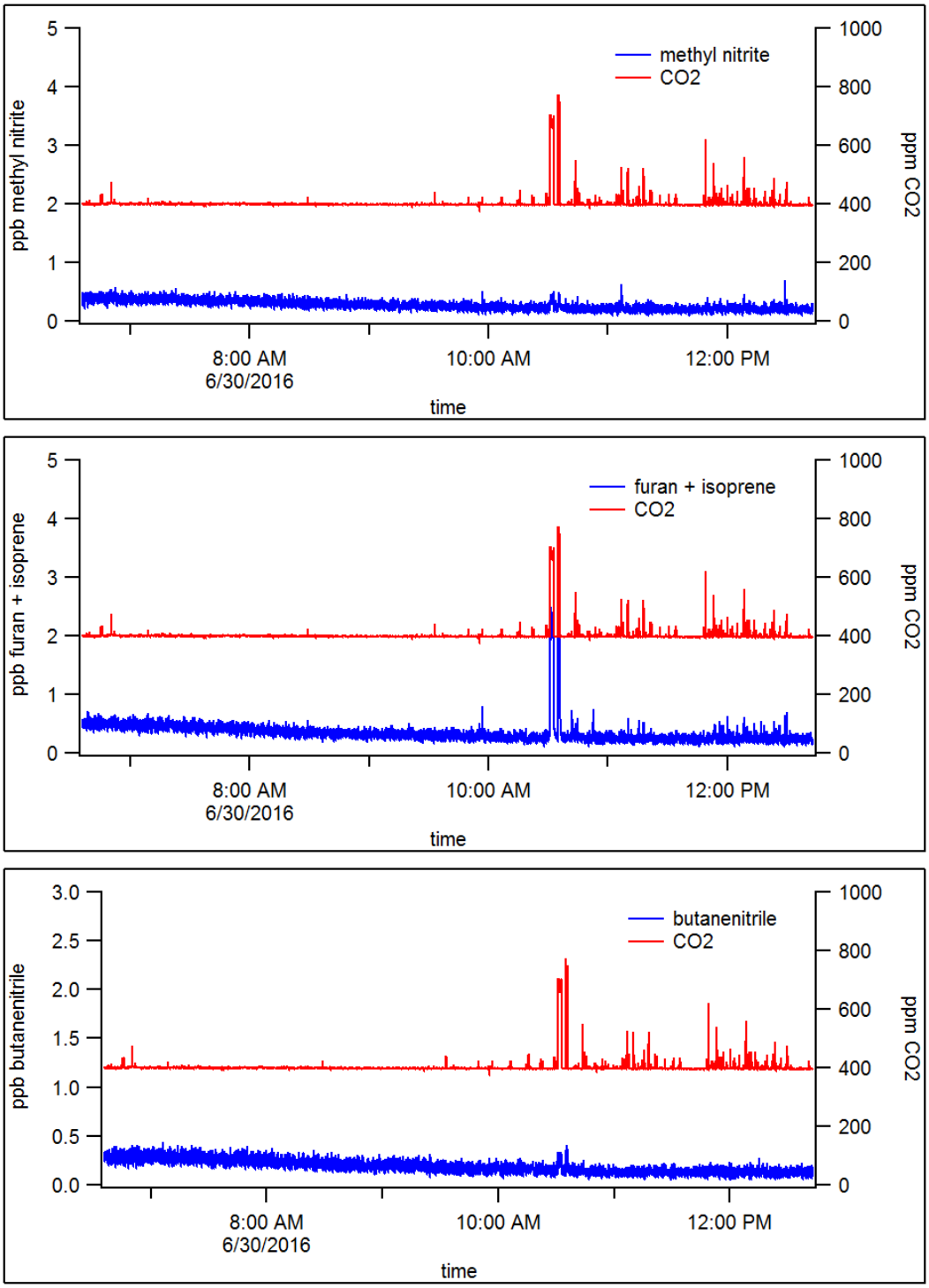


Figure B.2.4-5. June 30th - MVK + Dihydrofurans (TOP), Butanal (MIDDLE), N-nitrosodimethylamine [NDMA] (BOTTOM)

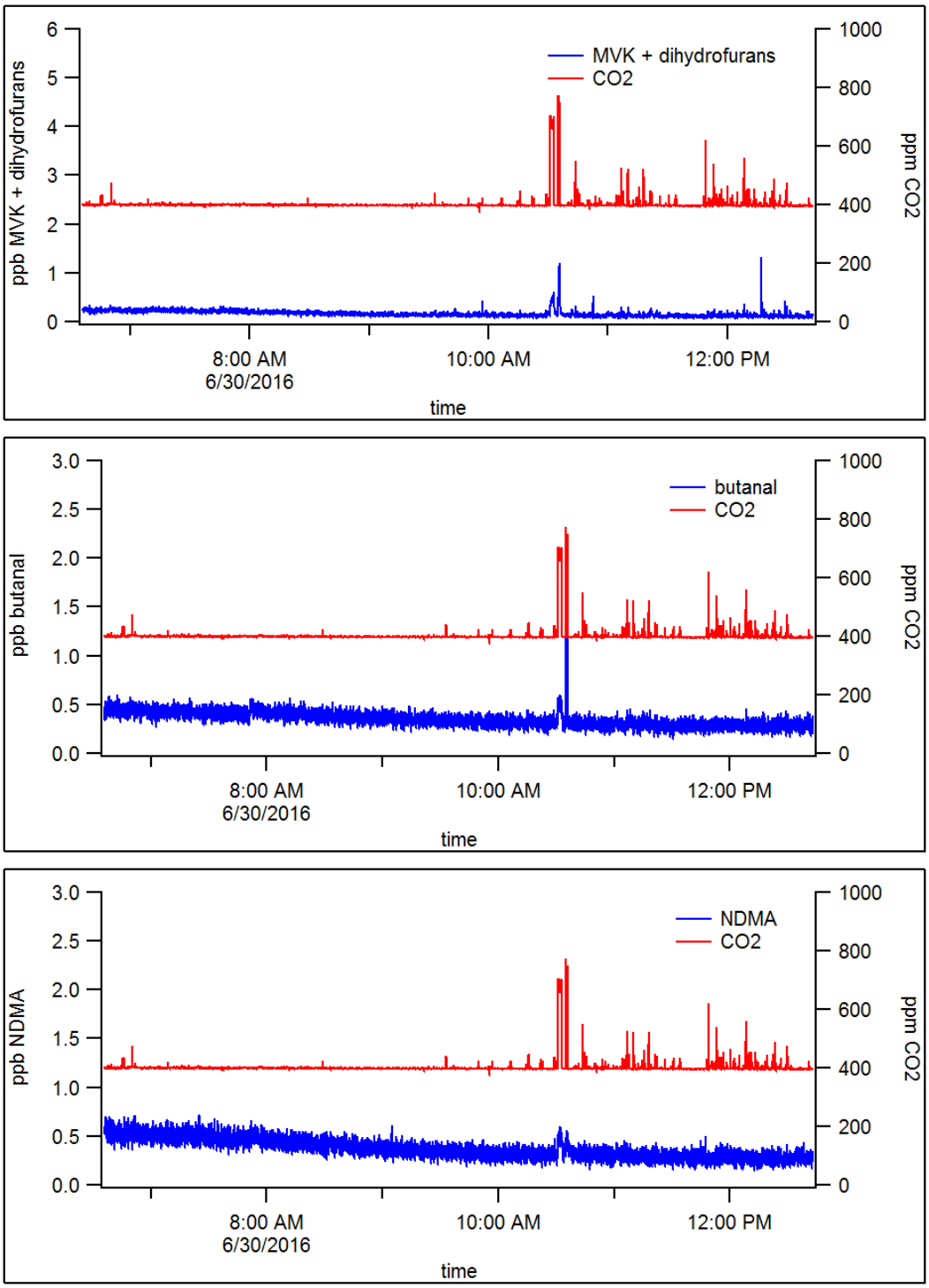


Figure B.2.4-6. June 30th - Benzene (TOP), 2,4-Pentadienenitrile; Pyridine (MIDDLE), 2-methylene Butanenitrile (BOTTOM)

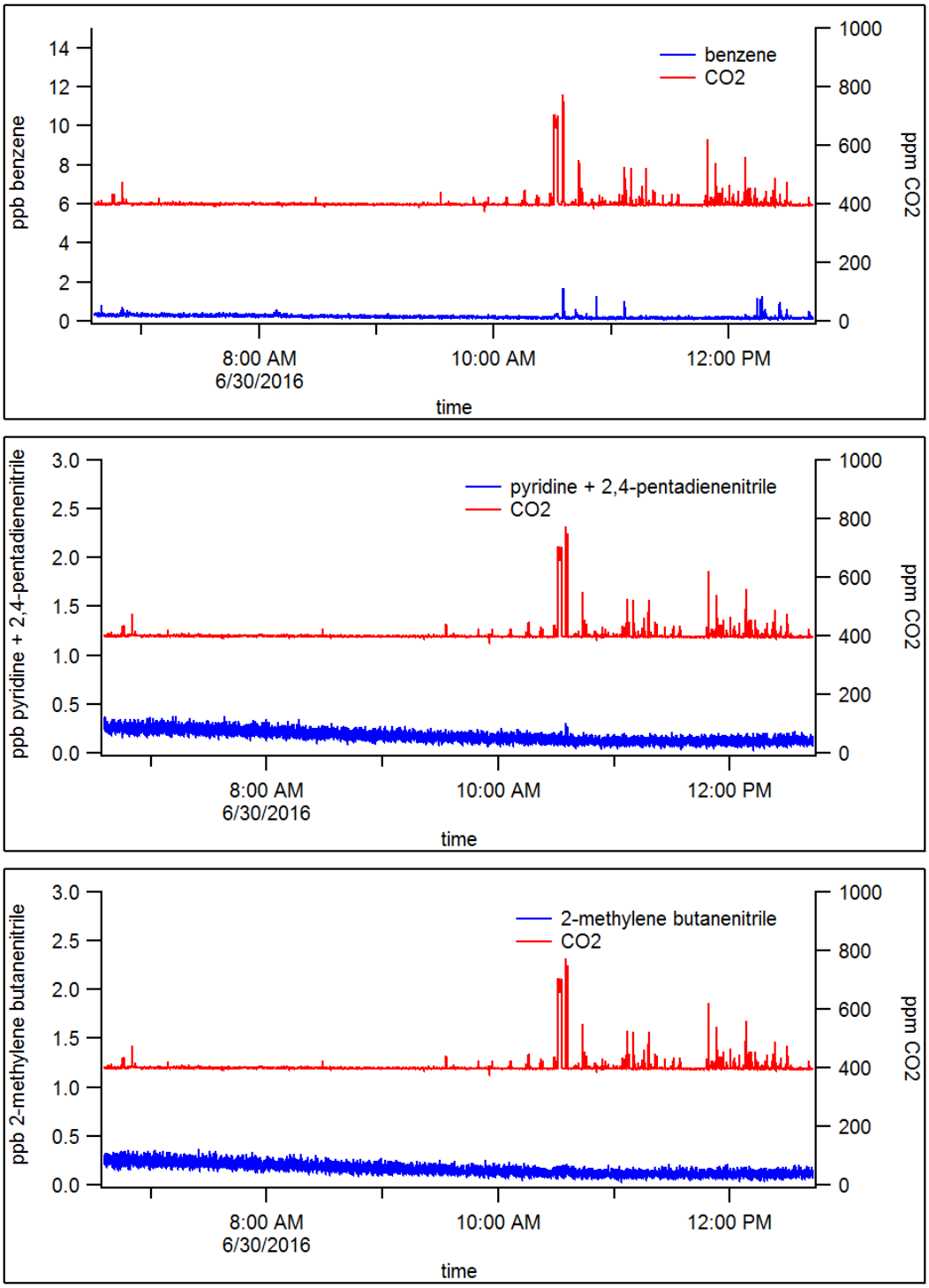


Figure B.2.4-7. June 30th - 2-methylfuran (TOP), Pentanenitrile (MIDDLE), 3-methyl-3-buten-2-one; 2-methyl-2-butenal (BOTTOM)

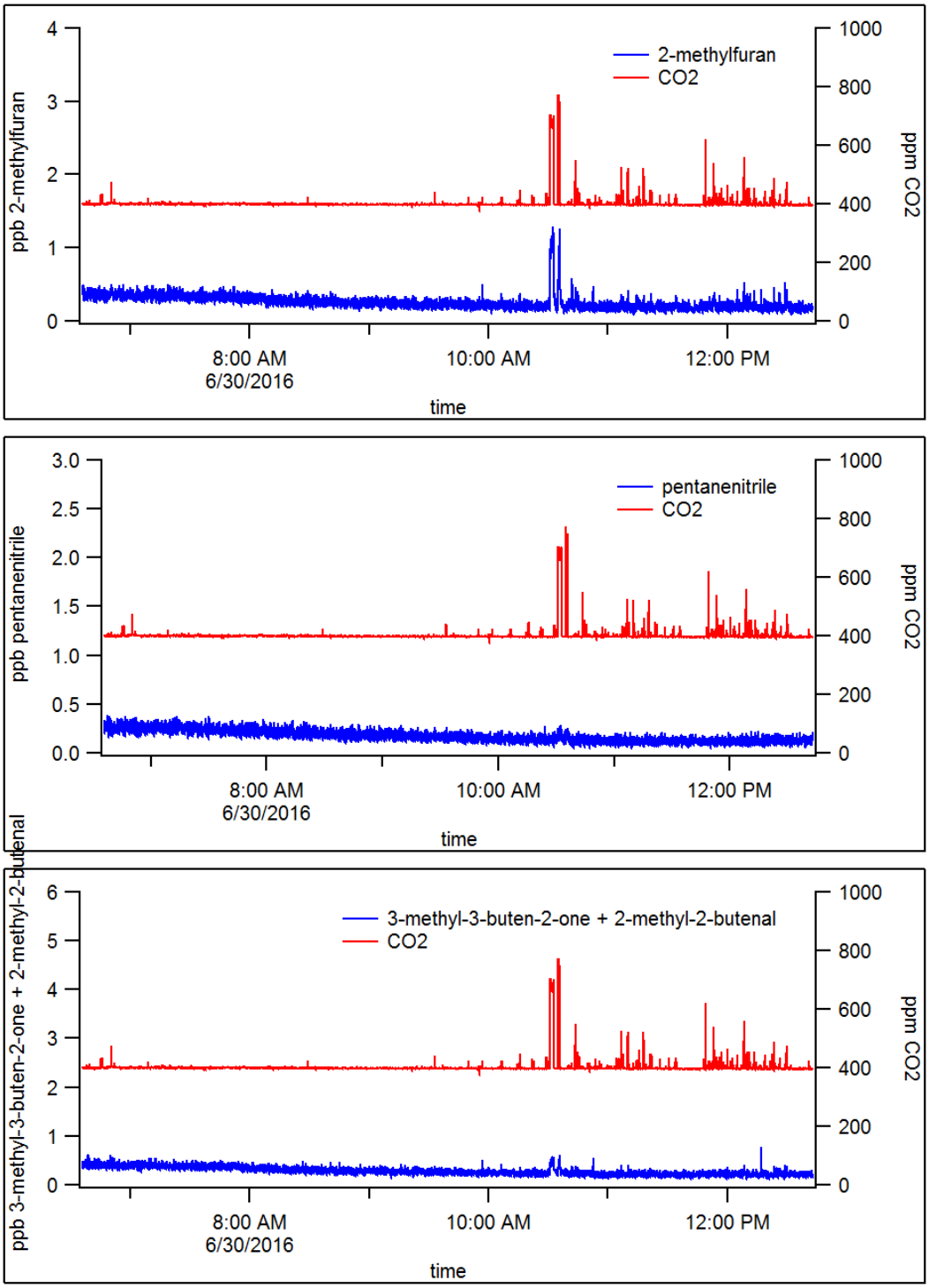


Figure B.2.4-8. June 30th - N-nitrosomethylethylamine [NEMA] (TOP), 2,5-dimethylfuran (MIDDLE), Hexanenitrile (BOTTOM)

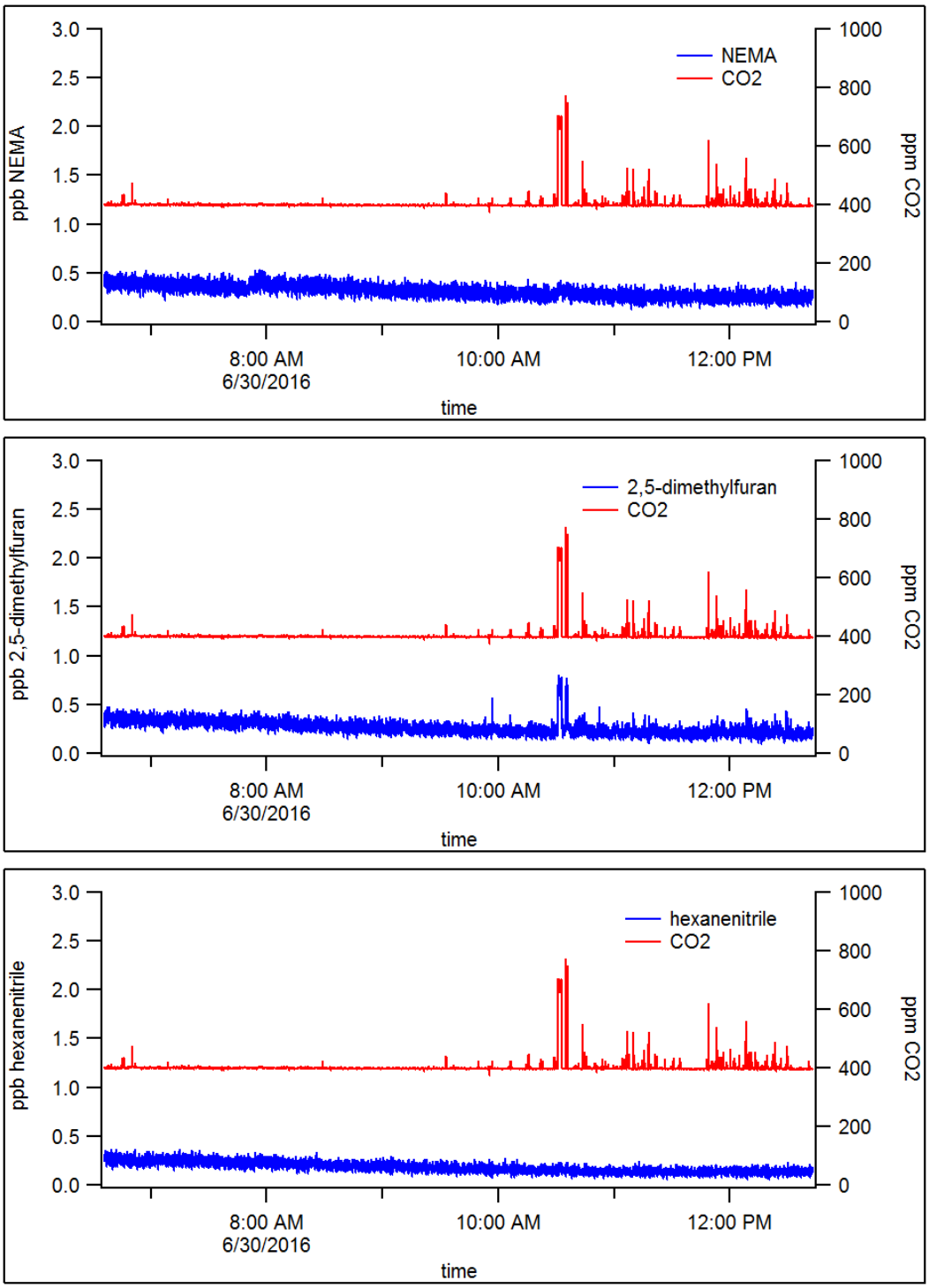


Figure B.2.4-9. June 30th - 2-hexanone [MBK] (TOP), N-nitrosodiethylamine [NDEA] (MIDDLE), Butyl Nitrite; 2-nitro-2-methylpropane (BOTTOM)

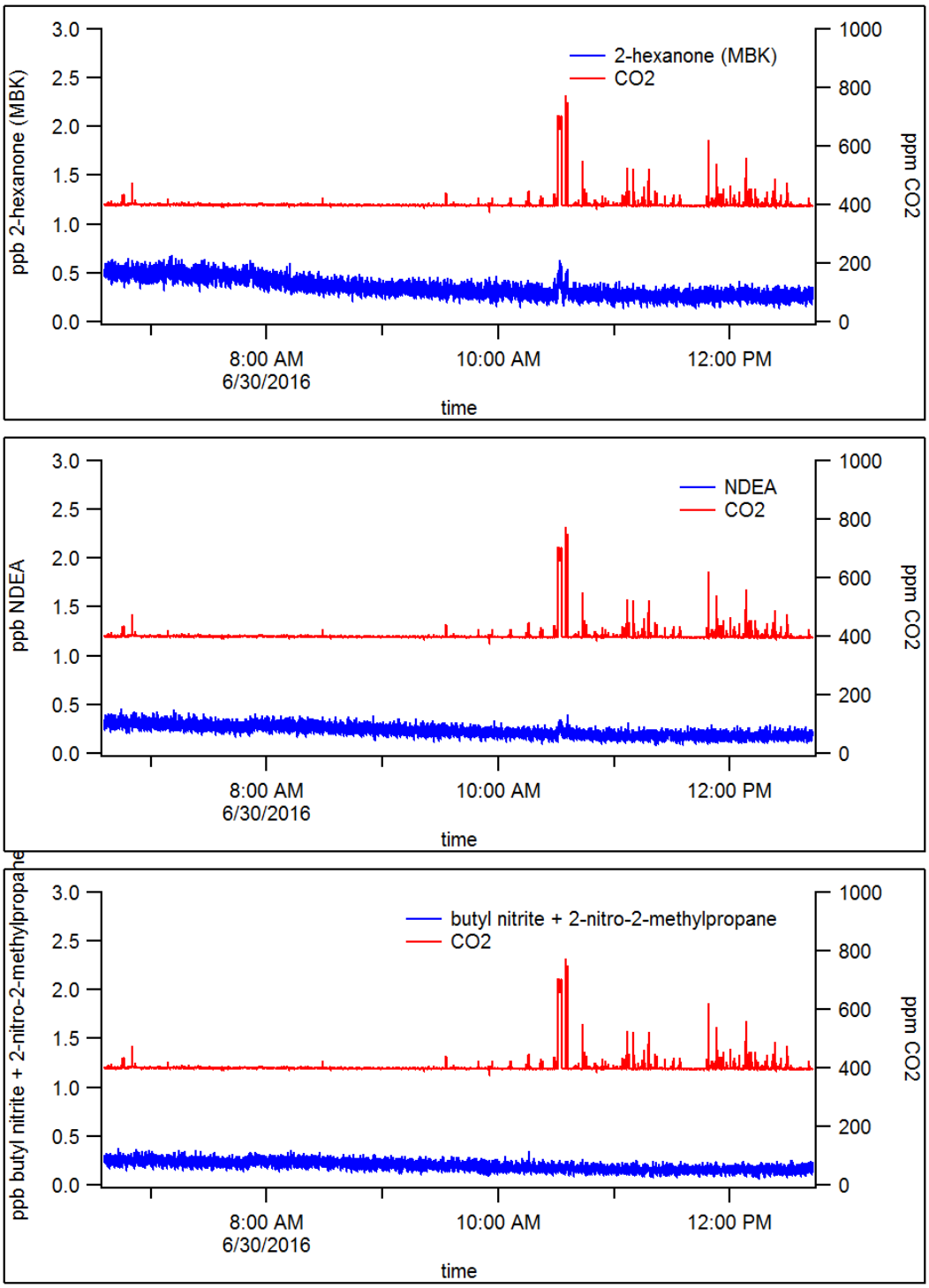


Figure B.2.4-10. June 30th - 2,4-dimethylpyridine (TOP), 2-ethyl-5-methylfuran (MIDDLE), Heptanenitrile (BOTTOM)

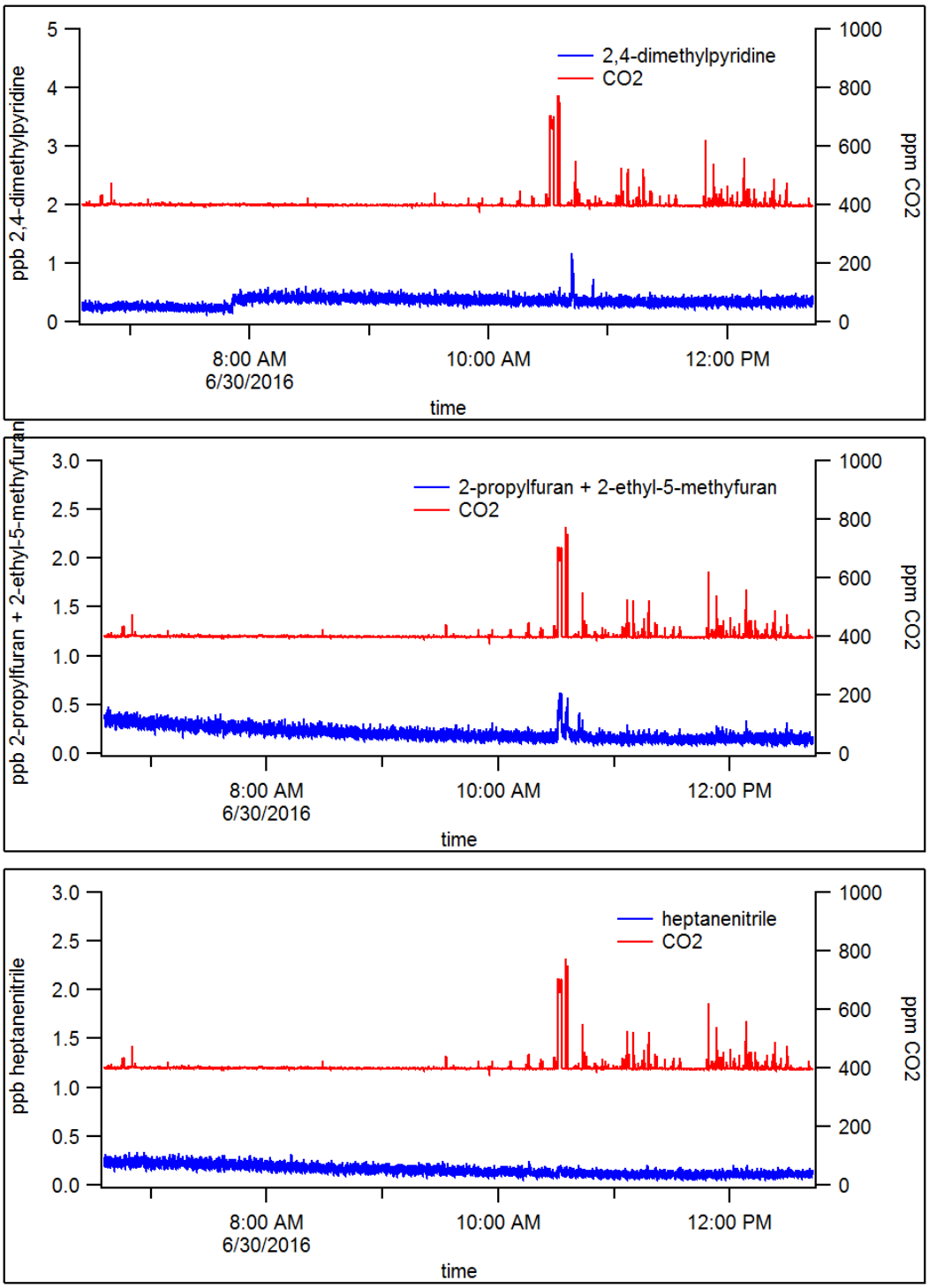


Figure B.2.4-11. June 30th - 4-methyl-2-hexanone (TOP), N-nitrosomorpholine [NMOR] (MIDDLE), Butyl Nitrate (BOTTOM)

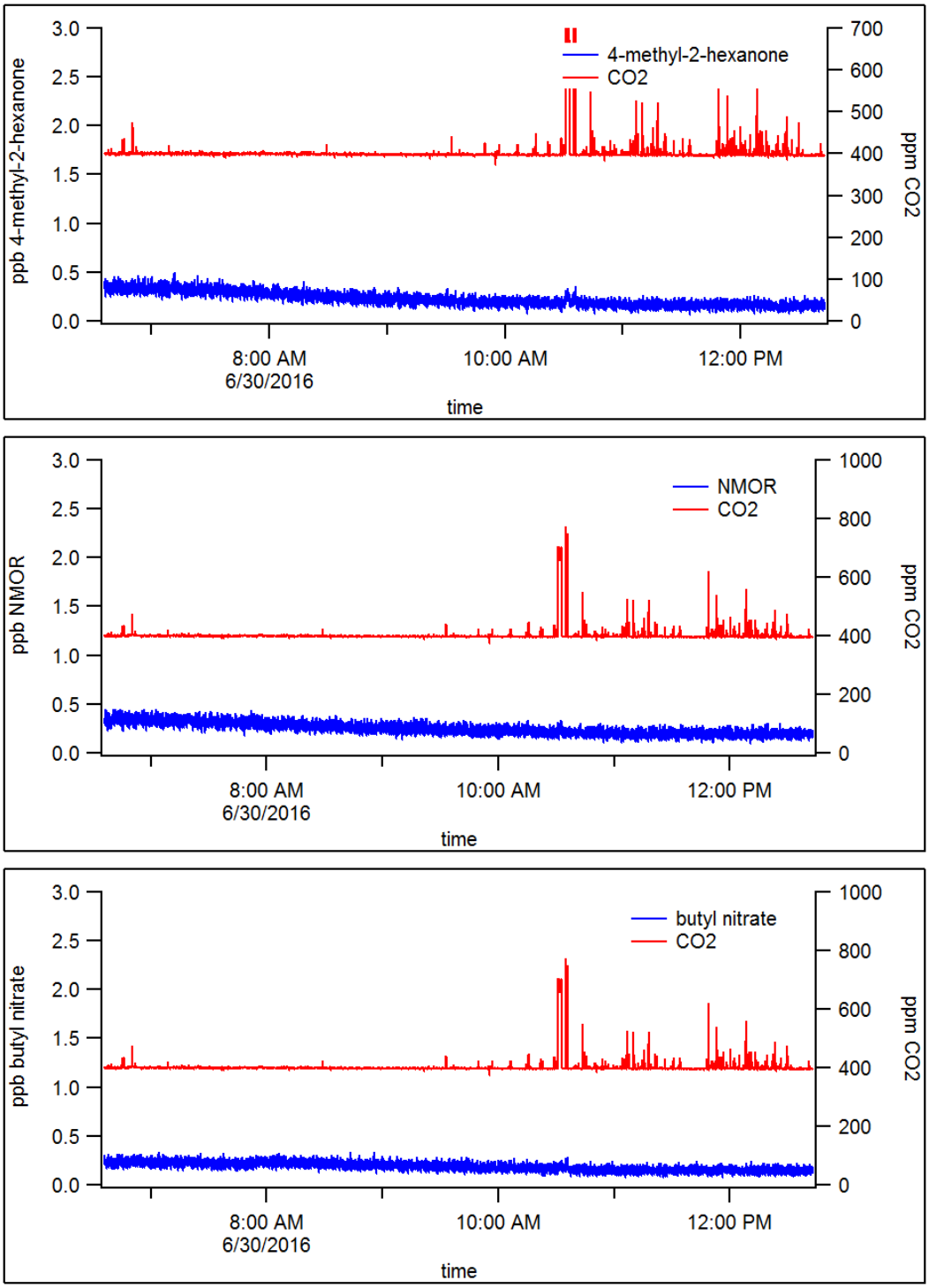


Figure B.2.4-12. June 30th - Multiple Furans [m/z 127] (TOP), 6-methyl-2-heptanone (MIDDLE), 2-pentylfuran (BOTTOM)

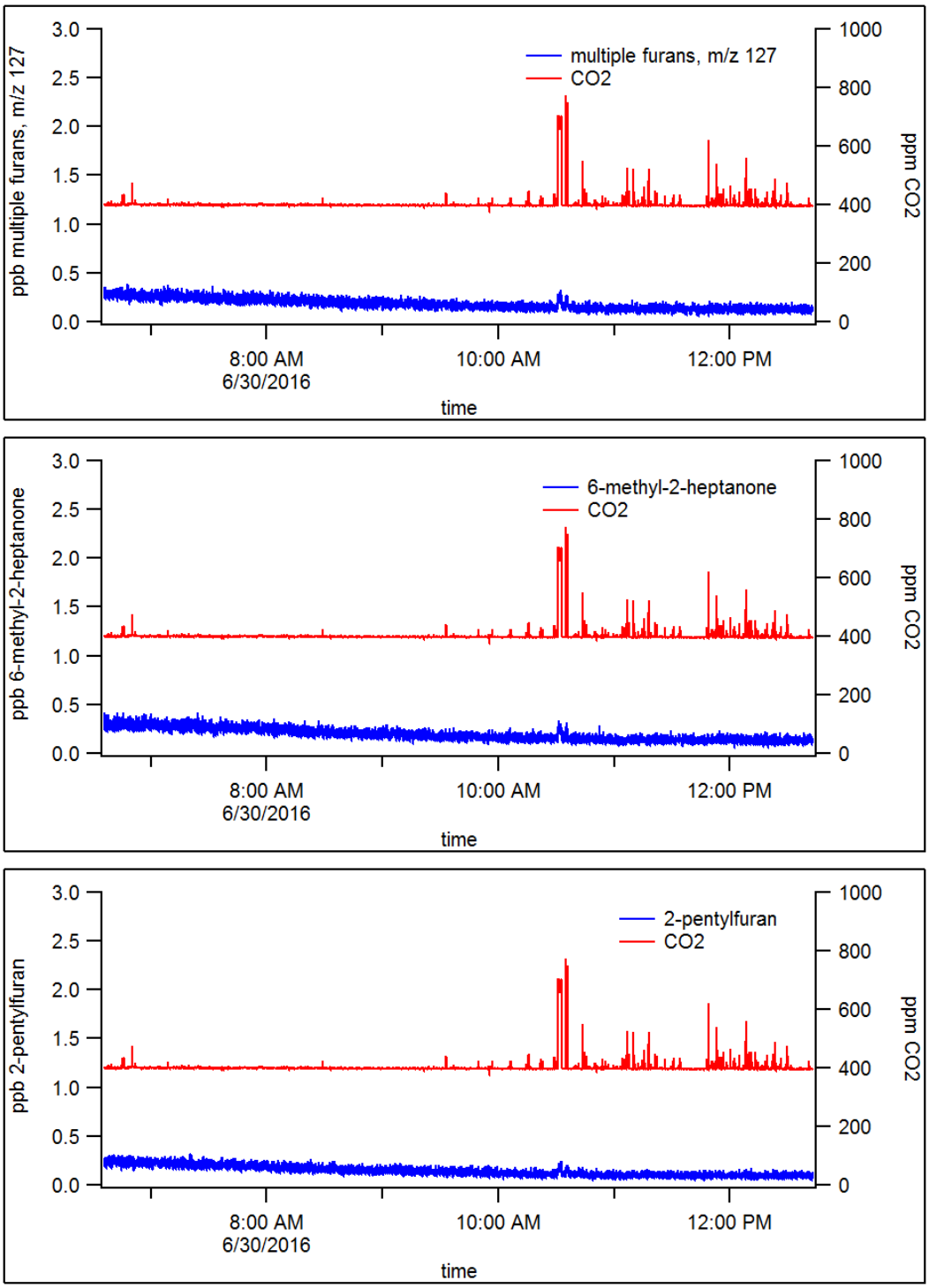


Figure B.2.4-13. June 30th - Biphenyl (TOP), 2-heptylfuran (MIDDLE), 2-octylfuran; 1,4-butanediol, Dinitrate (BOTTOM)

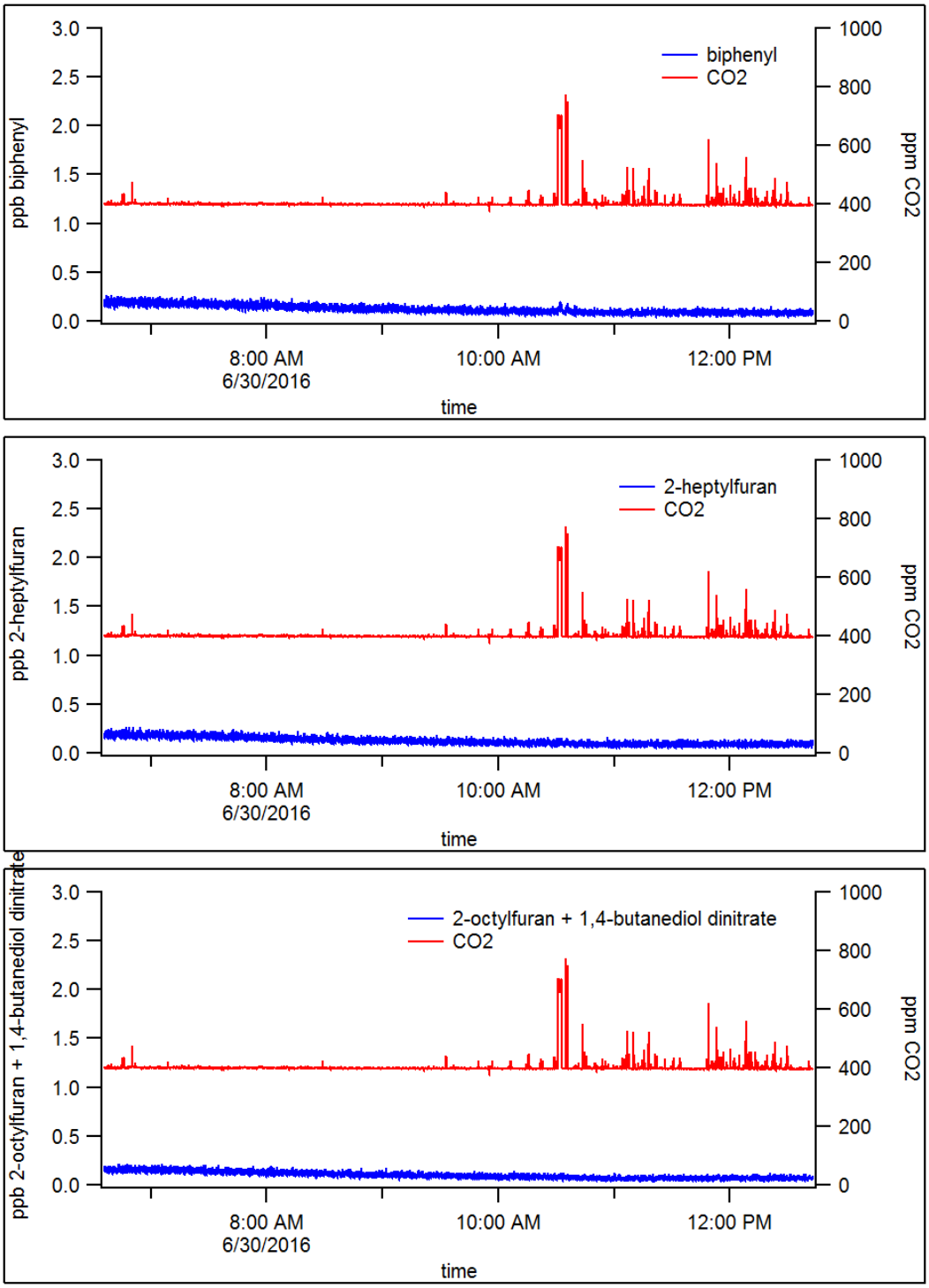


Figure B.2.4-14. June 30th - 1,2,3-propanetriol, 1,3-dinitrate (TOP), PCB (MIDDLE), 6-(2-furanyl)-6-methyl-2-heptanone (BOTTOM)

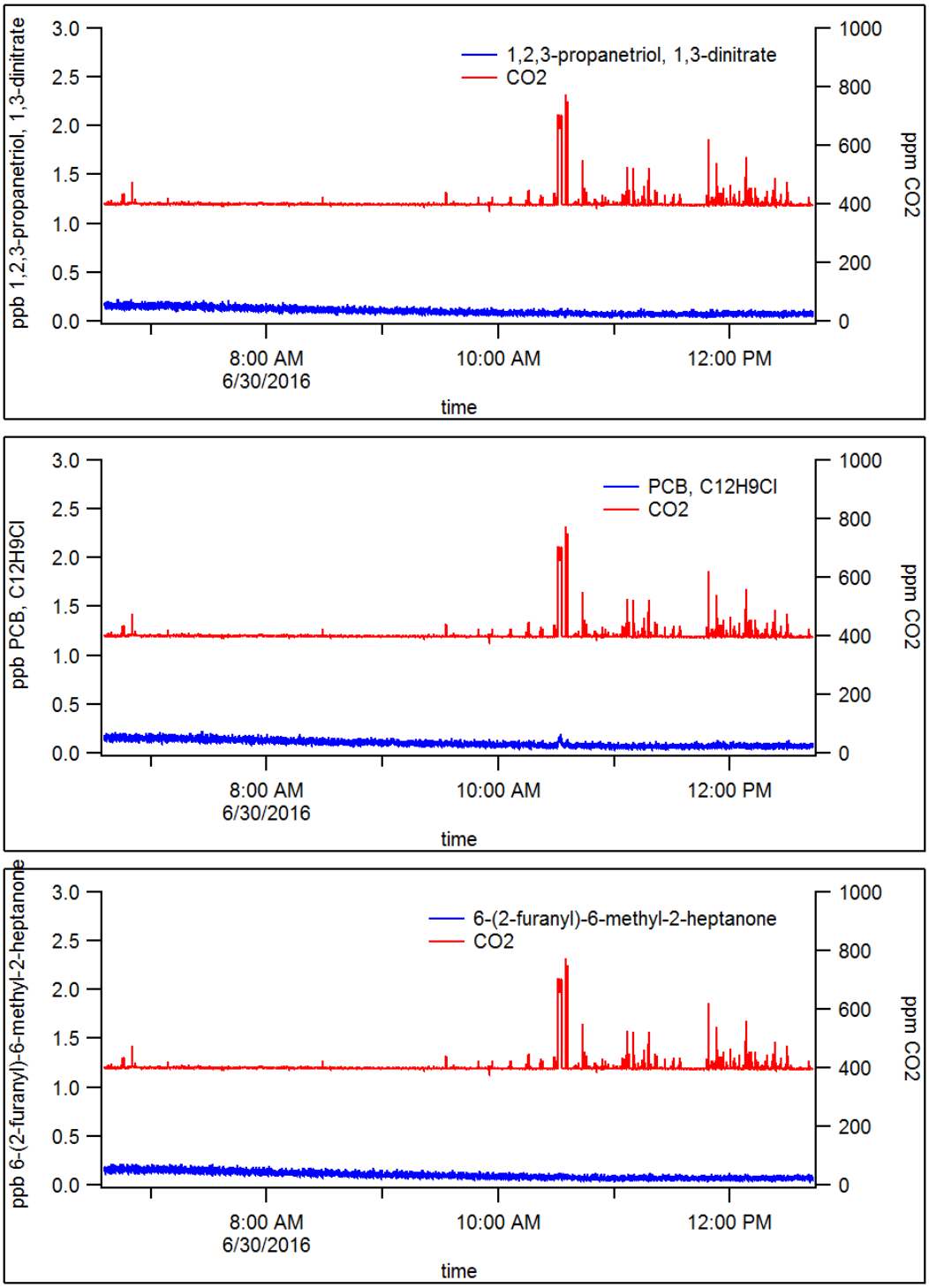
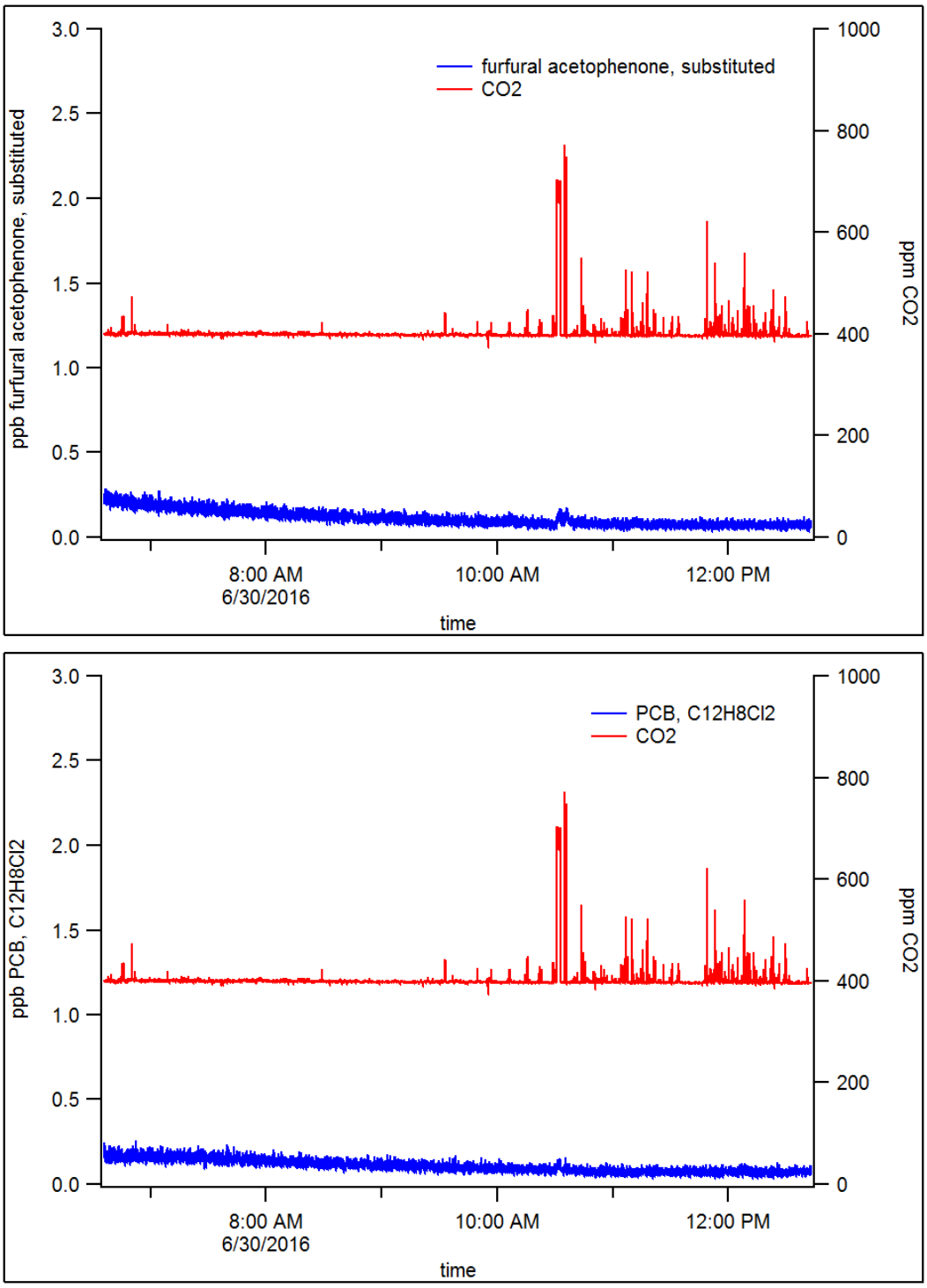


Figure B.2.4-15. June 30th - Furfural Acetophenone [3-(2-furanyl)-1-pheynyl-2-propen-1-one] (TOP), PCB [2] (BOTTOM)



B.3 WEEK 3

Week 3 refers to the third week of the initial data collection campaign. As stated above, each day has its own section within this appendix.

B.3.1 July 5th Data Collection

July 5th data collection started at 6:27 AM and ended at 12:33 PM. Data collection methods included both mobile and stationary lab techniques. Below are the graphs presented in order based on the Chemicals of Potential Concern (COPC) list.

Figure B.3.1-1. July 5th - Formaldehyde (TOP), Methanol (MIDDLE), Acetonitrile (BOTTOM)

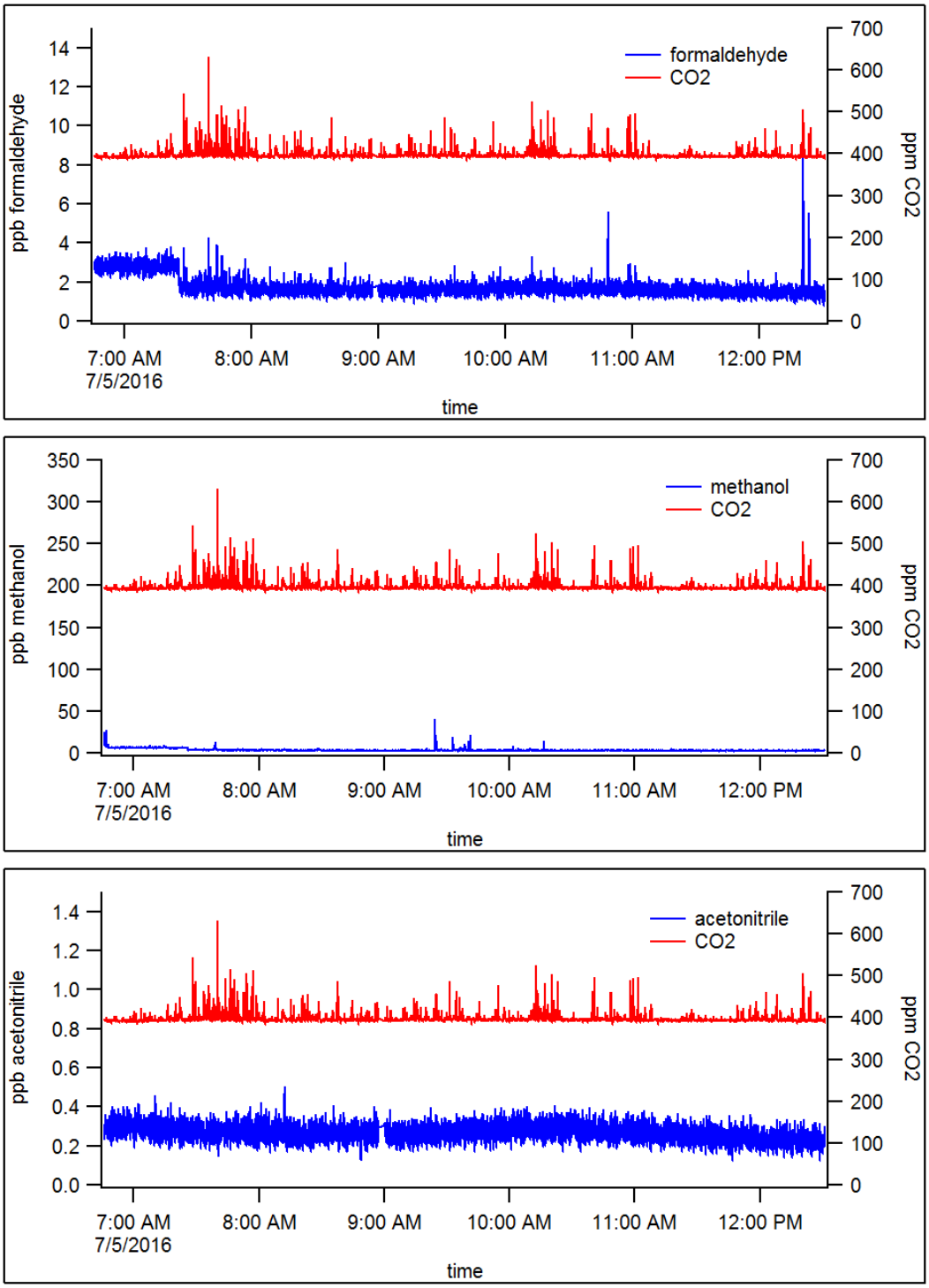


Figure B.3.1-2. July 5th - Acetaldehyde (TOP), Ethylamine (MIDDLE), 1,3-Butadiene (BOTTOM)

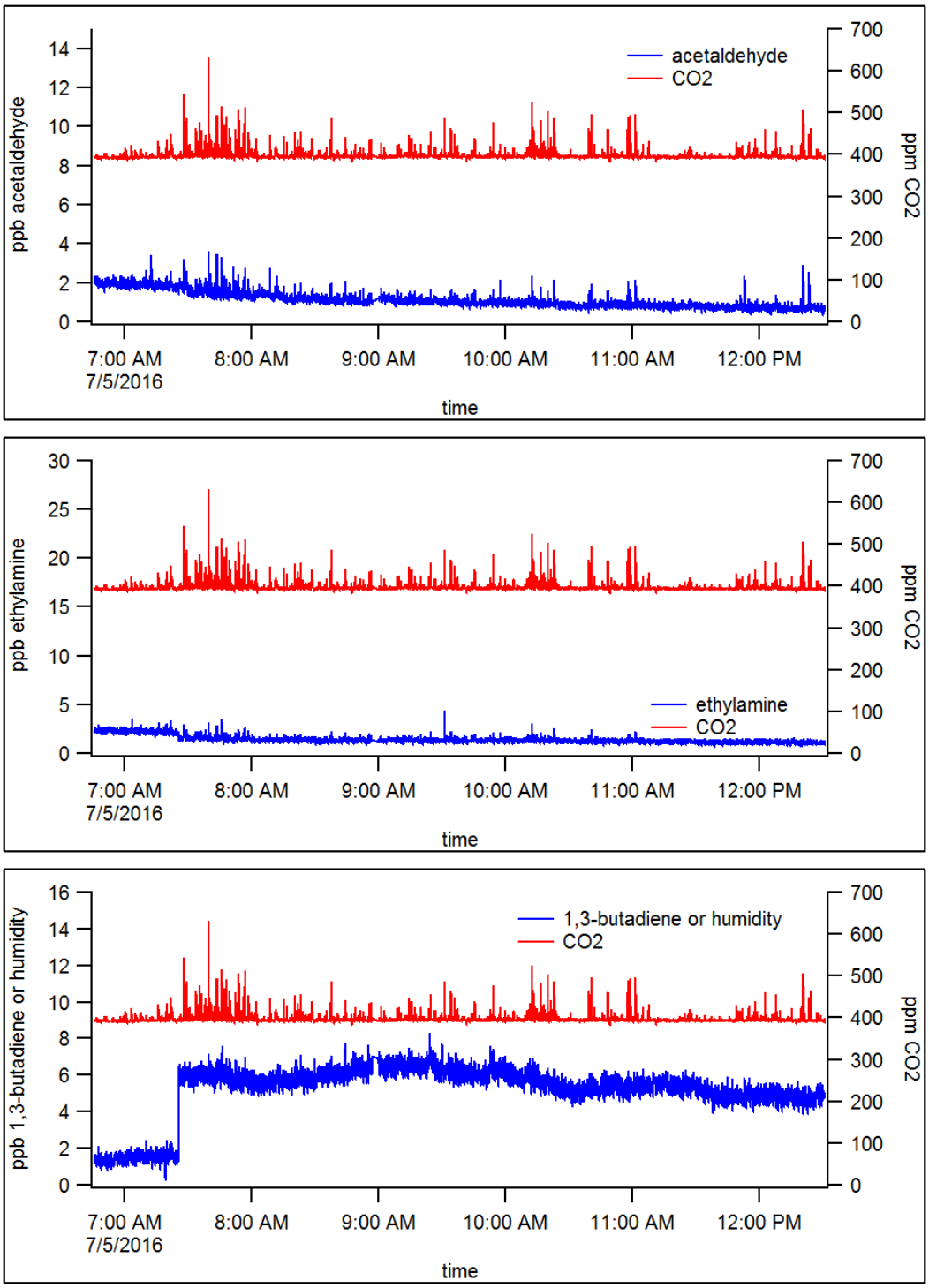


Figure B.3.1-3. July 5th - Propanenitrile (TOP), 1-Butanol; Butenes (MIDDLE), Methyl Isocyanate (BOTTOM)

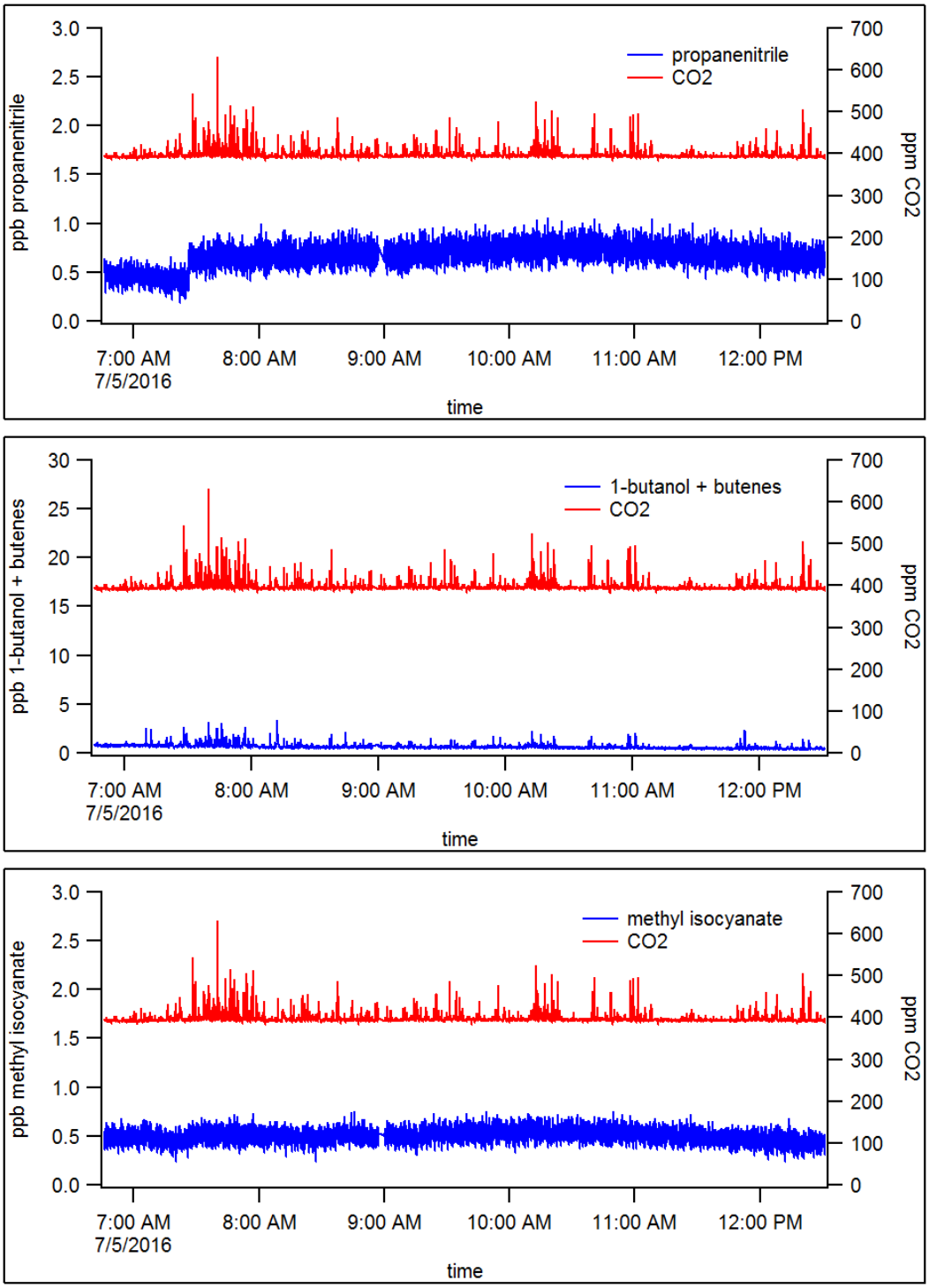


Figure B.3.1-4. July 5th - Methyl Nitrite (TOP), Furan; Isoprene (MIDDLE), Butanenitrile (BOTTOM)

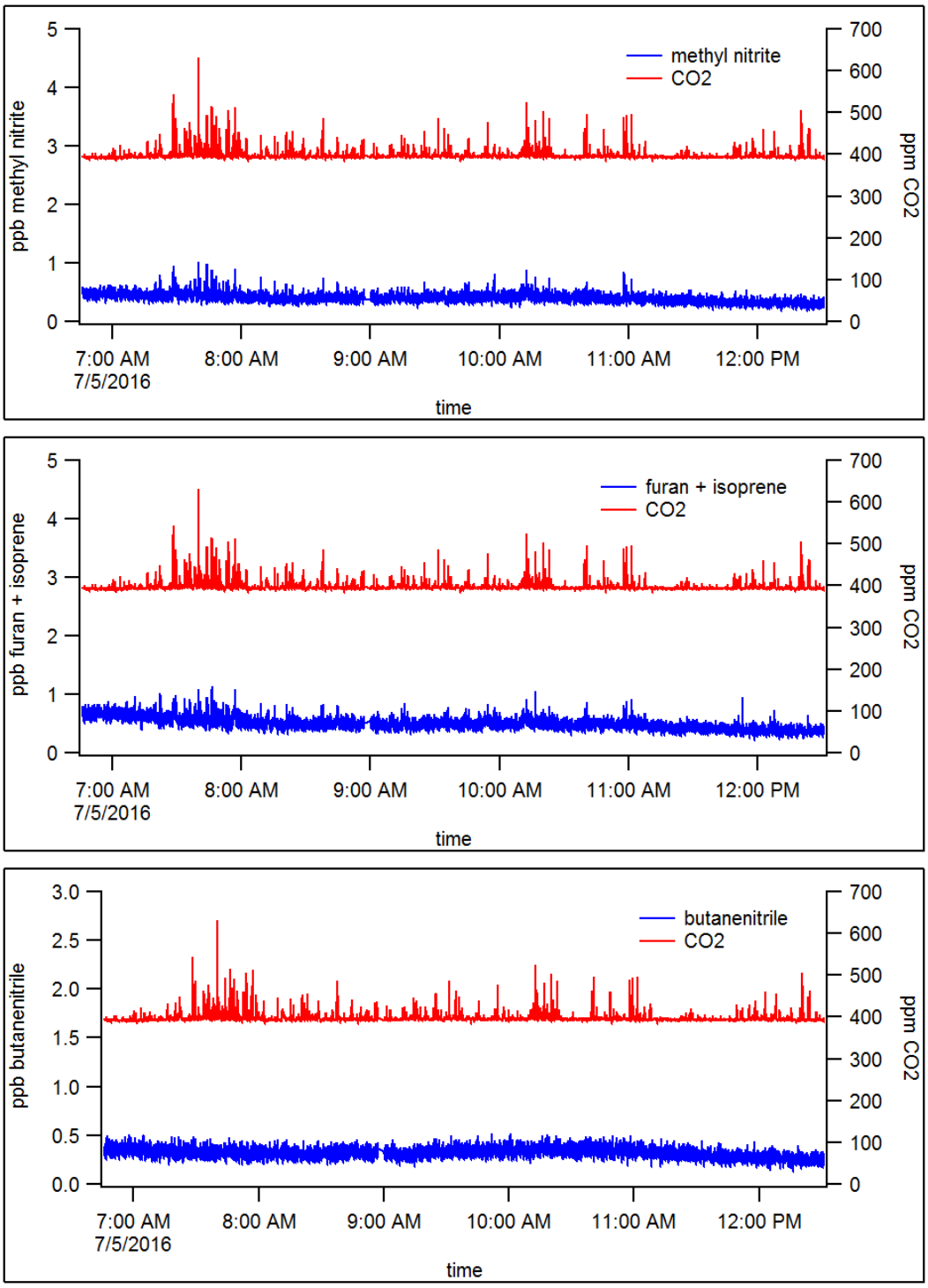


Figure B.3.1-5. July 5th - MVK + Dihydrofurans (TOP), Butanal (MIDDLE), N-nitrosodimethylamine [NDMA] (BOTTOM)

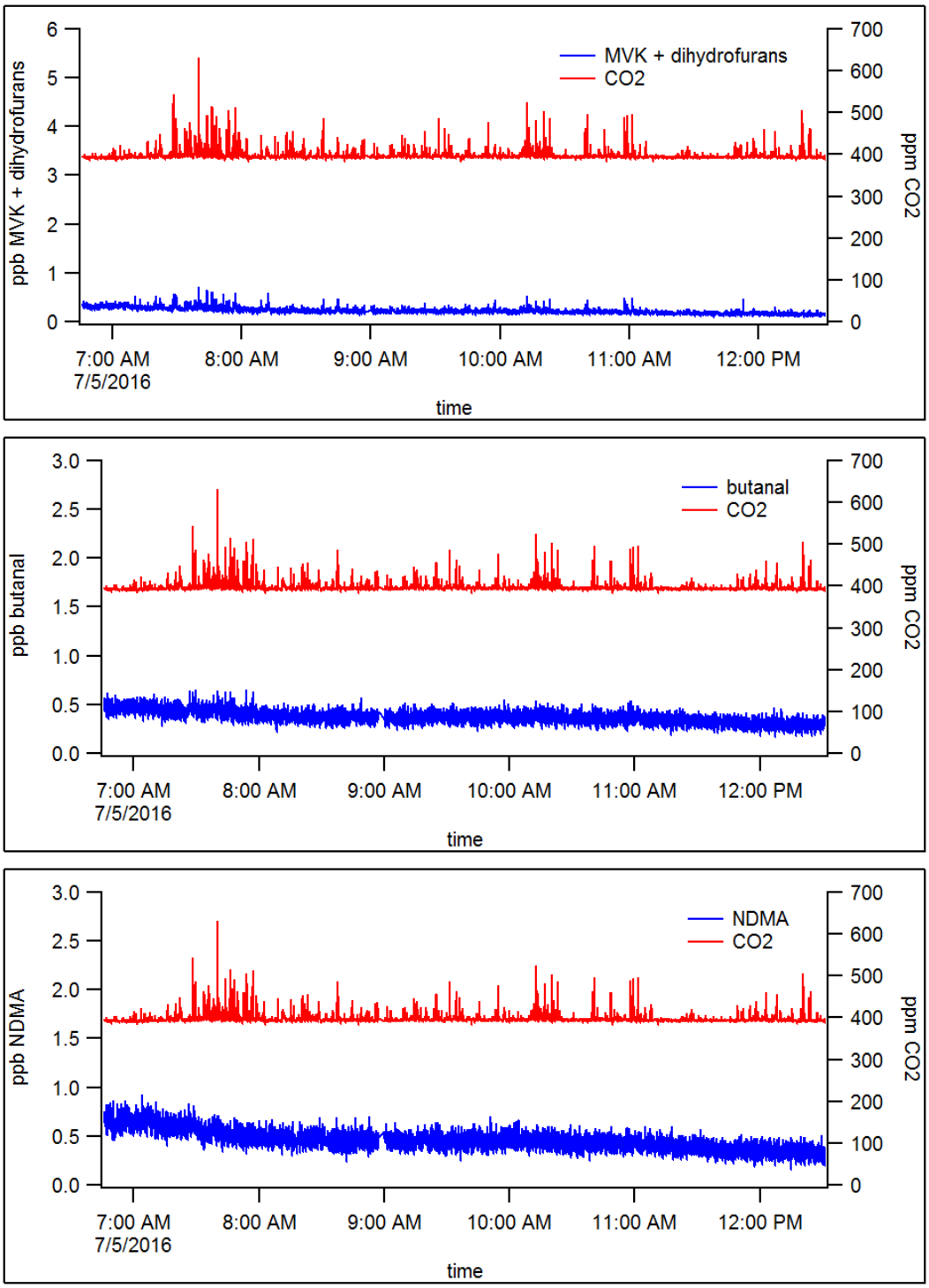


Figure B.3.1-6. July 5th - Benzene (TOP), 2,4-Pentadienenitrile; Pyridine (MIDDLE), 2-methylene Butanenitrile (BOTTOM)

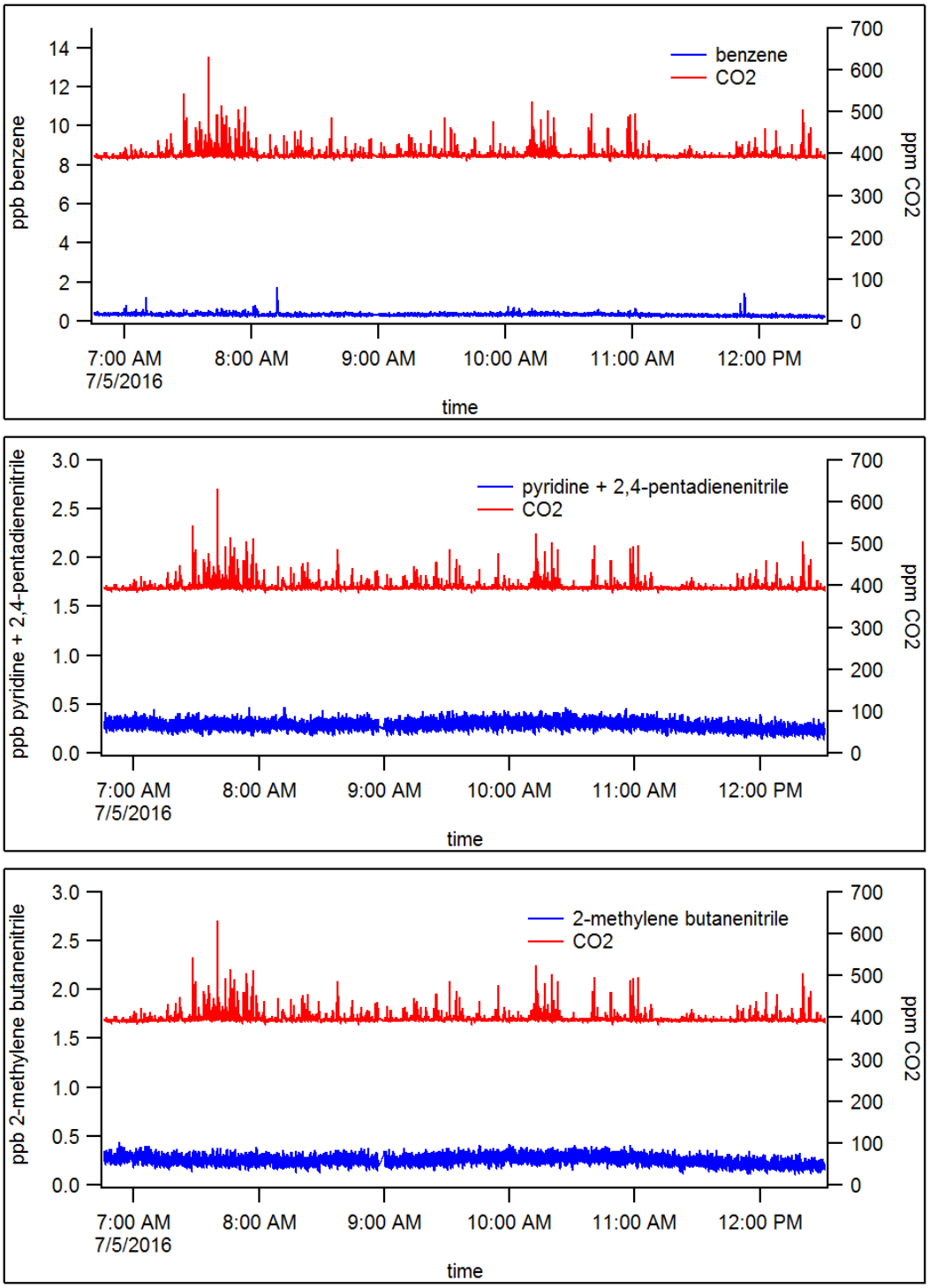


Figure B.3.1-7. July 5th - 2-methylfuran (TOP), Pentanenitrile (MIDDLE), 3-methyl-3-buten-2-one; 2-methyl-2-butenal (BOTTOM)

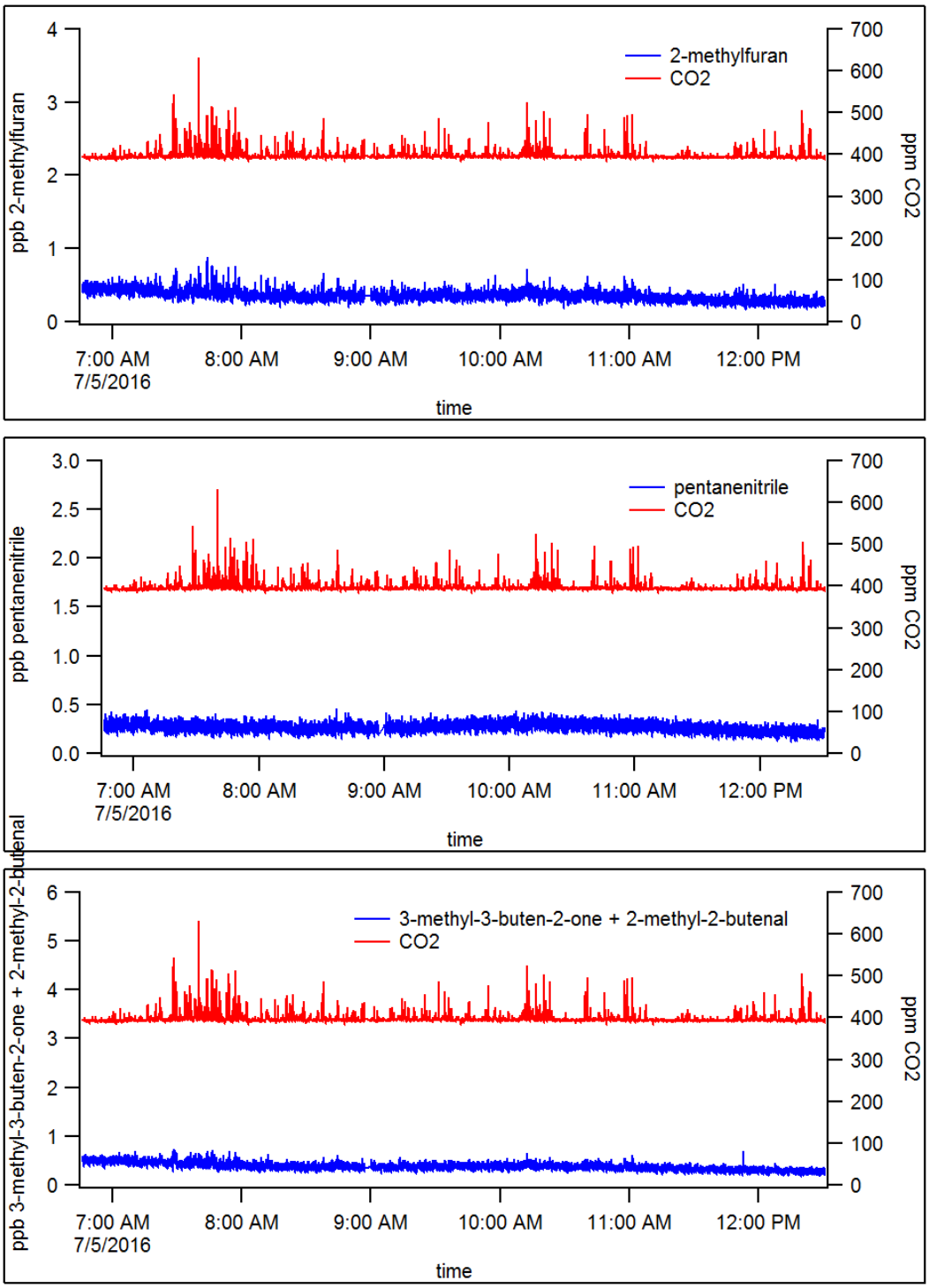


Figure B.3.1-8. July 5th - N-nitrosomethylethylamine [NEMA] (TOP), 2,5-dimethylfuran (MIDDLE), Hexanenitrile (BOTTOM)

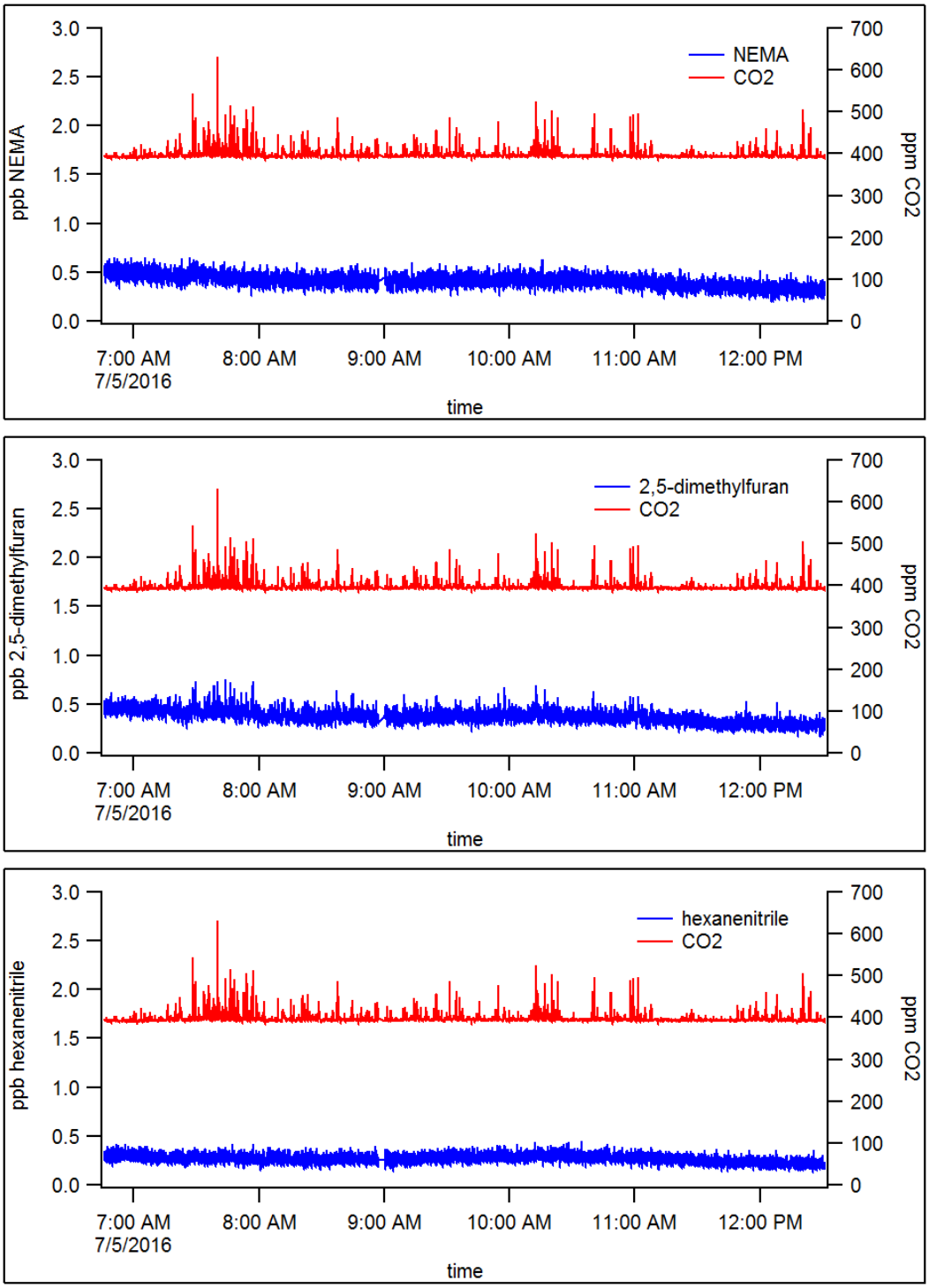


Figure B.3.1-9. July 5th - 2-hexanone [MBK] (TOP), N-nitrosodiethylamine [NDEA] (MIDDLE), Butyl Nitrite; 2-nitro-2-methylpropane (BOTTOM)

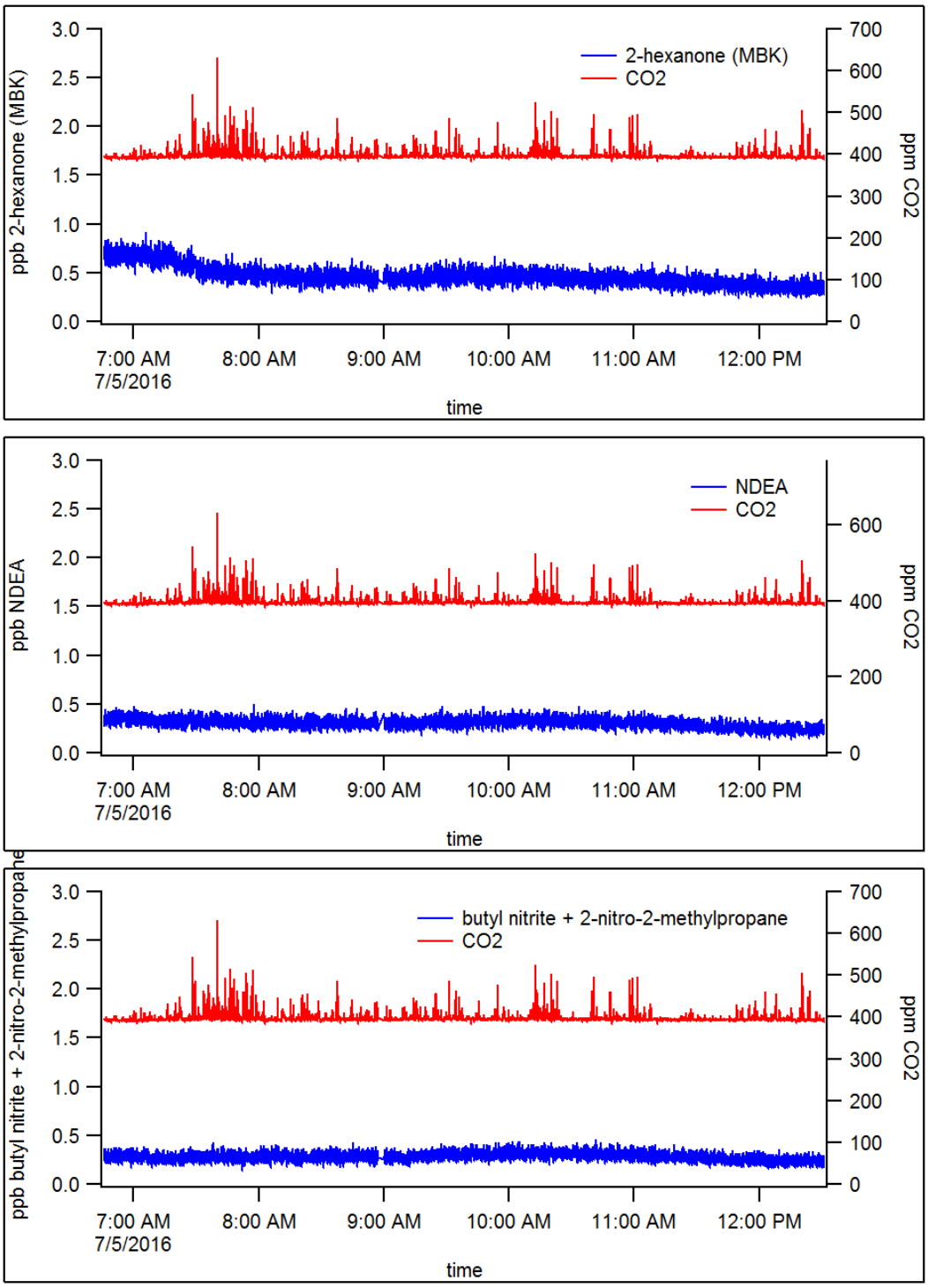


Figure B.3.1-10. July 5th - 2,4-dimethylpyridine (TOP), 2-ethyl-5-methylfuran (MIDDLE), Heptanenitrile (BOTTOM)

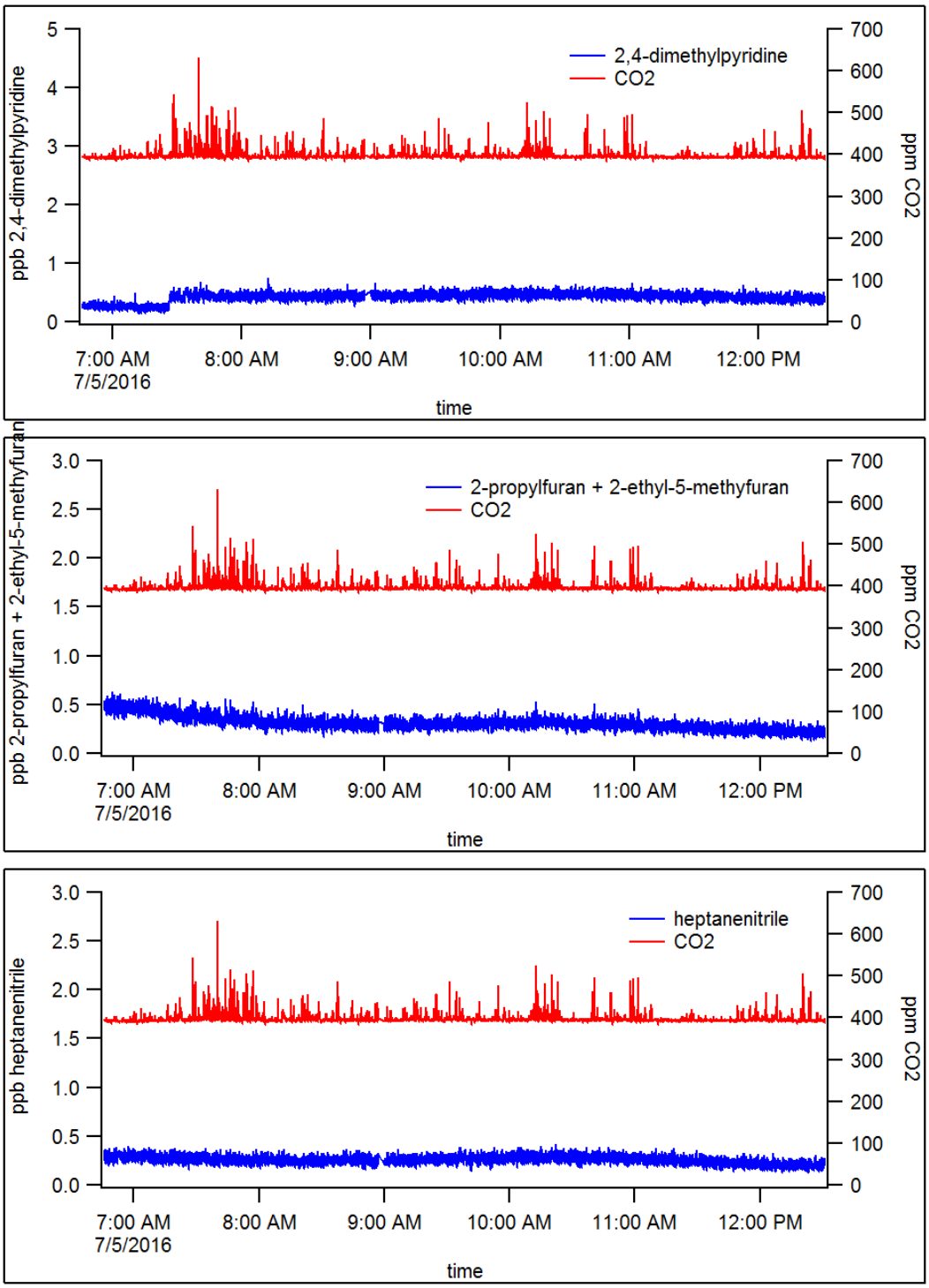


Figure B.3.1-11. July 5th - 4-methyl-2-hexanone (TOP), N-nitrosomorpholine [NMOR] (MIDDLE), Butyl Nitrate (BOTTOM)

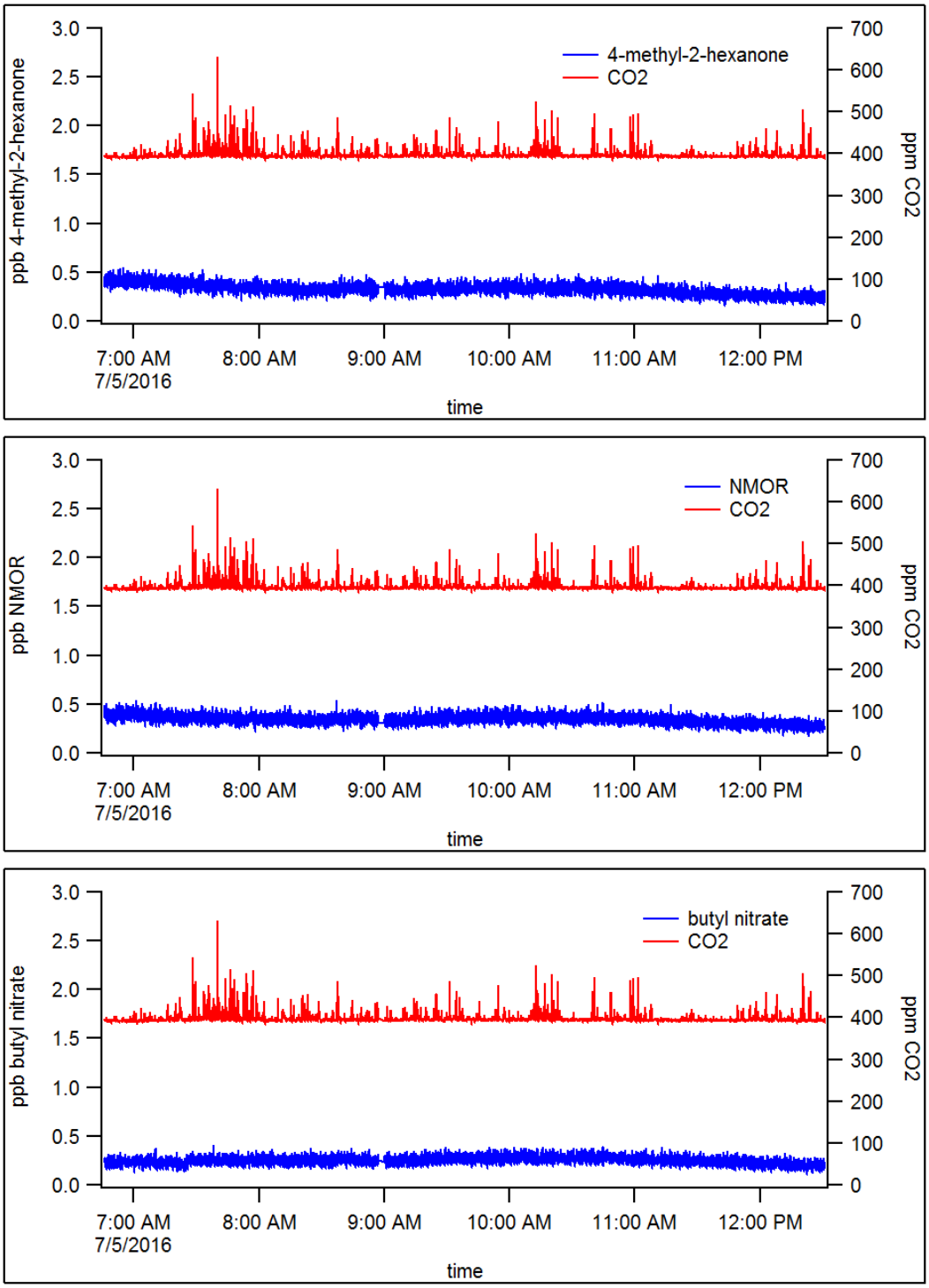


Figure B.3.1-12. July 5th - Multiple Furans [m/z 127] (TOP), 6-methyl-2-heptanone (MIDDLE), 2-pentylfuran (BOTTOM)

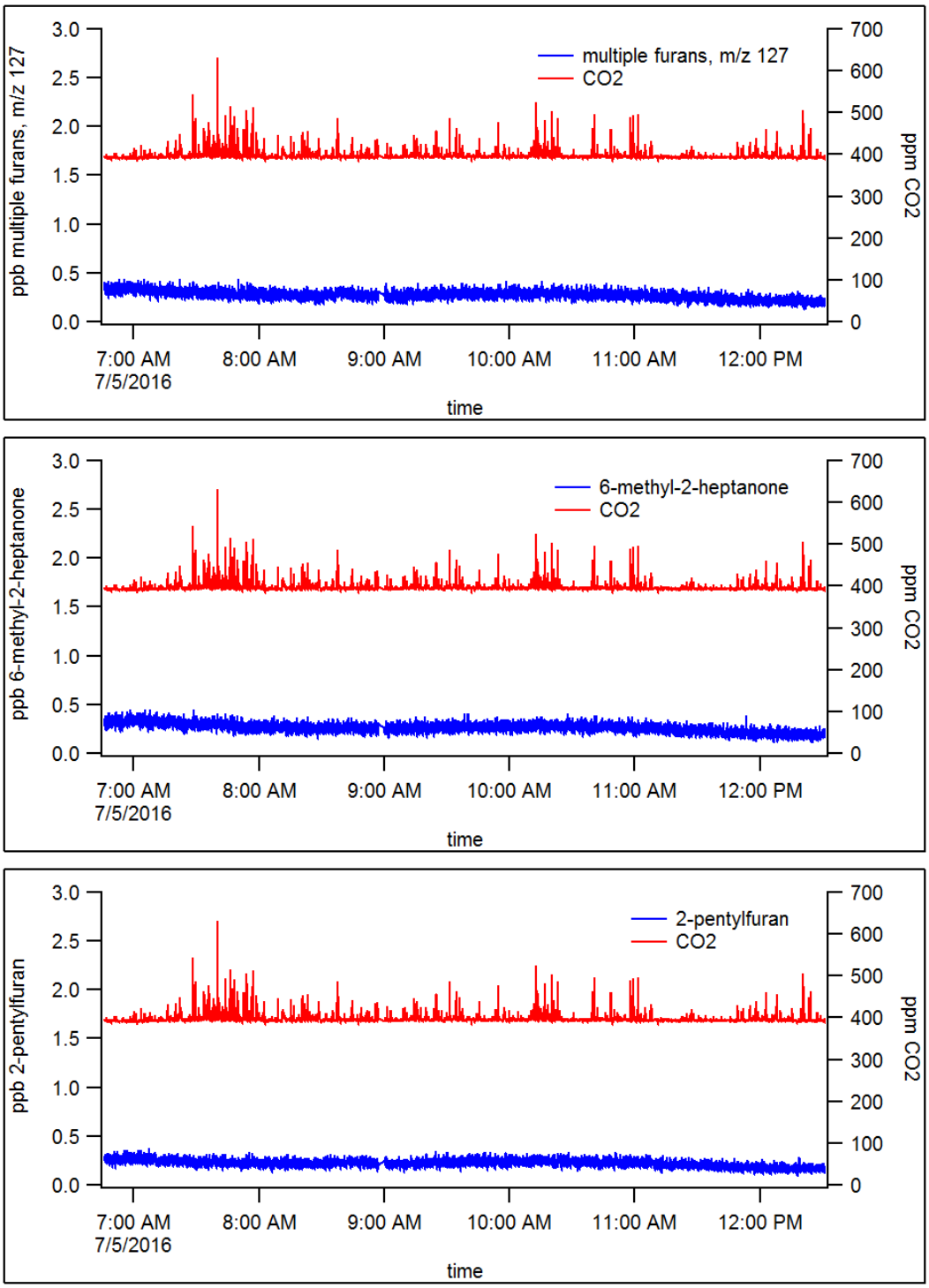


Figure B.3.1-13. July 5th - Biphenyl (TOP), 2-heptylfuran (MIDDLE), 2-octylfuran; 1,4-butanediol, Dinitrate (BOTTOM)

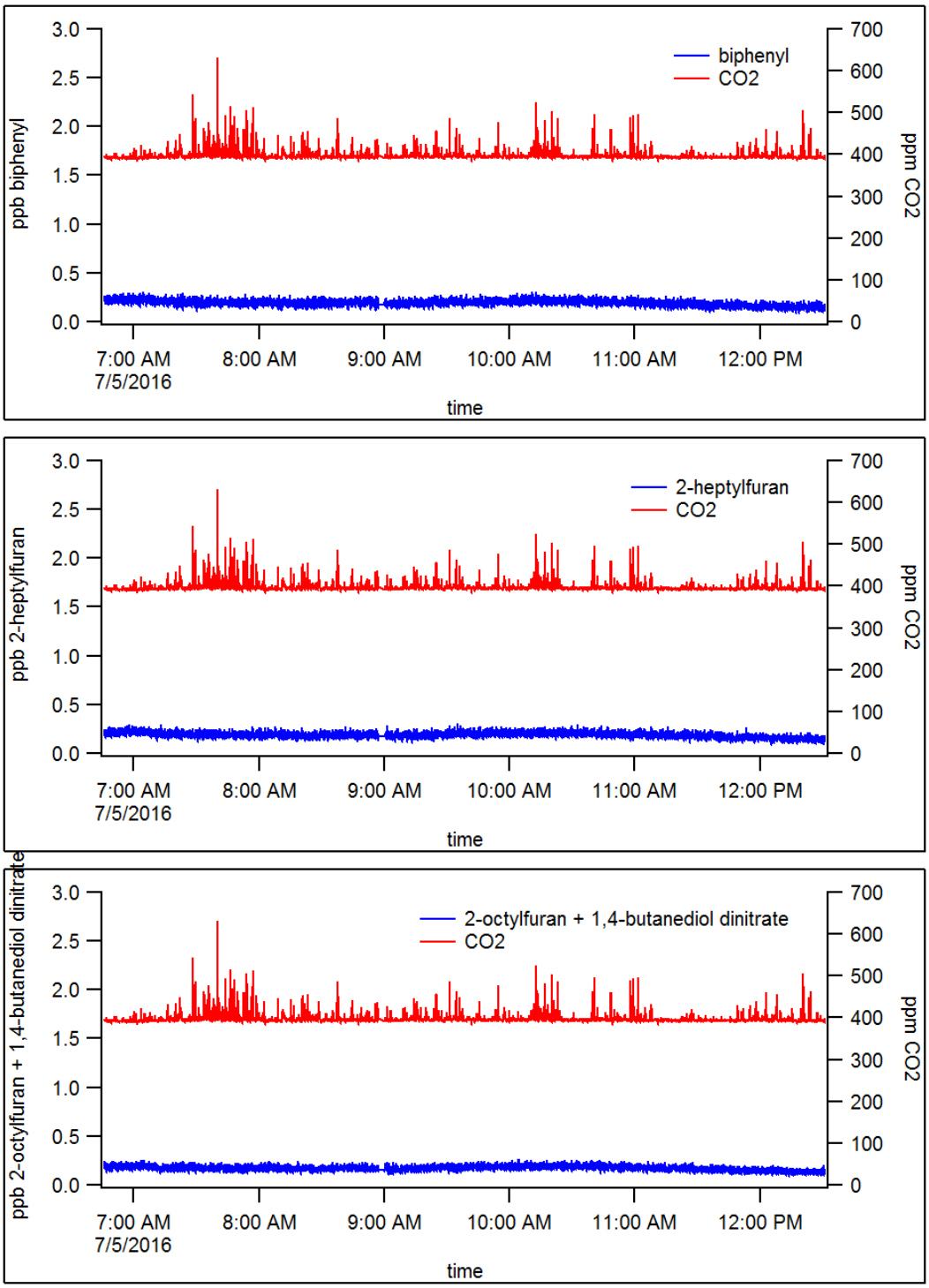


Figure B.3.1-14. July 5th - 1,2,3-propanetriol, 1,3-dinitrate (TOP), PCB (MIDDLE), 6-(2-furanyl)-6-methyl-2-heptanone (BOTTOM)

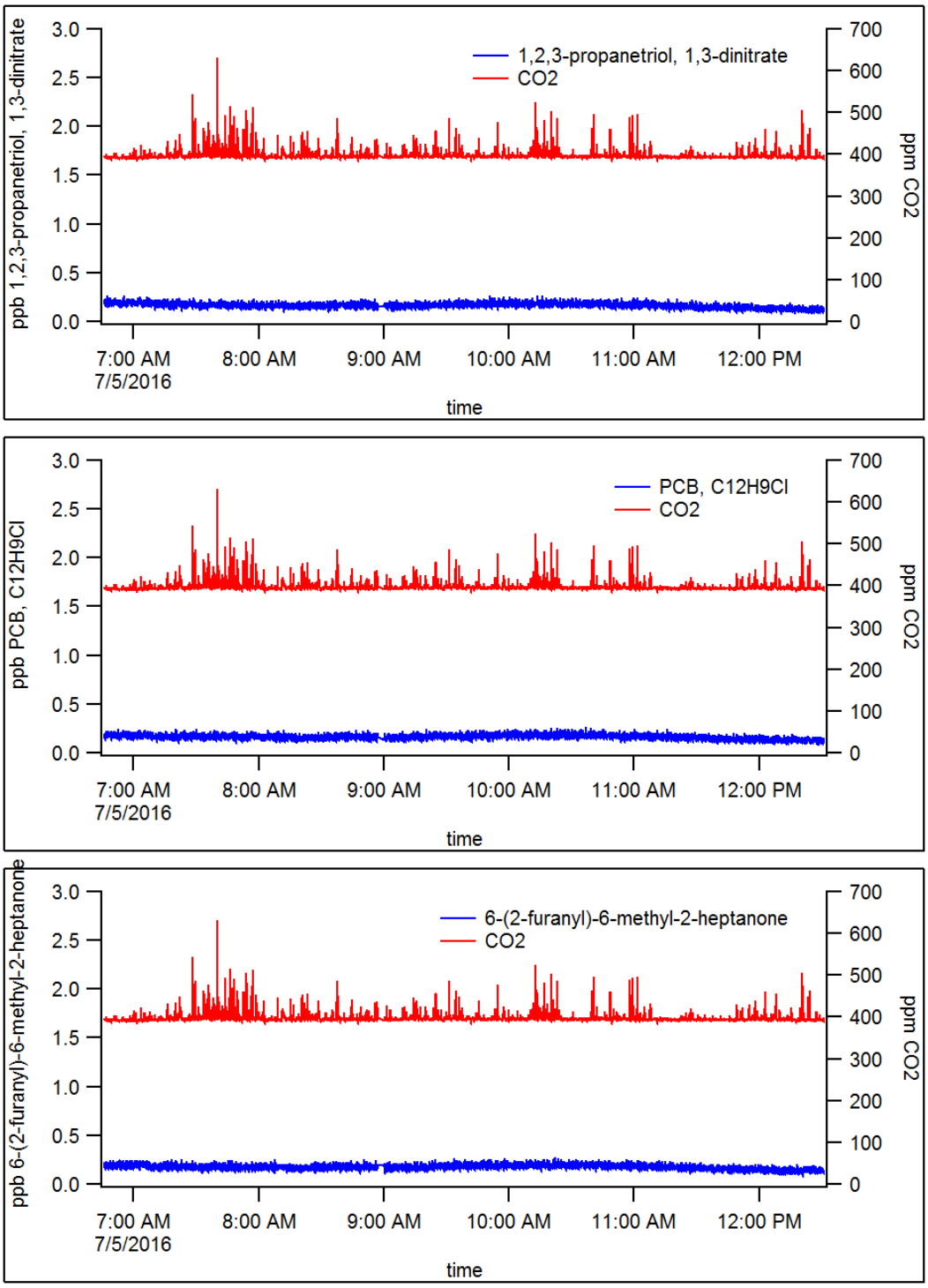
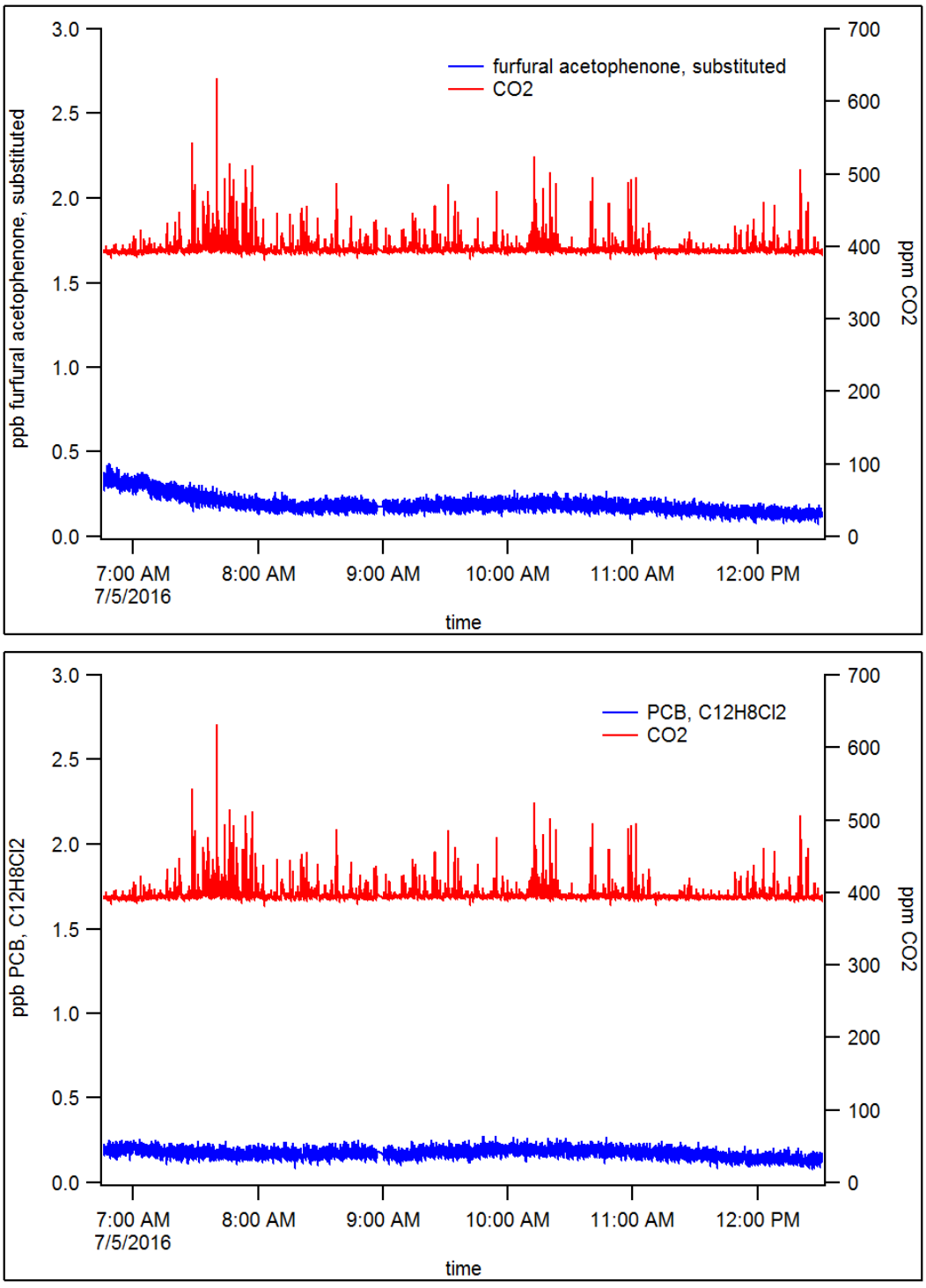


Figure B.3.1-15. July 5th - Furfural Acetophenone [3-(2-furanyl)-1-pheynyl-2-propen-1-one] (TOP), PCB [2] (BOTTOM)



B.3.2 July 6th Data Collection

July 6th data collection started at 6:30 AM and ended at 12:30 PM. Data collection methods included both mobile and stationary lab techniques. Below are the graphs presented in order based on the Chemicals of Potential Concern (COPC) list.

Figure B.3.2-1. July 6th - Formaldehyde (TOP), Methanol (MIDDLE), Acetonitrile (BOTTOM)

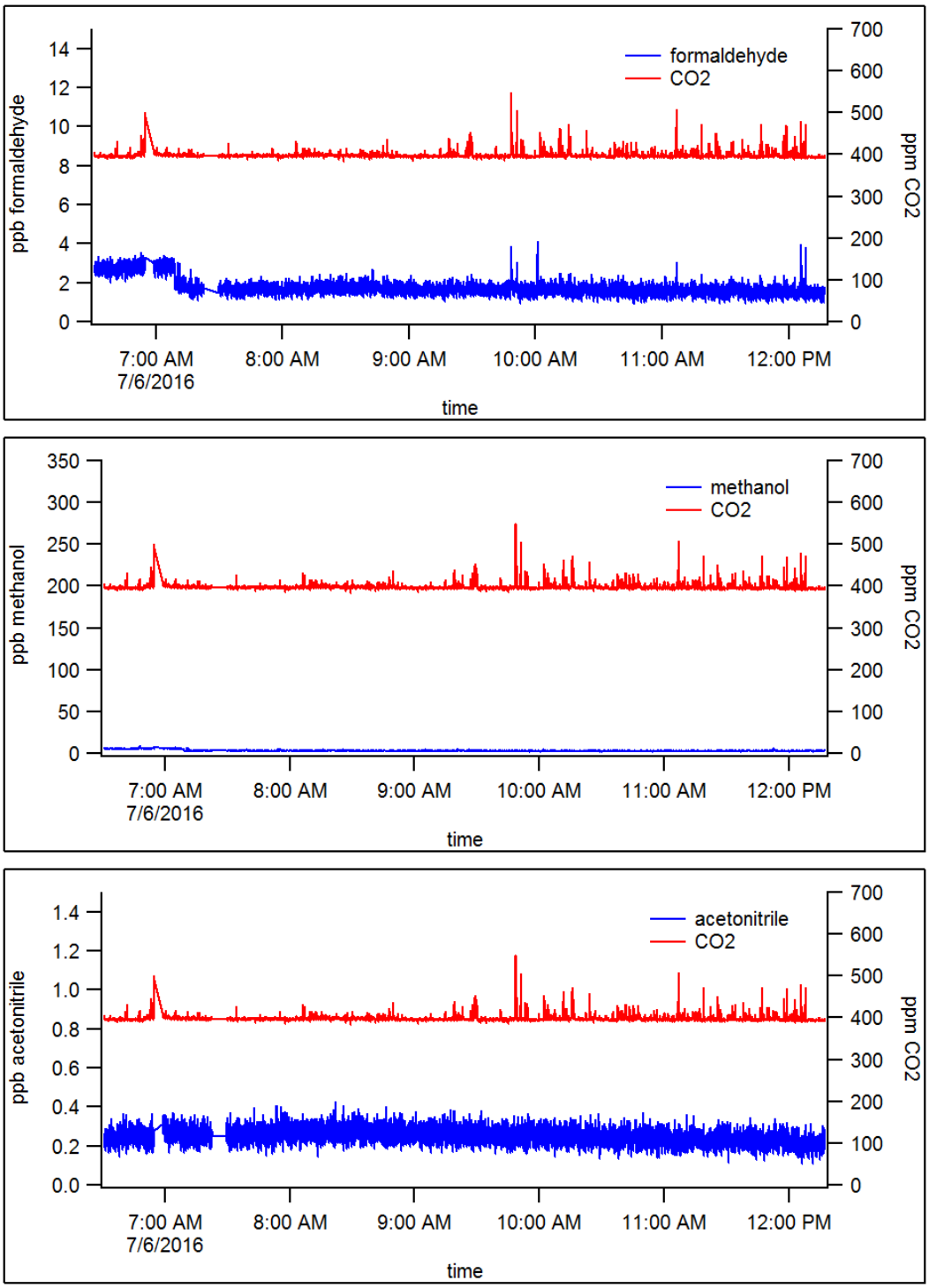


Figure B.3.2-2. July 6th - Acetaldehyde (TOP), Ethylamine (MIDDLE), 1,3-Butadiene (BOTTOM)

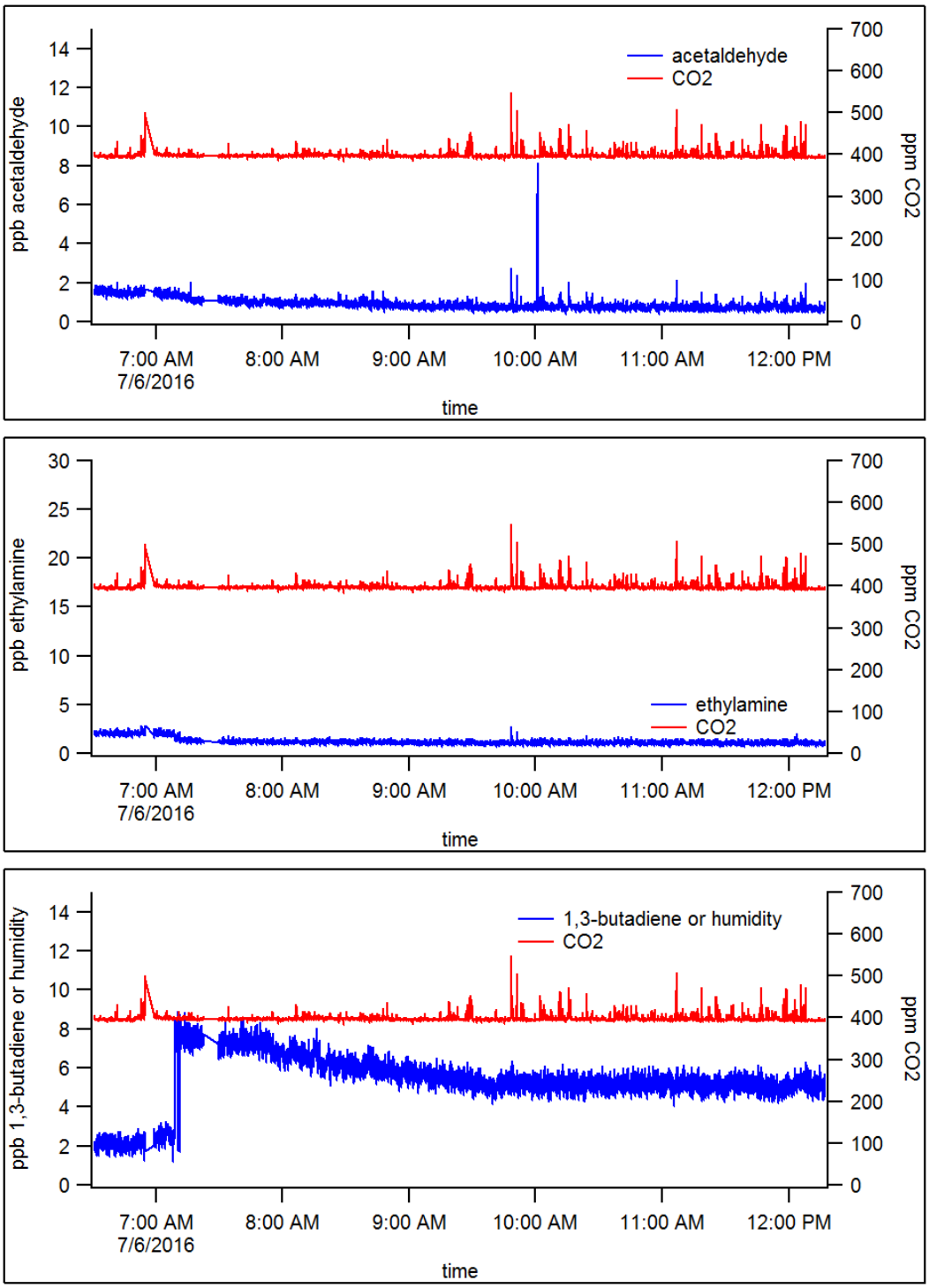


Figure B.3.2-3. July 6th - Propanenitrile (TOP), 1-Butanol; Butenes (MIDDLE), Methyl Isocyanate (BOTTOM)

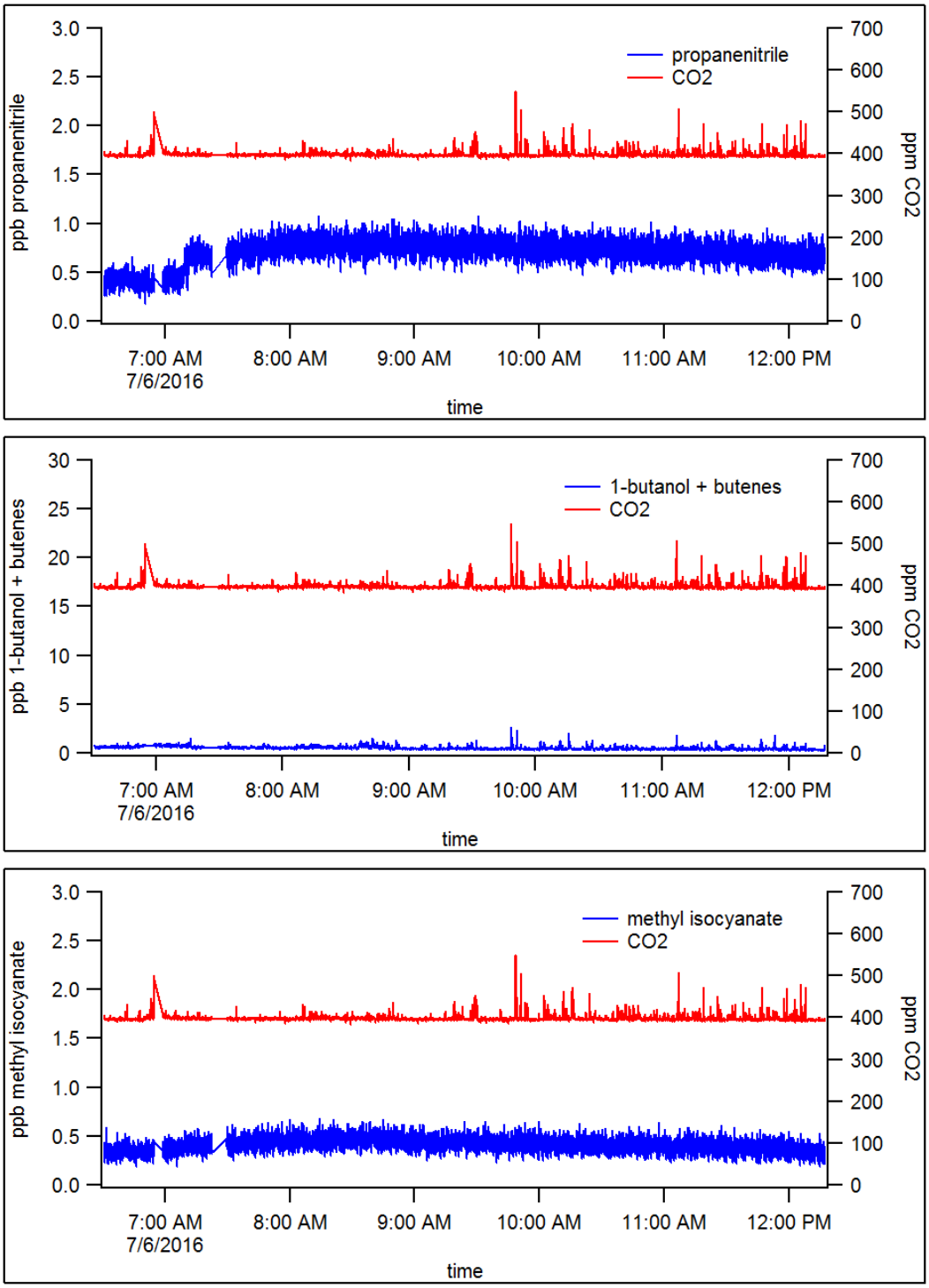


Figure B.3.2-4. July 6th - Methyl Nitrite (TOP), Furan; Isoprene(MIDDLE), Butanenitrile (BOTTOM)

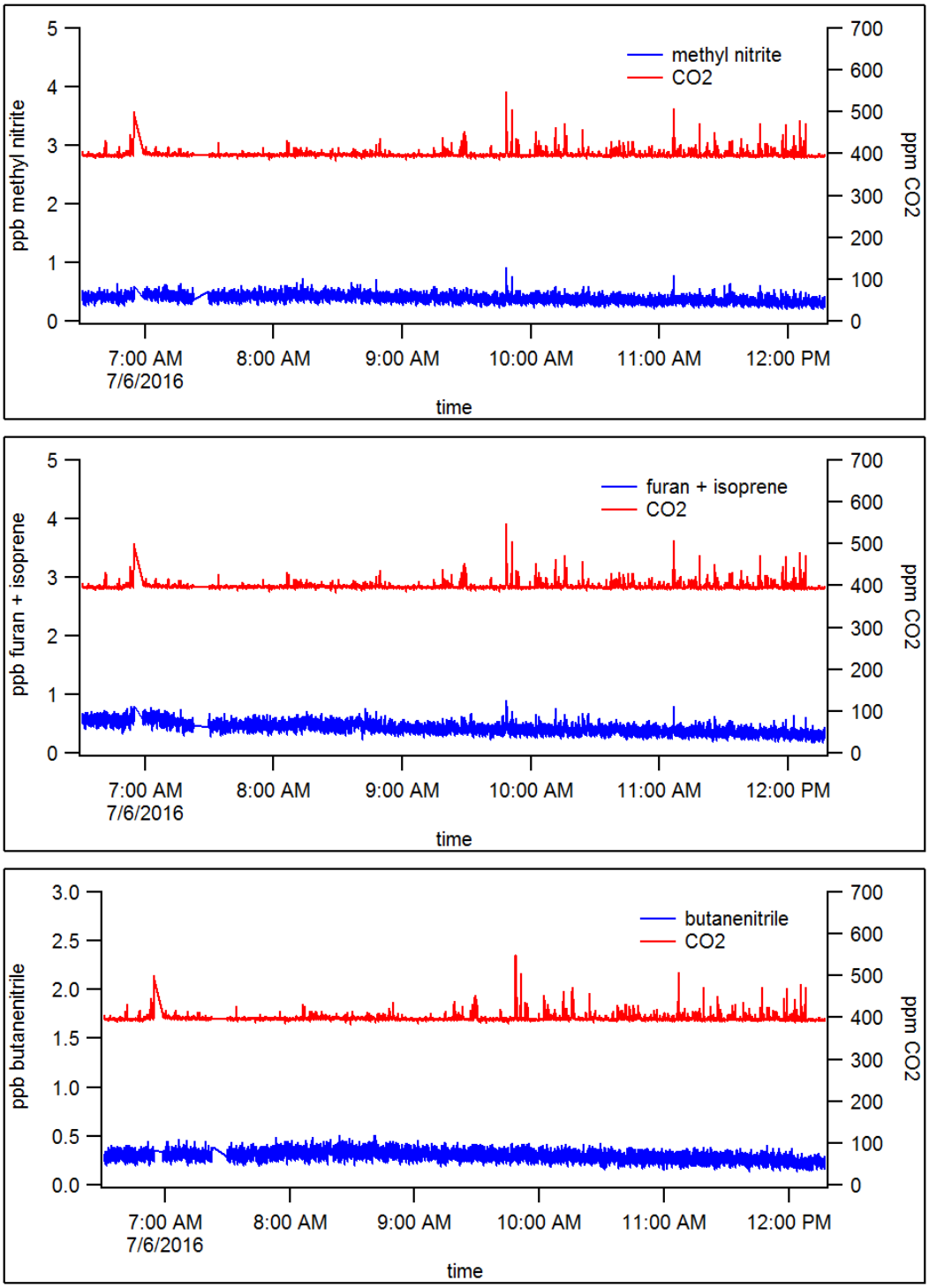


Figure B.3.2-5. July 6th - MVK + Dihydrofurans (TOP), Butanal (MIDDLE), N-nitrosodimethylamine [NDMA] (BOTTOM)

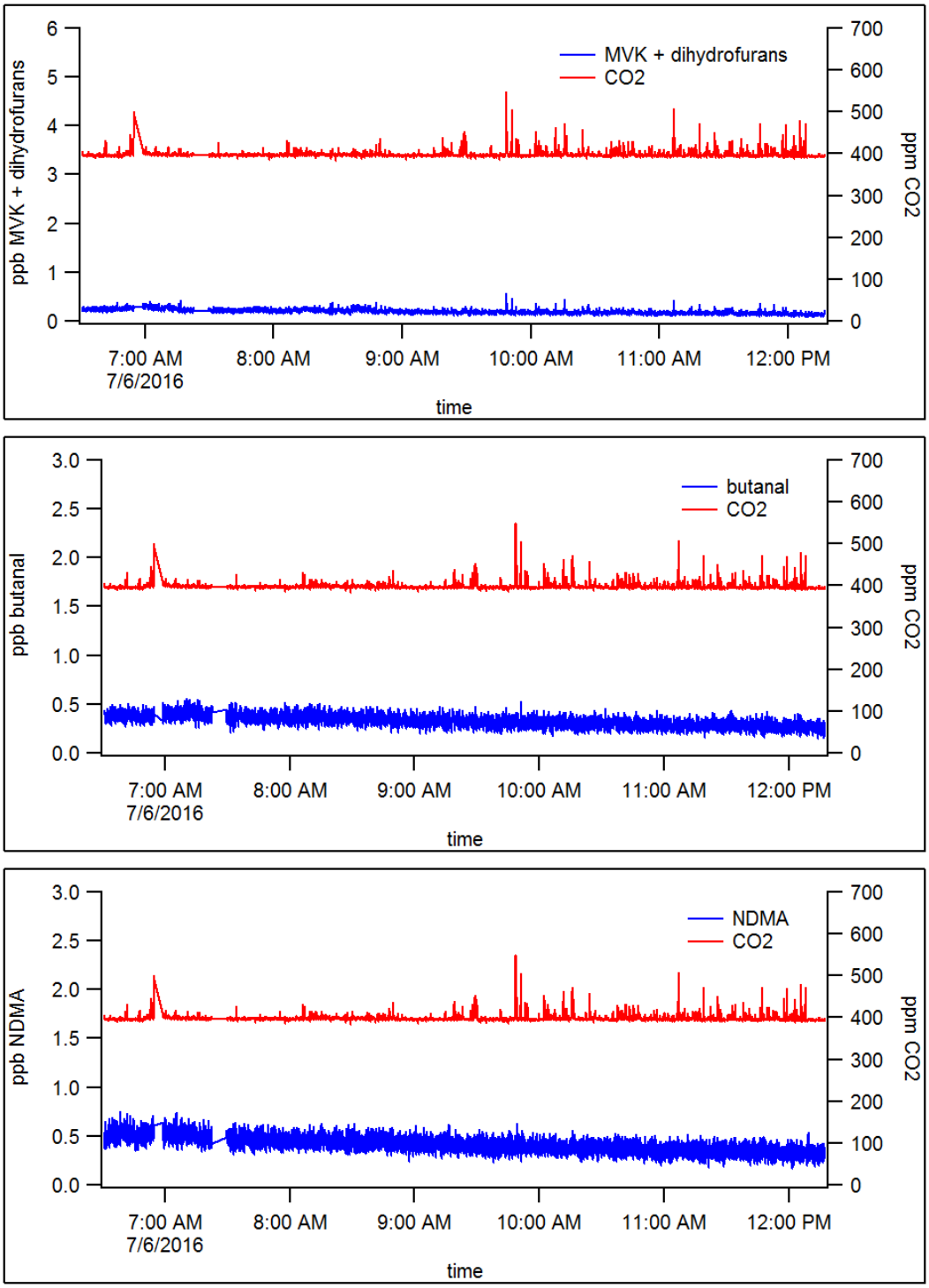


Figure B.3.2-6. July 6th - Benzene (TOP), 2,4-Pentadienenitrile; Pyridine (MIDDLE), 2-methylene Butanenitrile (BOTTOM)

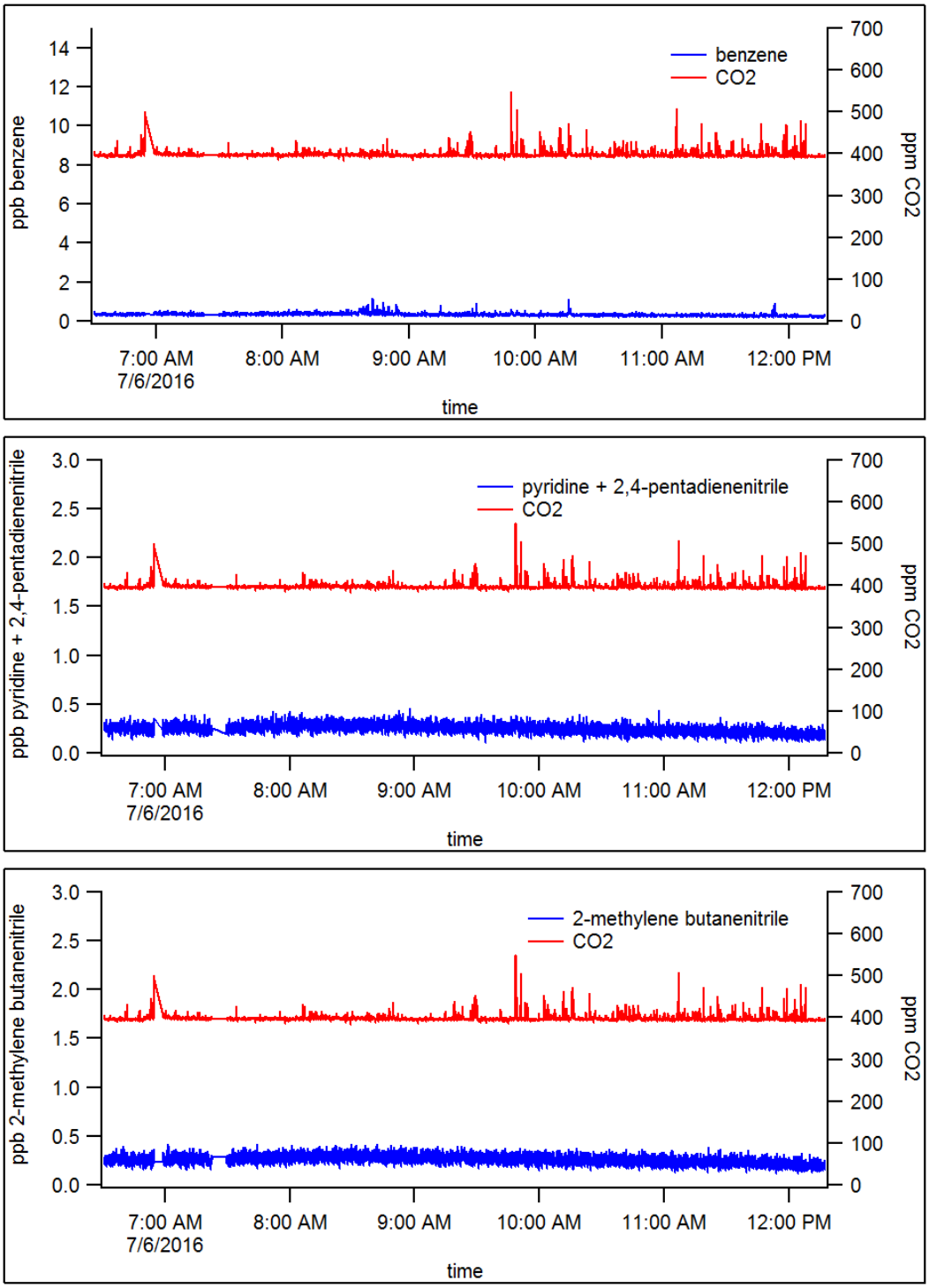


Figure B.3.2-7. July 6th - 2-methylfuran (TOP), Pentanenitrile (MIDDLE), 3-methyl-3-buten-2-one; 2-methyl-2-butenal (BOTTOM)

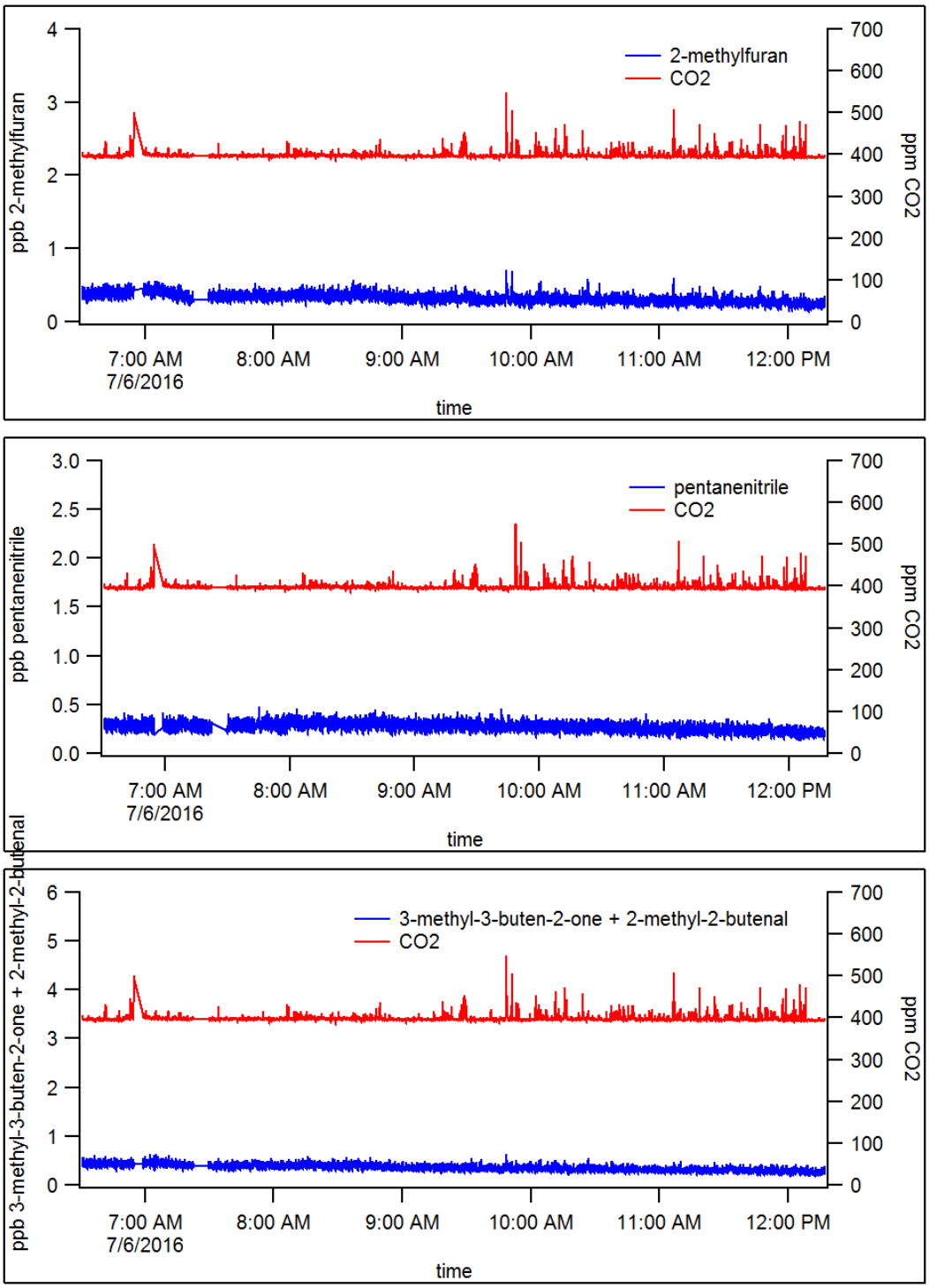


Figure B.3.2-8. July 6th - N-nitrosomethylethylamine [NEMA] (TOP), 2,5-dimethylfuran (MIDDLE), Hexanenitrile (BOTTOM)

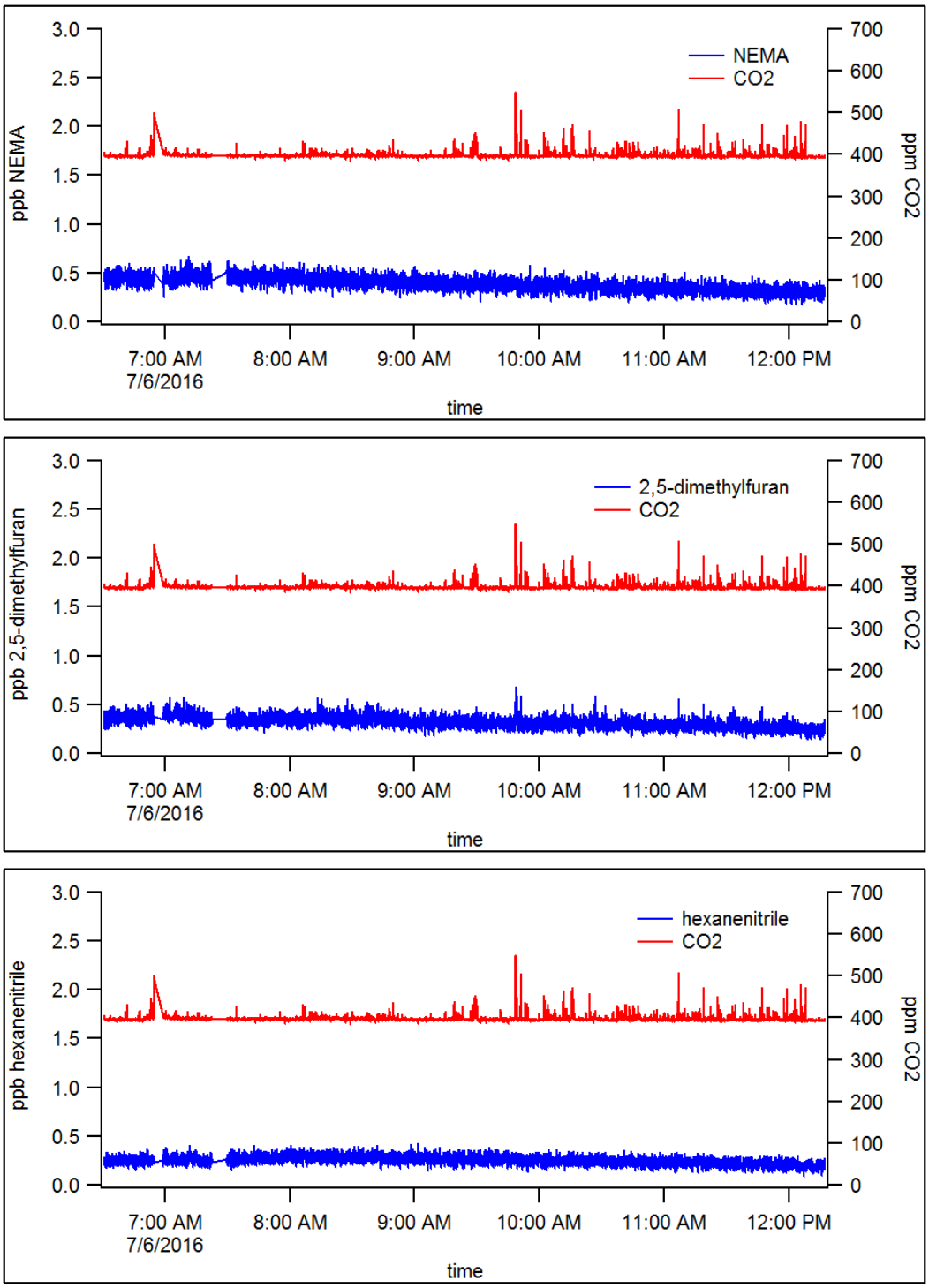


Figure B.3.2-9. July 6th - 2-hexanone [MBK] (TOP), N-nitrosodiethylamine [NDEA] (MIDDLE), Butyl Nitrite; 2-nitro-2-methylpropane (BOTTOM)

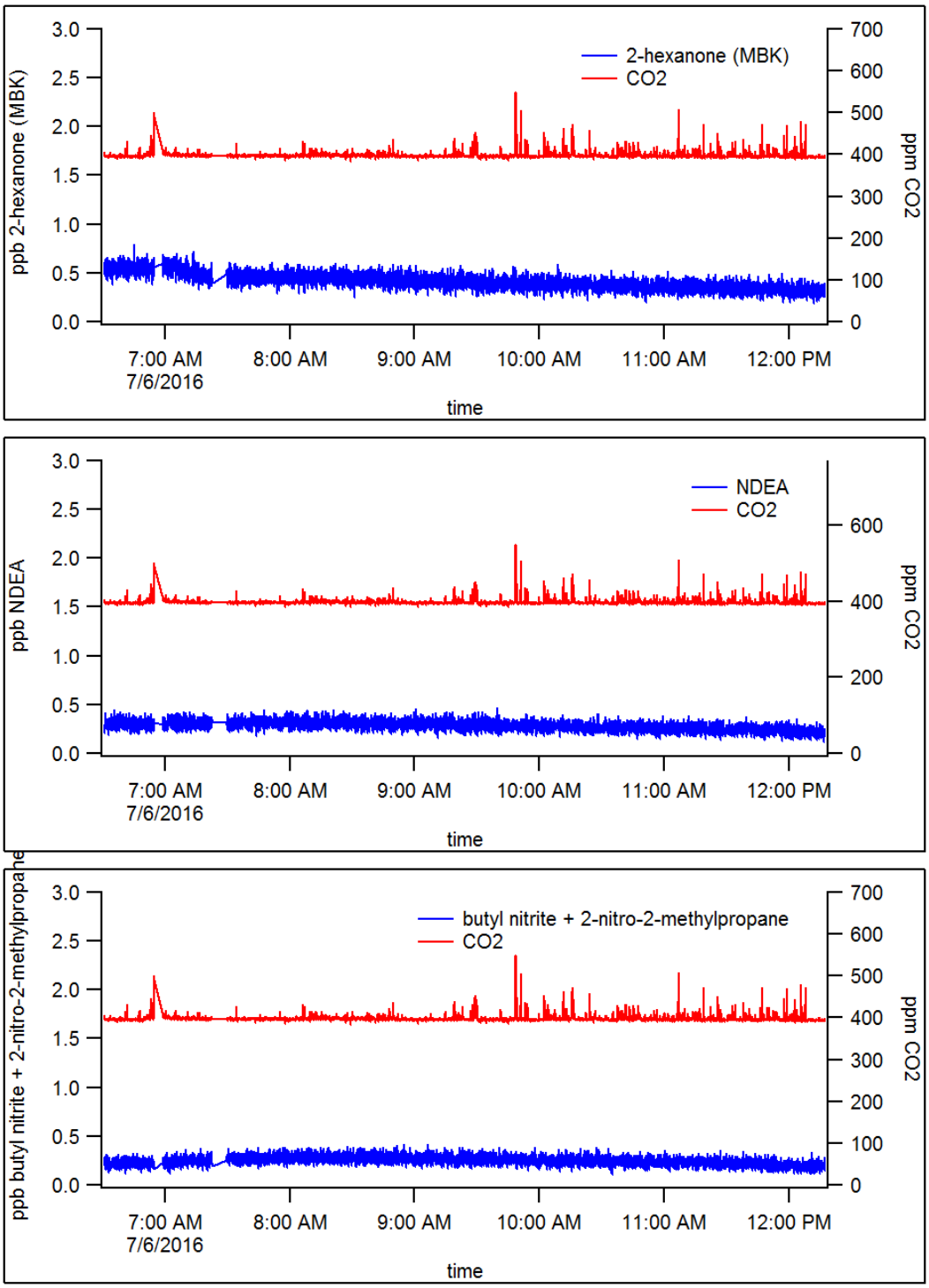


Figure B.3.2-10. July 6th - 2,4-dimethylpyridine (TOP), 2-ethyl-5-methylfuran (MIDDLE), Heptanenitrile (BOTTOM)

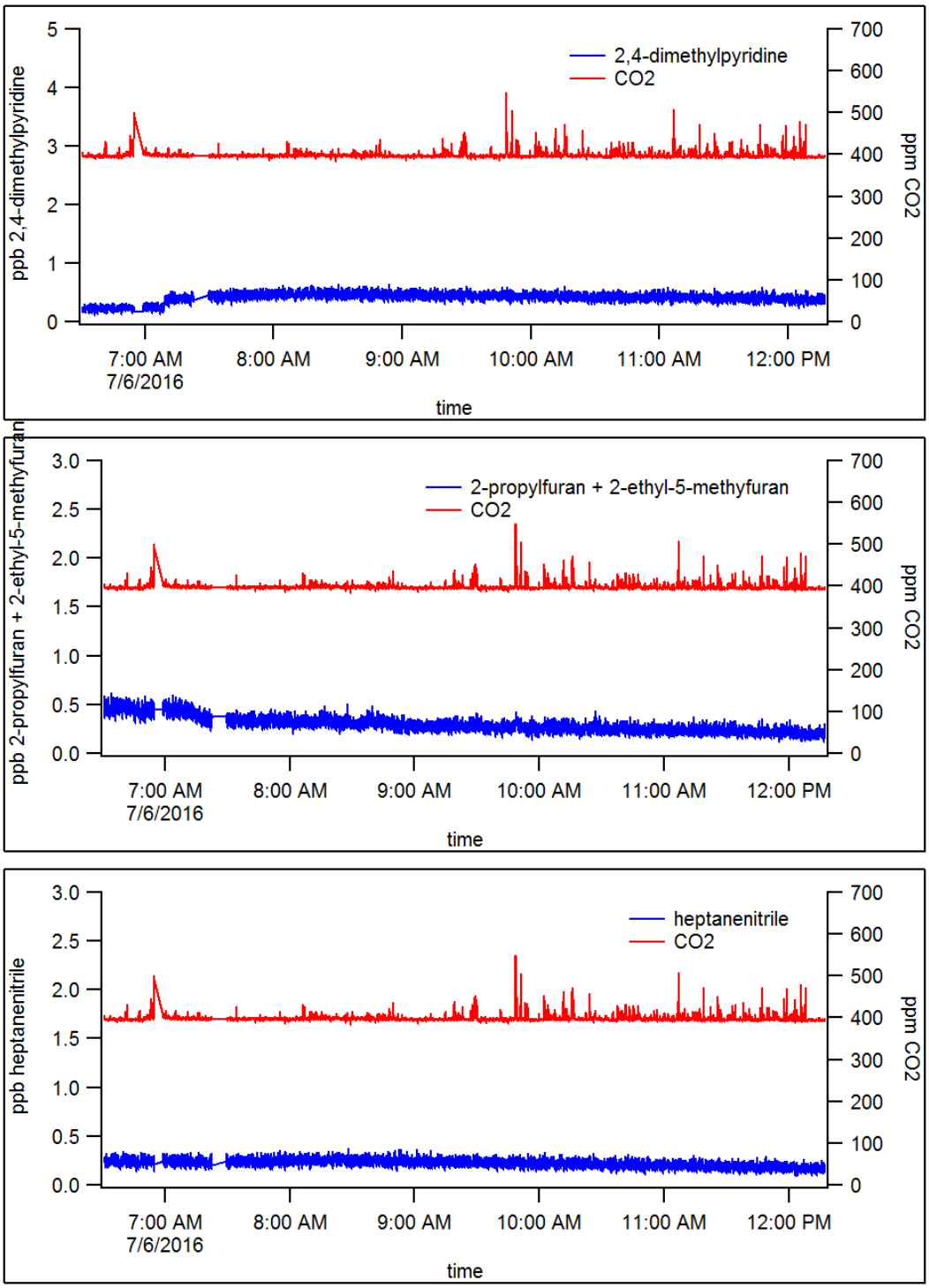


Figure B.3.2-11. July 6th - 4-methyl-2-hexanone (TOP), N-nitrosomorpholine [NMOR] (MIDDLE), Butyl Nitrate (BOTTOM)

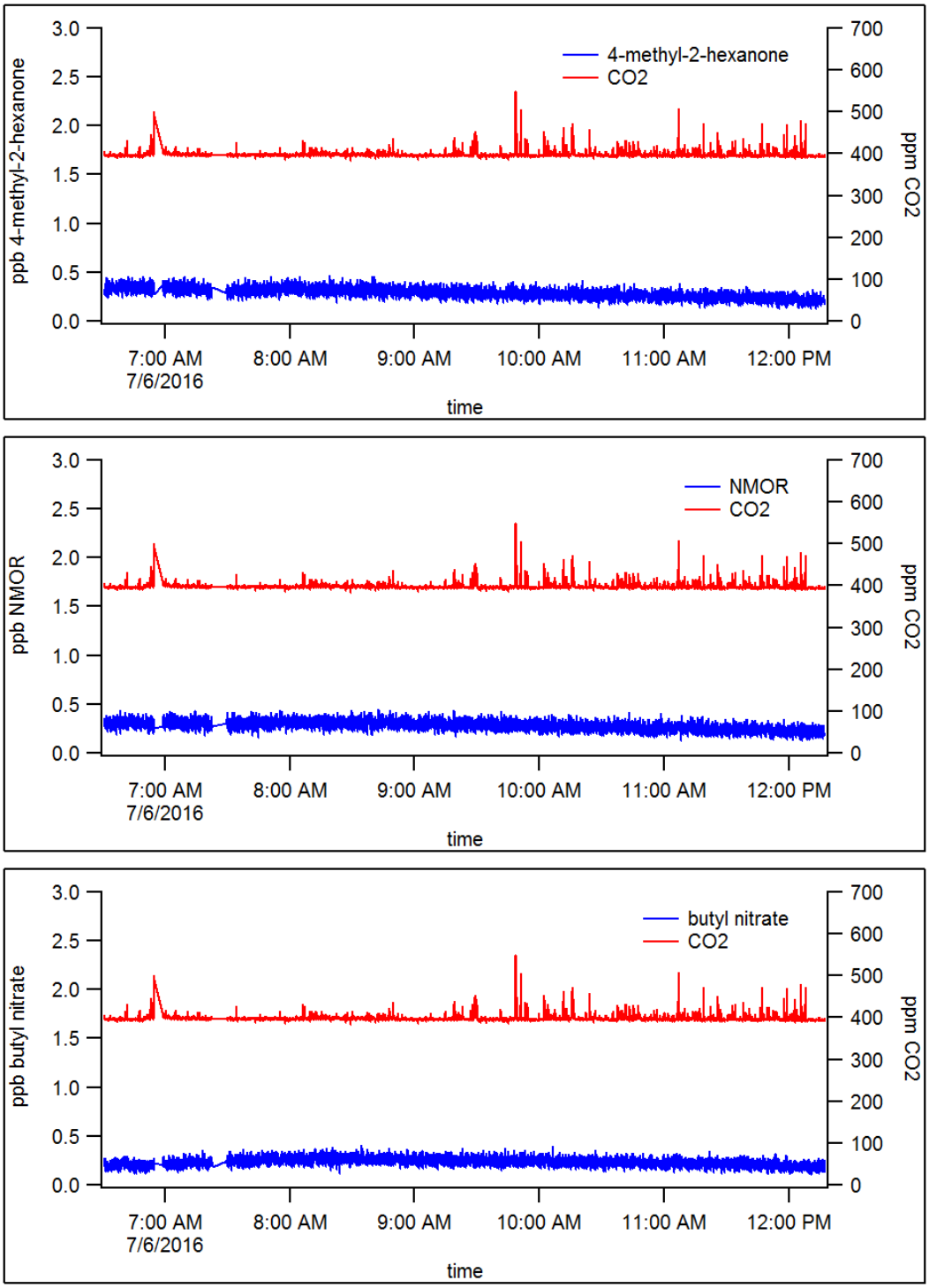


Figure B.3.2-12. July 6th - Multiple Furans [m/z 127] (TOP), 6-methyl-2-heptanone (MIDDLE), 2-pentylfuran (BOTTOM)

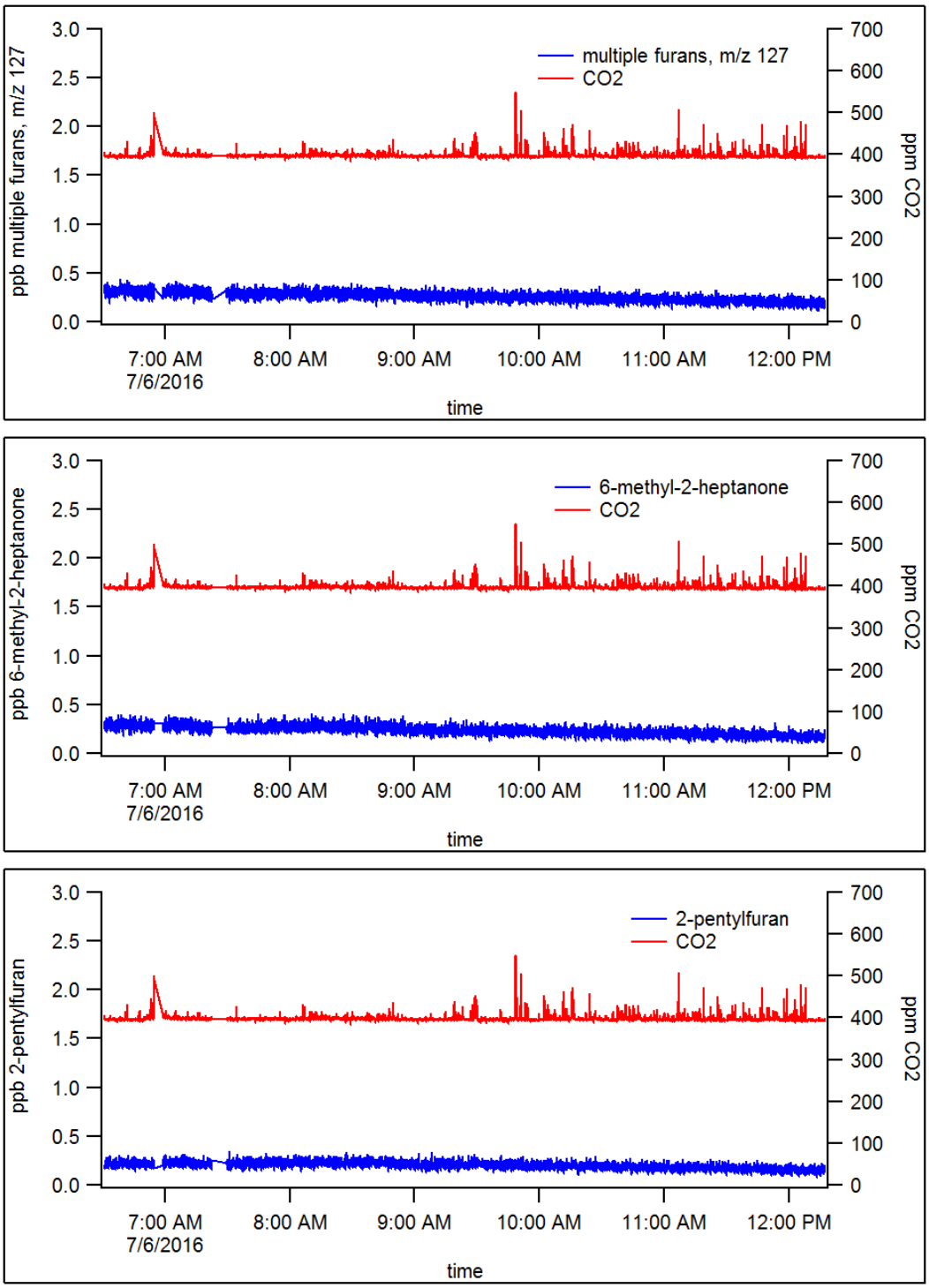


Figure B.3.2-13. July 6th - Biphenyl (TOP), 2-heptylfuran (MIDDLE), 2-octylfuran; 1,4-butanediol, Dinitrate (BOTTOM)

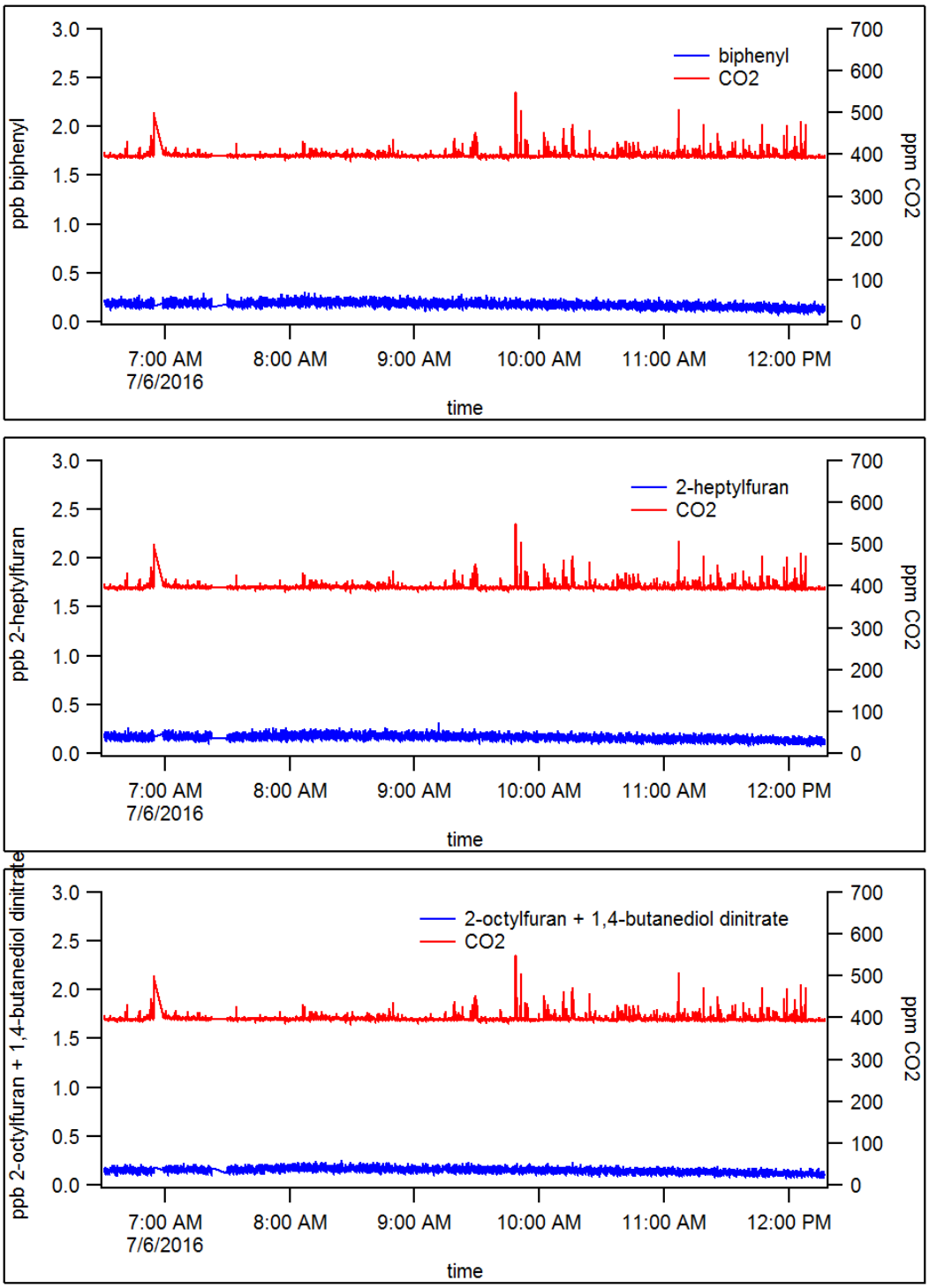


Figure B.3.2-14. July 6th - 1,2,3-propanetriol, 1,3-dinitrate (TOP), PCB (MIDDLE), 6-(2-furanyl)-6-methyl-2-heptanone (BOTTOM)

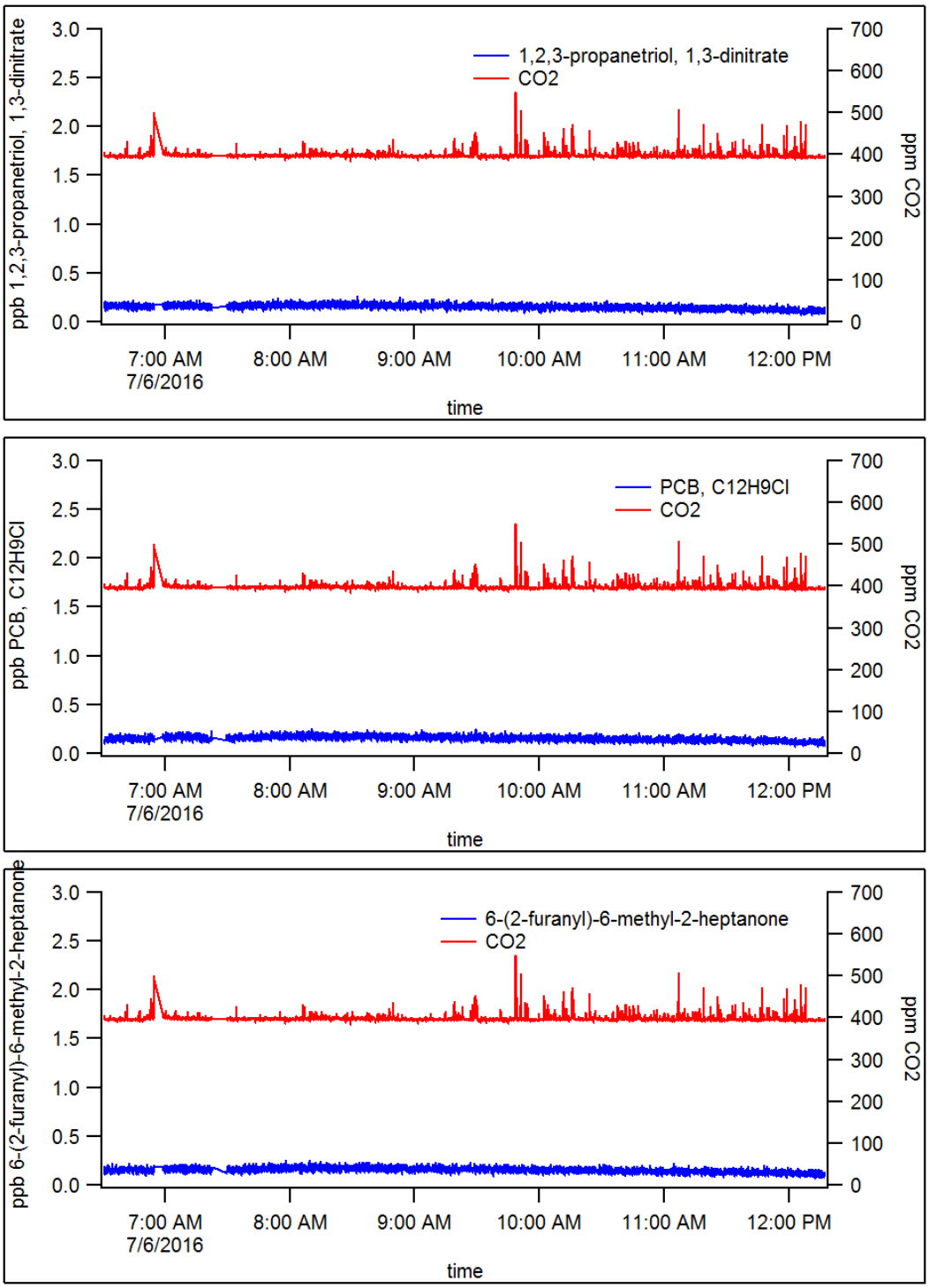
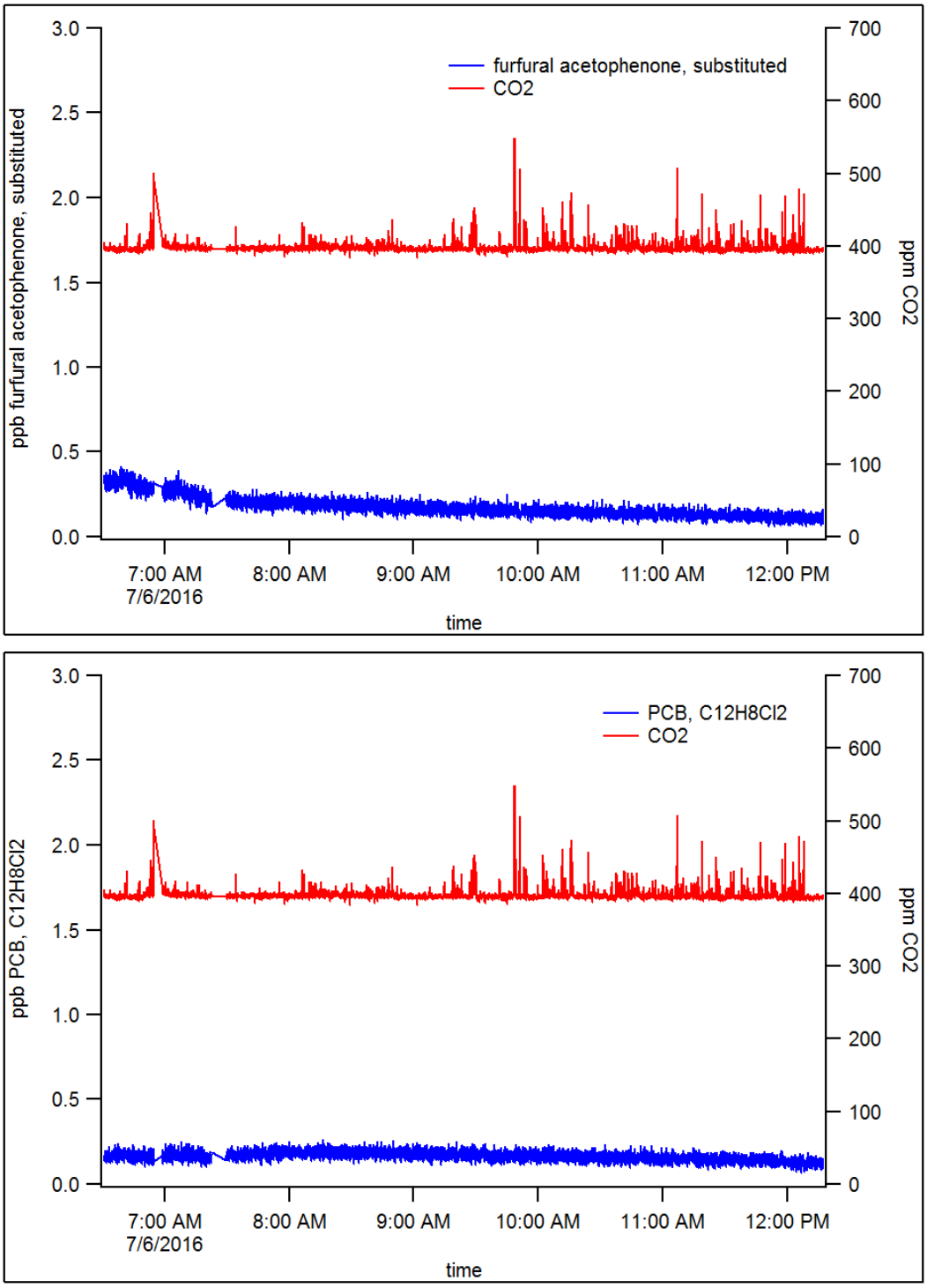


Figure B.3.2-15. July 6th - Furfural Acetophenone [3-(2-furanyl)-1-pheynyl-2-propen-1-one] (TOP), PCB [2] (BOTTOM)



B.3.3 July 7th Data Collection

July 7th data collection started at 6:35 AM and ended at 12:40 PM. Data collection methods included both mobile and stationary lab techniques. During data transferring, the files became corrupted due to a data saving glitch within the software itself. Due to this, there are no graphs to display.

B.3.4 July 11th Data Collection

July 11th data collection started at 6:27 AM and ended at 1:02 PM. Data collection methods included both mobile and stationary lab techniques. Below are the graphs presented in order based on the Chemicals of Potential Concern (COPC) list.

Figure B.3.4-1. July 11th - Formaldehyde (TOP), Methanol (MIDDLE), Acetonitrile (BOTTOM)

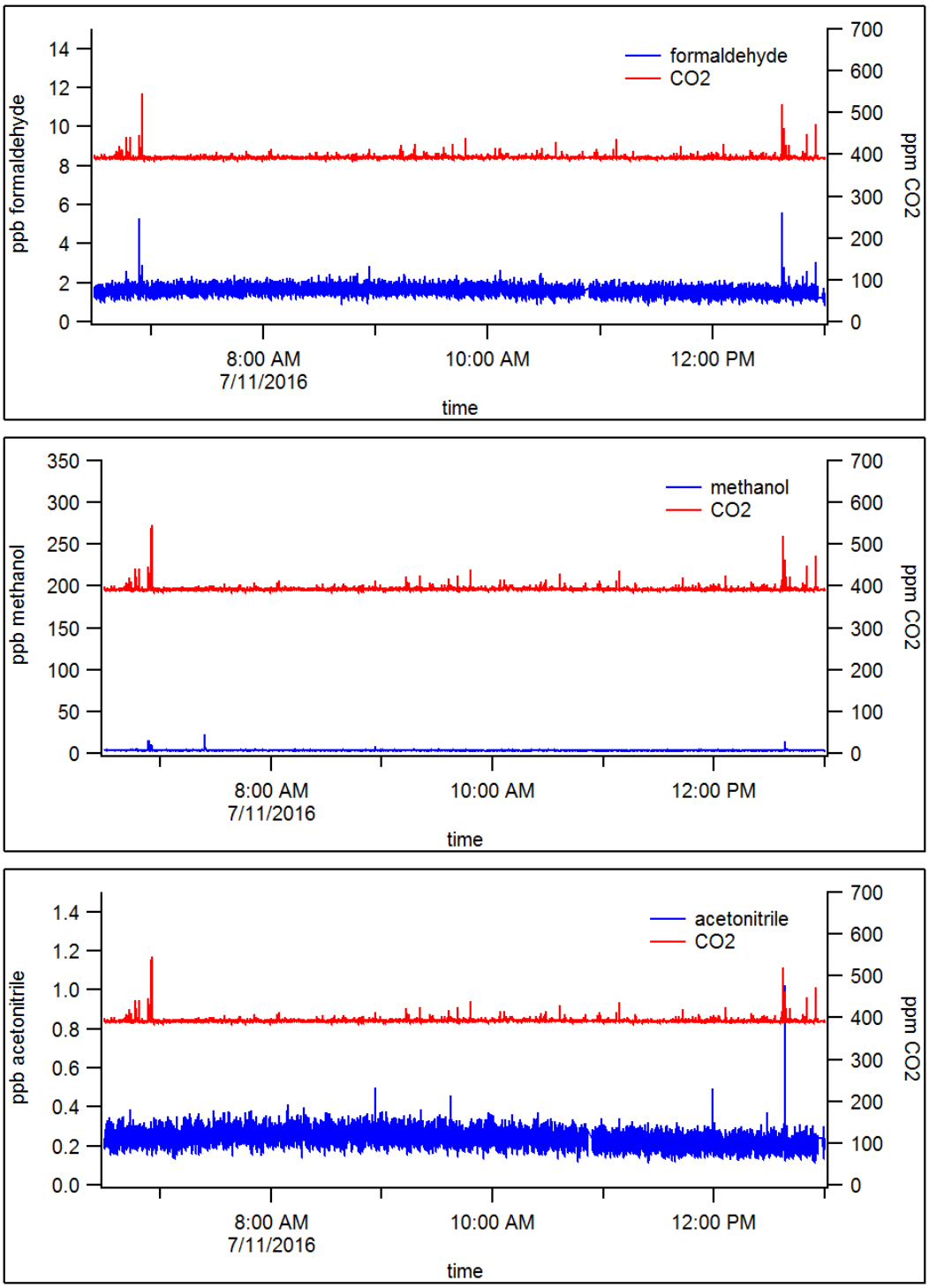


Figure B.3.4-2. July 11th - Acetaldehyde (TOP), Ethylamine (MIDDLE), 1,3-Butadiene (BOTTOM)

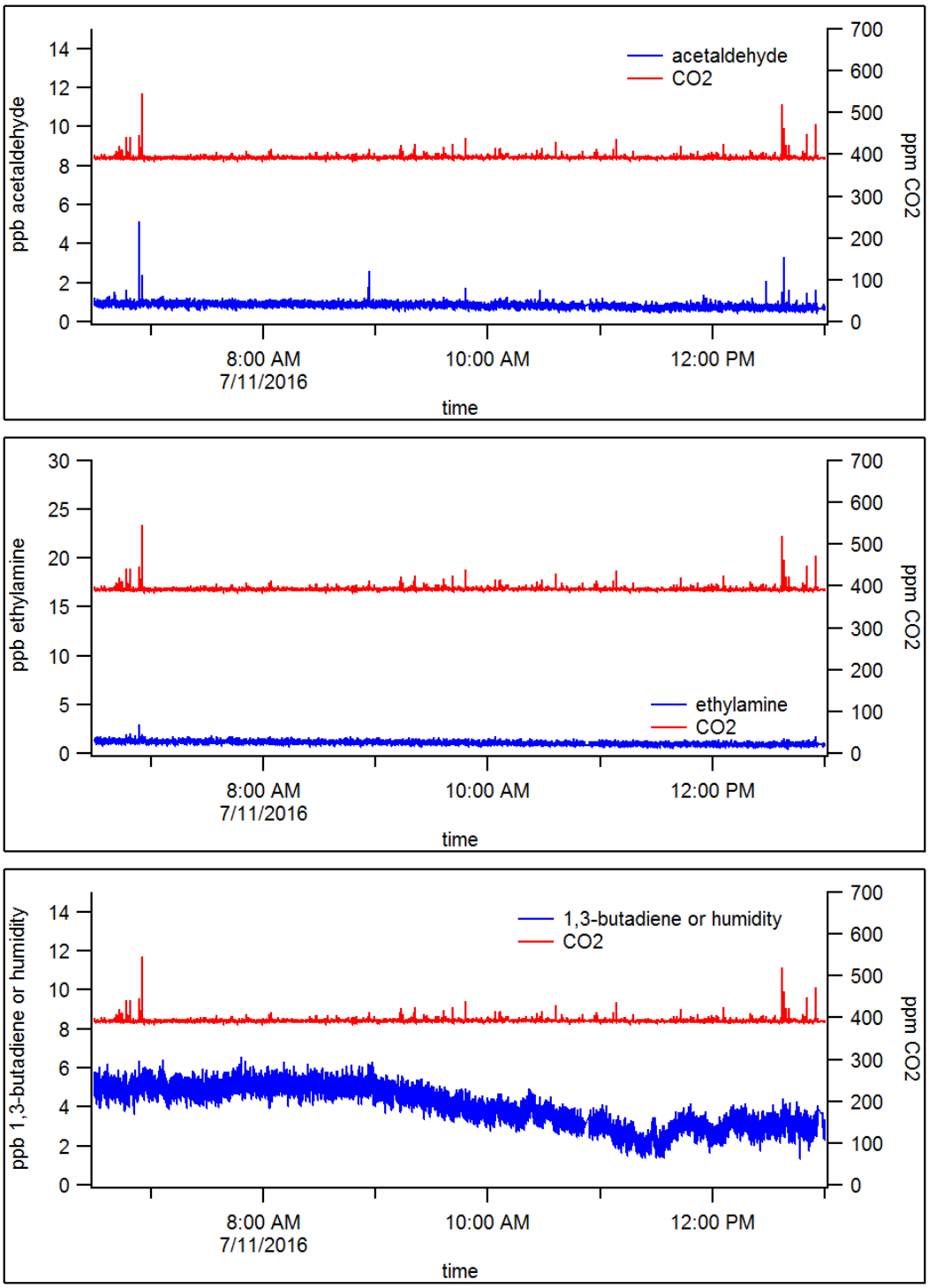


Figure B.3.4-3. July 11th - Propanenitrile (TOP), 1-Butanol; Butenes (MIDDLE), Methyl Isocyanate (BOTTOM)

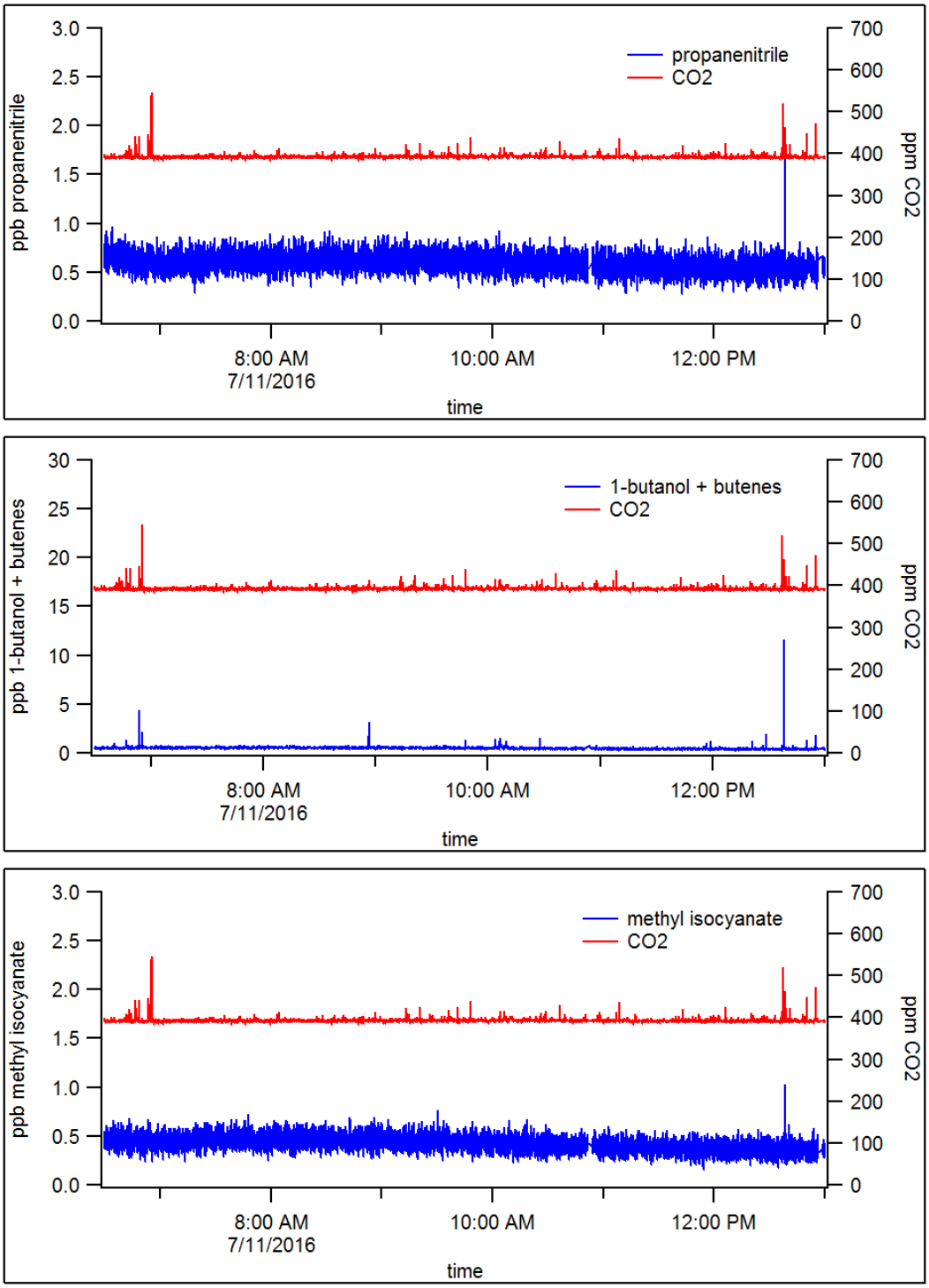


Figure B.3.4-4. July 11th - Methyl Nitrite (TOP), Furan; Isoprene (MIDDLE), Butanenitrile (BOTTOM)

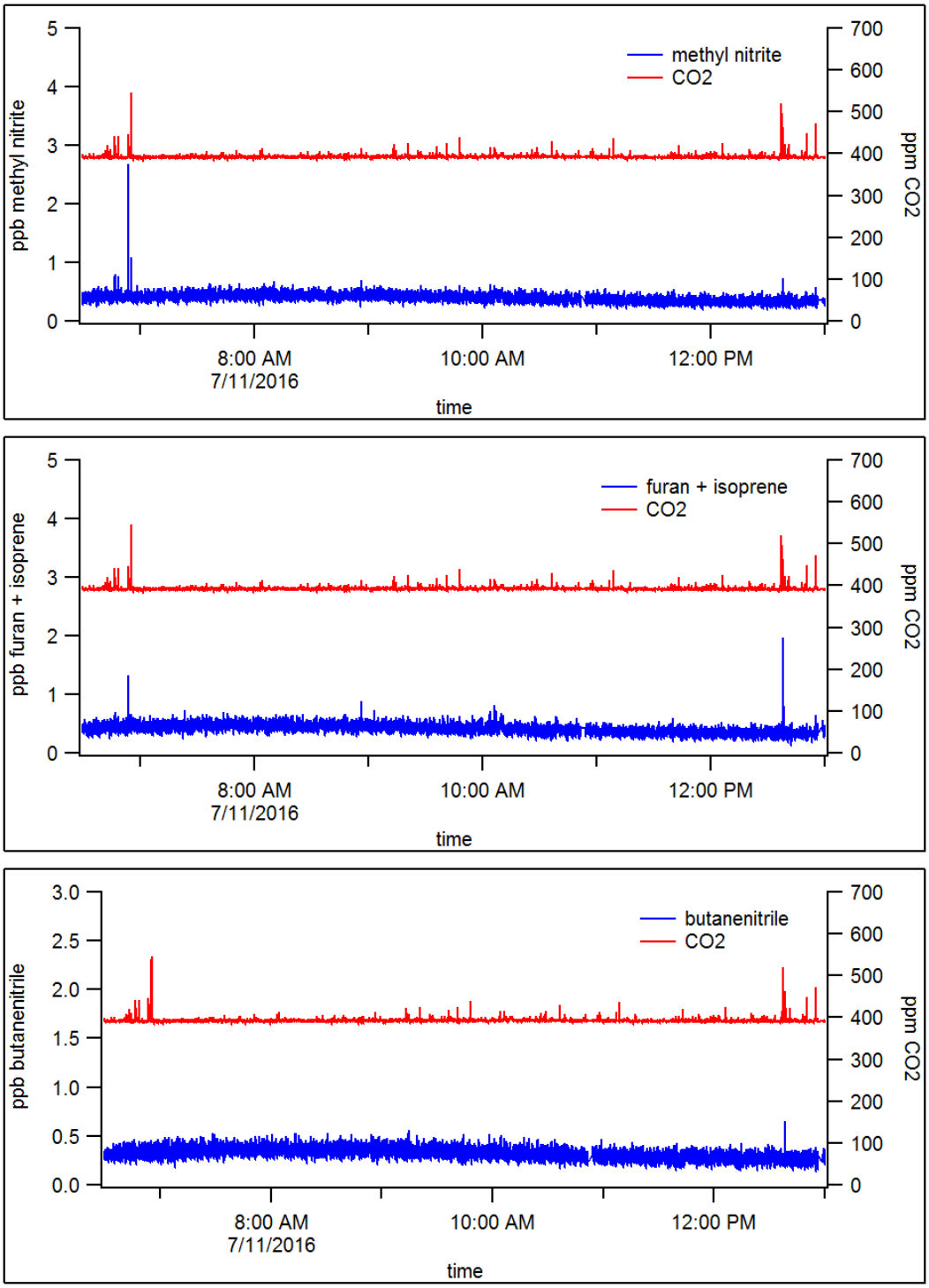


Figure B.3.4-5. July 11th - MVK + Dihydrofurans (TOP), Butanal (MIDDLE), N-nitrosodimethylamine [NDMA] (BOTTOM)

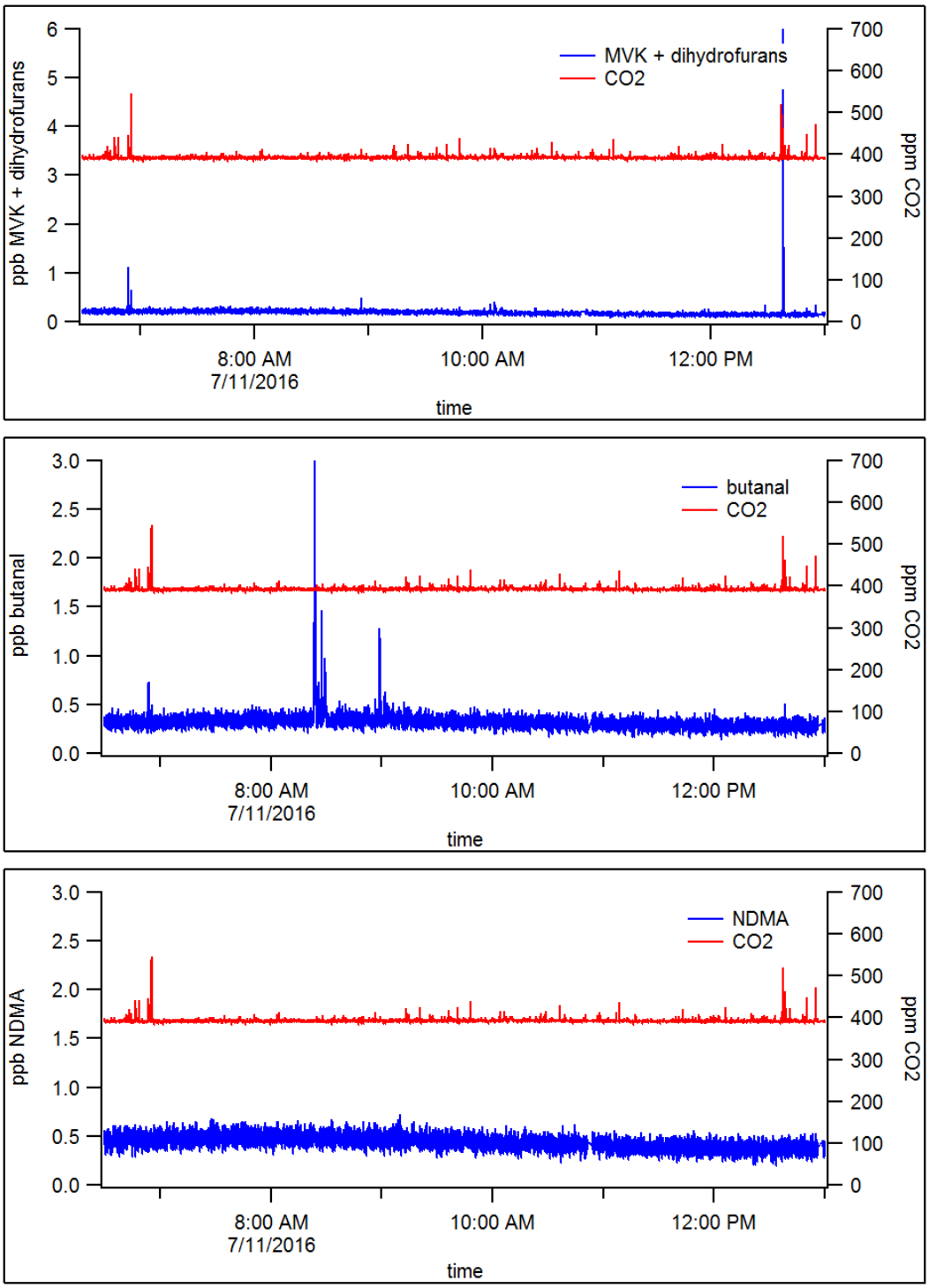


Figure B.3.4-6. July 11th - Benzene (TOP), 2,4-Pentadienenitrile; Pyridine (MIDDLE), 2-methylene Butanenitrile (BOTTOM)

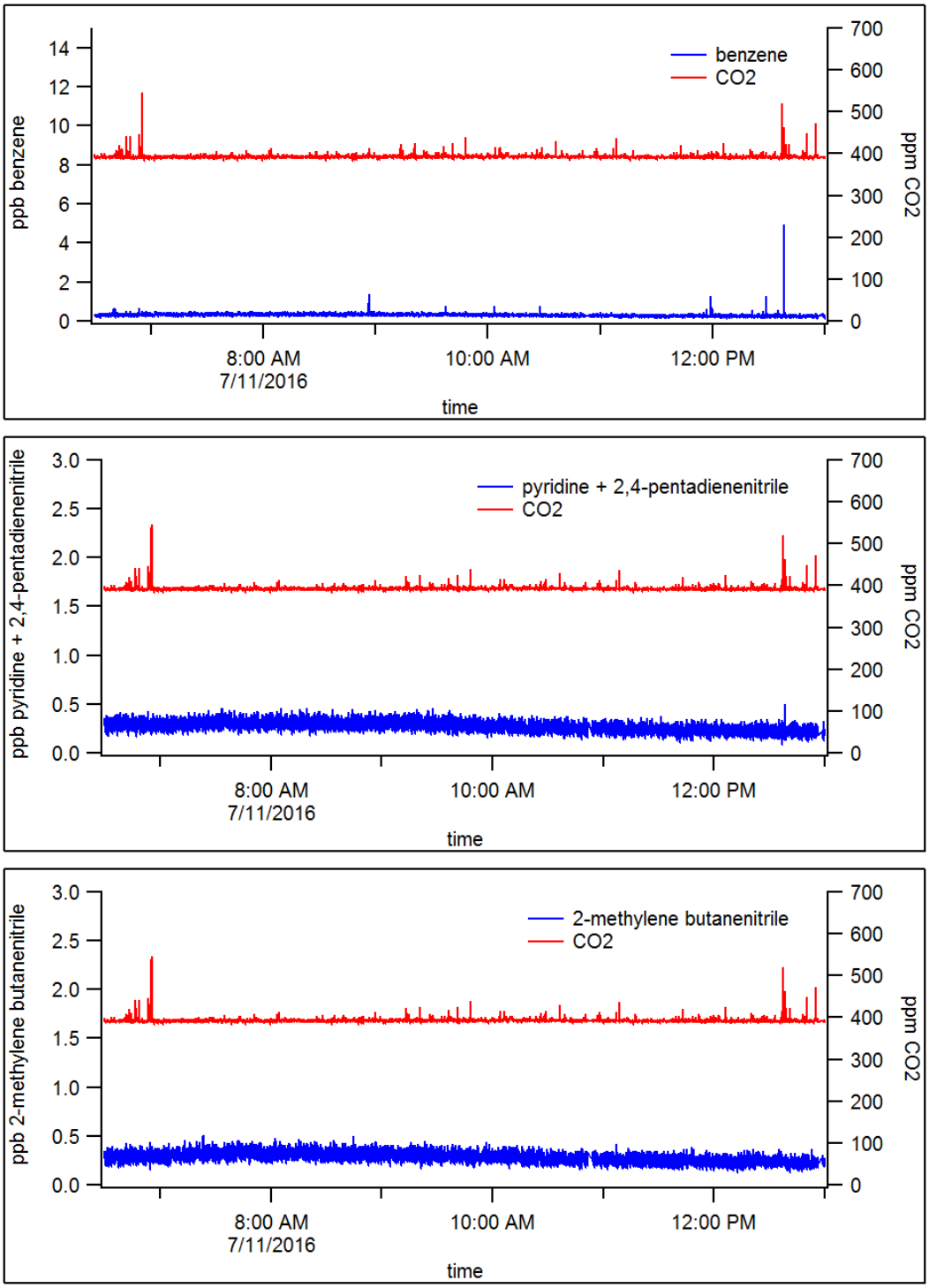


Figure B.3.4-7. July 11th - 2-methylfuran (TOP), Pentanenitrile (MIDDLE), 3-methyl-3-buten-2-one; 2-methyl-2-butenal (BOTTOM)

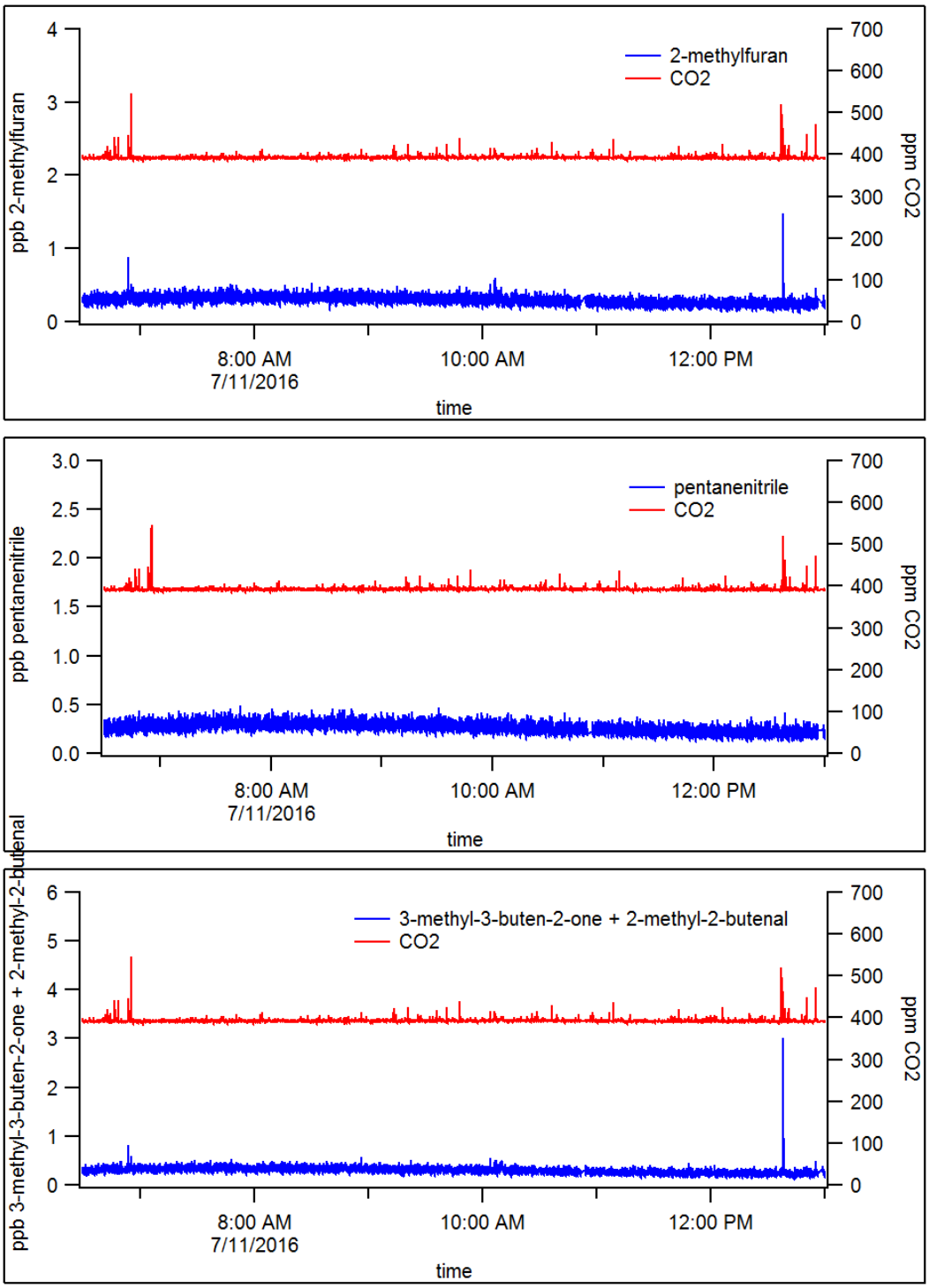


Figure B.3.4-8. July 11th - N-nitrosomethylethylamine [NEMA] (TOP), 2,5-dimethylfuran (MIDDLE), Hexanenitrile (BOTTOM)

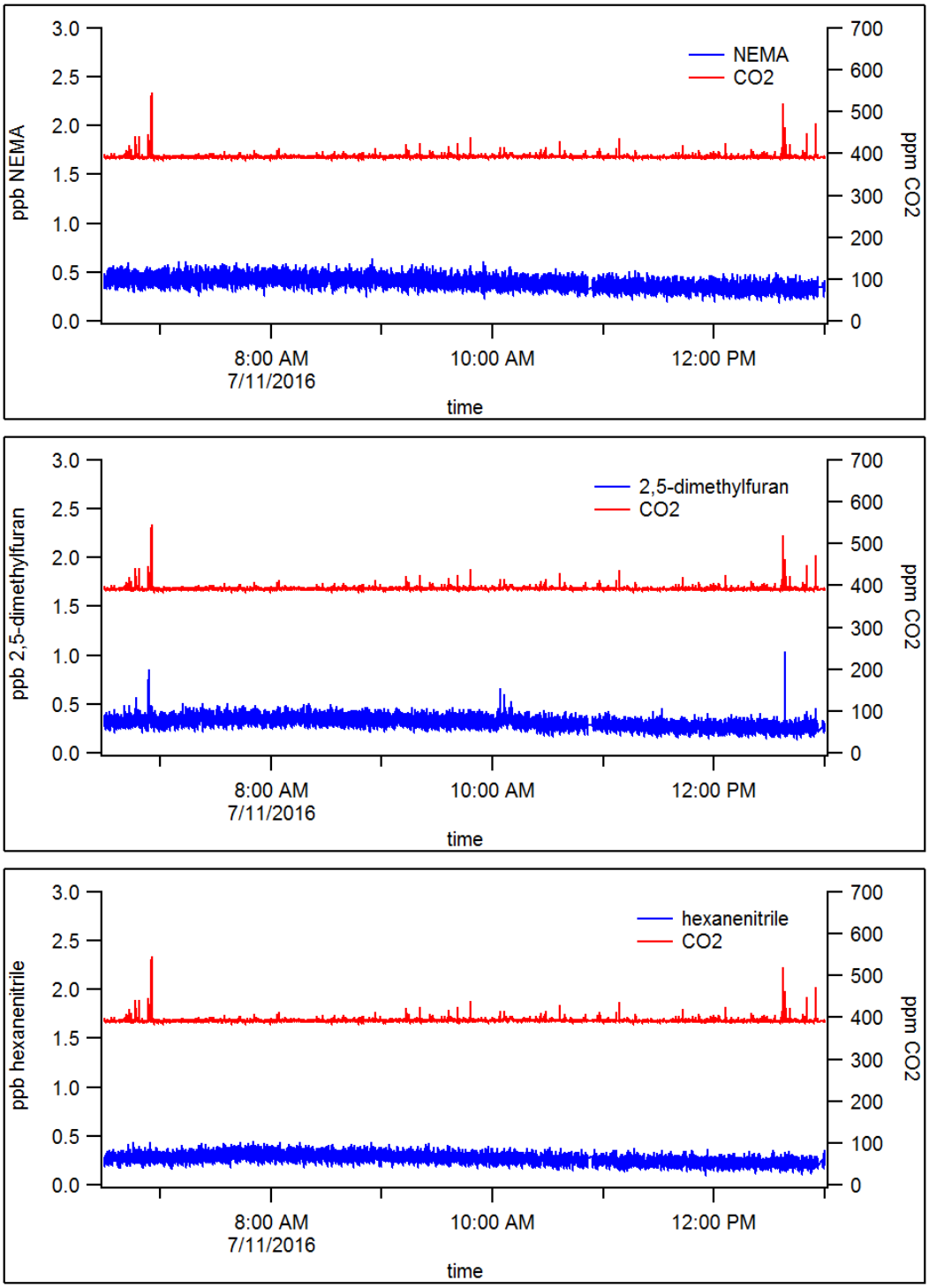


Figure B.3.4-9. July 11th - 2-hexanone [MBK] (TOP), N-nitrosodiethylamine [NDEA] (MIDDLE), Butyl Nitrite; 2-nitro-2-methylpropane (BOTTOM)

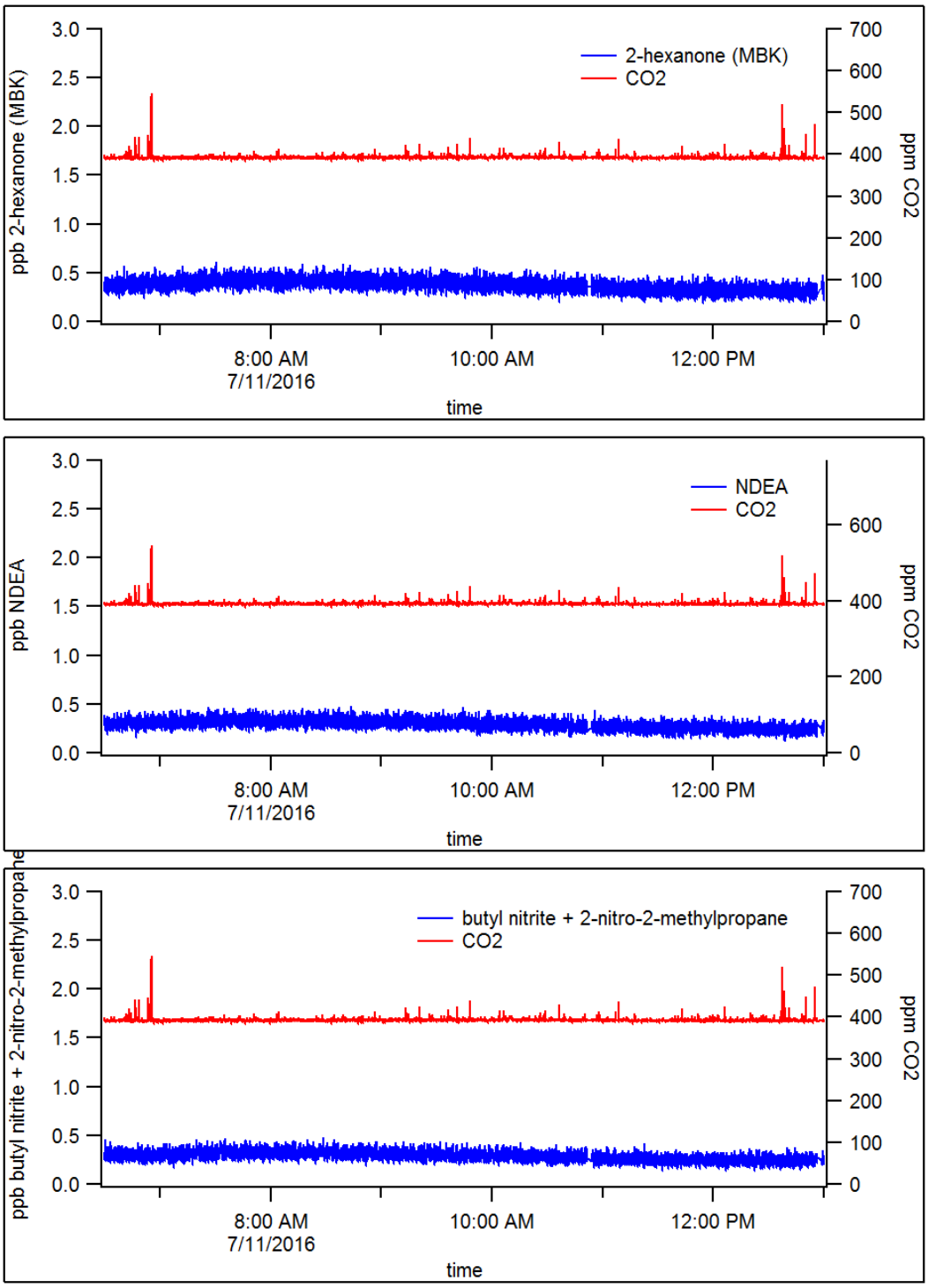


Figure B.3.4-10. July 11th - 2,4-dimethylpyridine (TOP), 2-ethyl-5-methylfuran (MIDDLE), Heptanenitrile (BOTTOM)

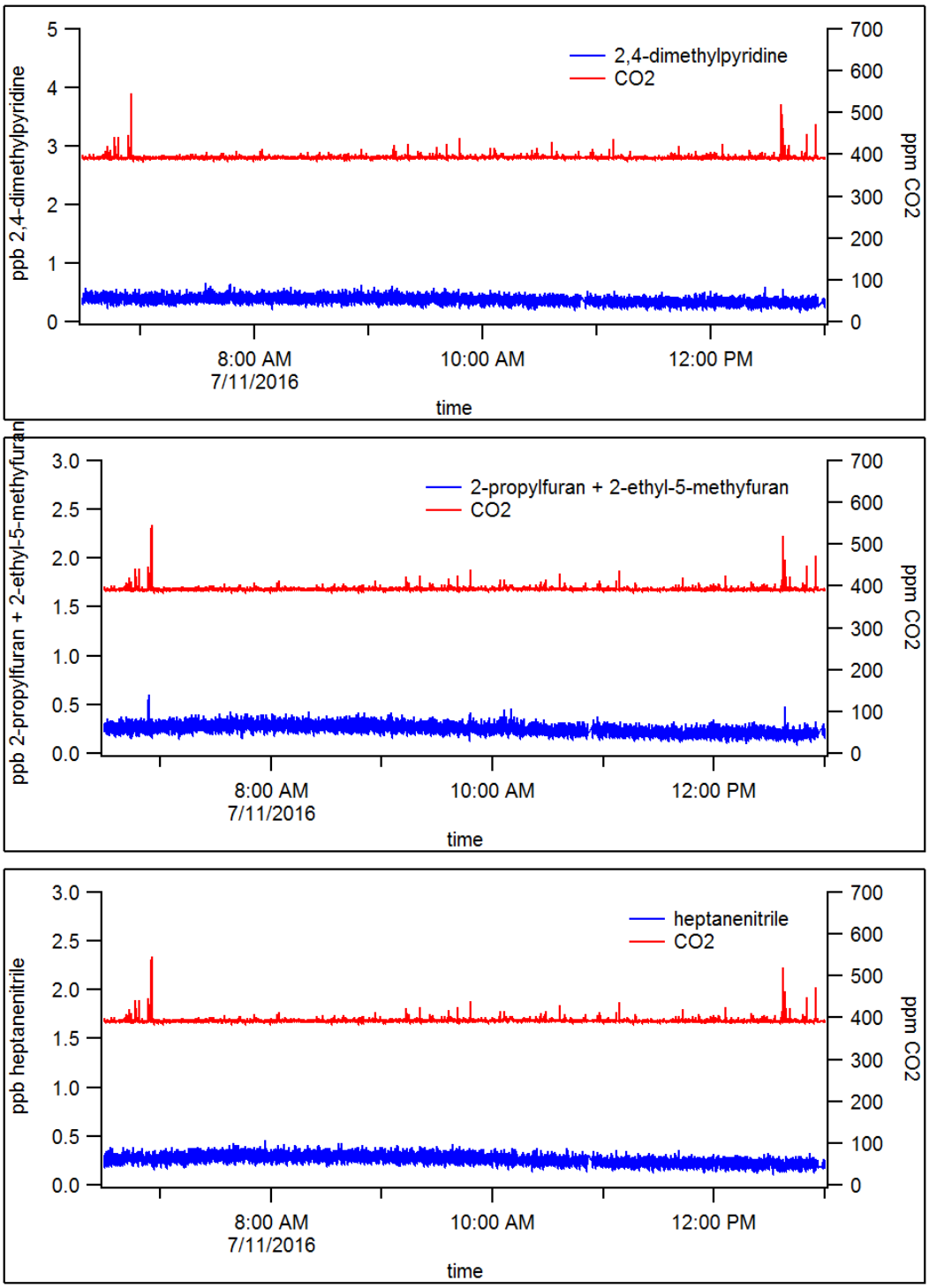


Figure B.3.4-11. July 11th - 4-methyl-2-hexanone (TOP), N-nitrosomorpholine [NMOR] (MIDDLE), Butyl Nitrate (BOTTOM)

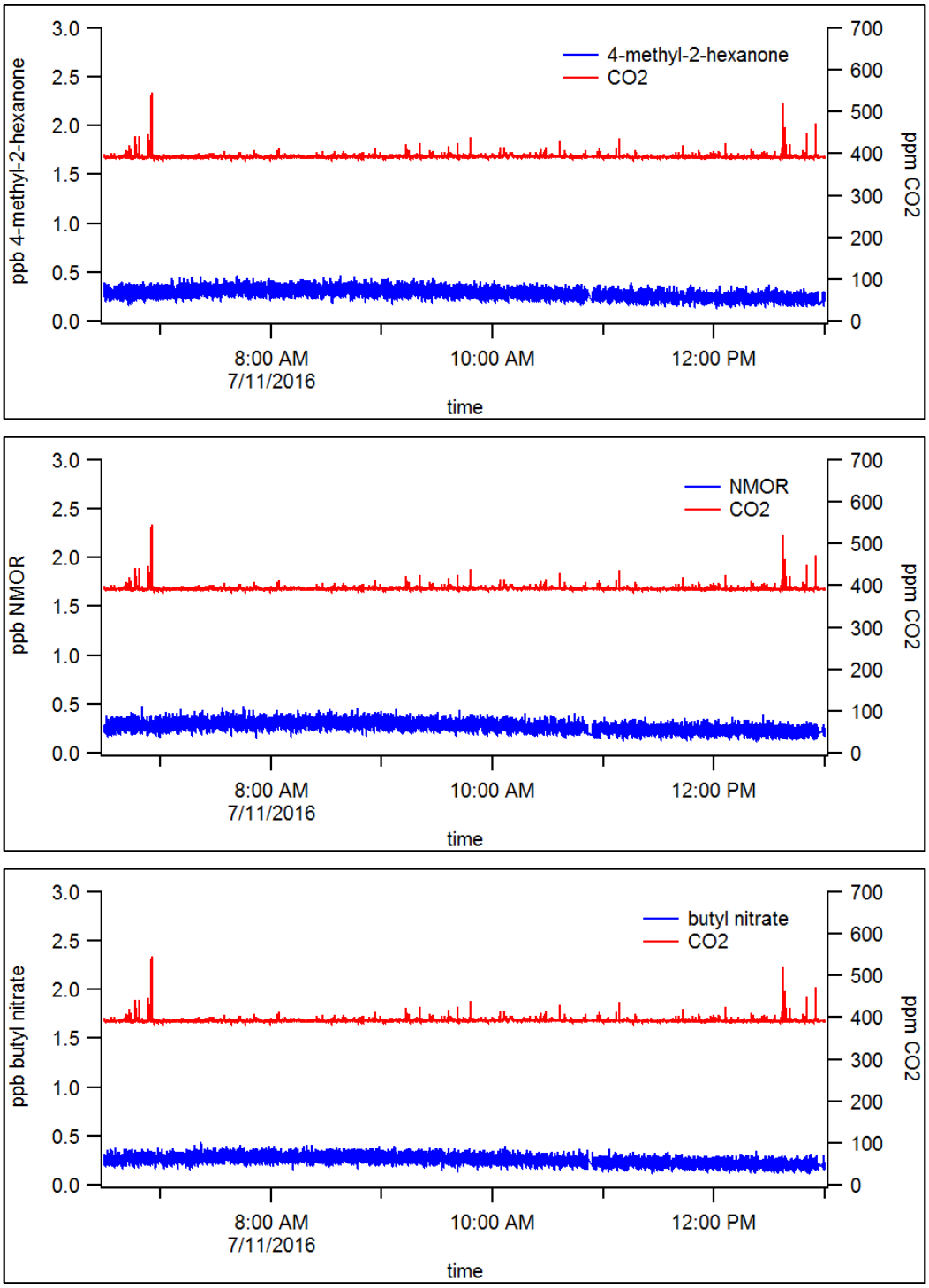


Figure B.3.4-12. July 11th - Multiple Furans [m/z 127] (TOP), 6-methyl-2-heptanone (MIDDLE), 2-pentylfuran (BOTTOM)

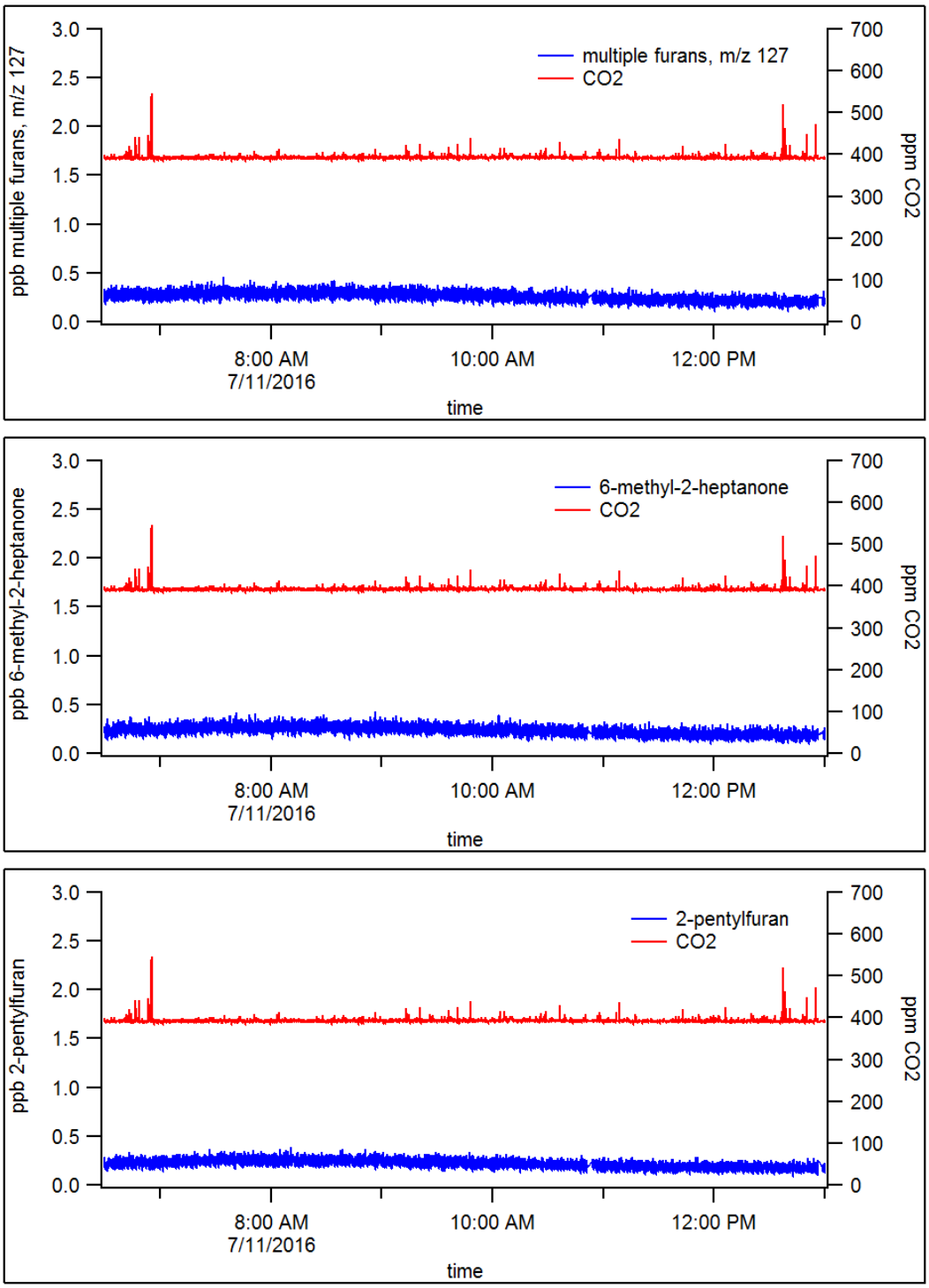


Figure B.3.4-13. July 11th - Biphenyl (TOP), 2-heptylfuran (MIDDLE), 2-octylfuran; 1,4-butanediol, Dinitrate (BOTTOM)

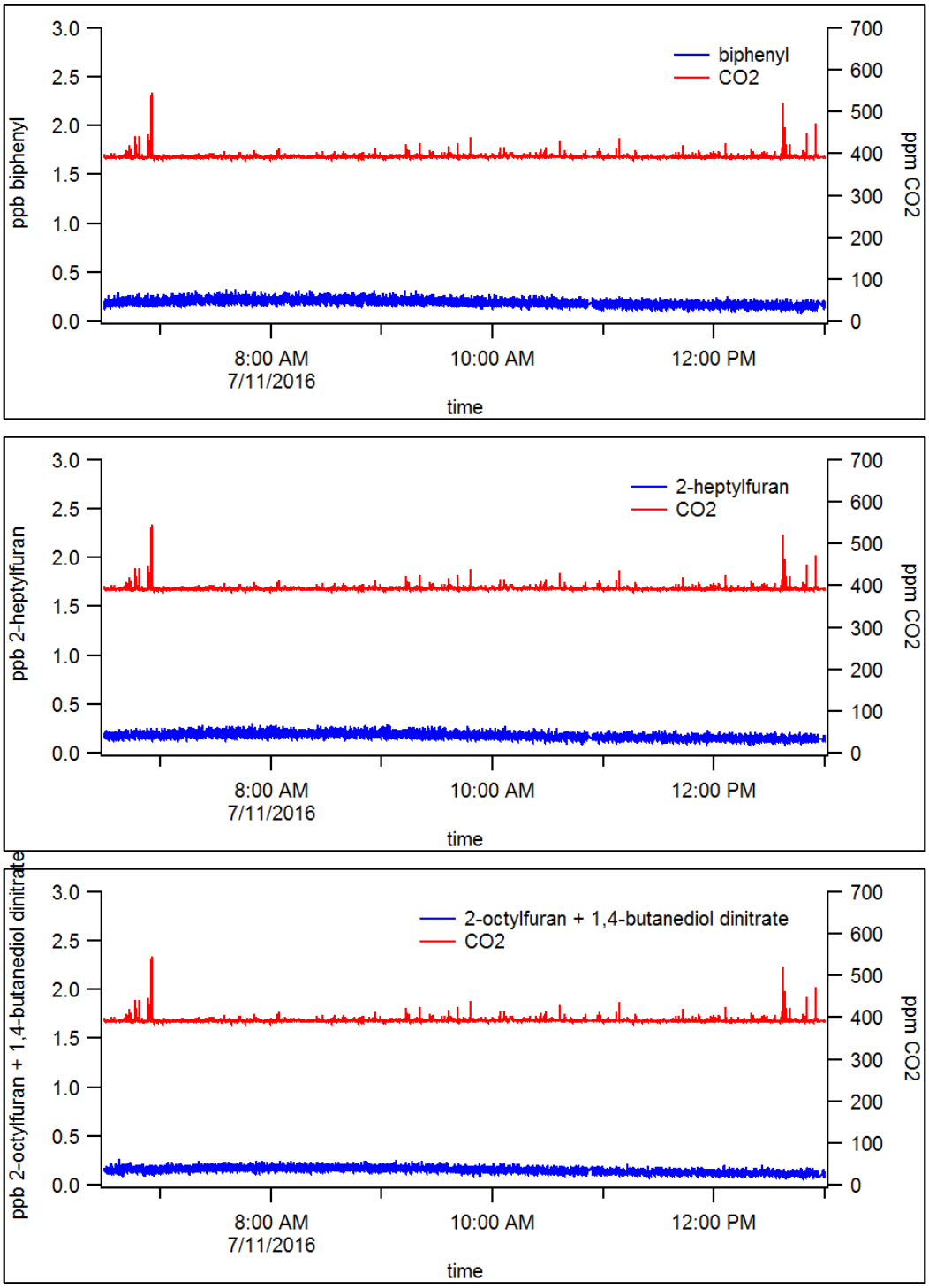


Figure B.3.4-14. July 11th - 1,2,3-propanetriol, 1,3-dinitrate (TOP), PCB (MIDDLE), 6-(2-furanyl)-6-methyl-2-heptanone (BOTTOM)

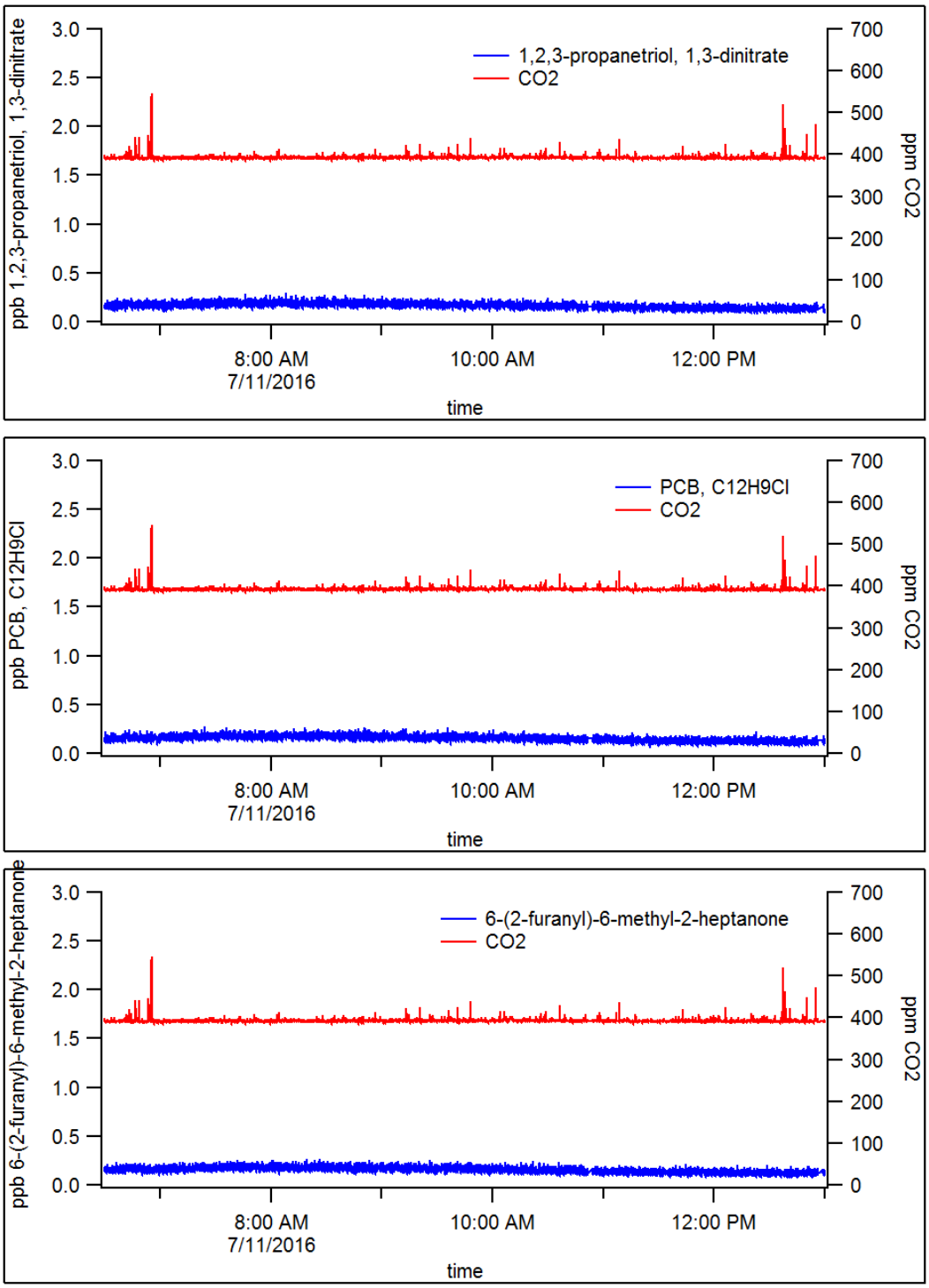
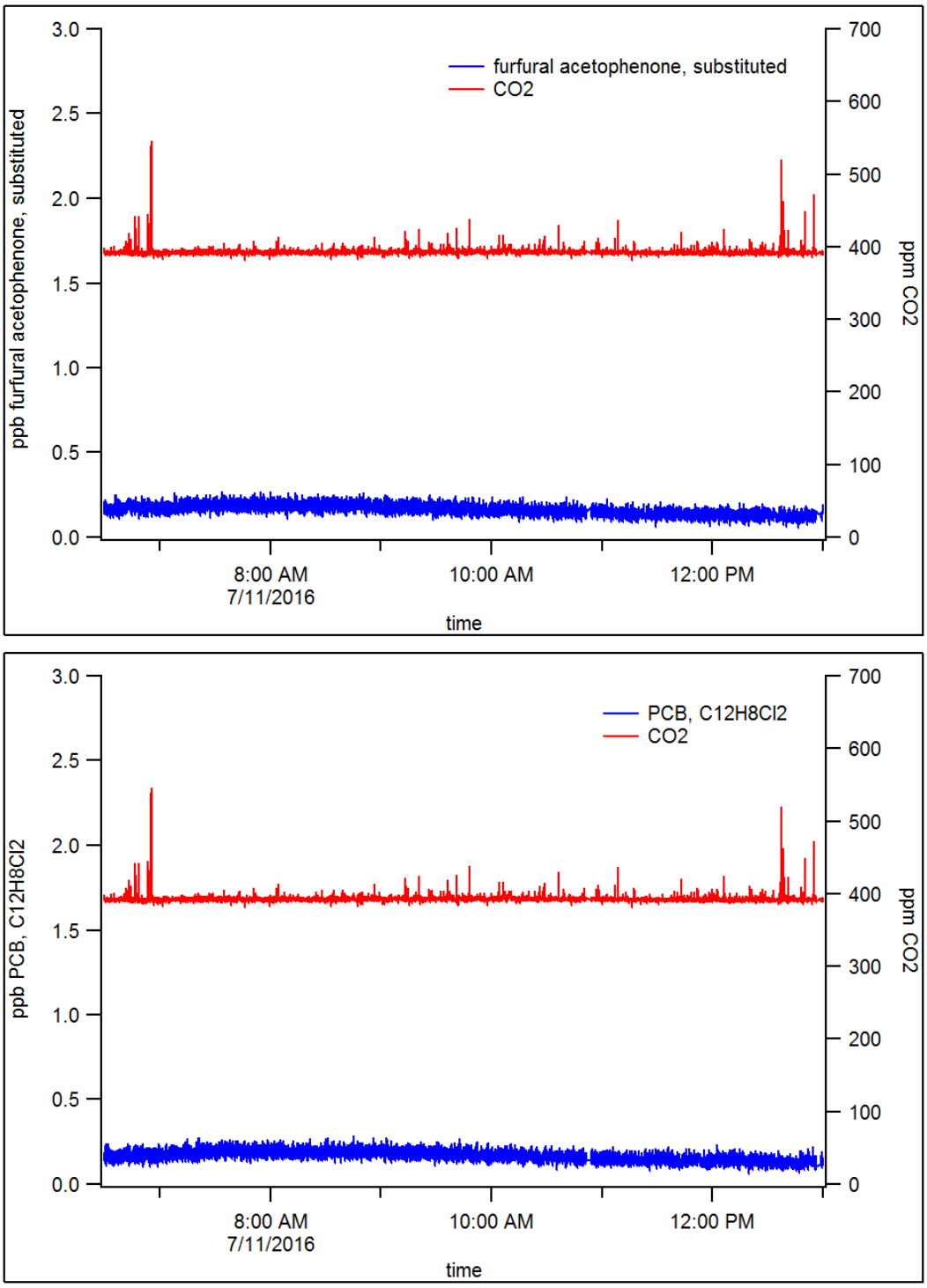


Figure B.3.4-15. July 11th - Furfural Acetophenone [3-(2-furanyl)-1-pheynyl-2-propen-1-one] (TOP), PCB [2] (BOTTOM)



B.4 WEEK 4

Week 4 refers to the fourth week of the initial data collection campaign. As stated above, each day has its own section within this appendix.

B.4.1 July 12th Data Collection

July 12th data collection started at 6:30 AM. Data collection methods included both mobile and stationary lab techniques. During Data collection, it was found that the instrument was not performing as needed for proper data collection, therefore corrupting the data itself. Due to this, there are no graphs to display.

B.4.2 July 13th Data Collection

July 13th data collection started at 6:30 AM and ended at 12:45 PM. Data collection methods included both mobile and stationary lab techniques. Below are the graphs presented in order based on the Chemicals of Potential Concern (COPC) list.

Figure B.4.2-1. July 13th - Formaldehyde (TOP), Methanol (MIDDLE), Acetonitrile (BOTTOM)

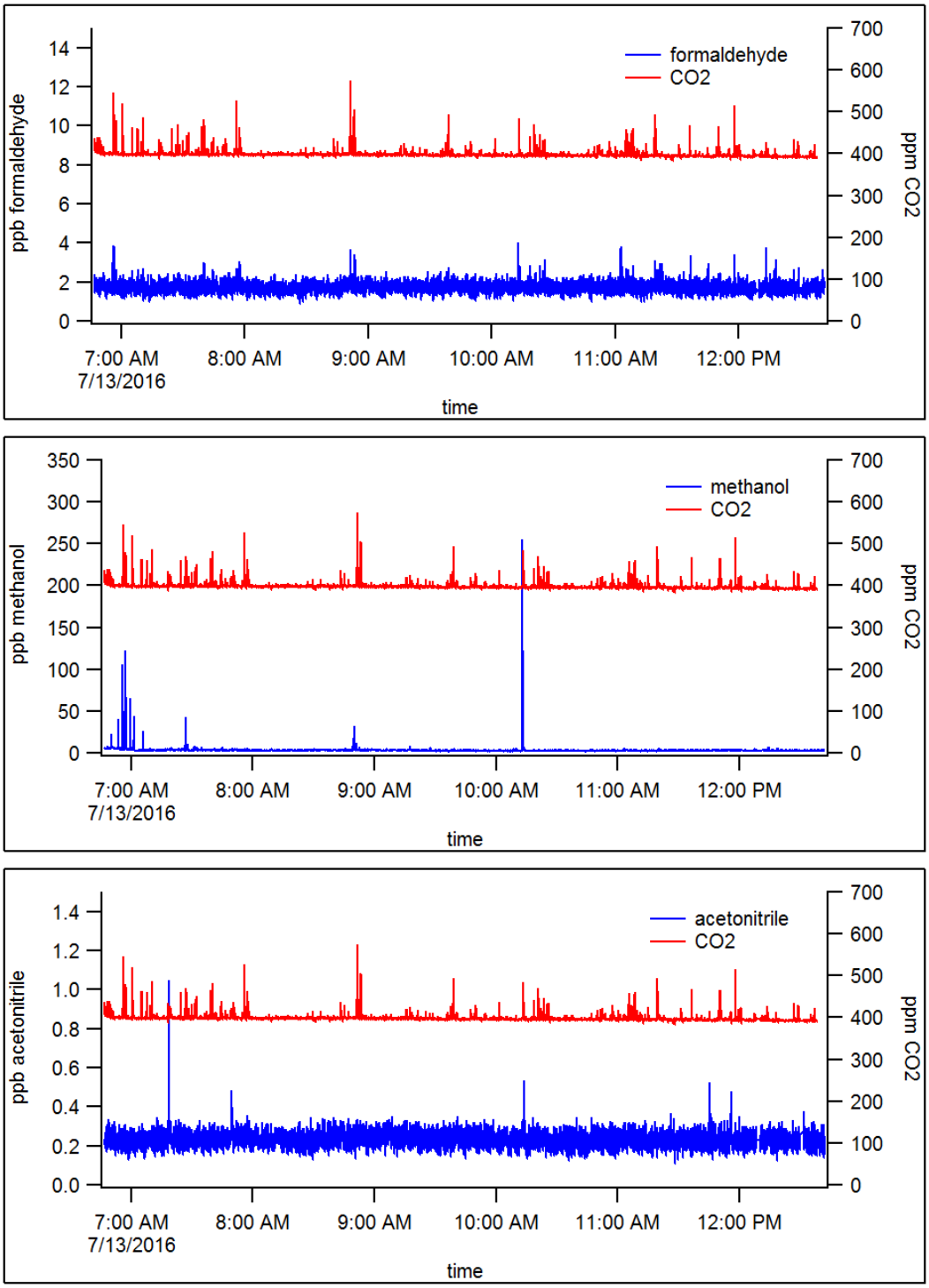


Figure B.4.2-2. July 13th - Acetaldehyde (TOP), Ethylamine (MIDDLE), 1,3-Butadiene (BOTTOM)

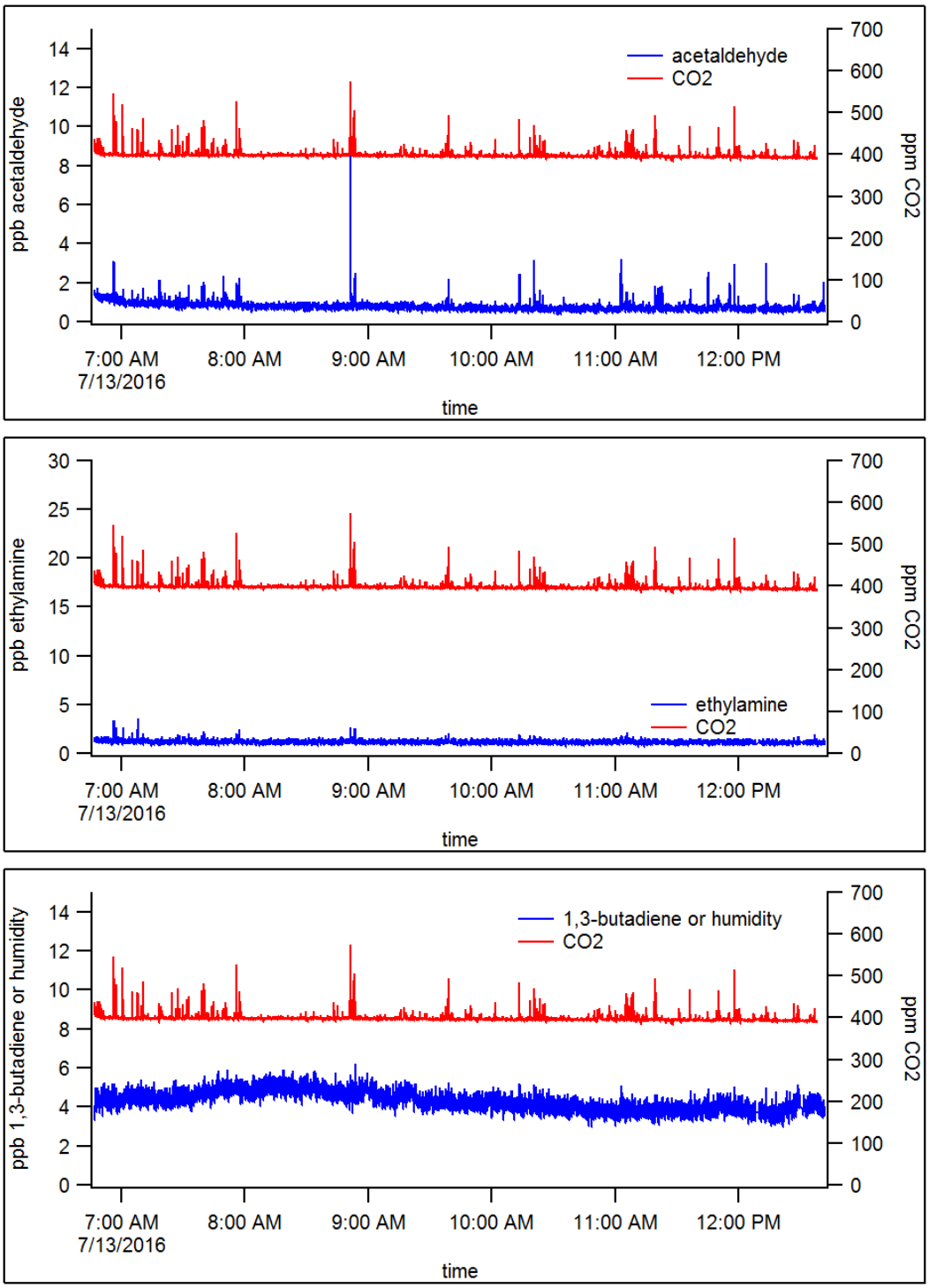


Figure B.4.2-3. July 13th - Propanenitrile (TOP), 1-Butanol; Butenes (MIDDLE), Methyl Isocyanate (BOTTOM)

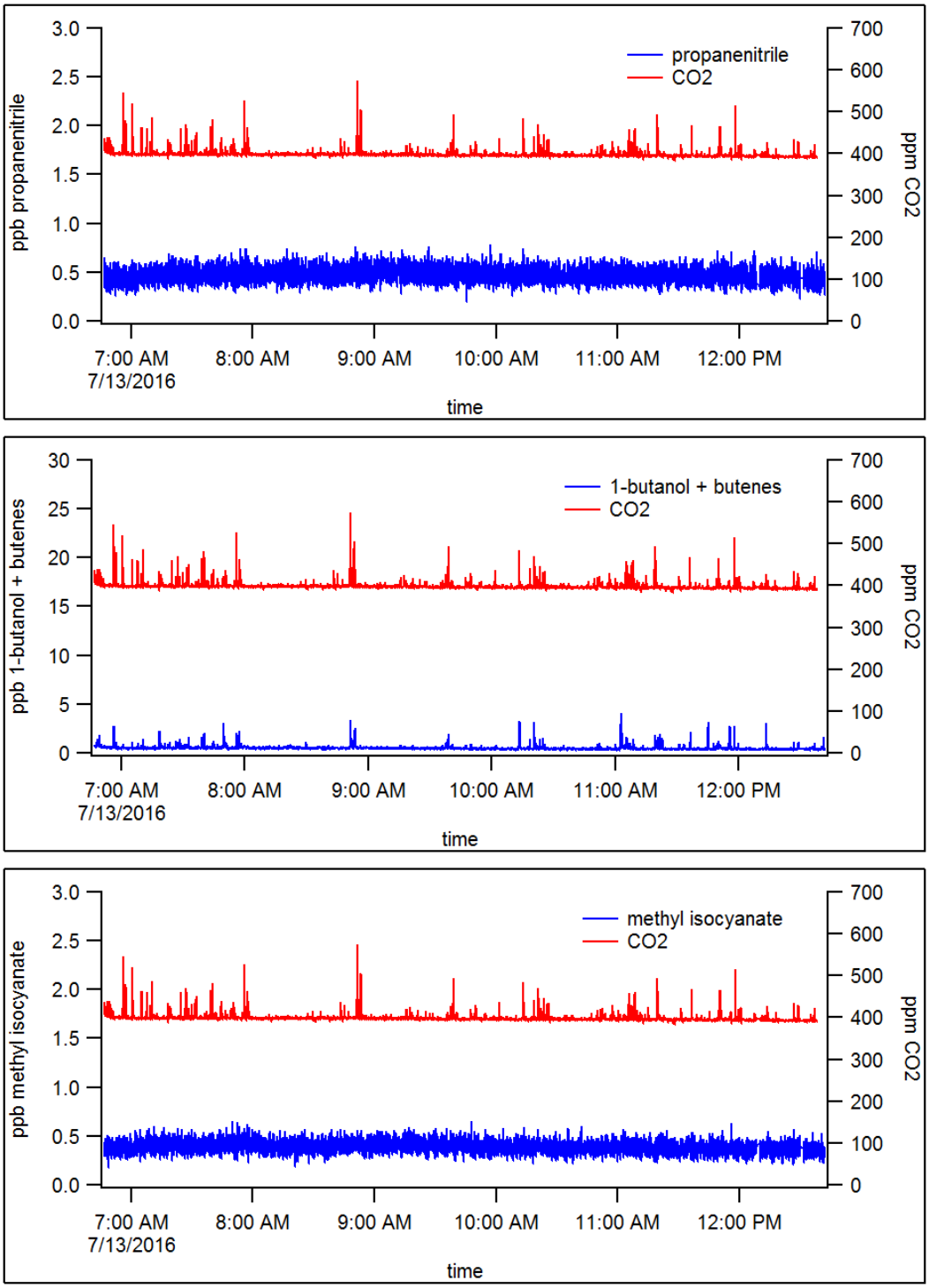


Figure B.4.2-4. July 13th - Methyl Nitrite (TOP), Furan; Isoprene (MIDDLE), Butanenitrile (BOTTOM)

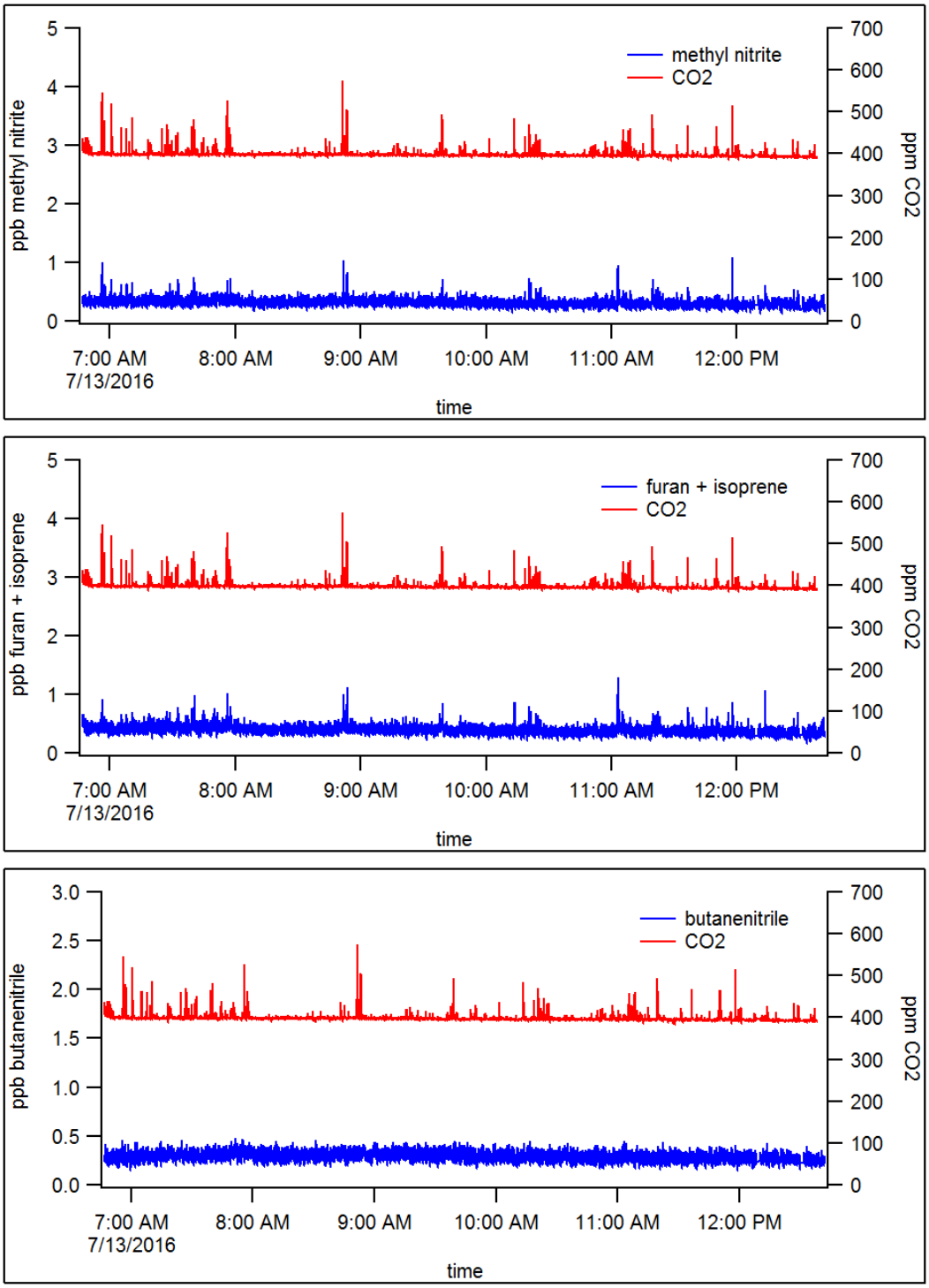


Figure B.4.2-5. July 13th - MVK + Dihydrofurans (TOP), Butanal (MIDDLE), N-nitrosodimethylamine [NDMA] (BOTTOM)

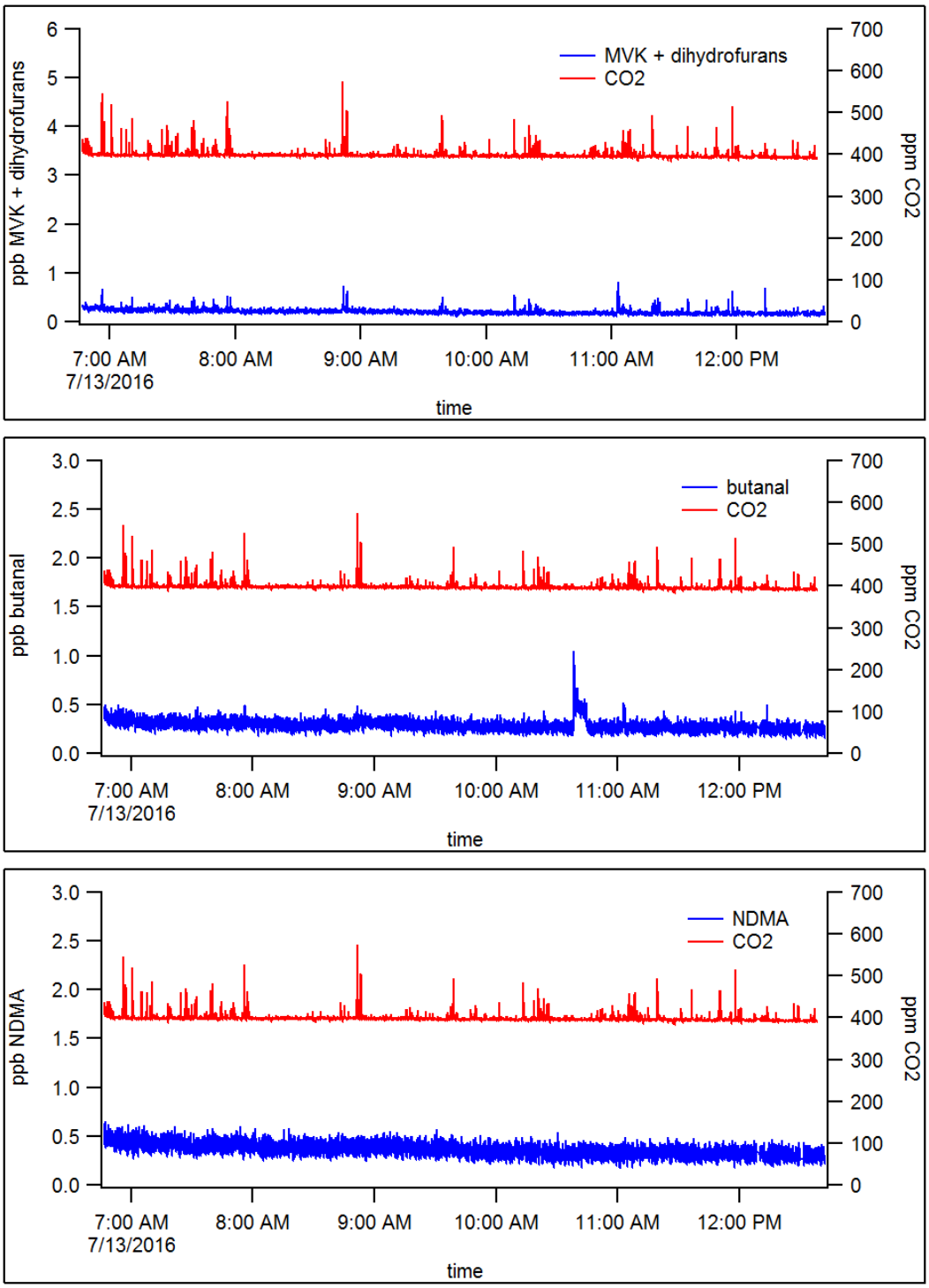


Figure B.4.2-6. July 13th - Benzene (TOP), 2,4-Pentadienenitrile; Pyridine (MIDDLE), 2-methylene Butanenitrile (BOTTOM)

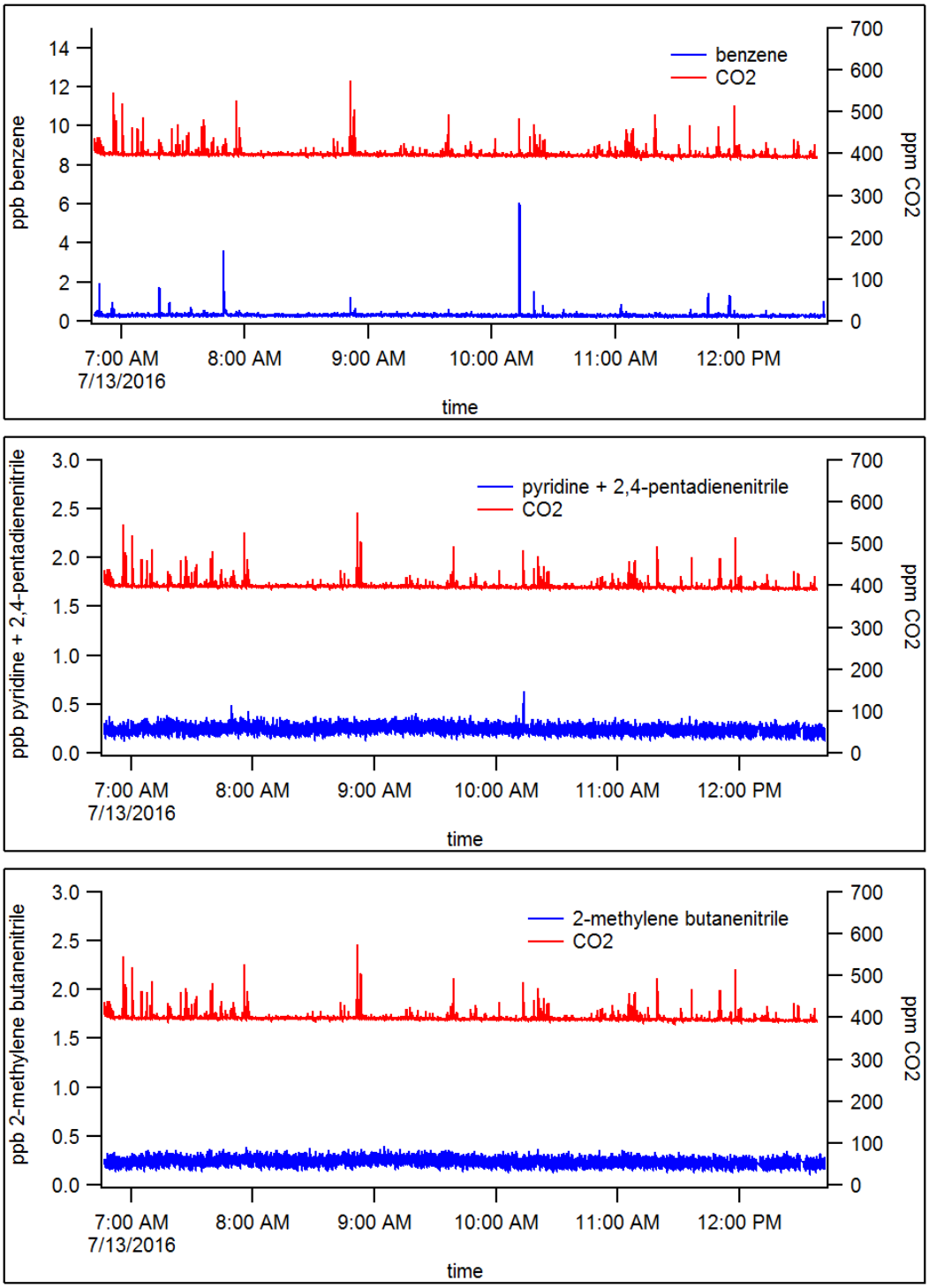


Figure B.4.2-7. July 13th - 2-methylfuran (TOP), Pentanenitrile (MIDDLE), 3-methyl-3-buten-2-one; 2-methyl-2-butenal (BOTTOM)

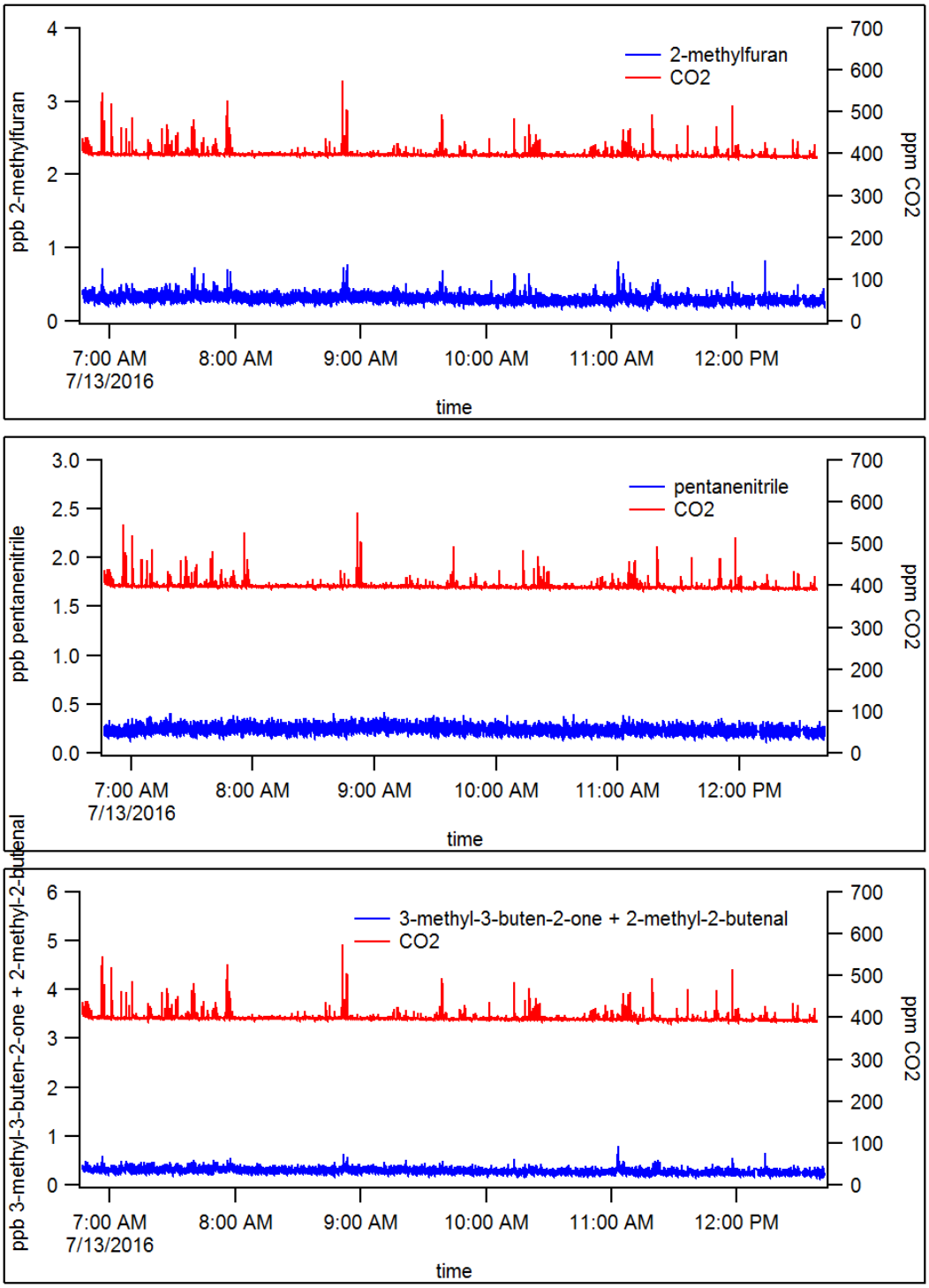


Figure B.4.2-8. July 13th - N-nitrosomethylethylamine [NEMA] (TOP), 2,5-dimethylfuran (MIDDLE), Hexanenitrile (BOTTOM)

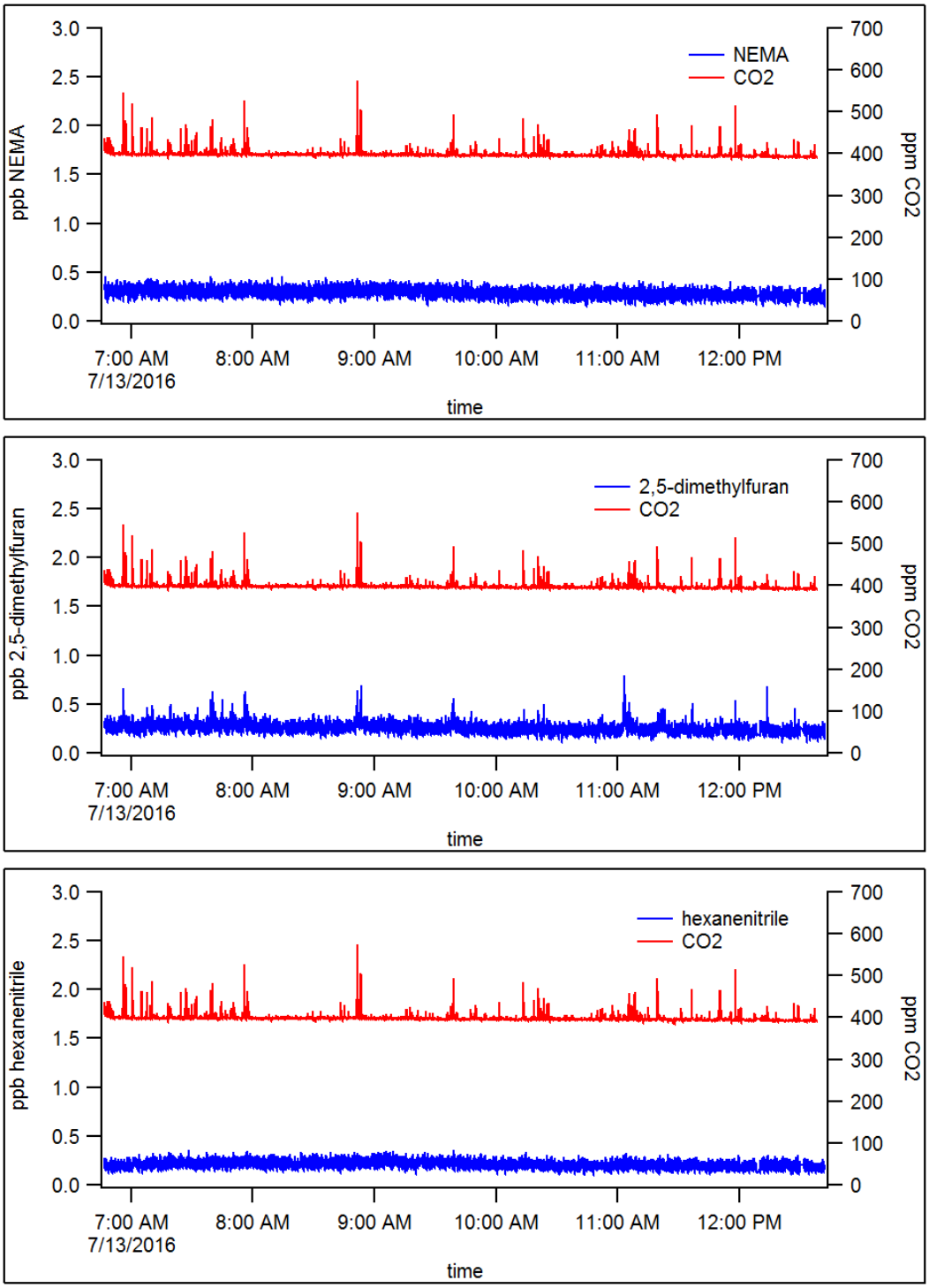


Figure B.4.2-9. July 13th - 2-hexanone [MBK] (TOP), N-nitrosodiethylamine [NDEA] (MIDDLE), Butyl Nitrite; 2-nitro-2-methylpropane (BOTTOM)

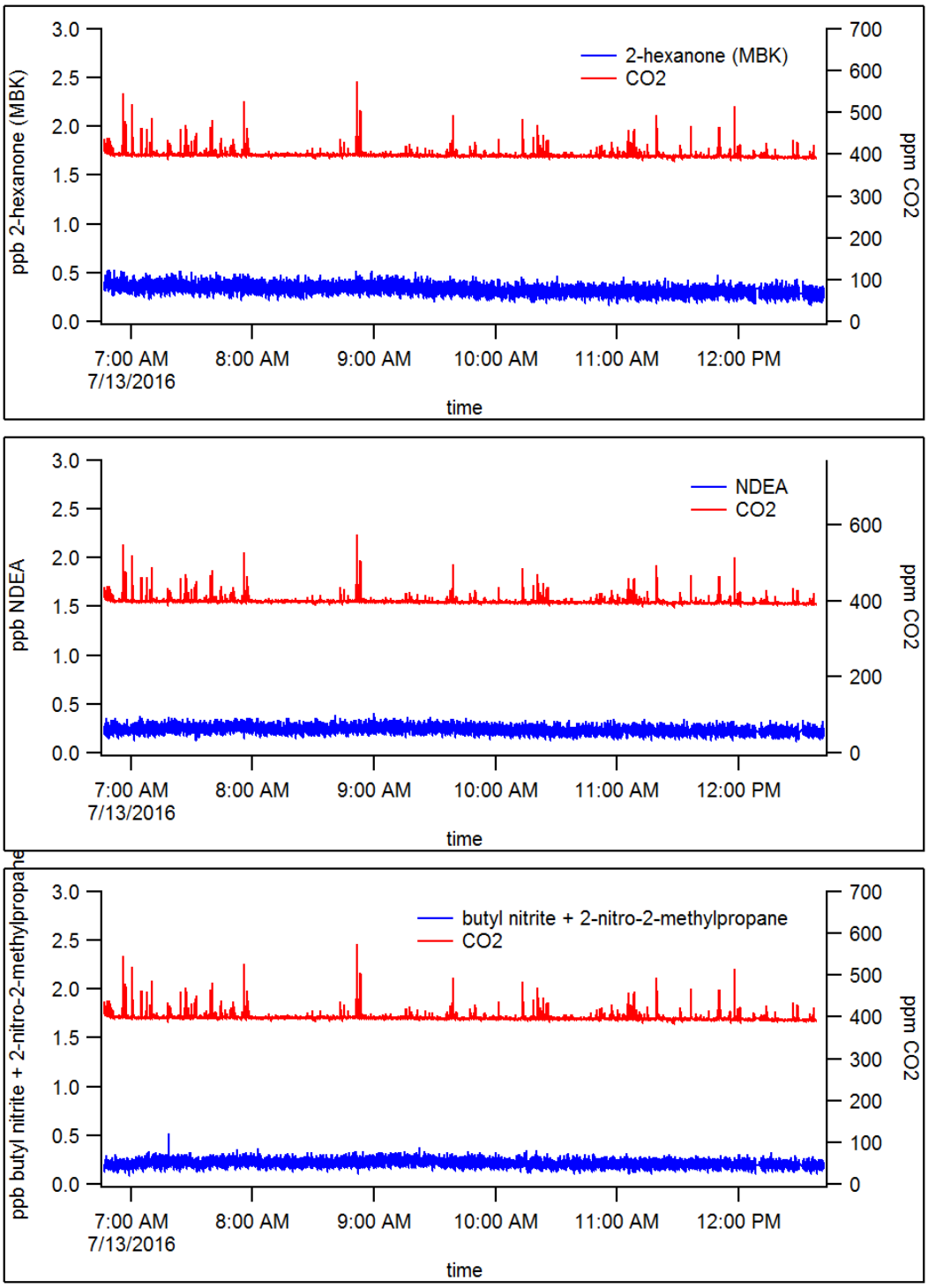


Figure B.4.2-10. July 13th - 2,4-dimethylpyridine (TOP), 2-ethyl-5-methylfuran (MIDDLE), Heptanenitrile (BOTTOM)

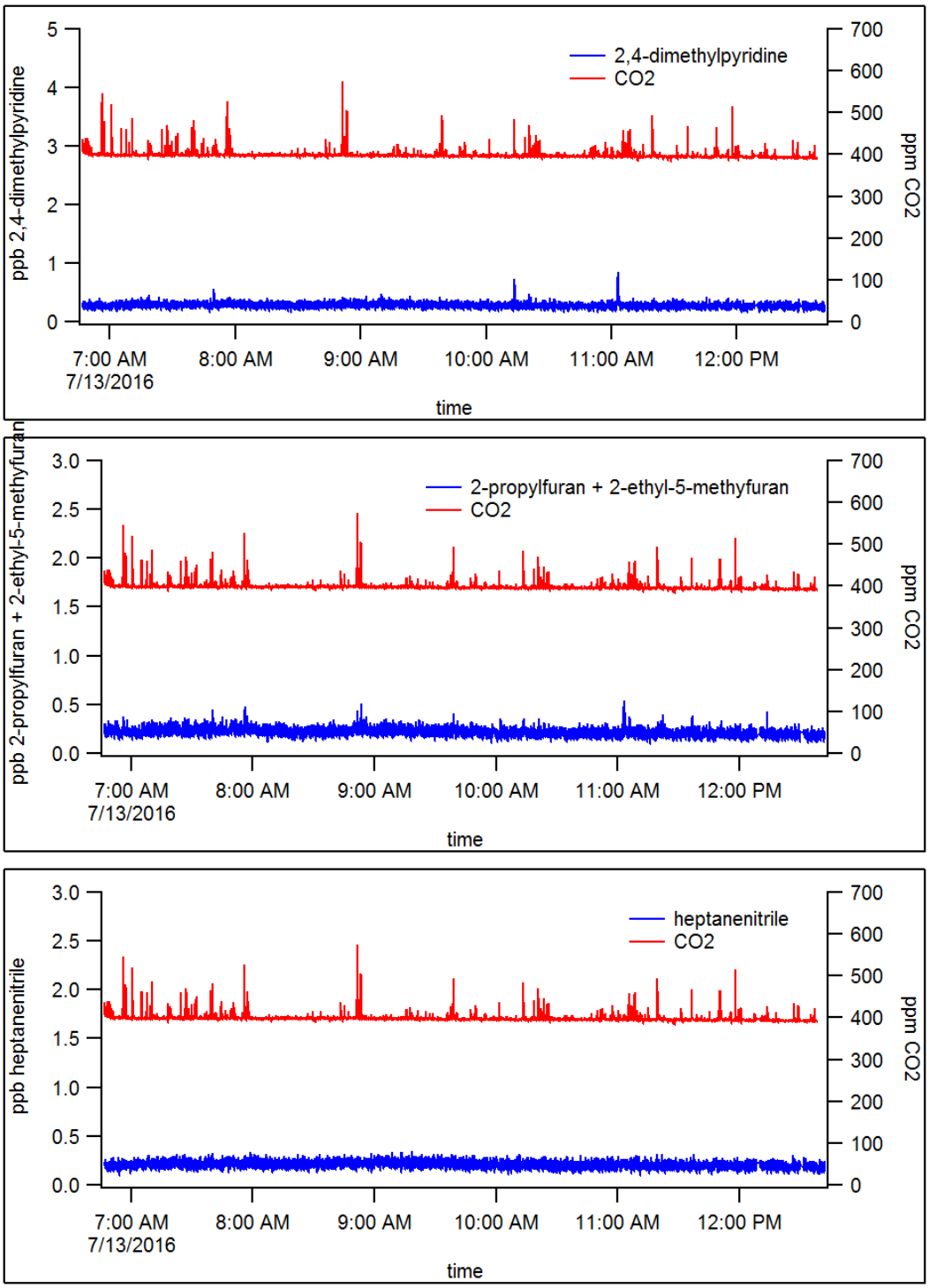


Figure B.4.2-11. July 13th - 4-methyl-2-hexanone (TOP), N-nitrosomorpholine [NMOR] (MIDDLE), Butyl Nitrate (BOTTOM)

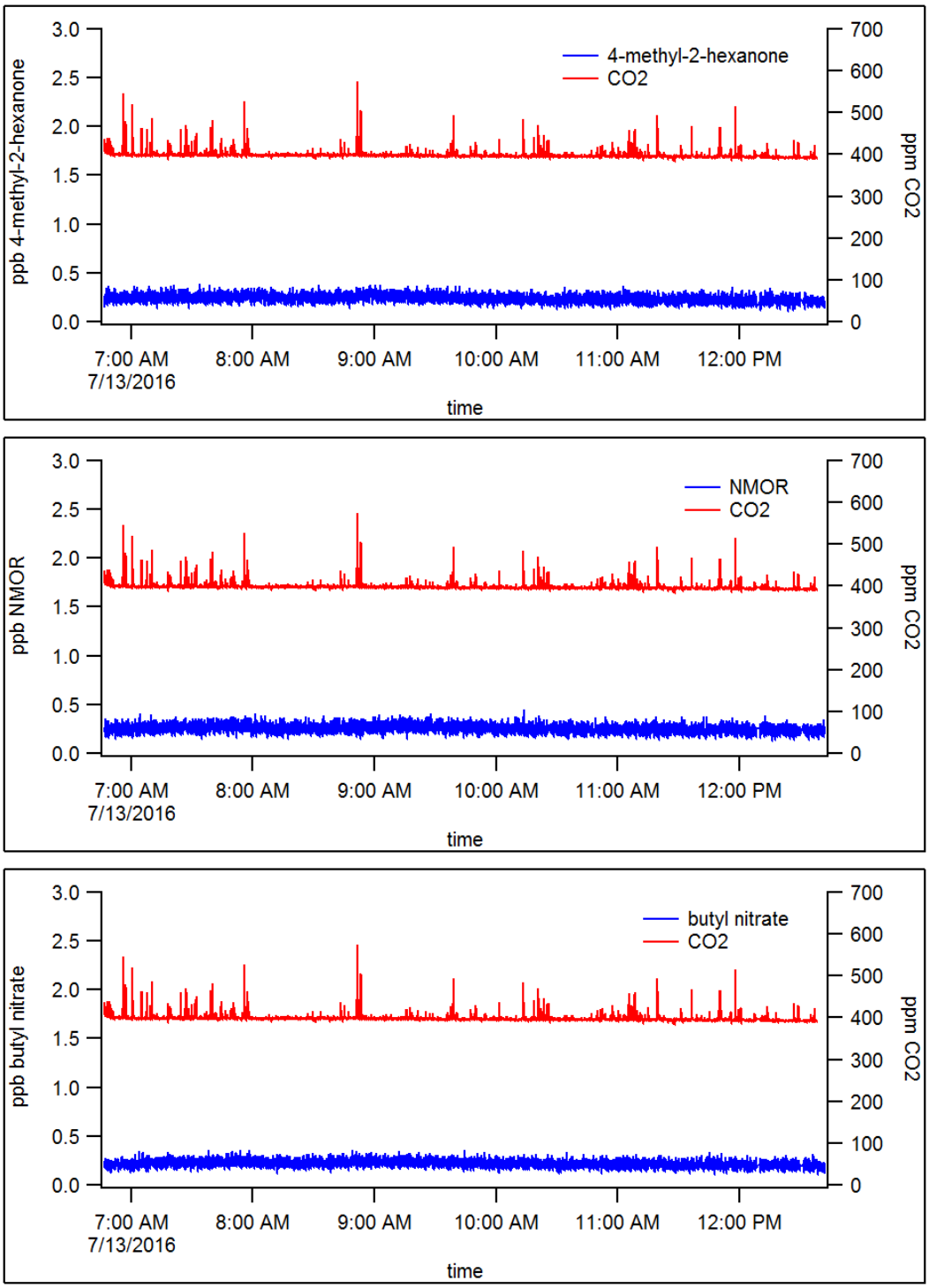


Figure B.4.2-12. July 13th - Multiple Furans [m/z 127] (TOP), 6-methyl-2-heptanone (MIDDLE), 2-pentylfuran (BOTTOM)

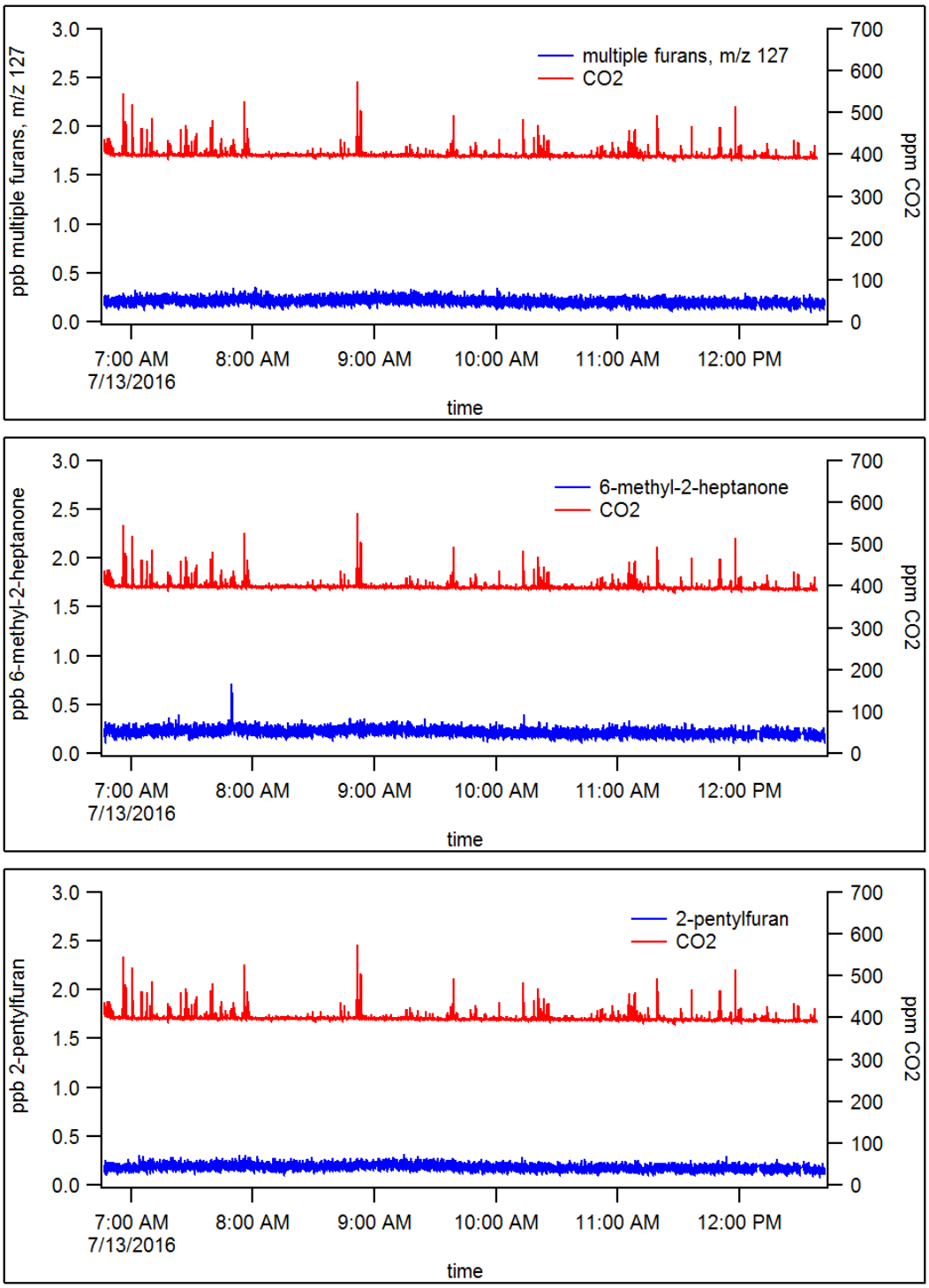


Figure B.4.2-13. July 13th - Biphenyl (TOP), 2-heptylfuran (MIDDLE), 2-octylfuran; 1,4-butanediol, Dinitrate (BOTTOM)

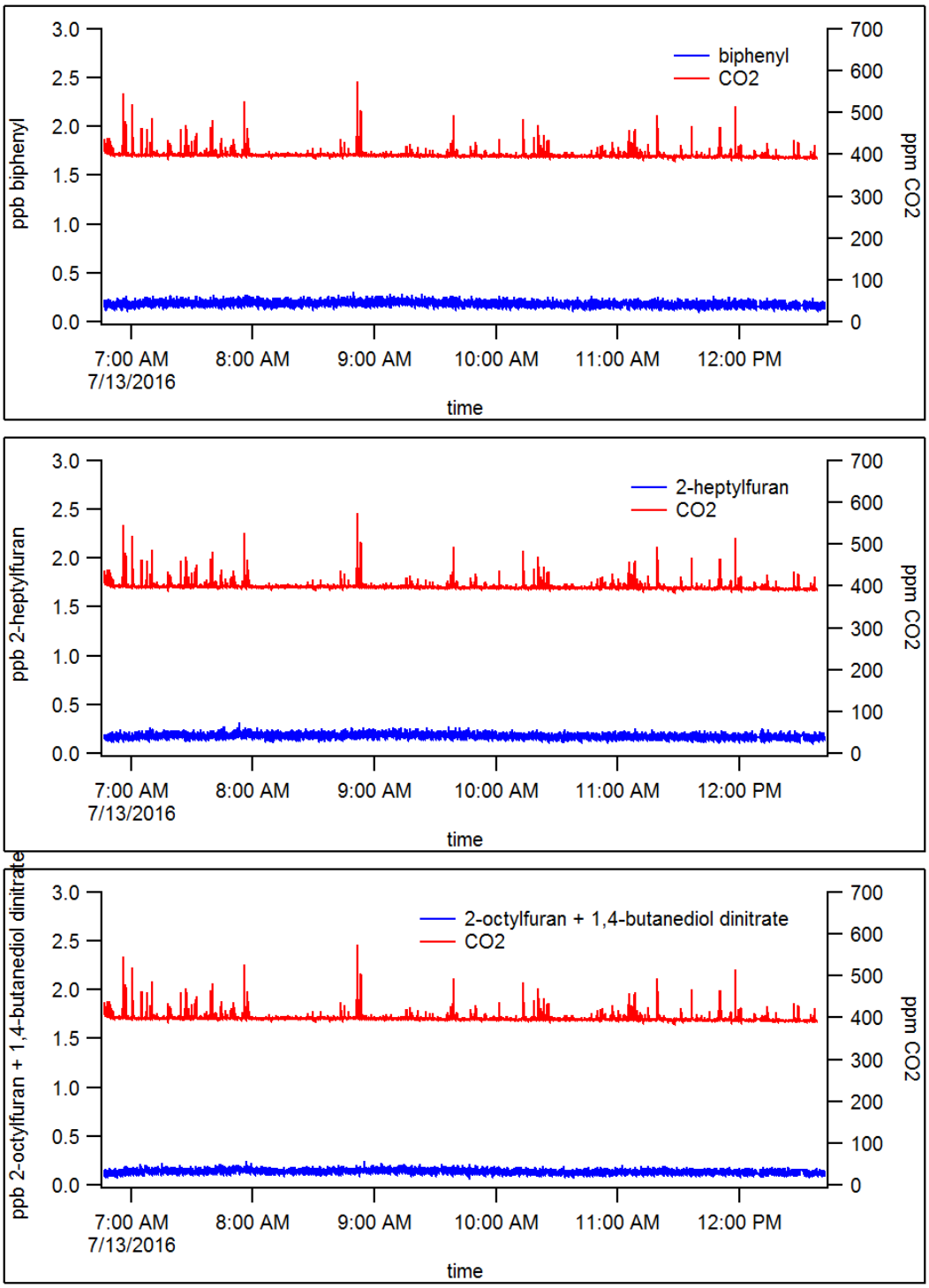


Figure B.4.2-14. July 13th - 1,2,3-propanetriol, 1,3-dinitrate (TOP), PCB (MIDDLE), 6-(2-furanyl)-6-methyl-2-heptanone (BOTTOM)

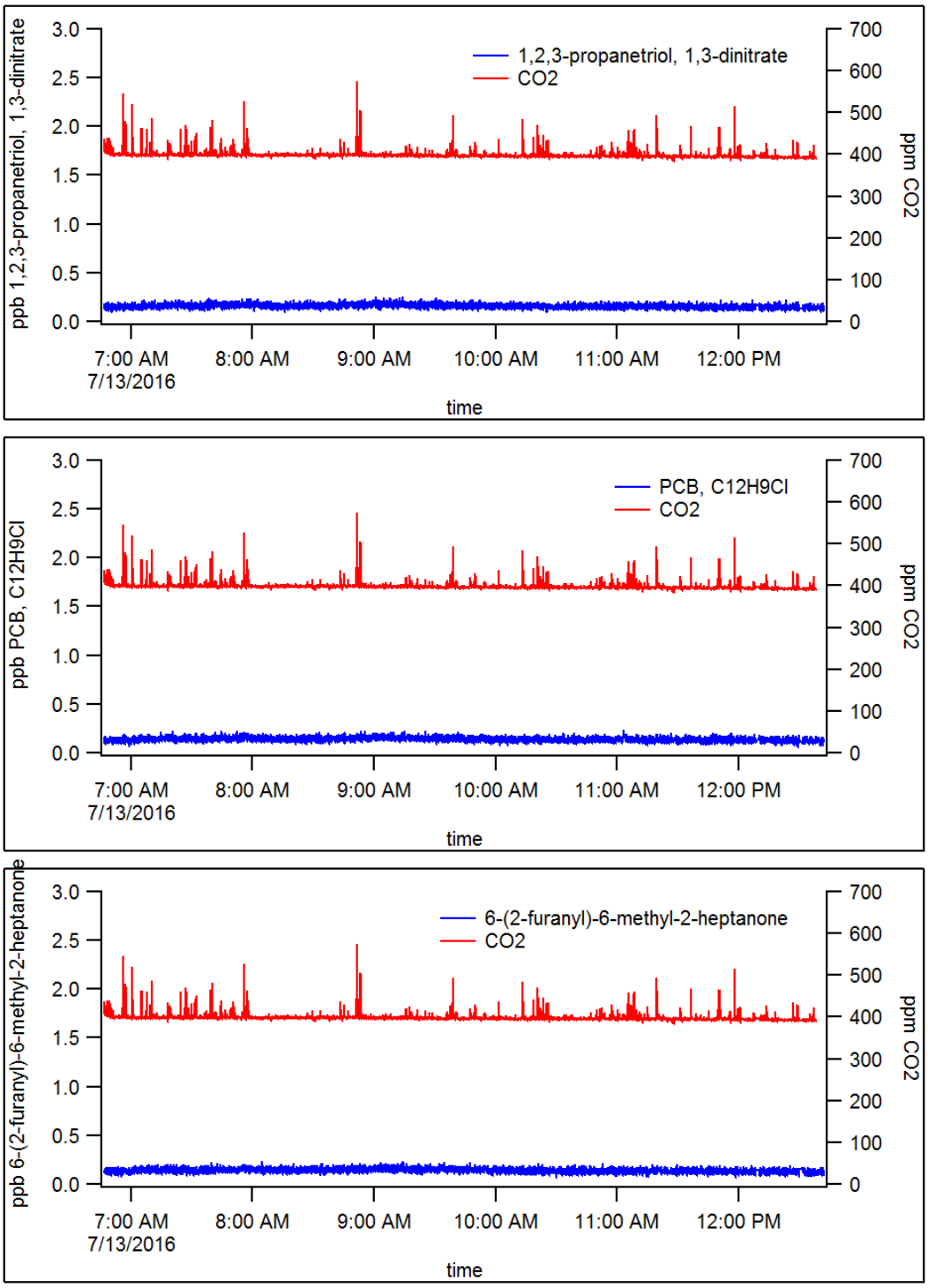
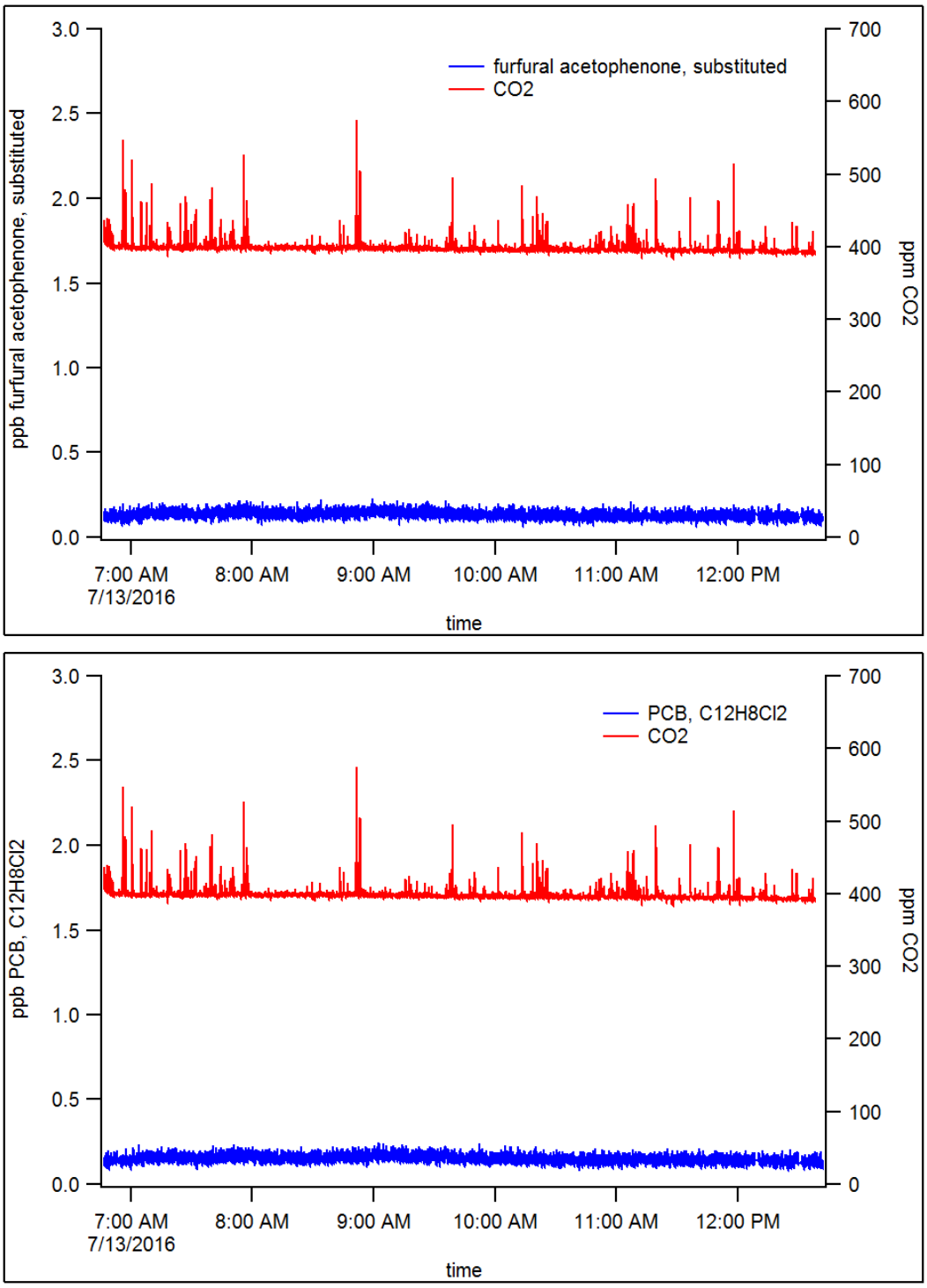


Figure B.4.2-15. July 13th - Furfural Acetophenone (3-(2-furanyl)-1-pheynyl-2-propen-1-one (TOP), PCB [2] (BOTTOM)



B.4.3 July 14th Data Collection

July 14th data collection started at 6:23 AM and ended at 11:48 AM. Data collection methods included both mobile and stationary lab techniques. Below are the graphs presented in order based on the Chemicals of Potential Concern (COPC) list.

Figure B.4.3-1. July 14th - Formaldehyde (TOP), Methanol (MIDDLE), Acetonitrile (BOTTOM)

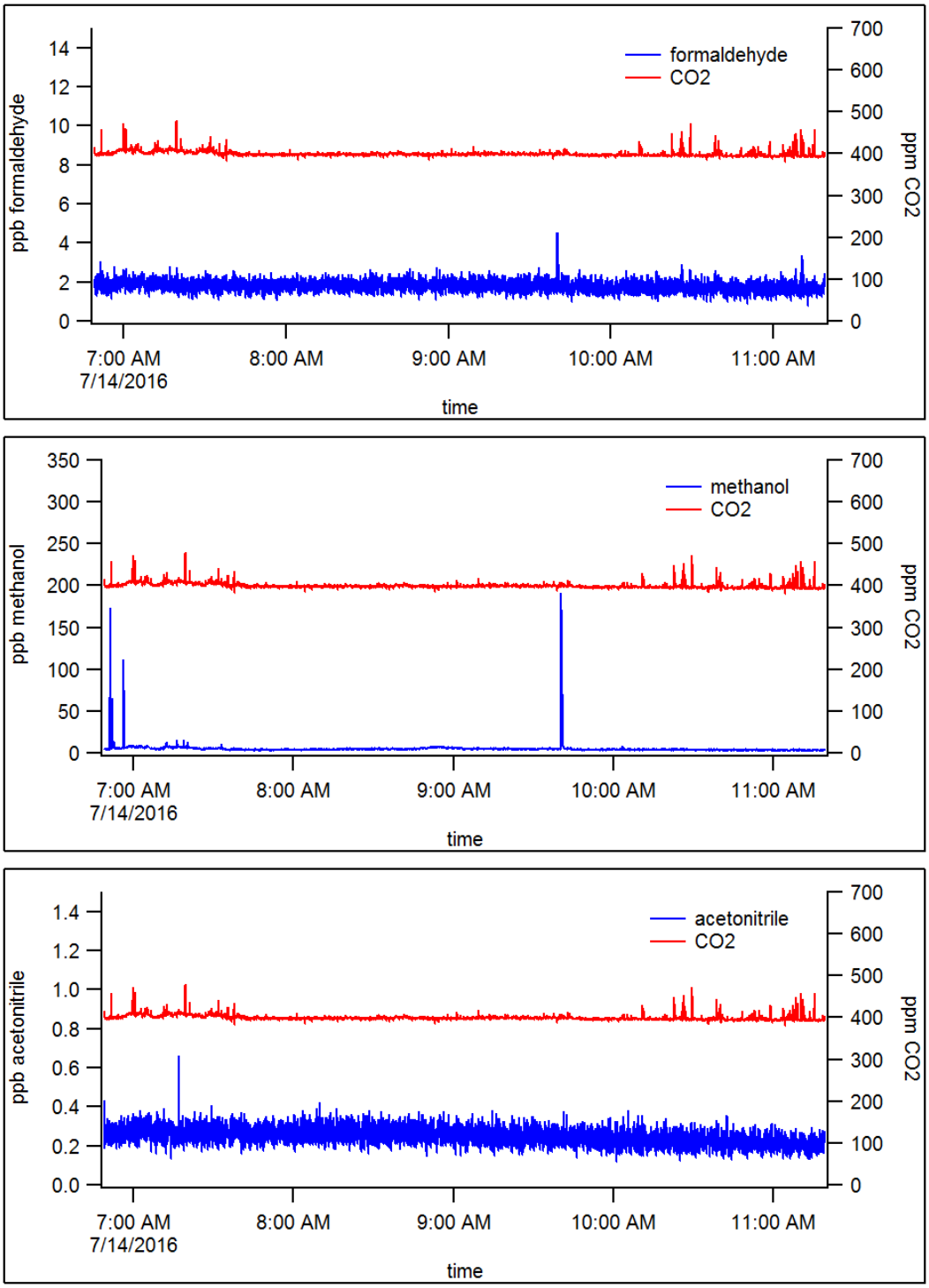


Figure B.4.3-2. July 14th - Acetaldehyde (TOP), Ethylamine (MIDDLE), 1,3-Butadiene (BOTTOM)

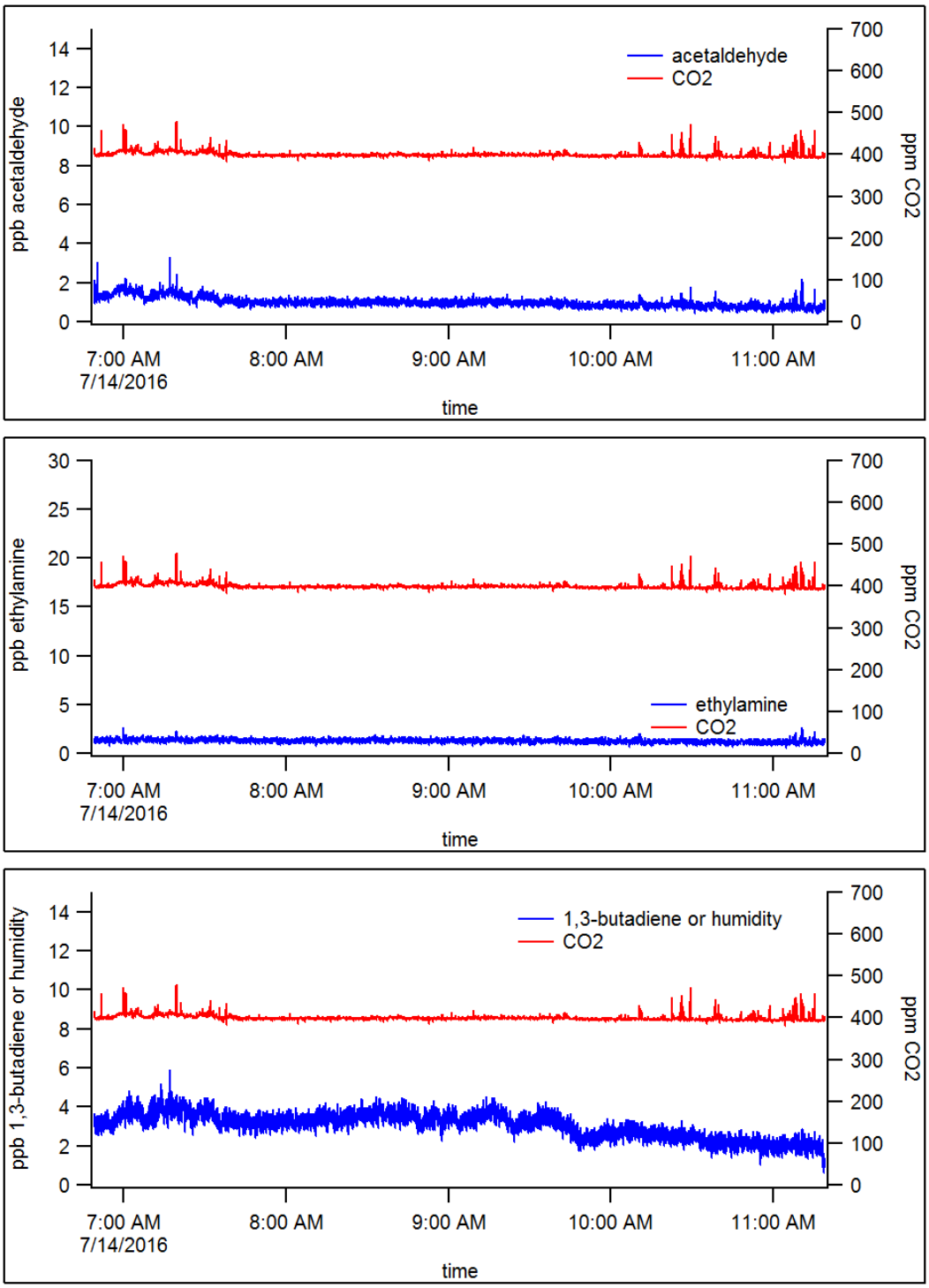


Figure B.4.3-3. July 14th - Propanenitrile (TOP), 1-Butanol; Butenes (MIDDLE), Methyl Isocyanate (BOTTOM)

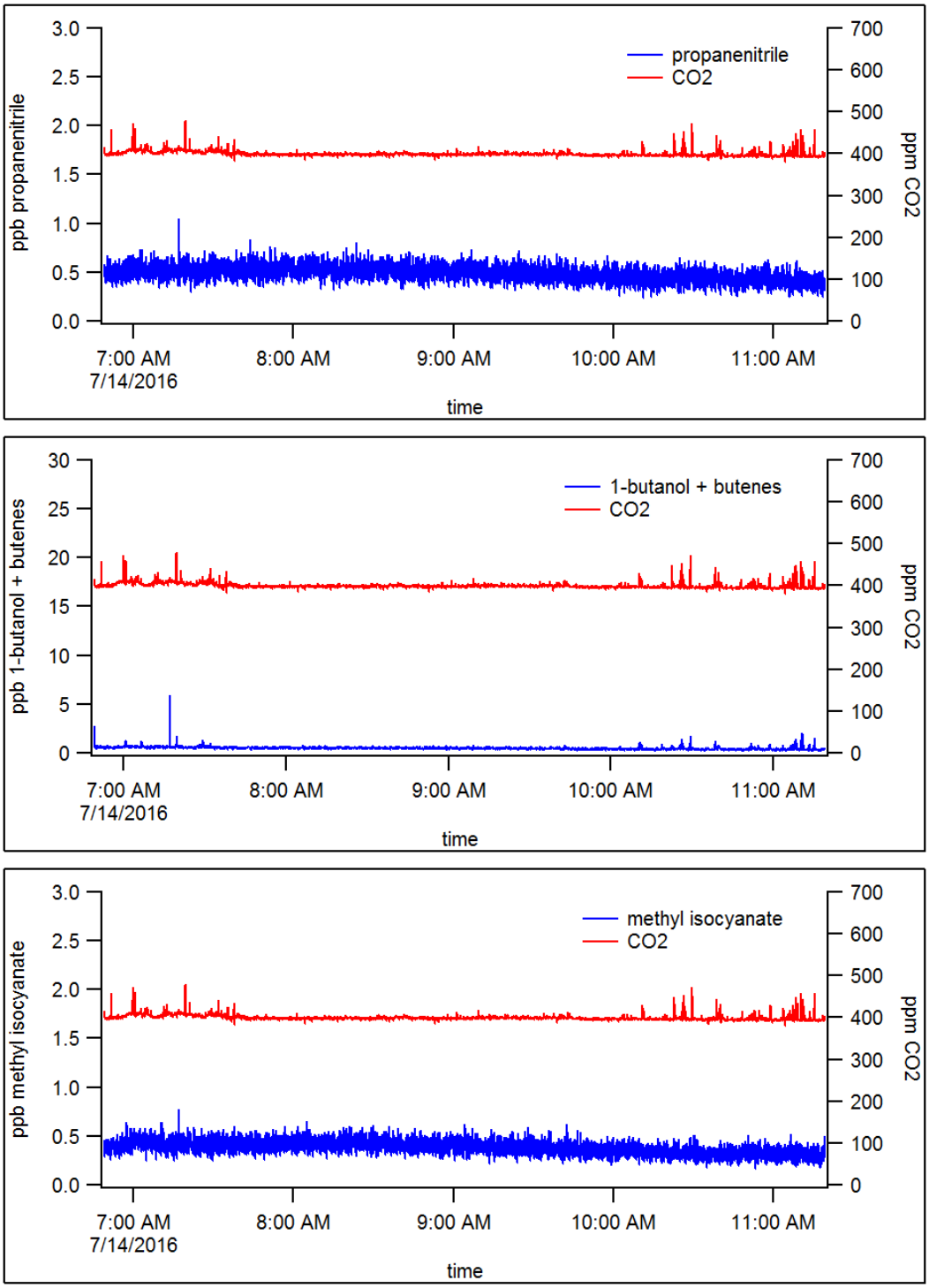


Figure B.4.3-4. July 14th - Methyl Nitrite (TOP), Furan; Isoprene (MIDDLE), Butanenitrile (BOTTOM)

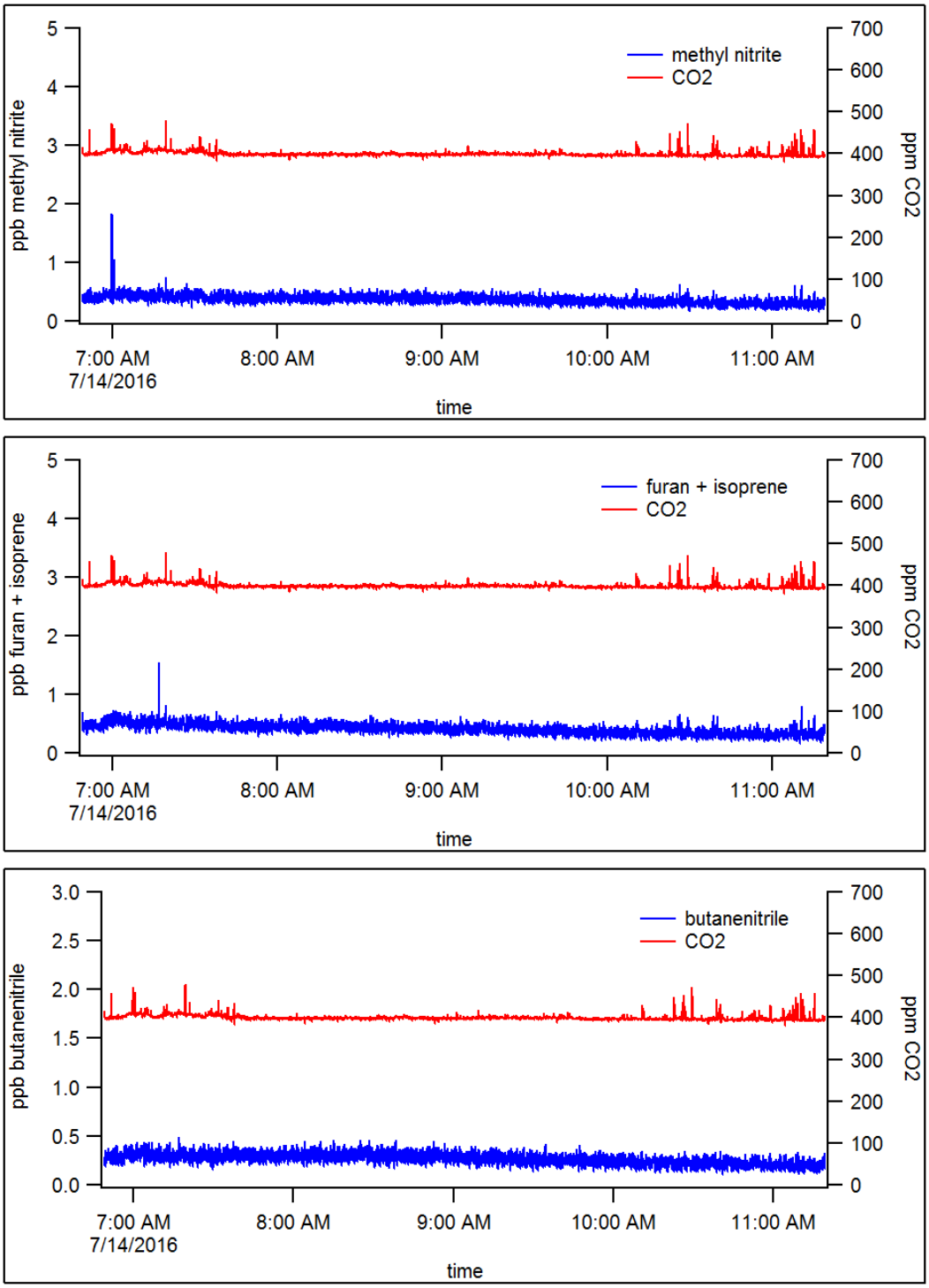


Figure B.4.3-5. July 14th - MVK + Dihydrofurans(TOP), Butanal (MIDDLE), N-nitrosodimethylamine [NDMA] (BOTTOM)

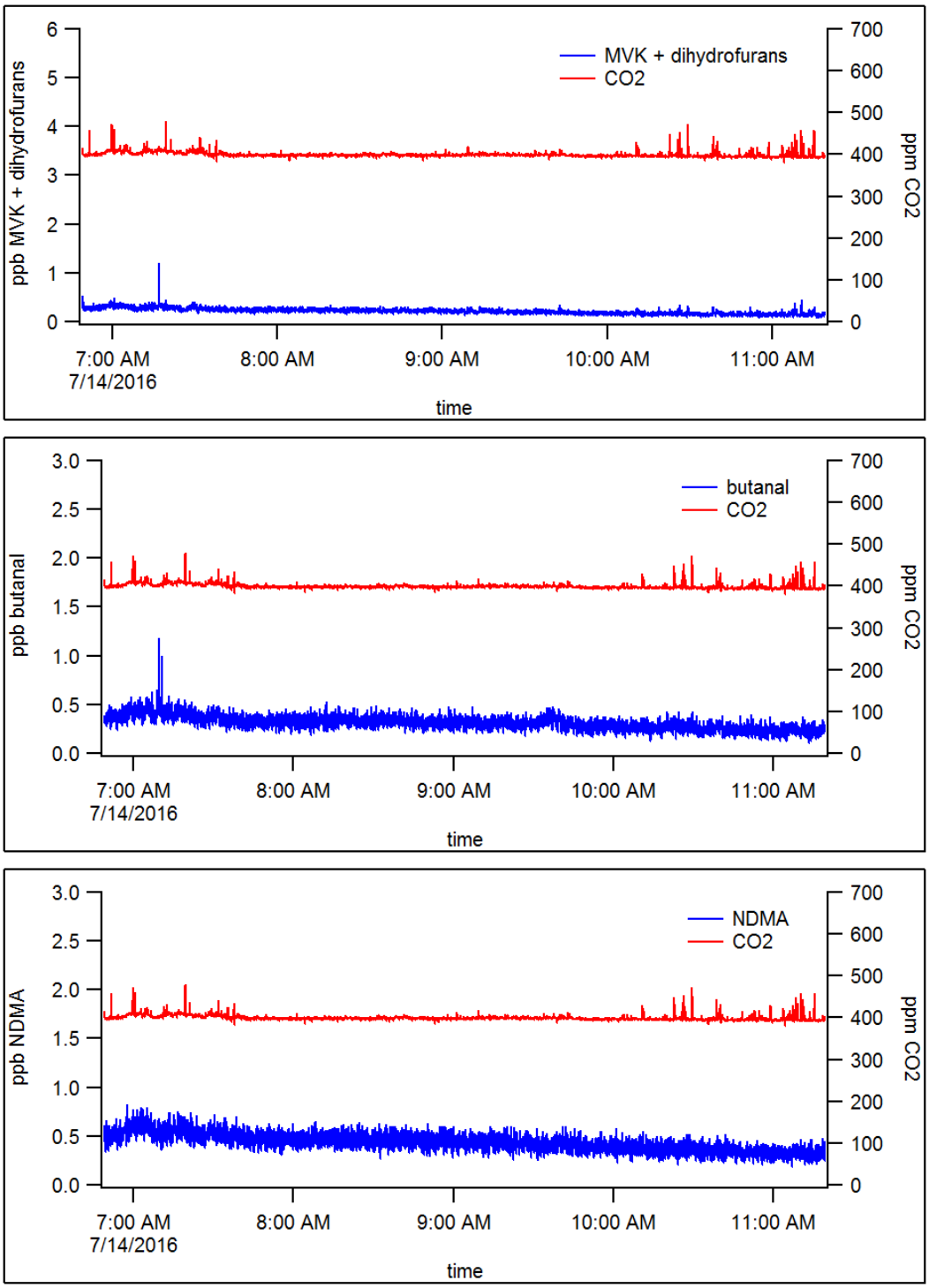


Figure B.4.3-6. July 14th - Benzene (TOP), 2,4-Pentadienenitrile; Pyridine (MIDDLE), 2-methylene Butanenitrile (BOTTOM)

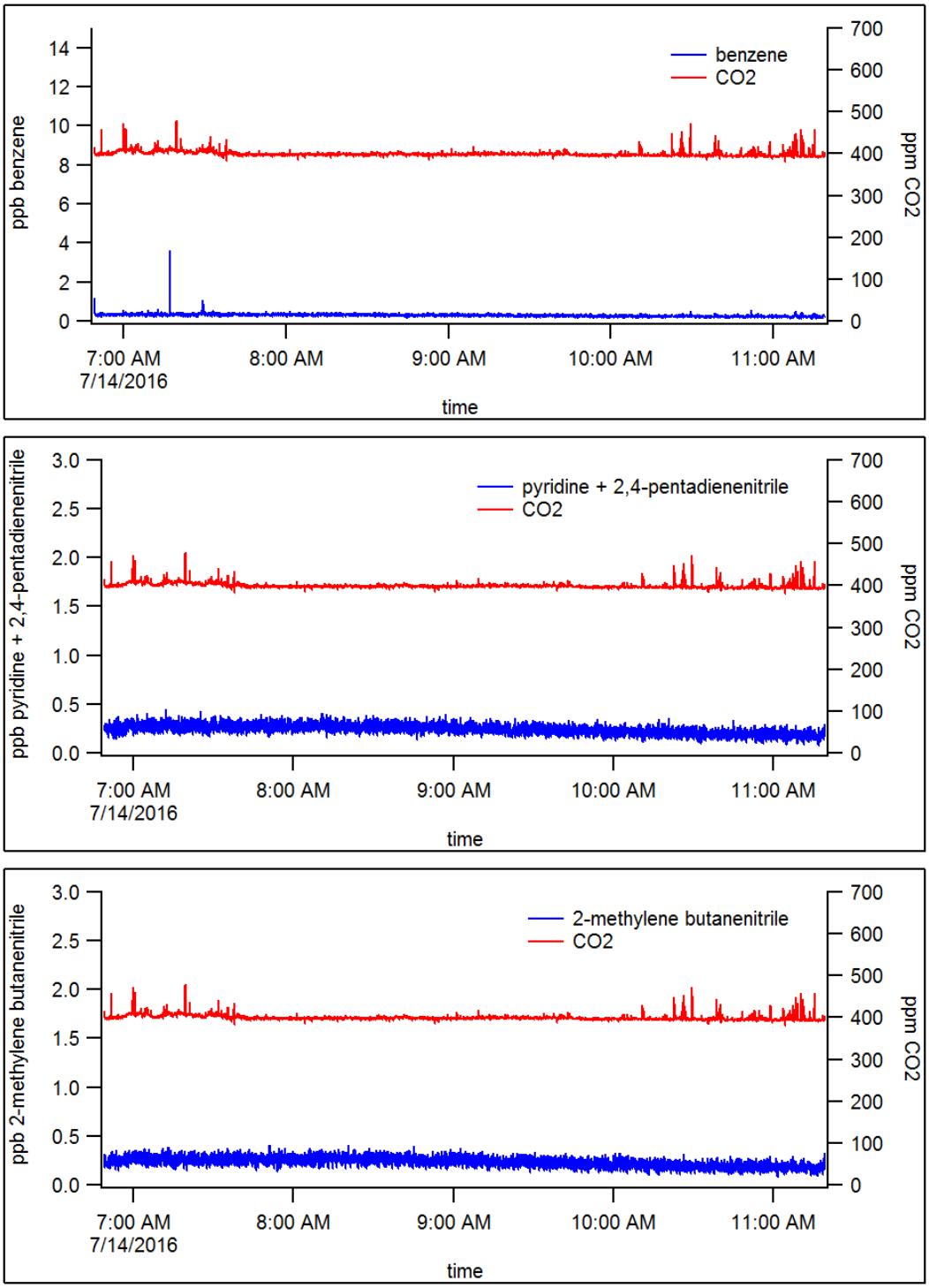


Figure B.4.3-7. July 14th - 2-methylfuran (TOP), Pentanenitrile (MIDDLE), 3-methyl-3-buten-2-one; 2-methyl-2-butenal (BOTTOM)

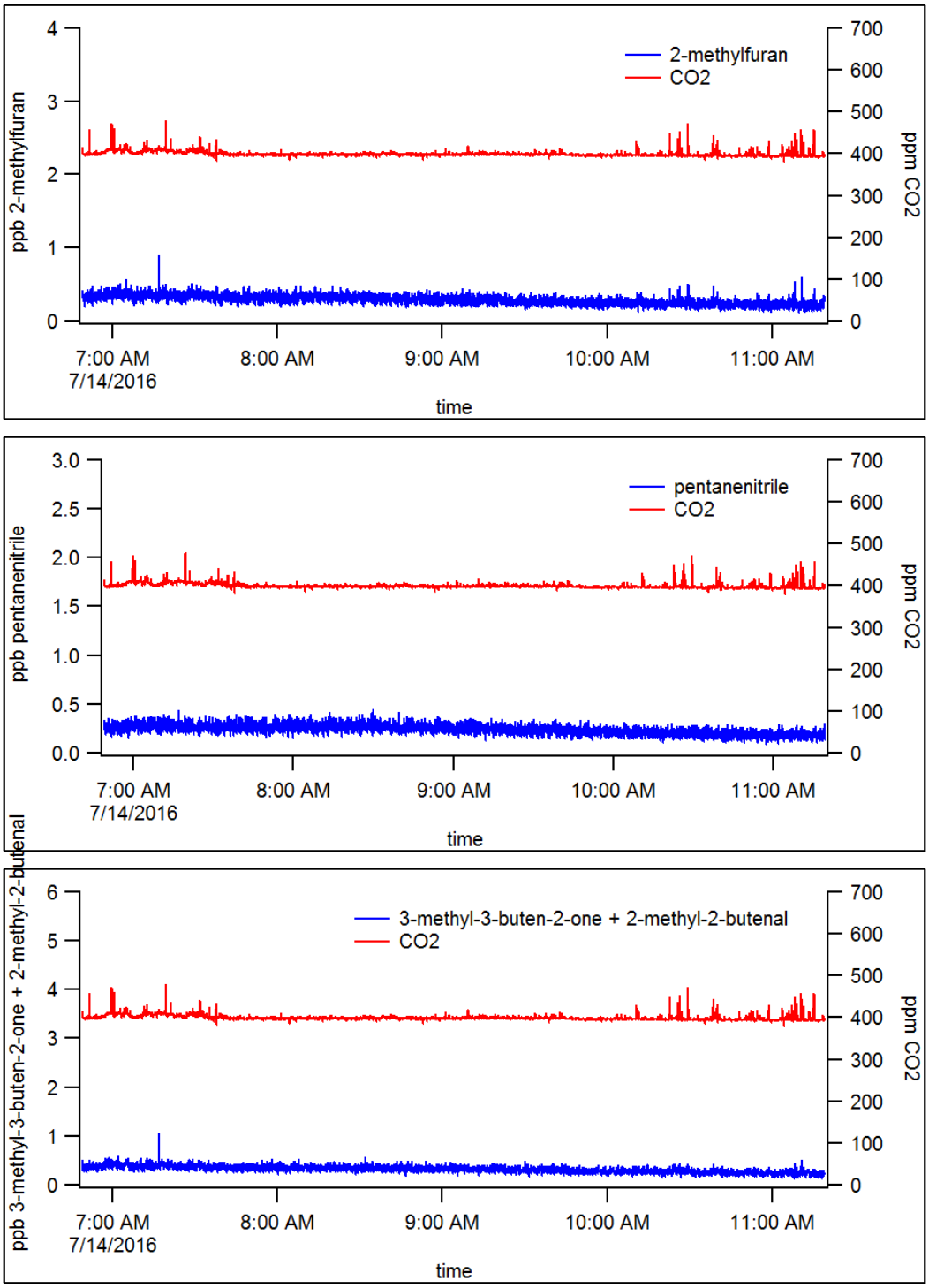


Figure B.4.3-8. July 14th - N-nitrosomethylethylamine [NEMA] (TOP), 2,5-dimethylfuran (MIDDLE), Hexanenitrile (BOTTOM)

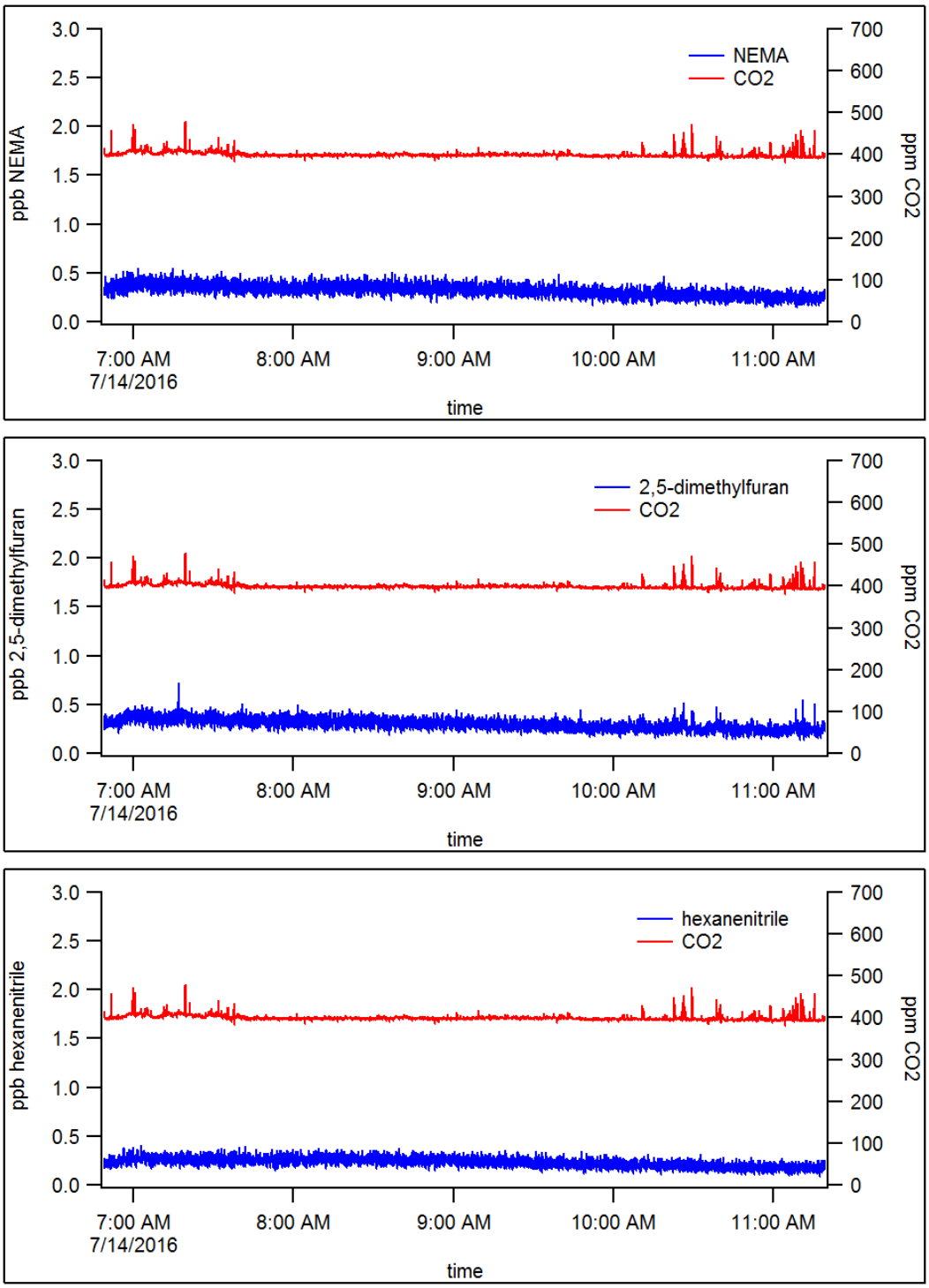


Figure B.4.3-9. July 14th - 2-hexanone [MBK] (TOP), N-nitrosodiethylamine [NDEA] (MIDDLE), Butyl Nitrite; 2-nitro-2-methylpropane (BOTTOM)

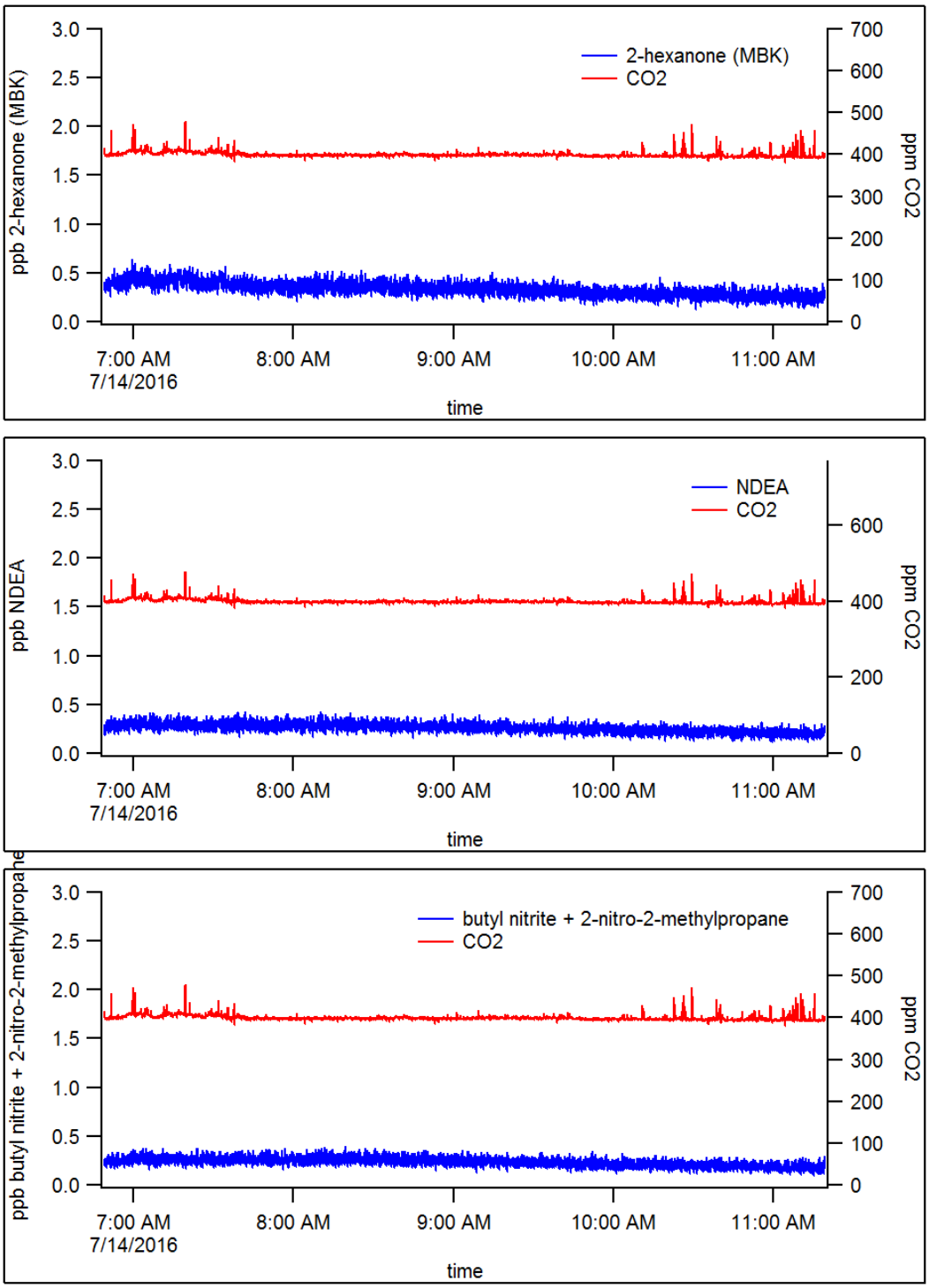


Figure B.4.3-10. July 14th - 2,4-dimethylpyridine (TOP), 2-ethyl-5-methylfuran (MIDDLE), Heptanenitrile (BOTTOM)

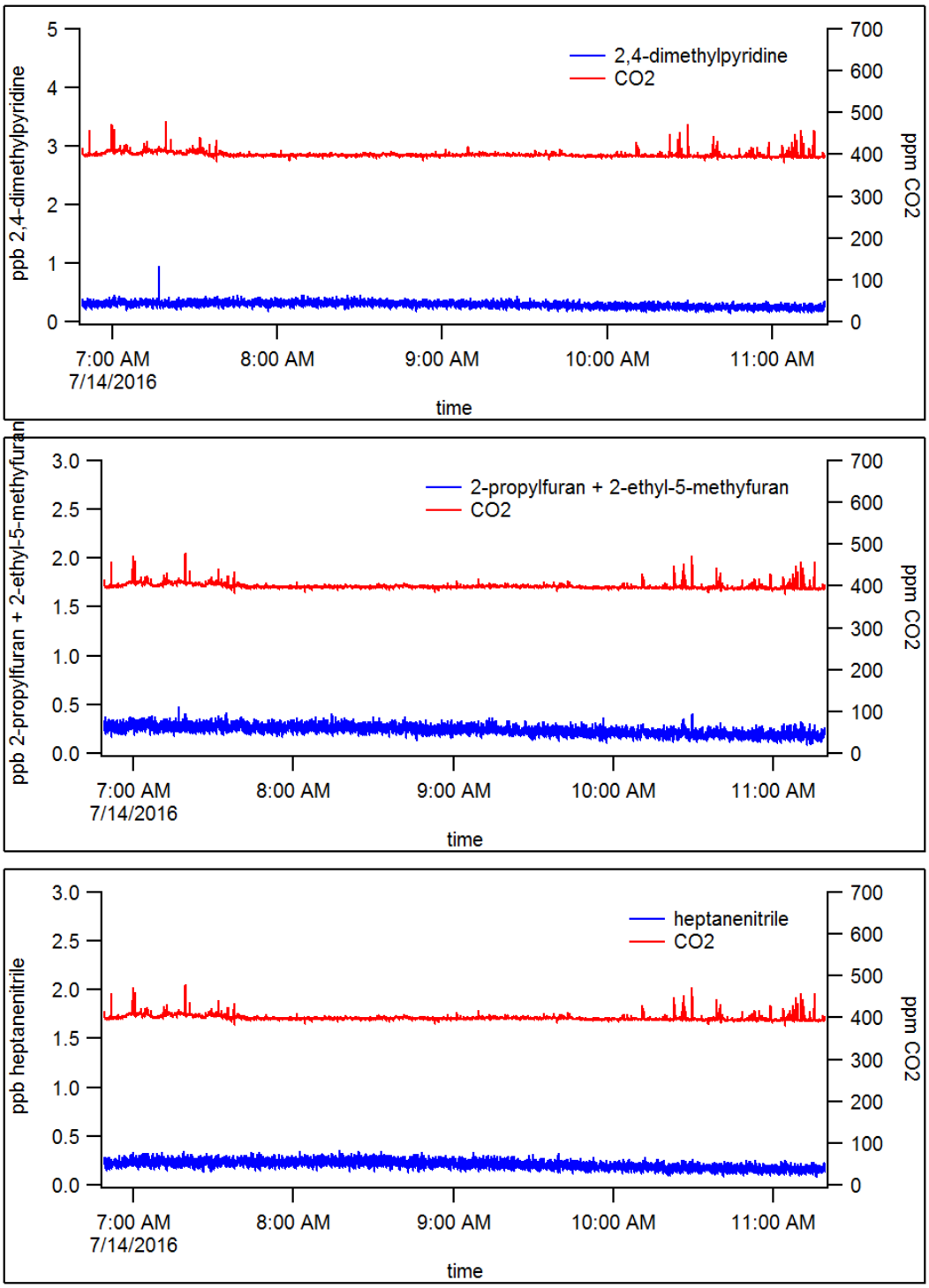


Figure B.4.3-11. July 14th - 4-methyl-2-hexanone (TOP), N-nitrosomorpholine [NMOR] (MIDDLE), Butyl Nitrate (BOTTOM)

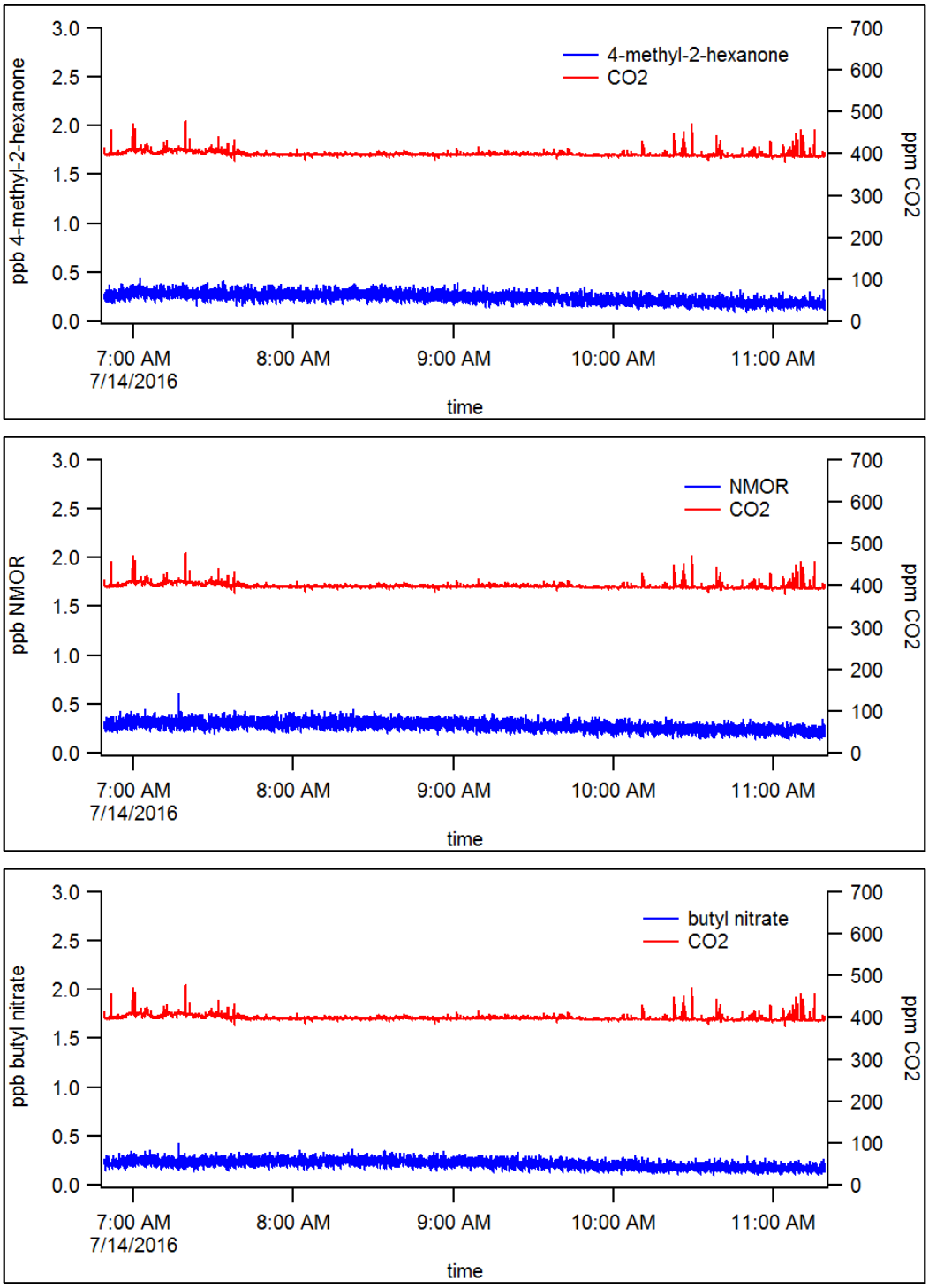


Figure B.4.3-12. July 14th - Multiple Furans [m/z 127] (TOP), 6-methyl-2-heptanone (MIDDLE), 2-pentylfuran (BOTTOM)

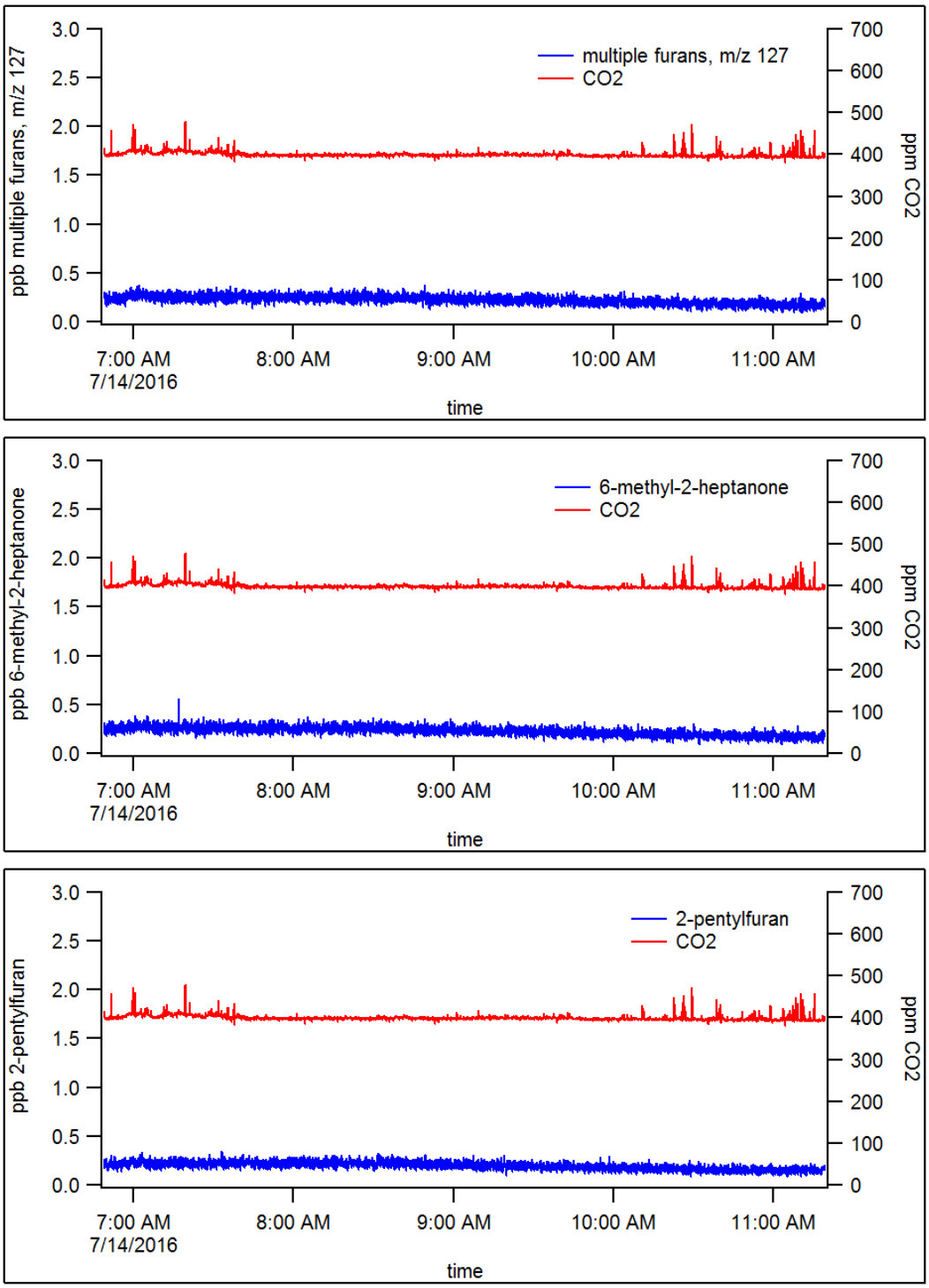


Figure B.4.3-13. July 14th - Biphenyl (TOP), 2-heptylfuran (MIDDLE), 2-octylfuran; 1,4-butanediol, Dinitrate (BOTTOM)

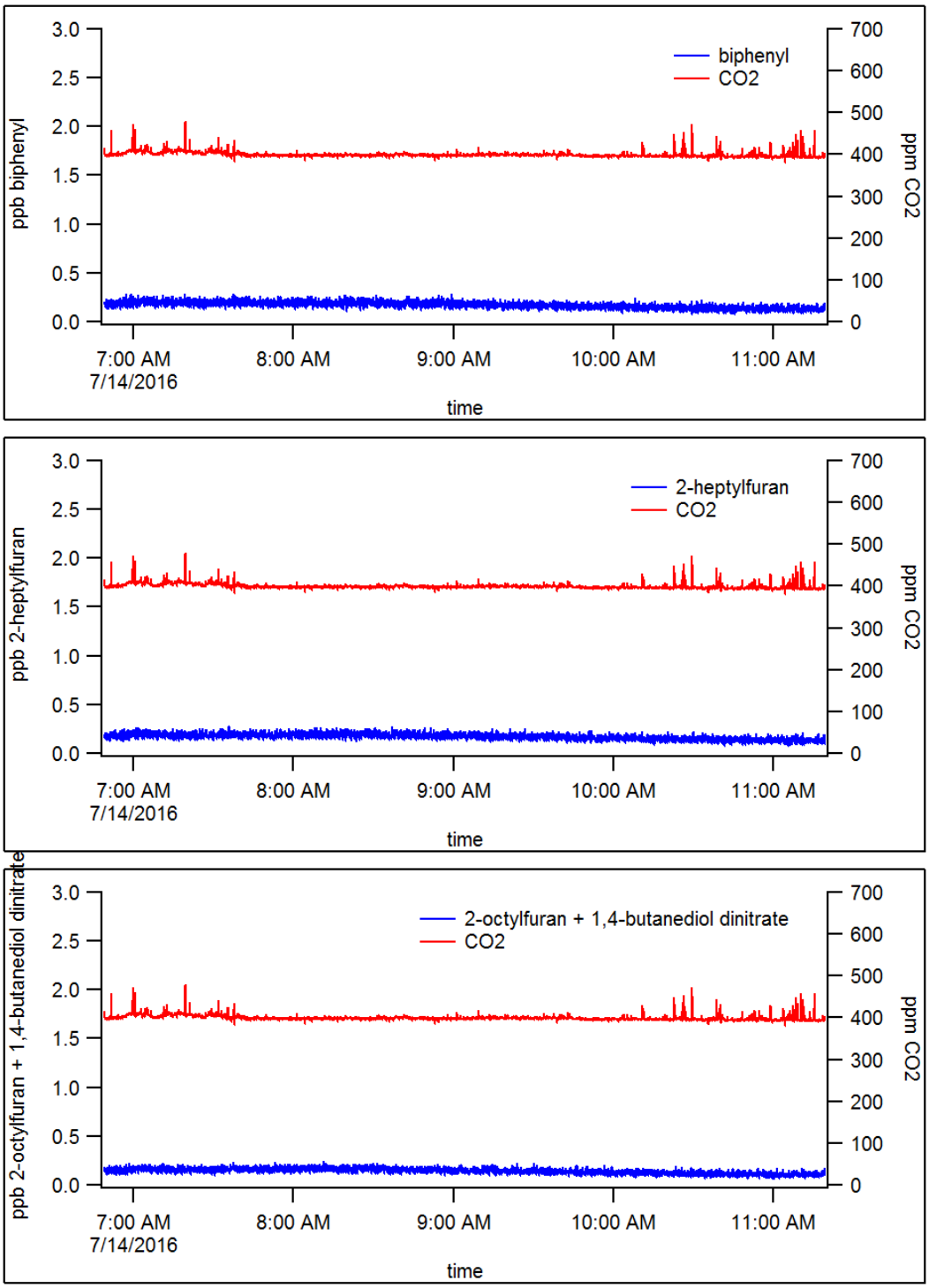


Figure B.4.3-14. July 14th - 1,2,3-propanetriol, 1,3-dinitrate (TOP), PCB (MIDDLE), 6-(2-furanyl)-6-methyl-2-heptanone (BOTTOM)

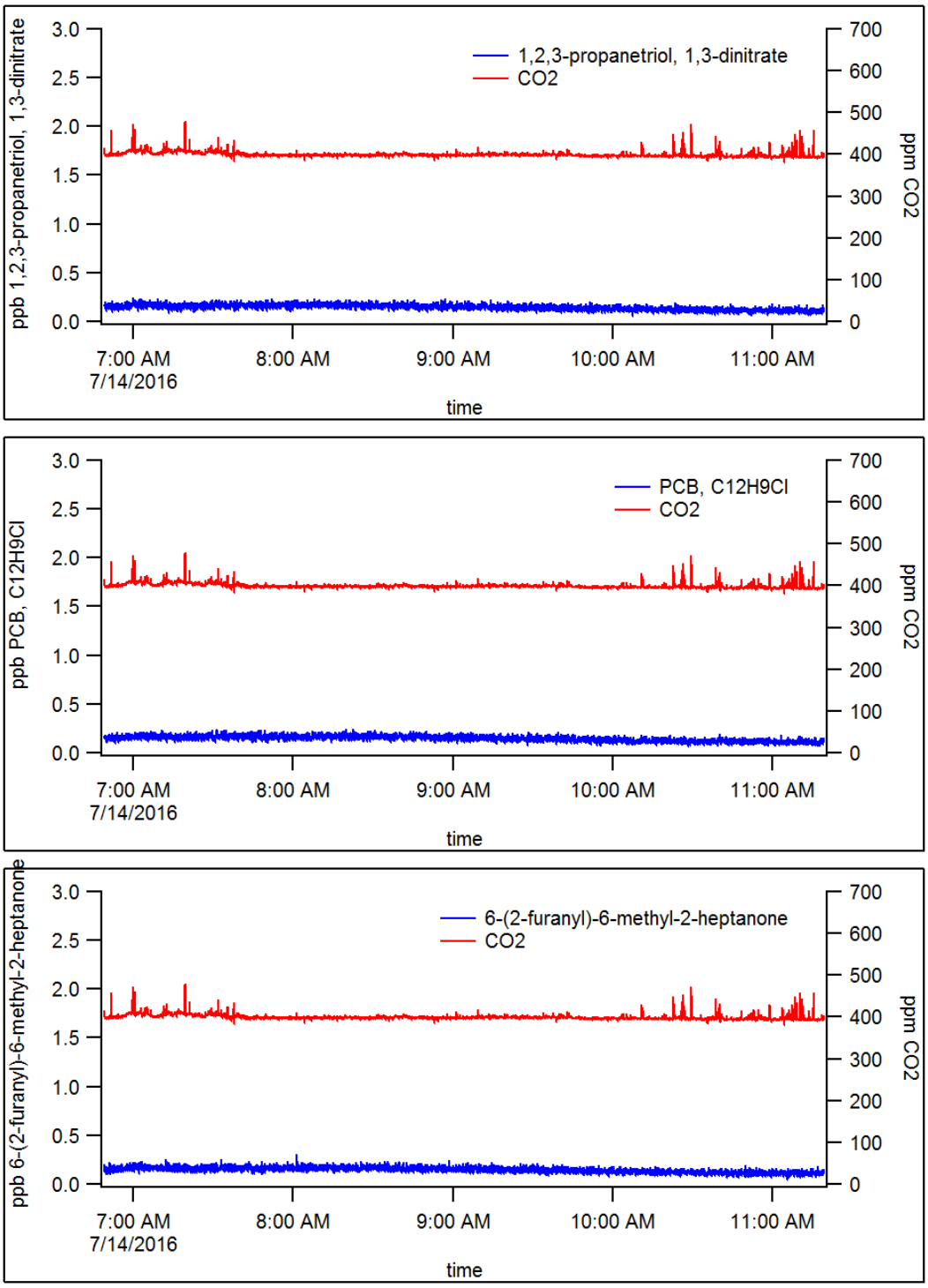
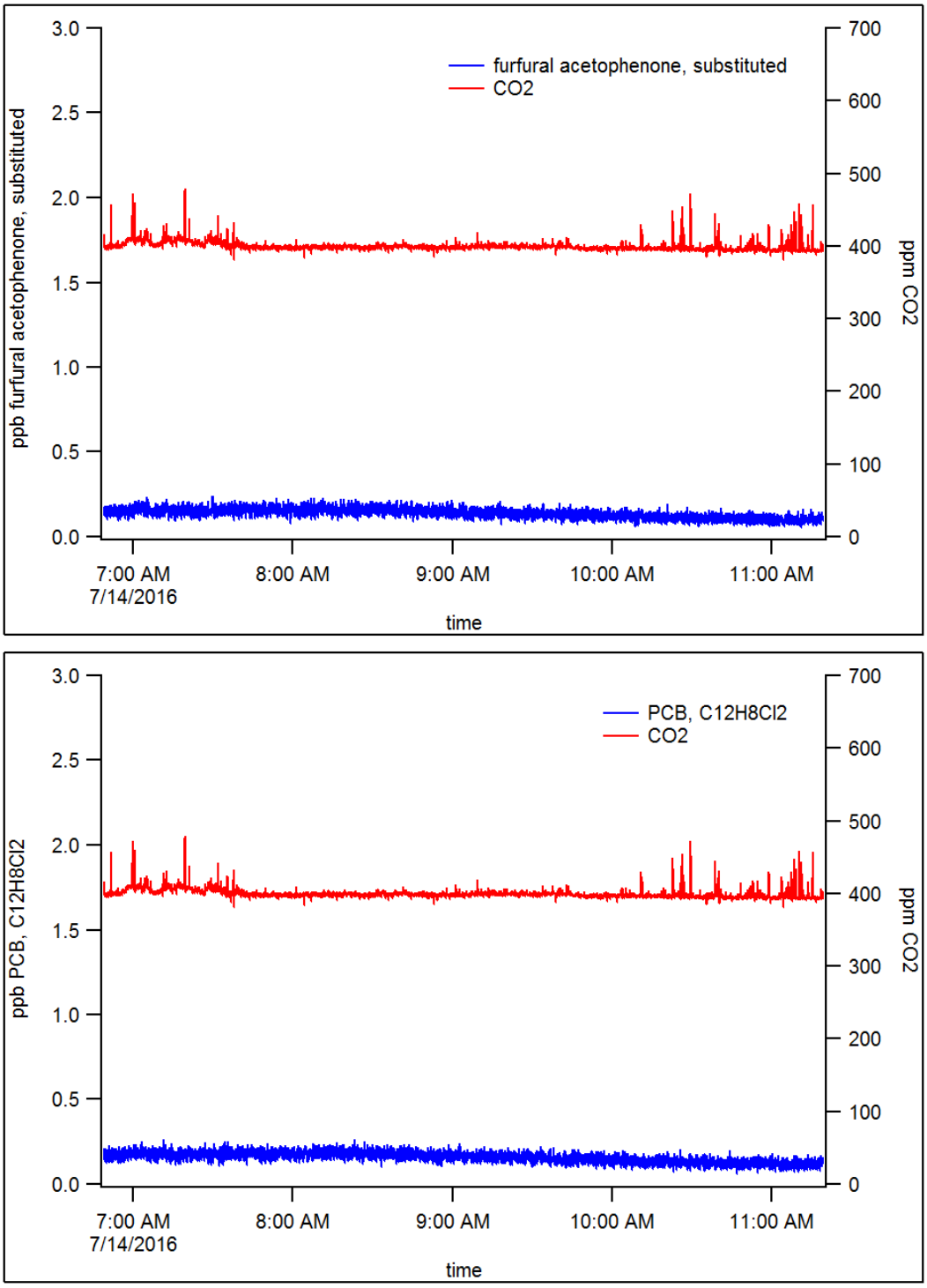


Figure B.4.3-15. July 14th - Furfural Acetophenone [3-(2-furanyl)-1-pheynyl-2-propen-1-one] (TOP), PCB [2] (BOTTOM)



B.4.4 July 18th Data Collection

July 18th data collection started at 6:47 AM and ended at 12:00 PM. Data collection methods included both mobile and stationary lab techniques. Below are the graphs presented in order based on the Chemicals of Potential Concern (COPC) list.

Figure B.4.4-1. July 18th - Formaldehyde (TOP), Methanol (MIDDLE), Acetonitrile (BOTTOM)

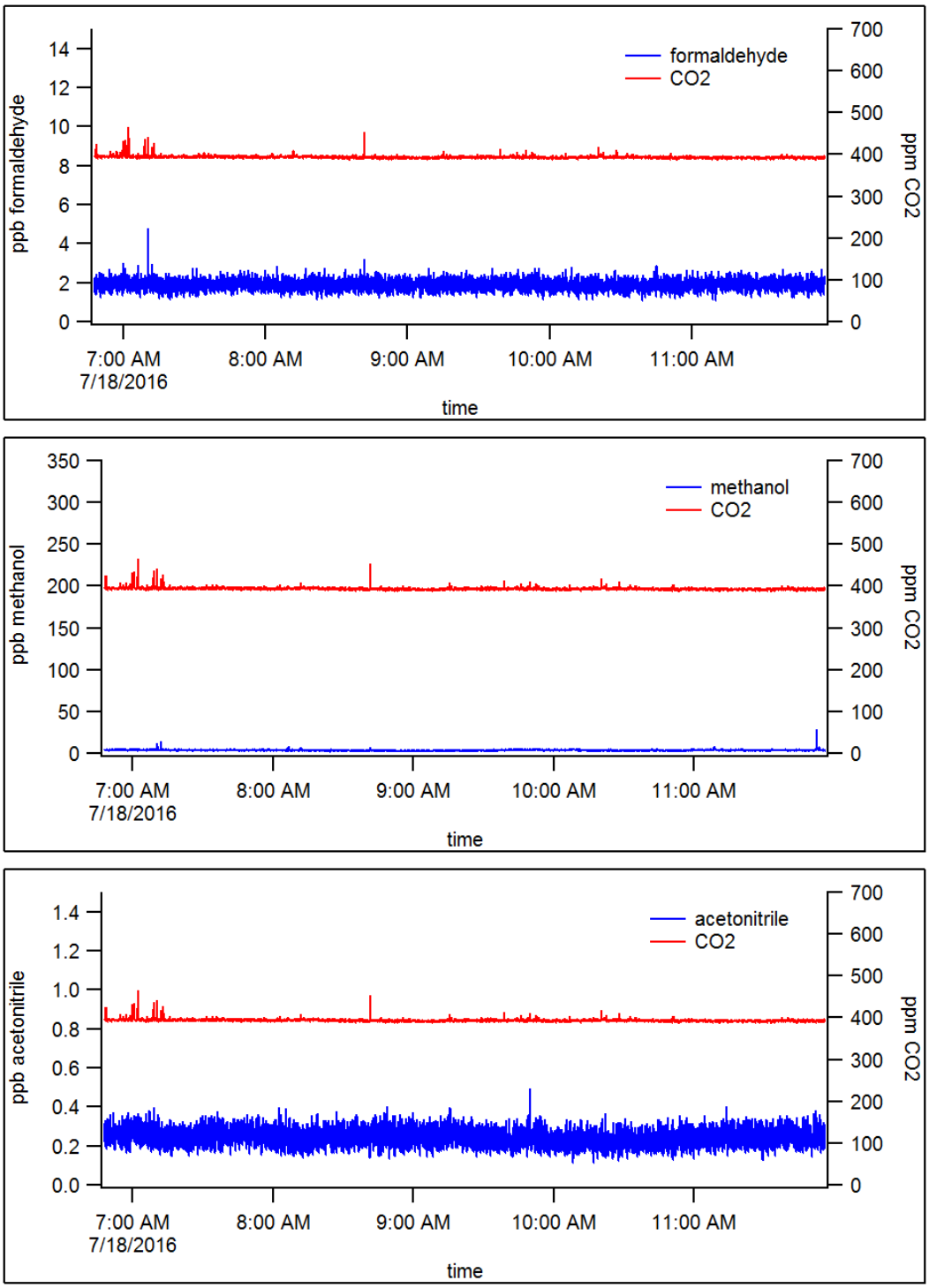


Figure B.4.4-2. July 18th - Acetaldehyde (TOP), Ethylamine (MIDDLE), 1,3-Butadiene (BOTTOM)

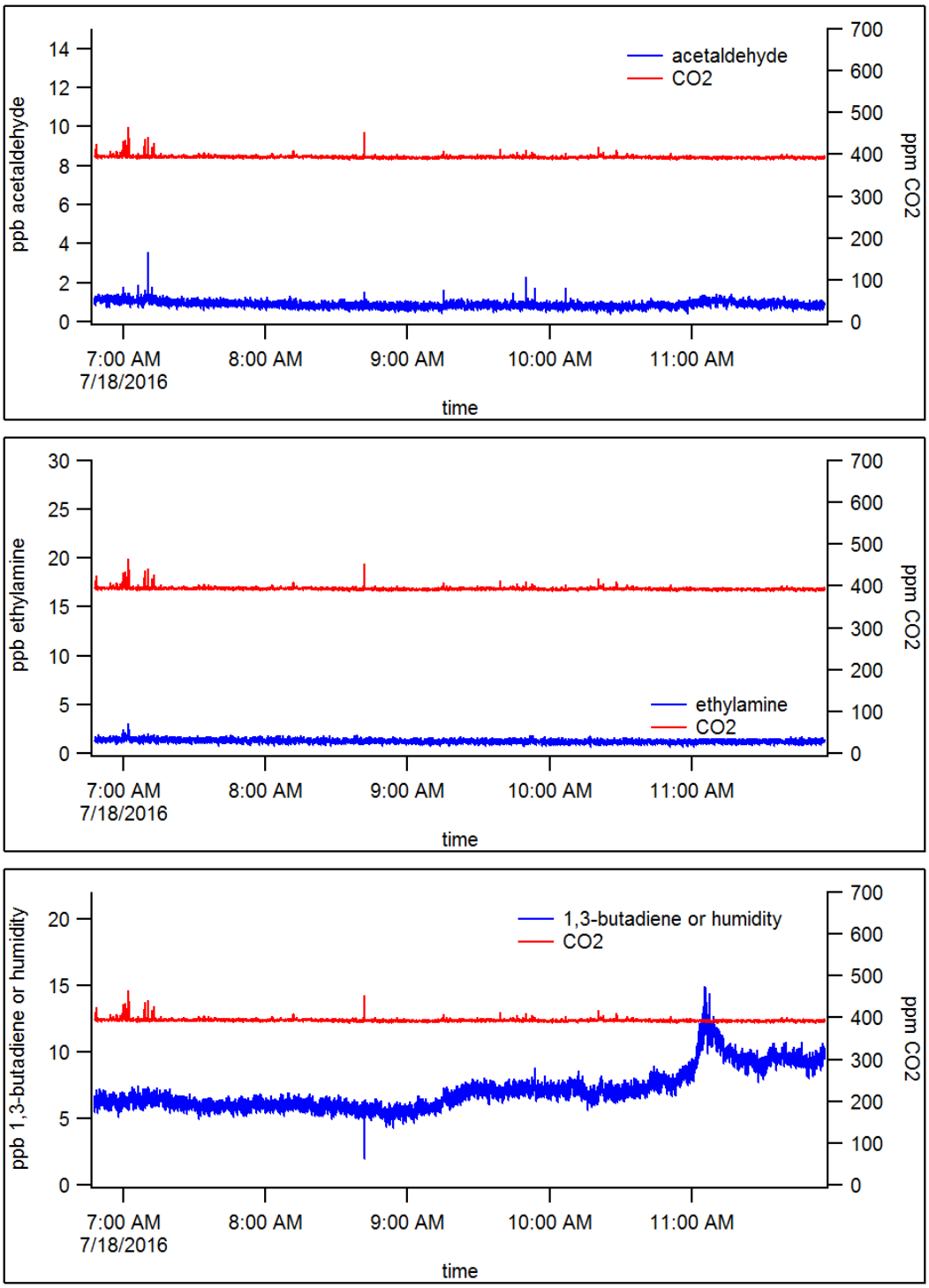


Figure B.4.4-3. July 18th - Propanenitrile (TOP), 1-Butanol; Butenes (MIDDLE), Methyl Isocyanate (BOTTOM)

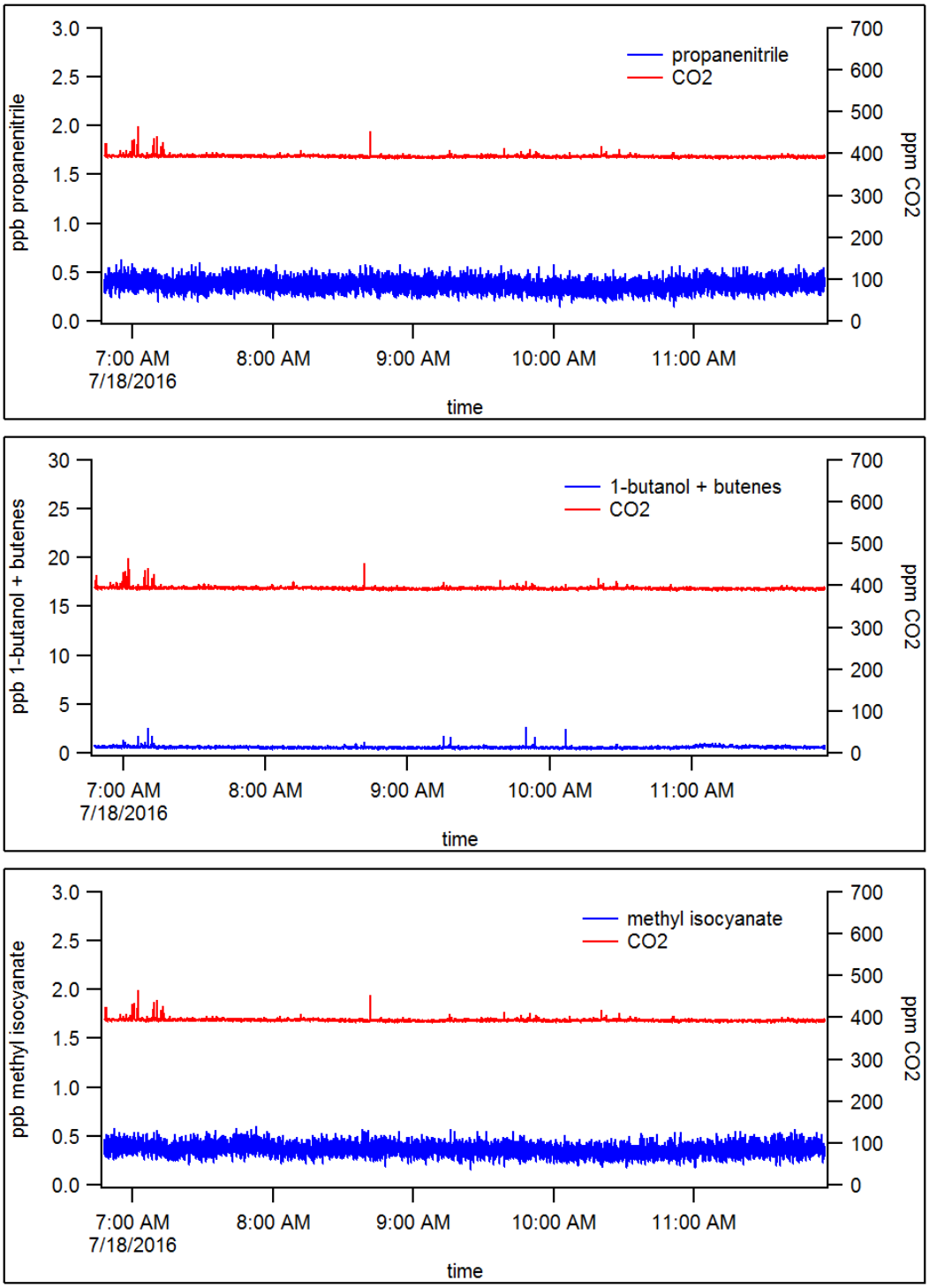


Figure B.4.4-4. July 18th - Methyl Nitrite (TOP), Furan; Isoprene (MIDDLE), Butanenitrile (BOTTOM)

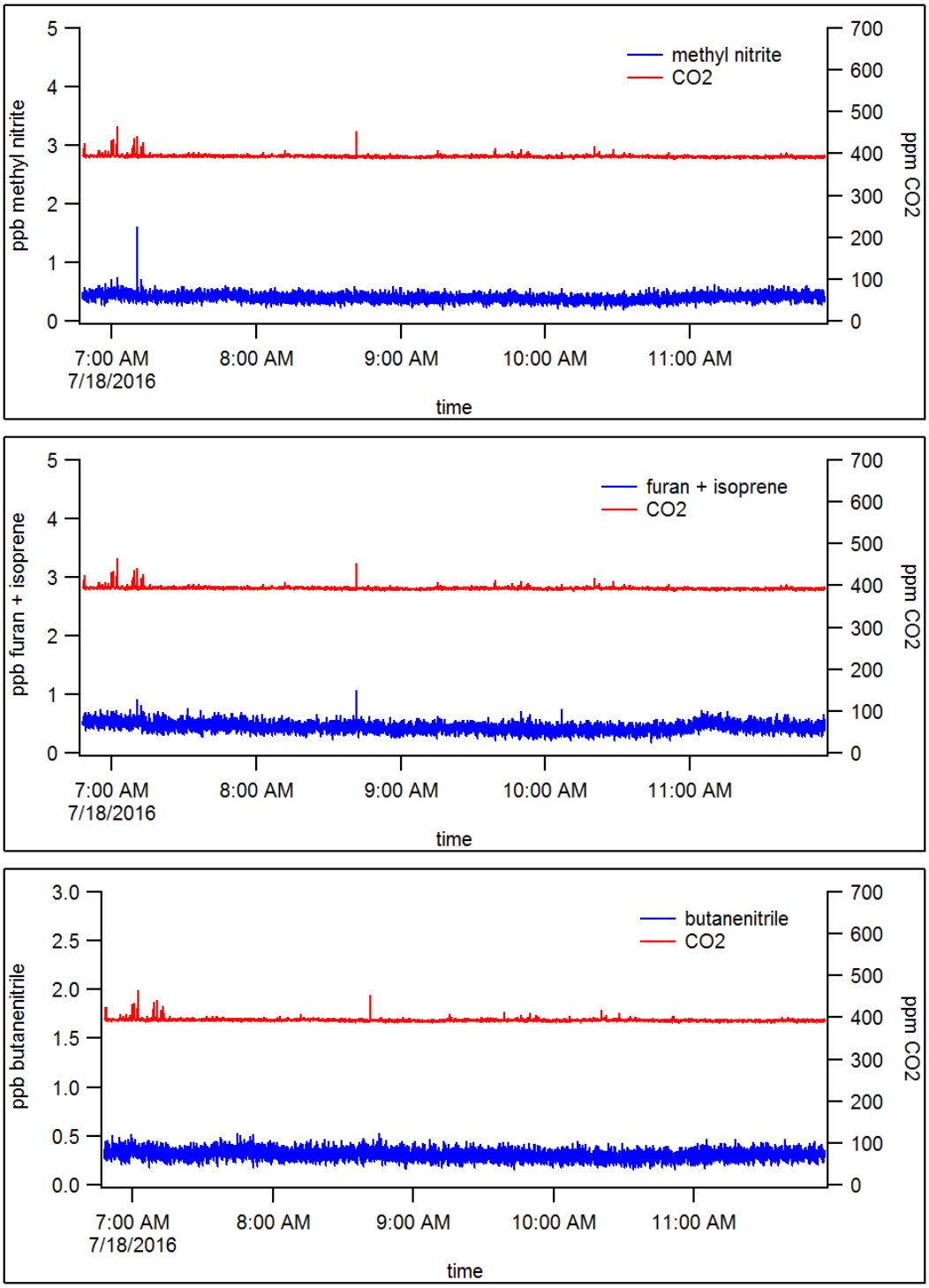


Figure B.4.4-5. July 18th - MVK + Dihydrofurans(TOP), Butanal (MIDDLE), N-nitrosodimethylamine [NDMA] (BOTTOM)

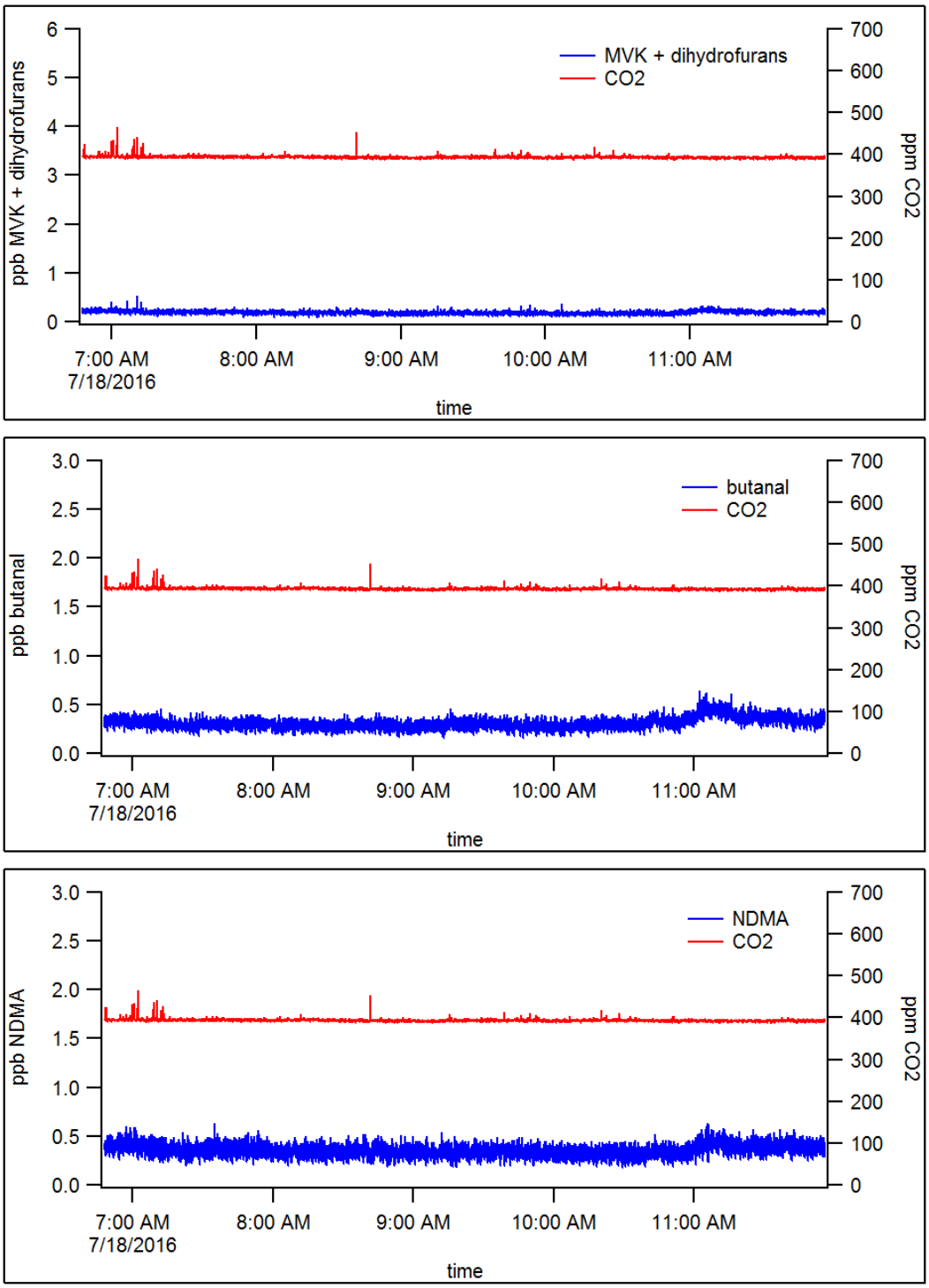


Figure B.4.4-6. July 18th - Benzene (TOP), 2,4-Pentadienenitrile; Pyridine (MIDDLE), 2-methylene Butanenitrile (BOTTOM)

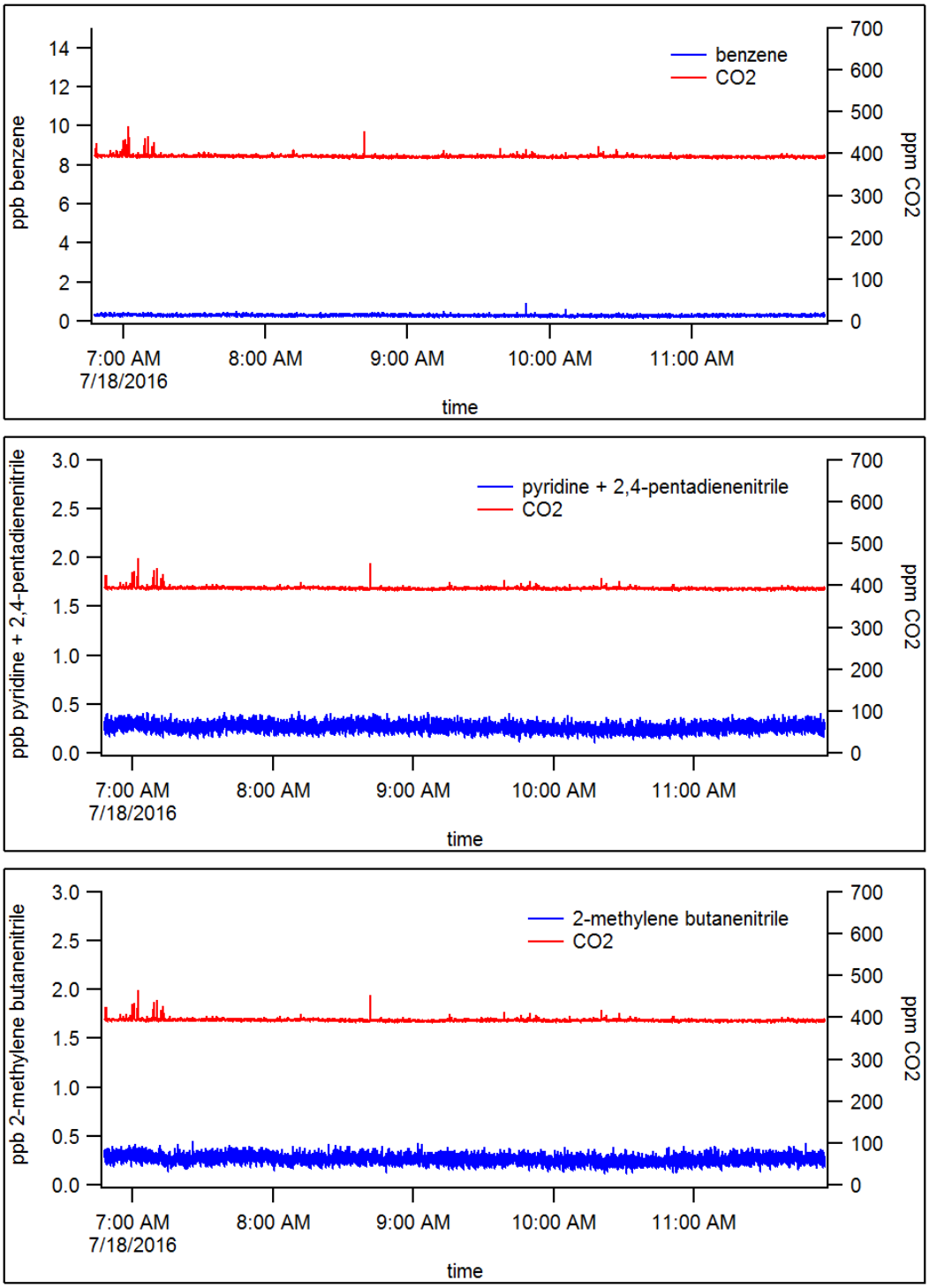


Figure B.4.4-7. July 18th - 2-methylfuran (TOP), Pentanenitrile (MIDDLE), 3-methyl-3-buten-2-one; 2-methyl-2-butenal (BOTTOM)

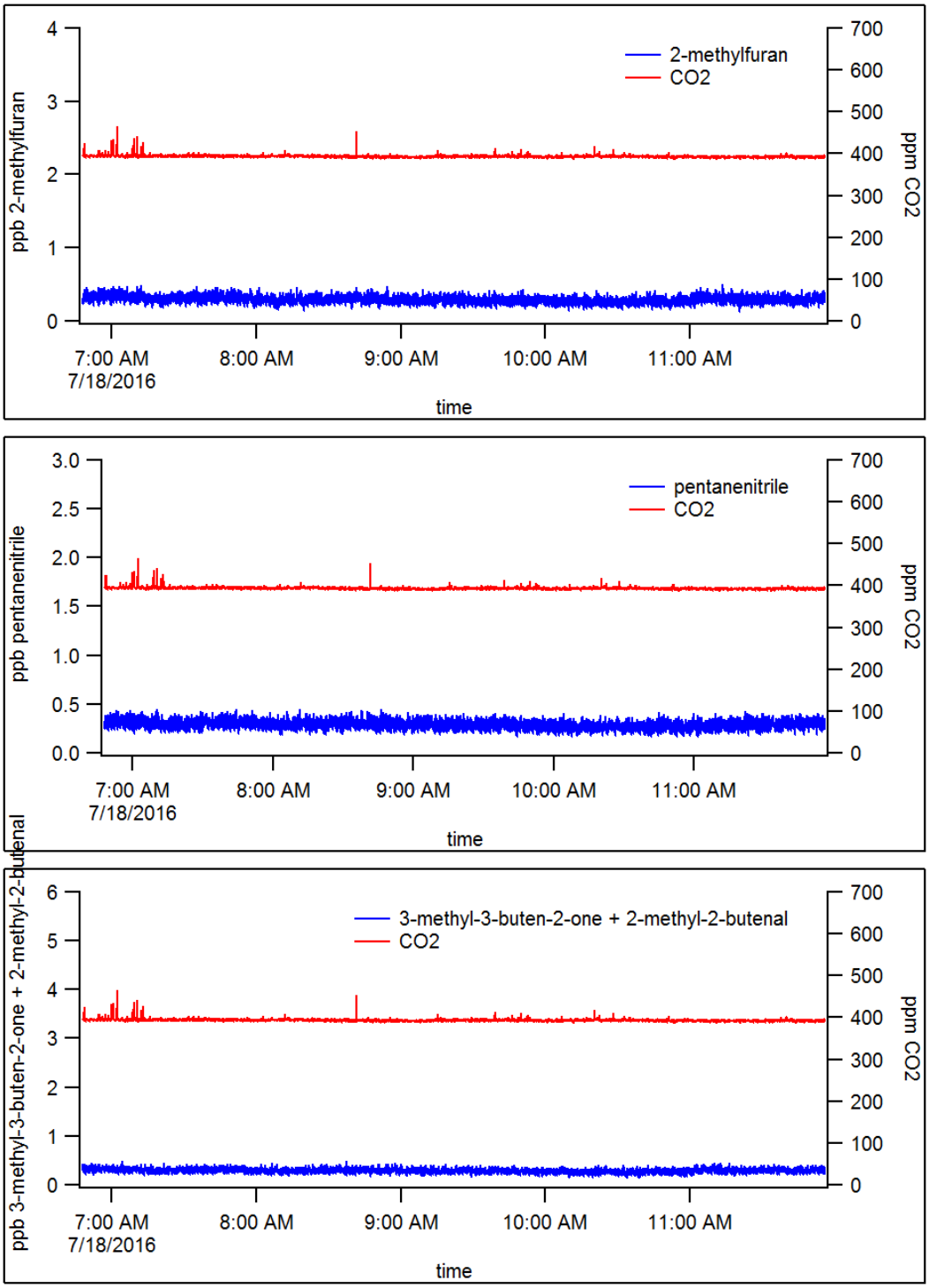


Figure B.4.4-8. July 18th - N-nitrosomethylethylamine [NEMA] (TOP), 2,5-dimethylfuran (MIDDLE), Hexanenitrile (BOTTOM)

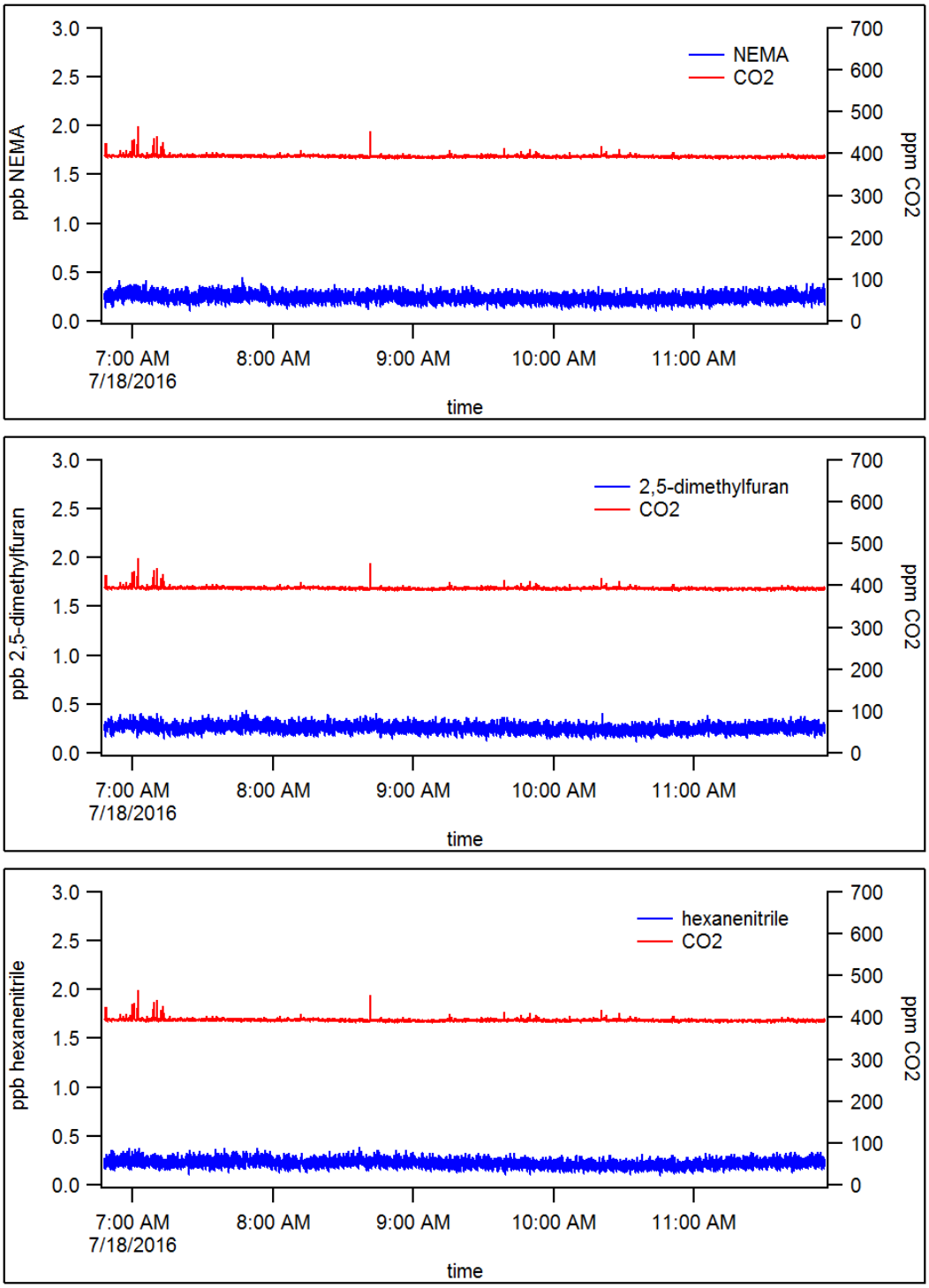


Figure B.4.4-9. July 18th - 2-hexanone [MBK] (TOP), N-nitrosodiethylamine [NDEA] (MIDDLE), Butyl Nitrite; 2-nitro-2-methylpropane (BOTTOM)

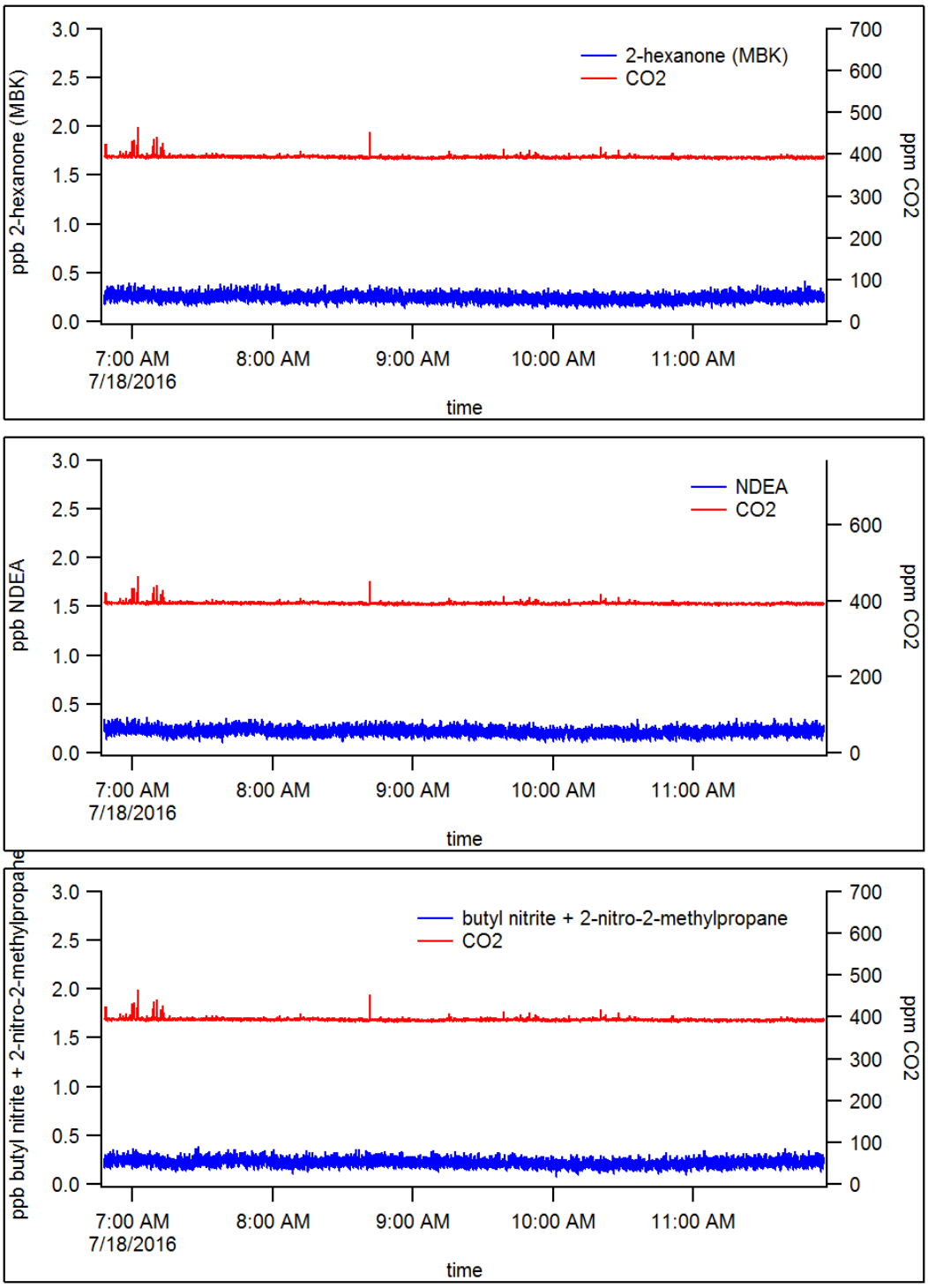


Figure B.4.4-10. July 18th - 2,4-dimethylpyridine (TOP), 2-ethyl-5-methylfuran (MIDDLE), Heptanenitrile (BOTTOM)

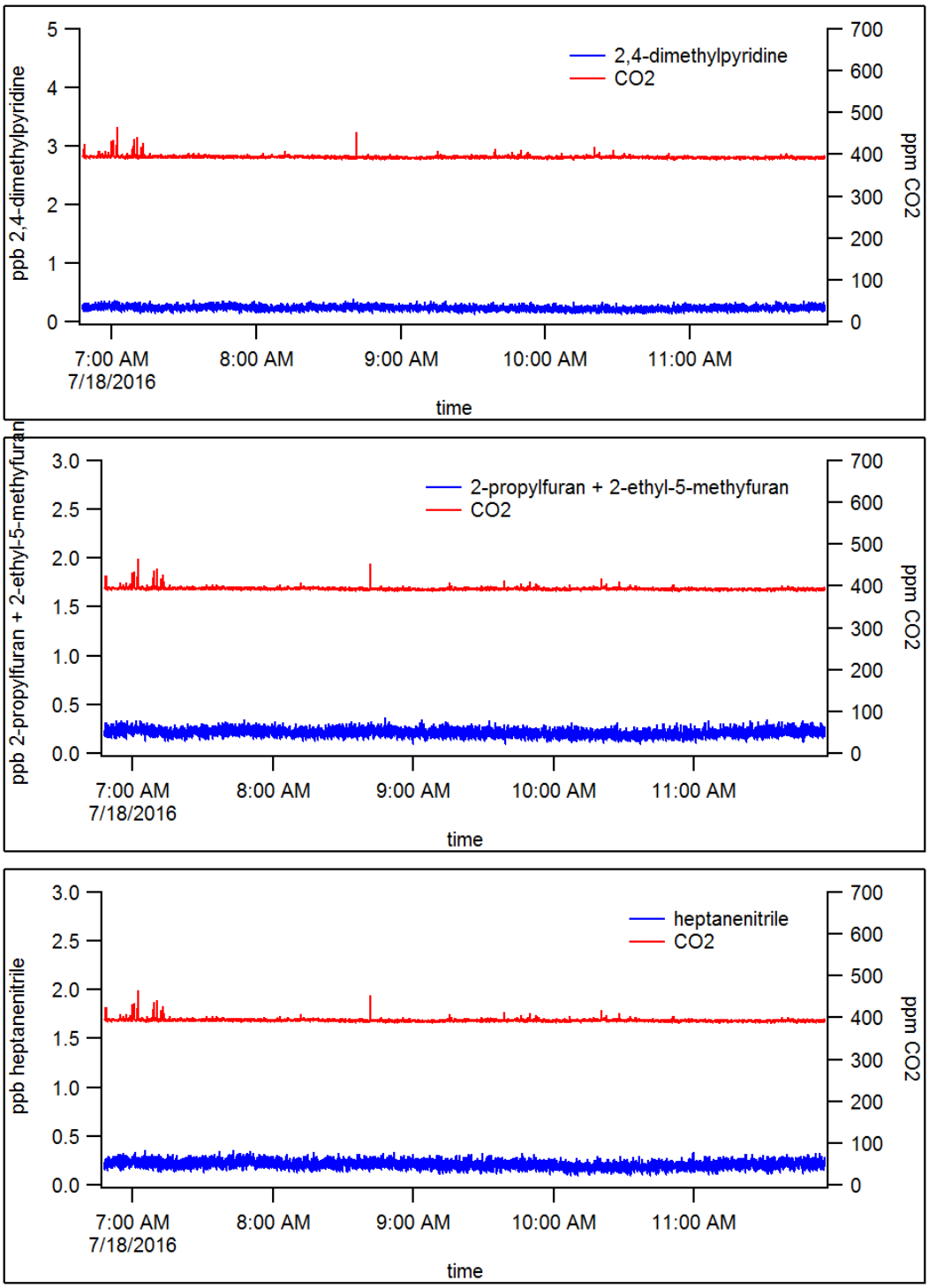


Figure B.4.4-11. July 18th - 4-methyl-2-hexanone (TOP), N-nitrosomorpholine [NMOR] (MIDDLE), Butyl Nitrate (BOTTOM)

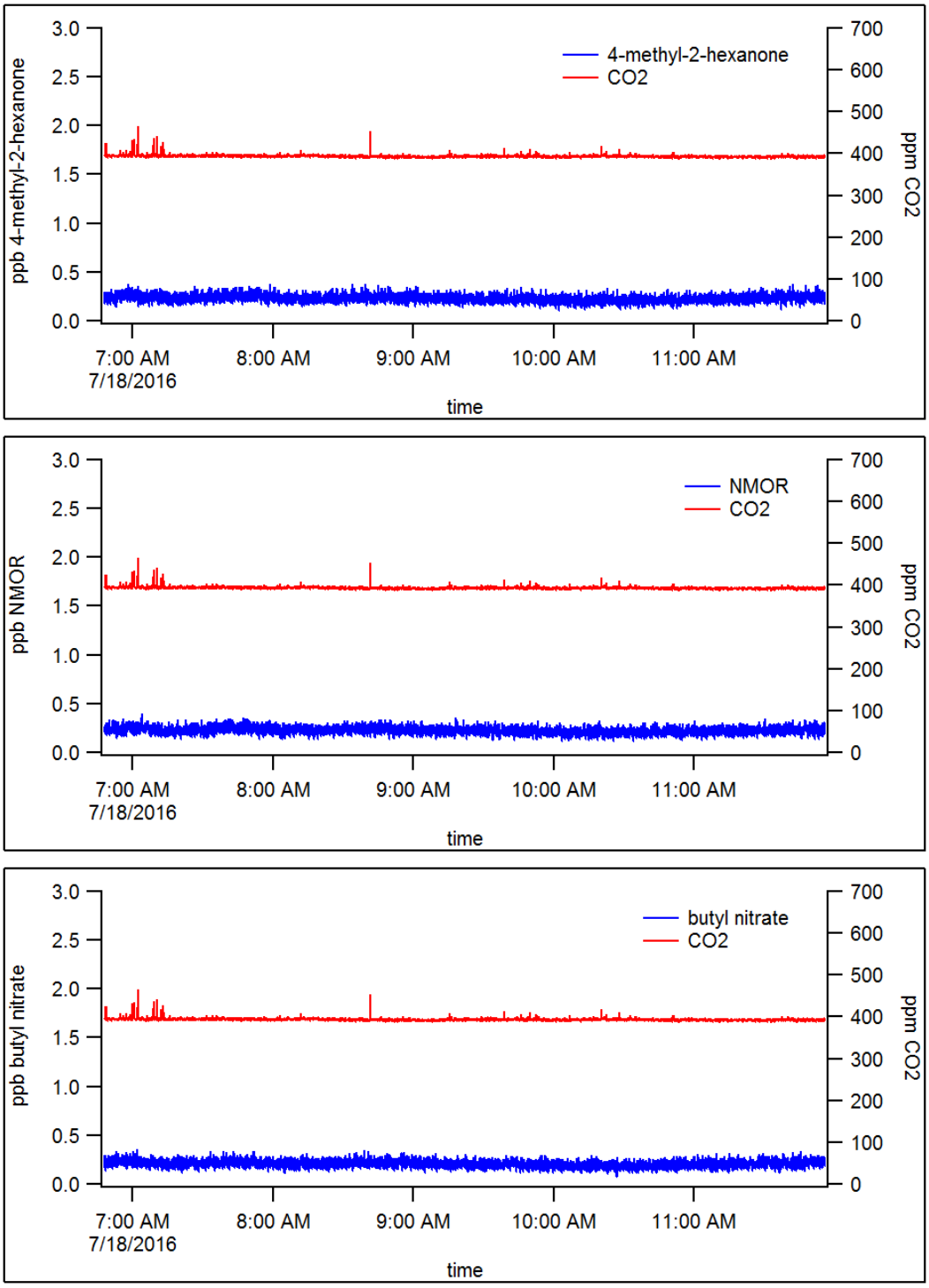


Figure B.4.4-12. July 18th - Multiple Furans [m/z 127] (TOP), 6-methyl-2-heptanone (MIDDLE), 2-pentylfuran (BOTTOM)

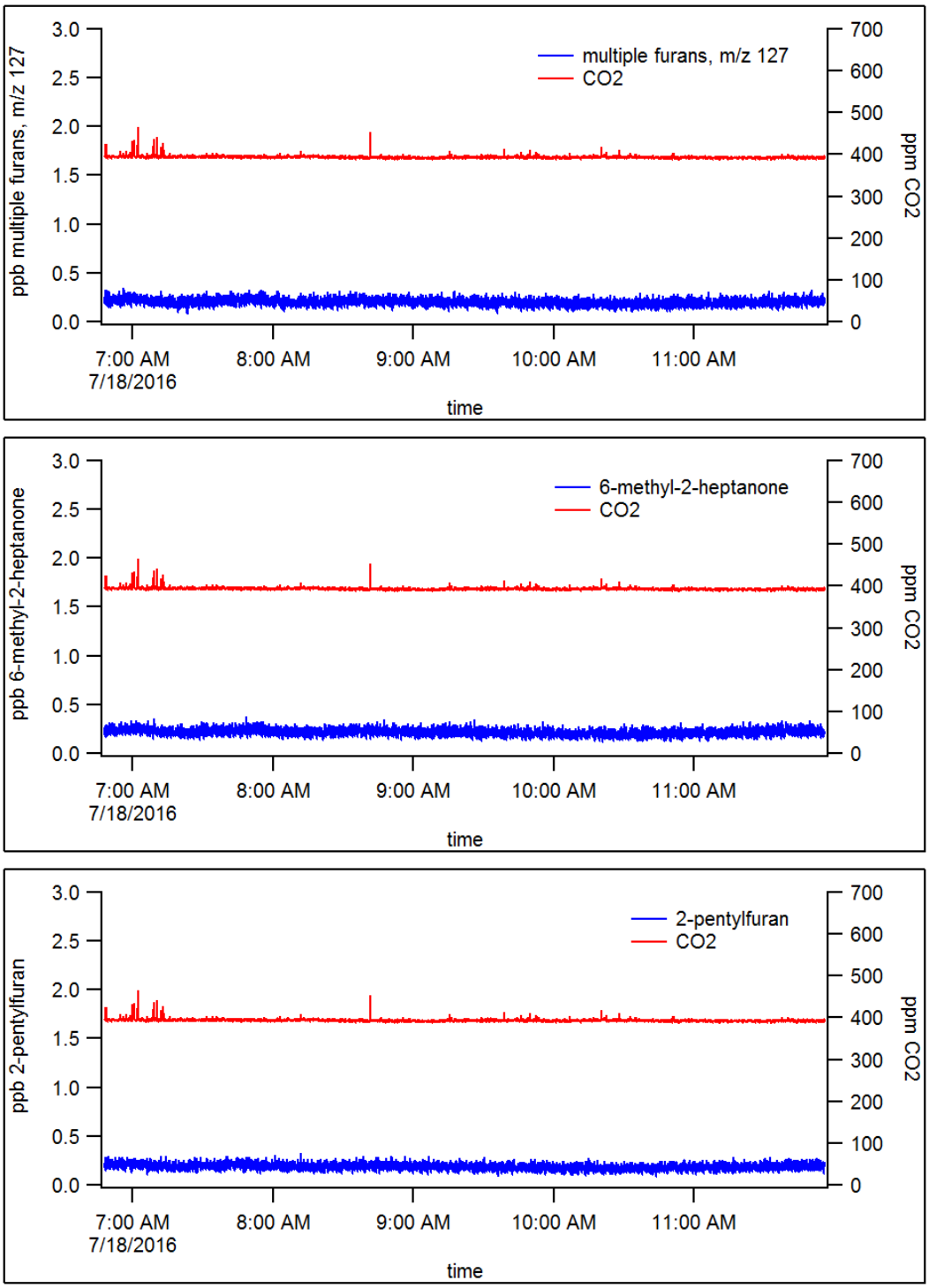


Figure B.4.4-13. July 18th - Biphenyl (TOP), 2-heptylfuran (MIDDLE), 2-octylfuran; 1,4-butanediol, Dinitrate (BOTTOM)

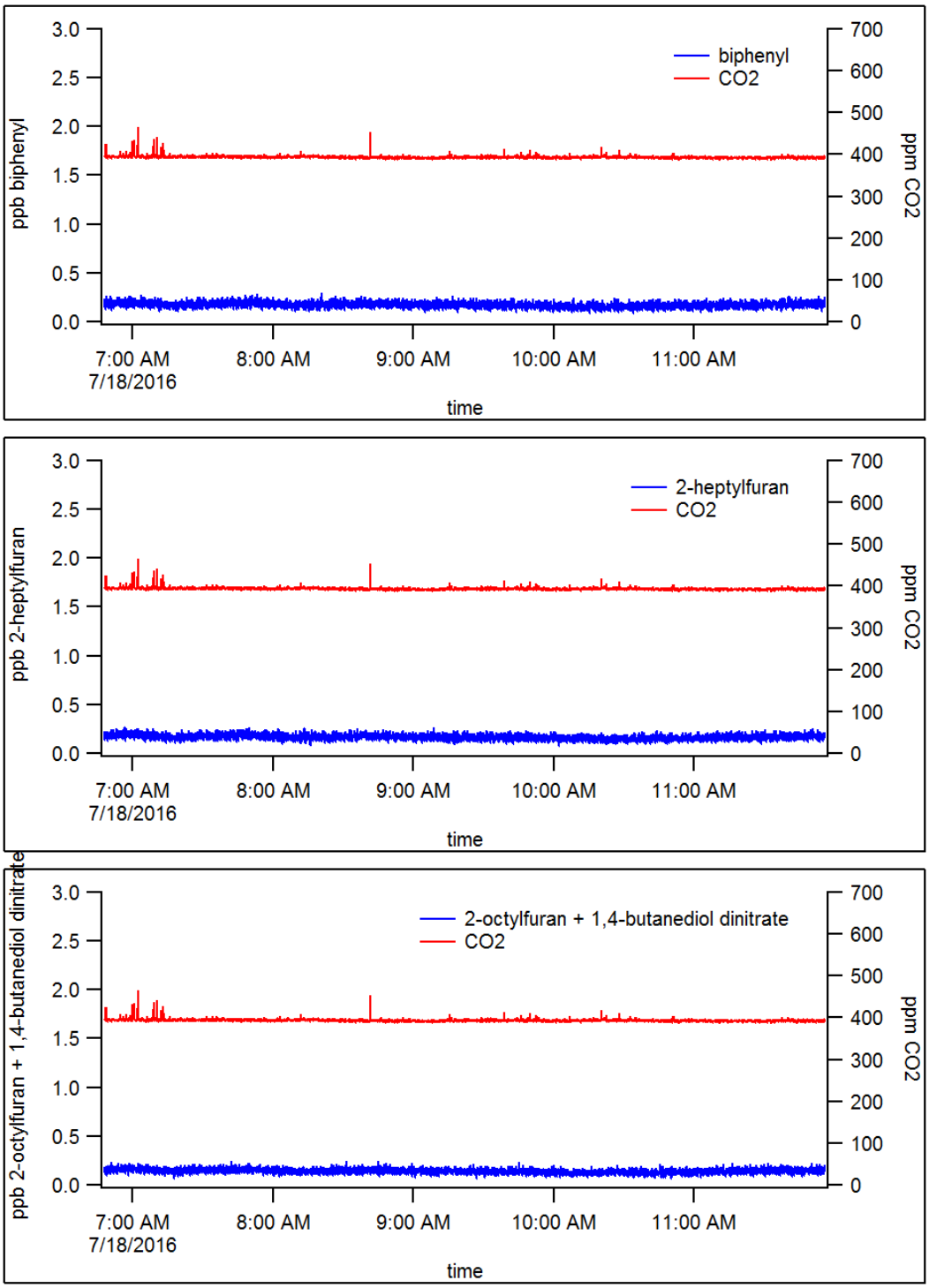


Figure B.4.4-14. July 18th - 1,2,3-propanetriol, 1,3-dinitrate (TOP), PCB (MIDDLE), 6-(2-furanyl)-6-methyl-2-heptanone (BOTTOM)

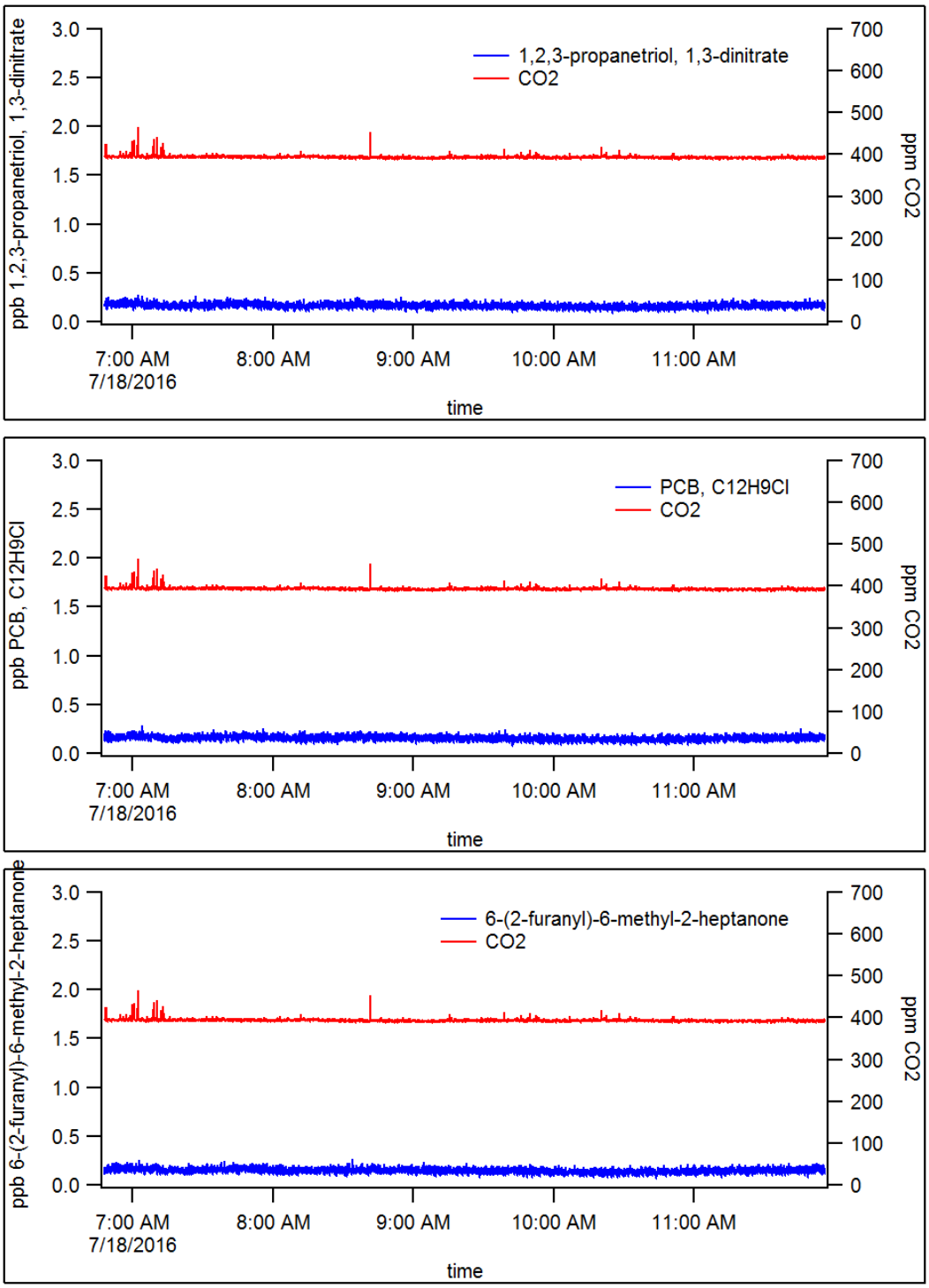
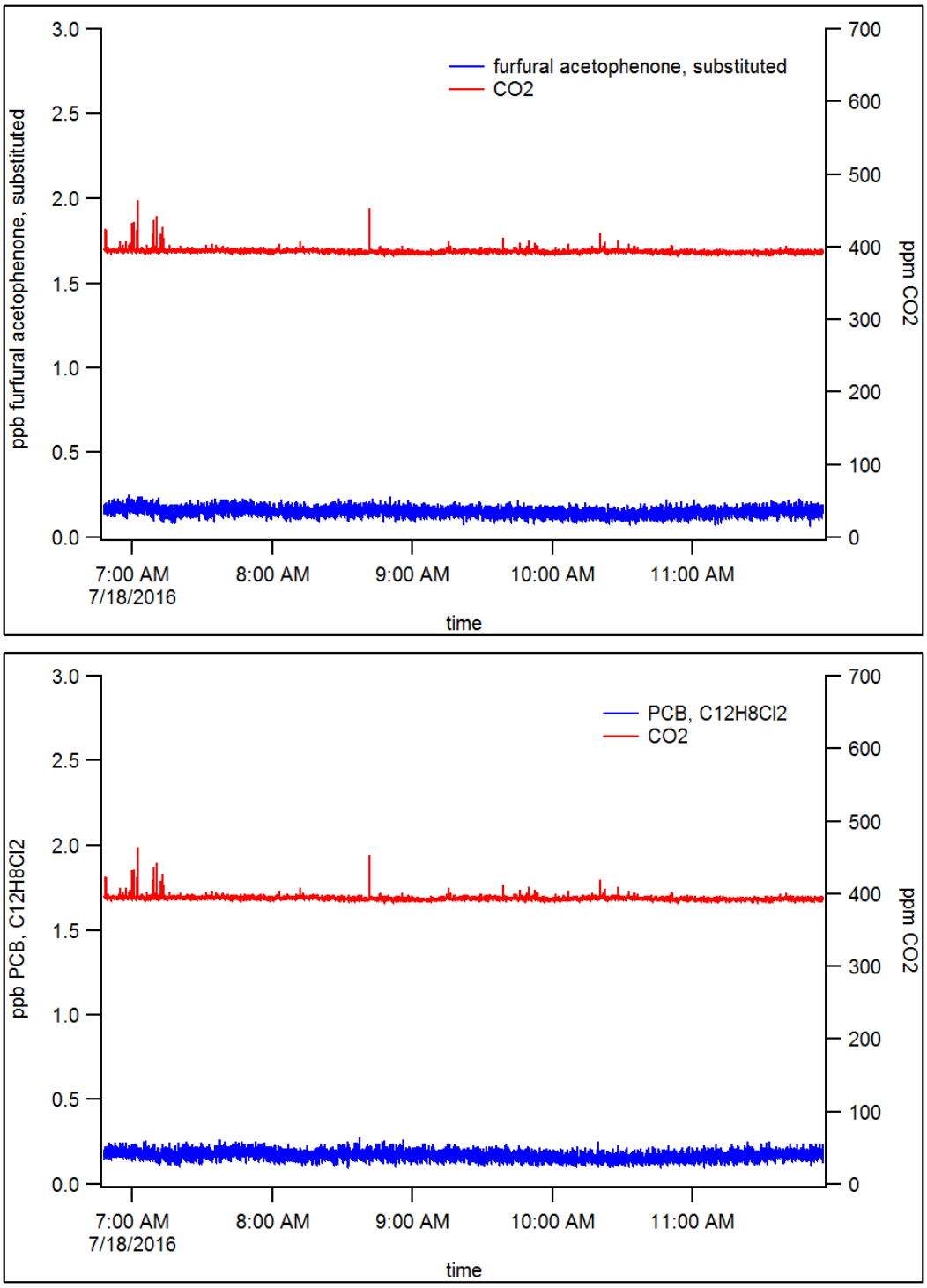


Figure B.4.4-15. July 18th - Furfural Acetophenone [3-(2-furanyl)-1-pheynyl-2-propen-1-one] (TOP), PCB [2] (BOTTOM)



APPENDIX C

AEROSOL WEEK

This appendix displays all the data via graphs of each COPC compound of the aerosol data collecting campaign involved in the week 5 of the PBI, structured to be shown by each day per week. This week includes the following:

- Section C.1 – Week 5
  - Section C.1.2 – May 20st 2016 Data Collection
  - Section C.1.3 – May 22nd 2016 Data Collection
  - Section C.1.4 – May 23rd 2016 Data Collection

C.1 WEEK 5

Week 5 consists of the Aerosol data collection campaign. As stated above, each day has its own section within this appendix.

C.1.1 May 24th Data Collection

May 24th data collection started at 8:16 AM and ended at 12:53 PM. Data collection methods included both mobile and stationary lab techniques. Below are the graphs presented in order based on the Chemicals of Potential Concern (COPC) list.

Figure C.1.1-1. May 24th - Formaldehyde (TOP), Methanol (MIDDLE), Acetonitrile (BOTTOM)

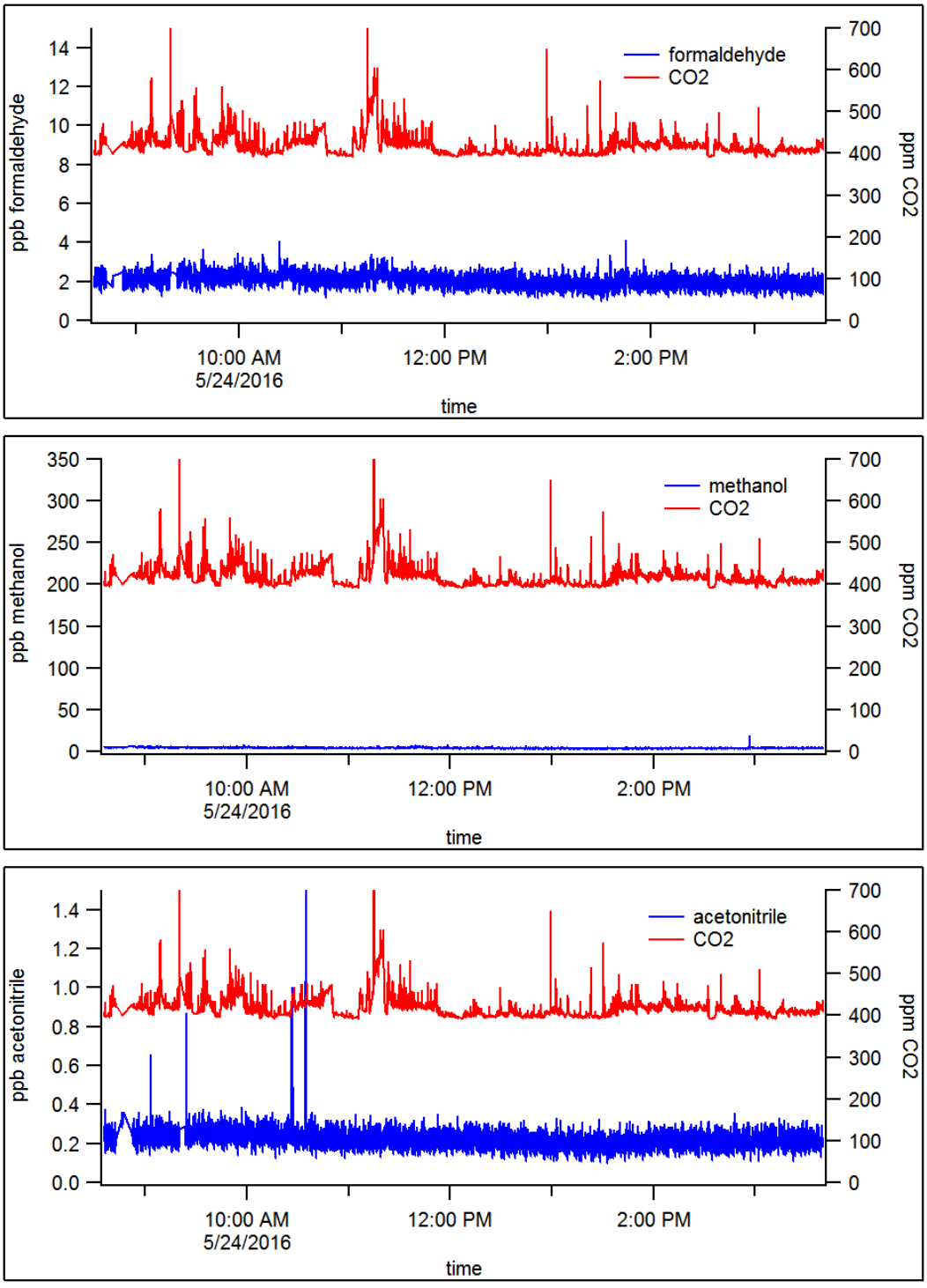


Figure C.1.1-2. May 24th - Ethylamine (TOP), Acetaldehyde (MIDDLE), 1,3-Butadiene (BOTTOM)

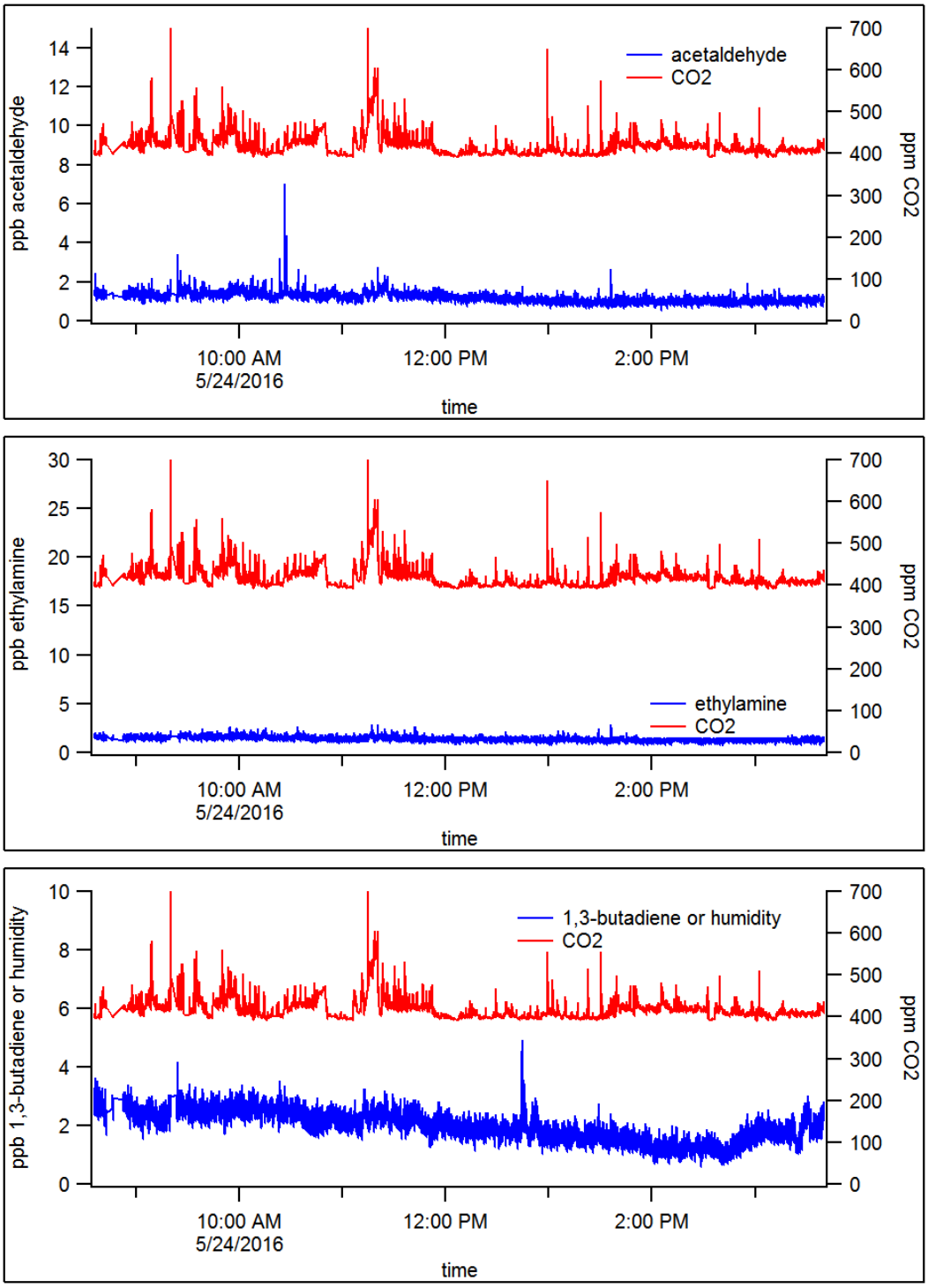


Figure C.1.1-3. May 24th - Propanenitrile (TOP), 1-Butanol; Butenes (MIDDLE), Methyl Isocyanate (BOTTOM)

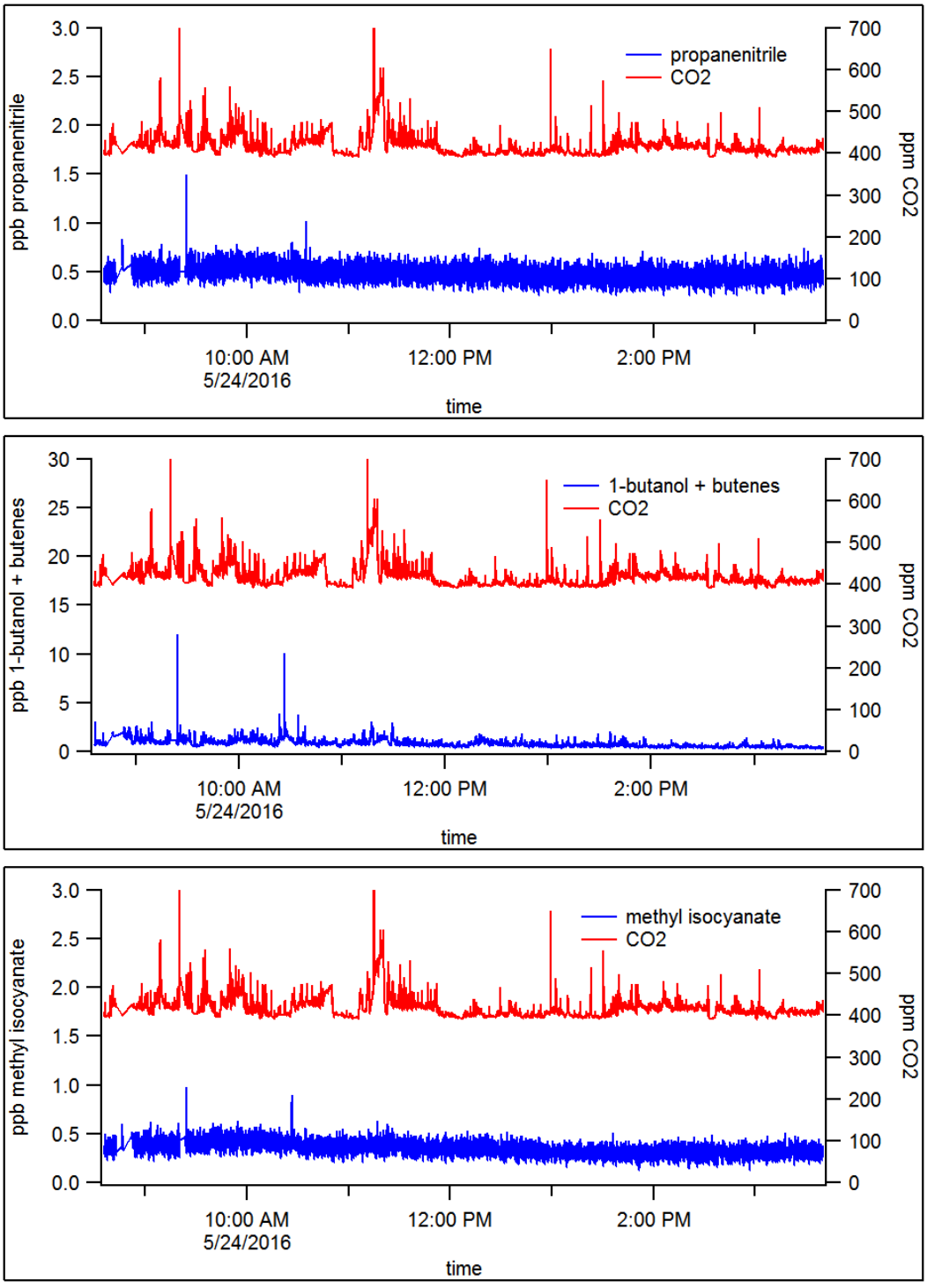


Figure C.1.1-4. May 24th - Methyl Nitrite (TOP), Furan; Isoprene(MIDDLE), Butanenitrile (BOTTOM)

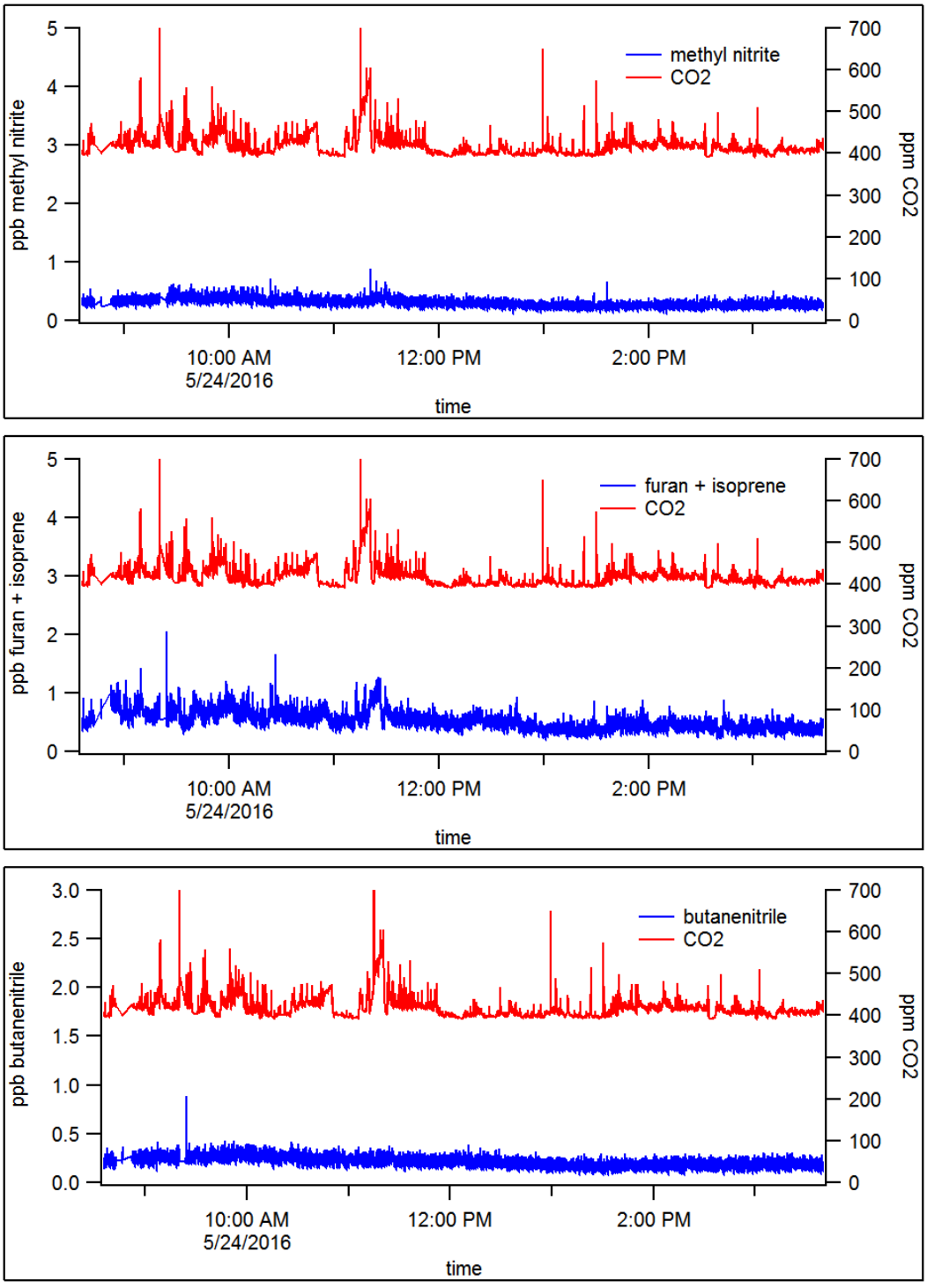


Figure C.1.1-5. May 24th - MVK + Dihydrofurans(TOP), Butanal (MIDDLE), N-nitrosodimethylamine [NDMA] (BOTTOM)

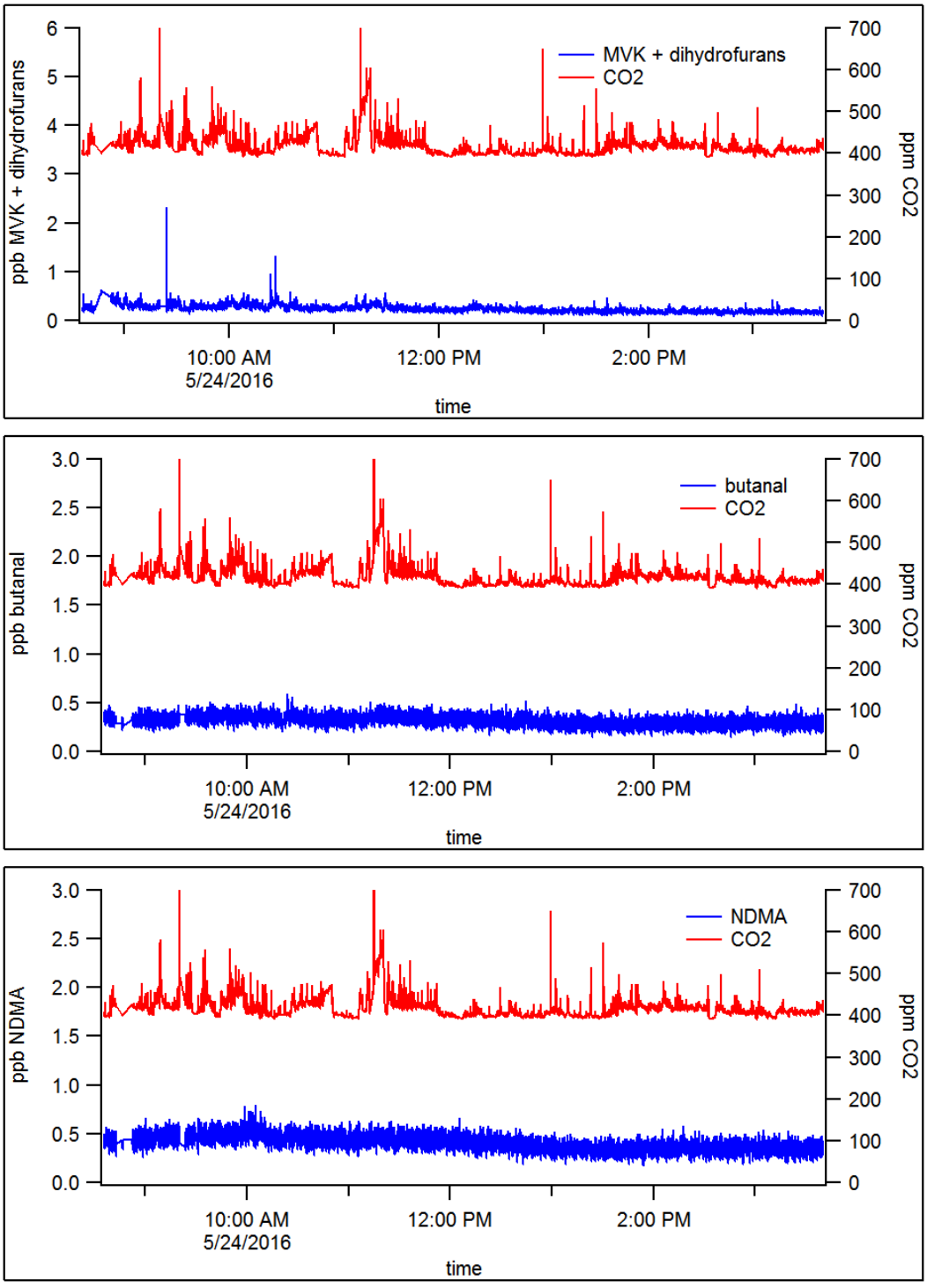


Figure C.1.1-6. May 24th - Benzene (TOP), 2,4-Pentadienenitrile; Pyridine (MIDDLE), 2-methylene Butanenitrile (BOTTOM)

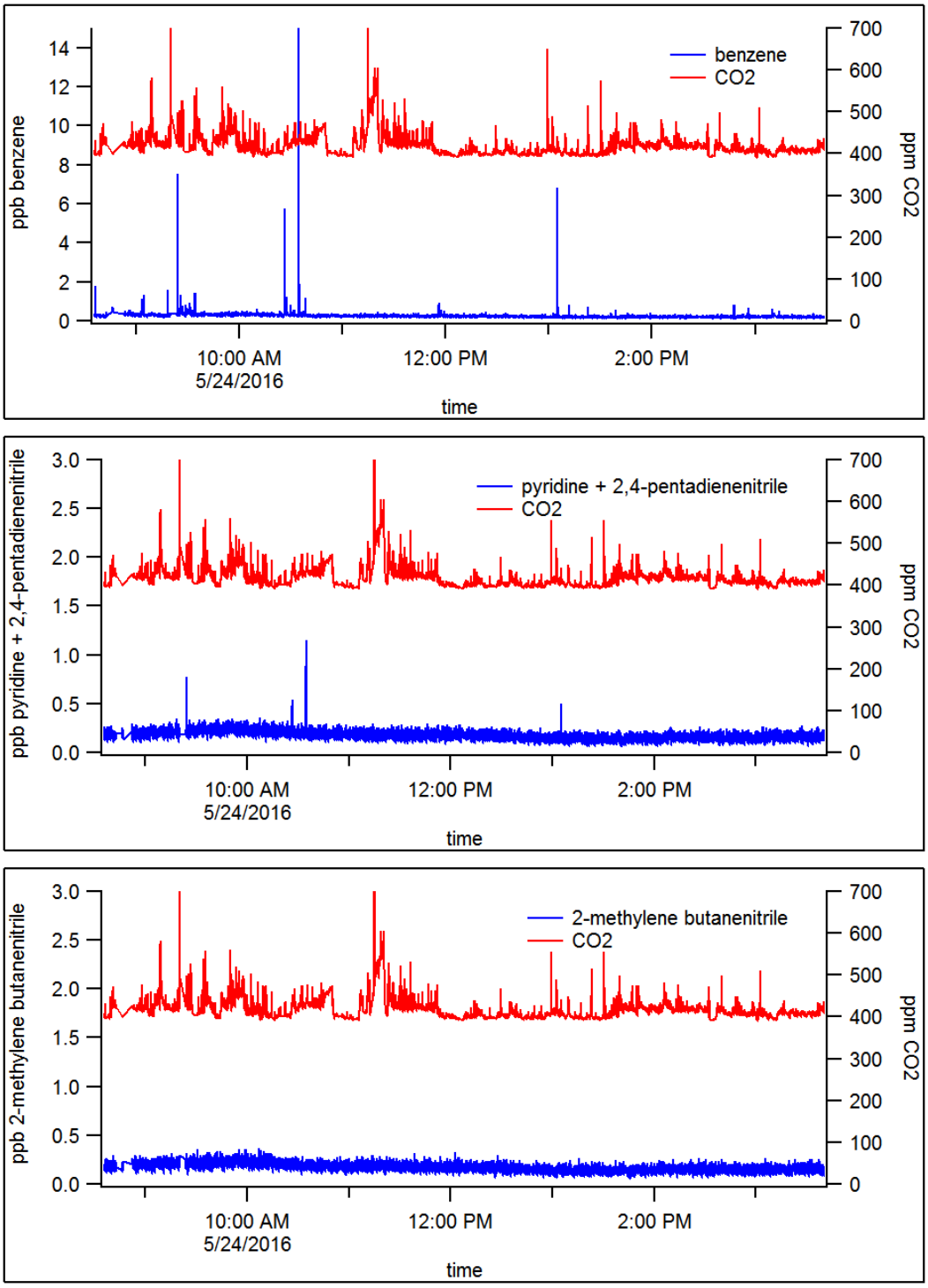


Figure C.1.1-7. May 24th - 2-methylfuran (TOP), Pentanenitrile (MIDDLE), 3-methyl-3-buten-2-one; 2-methyl-2-butenal (BOTTOM)

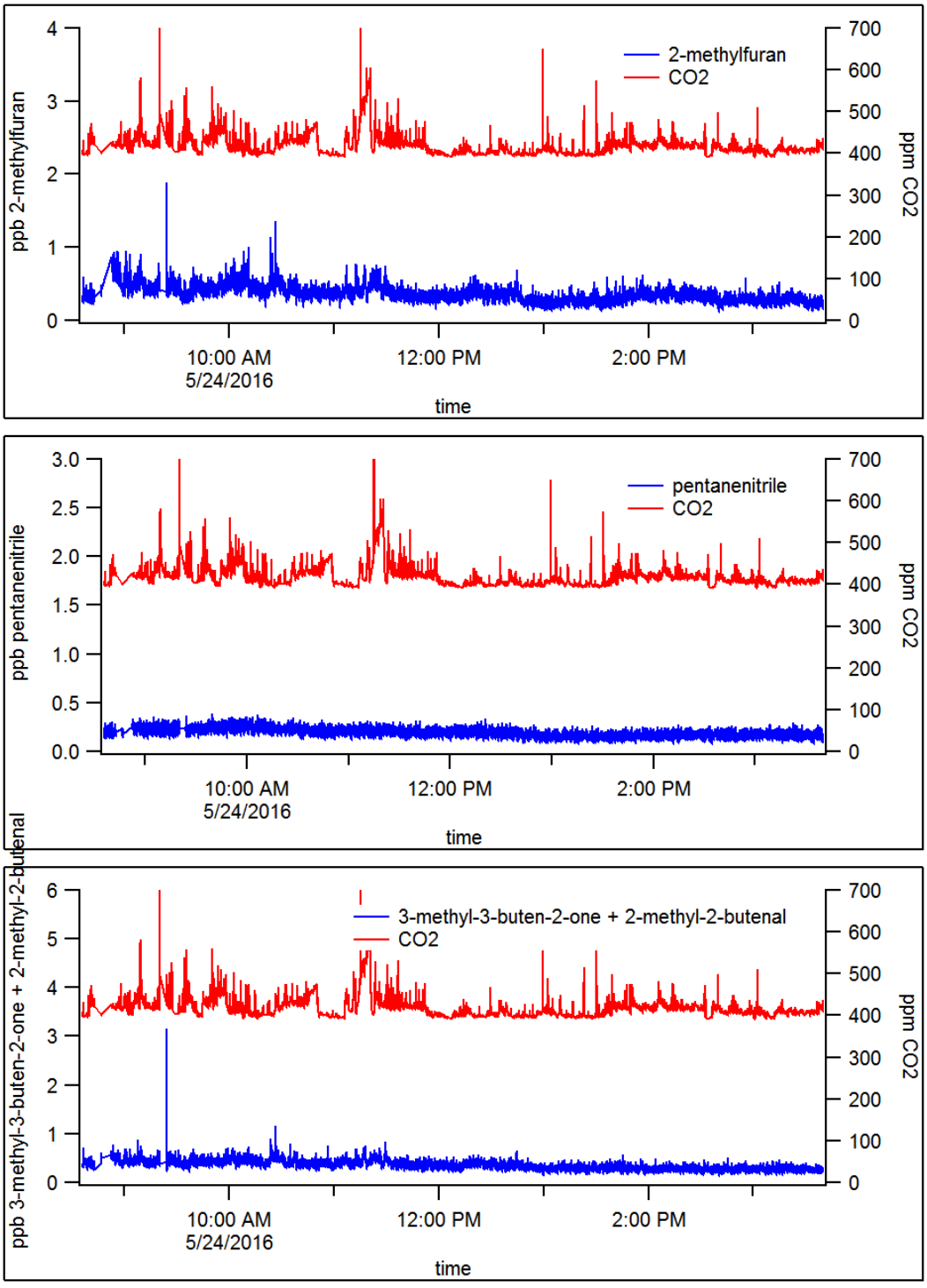


Figure C.1.1-8. May 24th - N-nitrosomethylethylamine [NEMA] (TOP), 2,5-dimethylfuran (MIDDLE), Hexanenitrile (BOTTOM)

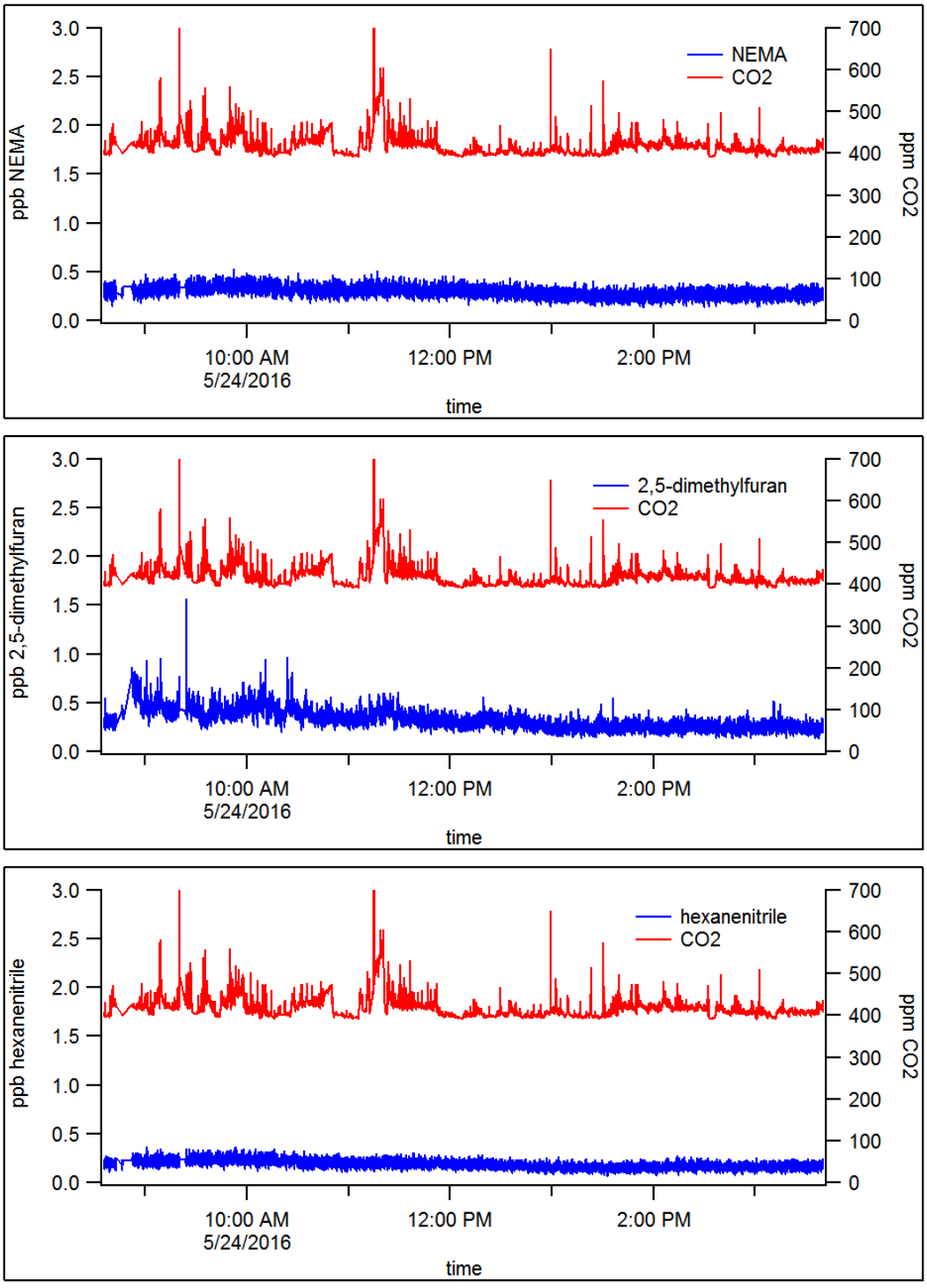


Figure C.1.1-9. May 24th - 2-hexanone [MBK] (TOP), N-nitrosodiethylamine [NDEA] (MIDDLE), Butyl Nitrite; 2-nitro-2-methylpropane (BOTTOM)

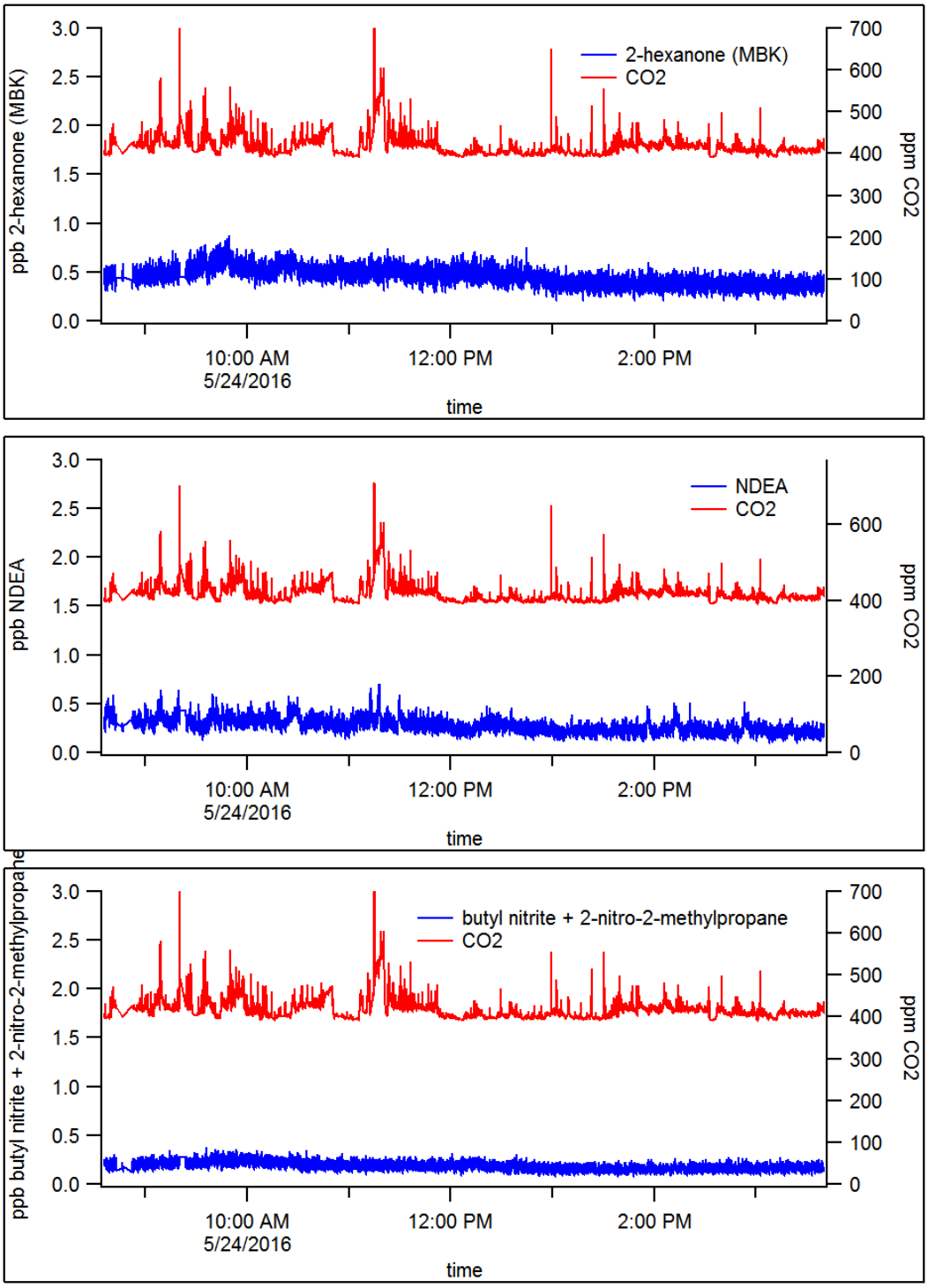


Figure C.1.1-10. May 24th - 2,4-dimethylpyridine (TOP), 2-ethyl-5-methylfuran (MIDDLE), Heptanenitrile (BOTTOM)

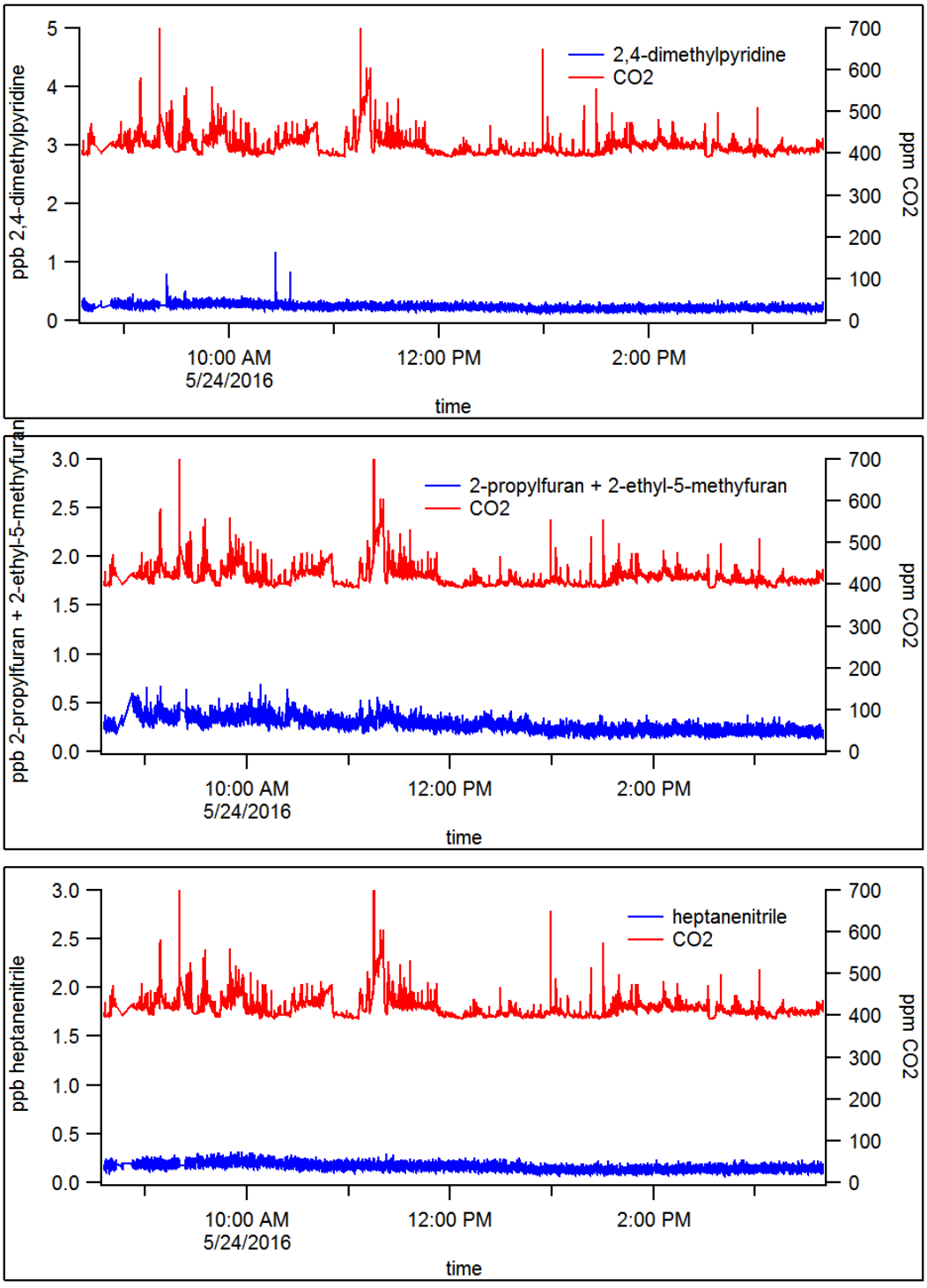


Figure C.1.1-11. May 24th - 4-methyl-2-hexanone (TOP), N-nitrosomorpholine [NMOR] (MIDDLE), Butyl Nitrate (BOTTOM)

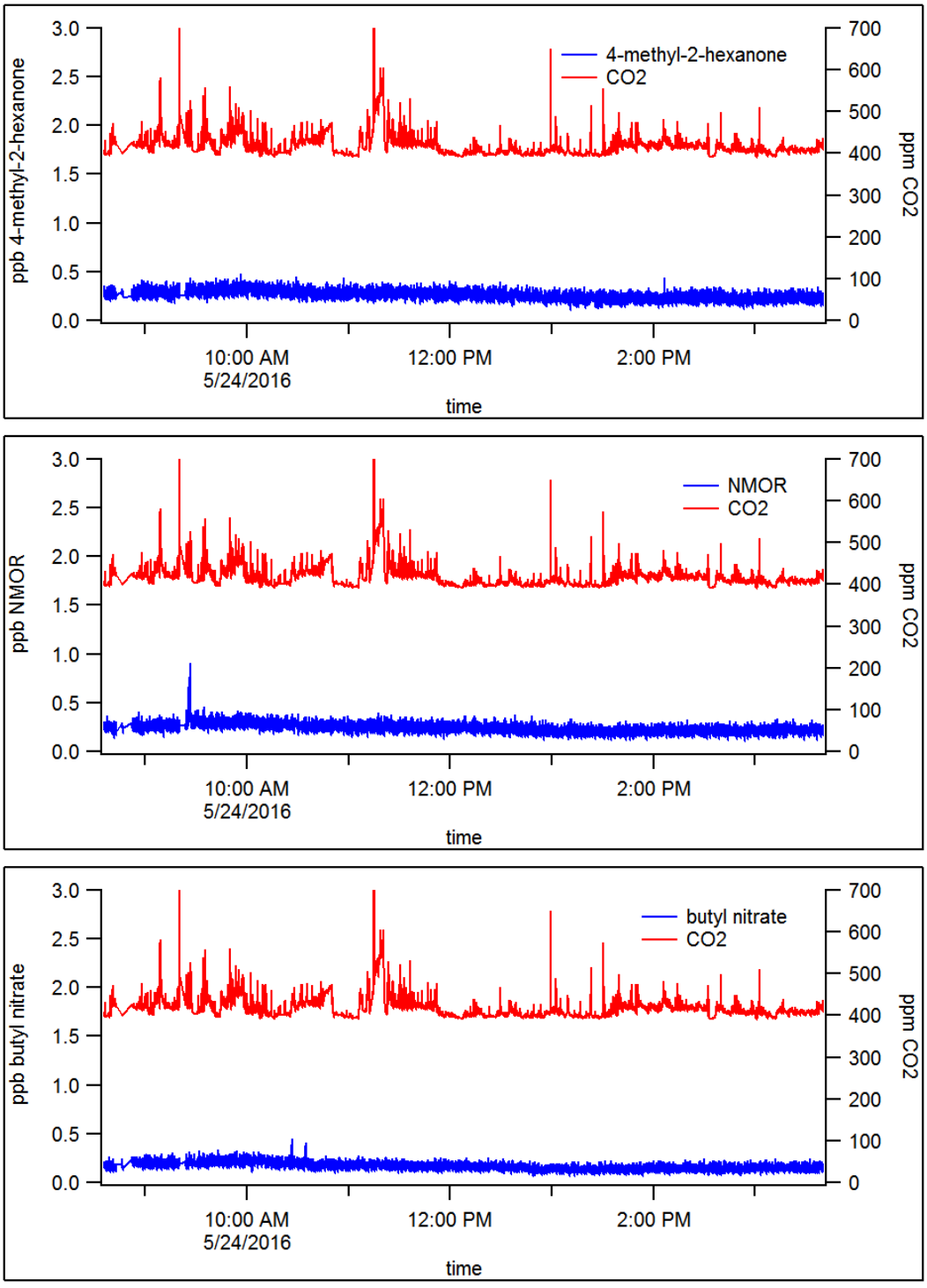


Figure C.1.1-12. May 24th - Multiple Furans [m/z 127] (TOP), 6-methyl-2-heptanone (MIDDLE), 2-pentylfuran (BOTTOM)

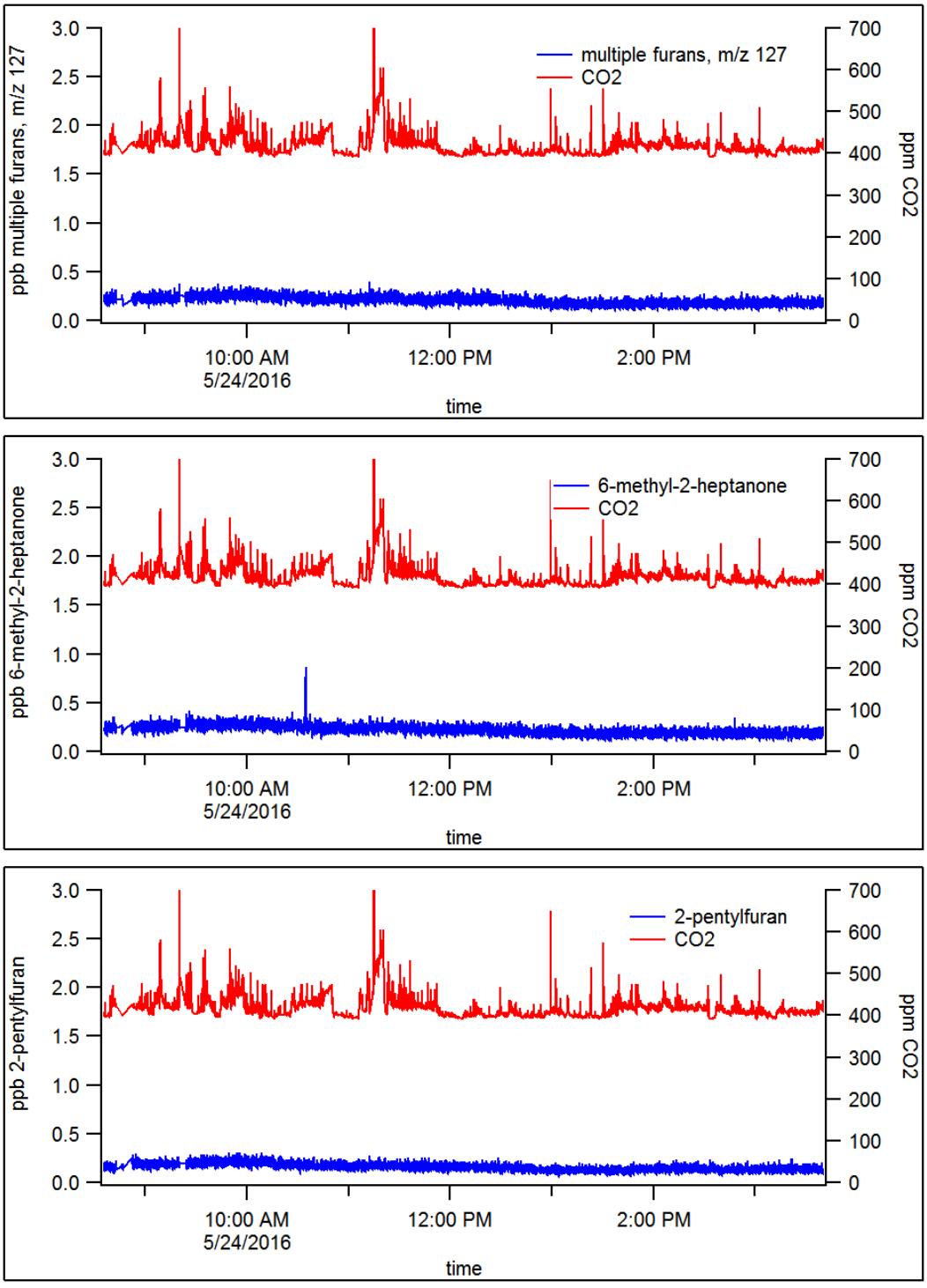


Figure C.1.1-13. May 24th - Biphenyl (TOP), 2-heptylfuran (MIDDLE), 2-octylfuran; 1,4-butanediol, dinitrate (BOTTOM)

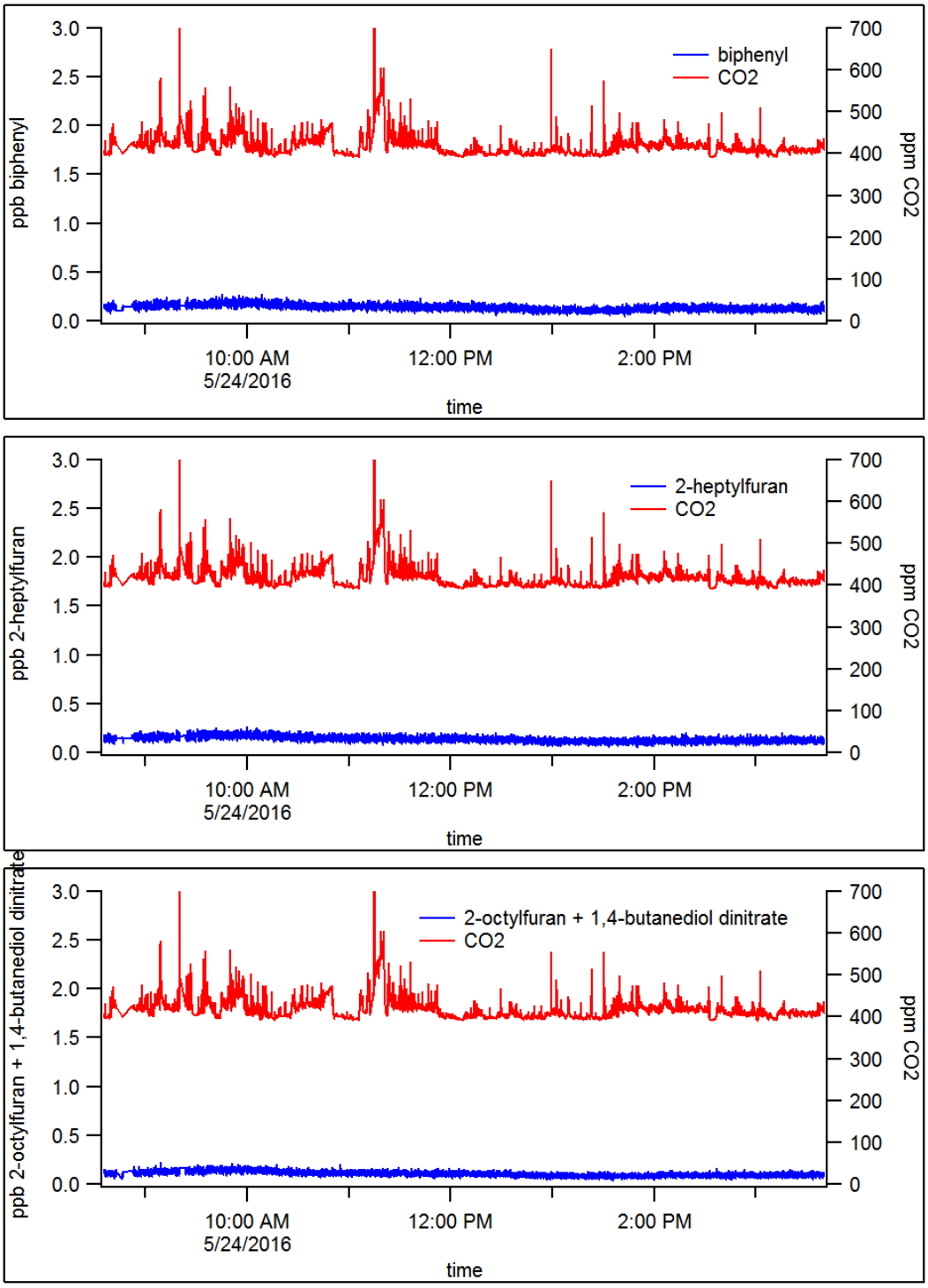


Figure C.1.1-14. May 24th - 1,2,3-propanetriol, 1,3-dinitrate (TOP), PCB (MIDDLE), 6-(2-furanyl)-6-methyl-2-heptanone (BOTTOM)

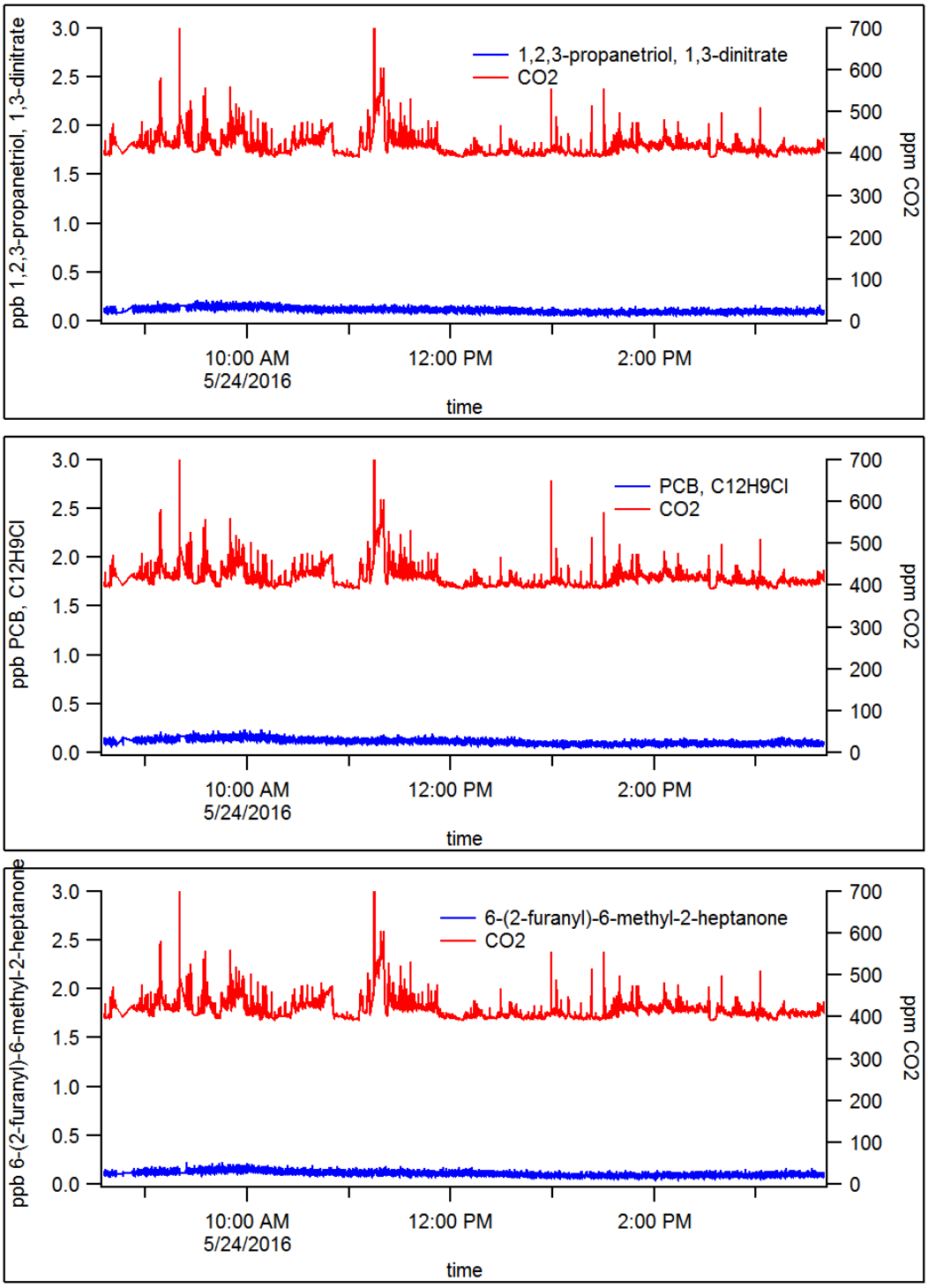
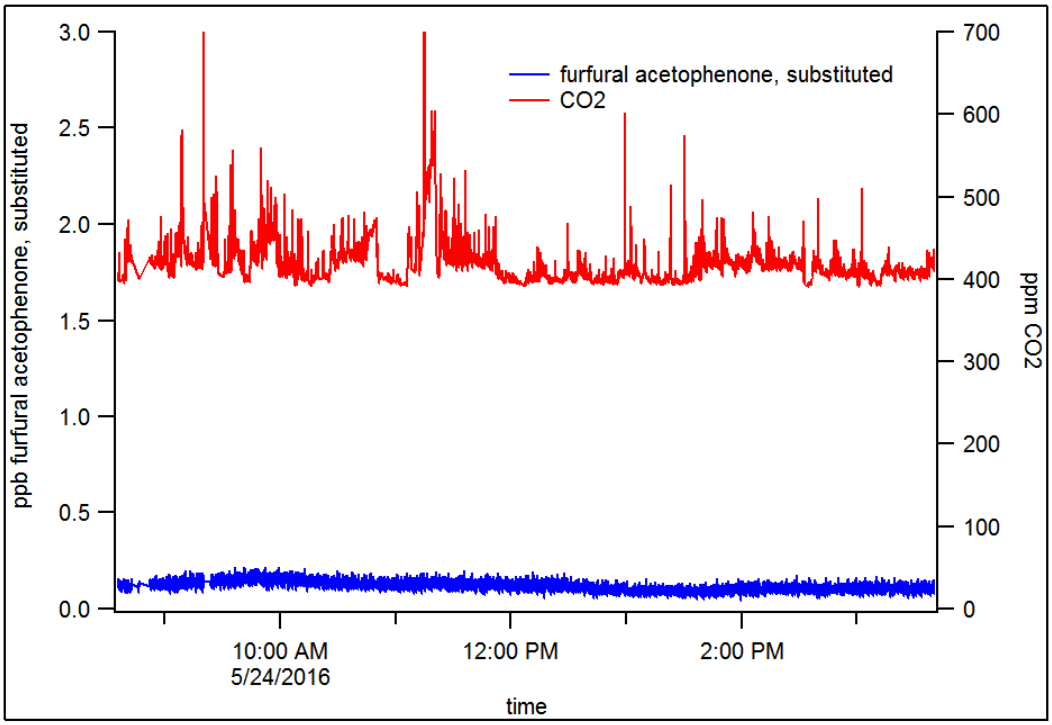
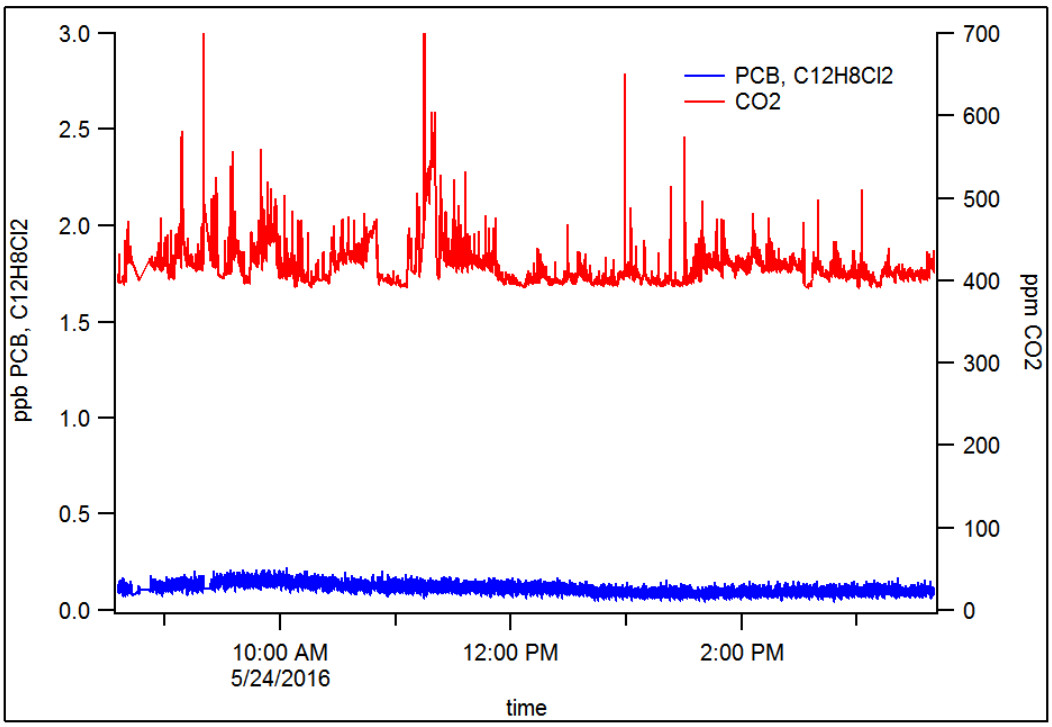


Figure C.1.1-15. May 24th - Furfural Acetophenone (3-(2-furanyl)-1-pheynyl-2-propen-1-one (TOP), PCB [2] (BOTTOM)





C.1.2 May 25th Data Collection

May 25th data collection started at 7:00 AM and ended at 1:57 PM. Data collection methods included both mobile and stationary lab techniques. Below are the graphs presented in order based on the Chemicals of Potential Concern (COPC) list.

Figure C.1.2-1. May 25th - Formaldehyde (TOP), Methanol (MIDDLE), Acetonitrile (BOTTOM)

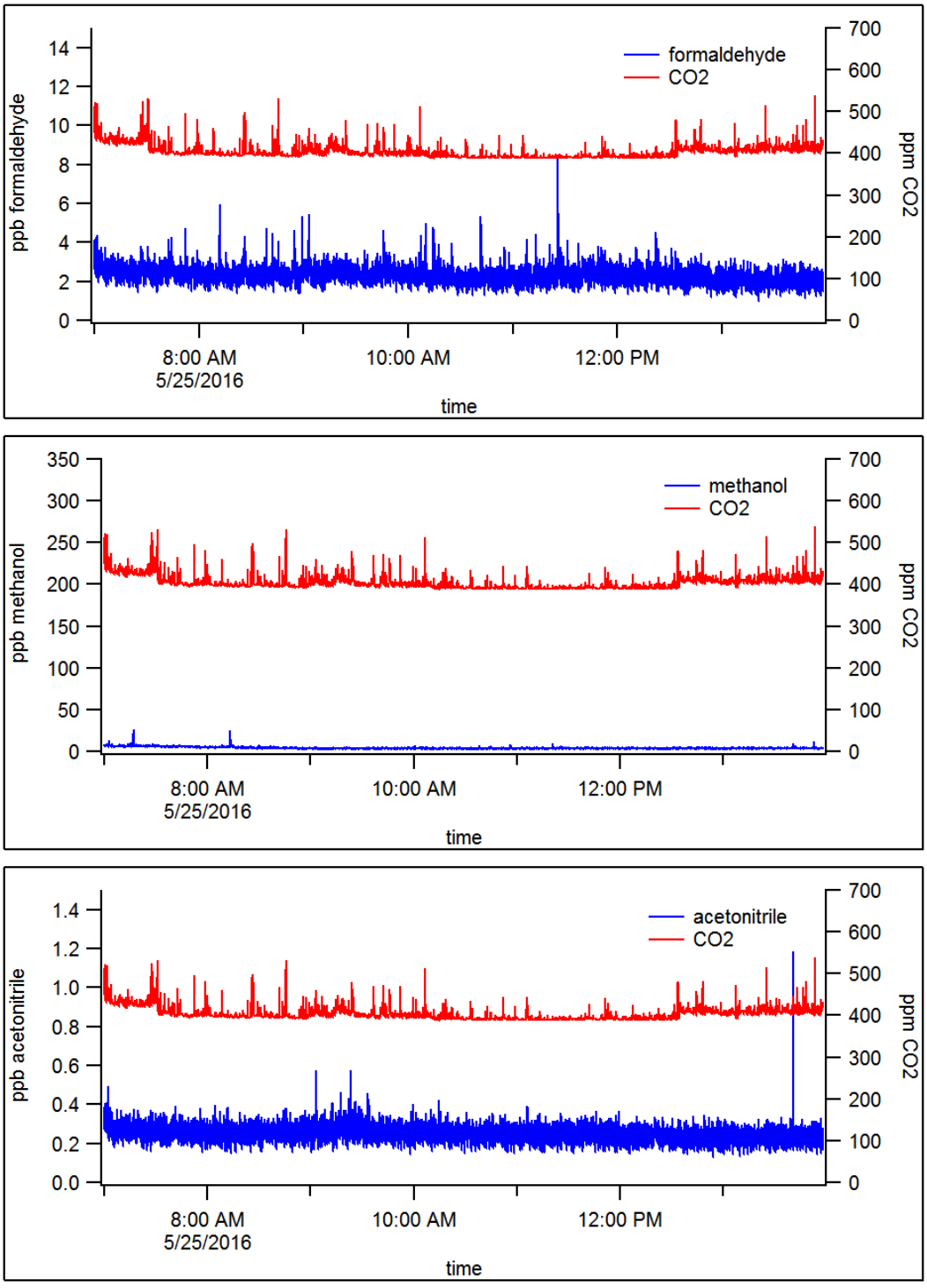


Figure C.1.2-2. May 25th - Ethylamine (TOP), Acetaldehyde (MIDDLE), 1,3-Butadiene (BOTTOM)

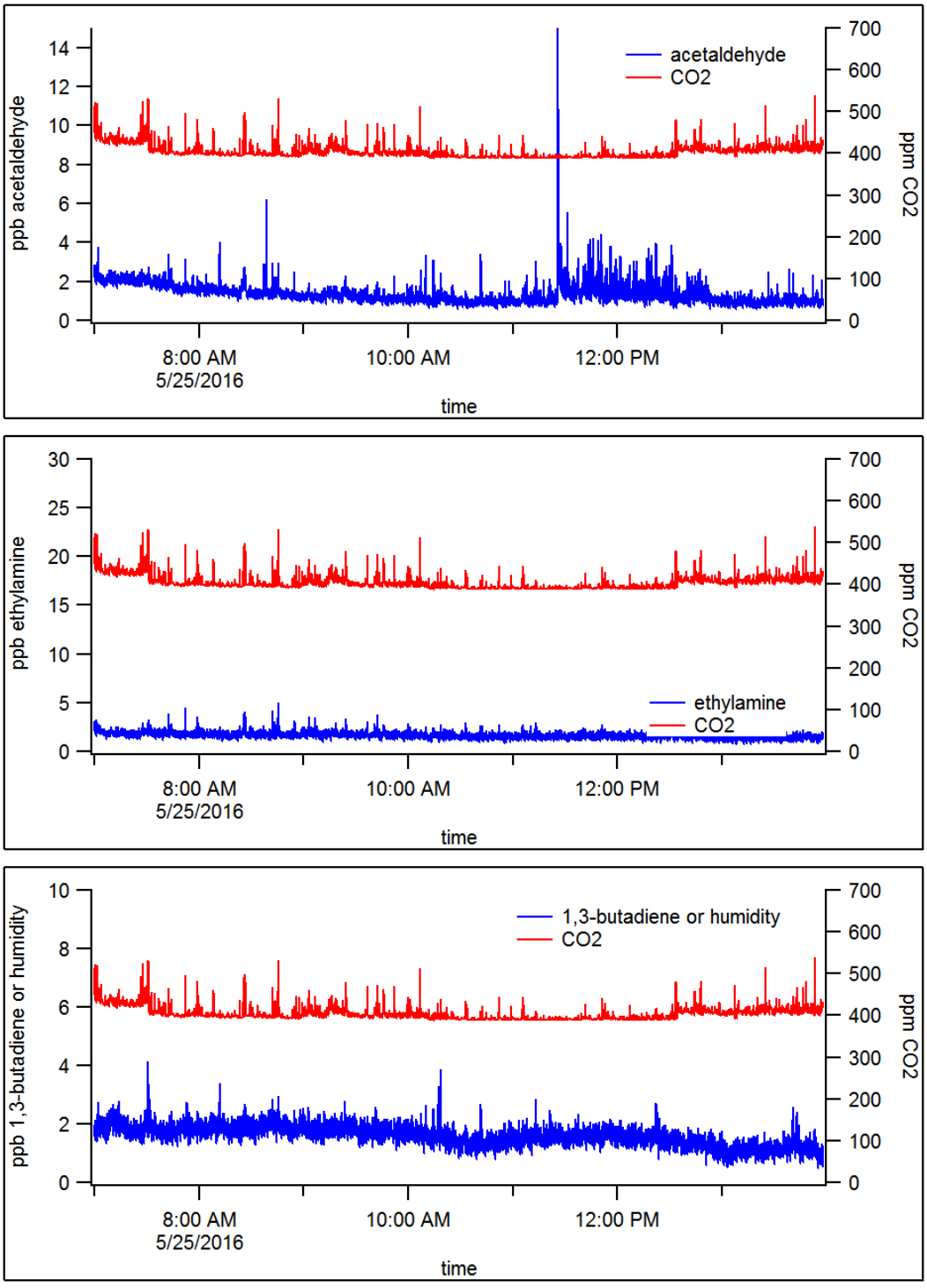


Figure C.1.2-3. May 25th - Propanenitrile (TOP), 1-Butanol; Butenes (MIDDLE), Methyl Isocyanate (BOTTOM)

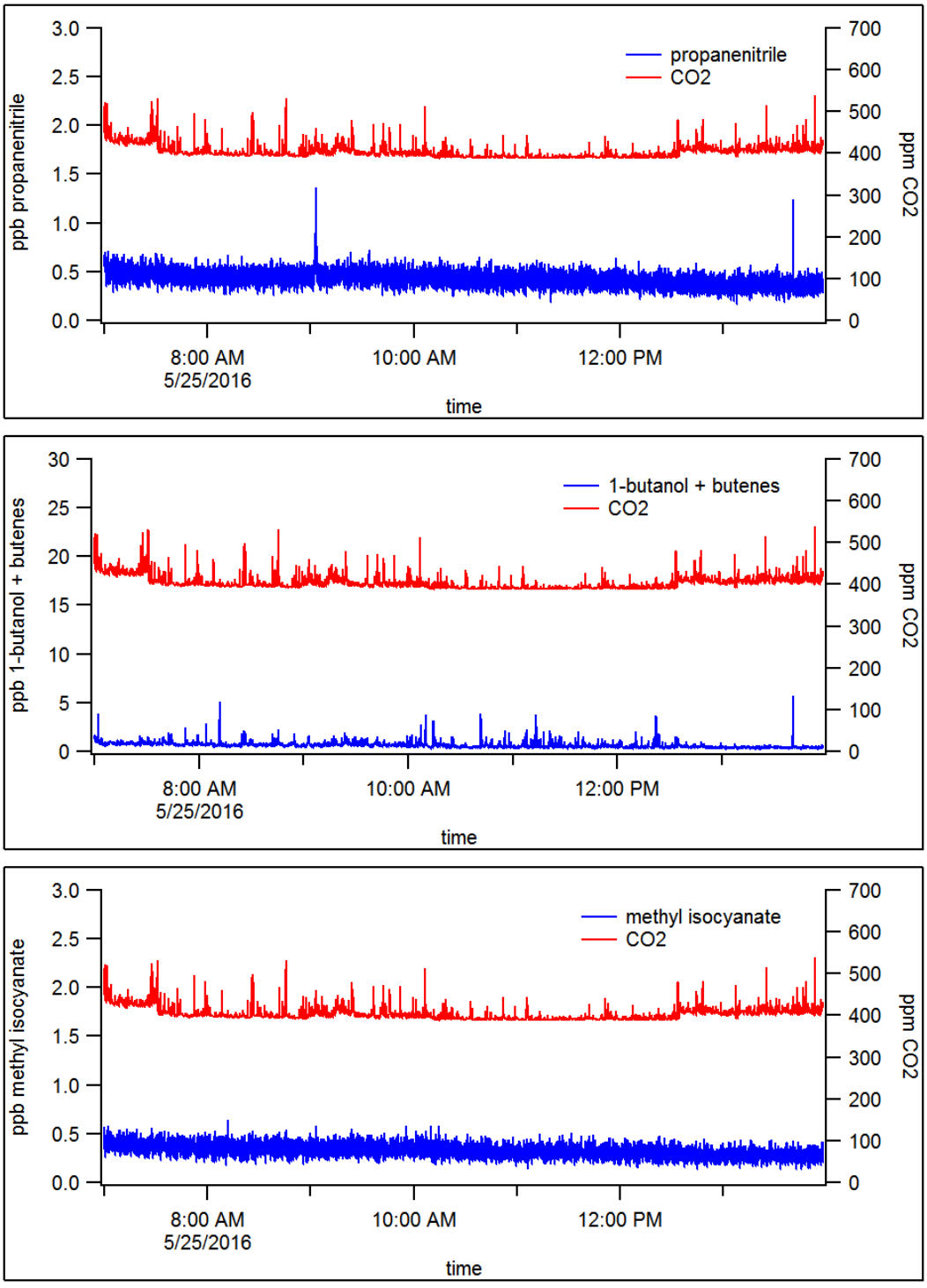


Figure C.1.2-4. May 25th - Methyl Nitrite (TOP), Furan; Isoprene(MIDDLE), Butanenitrile (BOTTOM)

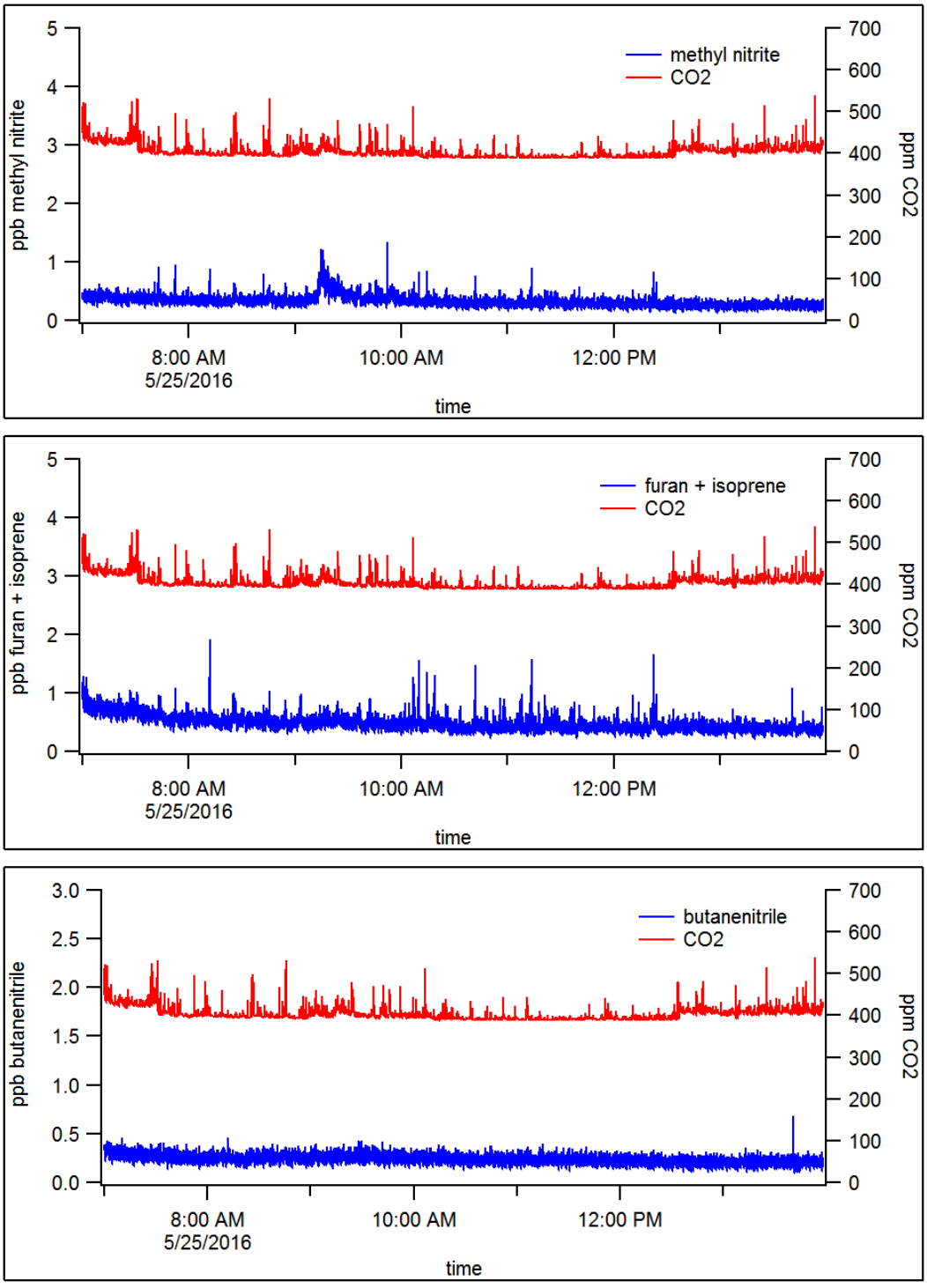


Figure C.1.2-5. May 25th - MVK + Dihydrofurans(TOP), Butanal (MIDDLE), N-nitrosodimethylamine [NDMA] (BOTTOM)

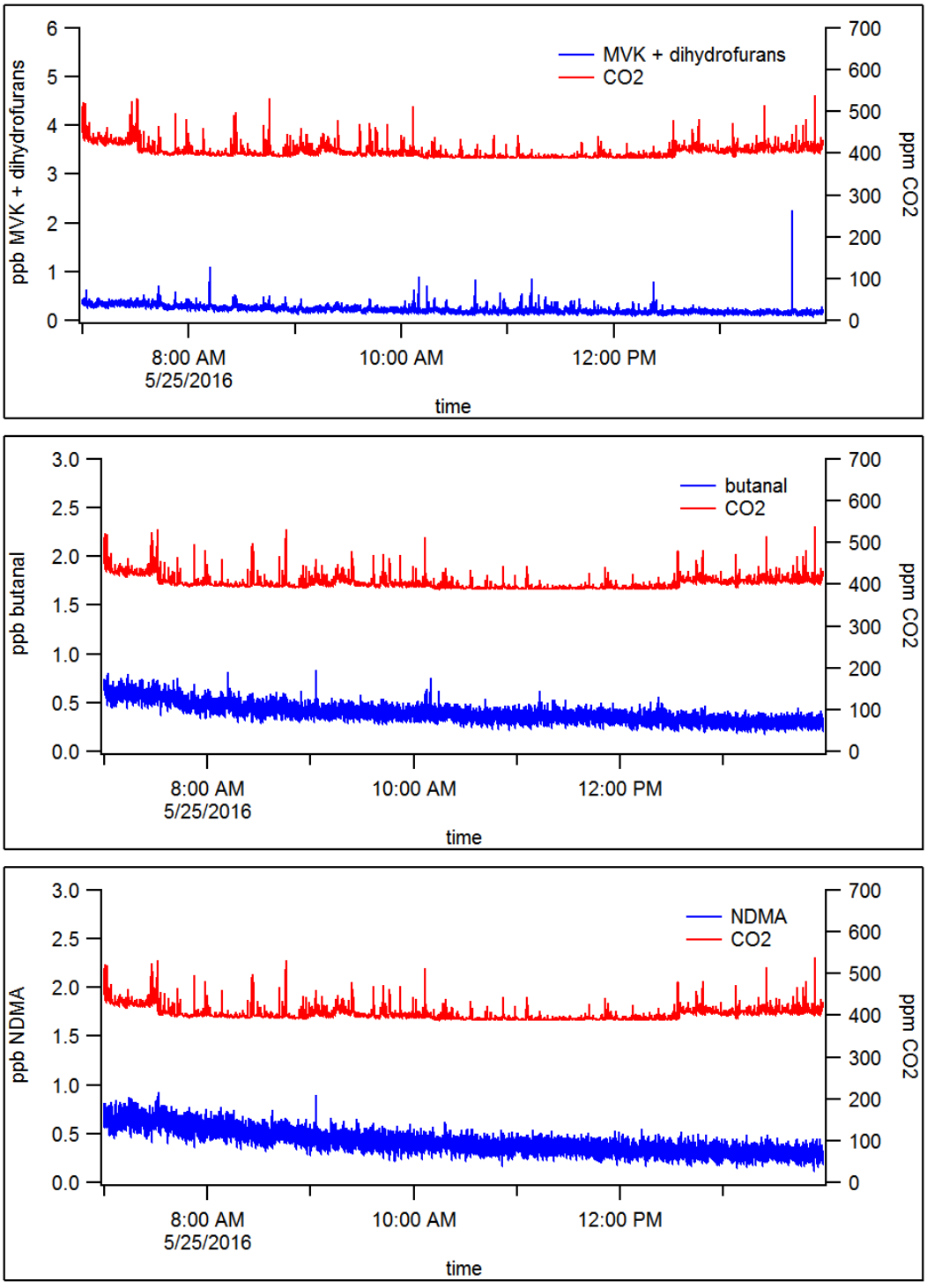


Figure C.1.2-6. May 25th - Benzene (TOP), 2,4-Pentadienenitrile; Pyridine (MIDDLE), 2-methylene Butanenitrile (BOTTOM)

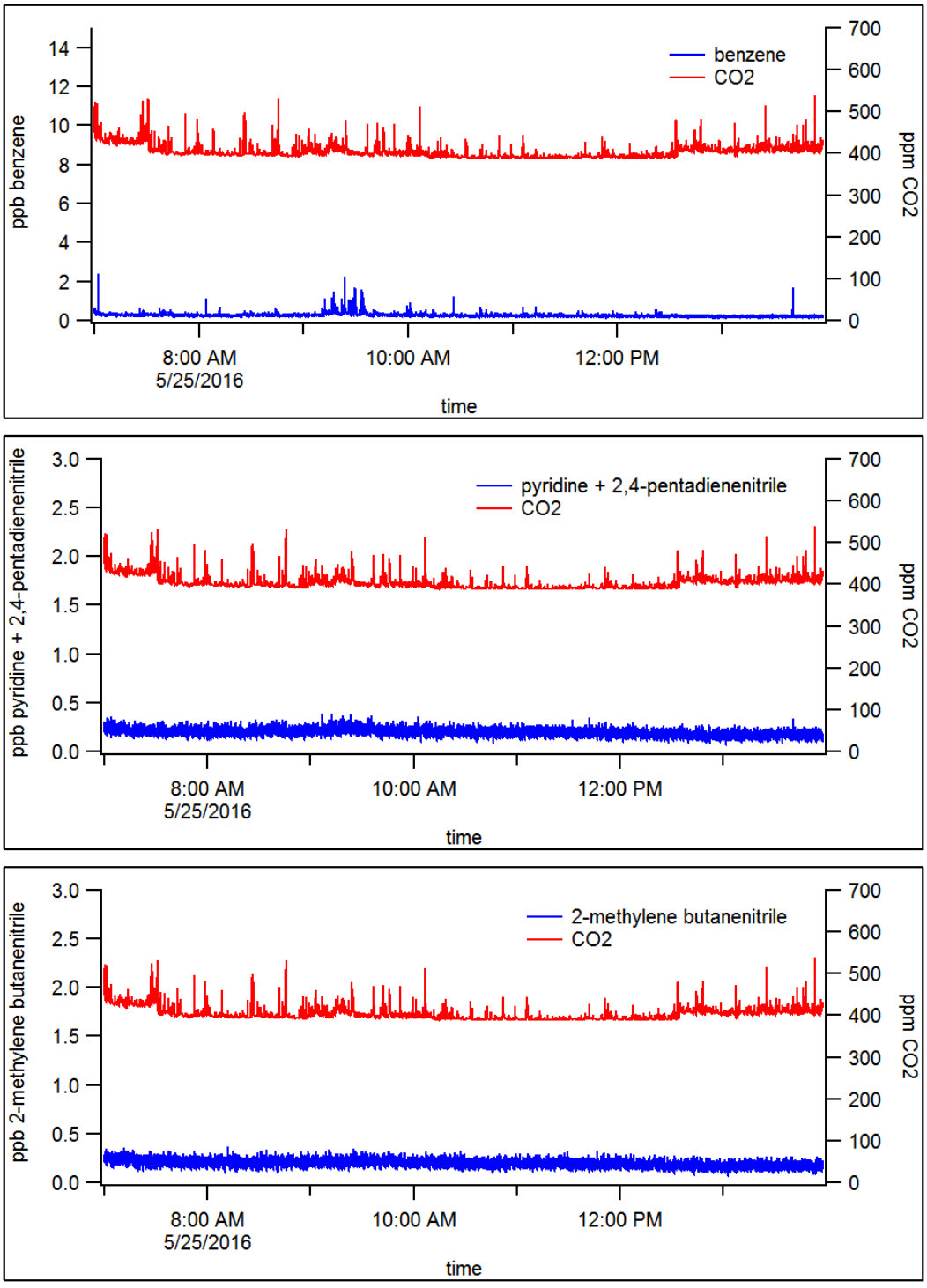


Figure C.1.2-7. May 25th - 2-methylfuran (TOP), Pentanenitrile (MIDDLE), 3-methyl-3-buten-2-one; 2-methyl-2-butenal (BOTTOM)

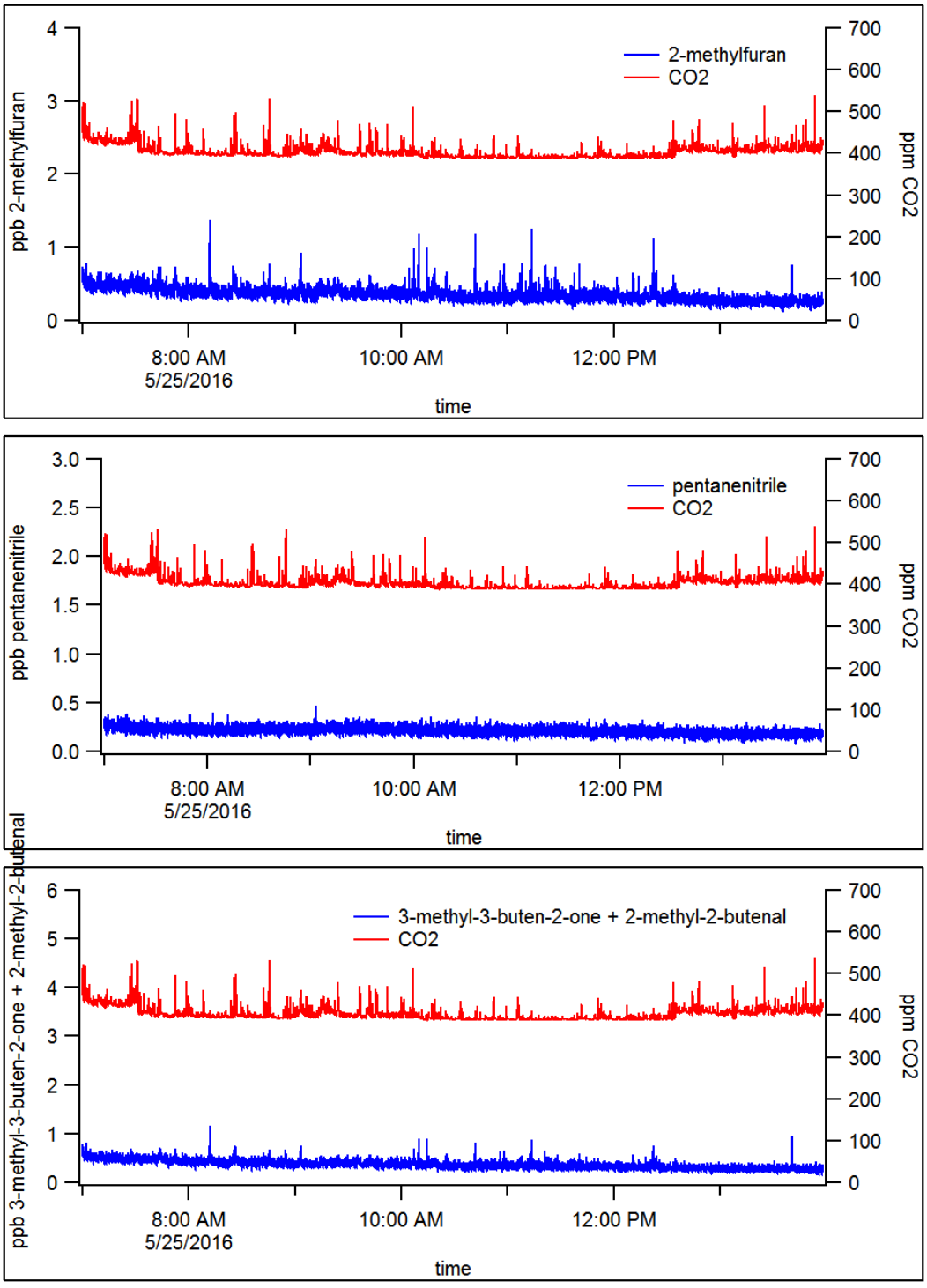


Figure C.1.2-8. May 25th - N-nitrosomethylethylamine [NEMA] (TOP), 2,5-dimethylfuran (MIDDLE), Hexanenitrile (BOTTOM)

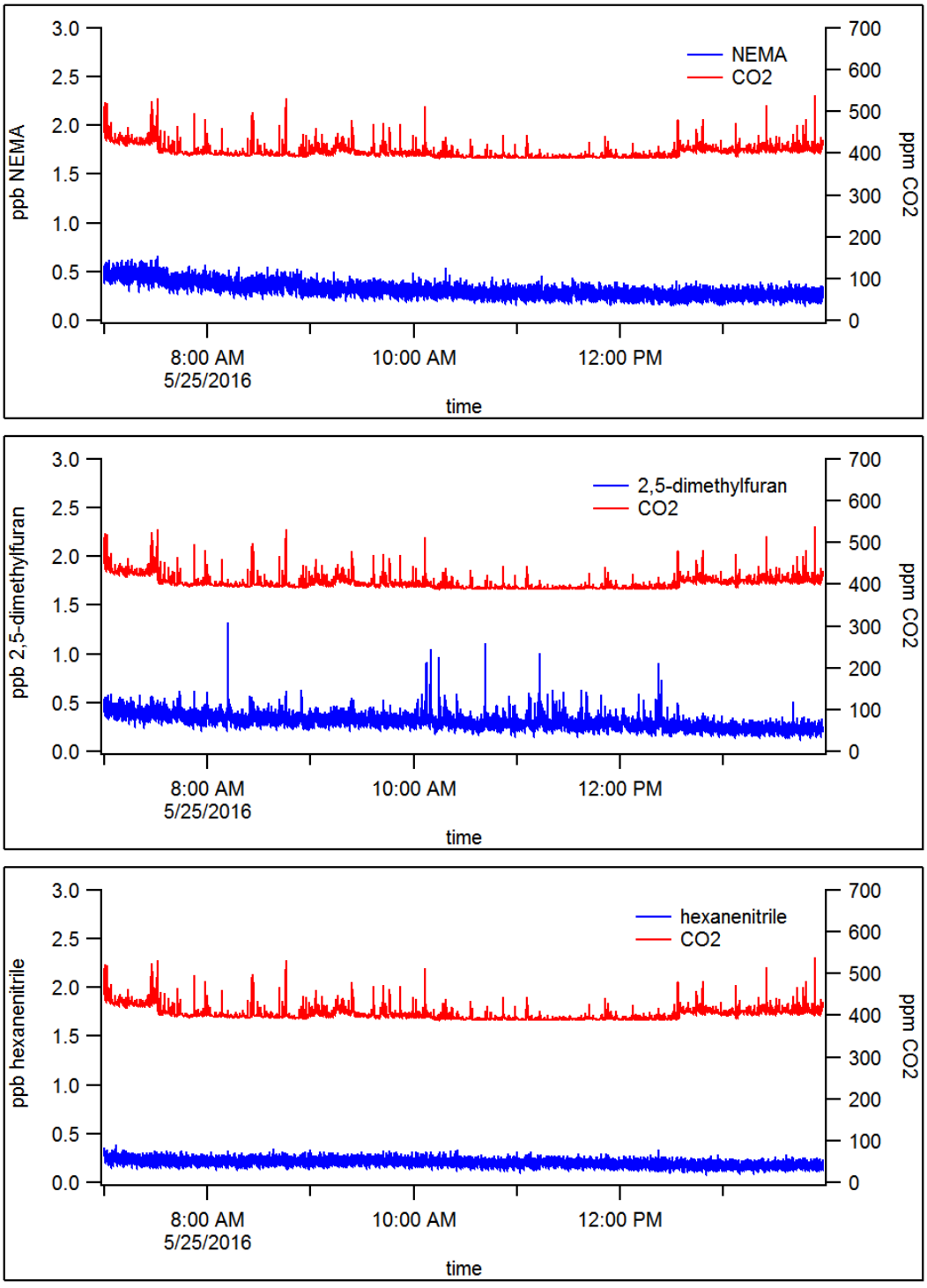


Figure C.1.2-9. May 25th - 2-hexanone [MBK] (TOP), N-nitrosodiethylamine [NDEA] (MIDDLE), Butyl Nitrite; 2-nitro-2-methylpropane (BOTTOM)

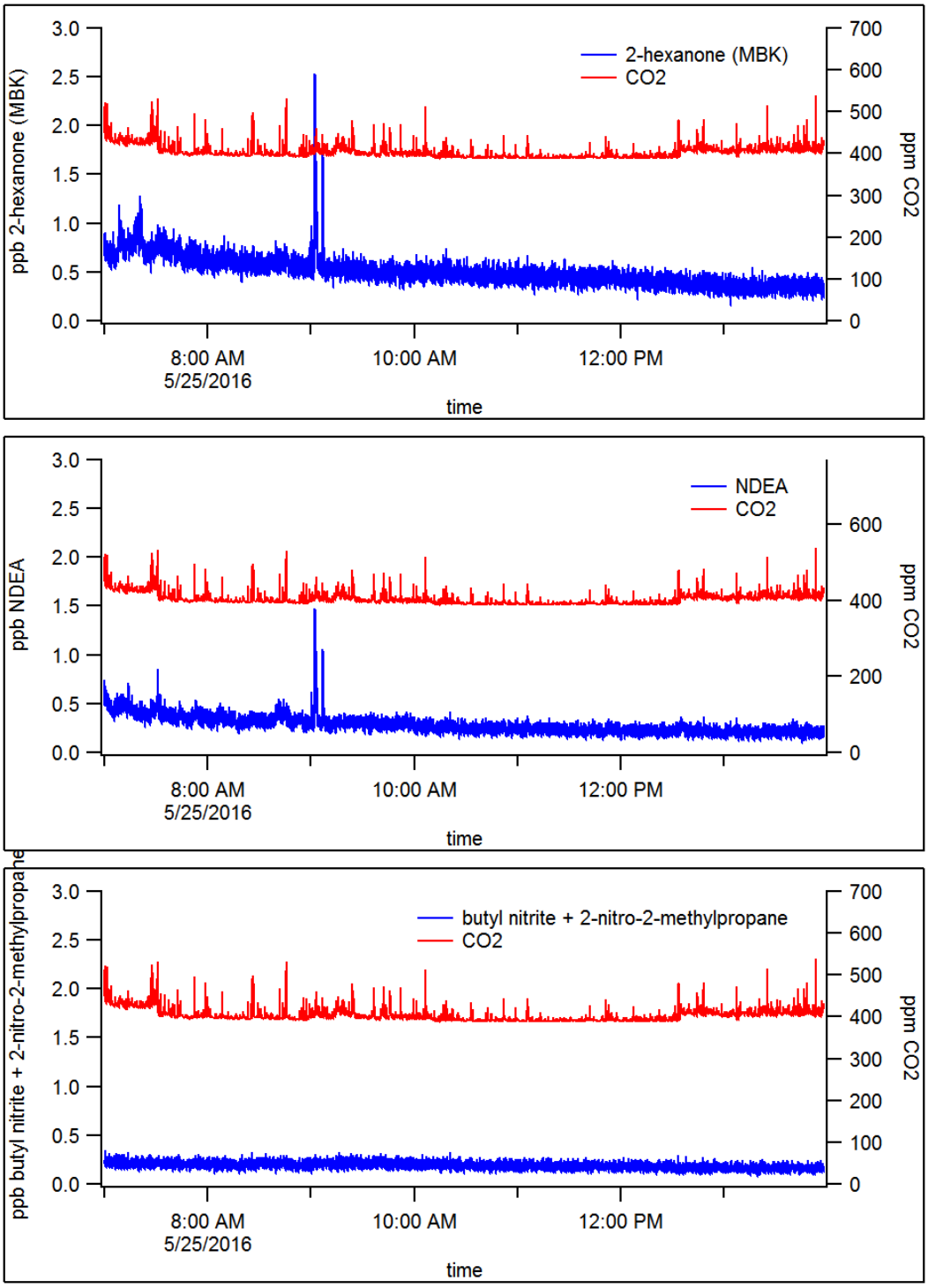


Figure C.1.2-10. May 25th - 2,4-dimethylpyridine (TOP), 2-ethyl-5-methylfuran (MIDDLE), Heptanenitrile (BOTTOM)

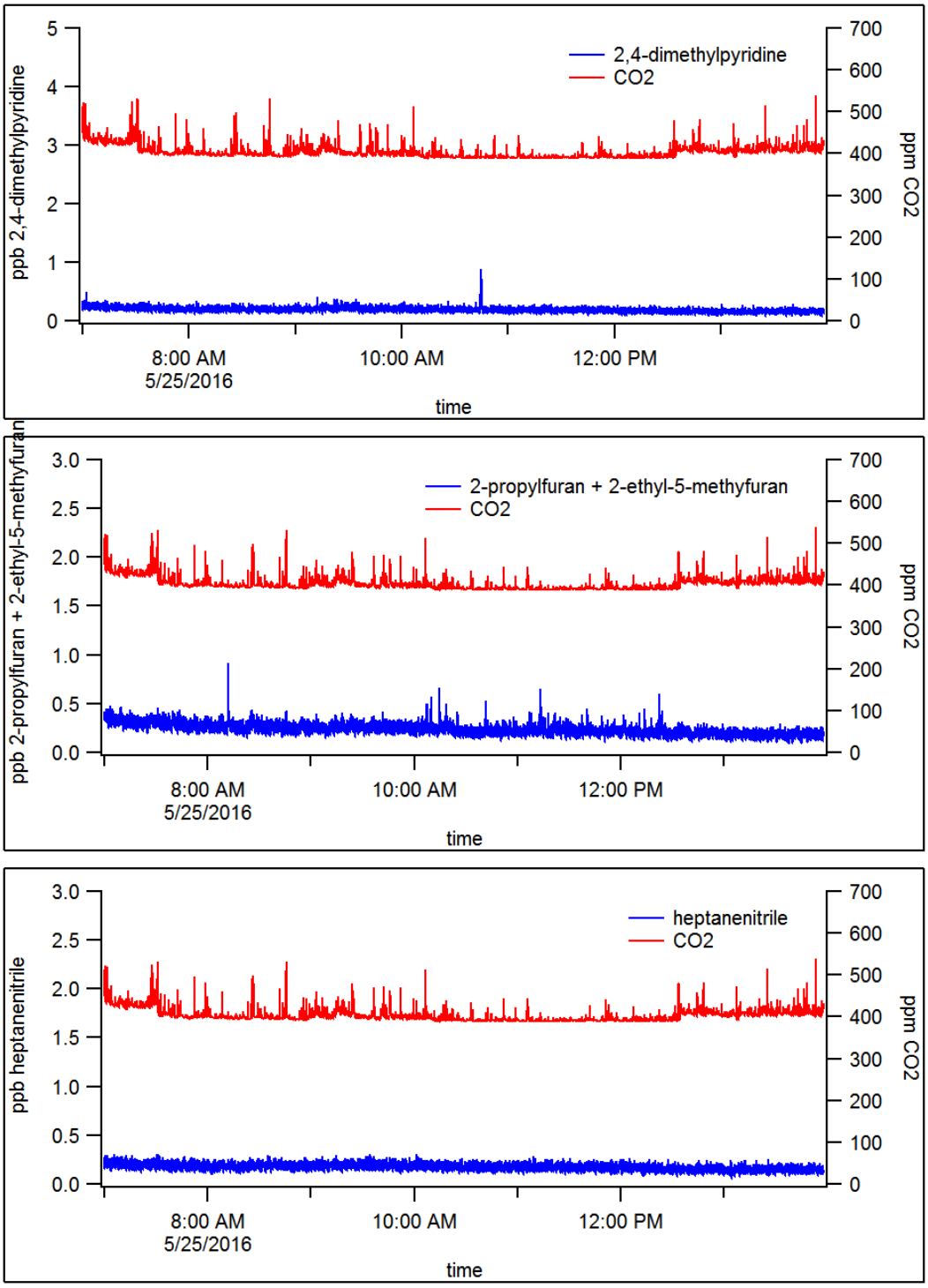


Figure C.1.2-11. May 25th - 4-methyl-2-hexanone (TOP), N-nitrosomorpholine [NMOR] (MIDDLE), Butyl Nitrate (BOTTOM)

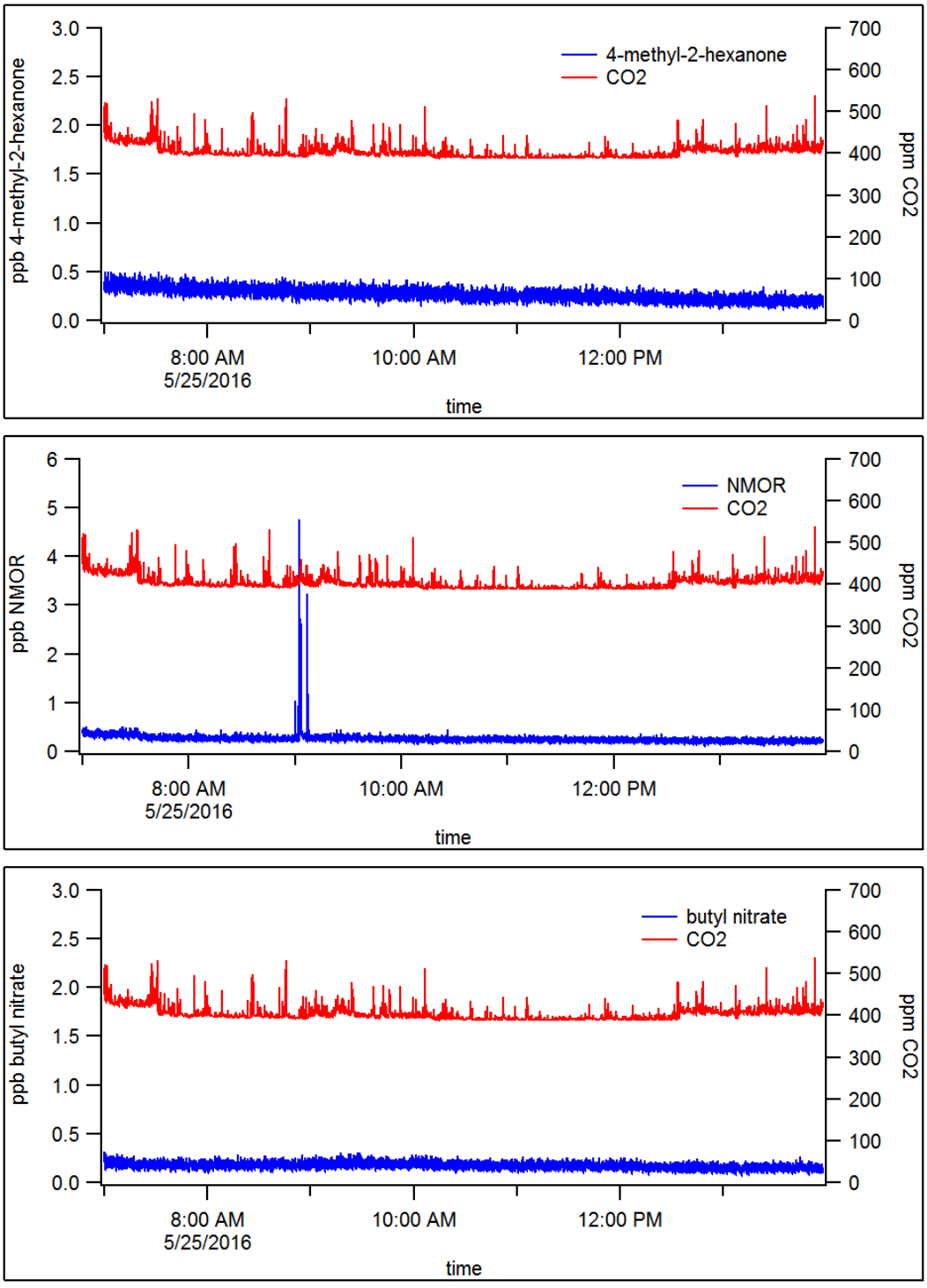


Figure C.1.2-12. May 25th - Multiple Furans [m/z 127] (TOP), 6-methyl-2-heptanone (MIDDLE), 2-pentylfuran (BOTTOM)

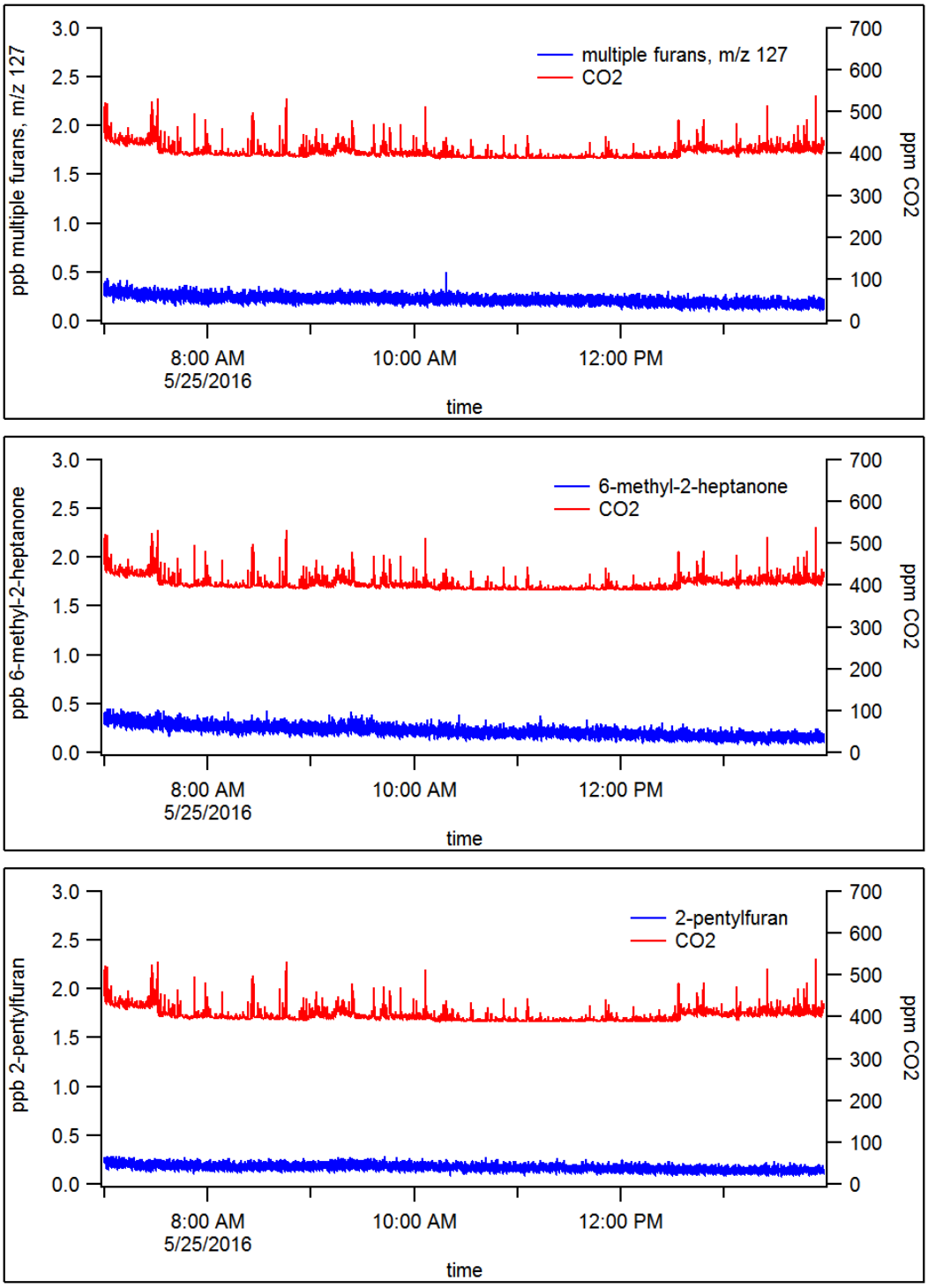


Figure C.1.2-13. May 25th - Biphenyl (TOP), 2-heptylfuran (MIDDLE), 2-octylfuran; 1,4-butanediol, dinitrate (BOTTOM)

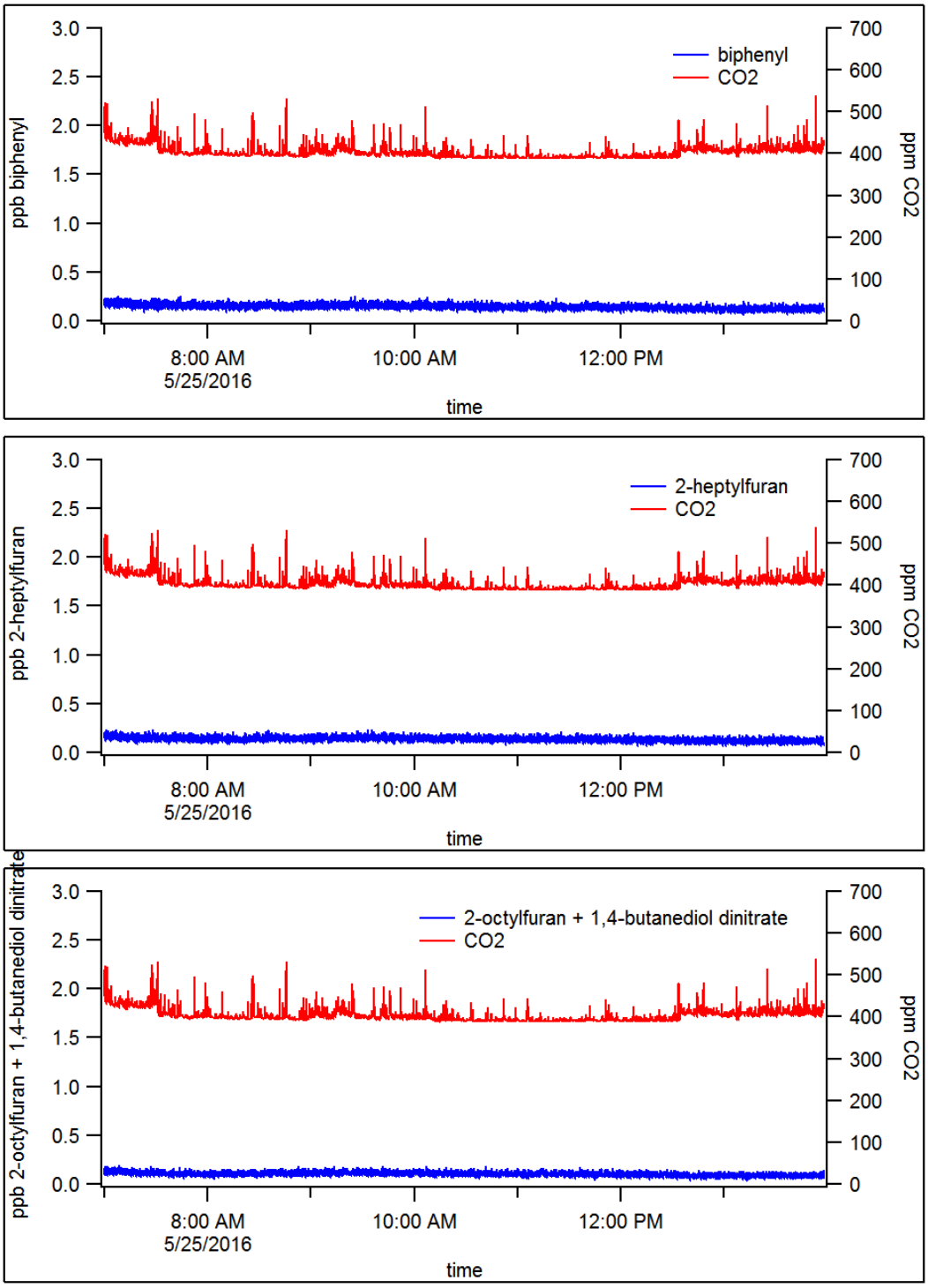


Figure C.1.2-14. May 25th - 1,2,3-propanetriol, 1,3-dinitrate (TOP), PCB (MIDDLE), 6-(2-furanyl)-6-methyl-2-heptanone (BOTTOM)

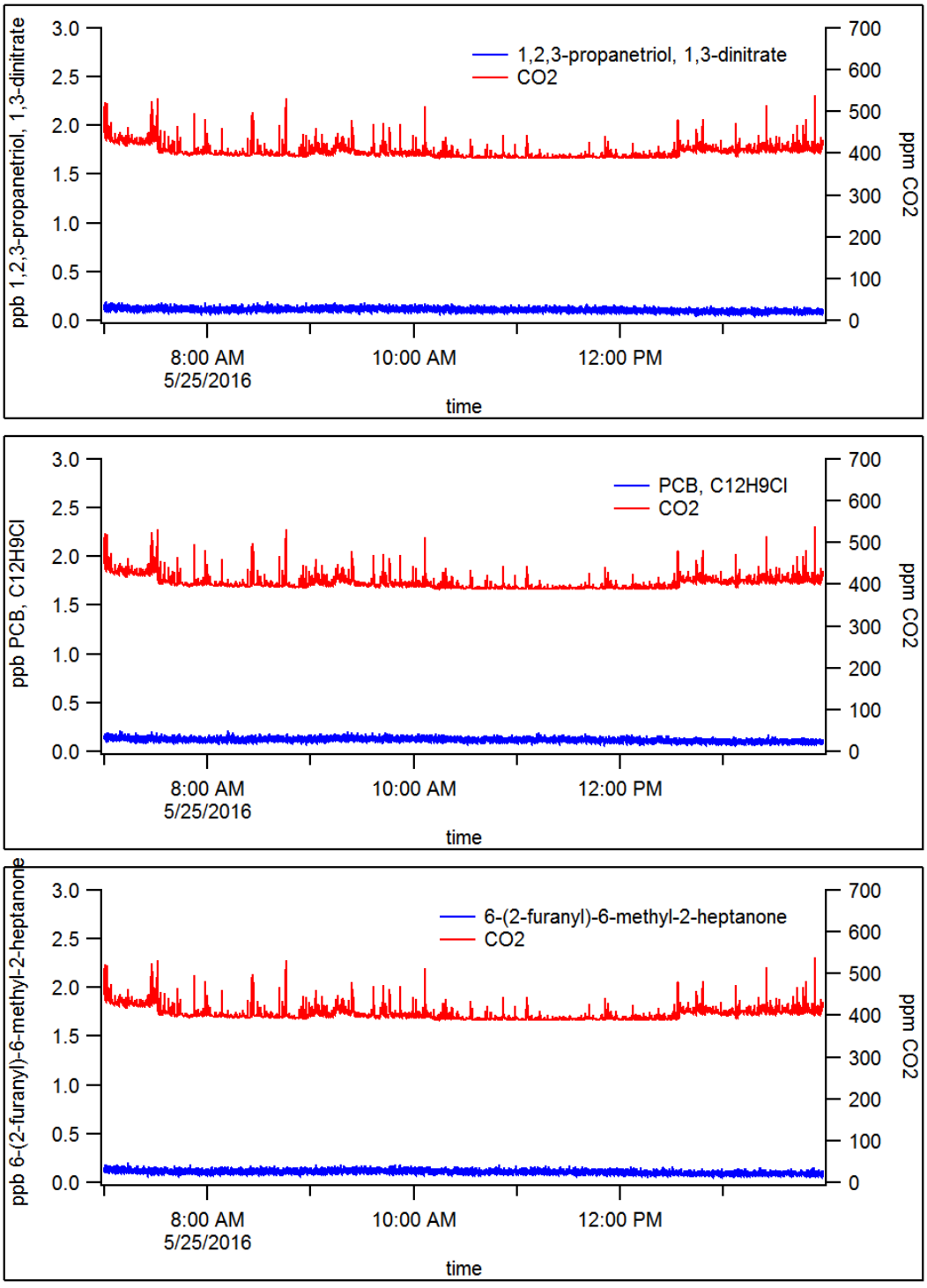
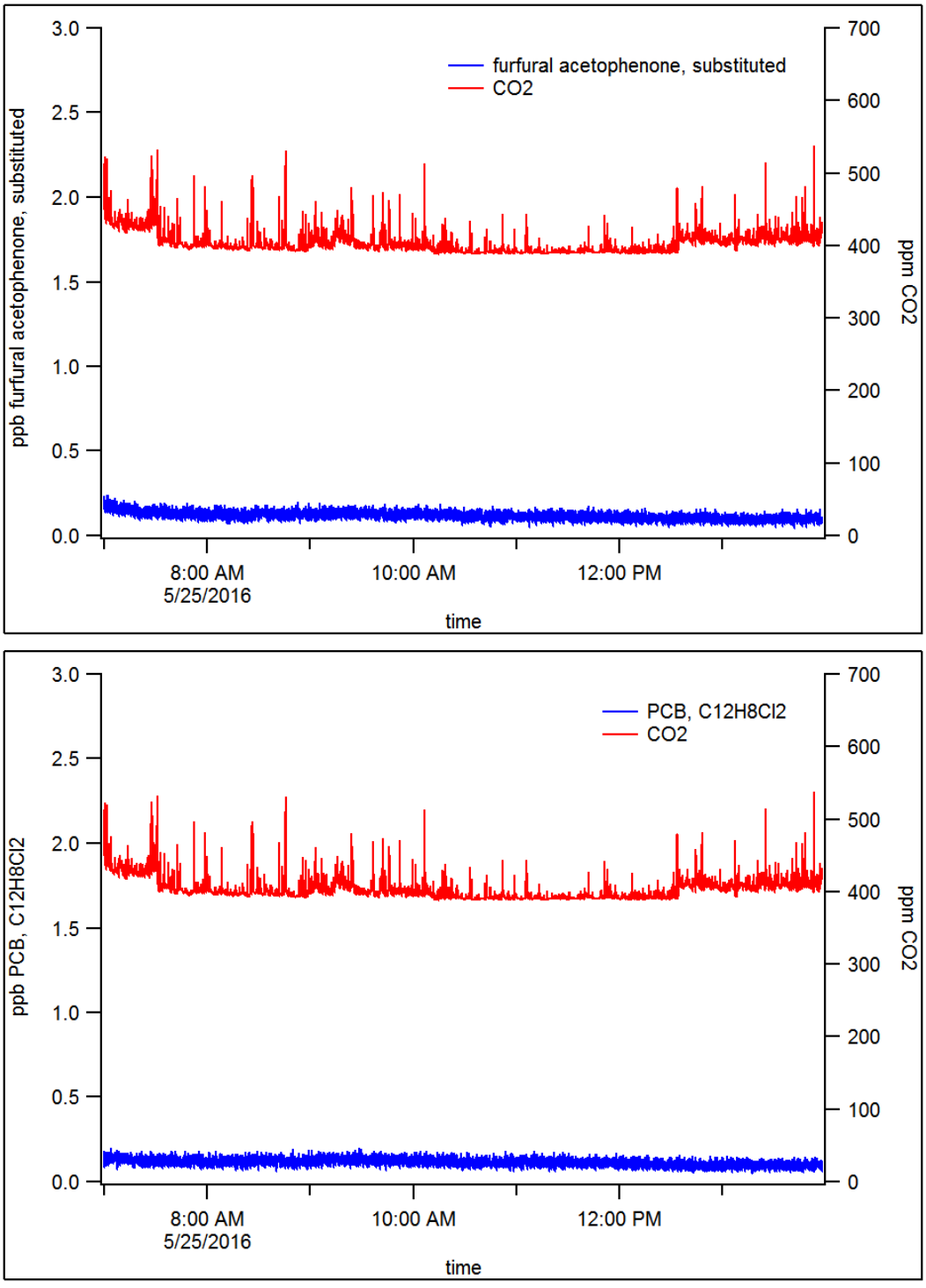


Figure C.1.2-15. May 25th - Furfural Acetophenone (3-(2-furanyl)-1-pheynyl-2-propen-1-one (TOP), PCB [2] (BOTTOM)



C.1.3 May 26th Data Collection

May 26th data collection started at 7:20 AM and ended at 3:45 PM. Data collection methods included both mobile and stationary lab techniques. Below are the graphs presented in order based on the Chemicals of Potential Concern (COPC) list.

Figure C.1.3-1. May 26th - Formaldehyde (TOP), Methanol (MIDDLE), Acetonitrile (BOTTOM)

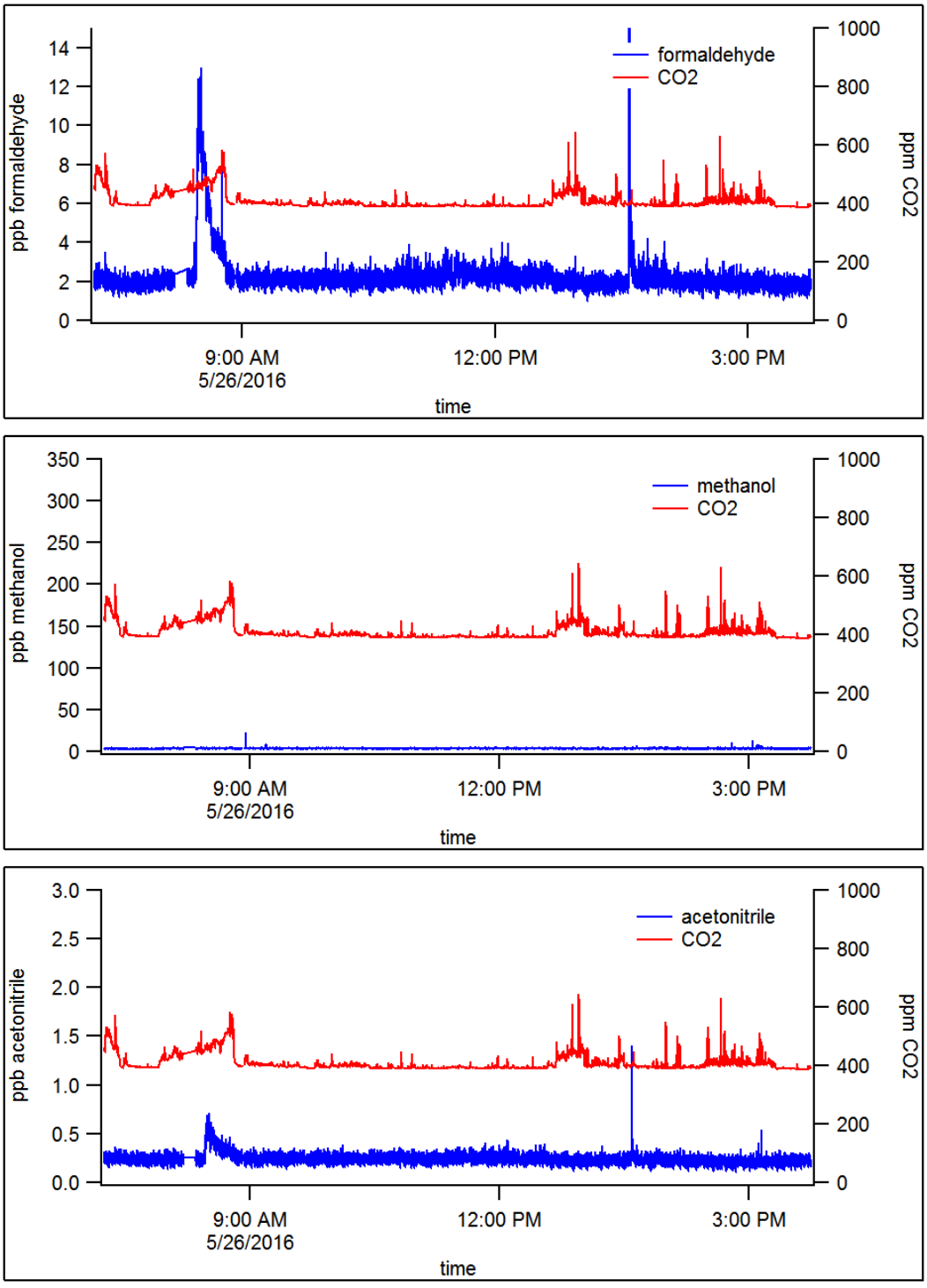


Figure C.1.3-2. May 26th - Ethylamine (TOP), Acetaldehyde (MIDDLE), 1,3-Butadiene (BOTTOM)

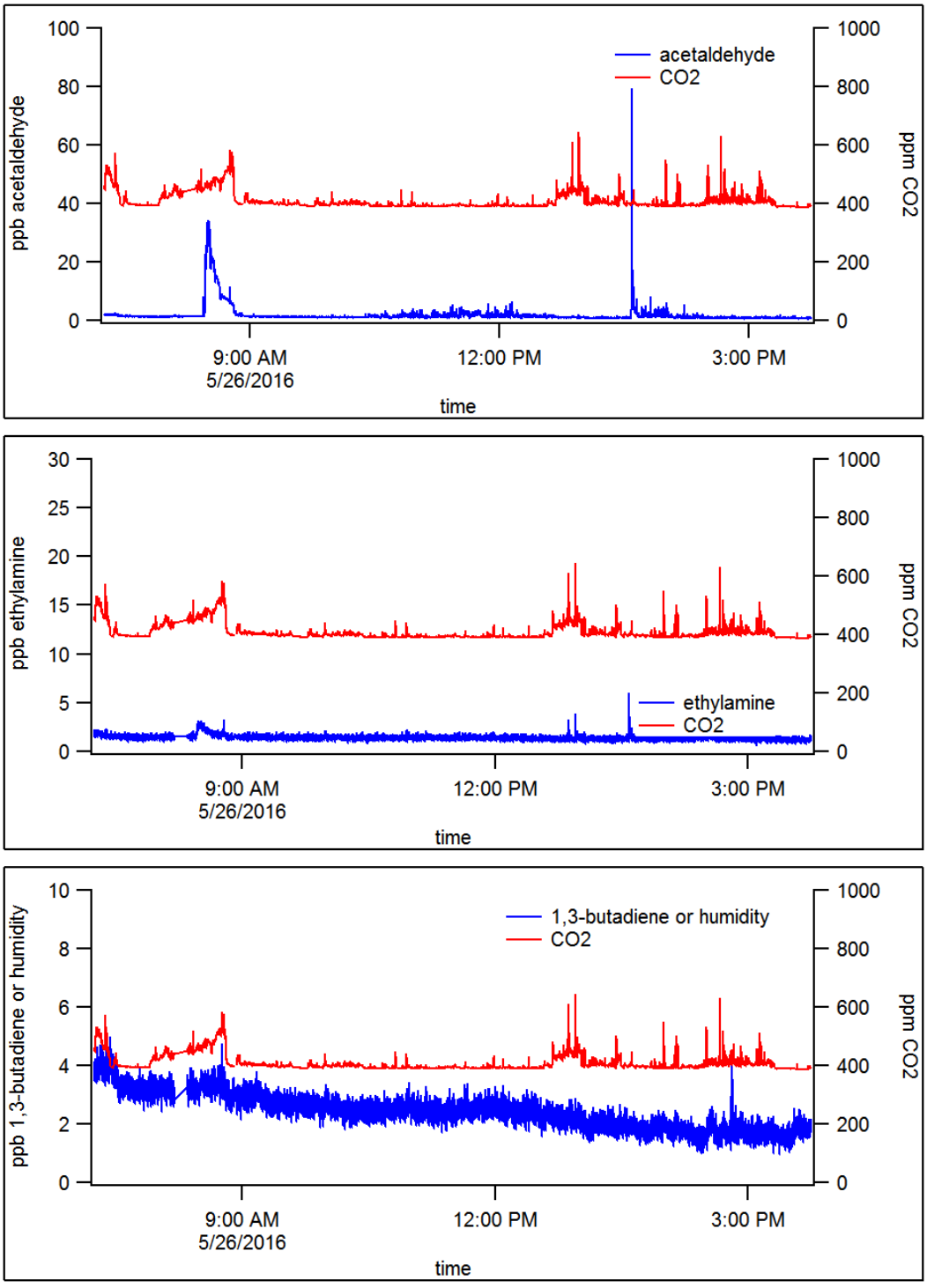


Figure C.1.3-3. May 26th - Propanenitrile (TOP), 1-Butanol; Butenes (MIDDLE), Methyl Isocyanate (BOTTOM)

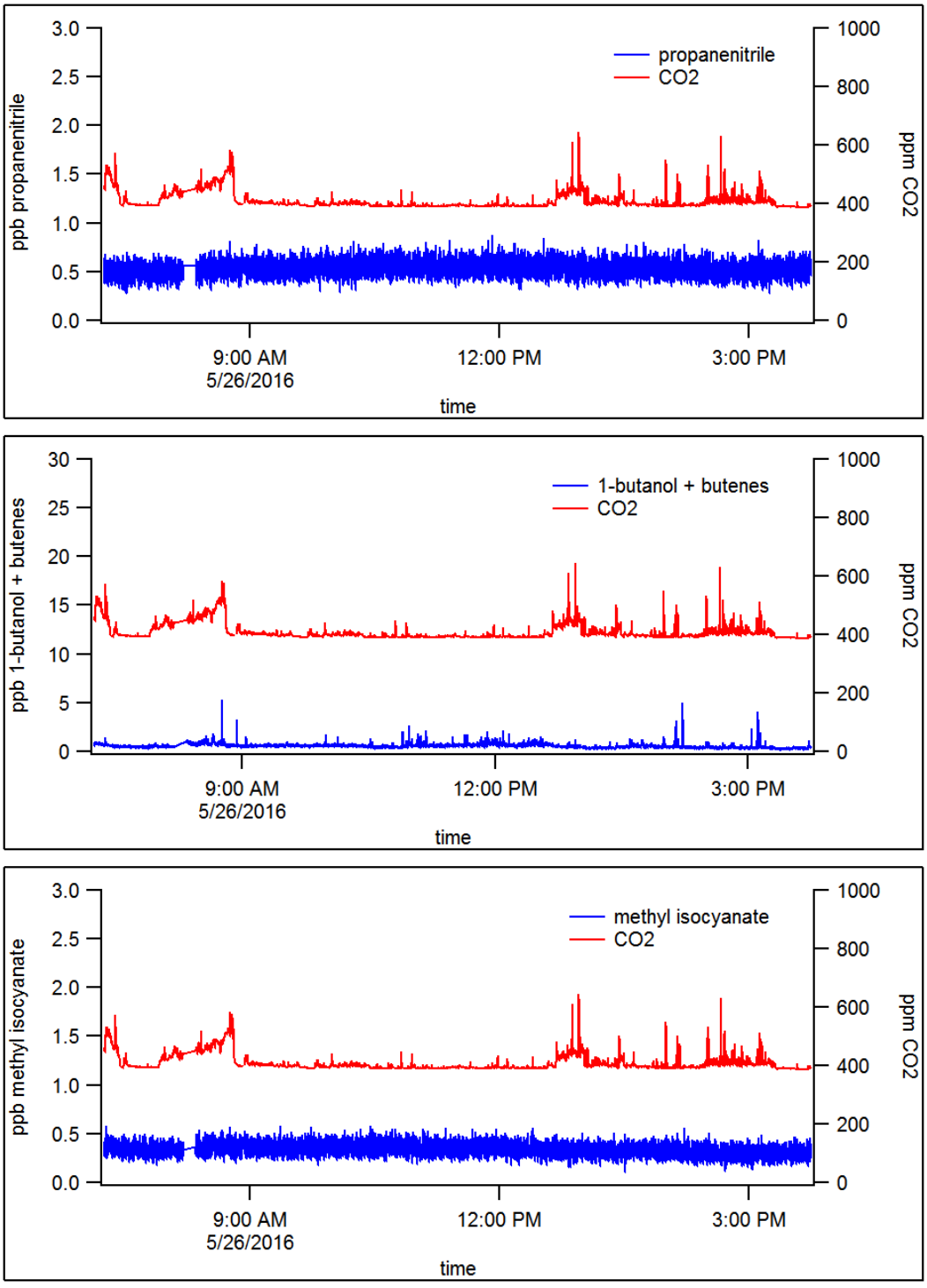


Figure C.1.3-4. May 26th - Methyl Nitrite (TOP), Furan; Isoprene(MIDDLE), Butanenitrile (BOTTOM)

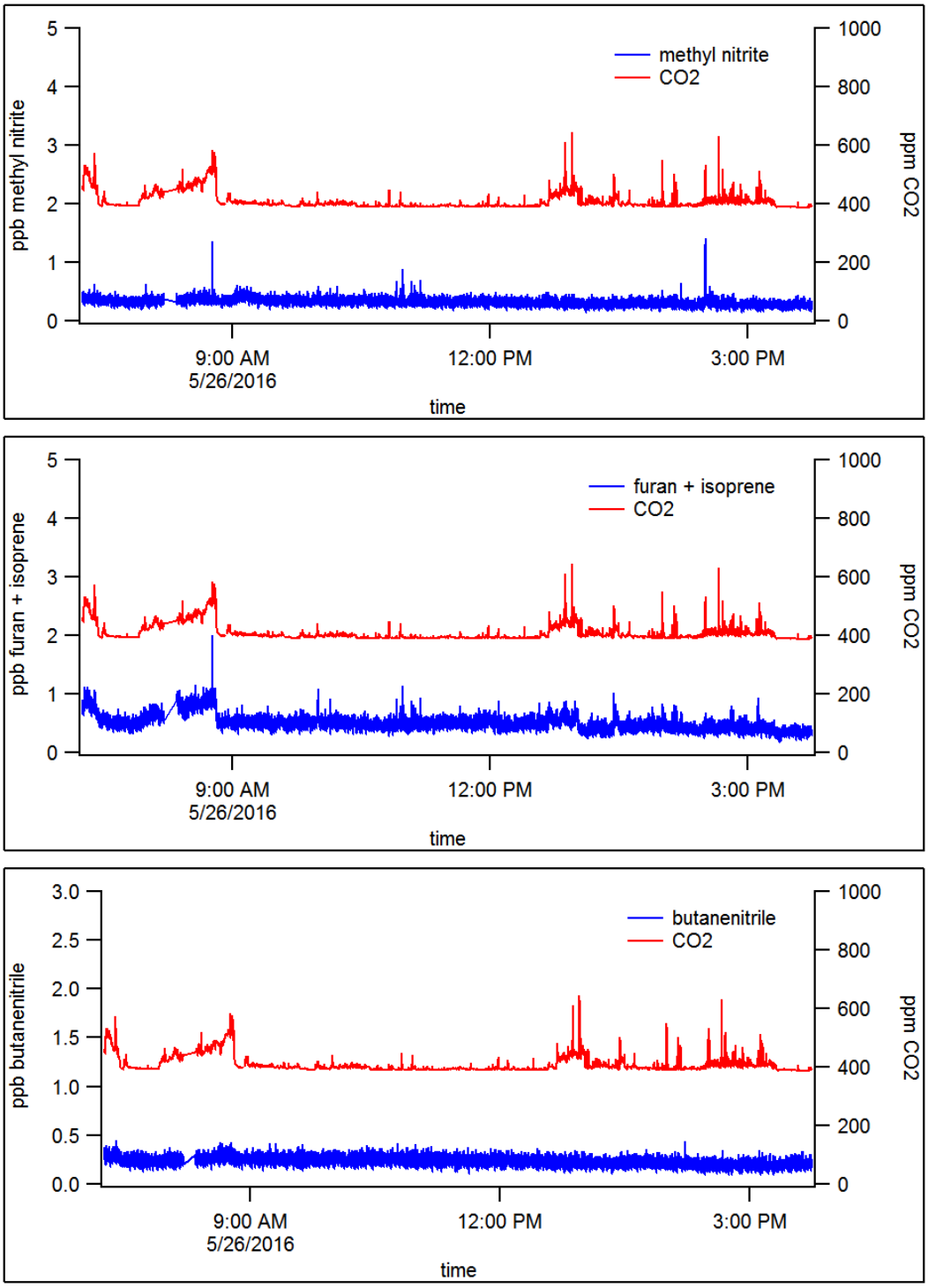


Figure C.1.3-5. May 26th - MVK + Dihydrofurans(TOP), Butanal (MIDDLE), N-nitrosodimethylamine [NDMA] (BOTTOM)

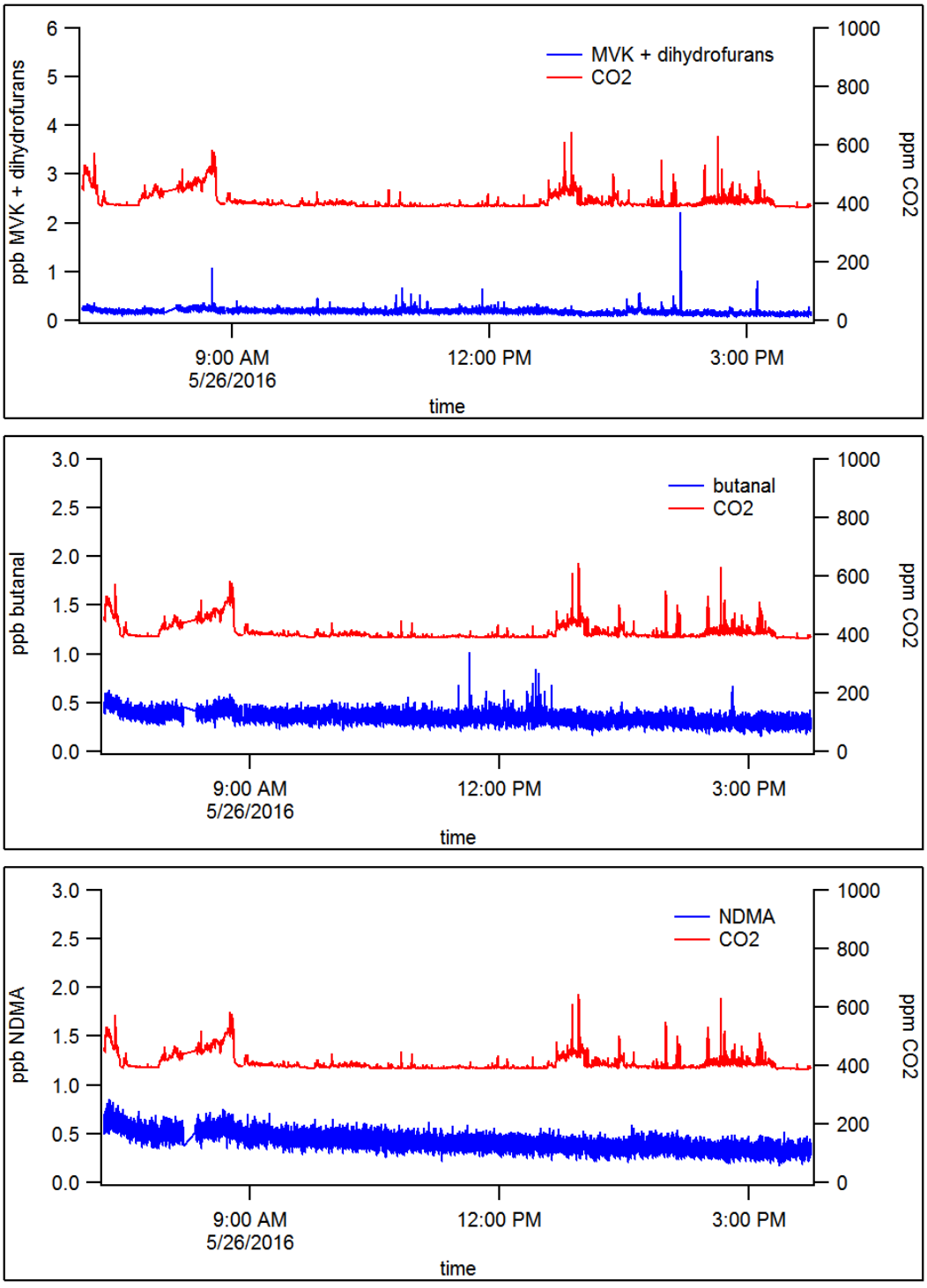


Figure C.1.3-6. May 26th - Benzene (TOP), 2,4-Pentadienenitrile; Pyridine (MIDDLE), 2-methylene Butanenitrile (BOTTOM)

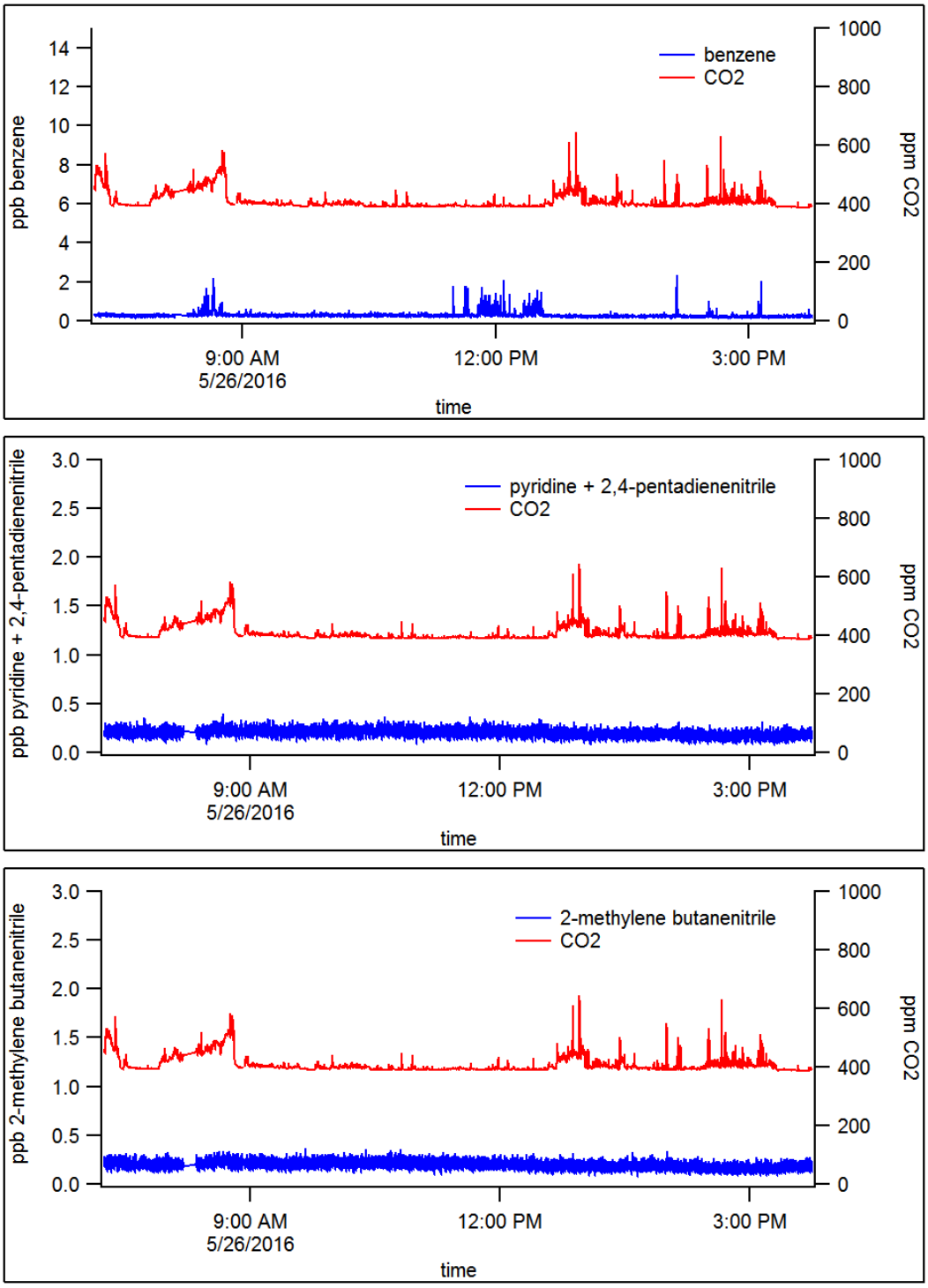


Figure C.1.3-7. May 26th - 2-methylfuran (TOP), Pentanenitrile (MIDDLE), 3-methyl-3-buten-2-one; 2-methyl-2-butenal (BOTTOM)

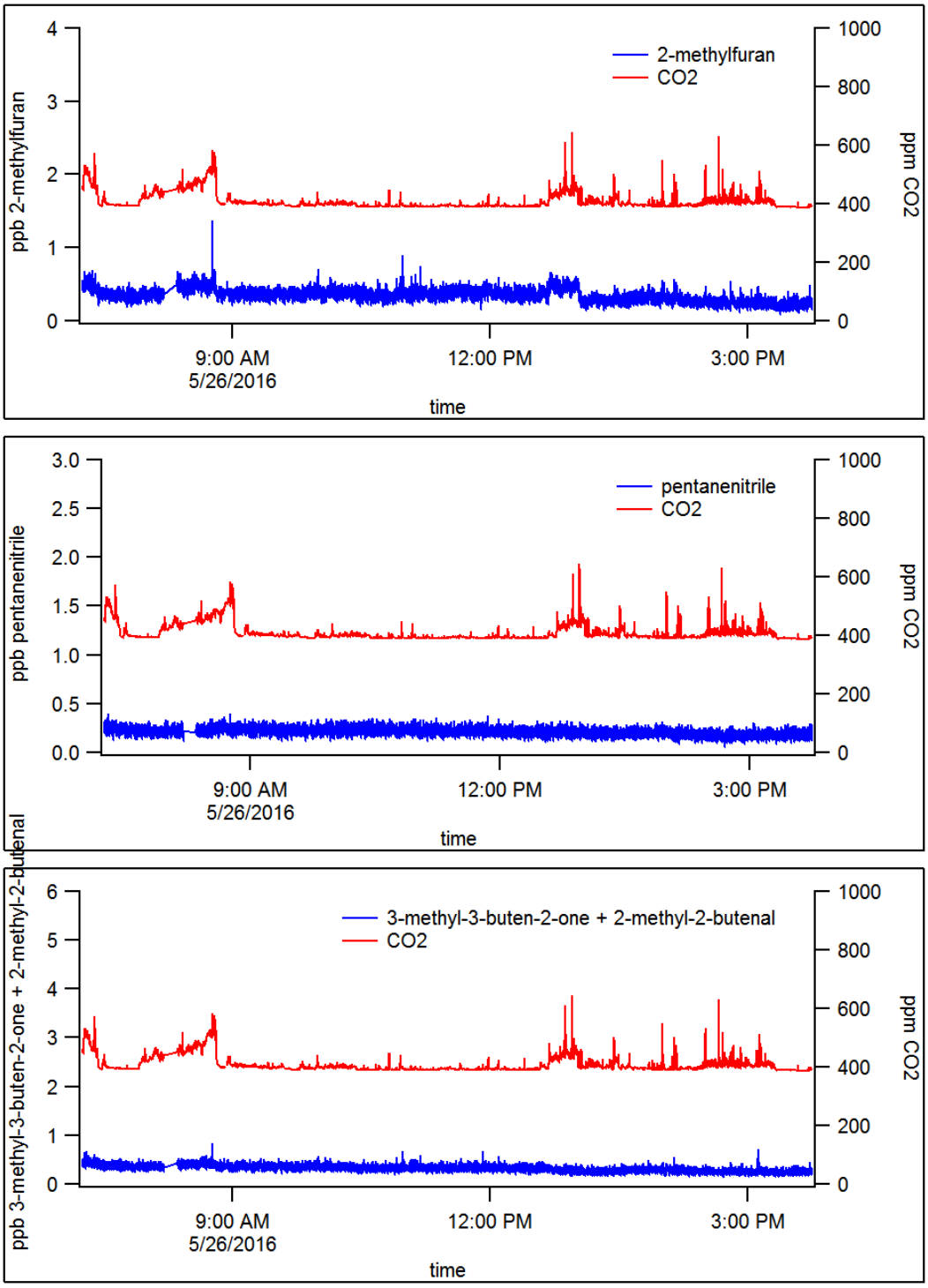


Figure C.1.3-8. May 26th - N-nitrosomethylethylamine [NEMA] (TOP), 2,5-dimethylfuran (MIDDLE), Hexanenitrile (BOTTOM)

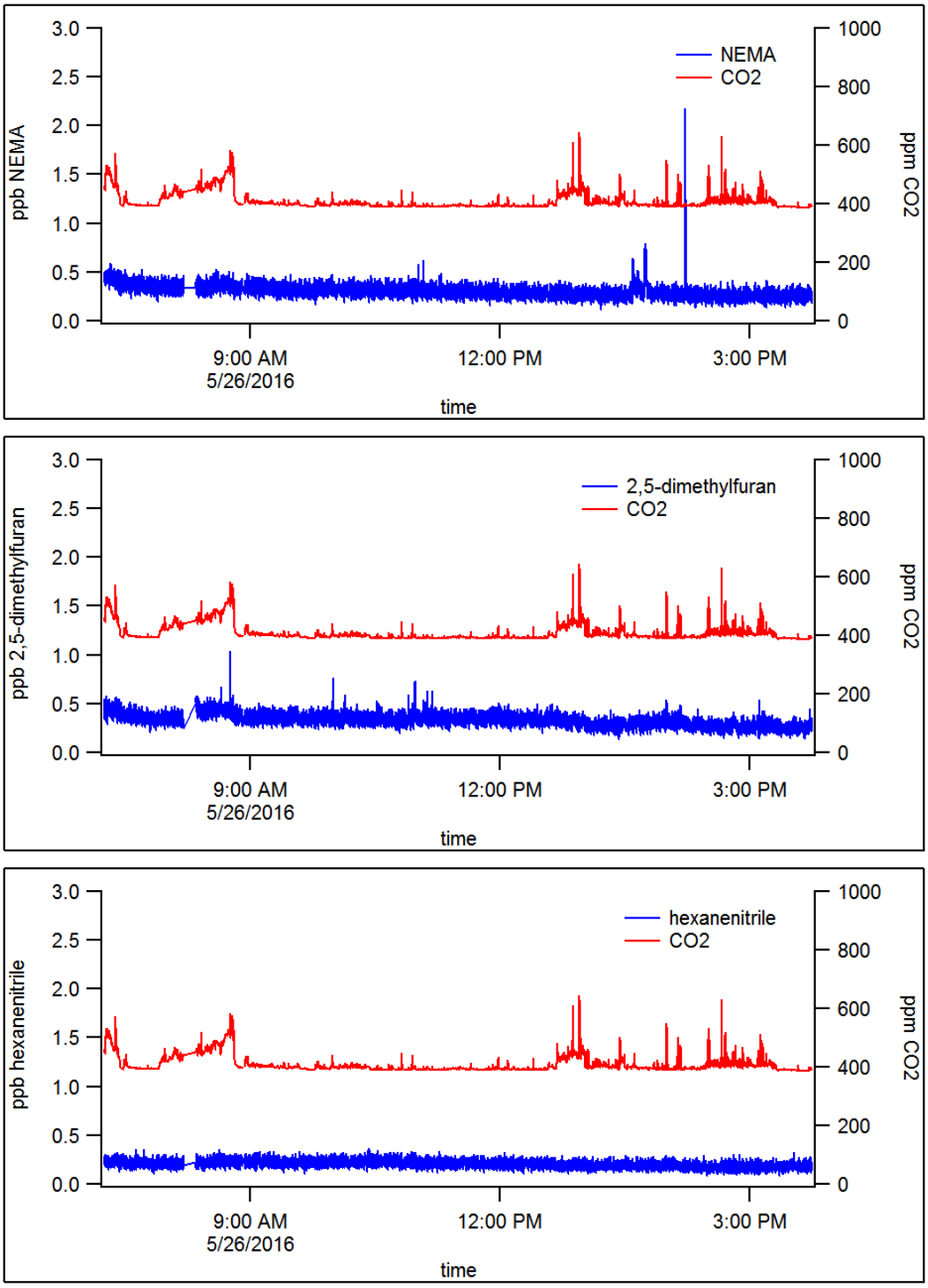


Figure C.1.3-9. May 26th - 2-hexanone [MBK] (TOP), N-nitrosodiethylamine [NDEA] (MIDDLE), Butyl Nitrite; 2-nitro-2-methylpropane (BOTTOM)

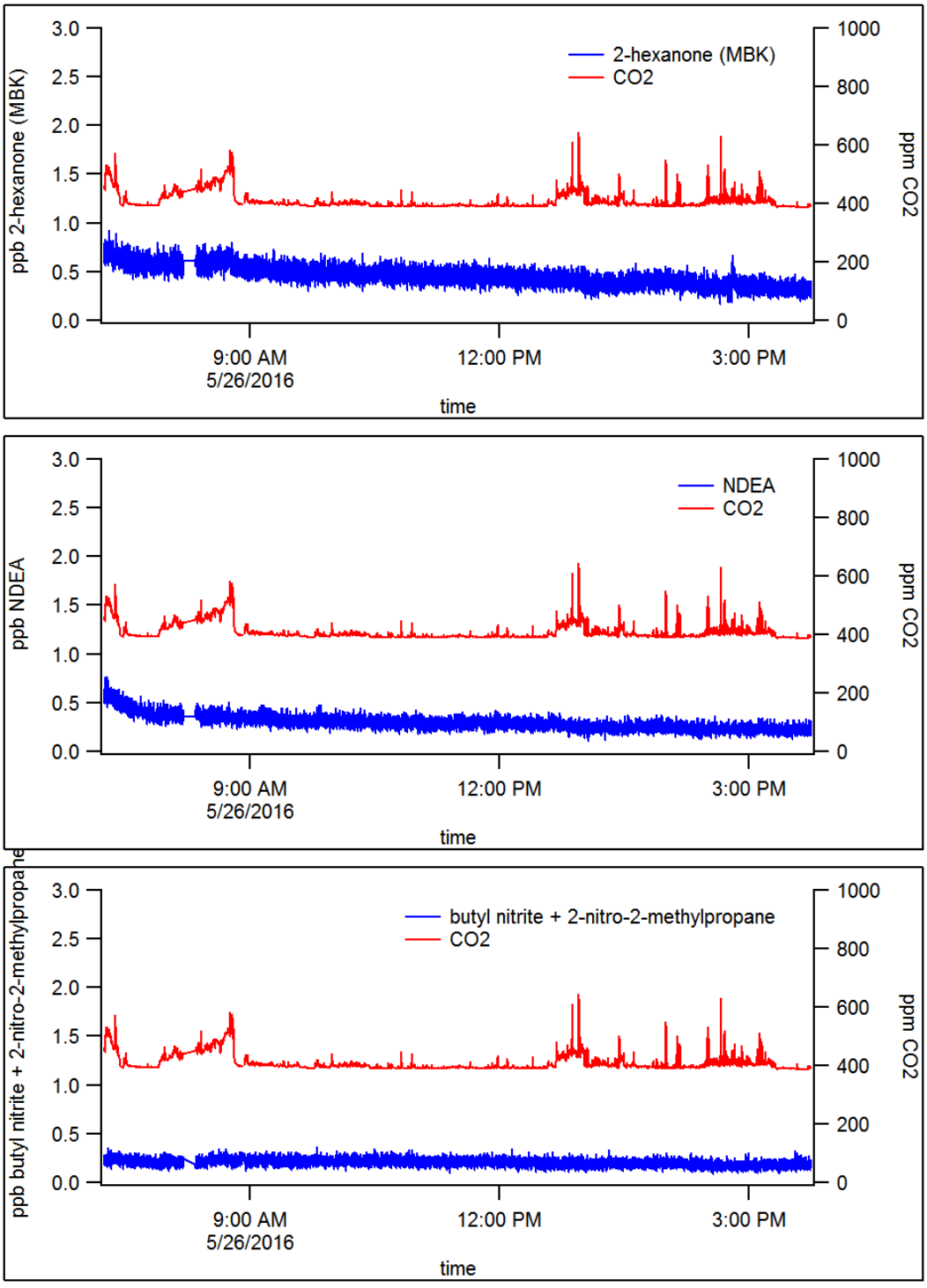


Figure C.1.3-10. May 26th - 2,4-dimethylpyridine (TOP), 2-ethyl-5-methylfuran (MIDDLE), Heptanenitrile (BOTTOM)

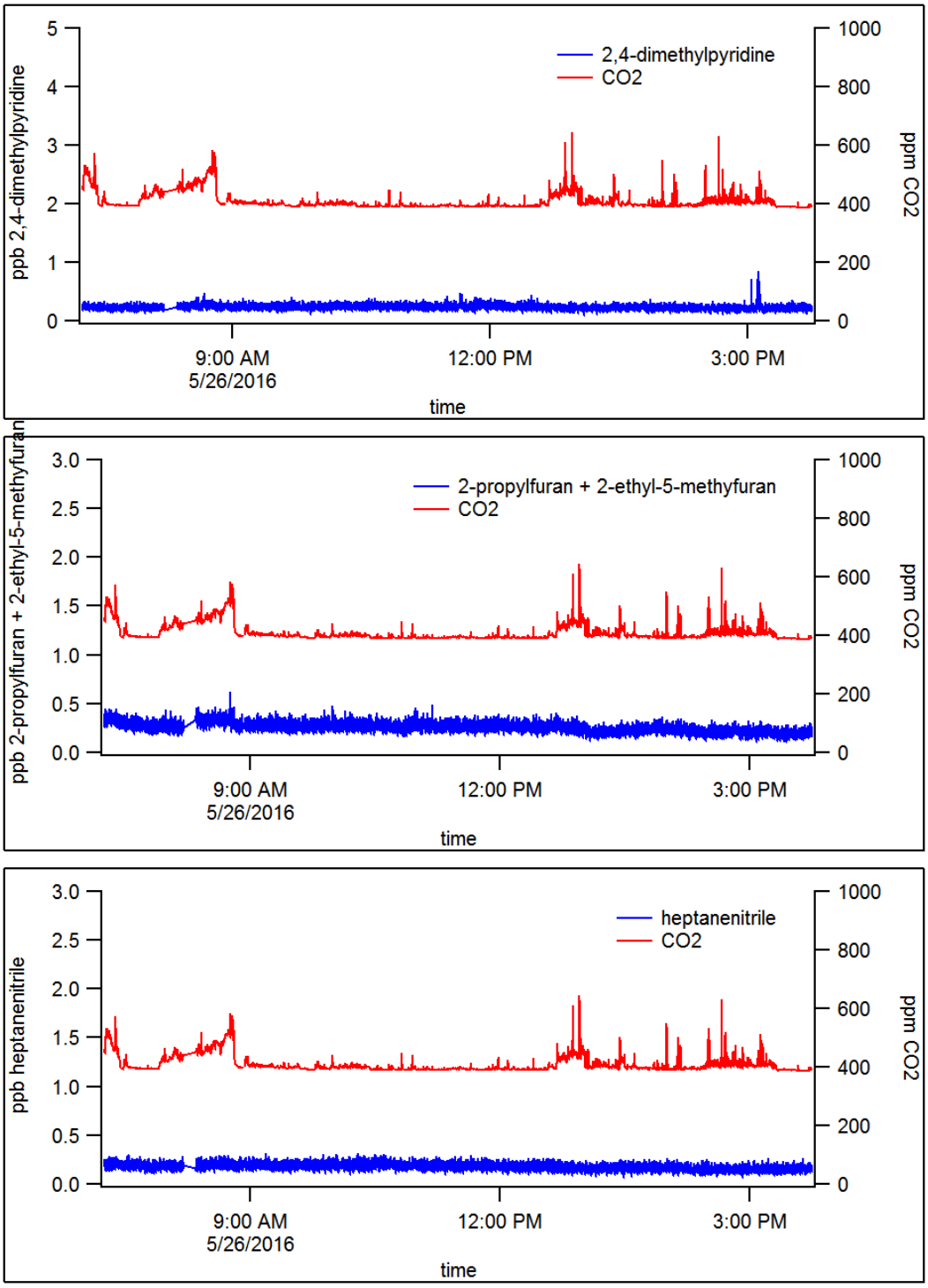


Figure C.1.3-11. May 26th - 4-methyl-2-hexanone (TOP), N-nitrosomorpholine [NMOR] (MIDDLE), Butyl Nitrate (BOTTOM)

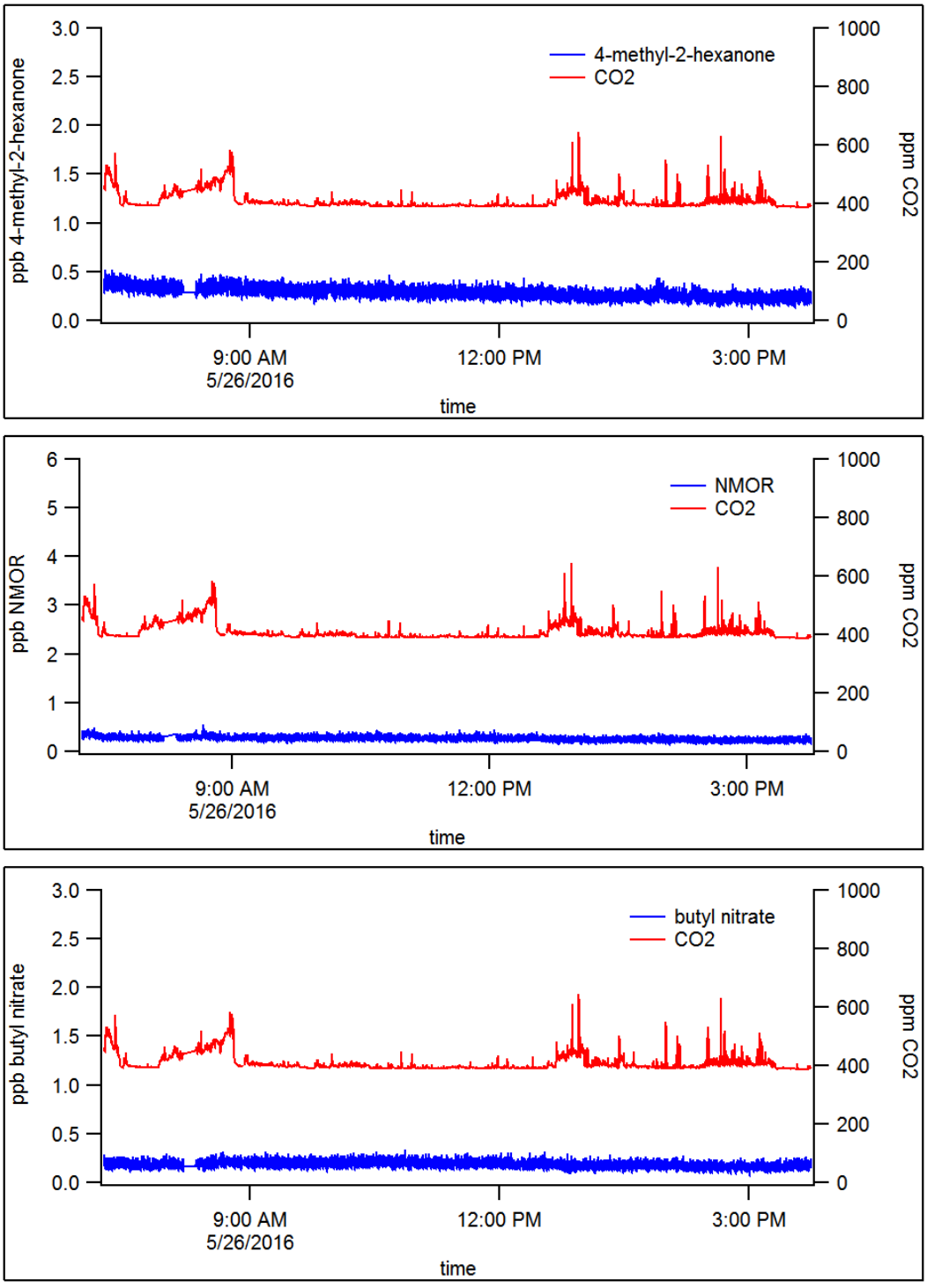


Figure C.1.3-12. May 26th - Multiple Furans [m/z 127] (TOP), 6-methyl-2-heptanone (MIDDLE), 2-pentylfuran (BOTTOM)

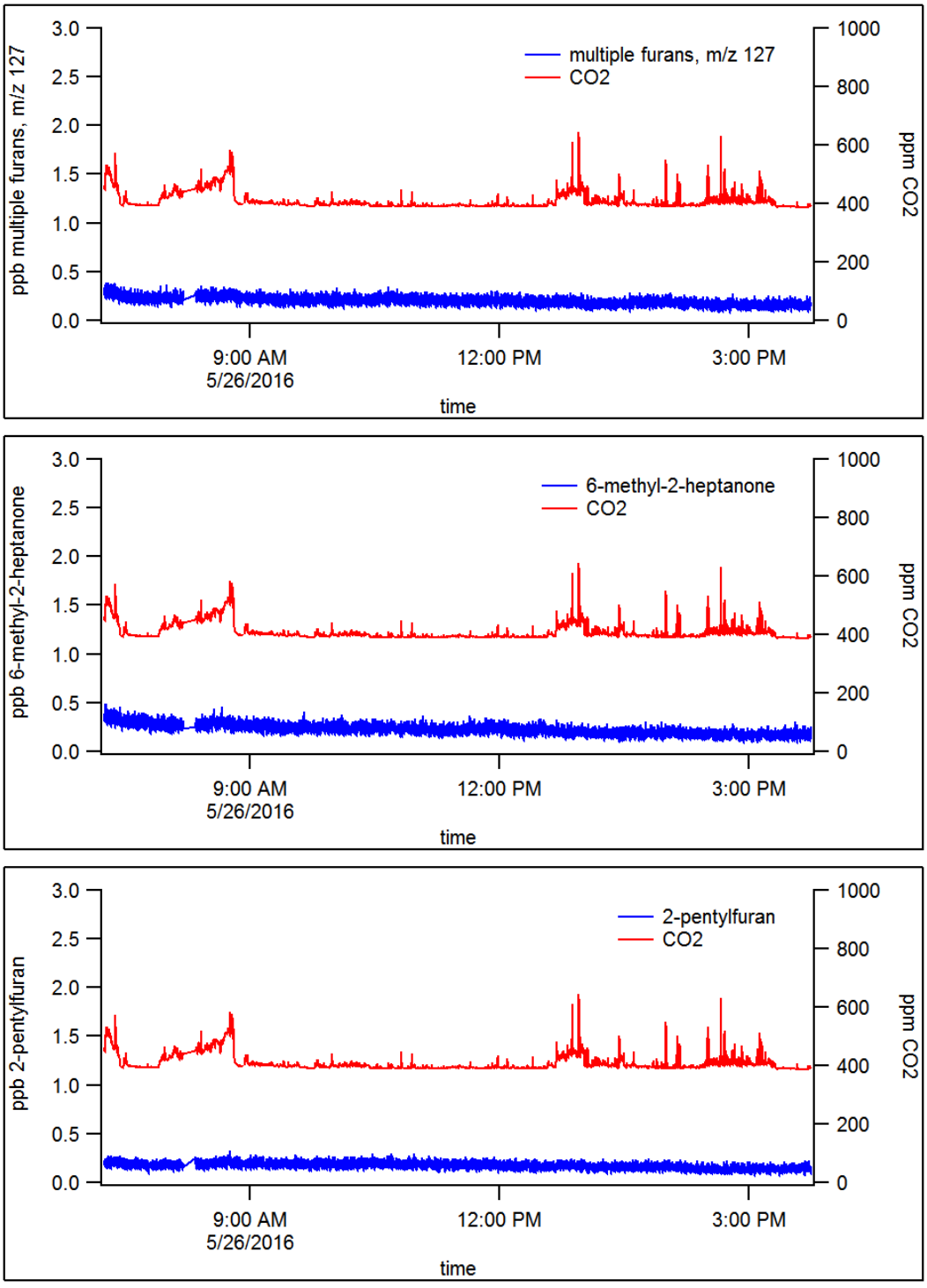


Figure C.1.3-13. May 26th - Biphenyl (TOP), 2-heptylfuran (MIDDLE), 2-octylfuran; 1,4-butanediol, dinitrate (BOTTOM)

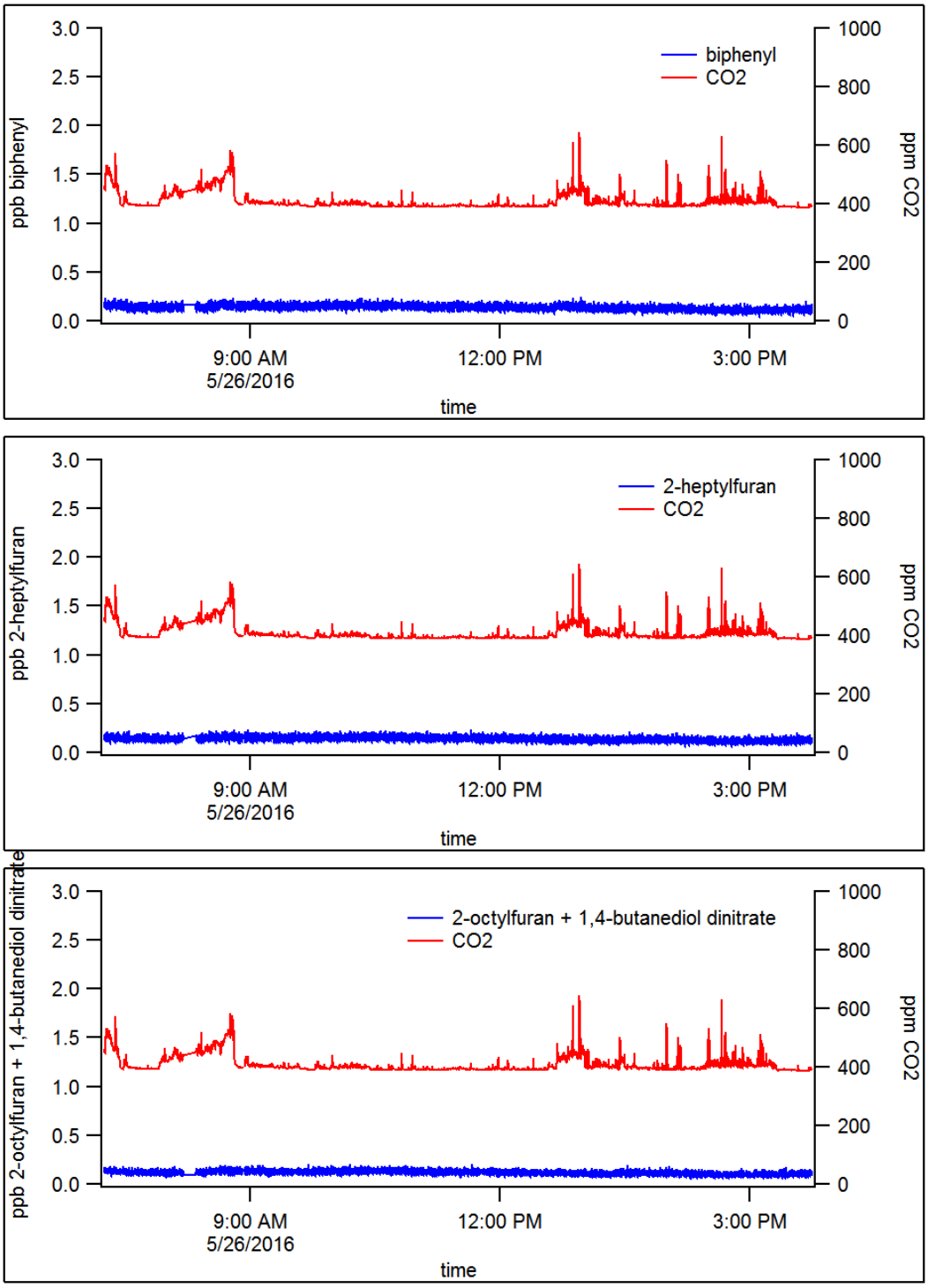


Figure C.1.3-14. May 26th - 1,2,3-propanetriol, 1,3-dinitrate (TOP), PCB (MIDDLE), 6-(2-furanyl)-6-methyl-2-heptanone (BOTTOM)

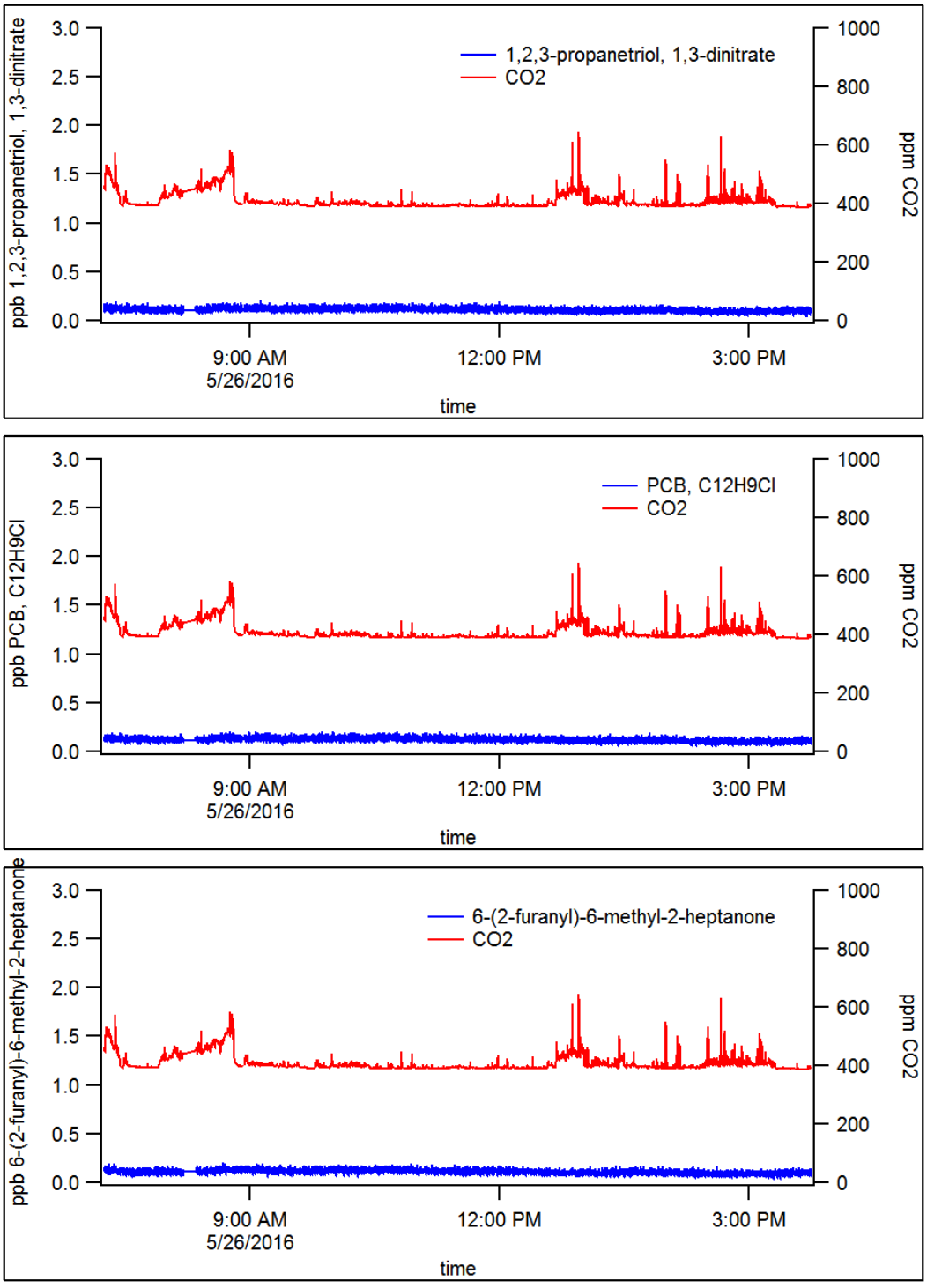
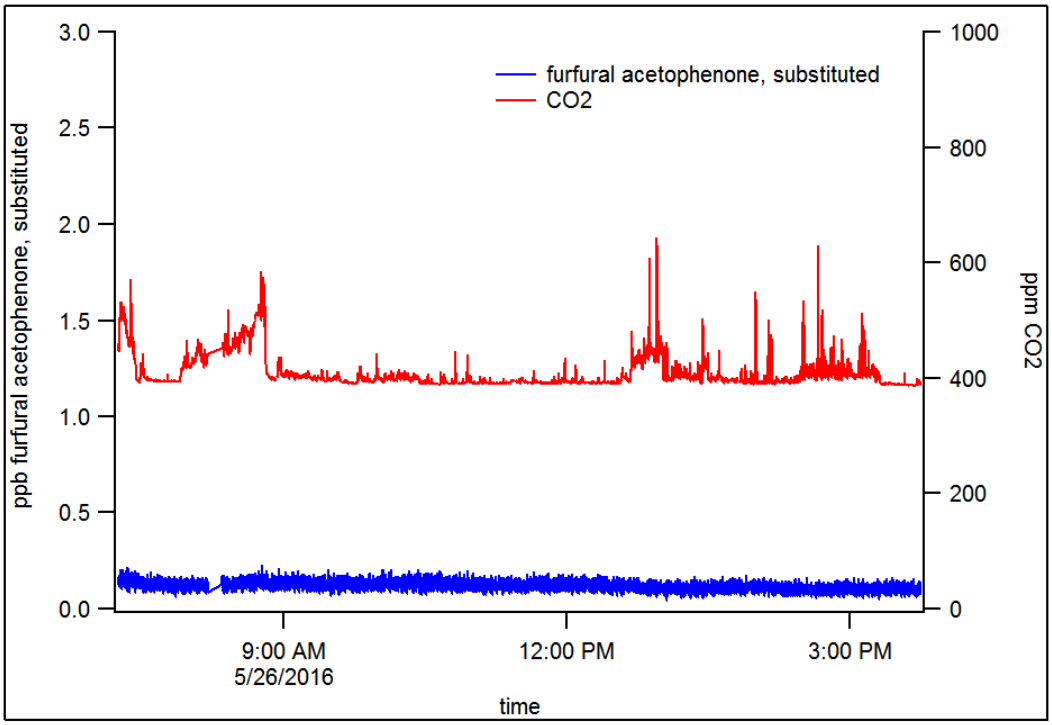
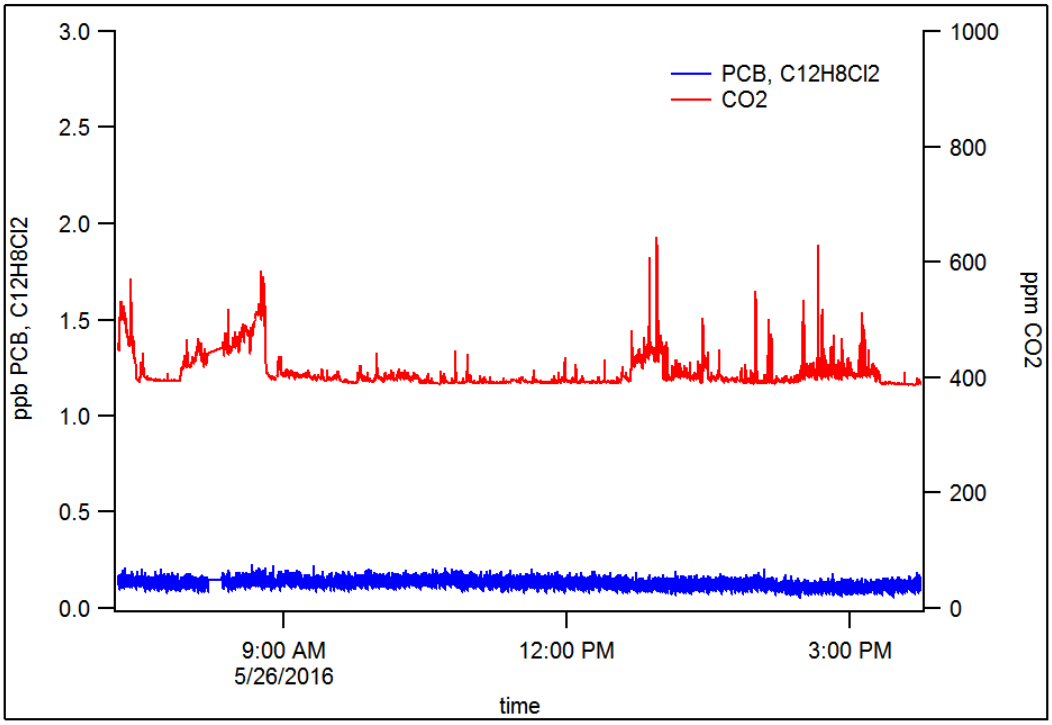


Figure C.1.3-15. May 26th - Furfural Acetophenone (3-(2-furanyl)-1-pheynyl-2-propen-1-one (TOP), PCB [2] (BOTTOM)



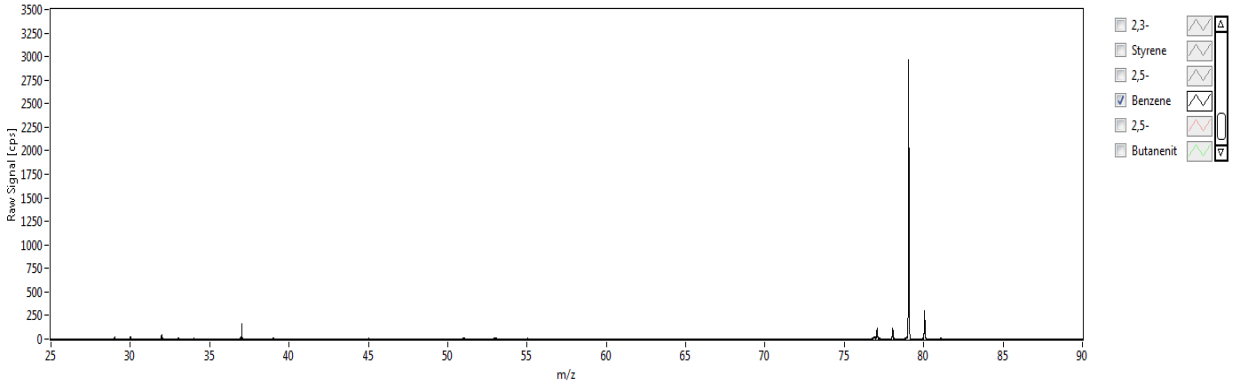


APPENDIX D

REPRESENTATIVE PTR-MS SPECTRA OF COMPOUNDS OF INTEREST

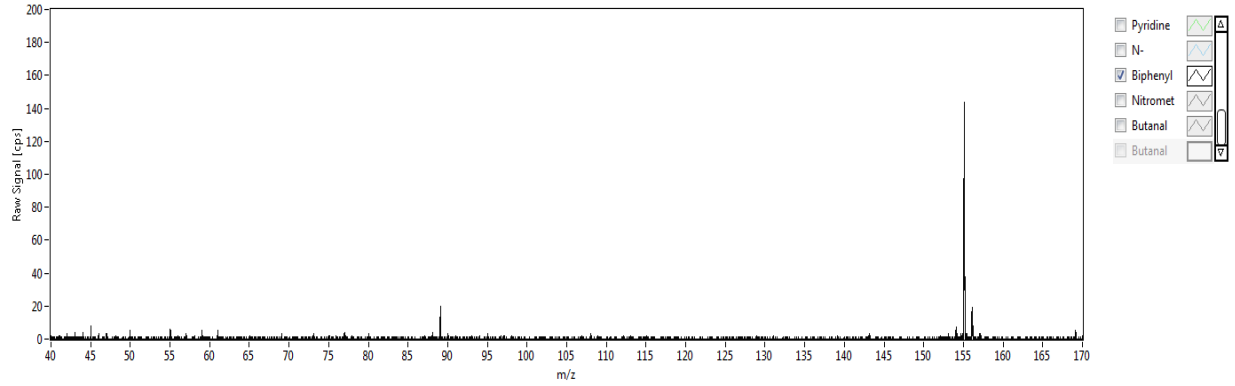
List of Figures

Figure 1. PTR-MS Spectra, Benzene.



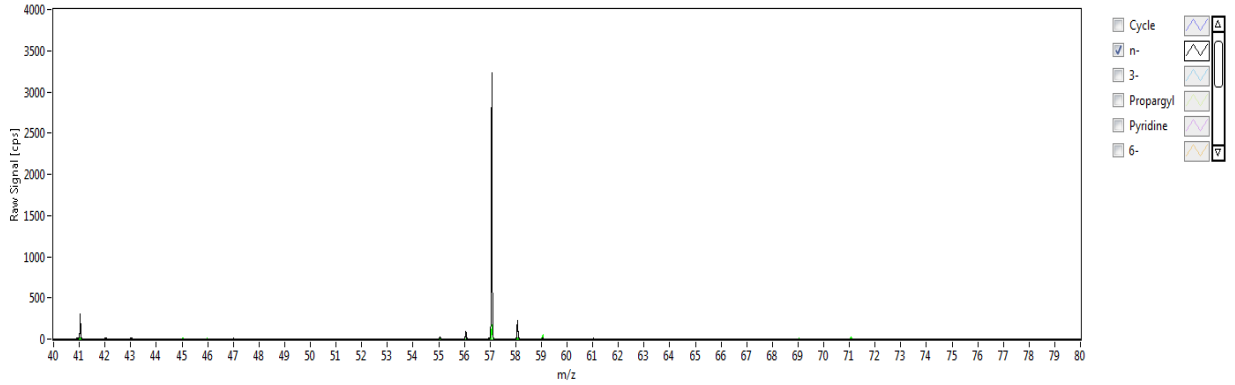
Benzene E/N = 120; T = 60C; P = 2.2 mbar

Figure 2. PTR-MS Spectra, Biphenyl



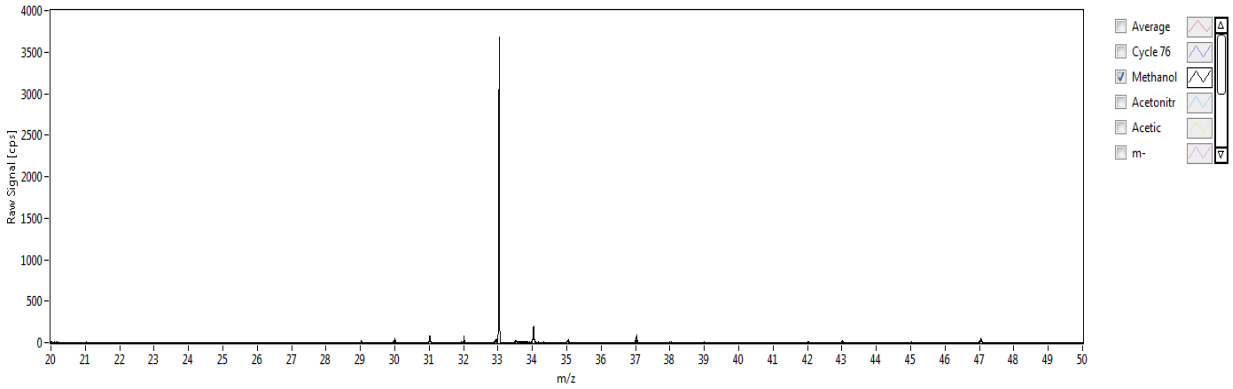
Biphenyl E/N = 120; T = 60C; P = 2.2 mbar

Figure 3. PTR-MS Spectra, n-Butanol



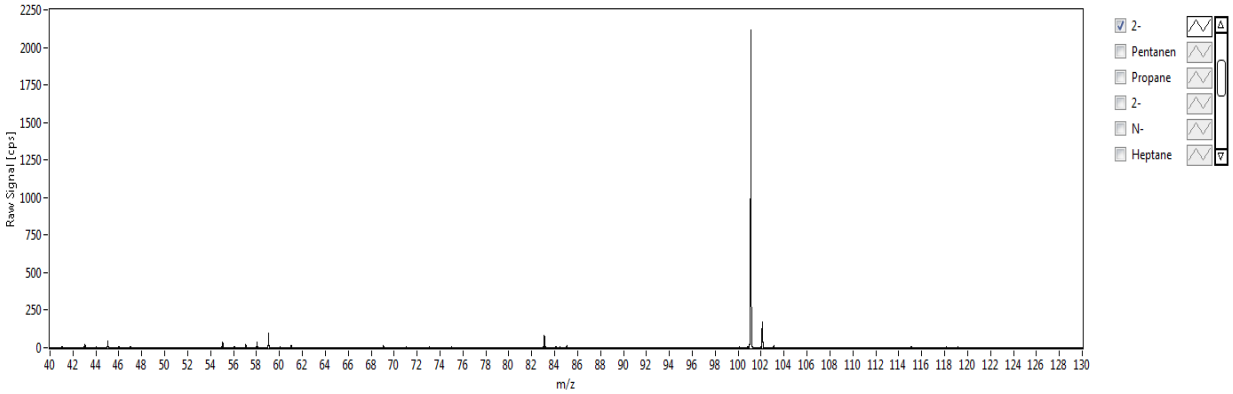
n-Butanol E/N = 120; T = 60C; P = 2.2 mbar

Figure 4. PTR-MS Spectra, Methanol



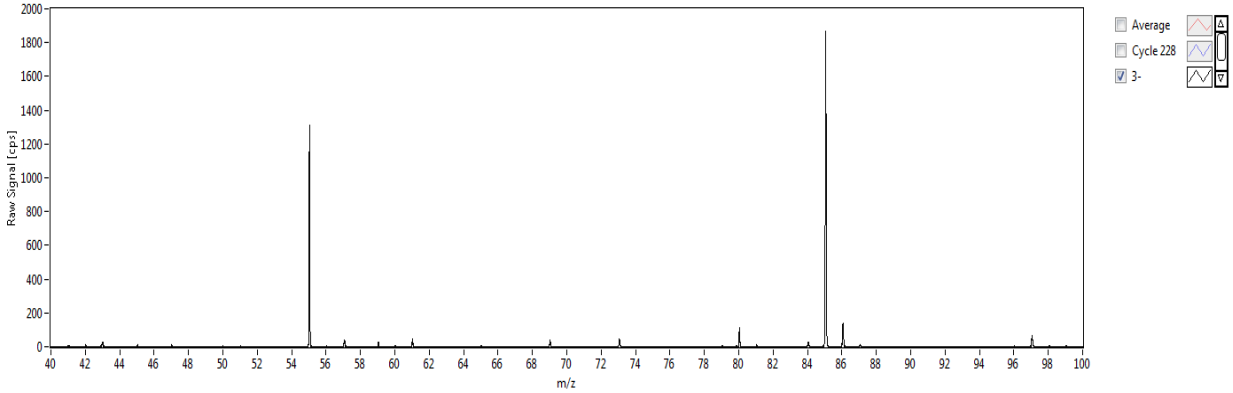
Methanol E/N = 120; T = 60C; P = 2.2 mbar

Figure 5. PTR-MS Spectra, 2-Hexanone.



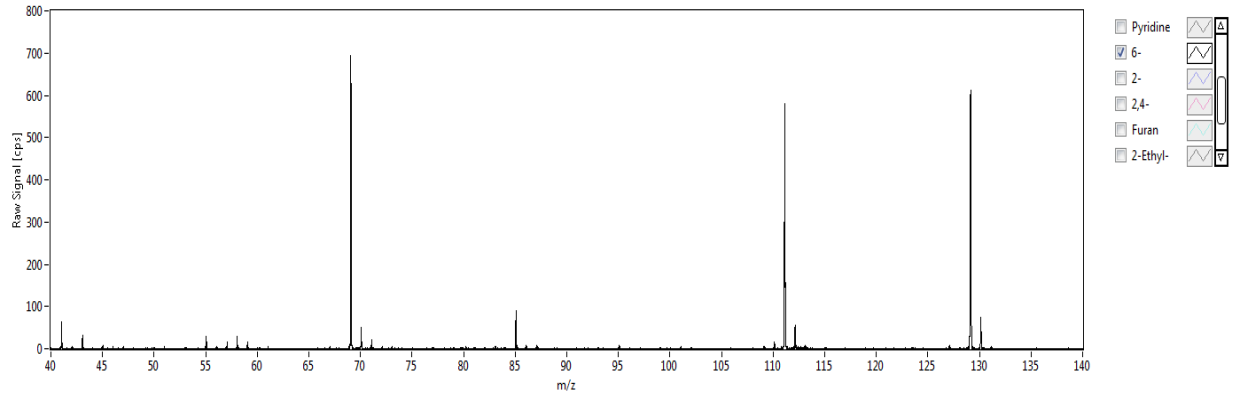
2-Hexanone E/N = 120; T = 60C; P = 2.2 mbar

Figure 6. PTR-MS Spectra, 3-Methyl-3-Butene-2-one



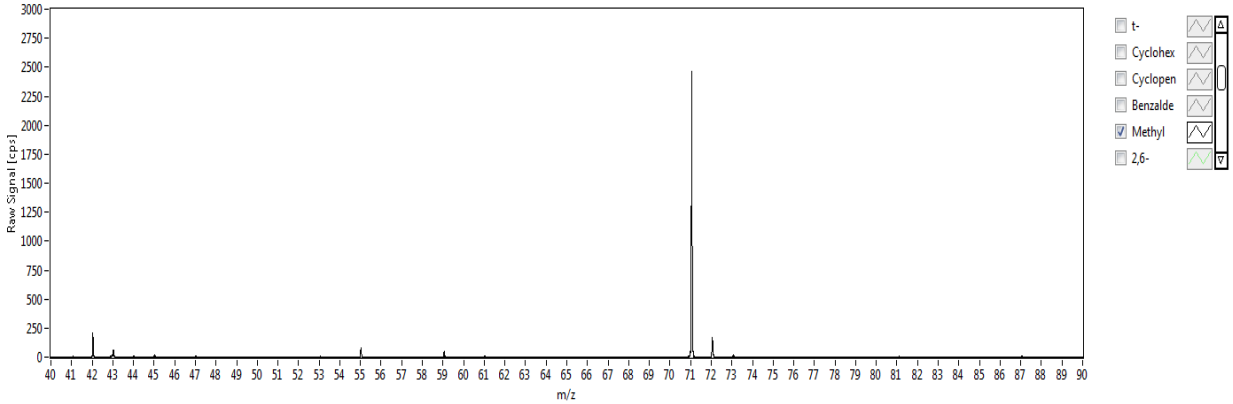
3-Methyl-3-Butene-2-one E/N = 120; T = 60C; P = 2.2 mbar

Figure 7. PTR-MS Spectra, 6-Methyl-2-heptanone.



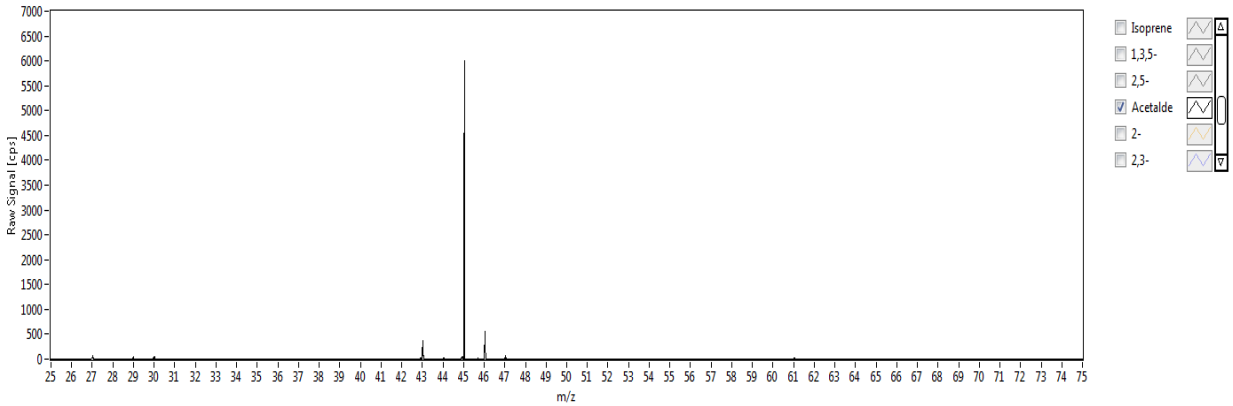
6-Methyl-2-heptanone E/N = 120; T = 60C; P = 2.2 mbar

Figure 8. PTR-MS Spectra, Methyl-Vinyl ketone



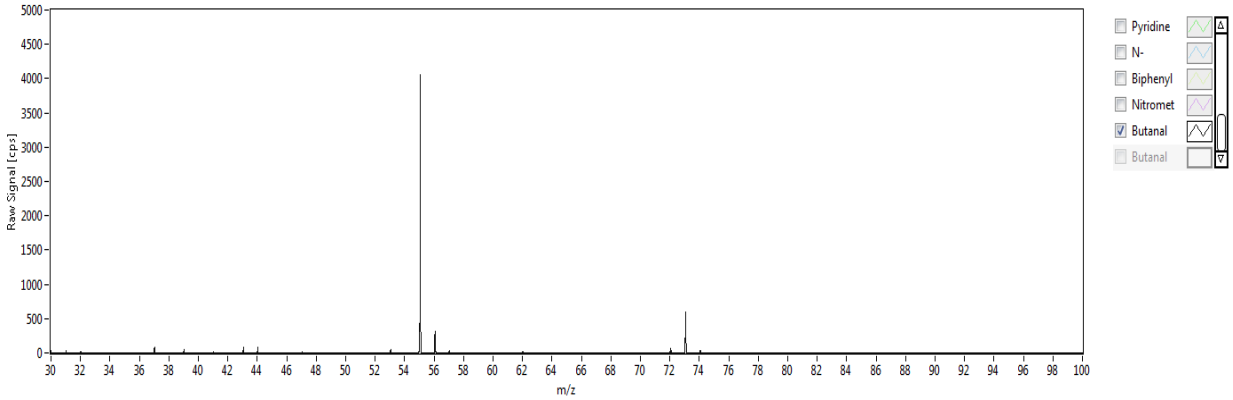
Methyl vinyl ketone E/N = 120; T = 60C; P = 2.2 mbar

Figure 9. PTR-MS Spectra, Acetaldehyde.



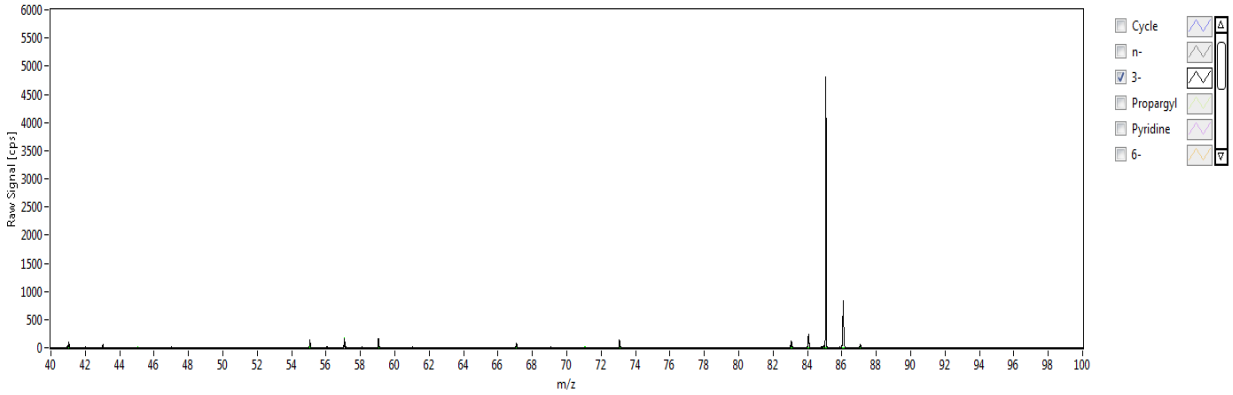
Acetaldehyde E/N = 120; T = 60C; P = 2.2 mbar

Figure 10. PTR-MS Spectra, Butanal.



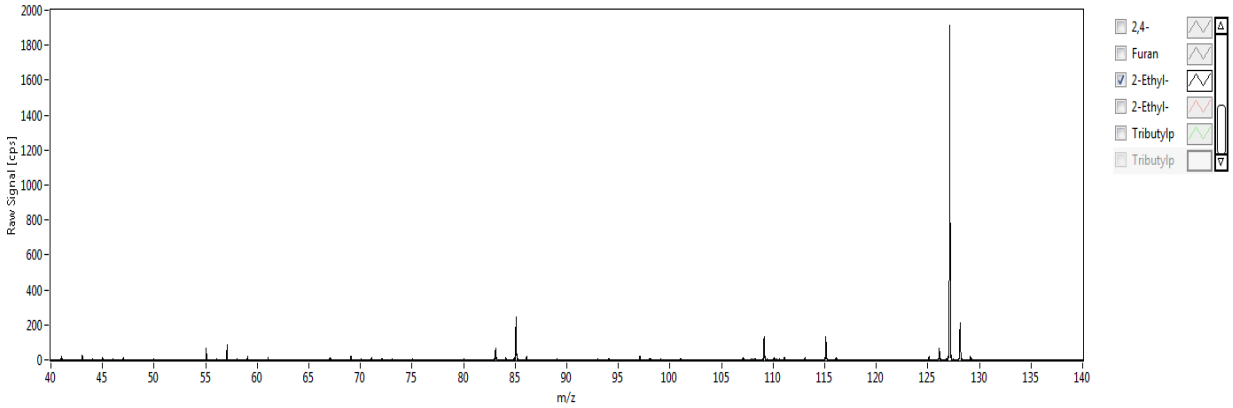
Butanal E/N = 120; T = 60C; P = 2.2 mbar

Figure 11. 2-Methyl-2-butanal.



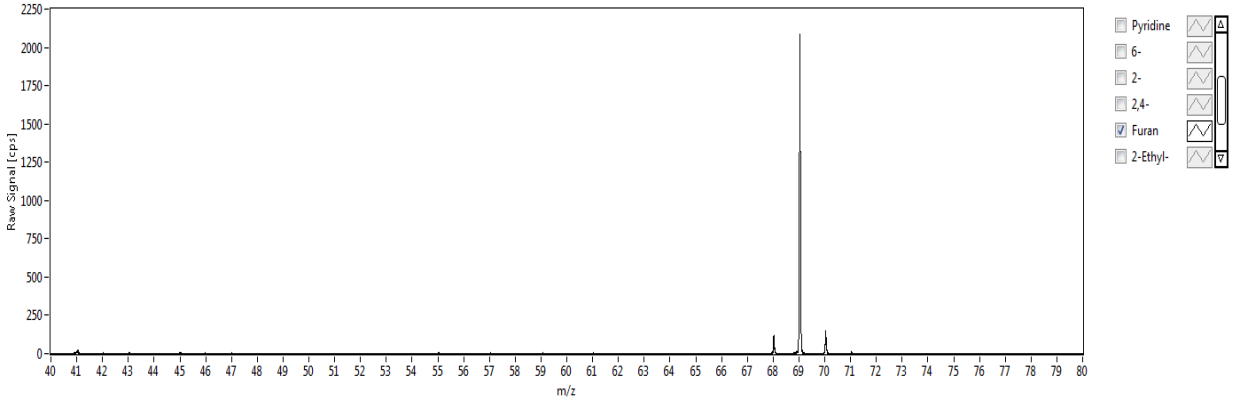
2-Methyl-2-butanal E/N = 120; T = 60C; P = 2.2 mbar

Figure 12. PTR-MS Spectra, 2-Ethyl-2-hexenal



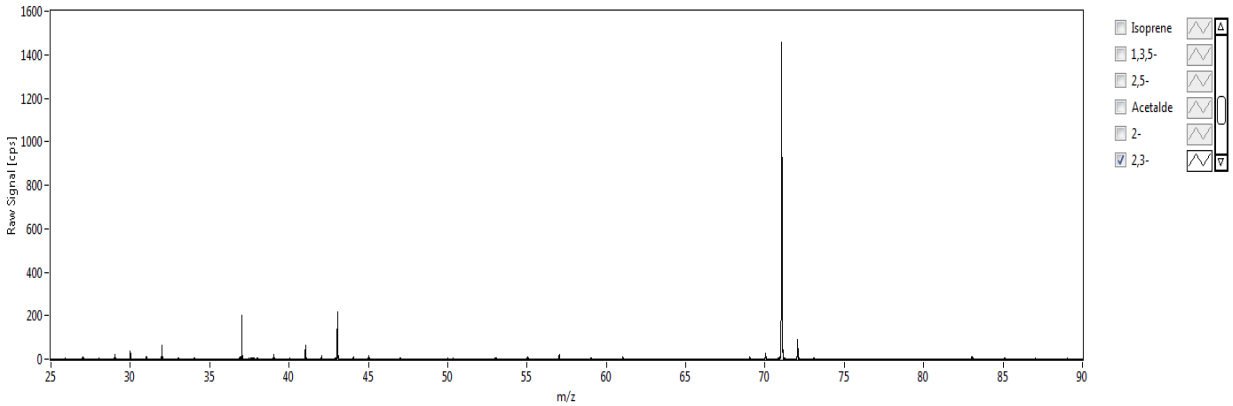
2-Ethyl-2-hexenal E/N = 120; T = 60C; P = 2.2 mbar

Figure 13. PTR-MS Spectra, Furan.



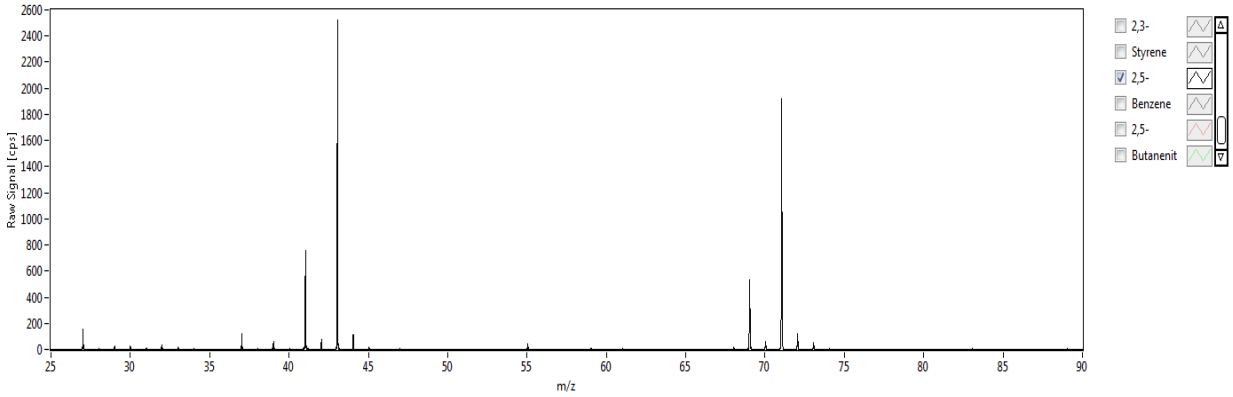
Furan E/N = 120; T = 60C; P = 2.2 mbar

Figure 14. PTR-MS Spectra, 2,3-Dihydrofuran.



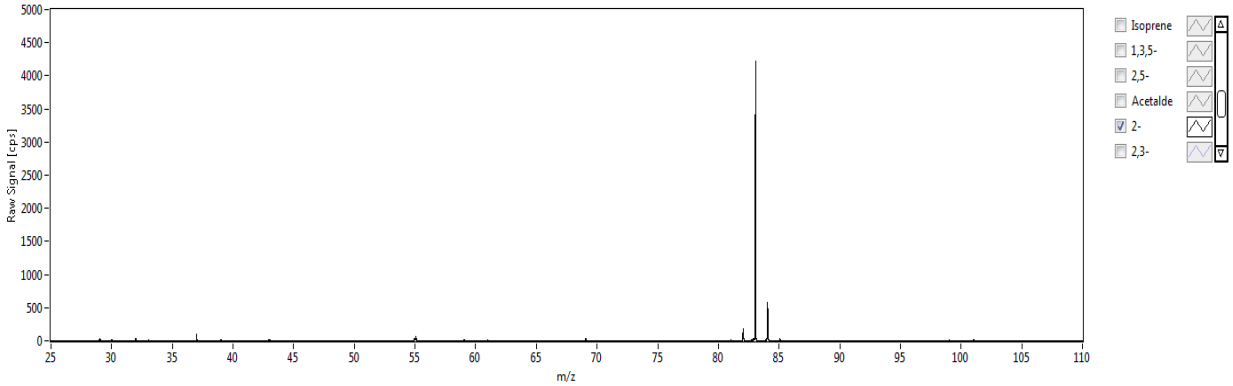
2,3-Dihydrofuran E/N = 120; T = 60C; P = 2.2 mbar

Figure 15. PTR-MS Spectra, 2,5-Dihydrofuran.



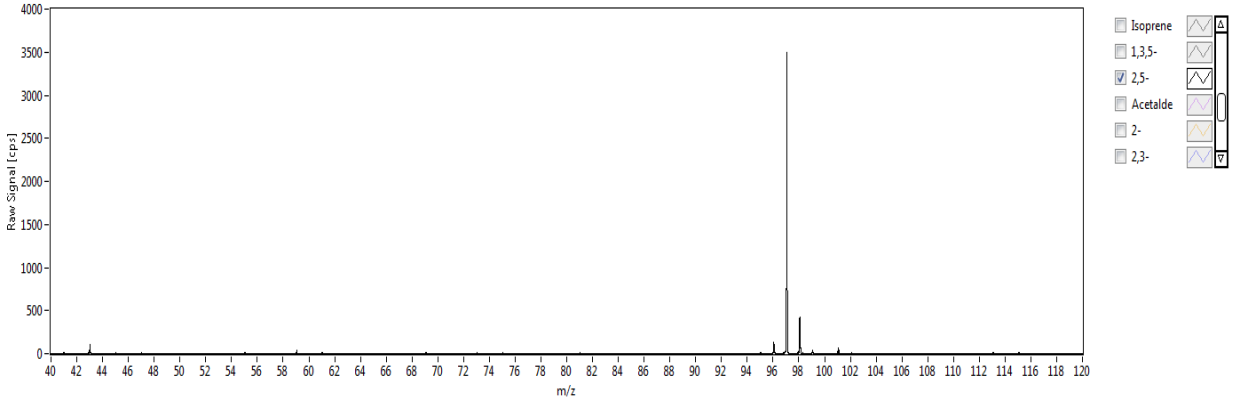
2,5-Dihydrofuran E/N = 120; T = 60C; P = 2.2 mbar

Figure 16. PTR-MS Spectra, 2-Methylfuran.



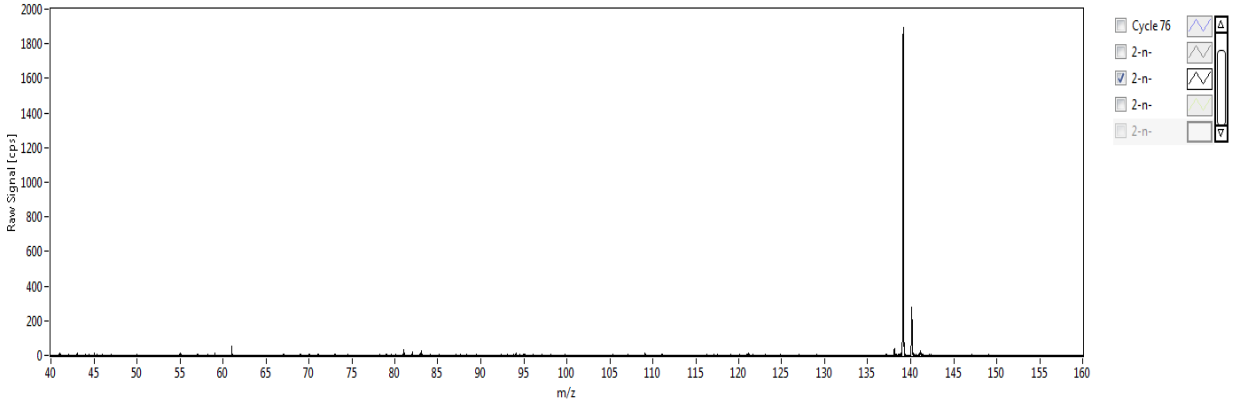
2-Methylfuran E/N = 120; T = 60C; P = 2.2 mbar

Figure 17. PTR-MS Spectra, 2,5-Dimethylfuran.



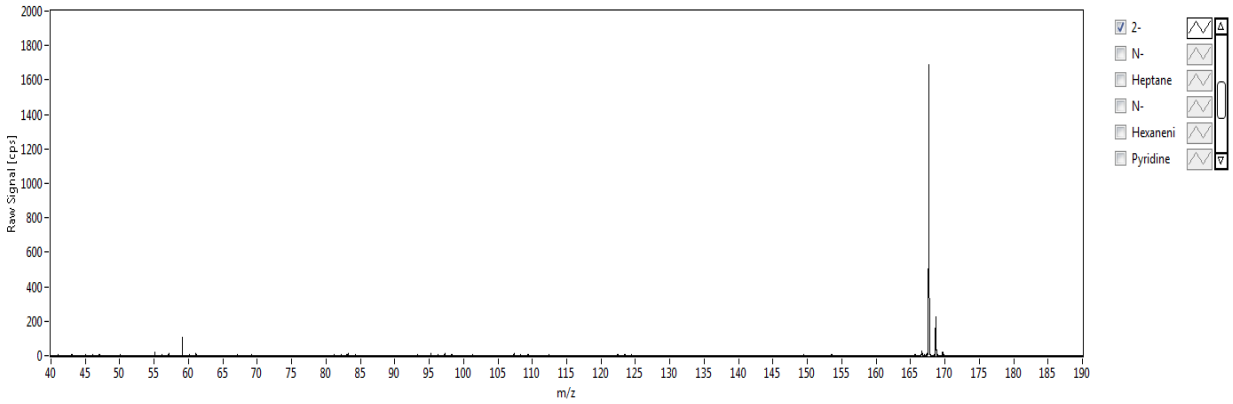
2,5-Dimethylfuran E/N = 120; T = 60C; P = 2.2 mbar

Figure 18. PTR-MS Spectra, 2-n-Pentylfuran.



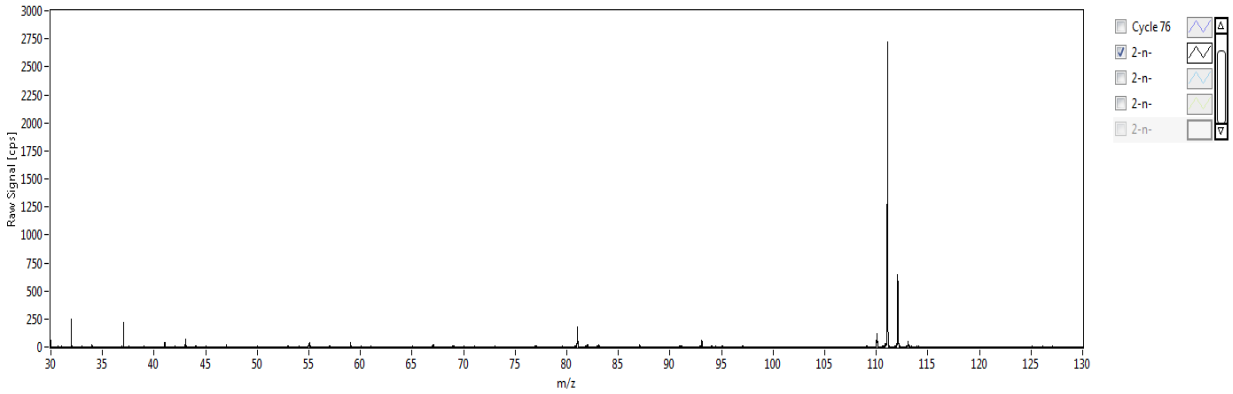
2-n-Pentylfuran E/N = 120; T = 60C; P = 2.2 mbar

Figure 19. PTR-MS Spectra2-Heptylfuran.



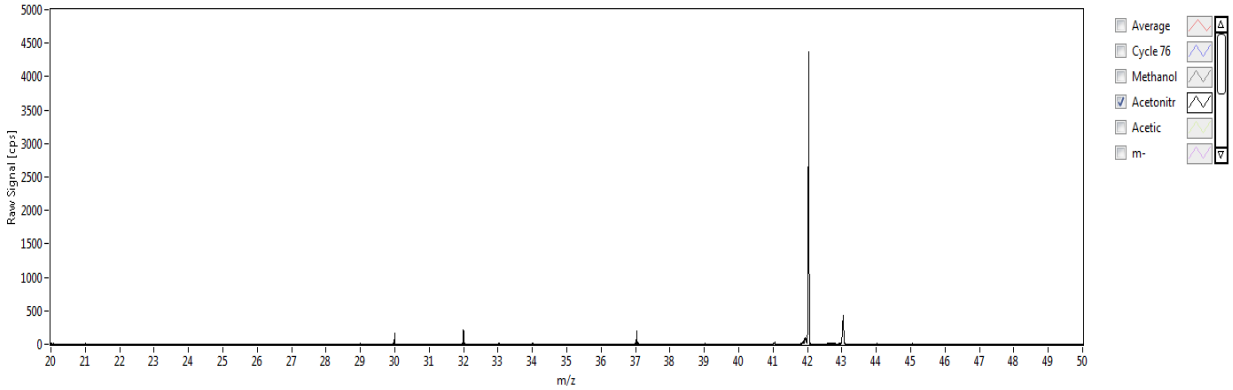
2-Heptylfuran E/N = 120; T = 60C; P = 2.2 mbar

Figure 20. PTR-MS Spectra, 2-n-Propylfuran.



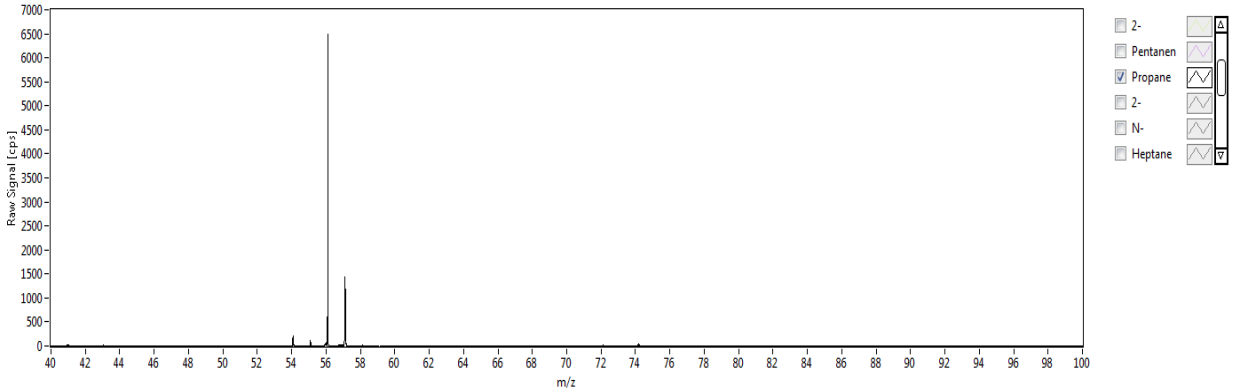
2-n-Propylfuran E/N = 120; T = 60C; P = 2.2 mbar

Figure 21. PTR-MS Spectra, Acetonitrile.



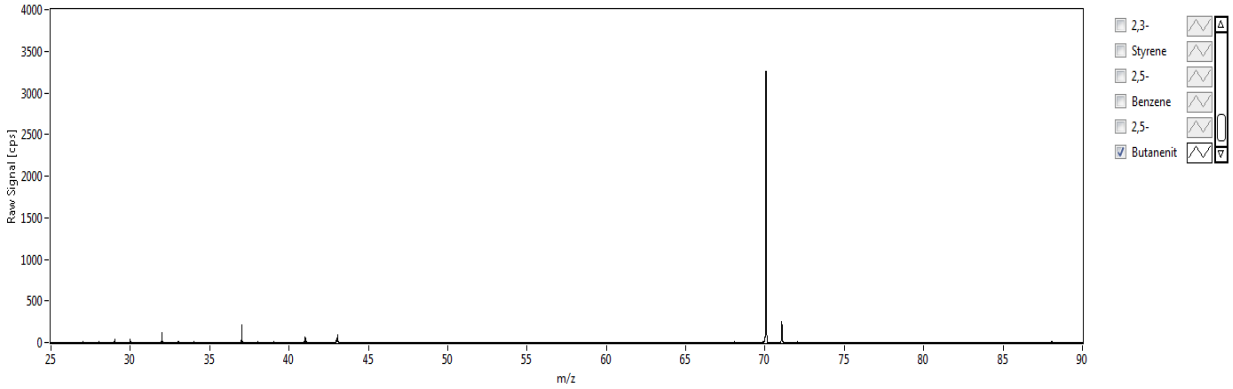
Acetonitrile E/N = 120; T = 60C; P = 2.2 mbar

Figure 22. PTR-MS Spectra, Propanenitrile.



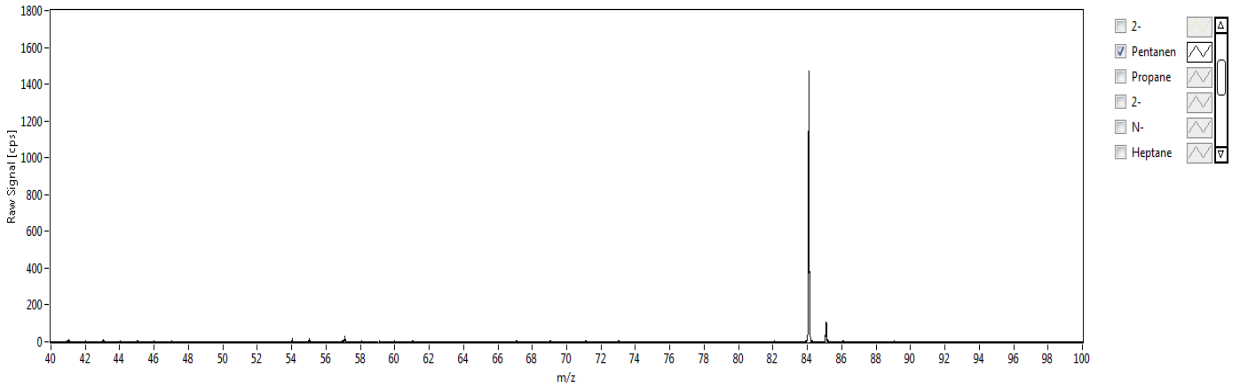
Propanenitrile E/N = 120; T = 60C; P = 2.2 mbar

Figure 23. PTR-MS Spectra, Butanenitrile.



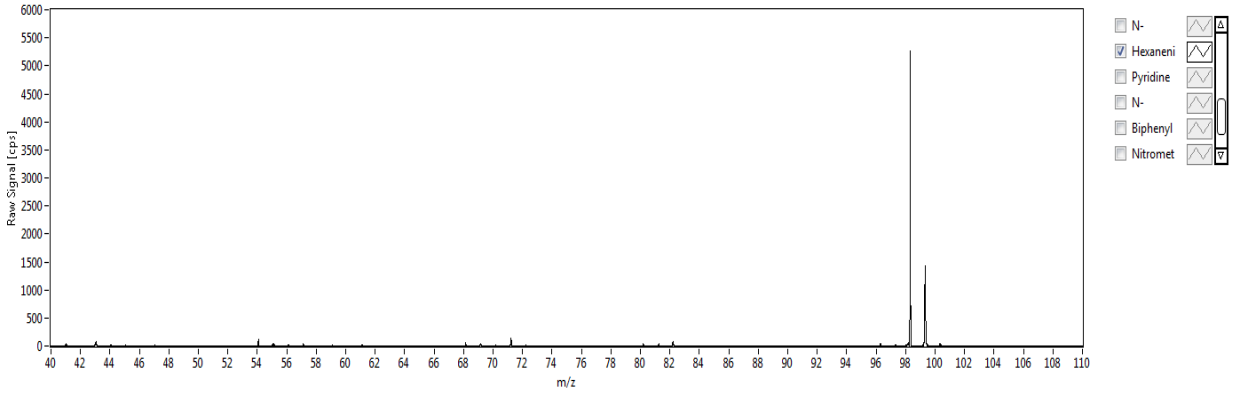
Butanenitrile E/N = 120; T = 60C; P = 2.2 mbar

Figure 24. PTR-MS Spectra, Pentanenitrile.



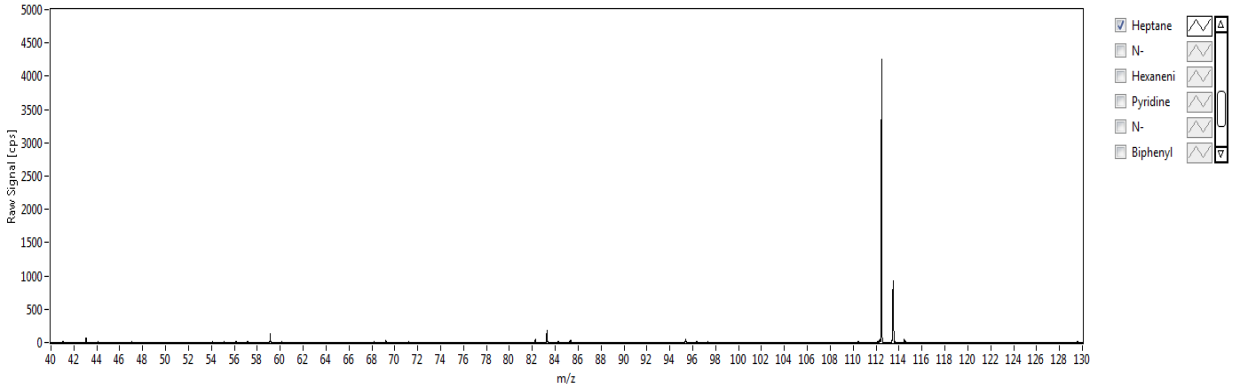
Pentanenitrile E/N = 120; T = 60C; P = 2.2 mbar

Figure 25. PTR-MS Spectra, Henanenitrile.



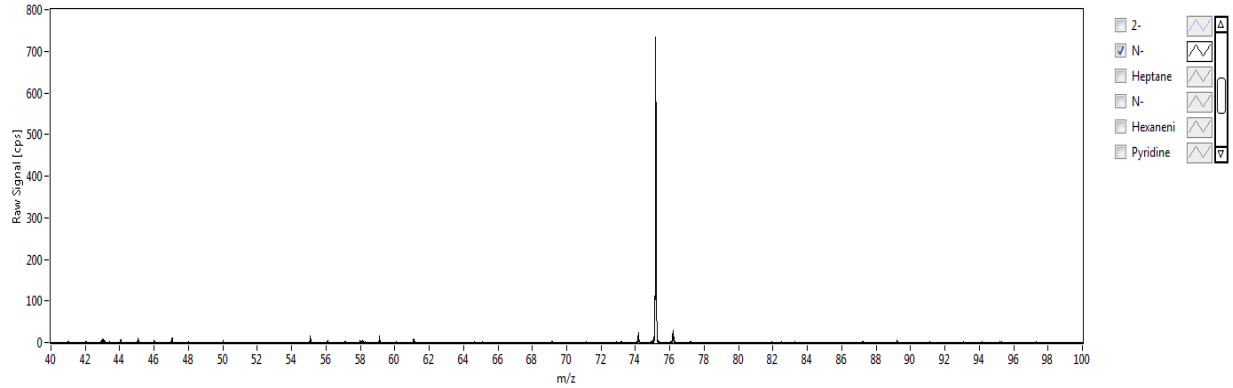
Hexanenitrile E/N = 120; T = 60C; P = 2.2 mbar

Figure 26. PTR-MS Spectra, Heptanenitrile.



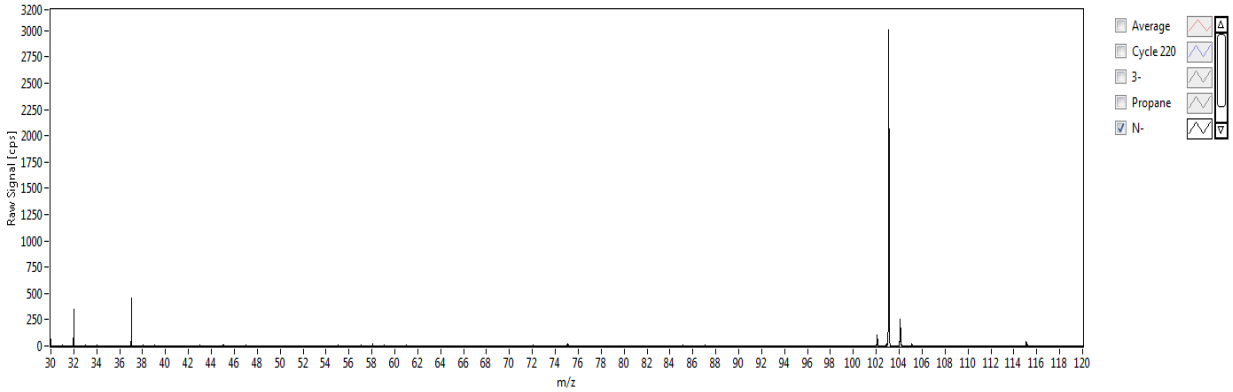
Heptanenitrile E/N = 120; T = 60C; P = 2.2 mbar

Figure 27. PTR-MS Spectra , N-Nitrosodiemethylamine.



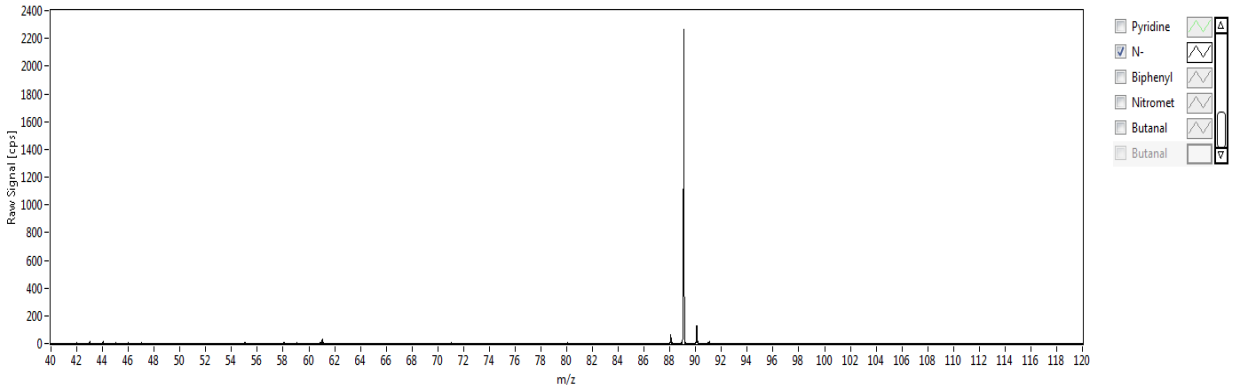
N-Nitrosodimethylamine E/N = 120; T = 60C; P = 2.2 mbar

Figure 28. PTR-MS Spectra , N-Nitrosodiethylamine.



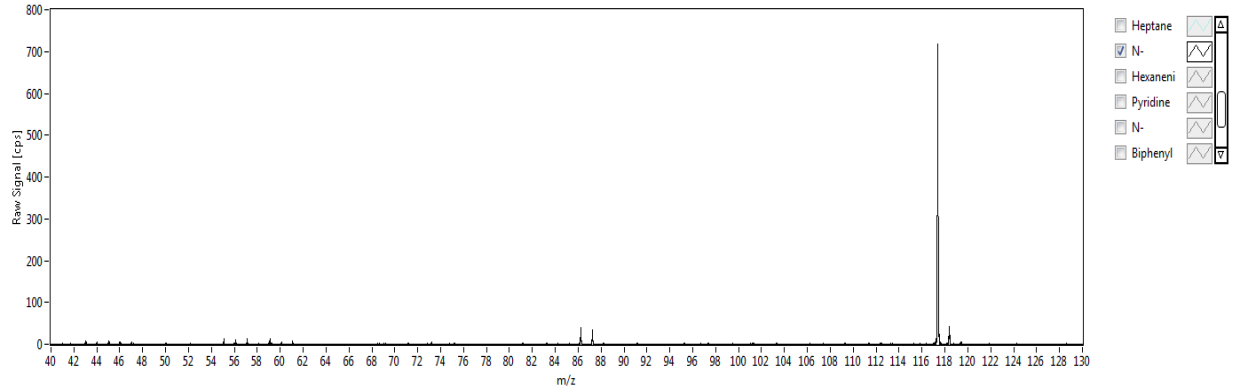
N-Nitrosodiethylamine E/N = 120; T = 60C; P = 2.2 mbar

Figure 29. PTR-MS Spectra, N-Nitrosomethylethylamine.



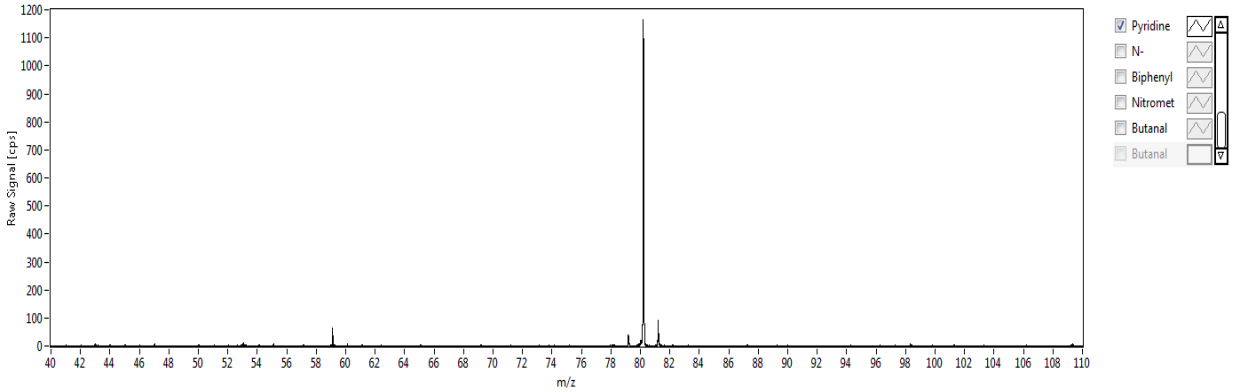
N-Nitrosomethylethylamine E/N = 120; T = 60C; P = 2.2 mbar

Figure 30. PTR-MS Spectra, N-Nitrosomorpholine.



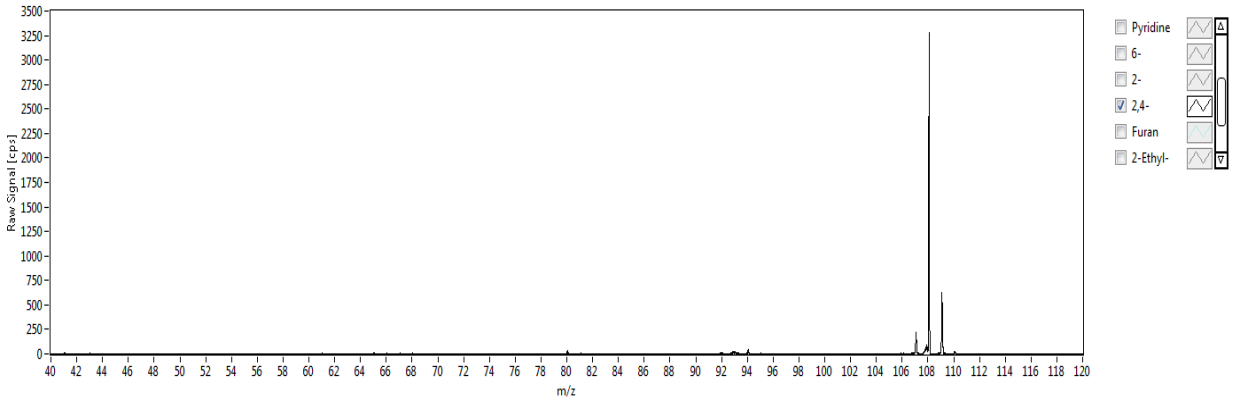
N-Nitrosomorpholine E/N = 120; T = 60C; P = 2.2 mbar

Figure 31. PTR-MS Spectra, Pyridine.



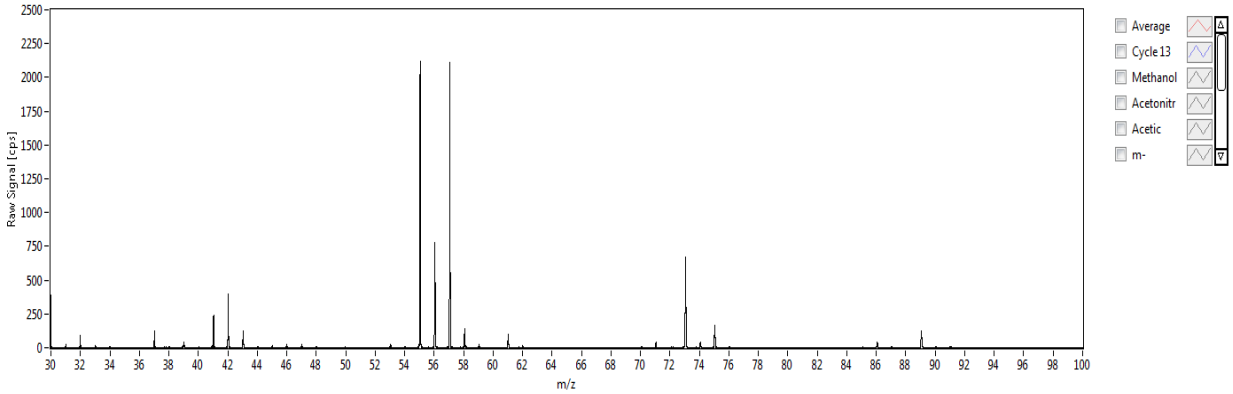
Pyridine E/N = 120; T = 60C; P = 2.2 mbar

Figure 32. PTR-MS Spectra, 2,4-Lutidine.



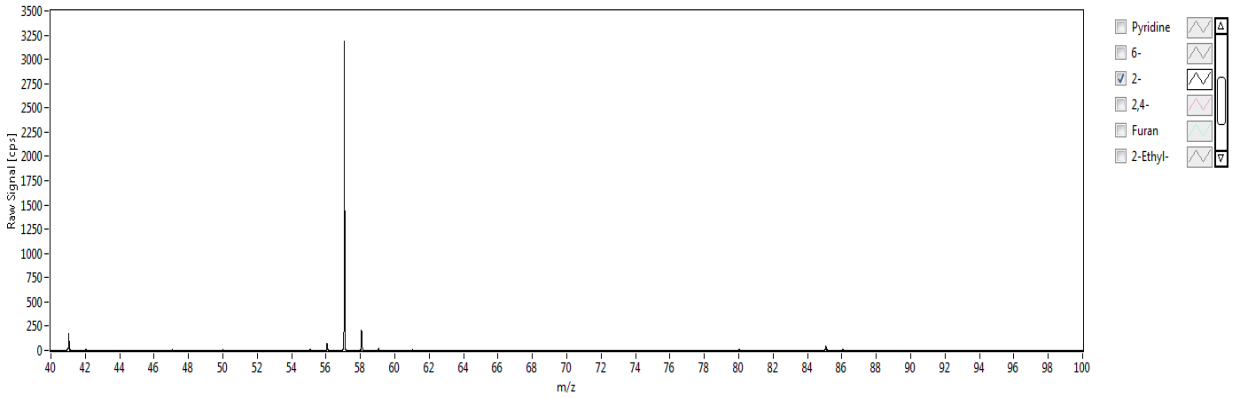
2,4-Lutidine E/N = 120; T = 60C; P = 2.2 mbar

Figure 33. PTR-MS Spectra, Butyl-Nitrate.



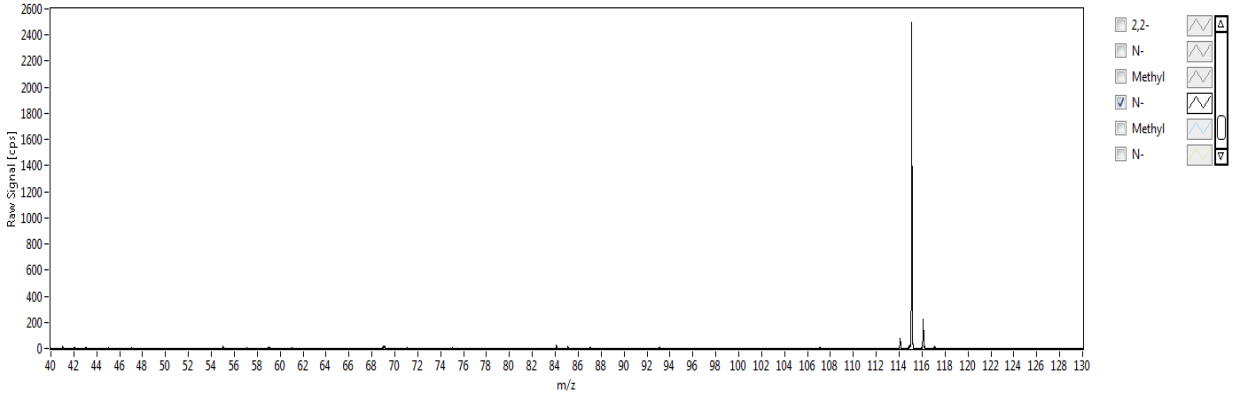
Butyl Nitrite E/N = 120; T = 60C; P = 2.2 mbar

Figure 34. PTR-MS Spectra, 2-Methyl-2-nitropropane.



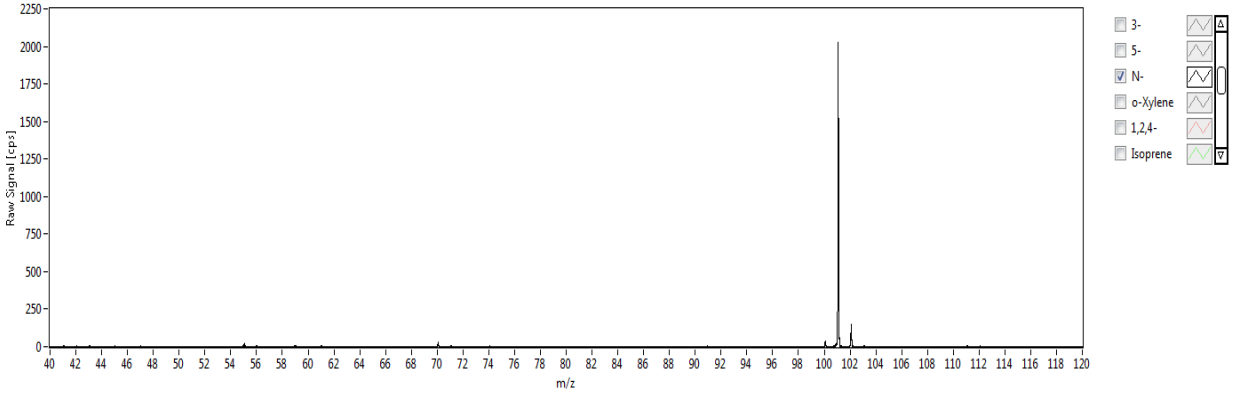
2-Methyl-2-nitropropane E/N = 120; T = 60C; P = 2.2 mbar

Figure 35. PTR-MS Spectra, N-Nitrosopiperidine.



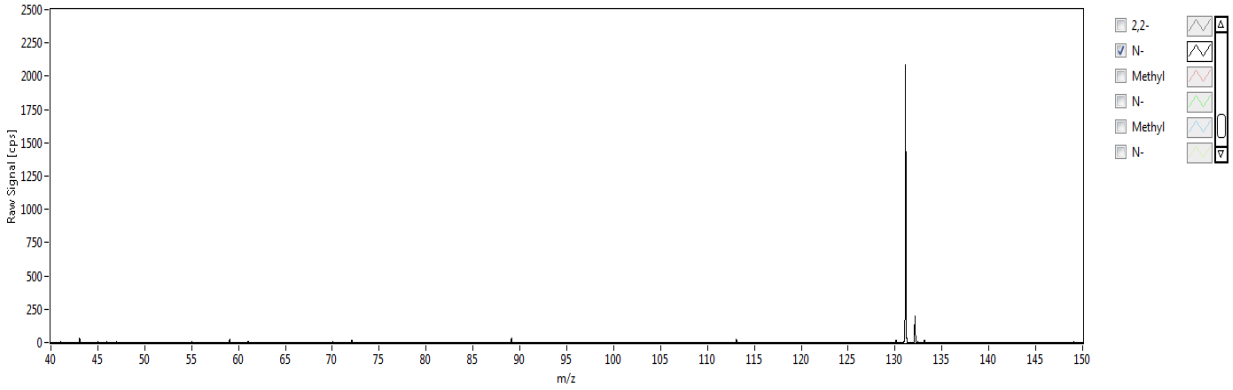
N-Nitrosopiperidine E/N = 120; T = 60C; P = 2.2 mbar

Figure 36. PTR-MS Spectra, N-Nitrosopyrrolidine.



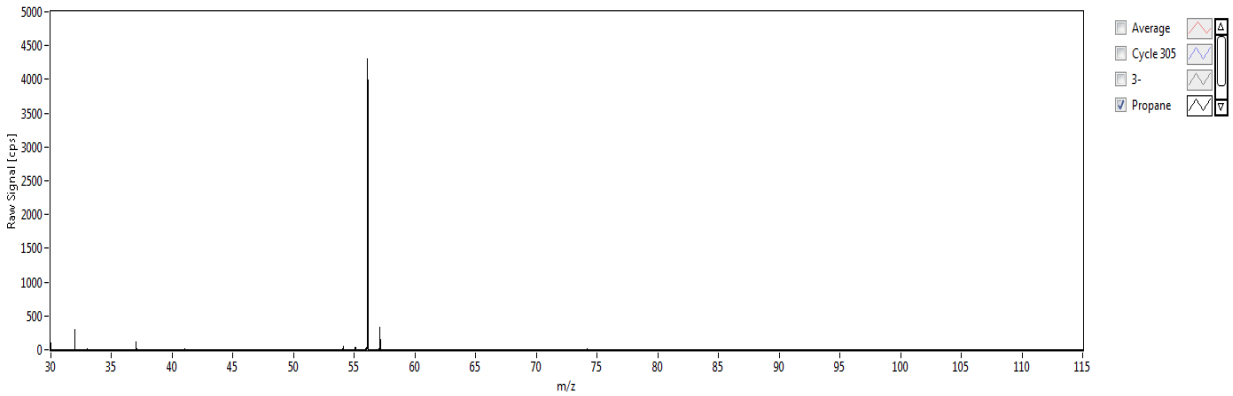
N-Nitrosopyrrolidine E/N = 120; T = 60C; P = 2.2 mbar

Figure 37. PTR-MS Spectra, N-Nitrosodi-n-propylamine.



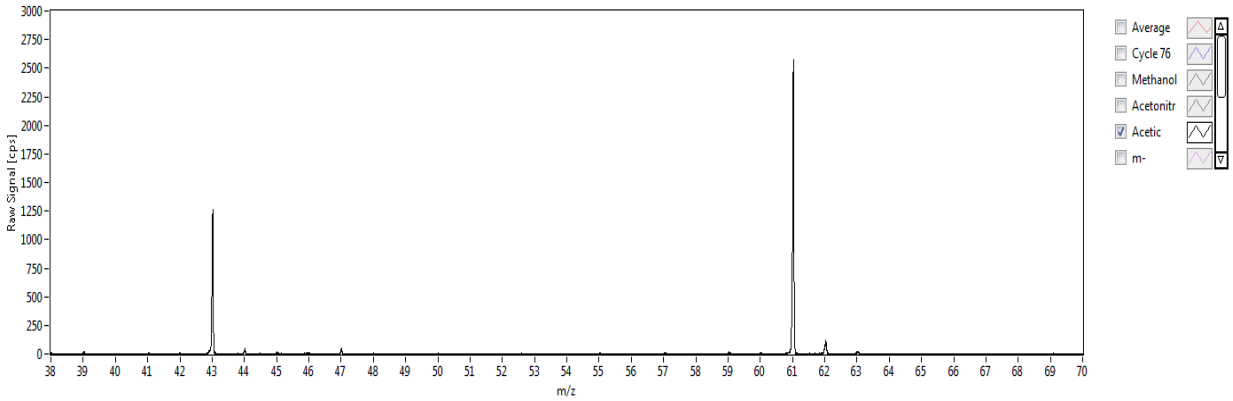
N-Nitrosodi-n-propylamine E/N = 120; T = 60C; P = 2.2 mbar

Figure 38. PTR-MS Spectra, Propanenitrile.



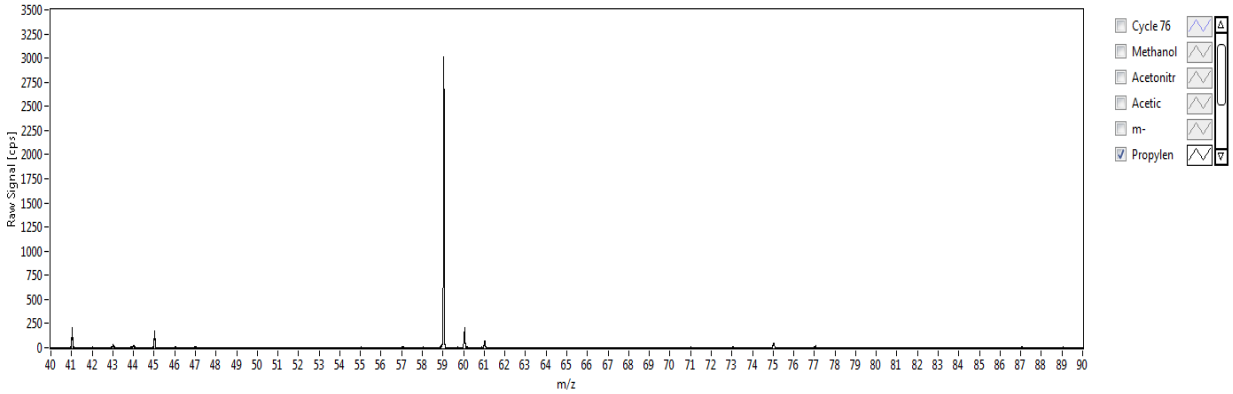
Propane nitrite E/N = 120; T = 60C; P = 2.2 mbar

Figure 39. PTR-MS Spectra, Acetic Acid.



Acetic Acid E/N = 120; T = 60C; P = 2.2 mbar

Figure 40. PTR-MS Spectra, Propylene-Glycol.

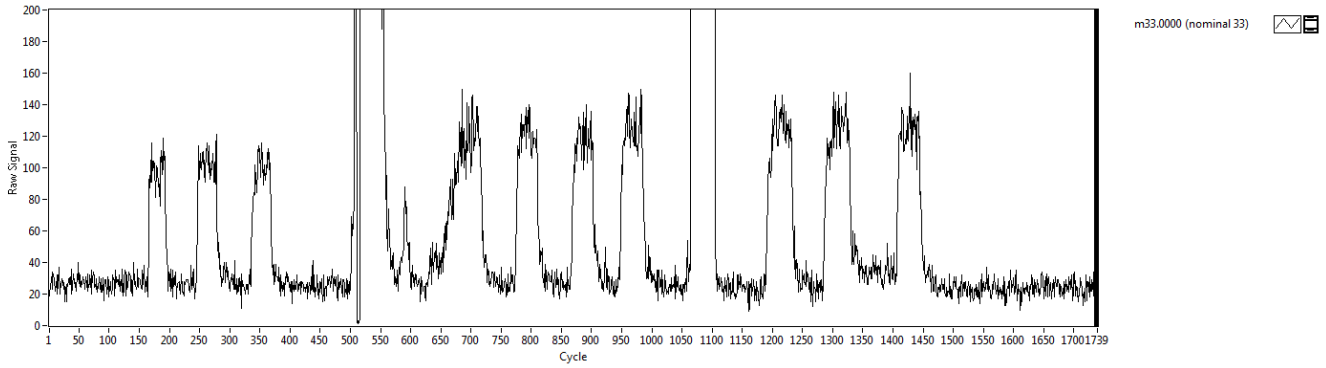


Propylene Glycol E/N = 120; T = 60C; P = 2.2 mbar

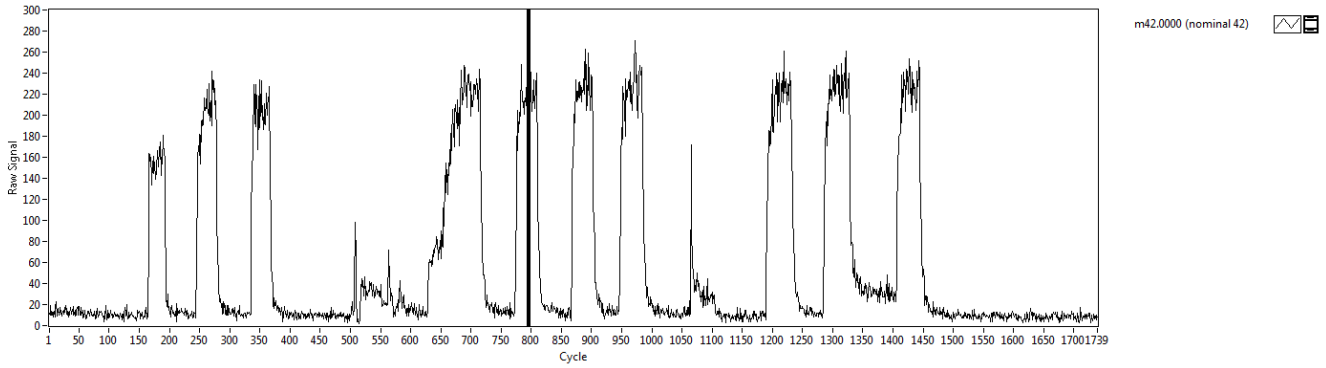
APPENDIX E

MEASUREMENTS OF COPCS AND OTHER COMPUNDS THROUGH THE SMSAPLING SYSTEM

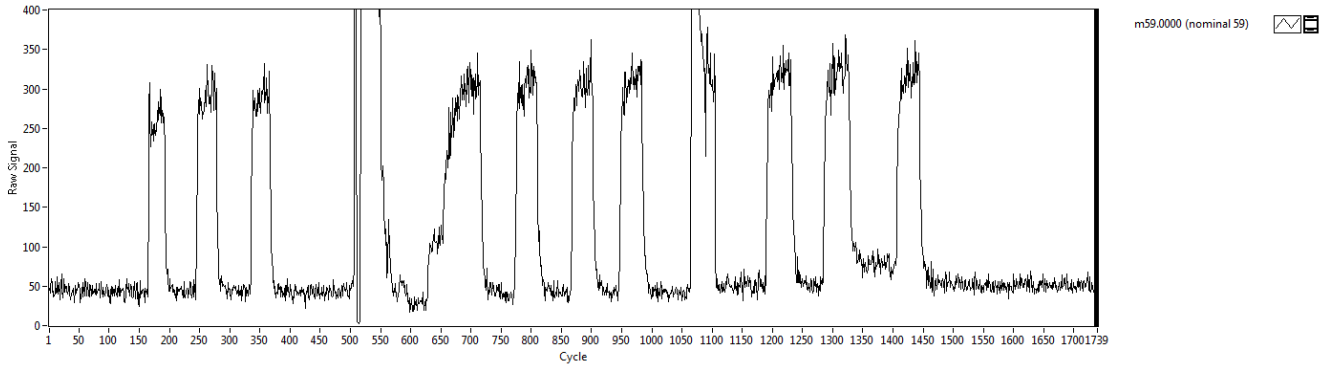
Methanol (0) E/N=120, T=60ºC



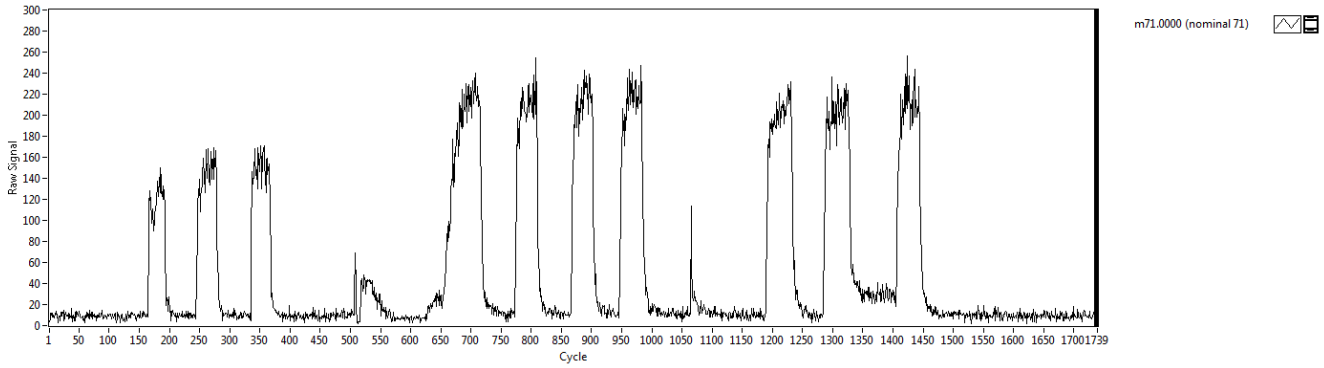
Acetonitrile (0) E/N=120, T=60ºC



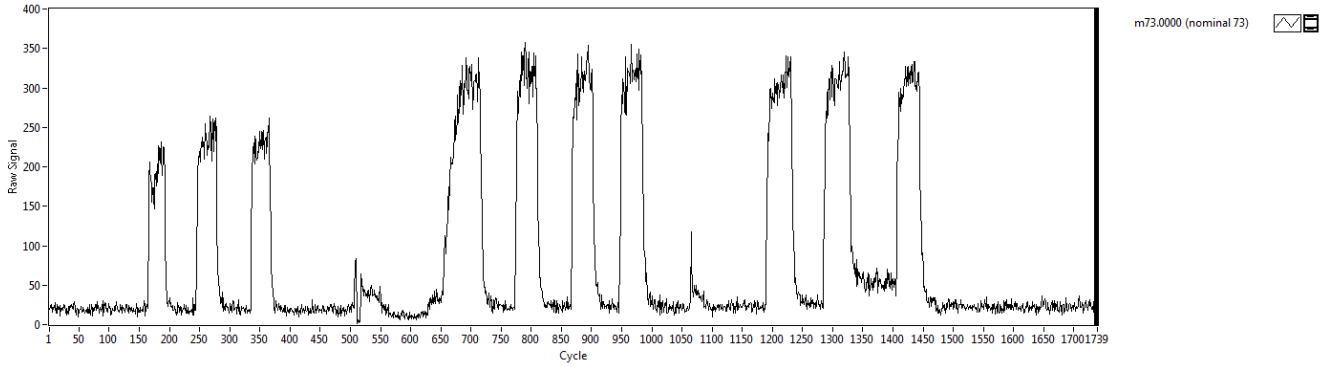
Acetone (0) E/N=120, T=60ºC



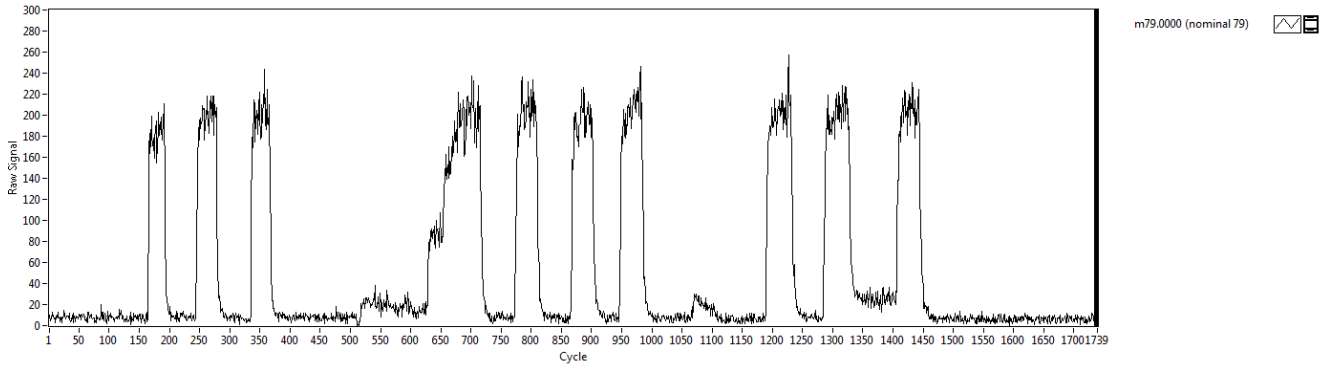
Methyl Vinyl Ketone (0) E/N=120, T=60ºC



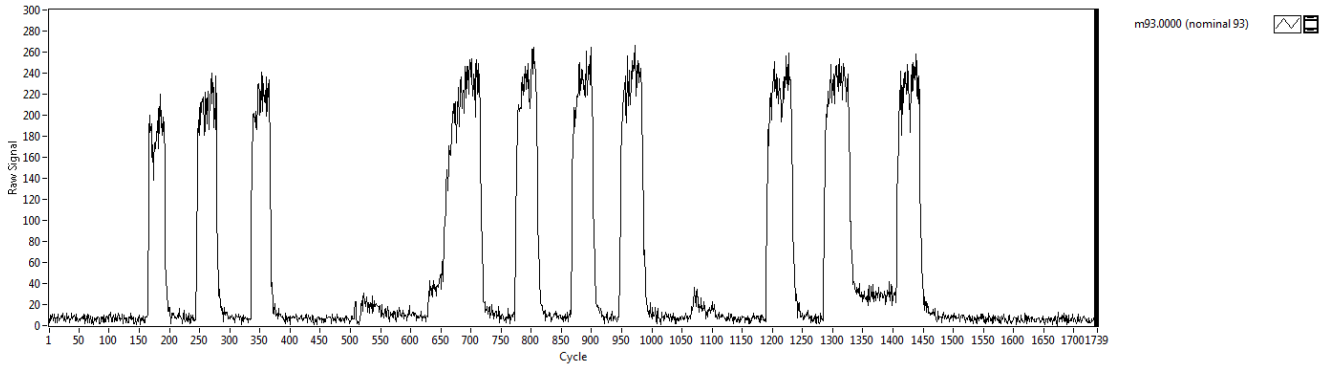
2-Butanone (Methyl ethyl ketone) (0) E/N=120, T=60ºC



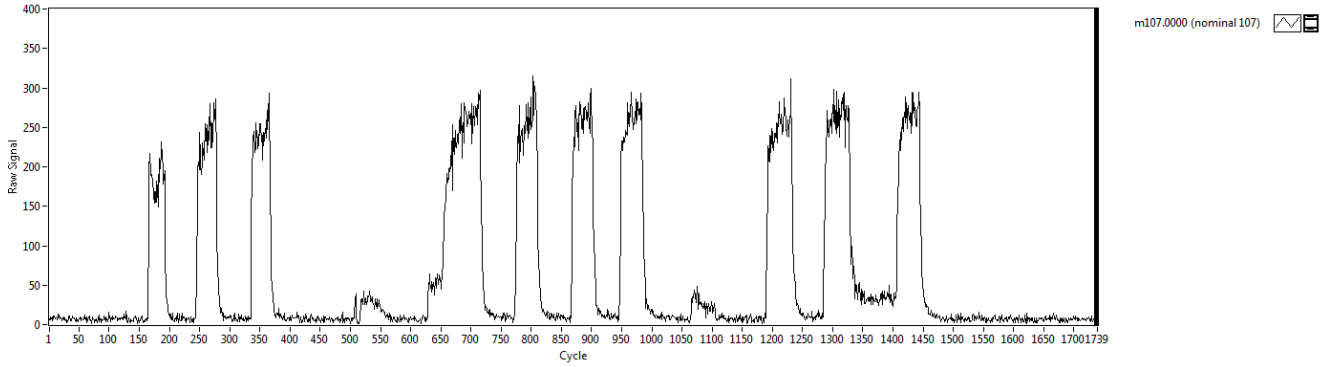
Benzene (0) E/N=120, T=60ºC



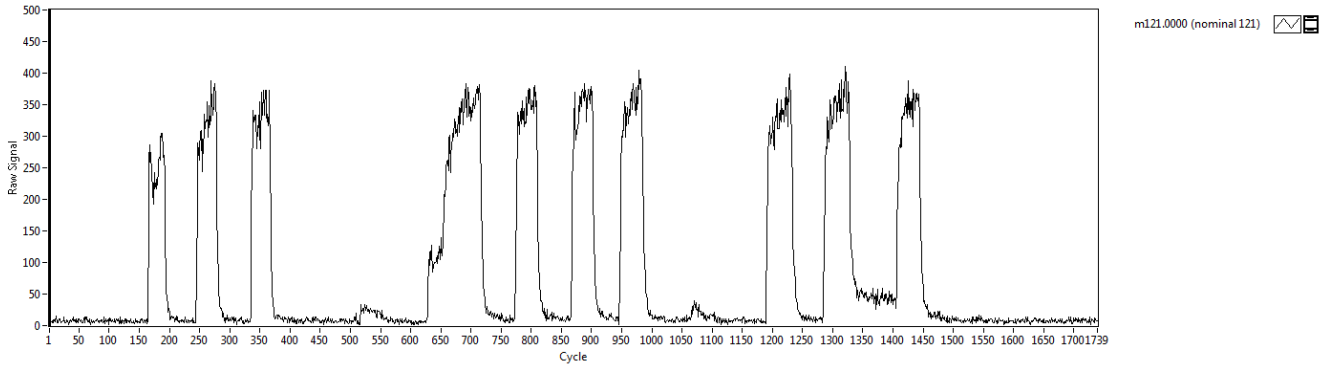
Toluene (0) E/N=120, T=60ºC



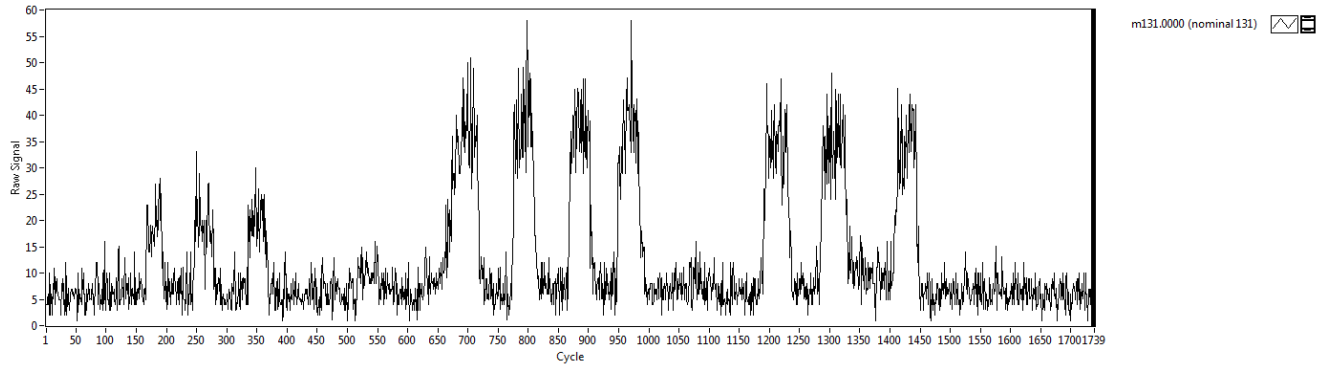
p-Xylene E/N=120, T=60ºC



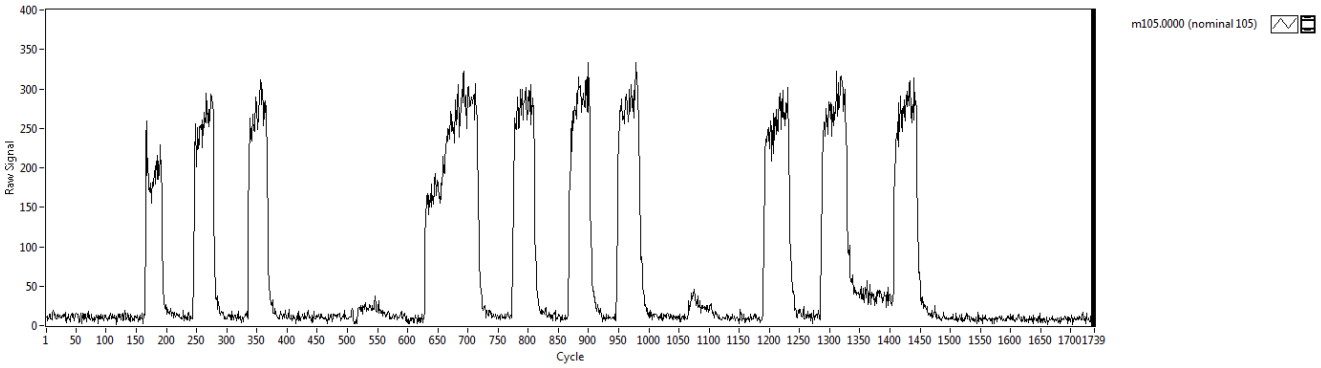
1,3,5-Trimethylbenzene (0) E/N=120, T=60ºC



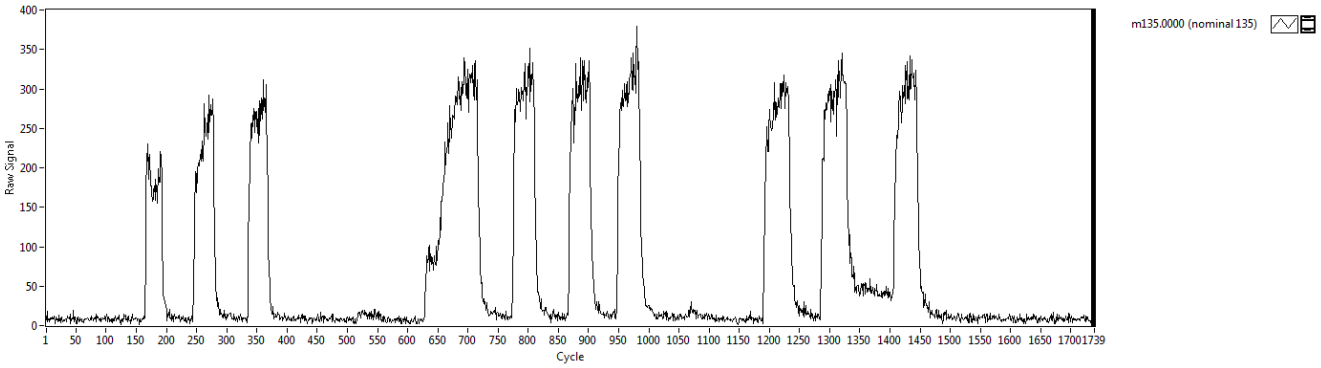
Trichloroethylene (0) E/N=120, T=60ºC



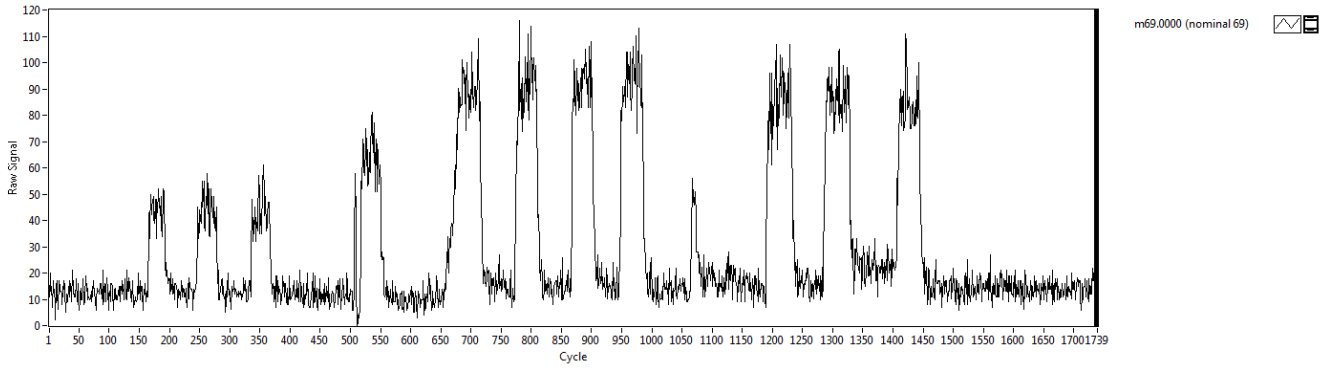
Styrene (0) E/N=120, T=60ºC



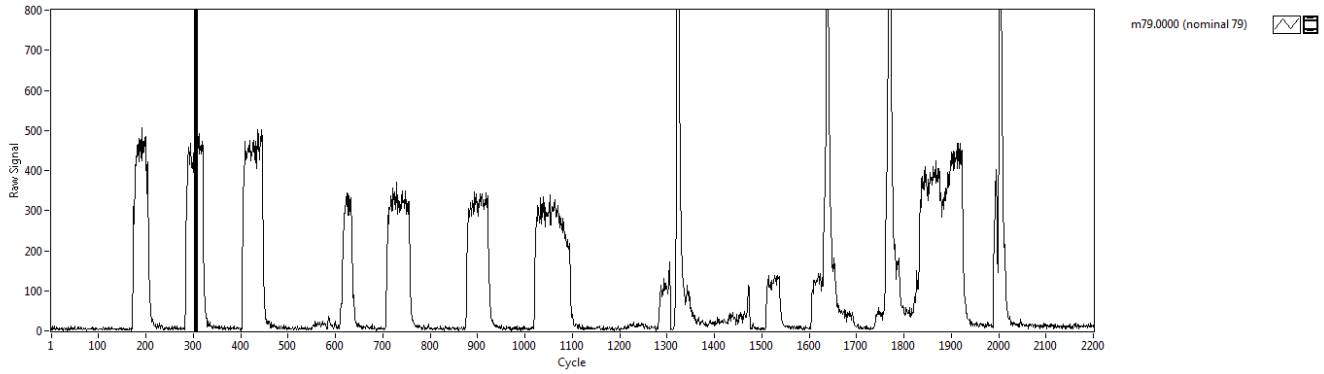
1,2,3,5-Tetramethylbenzene (0) E/N=120, T=60ºC



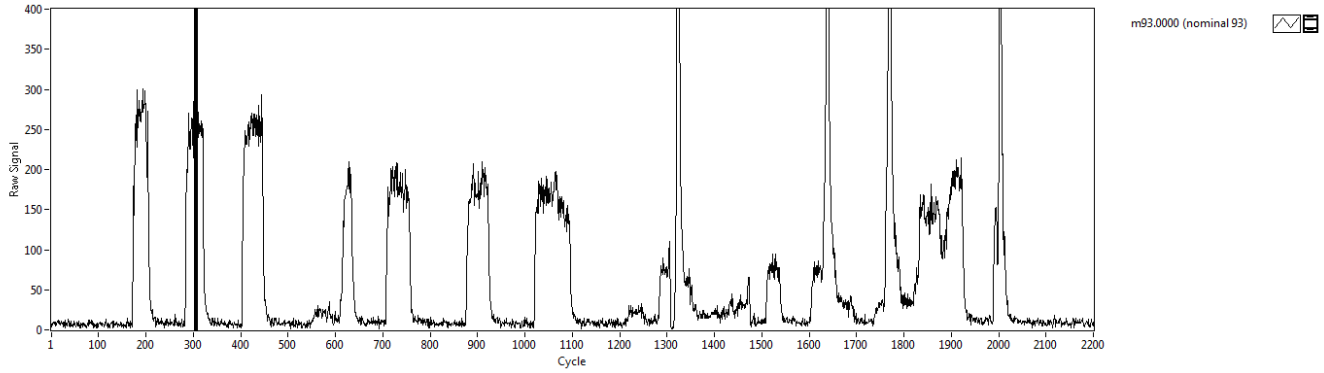
2-Methyl-1,3-butadiene (0) E/N=120, T=60ºC



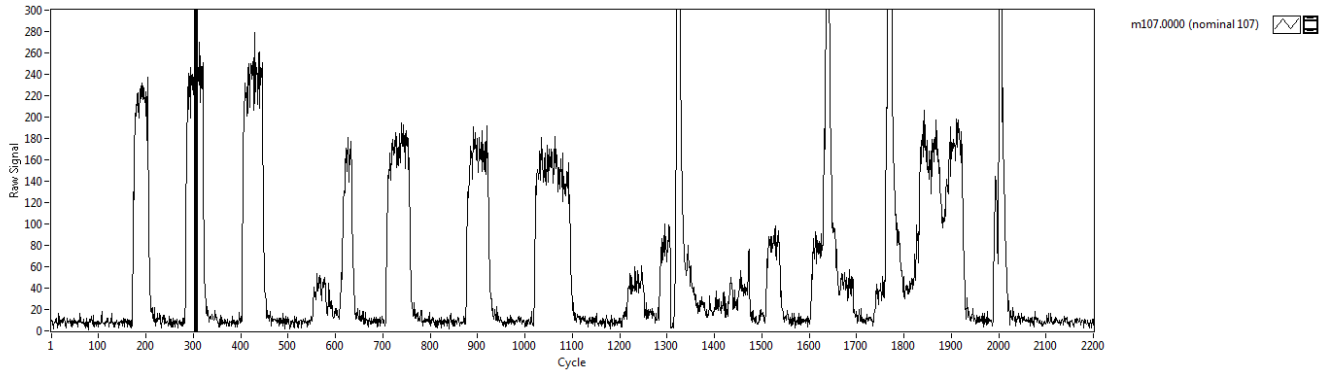
Benzene (1) E/N=120, T=60ºC



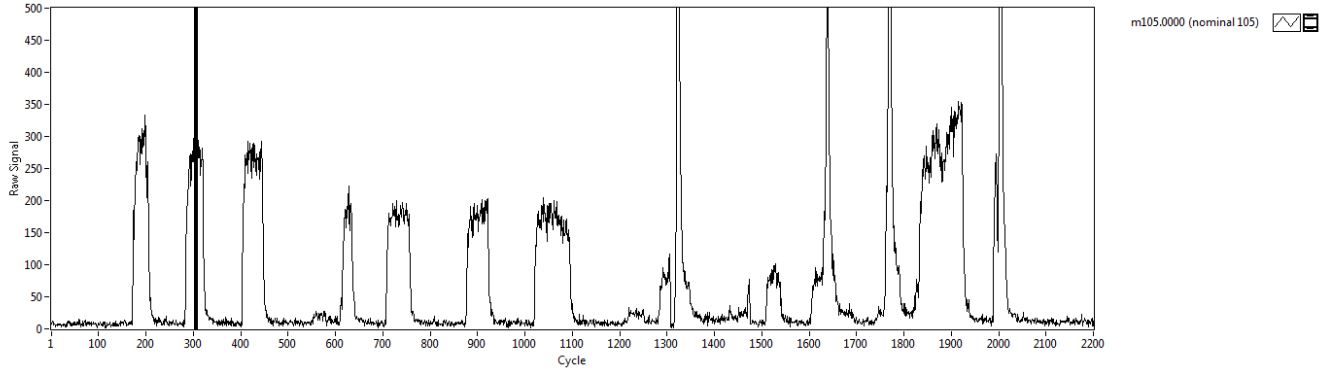
Toluene (1) E/N=120, T=60ºC



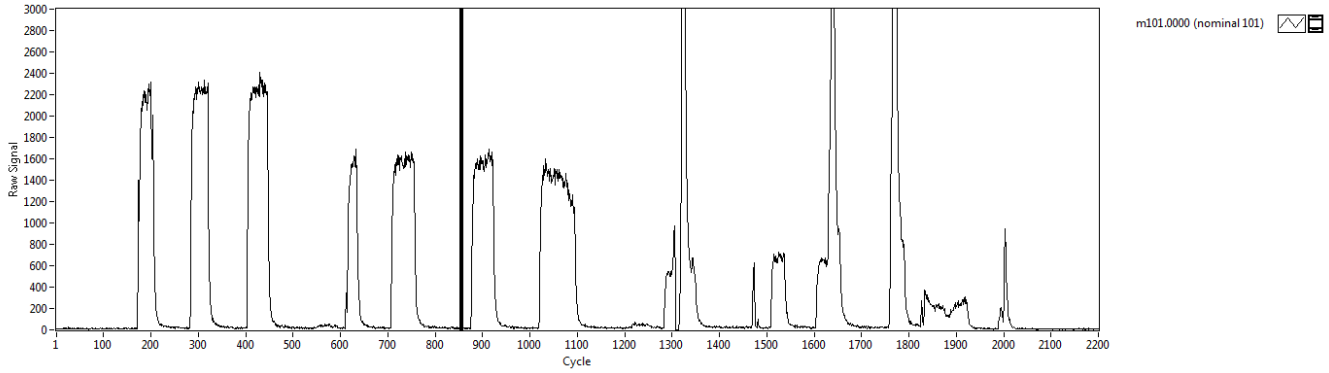
m-Xylene (1) E/N=120, T=60ºC



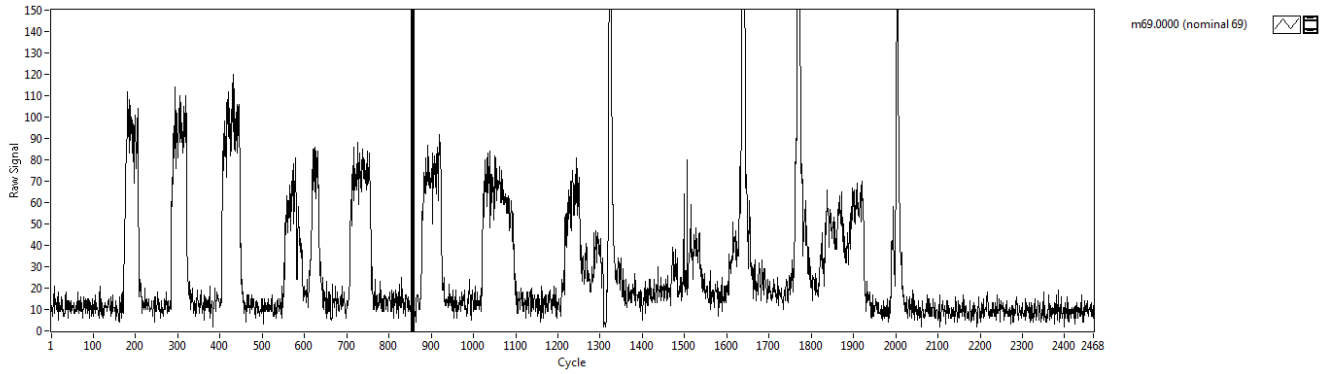
Styrene (1) E/N=120, T=60ºC



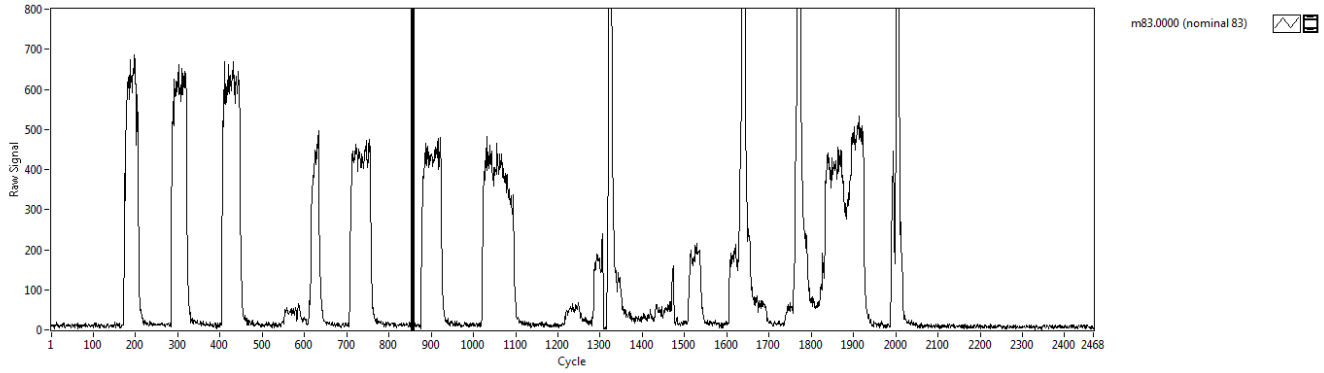
2-Hexanone (1) E/N=120, T=60ºC



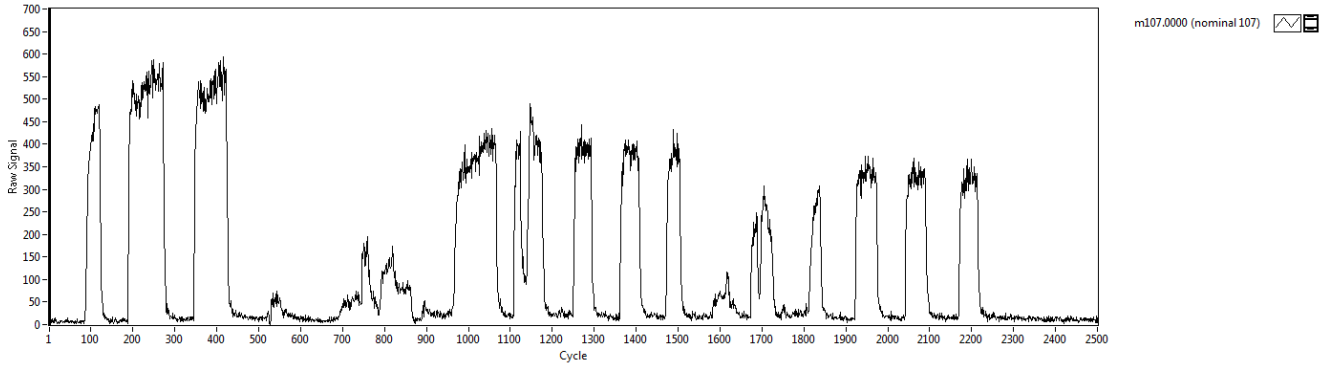
Furan (1) E/N=120, T=60ºC



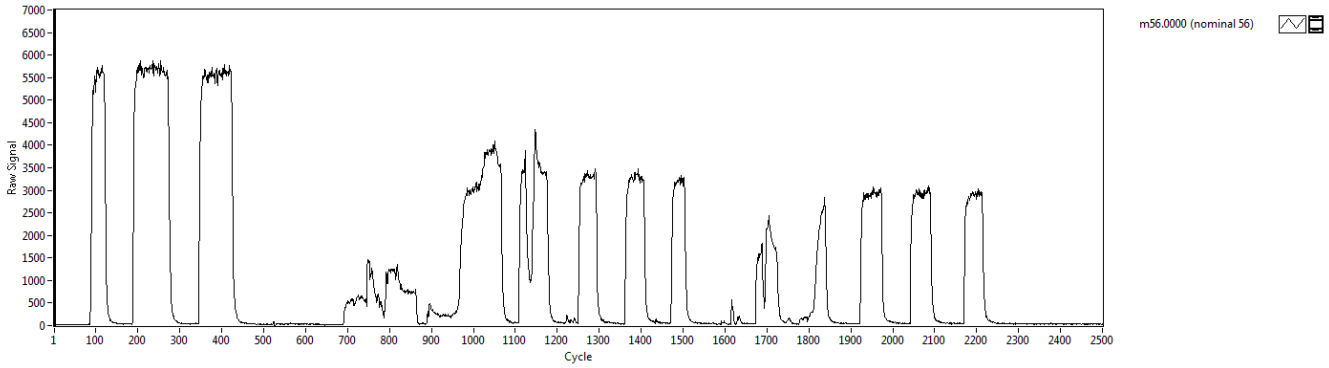
Methylfuran (1) E/N=120, T=60ºC



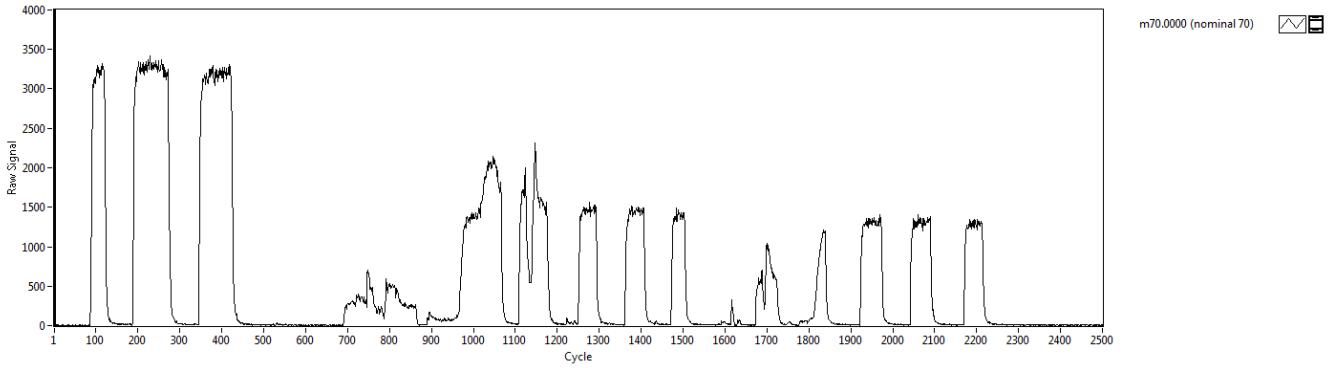
o-Xylene(2) E/N=120, T=60ºC



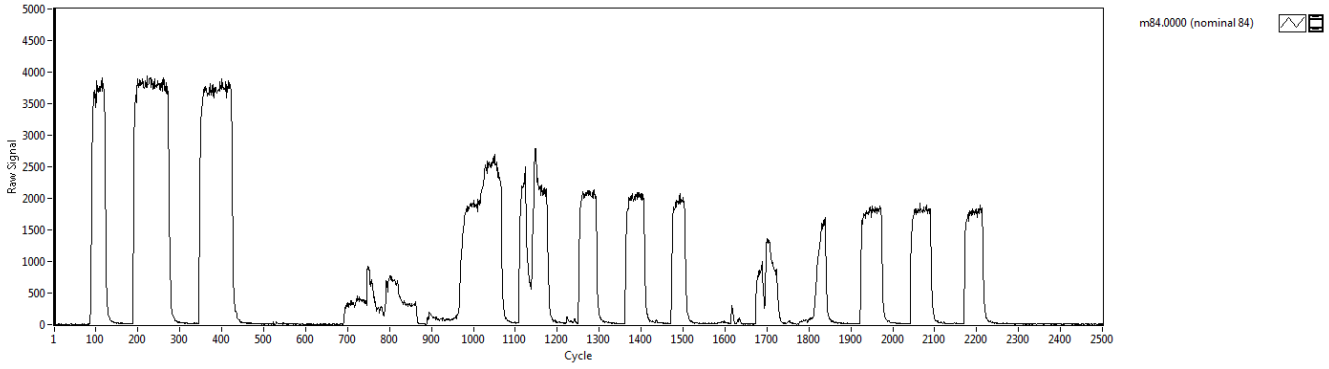
Propanenitrile (2) E/N=120, T=60ºC Sa



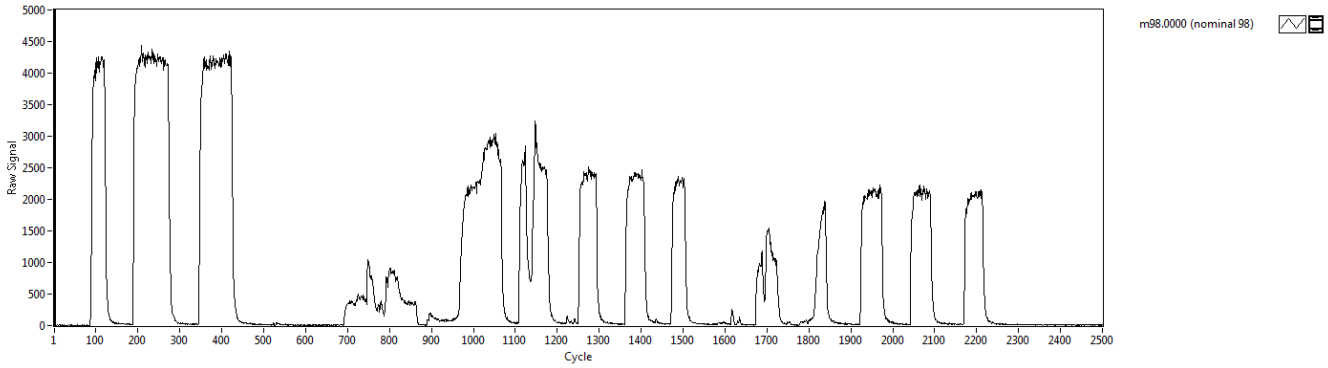
Butanenitrile (2) E/N=120, T=60ºC



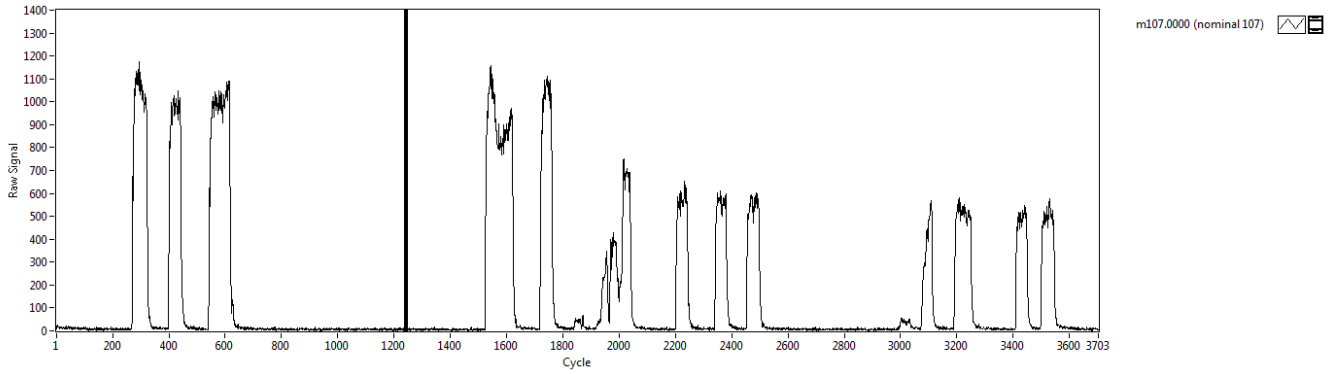
Pentanenitrile (2) S E/N=120, T=60ºC



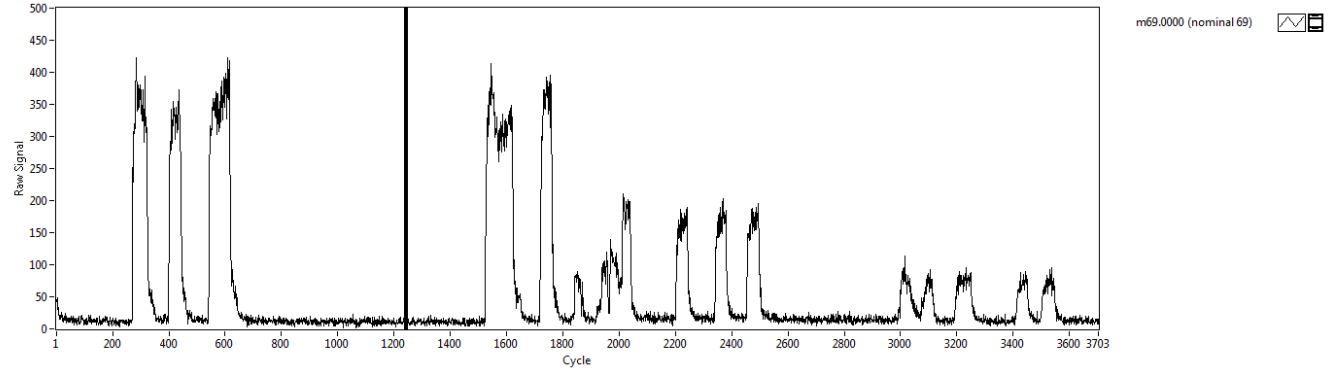
Hexanenitrile (2) E/N=120, T=60ºC



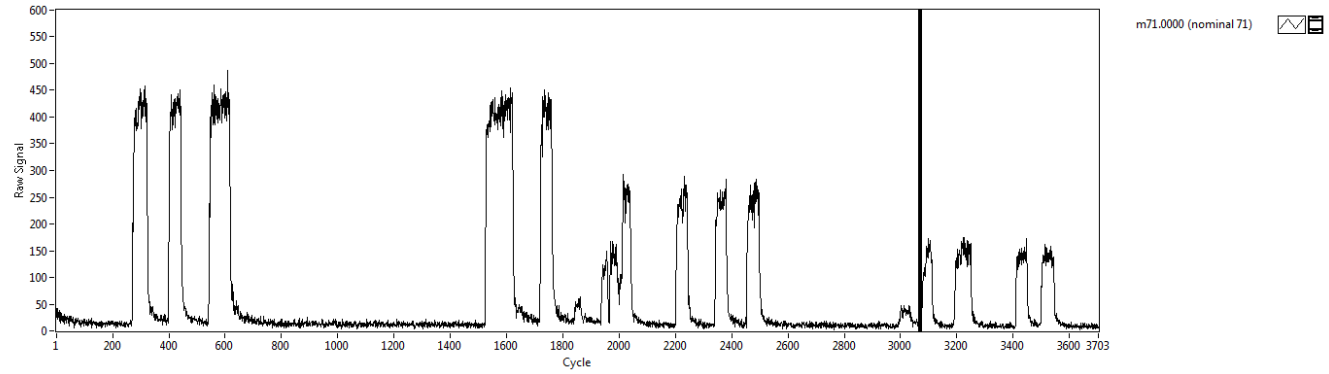
p-Xylene (3) E/N=120, T=60ºC



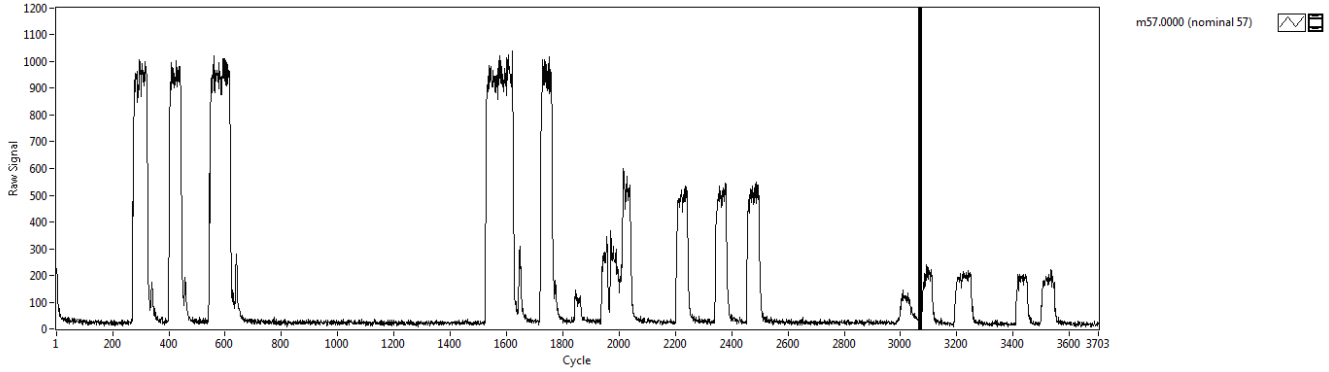
Isoprene (3) E/N=120, T=60ºC



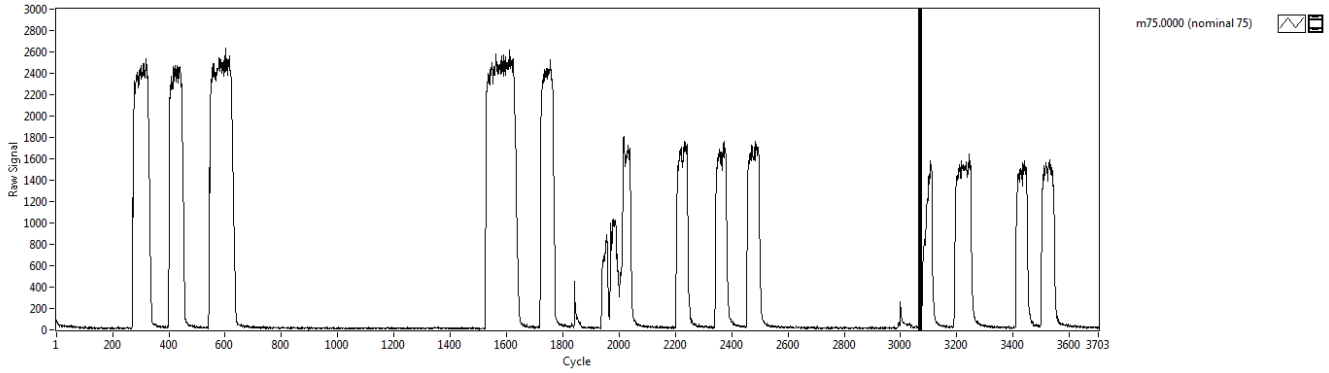
Methyl vinyl ketone (3) E/N=120, T=60ºC Study



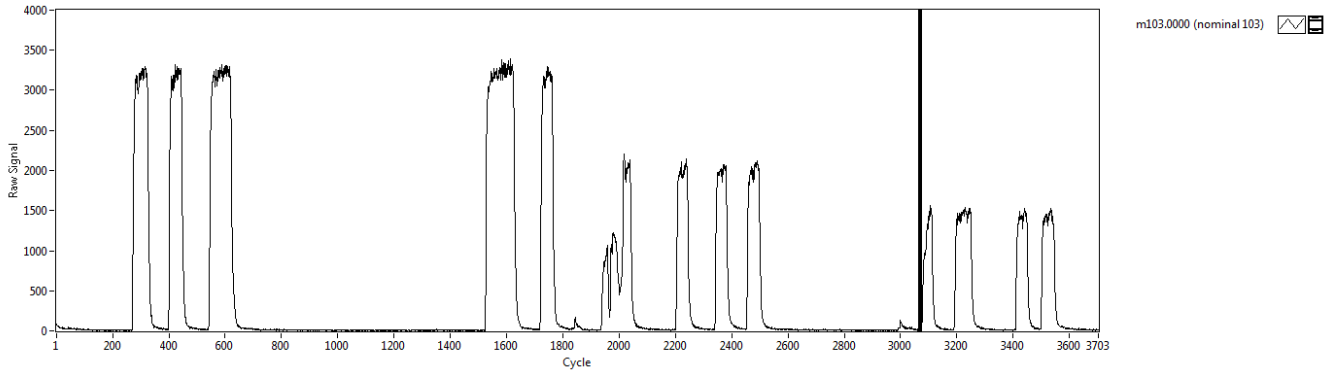
n-Butanol (3) E/N=120, T=60ºC



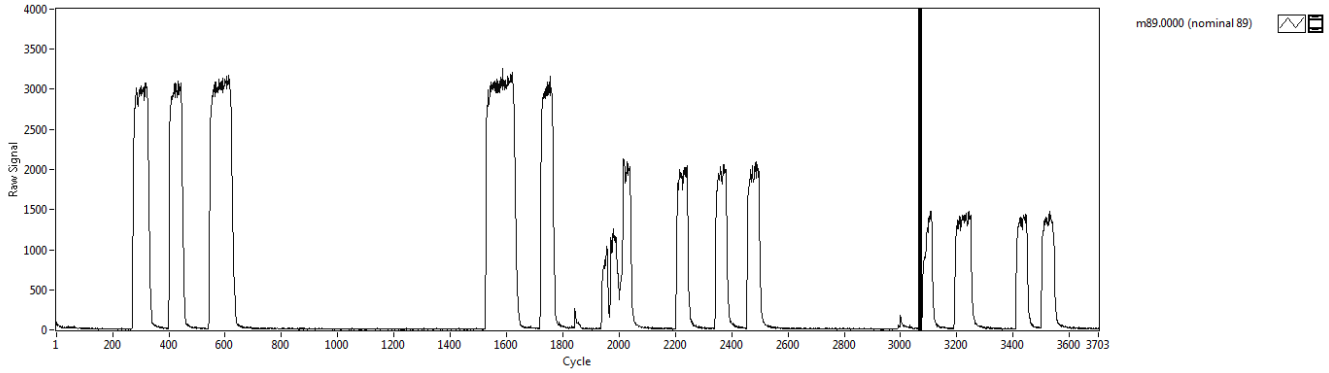
N-Nitrosodimethylamine (3) E/N=120, T=60ºC



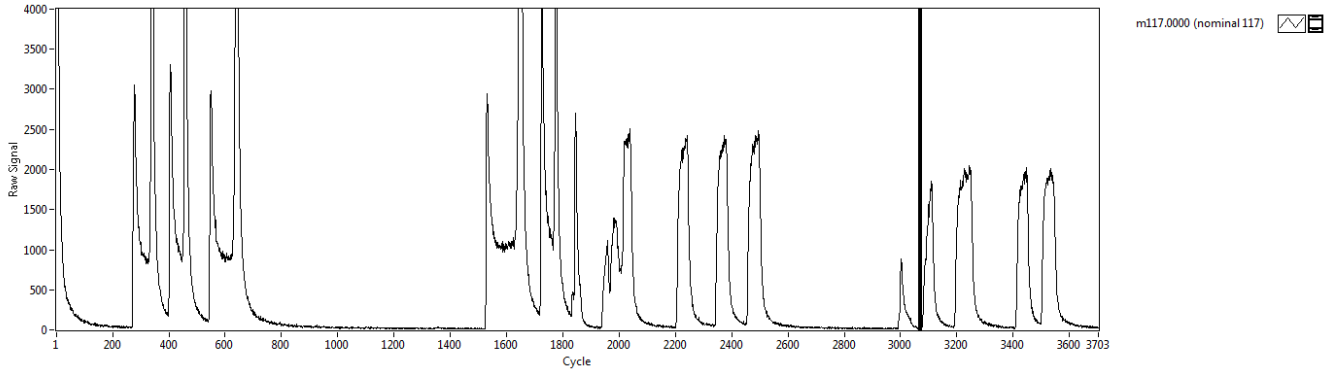
N-Nitrosodiethylamine (3) E/N=120, T=60ºC



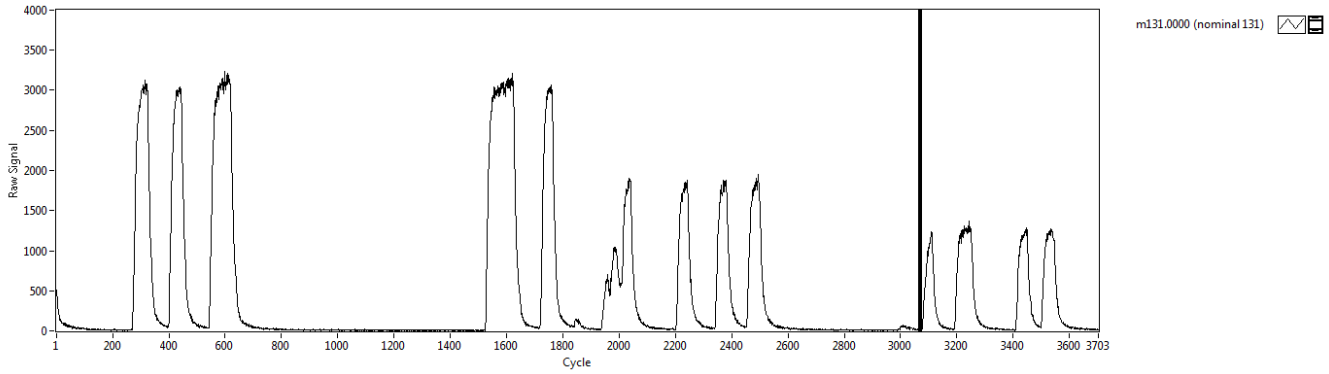
N-Nitrosomethylethylamine (3) E/N=120, T=60ºC



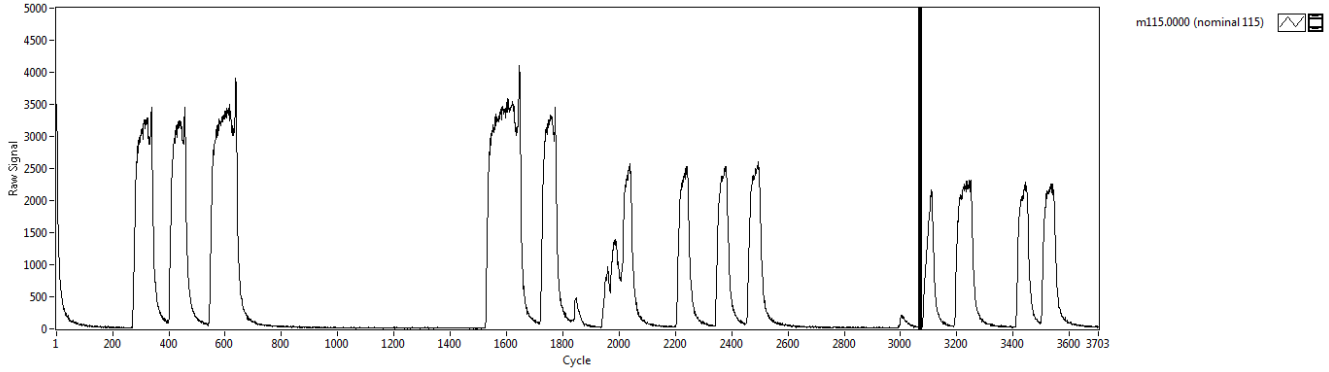
N-Nitrosomorpholine (3) E/N=120, T=60ºC



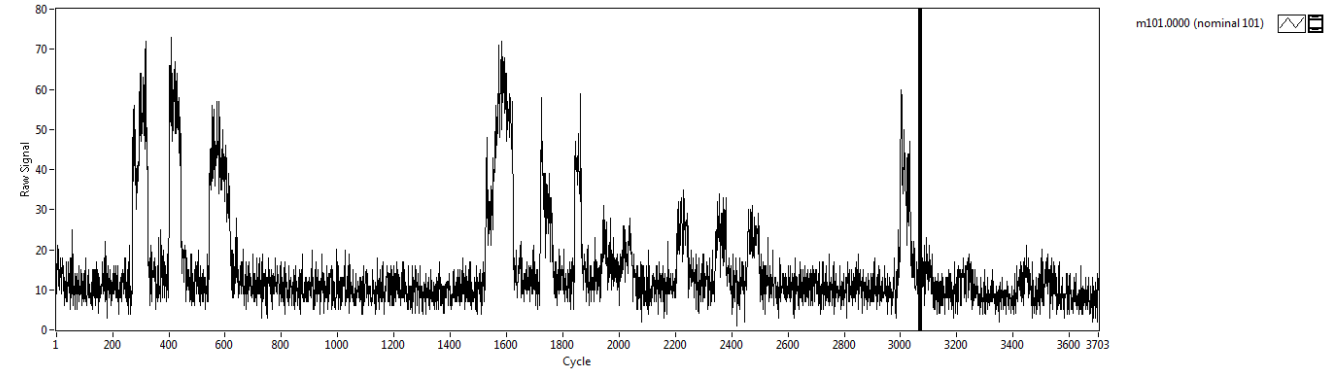
N-Nitrosodi-n-propylamine (3) E/N=120, T=60ºC



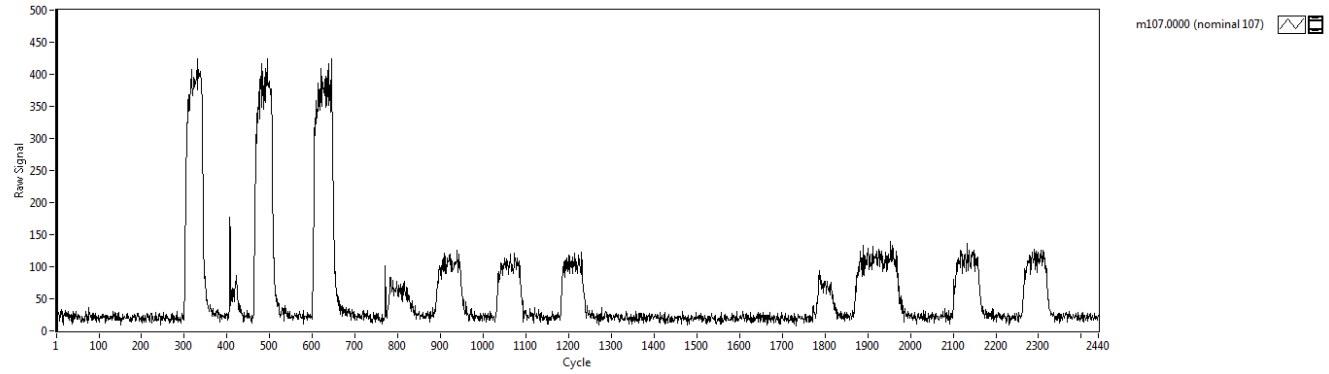
N-Nitrosopiperidine (3) E/N=120, T=60°C



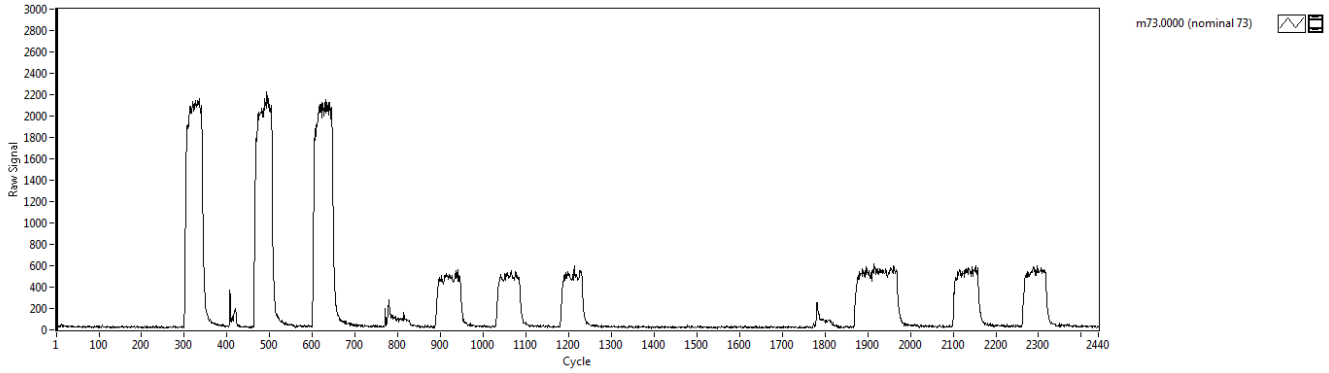
N-Nitrosopyrrolidine(3) E/N=120, T=60°C



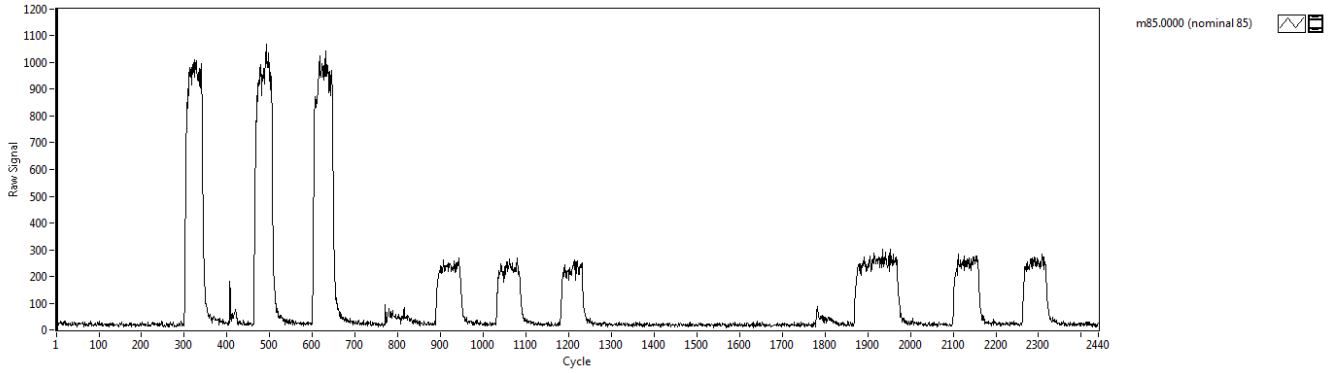
Ethylbenzene (4) E/N=120, T=60°C



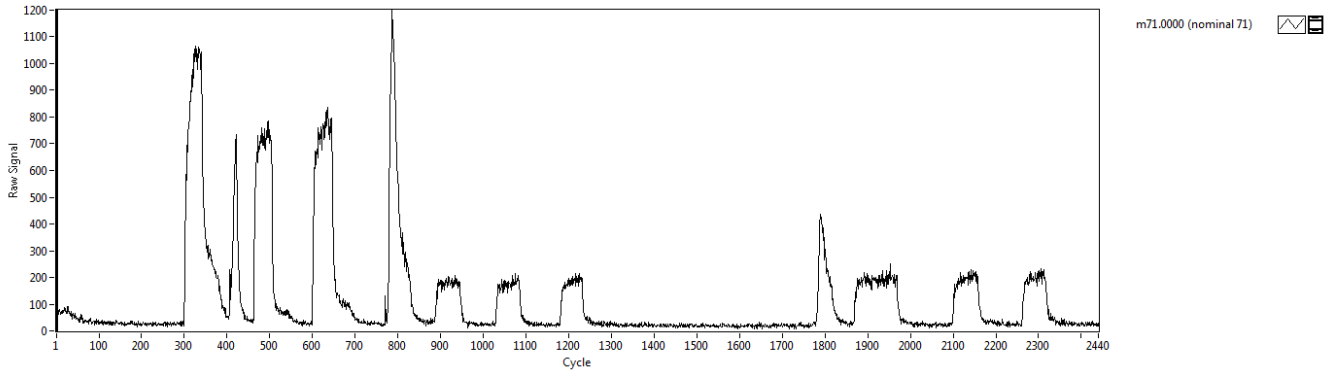
Methylethylketone (MEK) (4) E/N=120, T=60ºC



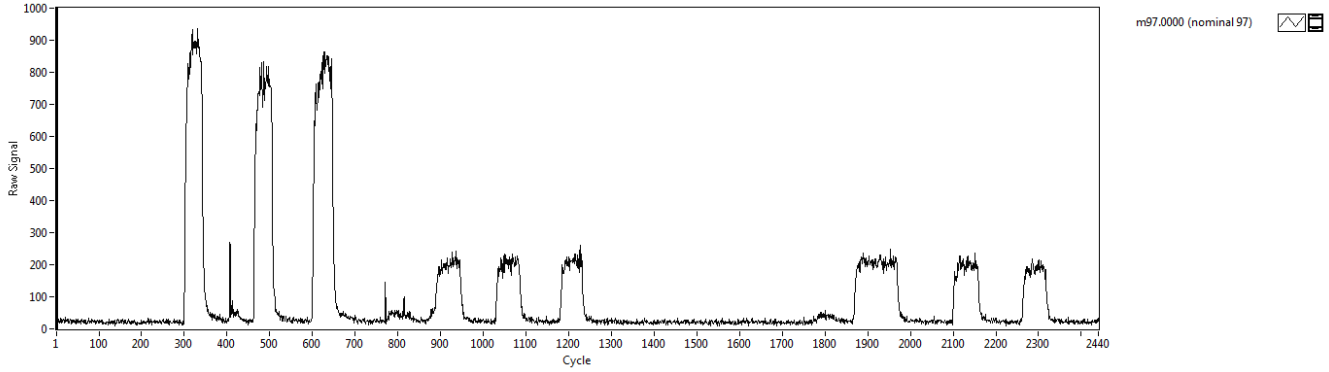
3-Methyl-3-butene-2-one (4) E/N=120, T=60ºC



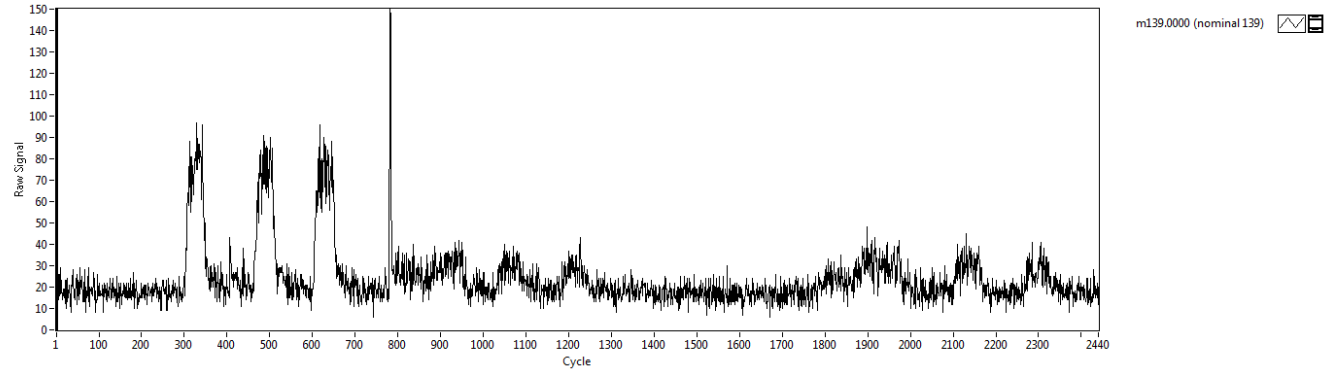
2,3-Dihydrofuran (4) E/N=120, T=60ºC



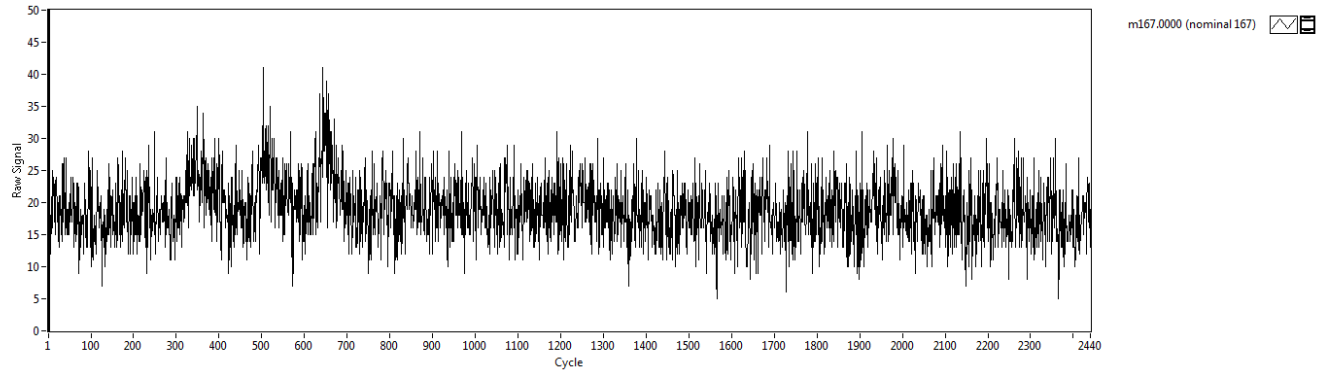
2,5-Dimethylfuran (4) E/N=120, T=60ºC



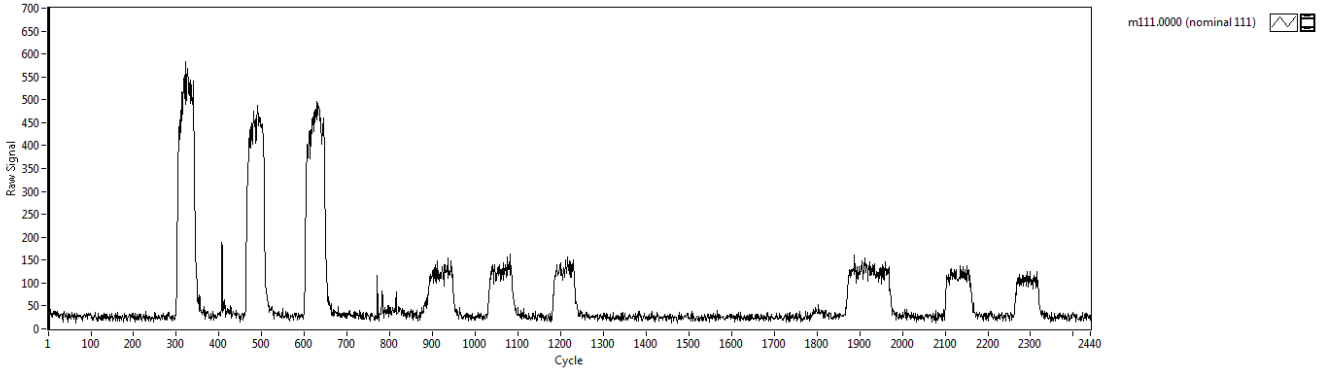
2-Pentylfuran (4) E/N=120, T=60ºC



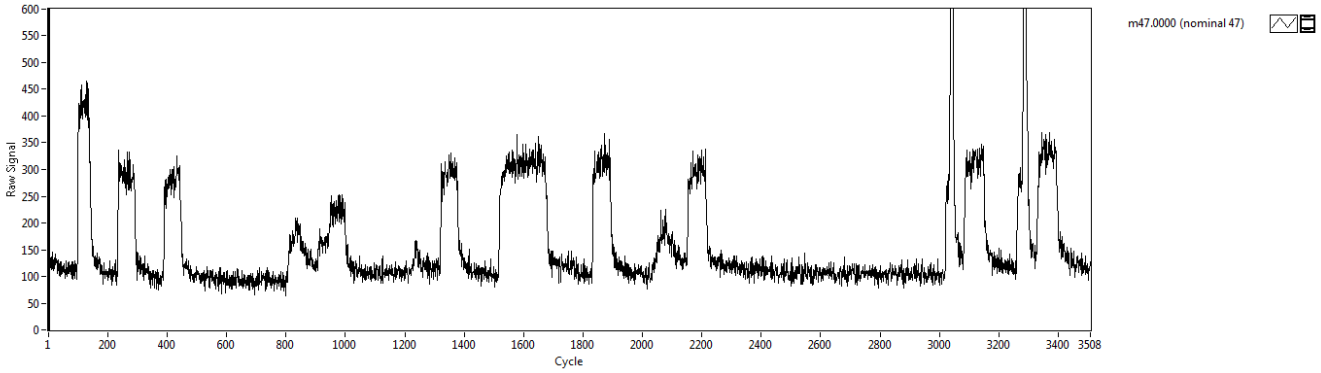
2-Heptylfuran(4) E/N=120, T=60ºC



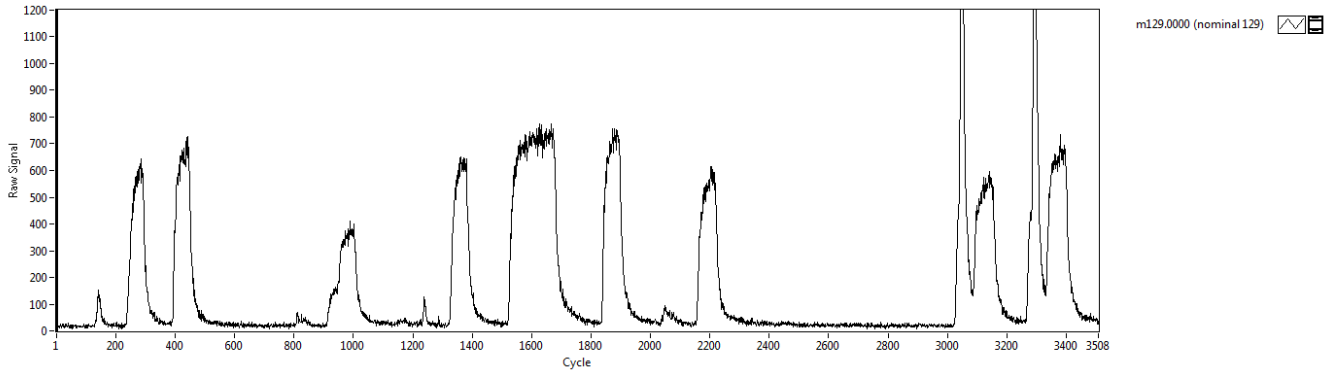
2-Propylfuran (4) E/N=120, T=60ºC



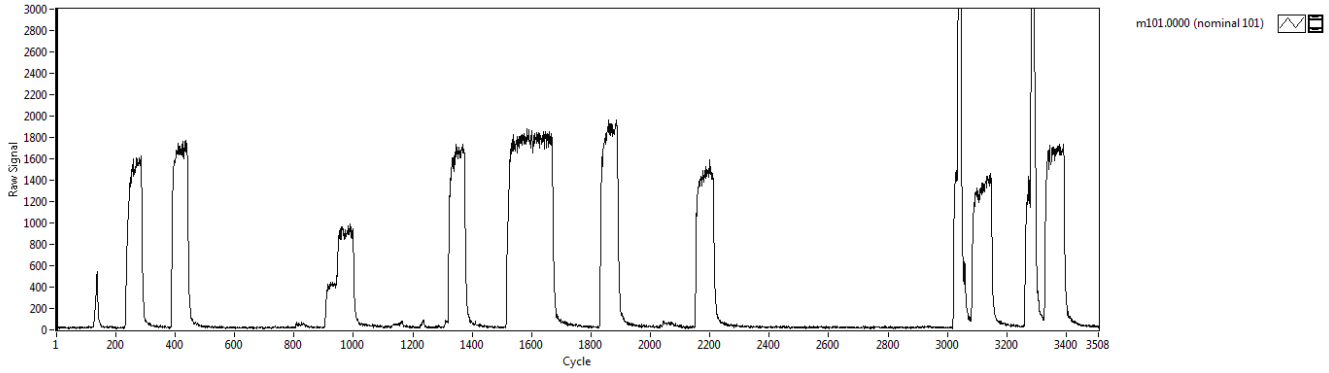
Ethanol (5) E/N=120, T=60ºC



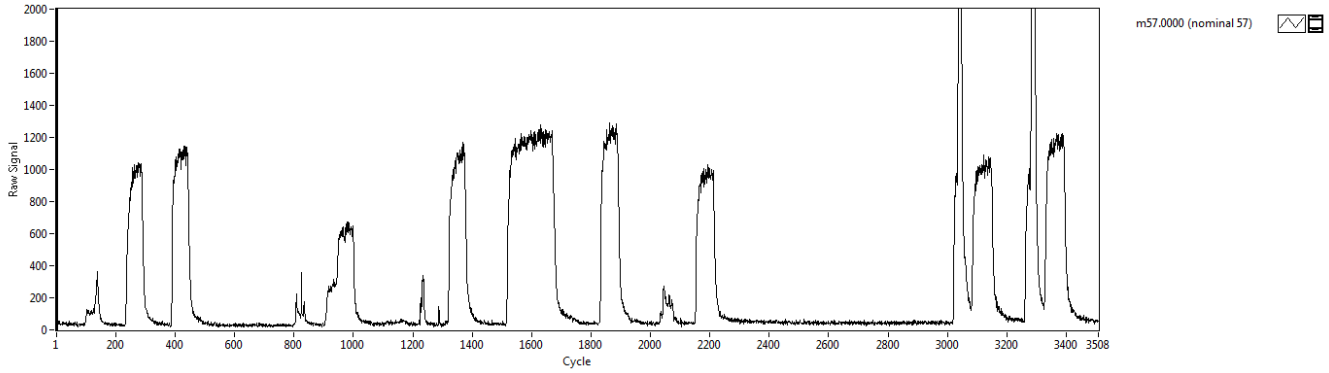
6-Methyl-2-heptanone (5) E/N=120, T=60ºC



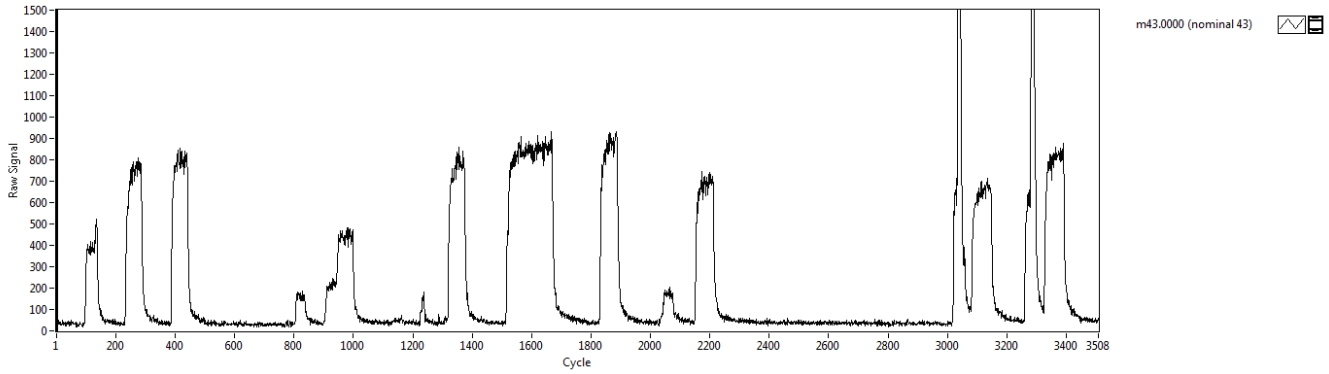
4-Methyl-2-pentanone (5) E/N=120, T=60ºC



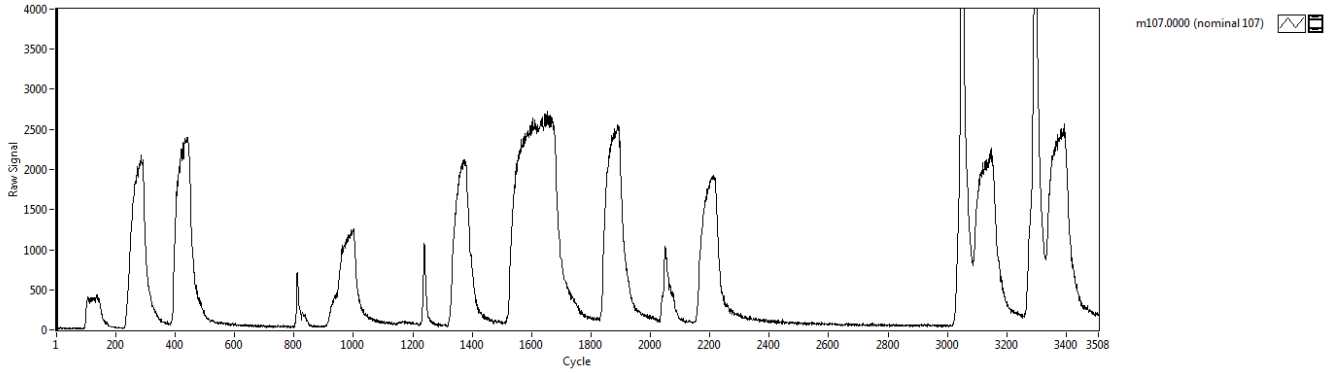
Butyl nitrite (5) E/N=120, T=60ºC



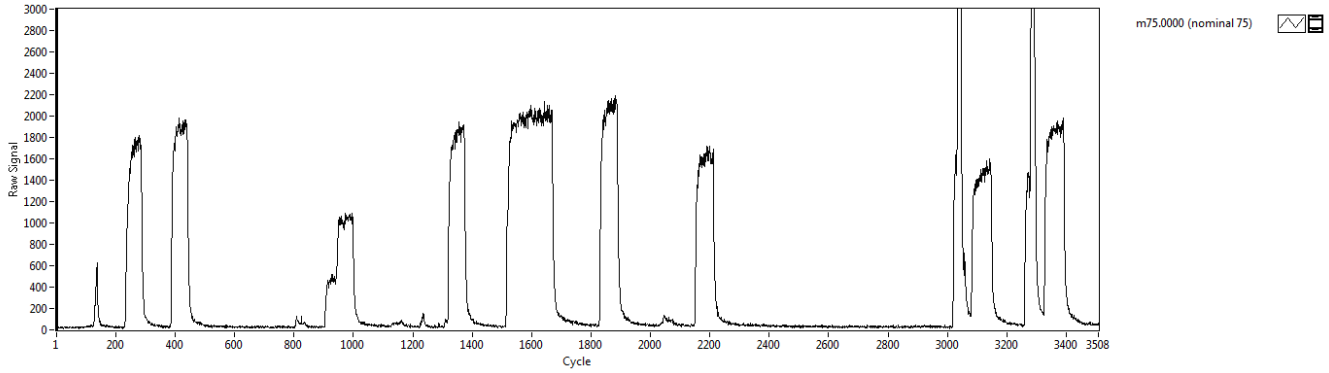
Isopropanol (5) E/N=120, T=60ºC



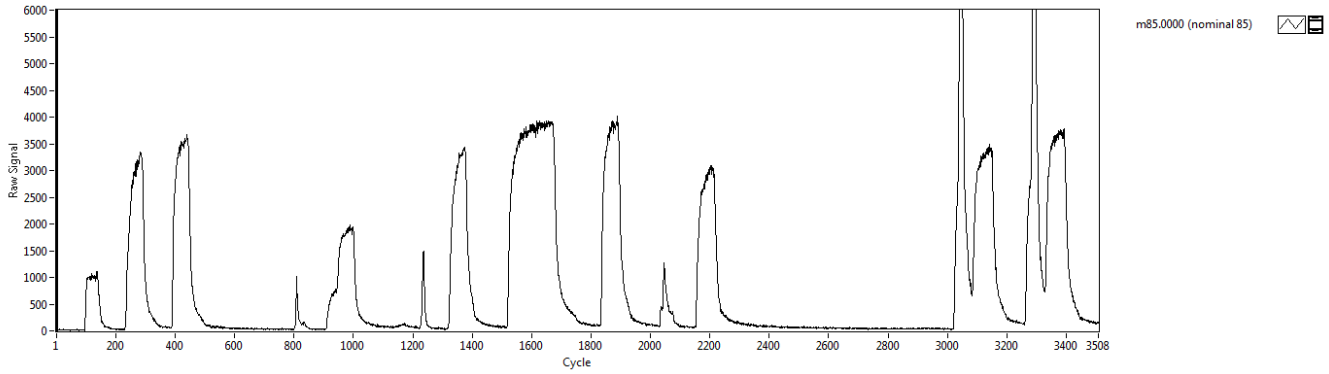
Benzaldehyde (5) E/N=120, T=60ºC



Methyl acetate (5) E/N=120, T=60ºC



3-Methyl-2-butanal (5) E/N=120, T=60ºC


m85.0000 (nominal 85)
Raw Signal
Cycle
6000
5500
5000
4500
4000
3500
3000
2500
2000
1500
1000
500
0
1
200
400
600
800
1000
1200
1400
1600
1800
2000
2200
2400
2600
2800
3000
3200
3400
3508

APPENDIX F

ANALYSIS OF VOCS FROM AEROSOL ELECTROSTATIC PRECIPITATOR PLATES

RJ LEE GROUP
DELIVERING SCIENTIFIC RESOLUTION

June 13, 2016

Washington River Protection Solutions, LLC.
Attention: George Weeks
Cc.
Richland, WA 99352

Subject: Analysis of VOCs from Aerosol Electrostatic Precipitator Plates

Enclosed is the report for the 17 electrostatic precipitator plates for VOCs in support of the Hanford Tank Farm aerosol sampling campaign conducted on May 24-26, 2016. The samples were received at the Columbia Basin Analytical Laboratory (CBAL) on May 26, 2016 and assigned a laboratory order number of W605131. This report consists of an individual VOC report for the 17 samples, a sample batch quality control report, a copy of the chain of custody. Note that samples W605131-01 through W605131-06 were analyzed in one analytical batch and samples W605131-07 through W605131-17 were analyzed under a second analytical batch.

General Set Comments
Columbia Basin Analytical Laboratory (CBAL) received 17 samples on May 26, 2016 to be tested for volatile organic compounds. The samples were collected in support of the aerosol sampling campaign at the Hanford tank farms conducted by Savanna River National Laboratory (SRNL). The reports of the individual samples contain a reference to both the SRNL sample name and the CBAL laboratory sample ID.

The samples were analyzed in accordance with EPA Compendium Method TO-17-Modified. The sample was transferred from its plastic storage container to a thermal desorption vessel equipped with a gas inlet and gas outlet. The vessel was sealed, then heated to 75°C for 30 minutes under a stream of ultrahigh purity nitrogen. Thermally desorbed VOCs were transferred by the nitrogen flow to a CarboTrap-300 thermal desorption tube that was maintained at room temperature (~23°C). The trapped VOCs were desorbed into a GC/MS system for analysis.

Results
All samples were processed against our standard TO-17 compound list of ~74 compounds. The reporting limit for each of these target compounds is 0.5 ppbv. The ppbv values were transposed to nanogram per sample units for the report.

Each sample was evaluated for 'Tentatively Identified Compounds' (TICs) with a search criteria of the 15 most abundant compounds that exceeded a 5% response threshold of the nearest internal standard. Each of these compounds was further evaluated by an experienced chemist to determine the 'reasonableness' of the computer generated report. Note that these compounds are estimated in concentration which may vary by +/- 50%, or more. This is due to

the unknown response factors of the specific compound under electron ionization as compared to the internal standard.

Recovery Failures in the CCV, MRL, LCS and LCSD

Any failures in recovery or response of the continuing calibration verification standard, the method detection limit sample, and the laboratory control samples for each analyte are indicated in the report as alpha/numeric flags. A listing of the description of each qualification flag can be found at the bottom of the report.

RSD Failures in the LCS and LCSD's

There were no RSD failures between the laboratory control samples.

Calibration Curves

The calibration curves for the 74 target compounds generally had R^2 values that were 0.990 or better, over a range of 0.2 ppbv to 25 ppbv.

This report has been prepared primarily as an internal document for the support of the Proton Transfer Reaction Mass Spectrometry measurements being conducted at the 200E and 200W tank farm locations on the Hanford Site. Data within this report will be used as a guide for the processing and evaluation of the associated PTRMS data. It is not intended for the support of either environmental or industrial hygiene related activities. Release of the data contained in this hard copy report has been authorized by the Laboratory Director or a designee as verified by the following signature. This test report shall not be reproduced, except in full, without written approval of CBAL.

Joe Sears

June 13, 2016

Senior Scientist; Joe Sears, Ph.D. Date

If you have any questions, please feel free to contact Dr. Joe Sears at 509-545-4989 or email at jsears@rjleegroup.com.

RJ LEE GROUP
DELIVERING SCIENTIFIC RESOLUTION

RJ Lee*Group*, Inc.|Columbia Basin Analytical Laboratory
2710 North 20th Avenue, Pasco WA 99301
Tel: (509) 545-4989 | Fax: (509) 544-6010

LABORATORY REPORT
EPA Compendium Method TO-17-Modified
Electrostatic Precipitator Plates

Client:	Washington River Protection Solt	RJ Lee Group Project:	W605131
Address:		Samples Received:	05/26/16
	Richland, WA 99352	Analysis Date:	06/01/16
Attention:	Attn: George Weeks	Report Date:	06/07/16
Telephone:		Sampling Date:	05/23/16
e-mail:		Purchase Order No.:	
		Client Project:	GAL601096

Sample ID				CAS			QC %	Reporting Limit		
Client	RJLG	Medium ID	Analyte	Number	Matrix	Type	REC	(ng)	Result (ng)	Qualifier
20160523-mACE-A103-2	W605131-01		Bromochloromethane	74-97-5	EP-Plate	Int. Std		1.1	**52.9**	
20160523-mACE-A103-2	W605131-01		Propene	115-07-1	EP-Plate	Ta		0.34	**1.52**	rR
20160523-mACE-A103-2	W605131-01		Dichlorodifluoromethane (F12)	75-71-8	EP-Plate	Ta		0.99	**< 0.99**	R
20160523-mACE-A103-2	W605131-01		Chloromethane	74-87-3	EP-Plate	Ta		0.41	**< 0.41**	
20160523-mACE-A103-2	W605131-01		1,2-Dichloro-tetrarfluoroethane	76-14-2	EP-Plate	Ta		1.4	**< 1.4**	
20160523-mACE-A103-2	W605131-01		Chloroethene	75-01-4	EP-Plate	Ta		0.51	**< 0.51**	
20160523-mACE-A103-2	W605131-01		1,3-Butadiene	106-99-0	EP-Plate	Ta		0.44	**< 0.44**	
20160523-mACE-A103-2	W605131-01		n-Butane	106-97-8	EP-Plate	Ta		0.48	**< 0.48**	
20160523-mACE-A103-2	W605131-01		Bromomethane	74-83-9	EP-Plate	Ta		0.78	**< 0.78**	R
20160523-mACE-A103-2	W605131-01		Chloroethane	75-00-3	EP-Plate	Ta		0.53	**< 0.53**	
20160523-mACE-A103-2	W605131-01		Ethanol	64-17-5	EP-Plate	Ta		0.38	**3.60**	
20160523-mACE-A103-2	W605131-01		Vinylbromide	593-60-2	EP-Plate	Ta		0.88	**< 0.88**	
20160523-mACE-A103-2	W605131-01		Trichlorofluoromethane	75-69-4	EP-Plate	Ta		1.1	**< 1.1**	
20160523-mACE-A103-2	W605131-01		Acrolein	107-02-8	EP-Plate	Ta		0.46	**4.22**	
20160523-mACE-A103-2	W605131-01		Acetone	67-64-1	EP-Plate	Ta		0.48	**12.5**	
20160523-mACE-A103-2	W605131-01		n-Pentane	109-66-0	EP-Plate	Ta		0.59	**< 0.59**	
20160523-mACE-A103-2	W605131-01		Isopropanol	67-63-0	EP-Plate	Ta		0.49	**< 0.49**	r
20160523-mACE-A103-2	W605131-01		1,1-Dichloroethene	75-35-4	EP-Plate	Ta		0.79	**< 0.79**	
20160523-mACE-A103-2	W605131-01		t-Butyl alcohol	75-65-0	EP-Plate	Ta		0.61	**< 0.61**	r
20160523-mACE-A103-2	W605131-01		1,1,2-Trichloro-1,2,2-trifluoroethane (	76-13-1	EP-Plate	Ta		1.5	**< 1.5**	
20160523-mACE-A103-2	W605131-01		3-Chloropropene	107-05-1	EP-Plate	Ta		0.63	**< 0.63**	r
20160523-mACE-A103-2	W605131-01		Methylene Chloride (Dichloromethane)	75-09-2	EP-Plate	Ta		0.70	**5.87**	r
20160523-mACE-A103-2	W605131-01		Carbon Disulfide	75-65-0	EP-Plate	Ta		0.62	**< 0.62**	r
20160523-mACE-A103-2	W605131-01		trans-1,2-Dichloroethene	156-60-5	EP-Plate	Ta		0.79	**< 0.79**	R
20160523-mACE-A103-2	W605131-01		Methyl-t-butyll ether (MTBE)	1634-04-4	EP-Plate	Ta		0.72	**< 0.72**	R

Sample ID										
Client	RJLG	Medium ID	Analyte	CAS Number	Matrix	Type	QC % REC	Reporting Limit (ng)	Result (ng)	Qualifier
20160523-mACE-A103-2	W605131-01		Vinyl Acetate	108-05-4	EP-Plate	Ta		0.70	< 0.70	Rr
20160523-mACE-A103-2	W605131-01		1,1-Dichloroethane	75-34-3	EP-Plate	Ta		0.81	< 0.81	
20160523-mACE-A103-2	W605131-01		2-Butanone (MEK)	78-93-3	EP-Plate	Ta		0.59	< 0.59	
20160523-mACE-A103-2	W605131-01		Hexane	110-54-3	EP-Plate	Ta		0.71	2.40	R
20160523-mACE-A103-2	W605131-01		cis-1,2-Dichloroethene	156-59-2	EP-Plate	Ta		0.79	< 0.79	R
20160523-mACE-A103-2	W605131-01		Ethyl Acetate	141-78-6	EP-Plate	Ta		0.72	< 0.72	
20160523-mACE-A103-2	W605131-01		Chloroform	540-36-3	EP-Plate	Ta		1.1	< 1.1	
20160523-mACE-A103-2	W605131-01		Tetrahydrofuran	67-66-3	EP-Plate	Ta		0.98	< 0.98	
20160523-mACE-A103-2	W605131-01		1,4-Difluorobenzene	71-55-6	EP-Plate	Int. Std		0.93	46.7	
20160523-mACE-A103-2	W605131-01		1,1,1-Trichloroethane	71-55-6	EP-Plate	Ta		1.1	< 1.1	
20160523-mACE-A103-2	W605131-01		1,2-Dichloroethane-d4	17060-07-0	EP-Plate	QA/Surr	98.6	0.84	41.5	
20160523-mACE-A103-2	W605131-01		1,2-Dichloroethane	107-06-2	EP-Plate	Ta		0.81	< 0.81	
20160523-mACE-A103-2	W605131-01		Benzene	71-43-2	EP-Plate	Ta		0.64	2.97	r
20160523-mACE-A103-2	W605131-01		Carbon Tetrachloride	56-23-5	EP-Plate	Ta		1.3	< 1.3	
20160523-mACE-A103-2	W605131-01		Cyclohexane	110-82-7	EP-Plate	Ta		0.69	< 0.69	
20160523-mACE-A103-2	W605131-01		2,2,4-Trimethylpentane	540-84-1	EP-Plate	Ta		0.93	< 0.93	
20160523-mACE-A103-2	W605131-01		Heptane	142-82-5	EP-Plate	Ta		0.82	< 0.82	
20160523-mACE-A103-2	W605131-01		Trichlorethylene	79-01-6	EP-Plate	Ta		1.1	< 1.1	
20160523-mACE-A103-2	W605131-01		1,2-Dichloropropane	78-87-5	EP-Plate	Ta		0.92	< 0.92	
20160523-mACE-A103-2	W605131-01		Methylmethacrylate	80-62-6	EP-Plate	Ta		0.82	< 0.82	
20160523-mACE-A103-2	W605131-01		1,4-Dioxane	123-91-1	EP-Plate	Ta		0.72	< 0.72	
20160523-mACE-A103-2	W605131-01		Bromodichloromethane	75-27-4	EP-Plate	Ta		1.3	< 1.3	
20160523-mACE-A103-2	W605131-01		Methyl isobutyl ketone (MIBK)	108-10-1	EP-Plate	Ta		0.82	< 0.82	
20160523-mACE-A103-2	W605131-01		cis-1,3-Dichloropropene	10061-01-5	EP-Plate	Ta		0.91	< 0.91	
20160523-mACE-A103-2	W605131-01		trans-1,3-Dichloropropene	10061-02-6	EP-Plate	Ta		0.91	< 0.91	
20160523-mACE-A103-2	W605131-01		Toluene-d8	2037-26-5	EP-Plate	QA/Surr	99.2	0.82	40.7	
20160523-mACE-A103-2	W605131-01		Toluene	108-88-3	EP-Plate	Ta		0.75	< 0.75	r
20160523-mACE-A103-2	W605131-01		1,1,2-Trichloroethane	79-00-5	EP-Plate	Ta		1.1	< 1.1	
20160523-mACE-A103-2	W605131-01		2-Hexanone	591-78-6	EP-Plate	Ta		0.90	< 0.90	
20160523-mACE-A103-2	W605131-01		Dibromochloromethane	124-48-1	EP-Plate	Ta		1.7	< 1.7	
20160523-mACE-A103-2	W605131-01		Tetrachloroethylene	127-18-4	EP-Plate	Ta		1.4	< 1.4	
20160523-mACE-A103-2	W605131-01		Chlorobenzene-d5	3114-55-4	EP-Plate	Int. Std		0.92	46.1	
20160523-mACE-A103-2	W605131-01		1,2-Dibromoethane	106-93-4	EP-Plate	Ta		1.5	< 1.5	
20160523-mACE-A103-2	W605131-01		Chlorobenzene	108-90-7	EP-Plate	Ta		0.92	< 0.92	
20160523-mACE-A103-2	W605131-01		Ethylbenzene	100-41-4	EP-Plate	Ta		0.87	< 0.87	

Sample ID										
Client	RJLG	Medium ID	Analyte	CAS Number	Matrix	Type	QC % REC	Reporting Limit (ng)	Result (ng)	Qualifier
20160523-mACE-A103-2	W605131-01		m,p-Xylene	179601-23-1	EP-Plate	Ta		0.87	< 0.87	
20160523-mACE-A103-2	W605131-01		Nonane	111-84-2	EP-Plate	Ta		1.0	< 1.0	
20160523-mACE-A103-2	W605131-01		o-Xylene	95-47-6	EP-Plate	Ta		0.87	< 0.87	r
20160523-mACE-A103-2	W605131-01		Styrene	100-42-5	EP-Plate	Ta		0.85	< 0.85	
20160523-mACE-A103-2	W605131-01		Bromoform	75-25-2	EP-Plate	Ta		2.1	< 2.1	
20160523-mACE-A103-2	W605131-01		1,1,2,2-Tetrachloroethane	79-34-5	EP-Plate	Ta		1.4	< 1.4	
20160523-mACE-A103-2	W605131-01		Cumene	98-82-8	EP-Plate	Ta		0.98	< 0.98	
20160523-mACE-A103-2	W605131-01		4-Bromofluorobenzene (BFB)	460-00-4	EP-Plate	QA/Surr	86.9	1.4	62.2	
20160523-mACE-A103-2	W605131-01		n-Propylbenzene	103-65-1	EP-Plate	Ta		0.98	< 0.98	
20160523-mACE-A103-2	W605131-01		2-Chlorotoluene	95-49-8	EP-Plate	Ta		1.0	< 1.0	
20160523-mACE-A103-2	W605131-01		4-Ethyltoluene	622-96-8	EP-Plate	Ta		0.98	< 0.98	r
20160523-mACE-A103-2	W605131-01		1,3,5-Trimethylbenzene	108-67-8	EP-Plate	Ta		0.98	< 0.98	R
20160523-mACE-A103-2	W605131-01		1,2,4-Trimethylbenzene	95-63-6	EP-Plate	Ta		0.98	< 0.98	Rr
20160523-mACE-A103-2	W605131-01		1,3-Dichlorobenzene	541-73-1	EP-Plate	Ta		1.2	< 1.2	Rr
20160523-mACE-A103-2	W605131-01		Benzyl Chloride	100-44-7	EP-Plate	Ta		1.0	< 1.0	Rr
20160523-mACE-A103-2	W605131-01		1,4-Dichlorobenzene	106-46-7	EP-Plate	Ta		1.2	< 1.2	Rr
20160523-mACE-A103-2	W605131-01		1,2-Dichlorobenzene	95-50-1	EP-Plate	Ta		1.2	< 1.2	Rr
20160523-mACE-A103-2	W605131-01		1,2,4-Trichlorobenzene	120-82-1	EP-Plate	PIC		1.5	< 1.5	Z
20160523-mACE-A103-2	W605131-01		Naphthalene	91-20-3	EP-Plate	PIC		1.0	< 1.0	Z
20160523-mACE-A103-2	W605131-01		Hexachloro-1,3-butadiene	87-68-3	EP-Plate	PIC		2.1	< 2.1	Z

Sample ID Client	RJLG	Medium ID	Analyte	CAS Number	Matrix	Type	QC % REC	Reporting Limit (ng)	Result (ng)	Qualifier
			Tentatively Identified Compounds							
20160523-mACE-A103-2	W605131-01		Norflurane	811-97-2	EP-Plate	TIC		0.83	**8.81**	90,N,T
20160523-mACE-A103-2	W605131-01		1-Propene, 2-methyl-	115-11-7	EP-Plate	TIC		0.46	**1.76**	83,N,T
20160523-mACE-A103-2	W605131-01		Acetaldehyde	75-07-0	EP-Plate	TIC		0.36	**1.60**	9,N,T
20160523-mACE-A103-2	W605131-01		Methyl isocyanide	593-75-9	EP-Plate	TIC		0.34	**1.57**	45,N,T
20160523-mACE-A103-2	W605131-01		Acetic acid	64-19-7	EP-Plate	TIC		0.49	**4.25**	91,N,T
20160523-mACE-A103-2	W605131-01		Heptane, 2,4-dimethyl-	2213-23-2	EP-Plate	TIC		1.0	**7.80**	94,N,T
20160523-mACE-A103-2	W605131-01		Octane, 4-methyl-	2216-34-4	EP-Plate	TIC		1.0	**6.49**	91,N,T
20160523-mACE-A103-2	W605131-01		Propanoic acid, 2-methyl-, 1-(1,1-dimethylethyl)-2-methyl-1,3-propar	74381-40-1	EP-Plate	TIC		2.3	**16.7**	80,N,T

Comments: Concentrations of the tentatively identified compounds is based on the comparison of peak area to that of the nearest internal standard.

ng = nanogram
ppbv = parts per billion volume
ug/m3 = micrograms per cubic meter

BDL = Below Detection Limit
N/A = Not Applicable

Qualifiers

B = Compound found in associated laboratory blank above the reporting limit.
D = Diluted sample
E = Report concentration was above the instrumental calibration range
I = Response failure of an internal standard; concentration should be considered an estimate
J = Concentration below reporting limit
N = Identification based on mass spectral library search
P = Library spectrum match, rsd >90% w RT match
Q = Qualitative results for non-target compounds
Ta = Target Analyte

R = Recovery failure in CCV or LCS.
S = Surrogate recovery failure
T = Compound is tentatively identified compound. Includes chemical library matches & chemist identified compounds.
X = Detected but not quantifiable
c = Sample RPD failure
d= Data that exceeds the %RSD criteria set by the method (70-130%)
PIC = Positively identified compound, for non-calibrated compounds
r = Recovery failure in MRL
Z = Positively Identified Compound; Quanlitative data only

Authorized Signature: L Joseph Sears
Laboratory Technical Manager - Dr. Joe Sears

Date: 06/07/16

RJ LEE GROUP
DELIVERING SCIENTIFIC RESOLUTION

RJ Lee*Group*, Inc. | Columbia Basin Analytical Laboratory
2710 North 20th Avenue, Pasco WA 99301
Tel: (509) 545-4989 | Fax: (509) 544-6010

LABORATORY REPORT
EPA Compendium Method TO-17-Modified
Electrostatic Precipitator Plates

Client: Washington River Protection Solutions
Address: Richland, WA 99352
Attention: Attn: George Weeks
Telephone:
Fax:

RJ Lee Group Project: W605131
Samples Received: 05/26/16
Analysis Prep/Date: 06/01/16
Report Date: 06/07/16
Sampling Date: 05/24/16
CACN: 0
Client Project: GAL601096

Sample ID								Reporting		
Client	RJLG	Medium ID	Analyte	CAS Number	Matrix	Type	QC % REC	Limit (ng)	Result (ng)	Qualifier
20160524-mACE-A103-2	W605131-02		Bromochloromethane	74-97-5	EP-Plate	Int. Std		1.1	**52.9**	
20160524-mACE-A103-2	W605131-02		Propene	115-07-1	EP-Plate	Ta		0.34	**< 0.34**	**rR**
20160524-mACE-A103-2	W605131-02		Dichlorodifluoromethane (F12)	75-71-8	EP-Plate	Ta		0.99	**< 0.99**	**R**
20160524-mACE-A103-2	W605131-02		Chloromethane	74-87-3	EP-Plate	Ta		0.41	**< 0.41**	
20160524-mACE-A103-2	W605131-02		1,2-Dichloro-tetrarfluoroethane	76-14-2	EP-Plate	Ta		1.4	**< 1.4**	
20160524-mACE-A103-2	W605131-02		Chloroethene	75-01-4	EP-Plate	Ta		0.51	**< 0.51**	
20160524-mACE-A103-2	W605131-02		1,3-Butadiene	106-99-0	EP-Plate	Ta		0.44	**< 0.44**	
20160524-mACE-A103-2	W605131-02		n-Butane	106-97-8	EP-Plate	Ta		0.48	**< 0.48**	
20160524-mACE-A103-2	W605131-02		Bromomethane	74-83-9	EP-Plate	Ta		0.78	**< 0.78**	**R**
20160524-mACE-A103-2	W605131-02		Chloroethane	75-00-3	EP-Plate	Ta		0.53	**< 0.53**	
20160524-mACE-A103-2	W605131-02		Ethanol	64-17-5	EP-Plate	Ta		0.38	**< 0.38**	
20160524-mACE-A103-2	W605131-02		Vinylbromide	593-60-2	EP-Plate	Ta		0.88	**< 0.88**	
20160524-mACE-A103-2	W605131-02		Trichlorofluoromethane	75-69-4	EP-Plate	Ta		1.1	**< 1.1**	
20160524-mACE-A103-2	W605131-02		Acrolein	107-02-8	EP-Plate	Ta		0.46	**< 0.46**	
20160524-mACE-A103-2	W605131-02		Acetone	67-64-1	EP-Plate	Ta		0.48	**4.23**	
20160524-mACE-A103-2	W605131-02		n-Pentane	109-66-0	EP-Plate	Ta		0.59	**< 0.59**	
20160524-mACE-A103-2	W605131-02		Isopropanol	67-63-0	EP-Plate	Ta		0.49	**< 0.49**	**r**
20160524-mACE-A103-2	W605131-02		1,1-Dichloroethene	75-35-4	EP-Plate	Ta		0.79	**< 0.79**	
20160524-mACE-A103-2	W605131-02		t-Butyl alcohol	75-65-0	EP-Plate	Ta		0.61	**< 0.61**	**r**
20160524-mACE-A103-2	W605131-02		1,1,2-Trichloro-1,2,2-trifluoroethane (	76-13-1	EP-Plate	Ta		1.5	**< 1.5**	
20160524-mACE-A103-2	W605131-02		3-Chloropropene	107-05-1	EP-Plate	Ta		0.63	**< 0.63**	**r**
20160524-mACE-A103-2	W605131-02		Methylene Chloride (Dichloromethane)	75-09-2	EP-Plate	Ta		0.70	**5.80**	**r**
20160524-mACE-A103-2	W605131-02		Carbon Disulfide	75-65-0	EP-Plate	Ta		0.62	**< 0.62**	**r**
20160524-mACE-A103-2	W605131-02		trans-1,2-Dichloroethene	156-60-5	EP-Plate	Ta		0.79	**< 0.79**	**R**
20160524-mACE-A103-2	W605131-02		Methyl-t-butyll ether (MTBE)	1634-04-4	EP-Plate	Ta		0.72	**< 0.72**	**R**
20160524-mACE-A103-2	W605131-02		Vinyl Acetate	108-05-4	EP-Plate	Ta		0.70	**< 0.70**	**Rr**

Sample ID										
Client	RJLG	Medium ID	Analyte	CAS Number	Matrix	Type	QC % REC	Reporting Limit (ng)	Result (ng)	Qualifier
20160524-mACE-A103-2	W605131-02		1,1-Dichloroethane	75-34-3	EP-Plate	Ta		0.81	< 0.81	
20160524-mACE-A103-2	W605131-02		2-Butanone (MEK)	78-93-3	EP-Plate	Ta		0.59	< 0.59	
20160524-mACE-A103-2	W605131-02		Hexane	110-54-3	EP-Plate	Ta		0.71	< 0.71	R
20160524-mACE-A103-2	W605131-02		cis-1,2-Dichloroethene	156-59-2	EP-Plate	Ta		0.79	< 0.79	R
20160524-mACE-A103-2	W605131-02		Ethyl Acetate	141-78-6	EP-Plate	Ta		0.72	< 0.72	
20160524-mACE-A103-2	W605131-02		Chloroform	540-36-3	EP-Plate	Ta		1.1	< 1.1	
20160524-mACE-A103-2	W605131-02		Tetrahydrofuran	67-66-3	EP-Plate	Ta		0.98	< 0.98	
20160524-mACE-A103-2	W605131-02		1,4-Difluorobenzene	71-55-6	EP-Plate	Int. Std		0.93	46.7	
20160524-mACE-A103-2	W605131-02		1,1,1-Trichloroethane	71-55-6	EP-Plate	Ta		1.1	< 1.1	
20160524-mACE-A103-2	W605131-02		1,2-Dichloroethane-d4	17060-07-0	EP-Plate	QA/Surr	96.9	0.84	40.8	
20160524-mACE-A103-2	W605131-02		1,2-Dichloroethane	107-06-2	EP-Plate	Ta		0.81	< 0.81	
20160524-mACE-A103-2	W605131-02		Benzene	71-43-2	EP-Plate	Ta		0.64	< 0.64	r
20160524-mACE-A103-2	W605131-02		Carbon Tetrachloride	56-23-5	EP-Plate	Ta		1.3	< 1.3	
20160524-mACE-A103-2	W605131-02		Cyclohexane	110-82-7	EP-Plate	Ta		0.69	< 0.69	
20160524-mACE-A103-2	W605131-02		2,2,4-Trimethylpentane	540-84-1	EP-Plate	Ta		0.93	< 0.93	
20160524-mACE-A103-2	W605131-02		Heptane	142-82-5	EP-Plate	Ta		0.82	< 0.82	
20160524-mACE-A103-2	W605131-02		Trichlorethylene	79-01-6	EP-Plate	Ta		1.1	< 1.1	
20160524-mACE-A103-2	W605131-02		1,2-Dichloropropane	78-87-5	EP-Plate	Ta		0.92	< 0.92	
20160524-mACE-A103-2	W605131-02		Methylmethacrylate	80-62-6	EP-Plate	Ta		0.82	< 0.82	
20160524-mACE-A103-2	W605131-02		1,4-Dioxane	123-91-1	EP-Plate	Ta		0.72	< 0.72	
20160524-mACE-A103-2	W605131-02		Bromodichloromethane	75-27-4	EP-Plate	Ta		1.3	< 1.3	
20160524-mACE-A103-2	W605131-02		Methyl isobutyl ketone (MIBK)	108-10-1	EP-Plate	Ta		0.82	< 0.82	
20160524-mACE-A103-2	W605131-02		cis-1,3-Dichloropropene	10061-01-5	EP-Plate	Ta		0.91	< 0.91	
20160524-mACE-A103-2	W605131-02		trans-1,3-Dichloropropene	10061-02-6	EP-Plate	Ta		0.91	< 0.91	
20160524-mACE-A103-2	W605131-02		Toluene-d8	2037-26-5	EP-Plate	QA/Surr	99.7	0.82	40.9	
20160524-mACE-A103-2	W605131-02		Toluene	108-88-3	EP-Plate	Ta		0.75	< 0.75	r
20160524-mACE-A103-2	W605131-02		1,1,2-Trichloroethane	79-00-5	EP-Plate	Ta		1.1	< 1.1	
20160524-mACE-A103-2	W605131-02		2-Hexanone	591-78-6	EP-Plate	Ta		0.90	< 0.90	
20160524-mACE-A103-2	W605131-02		Dibromochloromethane	124-48-1	EP-Plate	Ta		1.7	< 1.7	
20160524-mACE-A103-2	W605131-02		Tetrachloroethylene	127-18-4	EP-Plate	Ta		1.4	< 1.4	
20160524-mACE-A103-2	W605131-02		Chlorobenzene-d5	3114-55-4	EP-Plate	Int. Std		0.92	46.1	
20160524-mACE-A103-2	W605131-02		1,2-Dibromoethane	106-93-4	EP-Plate	Ta		1.5	< 1.5	
20160524-mACE-A103-2	W605131-02		Chlorobenzene	108-90-7	EP-Plate	Ta		0.92	< 0.92	
20160524-mACE-A103-2	W605131-02		Ethylbenzene	100-41-4	EP-Plate	Ta		0.87	< 0.87	
20160524-mACE-A103-2	W605131-02		m,p-Xylene	179601-23-1	EP-Plate	Ta		0.87	< 0.87	
20160524-mACE-A103-2	W605131-02		Nonane	111-84-2	EP-Plate	Ta		1.0	< 1.0	

Sample ID										
Client	RJLG	Medium ID	Analyte	CAS Number	Matrix	Type	QC % REC	Reporting Limit (ng)	Result (ng)	Qualifier
20160524-mACE-A103-2	W605131-02		o-Xylene	95-47-6	EP-Plate	Ta		0.87	**< 0.87**	**r**
20160524-mACE-A103-2	W605131-02		Styrene	100-42-5	EP-Plate	Ta		0.85	**< 0.85**	
20160524-mACE-A103-2	W605131-02		Bromoform	75-25-2	EP-Plate	Ta		2.1	**< 2.1**	
20160524-mACE-A103-2	W605131-02		1,1,2,2-Tetrachloroethane	79-34-5	EP-Plate	Ta		1.4	**< 1.4**	
20160524-mACE-A103-2	W605131-02		Cumene	98-82-8	EP-Plate	Ta		0.98	**< 0.98**	
20160524-mACE-A103-2	W605131-02		4-Bromofluorobenzene (BFB)	460-00-4	EP-Plate	QA/Surr	99.3	1.4	**71.1**	
20160524-mACE-A103-2	W605131-02		n-Propylbenzene	103-65-1	EP-Plate	Ta		0.98	**< 0.98**	
20160524-mACE-A103-2	W605131-02		2-Chlorotoluene	95-49-8	EP-Plate	Ta		1.0	**< 1.0**	
20160524-mACE-A103-2	W605131-02		4-Ethyltoluene	622-96-8	EP-Plate	Ta		0.98	**< 0.98**	**r**
20160524-mACE-A103-2	W605131-02		1,3,5-Trimethylbenzene	108-67-8	EP-Plate	Ta		0.98	**< 0.98**	**R**
20160524-mACE-A103-2	W605131-02		1,2,4-Trimethylbenzene	95-63-6	EP-Plate	Ta		0.98	**< 0.98**	**Rr**
20160524-mACE-A103-2	W605131-02		1,3-Dichlorobenzene	541-73-1	EP-Plate	Ta		1.2	**< 1.2**	**Rr**
20160524-mACE-A103-2	W605131-02		Benzyl Chloride	100-44-7	EP-Plate	Ta		1.0	**< 1.0**	**Rr**
20160524-mACE-A103-2	W605131-02		1,4-Dichlorobenzene	106-46-7	EP-Plate	Ta		1.2	**< 1.2**	**Rr**
20160524-mACE-A103-2	W605131-02		1,2-Dichlorobenzene	95-50-1	EP-Plate	Ta		1.2	**< 1.2**	**Rr**
20160524-mACE-A103-2	W605131-02		1,2,4-Trichlorobenzene	120-82-1	EP-Plate	PIC		1.5	**< 1.5**	**Z**
20160524-mACE-A103-2	W605131-02		Naphthalene	91-20-3	EP-Plate	PIC		1.0	**< 1.0**	**Z**
20160524-mACE-A103-2	W605131-02		Hexachloro-1,3-butadiene	87-68-3	EP-Plate	PIC		2.1	**< 2.1**	**Z**

Client	Sample ID RJLG	Medium ID	Analyte	CAS Number	Matrix	Type	QC % REC	Reporting Limit (ng)	Result (ng)	Qualifier
			Tentatively Identified Compounds							
20160524-mACE-A103-2	W605131-02		Norflurane	811-97-2	EP-Plate	TIC		0.83	**2.79**	7,N,T
20160524-mACE-A103-2	W605131-02		Propene	115-07-1	EP-Plate	TIC		0.34	**2.30**	90,N,T
20160524-mACE-A103-2	W605131-02		1-Propene, 2-methyl-	115-11-7	EP-Plate	TIC		0.46	**1.30**	49,N,T
20160524-mACE-A103-2	W605131-02		Acetaldehyde	75-07-0	EP-Plate	TIC		0.36	**0.994**	9,N,T
20160524-mACE-A103-2	W605131-02		Acetonitrile	75-05-8	EP-Plate	TIC		0.34	**2.65**	45,N,T
20160524-mACE-A103-2	W605131-02		Acetic acid	64-19-7	EP-Plate	TIC		0.49	**1.47**	90,N,T
20160524-mACE-A103-2	W605131-02		Nonanal	124-19-6	EP-Plate	TIC		1.2	**5.10**	91,N,T
20160524-mACE-A103-2	W605131-02		Decanal	112-31-2	EP-Plate	TIC		1.3	**5.64**	91,N,T

Comments: Concentrations of the tentatively identified compounds is based on the comparison of peak area to that of the nearest internal standard.

ng = nanogram
ppbv = parts per billion volume
ug/m3 = micrograms per cubic meter

BDL = Below Detection Limit
N/A = Not Applicable

Qualifiers

B = Compound found in associated laboratory blank above the reporting limit.
D = Diluted sample
E = Report concentration was above the instrumental calibration range
I = Response failure of an internal standard; concentration should be considered an estimate
J = Concentration below reporting limit
N = Identification based on mass spectral library search
P = Library spectrum match, rsd >90% w RT match
Q = Qualitative results for non-target compounds
Ta = Target Analyte

R = Recovery failure in CCV or LCS.
S = Surrogate recovery failure
T = Compound is tentatively identified compound. Includes chemical library matches & chemist identified compounds.
X = Detected but not quantifiable
c = Sample RPD failure
d= Data that exceeds the %RSD criteria set by the method (70-130%)
PIC = Positively identified compound, for non-calibrated compounds
r = Recovery failure in MRL
Z = Positively Identified Compound; Quanlitative data only

Authorized Signature: L Joseph Sears
Laboratory Technical Manager - Dr. Joe Sears

Date: 06/07/16

RJ LEE GROUP
DELIVERING SCIENTIFIC RESOLUTION

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LABORATORY REPORT
EPA Compendium Method TO-17-Modified
Electrostatic Precipitator Plates

Client: Washington River Protection Solutions
Address:
Richland, WA 99352
Attention: Attn: George Weeks
Telephone:
Fax:

RJ Lee Group Project: W605131
Samples Received: 05/26/16
Analysis Prep/Date: 06/01/16
Report Date: 06/07/16
Sampling Date: 05/24/16
Purchase Order No.: 0
Client Project: GAL601096

Sample ID								Reporting		
Client	RJLG	Medium ID	Analyte	CAS Number	Matrix	Type	QC % REC	Limit (ng)	Result (ng)	Qualifier
20160524-mACE-AP-2	W605131-03		Bromochloromethane	74-97-5	EP-Plate	Int. Std		1.1	52.9	
20160524-mACE-AP-2	W605131-03		Propene	115-07-1	EP-Plate	Ta		0.34	< 0.34	rR
20160524-mACE-AP-2	W605131-03		Dichlorodifluoromethane (F12)	75-71-8	EP-Plate	Ta		0.99	< 0.99	R
20160524-mACE-AP-2	W605131-03		Chloromethane	74-87-3	EP-Plate	Ta		0.41	< 0.41	
20160524-mACE-AP-2	W605131-03		1,2-Dichloro-tetrarfluoroethane	76-14-2	EP-Plate	Ta		1.4	< 1.4	
20160524-mACE-AP-2	W605131-03		Chloroethene	75-01-4	EP-Plate	Ta		0.51	< 0.51	
20160524-mACE-AP-2	W605131-03		1,3-Butadiene	106-99-0	EP-Plate	Ta		0.44	< 0.44	
20160524-mACE-AP-2	W605131-03		n-Butane	106-97-8	EP-Plate	Ta		0.48	< 0.48	
20160524-mACE-AP-2	W605131-03		Bromomethane	74-83-9	EP-Plate	Ta		0.78	< 0.78	R
20160524-mACE-AP-2	W605131-03		Chloroethane	75-00-3	EP-Plate	Ta		0.53	< 0.53	
20160524-mACE-AP-2	W605131-03		Ethanol	64-17-5	EP-Plate	Ta		0.38	< 0.38	
20160524-mACE-AP-2	W605131-03		Vinylbromide	593-60-2	EP-Plate	Ta		0.88	< 0.88	
20160524-mACE-AP-2	W605131-03		Trichlorofluoromethane	75-69-4	EP-Plate	Ta		1.1	< 1.1	
20160524-mACE-AP-2	W605131-03		Acrolein	107-02-8	EP-Plate	Ta		0.46	< 0.46	
20160524-mACE-AP-2	W605131-03		Acetone	67-64-1	EP-Plate	Ta		0.48	3.21	
20160524-mACE-AP-2	W605131-03		n-Pentane	109-66-0	EP-Plate	Ta		0.59	< 0.59	
20160524-mACE-AP-2	W605131-03		Isopropanol	67-63-0	EP-Plate	Ta		0.49	< 0.49	r
20160524-mACE-AP-2	W605131-03		1,1-Dichloroethene	75-35-4	EP-Plate	Ta		0.79	< 0.79	
20160524-mACE-AP-2	W605131-03		t-Butyl alcohol	75-65-0	EP-Plate	Ta		0.61	< 0.61	r
20160524-mACE-AP-2	W605131-03		1,1,2-Trichloro-1,2,2-trifluoroethane (	76-13-1	EP-Plate	Ta		1.5	< 1.5	
20160524-mACE-AP-2	W605131-03		3-Chloropropene	107-05-1	EP-Plate	Ta		0.63	< 0.63	r
20160524-mACE-AP-2	W605131-03		Methylene Chloride (Dichloromethane)	75-09-2	EP-Plate	Ta		0.70	< 0.70	r
20160524-mACE-AP-2	W605131-03		Carbon Disulfide	75-65-0	EP-Plate	Ta		0.62	< 0.62	r
20160524-mACE-AP-2	W605131-03		trans-1,2-Dichloroethene	156-60-5	EP-Plate	Ta		0.79	< 0.79	R
20160524-mACE-AP-2	W605131-03		Methyl-t-butyll ether (MTBE)	1634-04-4	EP-Plate	Ta		0.72	< 0.72	R
20160524-mACE-AP-2	W605131-03		Vinyl Acetate	108-05-4	EP-Plate	Ta		0.70	< 0.70	Rr
20160524-mACE-AP-2	W605131-03		1,1-Dichloroethane	75-34-3	EP-Plate	Ta		0.81	< 0.81	

Sample ID				CAS			QC %	Reporting Limit		
Client	RJLG	Medium ID	Analyte	Number	Matrix	Type	REC	(ng)	Result (ng)	Qualifier
20160524-mACE-AP-2	W605131-03		2-Butanone (MEK)	78-93-3	EP-Plate	Ta		0.59	< 0.59	
20160524-mACE-AP-2	W605131-03		Hexane	110-54-3	EP-Plate	Ta		0.71	< 0.71	R
20160524-mACE-AP-2	W605131-03		cis-1,2-Dichloroethene	156-59-2	EP-Plate	Ta		0.79	< 0.79	R
20160524-mACE-AP-2	W605131-03		Ethyl Acetate	141-78-6	EP-Plate	Ta		0.72	< 0.72	
20160524-mACE-AP-2	W605131-03		Chloroform	540-36-3	EP-Plate	Ta		1.1	< 1.1	
20160524-mACE-AP-2	W605131-03		Tetrahydrofuran	67-66-3	EP-Plate	Ta		0.98	< 0.98	
20160524-mACE-AP-2	W605131-03		1,4-Difluorobenzene	71-55-6	EP-Plate	Int. Std		0.93	46.7	
20160524-mACE-AP-2	W605131-03		1,1,1-Trichloroethane	71-55-6	EP-Plate	Ta		1.1	< 1.1	
20160524-mACE-AP-2	W605131-03		1,2-Dichloroethane-d4	17060-07-0	EP-Plate	QA/Surr	96.8	0.84	40.8	
20160524-mACE-AP-2	W605131-03		1,2-Dichloroethane	107-06-2	EP-Plate	Ta		0.81	< 0.81	
20160524-mACE-AP-2	W605131-03		Benzene	71-43-2	EP-Plate	Ta		0.64	< 0.64	r
20160524-mACE-AP-2	W605131-03		Carbon Tetrachloride	56-23-5	EP-Plate	Ta		1.3	< 1.3	
20160524-mACE-AP-2	W605131-03		Cyclohexane	110-82-7	EP-Plate	Ta		0.69	< 0.69	
20160524-mACE-AP-2	W605131-03		2,2,4-Trimethylpentane	540-84-1	EP-Plate	Ta		0.93	< 0.93	
20160524-mACE-AP-2	W605131-03		Heptane	142-82-5	EP-Plate	Ta		0.82	< 0.82	
20160524-mACE-AP-2	W605131-03		Trichlorethylene	79-01-6	EP-Plate	Ta		1.1	< 1.1	
20160524-mACE-AP-2	W605131-03		1,2-Dichloropropane	78-87-5	EP-Plate	Ta		0.92	< 0.92	
20160524-mACE-AP-2	W605131-03		Methylmethacrylate	80-62-6	EP-Plate	Ta		0.82	< 0.82	
20160524-mACE-AP-2	W605131-03		1,4-Dioxane	123-91-1	EP-Plate	Ta		0.72	< 0.72	
20160524-mACE-AP-2	W605131-03		Bromodichloromethane	75-27-4	EP-Plate	Ta		1.3	< 1.3	
20160524-mACE-AP-2	W605131-03		Methyl isobutyl ketone (MIBK)	108-10-1	EP-Plate	Ta		0.82	< 0.82	
20160524-mACE-AP-2	W605131-03		cis-1,3-Dichloropropene	10061-01-5	EP-Plate	Ta		0.91	< 0.91	
20160524-mACE-AP-2	W605131-03		trans-1,3-Dichloropropene	10061-02-6	EP-Plate	Ta		0.91	< 0.91	
20160524-mACE-AP-2	W605131-03		Toluene-d8	2037-26-5	EP-Plate	QA/Surr	98.4	0.82	40.3	
20160524-mACE-AP-2	W605131-03		Toluene	108-88-3	EP-Plate	Ta		0.75	< 0.75	r
20160524-mACE-AP-2	W605131-03		1,1,2-Trichloroethane	79-00-5	EP-Plate	Ta		1.1	< 1.1	
20160524-mACE-AP-2	W605131-03		2-Hexanone	591-78-6	EP-Plate	Ta		0.90	< 0.90	
20160524-mACE-AP-2	W605131-03		Dibromochloromethane	124-48-1	EP-Plate	Ta		1.7	< 1.7	
20160524-mACE-AP-2	W605131-03		Tetrachloroethylene	127-18-4	EP-Plate	Ta		1.4	< 1.4	
20160524-mACE-AP-2	W605131-03		Chlorobenzene-d5	3114-55-4	EP-Plate	Int. Std		0.92	46.1	
20160524-mACE-AP-2	W605131-03		1,2-Dibromoethane	106-93-4	EP-Plate	Ta		1.5	< 1.5	
20160524-mACE-AP-2	W605131-03		Chlorobenzene	108-90-7	EP-Plate	Ta		0.92	< 0.92	
20160524-mACE-AP-2	W605131-03		Ethylbenzene	100-41-4	EP-Plate	Ta		0.87	< 0.87	
20160524-mACE-AP-2	W605131-03		m,p-Xylene	179601-23-1	EP-Plate	Ta		0.87	< 0.87	
20160524-mACE-AP-2	W605131-03		Nonane	111-84-2	EP-Plate	Ta		1.0	< 1.0	
20160524-mACE-AP-2	W605131-03		o-Xylene	95-47-6	EP-Plate	Ta		0.87	< 0.87	r

Sample ID										
Client	RJLG	Medium ID	Analyte	CAS Number	Matrix	Type	QC % REC	Reporting Limit (ng)	Result (ng)	Qualifier
20160524-mACE-AP-2	W605131-03		Styrene	100-42-5	EP-Plate	Ta		0.85	**< 0.85**	
20160524-mACE-AP-2	W605131-03		Bromoform	75-25-2	EP-Plate	Ta		2.1	**< 2.1**	
20160524-mACE-AP-2	W605131-03		1,1,2,2-Tetrachloroethane	79-34-5	EP-Plate	Ta		1.4	**< 1.4**	
20160524-mACE-AP-2	W605131-03		Cumene	98-82-8	EP-Plate	Ta		0.98	**< 0.98**	
20160524-mACE-AP-2	W605131-03		4-Bromofluorobenzene (BFB)	460-00-4	EP-Plate	QA/Surr	91.5	1.4	**65.5**	
20160524-mACE-AP-2	W605131-03		n-Propylbenzene	103-65-1	EP-Plate	Ta		0.98	**< 0.98**	
20160524-mACE-AP-2	W605131-03		2-Chlorotoluene	95-49-8	EP-Plate	Ta		1.0	**< 1.0**	
20160524-mACE-AP-2	W605131-03		4-Ethyltoluene	622-96-8	EP-Plate	Ta		0.98	**< 0.98**	**r**
20160524-mACE-AP-2	W605131-03		1,3,5-Trimethylbenzene	108-67-8	EP-Plate	Ta		0.98	**< 0.98**	**R**
20160524-mACE-AP-2	W605131-03		1,2,4-Trimethylbenzene	95-63-6	EP-Plate	Ta		0.98	**< 0.98**	**Rr**
20160524-mACE-AP-2	W605131-03		1,3-Dichlorobenzene	541-73-1	EP-Plate	Ta		1.2	**< 1.2**	**Rr**
20160524-mACE-AP-2	W605131-03		Benzyl Chloride	100-44-7	EP-Plate	Ta		1.0	**< 1.0**	**Rr**
20160524-mACE-AP-2	W605131-03		1,4-Dichlorobenzene	106-46-7	EP-Plate	Ta		1.2	**< 1.2**	**Rr**
20160524-mACE-AP-2	W605131-03		1,2-Dichlorobenzene	95-50-1	EP-Plate	Ta		1.2	**< 1.2**	**Rr**
20160524-mACE-AP-2	W605131-03		1,2,4-Trichlorobenzene	120-82-1	EP-Plate	PIC		1.5	**< 1.5**	**Z**
20160524-mACE-AP-2	W605131-03		Naphthalene	91-20-3	EP-Plate	PIC		1.0	**< 1.0**	**Z**
20160524-mACE-AP-2	W605131-03		Hexachloro-1,3-butadiene	87-68-3	EP-Plate	PIC		2.1	**< 2.1**	**Z**

Client	Sample ID RJLG	Medium ID	Analyte	CAS Number	Matrix	Type	QC % REC	Reporting Limit (ng)	Result (ng)	Qualifier
			Tentatively Identified Compounds							
20160524-mACE-AP-2	W605131-03		Acetaldehyde	75-07-0	EP-Plate	TIC		0.36	**1.33**	64,N,T
20160524-mACE-AP-2	W605131-03		Acetonitrile	75-05-8	EP-Plate	TIC		0.34	**1.31**	50,N,T
20160524-mACE-AP-2	W605131-03		Pentane, 2-methyl-	107-83-5	EP-Plate	TIC		0.70	**3.77**	83,N,T
20160524-mACE-AP-2	W605131-03		Acetic acid	64-19-7	EP-Plate	TIC		0.49	**1.76**	90,N,T
20160524-mACE-AP-2	W605131-03		Nonanal	124-19-6	EP-Plate	TIC		1.2	**5.93**	91,N,T
20160524-mACE-AP-2	W605131-03		Decanal	112-31-2	EP-Plate	TIC		1.3	**6.35**	91,N,T

Comments: Concentrations of the tentatively identified compounds is based on the comparison of peak area to that of the nearest internal standard.

ng = nanogram
ppbv = parts per billion volume
ug/m3 = micrograms per cubic meter

BDL = Below Detection Limit
N/A = Not Applicable

Qualifiers

B = Compound found in associated laboratory blank above the reporting limit.
D = Diluted sample
E = Report concentration was above the instrumental calibration range
I = Response failure of an internal standard; concentration should be considered an estimate
J = Concentration below reporting limit
N = Identification based on mass spectral library search
P = Library spectrum match, rsd >90% w RT match
Q = Qualitative results for non-target compounds
Ta = Target Analyte
R = Recovery failure in CCV or LCS.
S = Surrogate recovery failure
T = Compound is tentatively identified compound. Includes chemical library matches & chemist identified compounds.
X = Detected but not quantifiable
c = Sample RPD failure
d= Data that exceeds the %RSD criteria set by the method (70-130%)
PIC = Positively identified compound, for non-calibrated compounds
r = Recovery failure in MRL
Z = Positively Identified Compound; Quanlitative data only

Authorized Signature: L Joseph Sears
Laboratory Technical Manager - Dr. Joe Sears

Date: 06/07/16

RJ LEE GROUP
DELIVERING SCIENTIFIC RESOLUTION

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LABORATORY REPORT

EPA Compendium Method TO-17-Modified
Electrostatic Precipitator Plates

Client:	Washington River Protection Solutions	RJ Lee Group Project:	W605131
Address:		Samples Received:	05/26/16
	Richland, WA 99352	Analysis Prep/Date:	06/01/16
Attention:	Attn: George Weeks	Report Date:	06/07/16
Telephone:		Sampling Date:	
Fax:		Purchase Order No.:	0
		Client Project:	GAL601096

Sample ID				CAS			QC %	Reporting		
Client	RJLG	Medium ID	Analyte	Number	Matrix	Type	REC	Limit (ng)	Result (ng)	Qualifier
20160524-ACE-B-D-2	W605131-04		Bromochloromethane	74-97-5	EP-Plate	Int. Std		1.1	**52.9**	
20160524-ACE-B-D-2	W605131-04		Propene	115-07-1	EP-Plate	Ta		0.34	**< 0.34**	**rR**
20160524-ACE-B-D-2	W605131-04		Dichlorodifluoromethane (F12)	75-71-8	EP-Plate	Ta		0.99	**< 0.99**	**R**
20160524-ACE-B-D-2	W605131-04		Chloromethane	74-87-3	EP-Plate	Ta		0.41	**< 0.41**	
20160524-ACE-B-D-2	W605131-04		1,2-Dichloro-tetrafluoroethane	76-14-2	EP-Plate	Ta		1.4	**< 1.4**	
20160524-ACE-B-D-2	W605131-04		Chloroethene	75-01-4	EP-Plate	Ta		0.51	**< 0.51**	
20160524-ACE-B-D-2	W605131-04		1,3-Butadiene	106-99-0	EP-Plate	Ta		0.44	**< 0.44**	
20160524-ACE-B-D-2	W605131-04		n-Butane	106-97-8	EP-Plate	Ta		0.48	**< 0.48**	
20160524-ACE-B-D-2	W605131-04		Bromomethane	74-83-9	EP-Plate	Ta		0.78	**< 0.78**	**R**
20160524-ACE-B-D-2	W605131-04		Chloroethane	75-00-3	EP-Plate	Ta		0.53	**< 0.53**	
20160524-ACE-B-D-2	W605131-04		Ethanol	64-17-5	EP-Plate	Ta		0.38	**< 0.38**	
20160524-ACE-B-D-2	W605131-04		Vinylbromide	593-60-2	EP-Plate	Ta		0.88	**< 0.88**	
20160524-ACE-B-D-2	W605131-04		Trichlorofluoromethane	75-69-4	EP-Plate	Ta		1.1	**< 1.1**	
20160524-ACE-B-D-2	W605131-04		Acrolein	107-02-8	EP-Plate	Ta		0.46	**< 0.46**	
20160524-ACE-B-D-2	W605131-04		Acetone	67-64-1	EP-Plate	Ta		0.48	**3.45**	
20160524-ACE-B-D-2	W605131-04		n-Pentane	109-66-0	EP-Plate	Ta		0.59	**< 0.59**	
20160524-ACE-B-D-2	W605131-04		Isopropanol	67-63-0	EP-Plate	Ta		0.49	**< 0.49**	**r**
20160524-ACE-B-D-2	W605131-04		1,1-Dichloroethene	75-35-4	EP-Plate	Ta		0.79	**< 0.79**	
20160524-ACE-B-D-2	W605131-04		t-Butyl alcohol	75-65-0	EP-Plate	Ta		0.61	**< 0.61**	**r**
20160524-ACE-B-D-2	W605131-04		1,1,2-Trichloro-1,2,2-trifluoroethane (	76-13-1	EP-Plate	Ta		1.5	**< 1.5**	
20160524-ACE-B-D-2	W605131-04		3-Chloropropene	107-05-1	EP-Plate	Ta		0.63	**< 0.63**	**r**
20160524-ACE-B-D-2	W605131-04		Methylene Chloride (Dichloromethane)	75-09-2	EP-Plate	Ta		0.70	**< 0.70**	**r**
20160524-ACE-B-D-2	W605131-04		Carbon Disulfide	75-65-0	EP-Plate	Ta		0.62	**< 0.62**	**r**
20160524-ACE-B-D-2	W605131-04		trans-1,2-Dichloroethene	156-60-5	EP-Plate	Ta		0.79	**< 0.79**	**R**
20160524-ACE-B-D-2	W605131-04		Methyl-t-butyll ether (MTBE)	1634-04-4	EP-Plate	Ta		0.72	**< 0.72**	**R**
20160524-ACE-B-D-2	W605131-04		Vinyl Acetate	108-05-4	EP-Plate	Ta		0.70	**< 0.70**	**Rr**

Client	Sample ID RJLG	Medium ID	Analyte	CAS Number	Matrix	Type	QC % REC	Reporting Limit (ng)	Result (ng)	Qualifier
20160524-ACE-B-D-2	W605131-04		1,1-Dichloroethane	75-34-3	EP-Plate	Ta		0.81	< 0.81	
20160524-ACE-B-D-2	W605131-04		2-Butanone (MEK)	78-93-3	EP-Plate	Ta		0.59	< 0.59	
20160524-ACE-B-D-2	W605131-04		Hexane	110-54-3	EP-Plate	Ta		0.71	< 0.71	R
20160524-ACE-B-D-2	W605131-04		cis-1,2-Dichloroethene	156-59-2	EP-Plate	Ta		0.79	< 0.79	R
20160524-ACE-B-D-2	W605131-04		Ethyl Acetate	141-78-6	EP-Plate	Ta		0.72	< 0.72	
20160524-ACE-B-D-2	W605131-04		Chloroform	540-36-3	EP-Plate	Ta		1.1	< 1.1	
20160524-ACE-B-D-2	W605131-04		Tetrahydrofuran	67-66-3	EP-Plate	Ta		0.98	< 0.98	
20160524-ACE-B-D-2	W605131-04		1,4-Difluorobenzene	71-55-6	EP-Plate	Int. Std		0.93	46.7	
20160524-ACE-B-D-2	W605131-04		1,1,1-Trichloroethane	71-55-6	EP-Plate	Ta		1.1	< 1.1	
20160524-ACE-B-D-2	W605131-04		1,2-Dichloroethane-d4	17060-07-0	EP-Plate	QA/Sur	99.2	0.84	41.8	
20160524-ACE-B-D-2	W605131-04		1,2-Dichloroethane	107-06-2	EP-Plate	Ta		0.81	< 0.81	
20160524-ACE-B-D-2	W605131-04		Benzene	71-43-2	EP-Plate	Ta		0.64	< 0.64	r
20160524-ACE-B-D-2	W605131-04		Carbon Tetrachloride	56-23-5	EP-Plate	Ta		1.3	< 1.3	
20160524-ACE-B-D-2	W605131-04		Cyclohexane	110-82-7	EP-Plate	Ta		0.69	< 0.69	
20160524-ACE-B-D-2	W605131-04		2,2,4-Trimethylpentane	540-84-1	EP-Plate	Ta		0.93	< 0.93	
20160524-ACE-B-D-2	W605131-04		Heptane	142-82-5	EP-Plate	Ta		0.82	< 0.82	
20160524-ACE-B-D-2	W605131-04		Trichlorethylene	79-01-6	EP-Plate	Ta		1.1	< 1.1	
20160524-ACE-B-D-2	W605131-04		1,2-Dichloropropane	78-87-5	EP-Plate	Ta		0.92	< 0.92	
20160524-ACE-B-D-2	W605131-04		Methylmethacrylate	80-62-6	EP-Plate	Ta		0.82	< 0.82	
20160524-ACE-B-D-2	W605131-04		1,4-Dioxane	123-91-1	EP-Plate	Ta		0.72	< 0.72	
20160524-ACE-B-D-2	W605131-04		Bromodichloromethane	75-27-4	EP-Plate	Ta		1.3	< 1.3	
20160524-ACE-B-D-2	W605131-04		Methyl isobutyl ketone (MIBK)	108-10-1	EP-Plate	Ta		0.82	< 0.82	
20160524-ACE-B-D-2	W605131-04		cis-1,3-Dichloropropene	10061-01-5	EP-Plate	Ta		0.91	< 0.91	
20160524-ACE-B-D-2	W605131-04		trans-1,3-Dichloropropene	10061-02-6	EP-Plate	Ta		0.91	< 0.91	
20160524-ACE-B-D-2	W605131-04		Toluene-d8	2037-26-5	EP-Plate	QA/Sur	99.7	0.82	40.9	
20160524-ACE-B-D-2	W605131-04		Toluene	108-88-3	EP-Plate	Ta		0.75	< 0.75	r
20160524-ACE-B-D-2	W605131-04		1,1,2-Trichloroethane	79-00-5	EP-Plate	Ta		1.1	< 1.1	
20160524-ACE-B-D-2	W605131-04		2-Hexanone	591-78-6	EP-Plate	Ta		0.90	< 0.90	
20160524-ACE-B-D-2	W605131-04		Dibromochloromethane	124-48-1	EP-Plate	Ta		1.7	< 1.7	
20160524-ACE-B-D-2	W605131-04		Tetrachloroethylene	127-18-4	EP-Plate	Ta		1.4	< 1.4	
20160524-ACE-B-D-2	W605131-04		Chlorobenzene-d5	3114-55-4	EP-Plate	Int. Std		0.92	46.1	
20160524-ACE-B-D-2	W605131-04		1,2-Dibromoethane	106-93-4	EP-Plate	Ta		1.5	< 1.5	
20160524-ACE-B-D-2	W605131-04		Chlorobenzene	108-90-7	EP-Plate	Ta		0.92	< 0.92	
20160524-ACE-B-D-2	W605131-04		Ethylbenzene	100-41-4	EP-Plate	Ta		0.87	< 0.87	
20160524-ACE-B-D-2	W605131-04		m,p-Xylene	179601-23-1	EP-Plate	Ta		0.87	< 0.87	

Client	Sample ID RJLG	Medium ID	Analyte	CAS Number	Matrix	Type	QC % REC	Reporting Limit (ng)	Result (ng)	Qualifier
20160524-ACE-B-D-2	W605131-04		Nonane	111-84-2	EP-Plate	Ta		1.0	**< 1.0**	
20160524-ACE-B-D-2	W605131-04		o-Xylene	95-47-6	EP-Plate	Ta		0.87	**< 0.87**	**r**
20160524-ACE-B-D-2	W605131-04		Styrene	100-42-5	EP-Plate	Ta		0.85	**< 0.85**	
20160524-ACE-B-D-2	W605131-04		Bromoform	75-25-2	EP-Plate	Ta		2.1	**< 2.1**	
20160524-ACE-B-D-2	W605131-04		1,1,2,2-Tetrachloroethane	79-34-5	EP-Plate	Ta		1.4	**< 1.4**	
20160524-ACE-B-D-2	W605131-04		Cumene	98-82-8	EP-Plate	Ta		0.98	**< 0.98**	
20160524-ACE-B-D-2	W605131-04		4-Bromofluorobenzene (BFB)	460-00-4	EP-Plate	QA/Sur	98.3	1.4	**70.4**	
20160524-ACE-B-D-2	W605131-04		n-Propylbenzene	103-65-1	EP-Plate	Ta		0.98	**< 0.98**	
20160524-ACE-B-D-2	W605131-04		2-Chlorotoluene	95-49-8	EP-Plate	Ta		1.0	**< 1.0**	
20160524-ACE-B-D-2	W605131-04		4-Ethyltoluene	622-96-8	EP-Plate	Ta		0.98	**< 0.98**	**r**
20160524-ACE-B-D-2	W605131-04		1,3,5-Trimethylbenzene	108-67-8	EP-Plate	Ta		0.98	**< 0.98**	**R**
20160524-ACE-B-D-2	W605131-04		1,2,4-Trimethylbenzene	95-63-6	EP-Plate	Ta		0.98	**< 0.98**	**Rr**
20160524-ACE-B-D-2	W605131-04		1,3-Dichlorobenzene	541-73-1	EP-Plate	Ta		1.2	**< 1.2**	**Rr**
20160524-ACE-B-D-2	W605131-04		Benzyl Chloride	100-44-7	EP-Plate	Ta		1.0	**< 1.0**	**Rr**
20160524-ACE-B-D-2	W605131-04		1,4-Dichlorobenzene	106-46-7	EP-Plate	Ta		1.2	**< 1.2**	**Rr**
20160524-ACE-B-D-2	W605131-04		1,2-Dichlorobenzene	95-50-1	EP-Plate	Ta		1.2	**< 1.2**	**Rr**
20160524-ACE-B-D-2	W605131-04		1,2,4-Trichlorobenzene	120-82-1	EP-Plate	PIC		1.5	**< 1.5**	**Z**
20160524-ACE-B-D-2	W605131-04		Naphthalene	91-20-3	EP-Plate	PIC		1.0	**< 1.0**	**Z**
20160524-ACE-B-D-2	W605131-04		Hexachloro-1,3-butadiene	87-68-3	EP-Plate	PIC		2.1	**< 2.1**	**Z**

Client	Sample ID RJLG	Medium ID	Analyte	CAS Number	Matrix	Type	QC % REC	Reporting Limit (ng)	Result (ng)	Qualifier
			Tentatively Identified Compounds							
20160524-ACE-B-D-2	W605131-04		Propene	115-07-1	EP-Plate	TIC		0.34	1.42	83,N,T
20160524-ACE-B-D-2	W605131-04		Acetaldehyde	75-07-0	EP-Plate	TIC		0.36	0.949	64,N,T
20160524-ACE-B-D-2	W605131-04		Acetonitrile	75-05-8	EP-Plate	TIC		0.34	1.14	45,N,T
20160524-ACE-B-D-2	W605131-04		Pentane, 2-methyl-	107-83-5	EP-Plate	TIC		0.70	3.01	87,N,T
20160524-ACE-B-D-2	W605131-04		Nonanal	124-19-6	EP-Plate	TIC		1.2	6.22	91,N,T
20160524-ACE-B-D-2	W605131-04		Decanal	112-31-2	EP-Plate	TIC		1.3	6.51	91,N,T
20160524-ACE-B-D-2	W605131-04		ntanoic acid, 2,2,4-trimethyl-3-carboxyisopropyl, isobutyl e	1000140-77-5	EP-Plate	TIC		2.3	19.0	74,N,T

Comments: Concentrations of the tentatively identified compounds is based on the comparison of peak area to that of the nearest internal standard.

ng = nanogram
ppbv = parts per billion volume
ug/m3 = micrograms per cubic meter

Qualifiers

B = Compound found in associated laboratory blank above the reporting limit.
D = Diluted sample
E = Report concentration was above the instrumental calibration range
I = Response failure of an internal standard; concentration should be considered an estimate
J = Concentration below reporting limit
N = Identification based on mass spectral library search
P = Library spectrum match, rsd >90% w RT match
Q = Qualitative results for non-target compounds
Ta = Target Analyte
R = Recovery failure in CCV or LCS.
S = Surrogate recovery failure
T = Compound is tentatively identified compound. Includes chemical library matches & chemist identified compounds.
X = Detected but not quantifiable
c = Sample RPD failure
d= Data that exceeds the %RSD criteria set by the method (70-130%)
PIC = Positively identified compound, for non-calibrated compounds
r = Recovery failure in MRL
Z = Positively Identified Compound; Quanlitative data only

Authorized Signature: L Joseph Sears
Laboratory Technical Manager - Joe Sears, Ph.D.

Date: 06/07/16

These results are submitted pursuant to RJ Lee Group's current terms and conditions of sale, including the company's standard warranty and limitation of liability provisions. No responsibility or liability is assumed for the manner in which the results are used or interpreted. Unless notified in writing to return the samples covered by this report, RJ Lee Group will store the samples for a period of ninty (90) days before discarding. A shipping and handling fee will be assessed for the return of any samples. Unless otherwise noted, samples were received in an acceptable condition. This laboratory operates in accordance with ISO 17025 guidelines, and holds limited scopes of accreditation under EPA ID WA01195, WA DOE Lab ID C859, AIHA Lab ID 178656, and ORELAP4061. This report may not be used to claim product endorsement by any laboratory accrediting agency. The results contained in this report relate only to the items tested or the sample(s) as received by the laboratory. Quality control data is available upon request.

RJ LEE GROUP
DELIVERING SCIENTIFIC RESOLUTION

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2710 North 20th Avenue, Pasco WA 99301
Tel: (509) 545-4989 | Fax: (509) 544-6010

LABORATORY REPORT
EPA Compendium Method TO-17-Modified
Electrostatic Precipitator Plates

Client:	Washington River Protection Solu	RJ Lee Group Project:	W605131
Address:		Samples Received:	05/26/16
	Richland, WA 99352	Analysis Date:	06/01/16
Attention:	Attn: George Weeks	Report Date:	06/13/16
Telephone:		Sampling Date:	05/24/16
e-mail:		Purchase Order No.:	
		Client Project:	GAL601096

Sample ID				CAS			QC %	Reporting Limit		
Client	RJLG	Medium ID	Analyte	Number	Matrix	Type	REC	(ng)	Result (ng)	Qualifier
20160524-ACE-B-U-2	W605131-05		Bromochloromethane	74-97-5	EP-Plate	Int. Std		1.1	52.9	
20160524-ACE-B-U-2	W605131-05		Propene	115-07-1	EP-Plate	Ta		0.34	2.51	rR
20160524-ACE-B-U-2	W605131-05		Dichlorodifluoromethane (F12)	75-71-8	EP-Plate	Ta		0.99	< 0.99	R
20160524-ACE-B-U-2	W605131-05		Chloromethane	74-87-3	EP-Plate	Ta		0.41	< 0.41	
20160524-ACE-B-U-2	W605131-05		1,2-Dichloro-tetrarfluoroethane	76-14-2	EP-Plate	Ta		1.4	9.79	
20160524-ACE-B-U-2	W605131-05		Chloroethene	75-01-4	EP-Plate	Ta		0.51	< 0.51	
20160524-ACE-B-U-2	W605131-05		1,3-Butadiene	106-99-0	EP-Plate	Ta		0.44	< 0.44	
20160524-ACE-B-U-2	W605131-05		n-Butane	106-97-8	EP-Plate	Ta		0.48	< 0.48	
20160524-ACE-B-U-2	W605131-05		Bromomethane	74-83-9	EP-Plate	Ta		0.78	< 0.78	R
20160524-ACE-B-U-2	W605131-05		Chloroethane	75-00-3	EP-Plate	Ta		0.53	< 0.53	
20160524-ACE-B-U-2	W605131-05		Ethanol	64-17-5	EP-Plate	Ta		0.38	1.24	
20160524-ACE-B-U-2	W605131-05		Vinylbromide	593-60-2	EP-Plate	Ta		0.88	< 0.88	
20160524-ACE-B-U-2	W605131-05		Trichlorofluoromethane	75-69-4	EP-Plate	Ta		1.1	< 1.1	
20160524-ACE-B-U-2	W605131-05		Acrolein	107-02-8	EP-Plate	Ta		0.46	4.86	
20160524-ACE-B-U-2	W605131-05		Acetone	67-64-1	EP-Plate	Ta		0.48	4.92	
20160524-ACE-B-U-2	W605131-05		n-Pentane	109-66-0	EP-Plate	Ta		0.59	< 0.59	
20160524-ACE-B-U-2	W605131-05		Isopropanol	67-63-0	EP-Plate	Ta		0.49	< 0.49	r
20160524-ACE-B-U-2	W605131-05		1,1-Dichloroethene	75-35-4	EP-Plate	Ta		0.79	< 0.79	
20160524-ACE-B-U-2	W605131-05		t-Butyl alcohol	75-65-0	EP-Plate	Ta		0.61	< 0.61	r
20160524-ACE-B-U-2	W605131-05		1,1,2-Trichloro-1,2,2-trifluoroethane (	76-13-1	EP-Plate	Ta		1.5	7.21	
20160524-ACE-B-U-2	W605131-05		3-Chloropropene	107-05-1	EP-Plate	Ta		0.63	< 0.63	r
20160524-ACE-B-U-2	W605131-05		Methylene Chloride (Dichloromethane)	75-09-2	EP-Plate	Ta		0.70	< 0.70	r
20160524-ACE-B-U-2	W605131-05		Carbon Disulfide	75-65-0	EP-Plate	Ta		0.62	< 0.62	r
20160524-ACE-B-U-2	W605131-05		trans-1,2-Dichloroethene	156-60-5	EP-Plate	Ta		0.79	< 0.79	R
20160524-ACE-B-U-2	W605131-05		Methyl-t-butyll ether (MTBE)	1634-04-4	EP-Plate	Ta		0.72	< 0.72	R

Sample ID										
Client	RJLG	Medium ID	Analyte	CAS Number	Matrix	Type	QC % REC	Reporting Limit (ng)	Result (ng)	Qualifier
20160524-ACE-B-U-2	W605131-05		Vinyl Acetate	108-05-4	EP-Plate	Ta		0.70	< 0.70	Rr
20160524-ACE-B-U-2	W605131-05		1,1-Dichloroethane	75-34-3	EP-Plate	Ta		0.81	< 0.81	
20160524-ACE-B-U-2	W605131-05		2-Butanone (MEK)	78-93-3	EP-Plate	Ta		0.59	< 0.59	
20160524-ACE-B-U-2	W605131-05		Hexane	110-54-3	EP-Plate	Ta		0.71	< 0.71	R
20160524-ACE-B-U-2	W605131-05		cis-1,2-Dichloroethene	156-59-2	EP-Plate	Ta		0.79	< 0.79	R
20160524-ACE-B-U-2	W605131-05		Ethyl Acetate	141-78-6	EP-Plate	Ta		0.72	< 0.72	
20160524-ACE-B-U-2	W605131-05		Chloroform	540-36-3	EP-Plate	Ta		1.1	< 1.1	
20160524-ACE-B-U-2	W605131-05		Tetrahydrofuran	67-66-3	EP-Plate	Ta		0.98	< 0.98	
20160524-ACE-B-U-2	W605131-05		1,4-Difluorobenzene	71-55-6	EP-Plate	Int. Std		0.93	46.7	
20160524-ACE-B-U-2	W605131-05		1,1,1-Trichloroethane	71-55-6	EP-Plate	Ta		1.1	< 1.1	
20160524-ACE-B-U-2	W605131-05		1,2-Dichloroethane-d4	17060-07-0	EP-Plate	QA/Surr	96.6	0.84	40.7	
20160524-ACE-B-U-2	W605131-05		1,2-Dichloroethane	107-06-2	EP-Plate	Ta		0.81	< 0.81	
20160524-ACE-B-U-2	W605131-05		Benzene	71-43-2	EP-Plate	Ta		0.64	5.18	r
20160524-ACE-B-U-2	W605131-05		Carbon Tetrachloride	56-23-5	EP-Plate	Ta		1.3	< 1.3	
20160524-ACE-B-U-2	W605131-05		Cyclohexane	110-82-7	EP-Plate	Ta		0.69	1.96	
20160524-ACE-B-U-2	W605131-05		2,2,4-Trimethylpentane	540-84-1	EP-Plate	Ta		0.93	< 0.93	
20160524-ACE-B-U-2	W605131-05		Heptane	142-82-5	EP-Plate	Ta		0.82	9.47	
20160524-ACE-B-U-2	W605131-05		Trichlorethylene	79-01-6	EP-Plate	Ta		1.1	< 1.1	
20160524-ACE-B-U-2	W605131-05		1,2-Dichloropropane	78-87-5	EP-Plate	Ta		0.92	< 0.92	
20160524-ACE-B-U-2	W605131-05		Methylmethacrylate	80-62-6	EP-Plate	Ta		0.82	< 0.82	
20160524-ACE-B-U-2	W605131-05		1,4-Dioxane	123-91-1	EP-Plate	Ta		0.72	< 0.72	
20160524-ACE-B-U-2	W605131-05		Bromodichloromethane	75-27-4	EP-Plate	Ta		1.3	< 1.3	
20160524-ACE-B-U-2	W605131-05		Methyl isobutyl ketone (MIBK)	108-10-1	EP-Plate	Ta		0.82	3.73	
20160524-ACE-B-U-2	W605131-05		cis-1,3-Dichloropropene	10061-01-5	EP-Plate	Ta		0.91	< 0.91	
20160524-ACE-B-U-2	W605131-05		trans-1,3-Dichloropropene	10061-02-6	EP-Plate	Ta		0.91	< 0.91	
20160524-ACE-B-U-2	W605131-05		Toluene-d8	2037-26-5	EP-Plate	QA/Surr	98.1	0.82	40.2	
20160524-ACE-B-U-2	W605131-05		Toluene	108-88-3	EP-Plate	Ta		0.75	< 0.75	r
20160524-ACE-B-U-2	W605131-05		1,1,2-Trichloroethane	79-00-5	EP-Plate	Ta		1.1	< 1.1	
20160524-ACE-B-U-2	W605131-05		2-Hexanone	591-78-6	EP-Plate	Ta		0.90	3.79	
20160524-ACE-B-U-2	W605131-05		Dibromochloromethane	124-48-1	EP-Plate	Ta		1.7	< 1.7	
20160524-ACE-B-U-2	W605131-05		Tetrachloroethylene	127-18-4	EP-Plate	Ta		1.4	< 1.4	
20160524-ACE-B-U-2	W605131-05		Chlorobenzene-d5	3114-55-4	EP-Plate	Int. Std		0.92	46.1	
20160524-ACE-B-U-2	W605131-05		1,2-Dibromoethane	106-93-4	EP-Plate	Ta		1.5	< 1.5	
20160524-ACE-B-U-2	W605131-05		Chlorobenzene	108-90-7	EP-Plate	Ta		0.92	4.88	
20160524-ACE-B-U-2	W605131-05		Ethylbenzene	100-41-4	EP-Plate	Ta		0.87	18.9	

Sample ID										
Client	RJLG	Medium ID	Analyte	CAS Number	Matrix	Type	QC % REC	Reporting Limit (ng)	Result (ng)	Qualifier
20160524-ACE-B-U-2	W605131-05		m,p-Xylene	179601-23-1	EP-Plate	Ta		0.87	**49.5**	
20160524-ACE-B-U-2	W605131-05		Nonane	111-84-2	EP-Plate	Ta		1.0	**9.03**	
20160524-ACE-B-U-2	W605131-05		o-Xylene	95-47-6	EP-Plate	Ta		0.87	**19.9**	**r**
20160524-ACE-B-U-2	W605131-05		Styrene	100-42-5	EP-Plate	Ta		0.85	**22.6**	
20160524-ACE-B-U-2	W605131-05		Bromoform	75-25-2	EP-Plate	Ta		2.1	**< 2.1**	
20160524-ACE-B-U-2	W605131-05		1,1,2,2-Tetrachloroethane	79-34-5	EP-Plate	Ta		1.4	**4.19**	
20160524-ACE-B-U-2	W605131-05		Cumene	98-82-8	EP-Plate	Ta		0.98	**15.4**	
20160524-ACE-B-U-2	W605131-05		4-Bromofluorobenzene (BFB)	460-00-4	EP-Plate	QA/Surr	91.1	1.4	**65.2**	
20160524-ACE-B-U-2	W605131-05		n-Propylbenzene	103-65-1	EP-Plate	Ta		0.98	**16.9**	
20160524-ACE-B-U-2	W605131-05		2-Chlorotoluene	95-49-8	EP-Plate	Ta		1.0	**23.2**	
20160524-ACE-B-U-2	W605131-05		4-Ethyltoluene	622-96-8	EP-Plate	Ta		0.98	**10.6**	**r**
20160524-ACE-B-U-2	W605131-05		1,3,5-Trimethylbenzene	108-67-8	EP-Plate	Ta		0.98	**11.6**	**R**
20160524-ACE-B-U-2	W605131-05		1,2,4-Trimethylbenzene	95-63-6	EP-Plate	Ta		0.98	**11.4**	**Rr**
20160524-ACE-B-U-2	W605131-05		1,3-Dichlorobenzene	541-73-1	EP-Plate	Ta		1.2	**30.3**	**Rr**
20160524-ACE-B-U-2	W605131-05		Benzyl Chloride	100-44-7	EP-Plate	Ta		1.0	**< 1.0**	**Rr**
20160524-ACE-B-U-2	W605131-05		1,4-Dichlorobenzene	106-46-7	EP-Plate	Ta		1.2	**31.2**	**Rr**
20160524-ACE-B-U-2	W605131-05		1,2-Dichlorobenzene	95-50-1	EP-Plate	Ta		1.2	**27.7**	**Rr**
20160524-ACE-B-U-2	W605131-05		1,2,4-Trichlorobenzene	120-82-1	EP-Plate	PIC		1.5	**< 1.5**	**Z**
20160524-ACE-B-U-2	W605131-05		Naphthalene	91-20-3	EP-Plate	PIC		1.0	**< 1.0**	**Z**
20160524-ACE-B-U-2	W605131-05		Hexachloro-1,3-butadiene	87-68-3	EP-Plate	PIC		2.1	**< 2.1**	**Z**

Client	Sample ID RJLG	Medium ID	Analyte	CAS Number	Matrix	Type	QC % REC	Reporting Limit (ng)	Result (ng)	Qualifier
			Tentatively Identified Compounds							
20160524-ACE-B-U-2	W605131-05		1-Propene, 2-methyl-	115-11-7	EP-Plate	TIC		0.46	**1.75**	91,N,T
20160524-ACE-B-U-2	W605131-05		Acetaldehyde	75-07-0	EP-Plate	TIC		0.36	**1.52**	74,N,T
20160524-ACE-B-U-2	W605131-05		Methyl isocyanide	593-75-9	EP-Plate	TIC		0.34	**1.68**	50,N,T
20160524-ACE-B-U-2	W605131-05		Propane, 2-methoxy-2-methyl-	1634-04-4	EP-Plate	TIC		0.72	**2.55**	78,N,T
20160524-ACE-B-U-2	W605131-05		Hexane	110-54-3	EP-Plate	TIC		0.70	**2.04**	78,N,T
20160524-ACE-B-U-2	W605131-05		Acetic acid	64-19-7	EP-Plate	TIC		0.49	**1.78**	90,N,T
20160524-ACE-B-U-2	W605131-05		Benzonitrile	100-47-0	EP-Plate	TIC		0.84	**2.86**	49,N,T
20160524-ACE-B-U-2	W605131-05		Acetophenone	98-86-2	EP-Plate	TIC		0.98	**2.95**	93,N,T

Comments: Concentrations of the tentatively identified compounds is based on the comparison of peak area to that of the nearest internal standard.

ng = nanogram
ppbv = parts per billion volume
ug/m3 = micrograms per cubic meter

BDL = Below Detection Limit
N/A = Not Applicable

Qualifiers

B = Compound found in associated laboratory blank above the reporting limit.
D = Diluted sample
E = Report concentration was above the instrumental calibration range
I = Response failure of an internal standard; concentration should be considered an estimate
J = Concentration below reporting limit
N = Identification based on mass spectral library search
P = Library spectrum match, rsd >90% w RT match
Q = Qualitative results for non-target compounds
Ta = Target Analyte

R = Recovery failure in CCV or LCS.
S = Surrogate recovery failure
T = Compound is tentatively identified compound. Includes chemical library matches & chemist identified compounds.
X = Detected but not quantifiable
c = Sample RPD failure
d= Data that exceeds the %RSD criteria set by the method (70-130%)
PIC = Positively identified compound, for non-calibrated compounds
r = Recovery failure in MRL
Z = Positively Identified Compound; Quantitative data only

Authorized Signature: J Joseph Sears
Laboratory Technical Manager - Dr. Joe Sears

Date: 06/13/16

RJ LEE GROUP
DELIVERING SCIENTIFIC RESOLUTION

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LABORATORY REPORT
EPA Compendium Method TO-17-Modified
Electrostatic Precipitator Plates

Client:	Washington River Protection Solutions
Address:	
	Richland, WA 99352
Attention:	Attn: George Weeks
Telephone:	
Fax:	

RJ Lee Group Project:	W605131
Samples Received:	05/26/16
Analysis Prep/Date:	06/01/16
Report Date:	06/13/16
Sampling Date:	05/25/16
CACN:	0
Client Project:	GAL601096

Sample ID										
Client	RJLG	Medium ID	Analyte	CAS Number	Matrix	Type	QC % REC	Reporting Limit (ng)	Result (ng)	Qualifier
20160525-mACE-A103-2	W605131-06		Bromochloromethane	74-97-5	EP-Plate	Int. Std		1.1	**52.9**	
20160525-mACE-A103-2	W605131-06		Propene	115-07-1	EP-Plate	Ta		0.34	**6.82**	r
20160525-mACE-A103-2	W605131-06		Dichlorodifluoromethane (F12)	75-71-8	EP-Plate	Ta		0.99	**< 0.99**	R
20160525-mACE-A103-2	W605131-06		Chloromethane	74-87-3	EP-Plate	Ta		0.41	**< 0.41**	r
20160525-mACE-A103-2	W605131-06		1,2-Dichloro-tetrarfluoroethane	76-14-2	EP-Plate	Ta		1.4	**< 1.4**	r
20160525-mACE-A103-2	W605131-06		Chloroethene	75-01-4	EP-Plate	Ta		0.51	**< 0.51**	
20160525-mACE-A103-2	W605131-06		1,3-Butadiene	106-99-0	EP-Plate	Ta		0.44	**< 0.44**	
20160525-mACE-A103-2	W605131-06		n-Butane	106-97-8	EP-Plate	Ta		0.48	**< 0.48**	
20160525-mACE-A103-2	W605131-06		Bromomethane	74-83-9	EP-Plate	Ta		0.78	**< 0.78**	SdrB
20160525-mACE-A103-2	W605131-06		Chloroethane	75-00-3	EP-Plate	Ta		0.53	**< 0.53**	
20160525-mACE-A103-2	W605131-06		Ethanol	64-17-5	EP-Plate	Ta		0.38	**1.23**	R
20160525-mACE-A103-2	W605131-06		Vinylbromide	593-60-2	EP-Plate	Ta		0.88	**< 0.88**	
20160525-mACE-A103-2	W605131-06		Trichlorofluoromethane	75-69-4	EP-Plate	Ta		1.1	**< 1.1**	
20160525-mACE-A103-2	W605131-06		Acrolein	107-02-8	EP-Plate	Ta		0.46	**6.22**	Rr
20160525-mACE-A103-2	W605131-06		Acetone	67-64-1	EP-Plate	Ta		0.48	**5.63**	r
20160525-mACE-A103-2	W605131-06		n-Pentane	109-66-0	EP-Plate	Ta		0.59	**< 0.59**	r
20160525-mACE-A103-2	W605131-06		Isopropanol	67-63-0	EP-Plate	Ta		0.49	**< 0.49**	r
20160525-mACE-A103-2	W605131-06		1,1-Dichloroethene	75-35-4	EP-Plate	Ta		0.79	**< 0.79**	
20160525-mACE-A103-2	W605131-06		t-Butyl alcohol	75-65-0	EP-Plate	Ta		0.61	**< 0.61**	r
20160525-mACE-A103-2	W605131-06		1,1,2-Trichloro-1,2,2-trifluoroethane (	76-13-1	EP-Plate	Ta		1.5	**< 1.5**	B
20160525-mACE-A103-2	W605131-06		3-Chloropropene	107-05-1	EP-Plate	Ta		0.63	**< 0.63**	r
20160525-mACE-A103-2	W605131-06		Methylene Chloride (Dichloromethane)	75-09-2	EP-Plate	Ta		0.70	**< 0.70**	B
20160525-mACE-A103-2	W605131-06		Carbon Disulfide	75-65-0	EP-Plate	Ta		0.62	**< 0.62**	r
20160525-mACE-A103-2	W605131-06		trans-1,2-Dichloroethene	156-60-5	EP-Plate	Ta		0.79	**< 0.79**	RR
20160525-mACE-A103-2	W605131-06		Methyl-t-butyll ether (MTBE)	1634-04-4	EP-Plate	Ta		0.72	**< 0.72**	RR
20160525-mACE-A103-2	W605131-06		Vinyl Acetate	108-05-4	EP-Plate	Ta		0.70	**< 0.70**	Rr

Sample ID										
Client	RJLG	Medium ID	Analyte	CAS Number	Matrix	Type	QC % REC	Reporting Limit (ng)	Result (ng)	Qualifier
20160525-mACE-A103-2	W605131-06		1,1-Dichloroethane	75-34-3	EP-Plate	Ta		0.81	< 0.81	Rr
20160525-mACE-A103-2	W605131-06		2-Butanone (MEK)	78-93-3	EP-Plate	Ta		0.59	< 0.59	
20160525-mACE-A103-2	W605131-06		Hexane	110-54-3	EP-Plate	Ta		0.71	< 0.71	SBR
20160525-mACE-A103-2	W605131-06		cis-1,2-Dichloroethene	156-59-2	EP-Plate	Ta		0.79	< 0.79	R
20160525-mACE-A103-2	W605131-06		Ethyl Acetate	141-78-6	EP-Plate	Ta		0.72	< 0.72	R
20160525-mACE-A103-2	W605131-06		Chloroform	540-36-3	EP-Plate	Ta		1.1	< 1.1	S
20160525-mACE-A103-2	W605131-06		Tetrahydrofuran	67-66-3	EP-Plate	Ta		0.98	< 0.98	R
20160525-mACE-A103-2	W605131-06		1,4-Difluorobenzene	71-55-6	EP-Plate	Int. Std		0.93	46.7	
20160525-mACE-A103-2	W605131-06		1,1,1-Trichloroethane	71-55-6	EP-Plate	Ta		1.1	< 1.1	
20160525-mACE-A103-2	W605131-06		1,2-Dichloroethane-d4	17060-07-0	EP-Plate	QA/Surr	98.1	0.84	41.3	
20160525-mACE-A103-2	W605131-06		1,2-Dichloroethane	107-06-2	EP-Plate	Ta		0.81	< 0.81	
20160525-mACE-A103-2	W605131-06		Benzene	71-43-2	EP-Plate	Ta		0.64	2.11	S
20160525-mACE-A103-2	W605131-06		Carbon Tetrachloride	56-23-5	EP-Plate	Ta		1.3	< 1.3	
20160525-mACE-A103-2	W605131-06		Cyclohexane	110-82-7	EP-Plate	Ta		0.69	< 0.69	
20160525-mACE-A103-2	W605131-06		2,2,4-Trimethylpentane	540-84-1	EP-Plate	Ta		0.93	< 0.93	
20160525-mACE-A103-2	W605131-06		Heptane	142-82-5	EP-Plate	Ta		0.82	< 0.82	
20160525-mACE-A103-2	W605131-06		Trichlorethylene	79-01-6	EP-Plate	Ta		1.1	< 1.1	
20160525-mACE-A103-2	W605131-06		1,2-Dichloropropane	78-87-5	EP-Plate	Ta		0.92	< 0.92	
20160525-mACE-A103-2	W605131-06		Methylmethacrylate	80-62-6	EP-Plate	Ta		0.82	< 0.82	r
20160525-mACE-A103-2	W605131-06		1,4-Dioxane	123-91-1	EP-Plate	Ta		0.72	< 0.72	
20160525-mACE-A103-2	W605131-06		Bromodichloromethane	75-27-4	EP-Plate	Ta		1.3	< 1.3	
20160525-mACE-A103-2	W605131-06		Methyl isobutyl ketone (MIBK)	108-10-1	EP-Plate	Ta		0.82	< 0.82	
20160525-mACE-A103-2	W605131-06		cis-1,3-Dichloropropene	10061-01-5	EP-Plate	Ta		0.91	< 0.91	
20160525-mACE-A103-2	W605131-06		trans-1,3-Dichloropropene	10061-02-6	EP-Plate	Ta		0.91	< 0.91	
20160525-mACE-A103-2	W605131-06		Toluene-d8	2037-26-5	EP-Plate	QA/Surr	99.2	0.82	40.7	
20160525-mACE-A103-2	W605131-06		Toluene	108-88-3	EP-Plate	Ta		0.75	< 0.75	r
20160525-mACE-A103-2	W605131-06		1,1,2-Trichloroethane	79-00-5	EP-Plate	Ta		1.1	< 1.1	
20160525-mACE-A103-2	W605131-06		2-Hexanone	591-78-6	EP-Plate	Ta		0.90	< 0.90	r
20160525-mACE-A103-2	W605131-06		Dibromochloromethane	124-48-1	EP-Plate	Ta		1.7	< 1.7	
20160525-mACE-A103-2	W605131-06		Tetrachloroethylene	127-18-4	EP-Plate	Ta		1.4	< 1.4	
20160525-mACE-A103-2	W605131-06		Chlorobenzene-d5	3114-55-4	EP-Plate	Int. Std		0.92	46.1	
20160525-mACE-A103-2	W605131-06		1,2-Dibromoethane	106-93-4	EP-Plate	Ta		1.5	< 1.5	
20160525-mACE-A103-2	W605131-06		Chlorobenzene	108-90-7	EP-Plate	Ta		0.92	< 0.92	
20160525-mACE-A103-2	W605131-06		Ethylbenzene	100-41-4	EP-Plate	Ta		0.87	< 0.87	
20160525-mACE-A103-2	W605131-06		m,p-Xylene	179601-23-1	EP-Plate	Ta		0.87	< 0.87	
20160525-mACE-A103-2	W605131-06		Nonane	111-84-2	EP-Plate	Ta		1.0	< 1.0	

Sample ID								Reporting		
Client	RJLG	Medium ID	Analyte	CAS Number	Matrix	Type	QC % REC	Limit (ng)	Result (ng)	Qualifier
20160525-mACE-A103-2	W605131-06		o-Xylene	95-47-6	EP-Plate	Ta		0.87	**< 0.87**	**r**
20160525-mACE-A103-2	W605131-06		Styrene	100-42-5	EP-Plate	Ta		0.85	**< 0.85**	
20160525-mACE-A103-2	W605131-06		Bromoform	75-25-2	EP-Plate	Ta		2.1	**< 2.1**	**B**
20160525-mACE-A103-2	W605131-06		1,1,2,2-Tetrachloroethane	79-34-5	EP-Plate	Ta		1.4	**< 1.4**	**B**
20160525-mACE-A103-2	W605131-06		Cumene	98-82-8	EP-Plate	Ta		0.98	**< 0.98**	**S**
20160525-mACE-A103-2	W605131-06		4-Bromofluorobenzene (BFB)	460-00-4	EP-Plate	QA/Sur	90.2	1.4	**64.6**	
20160525-mACE-A103-2	W605131-06		n-Propylbenzene	103-65-1	EP-Plate	Ta		0.98	**< 0.98**	
20160525-mACE-A103-2	W605131-06		2-Chlorotoluene	95-49-8	EP-Plate	Ta		1.0	**< 1.0**	
20160525-mACE-A103-2	W605131-06		4-Ethyltoluene	622-96-8	EP-Plate	Ta		0.98	**< 0.98**	**r**
20160525-mACE-A103-2	W605131-06		1,3,5-Trimethylbenzene	108-67-8	EP-Plate	Ta		0.98	**< 0.98**	**RR**
20160525-mACE-A103-2	W605131-06		1,2,4-Trimethylbenzene	95-63-6	EP-Plate	Ta		0.98	**< 0.98**	**RRr**
20160525-mACE-A103-2	W605131-06		1,3-Dichlorobenzene	541-73-1	EP-Plate	Ta		1.2	**< 1.2**	**RRr**
20160525-mACE-A103-2	W605131-06		Benzyl Chloride	100-44-7	EP-Plate	Ta		1.0	**< 1.0**	**B**
20160525-mACE-A103-2	W605131-06		1,4-Dichlorobenzene	106-46-7	EP-Plate	Ta		1.2	**< 1.2**	**RRr**
20160525-mACE-A103-2	W605131-06		1,2-Dichlorobenzene	95-50-1	EP-Plate	Ta		1.2	**< 1.2**	**B**
20160525-mACE-A103-2	W605131-06		1,2,4-Trichlorobenzene	120-82-1	EP-Plate	PIC		1.5	**< 1.5**	**RB**
20160525-mACE-A103-2	W605131-06		Naphthalene	91-20-3	EP-Plate	PIC		1.0	**< 1.0**	**RrB**
20160525-mACE-A103-2	W605131-06		Hexachloro-1,3-butadiene	87-68-3	EP-Plate	PIC		2.1	**< 2.1**	**RB**

Client	Sample ID RJLG	Medium ID	Analyte	CAS Number	Matrix	Type	QC % REC	Reporting Limit (ng)	Result (ng)	Qualifier
			Tentatively Identified Compounds							
20160525-mACE-A103-2	W605131-06		Acetaldehyde	000075-07-0	EP-Plate	TIC		0.36	**1.96**	74,N,T
20160525-mACE-A103-2	W605131-06		Acetonitrile	000075-05-8	EP-Plate	TIC		0.34	**1.73**	9,N,T
20160525-mACE-A103-2	W605131-06		Acetic acid	000064-19-7	EP-Plate	TIC		0.49	**1.39**	90,N,T

Comments: Concentrations of the tentatively identified compounds is based on the comparison of peak area to that of the nearest internal standard.

ng - nanogram
ppbv - parts per billion volume
ug/m3 - micrograms per cubic meter

BDL = Below Detection Limit
N/A - Not Applicable

Qualifiers

B = Compound found in associated laboratory blank above the reporting limit.
D = Diluted sample
E = Report concentration was above the instrumental calibration range
I = Response failure of an internal standard; concentration should be considered an estimate
J = Concentration below reporting limit
N = Identification based on mass spectral library search
P = Library spectrum match, rsd >90% w RT match
Q = Qualitative results for non-target compounds
Ta = Target Analyte
R = Recovery failure in CCV or LCS.
S = Surrogate recovery failure
T = Compound is tentatively identified compound. Includes chemical library matches & chemist identified compounds.
X = Detected but not quantifiable
c = Sample RPD failure
d= Data that exceeds the %RSD criteria set by the method (70-130%)
PIC = Positively identified compound, for non-calibrated compounds
r = Recovery failure in MRL
Z = Positively Identified Compound; Quanlitative data only

Authorized Signature:
Laboratory Technical Manager - Dr. Joe Sears

Date: 06/13/16

RJ LEE GROUP
DELIVERING SCIENTIFIC RESOLUTION

RJ LeeGroup, Inc. | Columbia Basin Analytical Laboratory
2710 North 20th Avenue, Pasco WA 99301
Tel: (509) 545-4989 | Fax: (509) 544-6010

QUALITY CONTROL REPORT
EPA Compendium Method TO-17-Modified
Electrostatic Precipitator Plates

Washington River Protection Solution

Richland, WA 99352
Attn: George Weeks

RJ Lee Group Project: W605131
Samples Received: 5/26/2016
Analysis Date: 6/1/2016
Report Date: 6/13/2016
Sampling Date:
Purchase Order No.:
Client Project:

Analyte	CAS No.	QC Analyte Type	QC Sample Type	Ret. Time	Peak Area	Expected (ppbv)	Result (ppbv)	Result (ug/m3)	%REC	%RPD	Qualifier
Bromochloromethane	74-97-5	Int. Std	CCV	8.535	15017094	10.0	10.0	52.9	100		
Propene	115-07-1	Ta	CCV	3.352	4665034	10.5	10.4	17.9	99.1		
Dichlorodifluoromethane (F12)	75-71-8	Ta	CCV	3.415	14237411	10.1	11.6	57.5	115		
Chloromethane	74-87-3	Ta	CCV	3.728	6261126	10.1	13.0	26.9	129		
1,2-Dichloro-tetrarfluoroethane	76-14-2	Ta	CCV	3.630	4649812	10.2	7.35	51.4	72.1		
Chloroethene	75-01-4	Ta	CCV	3.912	9964626	10.2	10.4	26.6	102		
1,3-Butadiene	106-99-0	Ta	CCV	3.979	6208520	10.2	9.44	20.9	92.5		
n-Butane	106-97-8	Ta	CCV	3.904	9876182	10.4	10.2	24.2	97.9		
Bromomethane	74-83-9	Ta	CCV	4.484	8587364	9.90	8.57	33.3	86.6		
Chloroethane	75-00-3	Ta	CCV	4.651	4028850	9.90	8.80	23.2	88.9		
Ethanol	64-17-5	Ta	CCV	5.266	2186187	10.6	9.44	17.8	89.1		
Vinylbromide	593-60-2	Ta	CCV	4.950	11837793	10.8	11.2	49.0	104		
Trichlorofluoromethane	75-69-4	Ta	CCV	5.063	28803711	10.4	11.0	61.8	106		
Acrolein	107-02-8	Ta	CCV	5.664	2290325	10.1	9.53	21.9	94.4		
Acetone	67-64-1	Ta	CCV	5.854	4941704	10.5	10.2	24.1	96.8		
n-Pentane	109-66-0	Ta	CCV	5.174	10469566	10.2	10.2	30.1	99.9		
Isopropanol	67-63-0	Ta	CCV	6.019	10446074	11.0	10.5	25.8	95.5		
1,1-Dichloroethene	75-35-4	Ta	CCV	5.816	13212578	10.2	10.8	43.0	106		
t-Butyl alcohol	75-65-0	Ta	CCV	6.598	17952402	11.7	12.9	39.0	110		
1,1,2-Trichloro-1,2,2-trifluoroethane (	76-13-1	Ta	CCV	5.820	25960032	10.0	11.7	89.4	117		
3-Chloropropene	107-05-1	Ta	CCV	6.315	4948138	10.8	10.2	31.8	94.1		
Methylene Chloride (Dichloromethan	75-09-2	Ta	CCV	6.487	6835050	10.2	10.2	35.5	100		
Carbon Disulfide	75-65-0	Ta	CCV	6.187	28074647	10.2	10.6	33.0	104		
trans-1,2-Dichloroethene	156-60-5	Ta	CCV	6.864	9746548	10.0	4.40	17.5	44.0		R
Methyl-t-butyll ether (MTBE)	1634-04-4	Ta	CCV	6.853	23054748	10.2	4.78	17.2	46.9		R
Vinyl Acetate	108-05-4	Ta	CCV	7.395	7518370	11.0	4.69	16.5	42.6		R
1,1-Dichloroethane	75-34-3	Ta	CCV	7.449	29179333	10.1	10.7	43.3	106		
2-Butanone (MEK)	78-93-3	Ta	CCV	8.163	3858350	10.4	10.8	31.9	104		
Hexane	110-54-3	Ta	CCV	7.206	11894373	10.2	4.96	17.5	48.6		R
cis-1,2-Dichloroethene	156-59-2	Ta	CCV	6.864	7749070	10.4	4.15	16.5	39.9		R
Ethyl Acetate	141-78-6	Ta	CCV	8.171	23182084	10.0	9.36	33.7	93.6		
Chloroform	540-36-3	Ta	CCV	8.630	14583669	10.0	10.6	56.1	106		
Tetrahydrofuran	67-66-3	Ta	CCV	8.581	6437759	10.3	10.7	52.5	104		
1,4-Difluorobenzene	71-55-6	Int. Std	CCV	9.895	65323890	10.0	10.0	46.7	100		
1,1,1-Trichloroethane	71-55-6	Ta	CCV	8.914	16605165	10.2	10.5	57.2	103		
1,2-Dichloroethane-d4	17060-07-0	QA/Surr	CCV	9.336	14366876	10.0	10.0	42.3	100		
1,2-Dichloroethane	107-06-2	Ta	CCV	9.440	8117731	10.3	10.4	42.1	101		
Benzene	71-43-2	Ta	CCV	9.395	25333763	10.4	9.91	31.7	95.3		
Carbon Tetrachloride	56-23-5	Ta	CCV	9.137	17890736	10.4	11.8	74.0	113		
Cyclohexane	110-82-7	Ta	CCV	9.036	12418695	10.3	10.6	36.6	103		
2,2,4-Trimethylpentane	540-84-1	Ta	CCV	9.496	33444710	10.6	11.0	51.2	103		
Heptane	142-82-5	Ta	CCV	9.692	11002786	10.4	7.73	31.7	74.3		
Trichlorethylene	79-01-6	Ta	CCV	10.263	12411111	10.3	9.88	53.1	95.9		
1,2-Dichloropropane	78-87-5	Ta	CCV	10.636	8409161	10.4	10.8	49.8	104		
Methylmethacrylate	80-62-6	Ta	CCV	10.599	11822210	10.1	10.3	42.4	102		
1,4-Dioxane	123-91-1	Ta	CCV	10.713	6710471	10.3	9.73	35.1	94.5		
Bromodichloromethane	75-27-4	Ta	CCV	10.969	15919649	10.3	10.8	72.2	105		
Methyl isobutyl ketone (MIBK)	108-10-1	Ta	CCV	11.731	17238385	10.1	10.9	44.5	108		
cis-1,3-Dichloropropene	10061-01-5	Ta	CCV	11.578	13287334	11.0	11.6	52.8	106		
trans-1,3-Dichloropropene	10061-02-6	Ta	CCV	12.378	11490416	10.9	11.3	51.2	103		

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QUALITY CONTROL REPORT
EPA Compendium Method TO-17-Modified
Electrostatic Precipitator Plates

Washington River Protection Solution

Richland, WA 99352
Attn: George Weeks

RJ Lee Group Project: W605131
Samples Received: 5/26/2016
Analysis Date: 6/1/2016
Report Date: 6/13/2016
Sampling Date:
Purchase Order No.:
Client Project:

Toluene-d8	2037-26-5	QA/Surr	CCV	11.997	62896465	10.0	10.4	42.6	104		
Toluene	108-88-3	Ta	CCV	12.102	34003054	10.5	10.4	39.1	98.8		
1,1,2-Trichloroethane	79-00-5	Ta	CCV	12.699	10565071	10.4	10.2	55.8	98.4		
2-Hexanone	591-78-6	Ta	CCV	12.948	17767483	10.7	12.1	54.3	113		
Dibromochloromethane	124-48-1	Ta	CCV	13.320	18628117	10.7	11.3	96.4	106		
Tetrachloroethylene	127-18-4	Ta	CCV	12.890	17547869	10.2	9.87	67.0	96.8		
Chlorobenzene-d5	3114-55-4	Int. Std	CCV	14.238	60618308	10.0	10.0	46.1	100		
1,2-Dibromoethane	106-93-4	Ta	CCV	13.550	16346584	10.4	10.7	82.4	103		
Chlorobenzene	108-90-7	Ta	CCV	14.288	27916853	10.5	9.67	44.5	92.1		
Ethylbenzene	100-41-4	Ta	CCV	14.396	45330202	10.5	11.1	48.2	106		
m,p-Xylene	179601-23-1	Ta	CCV	14.594	69429125	20.4	22.9	99.6	112		
Nonane	111-84-2	Ta	CCV	14.538	19364373	10.5	8.40	44.1	80.0		
o-Xylene	95-47-6	Ta	CCV	15.231	35475858	10.5	10.1	44.0	96.5		
Styrene	100-42-5	Ta	CCV	15.256	29224023	10.5	9.91	42.2	94.4		
Bromoform	75-25-2	Ta	CCV	15.615	18331456	10.2	9.48	98.0	92.9		
1,1,2,2-Tetrachloroethane	79-34-5	Ta	CCV	16.281	21184564	10.5	8.72	59.9	83.0		
Cumene	98-82-8	Ta	CCV	15.811	49332956	10.4	9.55	47.0	91.8		
4-Bromofluorobenzene (BFB)	460-00-4	QA/Surr	CCV	16.139	42975648	10.0	10.7	76.8	107		
n-Propylbenzene	103-65-1	Ta	CCV	16.502	13576325	10.3	7.61	37.4	73.9		
2-Chlorotoluene	95-49-8	Ta	CCV	16.703	12255727	10.8	8.02	41.5	74.3		
4-Ethyltoluene	622-96-8	Ta	CCV	16.693	14603414	10.1	7.66	37.7	75.8		
1,3,5-Trimethylbenzene	108-67-8	Ta	CCV	16.778	35071447	10.2	7.00	34.4	68.6		R
1,2,4-Trimethylbenzene	95-63-6	Ta	CCV	17.427	15195767	10.2	6.77	33.3	66.4		R
1,3-Dichlorobenzene	541-73-1	Ta	CCV	17.973	18514453	10.3	5.40	32.5	52.4		R
Benzyl Chloride	100-44-7	Ta	CCV	18.304	17742950	10.3	4.28	22.2	41.6		R
1,4-Dichlorobenzene	106-46-7	Ta	CCV	18.141	16820160	10.1	4.93	29.7	48.8		R
1,2-Dichlorobenzene	95-50-1	Ta	CCV	18.764	12483155	10.1	3.91	23.5	38.7		R
1,2,4-Trichlorobenzene	120-82-1	PIC	CCV		363328				#VALUE!		Z
Naphthalene	91-20-3	PIC	CCV		939306				#VALUE!		Z
Hexachloro-1,3-butadiene	87-68-3	PIC	CCV		221437				#VALUE!		Z

Analyte	CAS No.	QC Sample ID		Ret. Time	Peak Area	Expected (ppbv)	Result (ppbv)	Result (ug/m3)	%REC	%RPD	Qualifier
Bromochloromethane	74-97-5	Int. Std	LCS	8.535	15017094	10.0	10.0	52.9	100		
Propene	115-07-1	Ta	LCS	3.352	4665034	10.5	10.4	17.9	99.1		
Dichlorodifluoromethane (F12)	75-71-8	Ta	LCS	3.415	14237411	10.1	11.6	57.5	115		
Chloromethane	74-87-3	Ta	LCS	3.728	6261126	10.1	13.0	26.9	129		
1,2-Dichloro-tetrarfluoroethane	76-14-2	Ta	LCS	3.630	4649812	10.2	7.35	51.4	72.1		
Chloroethene	75-01-4	Ta	LCS	3.912	9964626	10.2	10.4	26.6	102		
1,3-Butadiene	106-99-0	Ta	LCS	3.979	6208520	10.2	9.44	20.9	92.5		
n-Butane	106-97-8	Ta	LCS	3.904	9876182	10.4	10.2	24.2	97.9		
Bromomethane	74-83-9	Ta	LCS	4.484	8587364	9.90	8.57	33.3	86.6		
Chloroethane	75-00-3	Ta	LCS	4.651	4028850	9.90	8.80	23.2	88.9		
Ethanol	64-17-5	Ta	LCS	5.266	2186187	10.6	9.44	17.8	89.1		
Vinylbromide	593-60-2	Ta	LCS	4.950	11837793	10.8	11.2	49.0	104		
Trichlorofluoromethane	75-69-4	Ta	LCS	5.063	28803711	10.4	11.0	61.8	106		
Acrolein	107-02-8	Ta	LCS	5.664	2290325	10.1	9.53	21.9	94.4		
Acetone	67-64-1	Ta	LCS	5.854	4941704	10.5	10.2	24.1	96.8		
n-Pentane	109-66-0	Ta	LCS	5.174	10469566	10.2	10.2	30.1	99.9		
Isopropanol	67-63-0	Ta	LCS	6.019	10446074	11.0	10.5	25.8	95.5		
1,1-Dichloroethene	75-35-4	Ta	LCS	5.816	13212578	10.2	10.8	43.0	106		
t-Butyl alcohol	75-65-0	Ta	LCS	6.598	17952402	11.7	12.9	39.0	110		

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QUALITY CONTROL REPORT
EPA Compendium Method TO-17-Modified
Electrostatic Precipitator Plates

Washington River Protection Solution

Richland, WA 99352
Attn: George Weeks

RJ Lee Group Project: W605131
Samples Received: 5/26/2016
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1,1,2-Trichloro-1,2,2-trifluoroethane (	76-13-1	Ta	LCS	5.820	25960032	10.0	11.7	89.4	117		
3-Chloropropene	107-05-1	Ta	LCS	6.315	4948138	10.8	10.2	31.8	94.1		
Methylene Chloride (Dichloromethan	75-09-2	Ta	LCS	6.487	6835050	10.2	10.2	35.5	100		
Carbon Disulfide	75-65-0	Ta	LCS	6.187	28074647	10.2	10.6	33.0	104		
trans-1,2-Dichloroethene	156-60-5	Ta	LCS	6.864	9746548	10.0	4.40	17.5	44.0		R
Methyl-t-butyll ether (MTBE)	1634-04-4	Ta	LCS	6.853	23054748	10.2	4.78	17.2	46.9		R
Vinyl Acetate	108-05-4	Ta	LCS	7.395	7518370	11.0	4.69	16.5	42.6		R
1,1-Dichloroethane	75-34-3	Ta	LCS	7.449	29179333	10.1	10.7	43.3	106		
2-Butanone (MEK)	78-93-3	Ta	LCS	8.163	3858350	10.4	10.8	31.9	104		
Hexane	110-54-3	Ta	LCS	7.206	11894373	10.2	4.96	17.5	48.6		R
cis-1,2-Dichloroethene	156-59-2	Ta	LCS	6.864	7749070	10.4	4.15	16.5	39.9		R
Ethyl Acetate	141-78-6	Ta	LCS	8.171	23182084	10.0	9.36	33.7	93.6		
Chloroform	540-36-3	Ta	LCS	8.630	14583669	10.0	10.6	56.1	106		
Tetrahydrofuran	67-66-3	Ta	LCS	8.581	6437759	10.3	10.7	52.5	104		
1,4-Difluorobenzene	71-55-6	Int. Std	LCS	9.895	65323890	10.0	10.0	46.7	100		
1,1,1-Trichloroethane	71-55-6	Ta	LCS	8.914	16605165	10.2	10.5	57.2	103		
1,2-Dichloroethane-d4	17060-07-0	QA/Surr	LCS	9.336	14366876	10.0	10.0	42.3	100		
1,2-Dichloroethane	107-06-2	Ta	LCS	9.440	8117731	10.3	10.4	42.1	101		
Benzene	71-43-2	Ta	LCS	9.395	25333763	10.4	9.91	31.7	95.3		
Carbon Tetrachloride	56-23-5	Ta	LCS	9.137	17890736	10.4	11.8	74.0	113		
Cyclohexane	110-82-7	Ta	LCS	9.036	12418695	10.3	10.6	36.6	103		
2,2,4-Trimethylpentane	540-84-1	Ta	LCS	9.496	33444710	10.6	11.0	51.2	103		
Heptane	142-82-5	Ta	LCS	9.692	11002786	10.4	7.73	31.7	74.3		
Trichlorethylene	79-01-6	Ta	LCS	10.263	12411111	10.3	9.88	53.1	95.9		
1,2-Dichloropropane	78-87-5	Ta	LCS	10.636	8409161	10.4	10.8	49.8	104		
Methylmethacrylate	80-62-6	Ta	LCS	10.599	11822210	10.1	10.3	42.4	102		
1,4-Dioxane	123-91-1	Ta	LCS	10.713	6710471	10.3	9.73	35.1	94.5		
Bromodichloromethane	75-27-4	Ta	LCS	10.969	15919649	10.3	10.8	72.2	105		
Methyl isobutyl ketone (MIBK)	108-10-1	Ta	LCS	11.731	17238385	10.1	10.9	44.5	108		
cis-1,3-Dichloropropene	10061-01-5	Ta	LCS	11.578	13287334	11.0	11.6	52.8	106		
trans-1,3-Dichloropropene	10061-02-6	Ta	LCS	12.378	11490416	10.9	11.3	51.2	103		
Toluene-d8	2037-26-5	QA/Surr	LCS	11.997	62896465	10.0	10.4	42.6	104		
Toluene	108-88-3	Ta	LCS	12.102	34003054	10.5	10.4	39.1	98.8		
1,1,2-Trichloroethane	79-00-5	Ta	LCS	12.699	10565071	10.4	10.2	55.8	98.4		
2-Hexanone	591-78-6	Ta	LCS	12.948	17767483	10.7	12.1	54.3	113		
Dibromochloromethane	124-48-1	Ta	LCS	13.320	18628117	10.7	11.3	96.4	106		
Tetrachloroethylene	127-18-4	Ta	LCS	12.890	17547869	10.2	9.87	67.0	96.8		
Chlorobenzene-d5	3114-55-4	Int. Std	LCS	14.238	60618308	10.0	10.0	46.1	100		
1,2-Dibromoethane	106-93-4	Ta	LCS	13.550	16346584	10.4	10.7	82.4	103		
Chlorobenzene	108-90-7	Ta	LCS	14.288	27916853	10.5	9.67	44.5	92.1		
Ethylbenzene	100-41-4	Ta	LCS	14.396	45330202	10.5	11.1	48.2	106		
m,p-Xylene	179601-23-1	Ta	LCS	14.594	69429125	20.4	22.9	99.6	112		
Nonane	111-84-2	Ta	LCS	14.538	19364373	10.5	8.40	44.1	80.0		
o-Xylene	95-47-6	Ta	LCS	15.231	35475858	10.5	10.1	44.0	96.5		
Styrene	100-42-5	Ta	LCS	15.256	29224023	10.5	9.91	42.2	94.4		
Bromoform	75-25-2	Ta	LCS	15.615	18331456	10.2	9.48	98.0	92.9		
1,1,2,2-Tetrachloroethane	79-34-5	Ta	LCS	16.281	21184564	10.5	8.72	59.9	83.0		
Cumene	98-82-8	Ta	LCS	15.811	49332956	10.4	9.55	47.0	91.8		
4-Bromofluorobenzene (BFB)	460-00-4	QA/Surr	LCS	16.139	42975648	10.0	10.7	76.8	107		
n-Propylbenzene	103-65-1	Ta	LCS	16.502	13576325	10.3	7.61	37.4	73.9		
2-Chlorotoluene	95-49-8	Ta	LCS	16.703	12255727	10.8	8.02	41.5	74.3		
4-Ethyltoluene	622-96-8	Ta	LCS	16.693	14603414	10.1	7.66	37.7	75.8		
1,3,5-Trimethylbenzene	108-67-8	Ta	LCS	16.778	35071447	10.2	7.00	34.4	68.6		R

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1,2,4-Trimethylbenzene	95-63-6	Ta	LCS	17.427	15195767	10.2	6.77	33.3	66.4		R
1,3-Dichlorobenzene	541-73-1	Ta	LCS	17.973	18514453	10.3	5.40	32.5	52.4		R
Benzyl Chloride	100-44-7	Ta	LCS	18.304	17742950	10.3	4.28	22.2	41.6		R
1,4-Dichlorobenzene	106-46-7	Ta	LCS	18.141	16820160	10.1	4.93	29.7	48.8		R
1,2-Dichlorobenzene	95-50-1	Ta	LCS	18.764	12483155	10.1	3.91	23.5	38.7		R
1,2,4-Trichlorobenzene	120-82-1	PIC	LCS		363328				#VALUE!		Z
Naphthalene	91-20-3	PIC	LCS		939306				#VALUE!		Z
Hexachloro-1,3-butadiene	87-68-3	PIC	LCS		221437				#VALUE!		Z

Analyte	CAS No.	QC Sample ID		Ret. Time	Peak Area	Expected (ppbv)	Result (ppbv)	Result (ug/m3)	%REC	%RPD	Qualifier
Bromochloromethane	74-97-5	Int. Std	LCSD	8.545	14116511	10.0	10.0	52.9	100	0.0	
Propene	115-07-1	Ta	LCSD	3.353	4353321	10.5	10.3	17.8	98.3	0.8	
Dichlorodifluoromethane (F12)	75-71-8	Ta	LCSD	3.417	12687422	10.1	11.0	54.5	109	5.4	
Chloromethane	74-87-3	Ta	LCSD	3.731	5337098	10.1	11.8	24.3	117	9.8	
1,2-Dichloro-tetrarfluoroethane	76-14-2	Ta	LCSD	3.630	5310454	10.2	8.94	62.5	87.6	19.4	
Chloroethene	75-01-4	Ta	LCSD	3.914	9603680	10.2	10.7	27.3	105	2.9	
1,3-Butadiene	106-99-0	Ta	LCSD	3.981	5653108	10.2	9.14	20.2	89.6	3.2	
n-Butane	106-97-8	Ta	LCSD	3.905	9302329	10.4	10.2	24.3	98.1	0.2	
Bromomethane	74-83-9	Ta	LCSD	4.488	7946330	9.90	8.44	32.8	85.3	1.5	
Chloroethane	75-00-3	Ta	LCSD	4.655	4401433	9.90	10.2	27.0	103	14.7	
Ethanol	64-17-5	Ta	LCSD	5.271	2177928	10.6	10.1	19.0	95.0	6.4	
Vinylbromide	593-60-2	Ta	LCSD	4.955	11175103	10.8	11.2	49.2	104	0.0	
Trichlorofluoromethane	75-69-4	Ta	LCSD	5.068	27340499	10.4	11.1	62.4	107	0.9	
Acrolein	107-02-8	Ta	LCSD	5.668	2163235	10.1	9.58	22.0	94.9	0.5	
Acetone	67-64-1	Ta	LCSD	5.859	4897287	10.5	10.8	25.6	103	6.2	
n-Pentane	109-66-0	Ta	LCSD	5.179	10179878	10.2	10.6	31.1	103	3.1	
Isopropanol	67-63-0	Ta	LCSD	6.024	9605712	11.0	10.3	25.3	93.4	2.2	
1,1-Dichloroethene	75-35-4	Ta	LCSD	5.822	12593360	10.2	11.0	43.6	108	1.9	
t-Butyl alcohol	75-65-0	Ta	LCSD	6.604	17851038	11.7	13.6	41.4	117	6.2	
1,1,2-Trichloro-1,2,2-trifluoroethane (	76-13-1	Ta	LCSD	5.826	24737881	10.0	11.8	90.6	118	0.9	
3-Chloropropene	107-05-1	Ta	LCSD	6.322	4394087	10.8	9.56	29.9	88.5	6.1	
Methylene Chloride (Dichloromethan	75-09-2	Ta	LCSD	6.493	6704020	10.2	10.7	37.1	105	4.9	
Carbon Disulfide	75-65-0	Ta	LCSD	6.192	26571595	10.2	10.7	33.3	105	1.0	
trans-1,2-Dichloroethene	156-60-5	Ta	LCSD	6.874	21381877	10.0	10.2	40.6	102	79.5	
Methyl-t-butyll ether (MTBE)	1634-04-4	Ta	LCSD	6.863	50900307	10.2	11.2	40.3	109	79.7	
Vinyl Acetate	108-05-4	Ta	LCSD	7.409	17271697	11.0	11.9	41.7	108	86.9	
1,1-Dichloroethane	75-34-3	Ta	LCSD	7.465	27934893	10.1	10.9	44.1	108	1.9	
2-Butanone (MEK)	78-93-3	Ta	LCSD	8.169	3902762	10.4	11.7	34.4	112	7.4	
Hexane	110-54-3	Ta	LCSD	7.222	24050523	10.2	10.7	37.7	105	73.4	
cis-1,2-Dichloroethene	156-59-2	Ta	LCSD	6.874	19318602	10.4	11.0	43.6	106	90.6	
Ethyl Acetate	141-78-6	Ta	LCSD	8.179	23264045	10.0	10.0	36.1	100	6.6	
Chloroform	540-36-3	Ta	LCSD	8.639	14134121	10.0	10.9	57.8	109	2.8	
Tetrahydrofuran	67-66-3	Ta	LCSD	8.587	6282952	10.3	11.2	54.5	108	3.8	
1,4-Difluorobenzene	71-55-6	Int. Std	LCSD	9.901	64582680	10.0	10.0	46.7	100	0.0	
1,1,1-Trichloroethane	71-55-6	Ta	LCSD	8.924	16094478	10.2	10.3	56.1	101	2.0	
1,2-Dichloroethane-d4	17060-07-0	QA/Surr	LCSD	9.341	14045022	10.0	9.92	41.8	99.2	0.8	
1,2-Dichloroethane	107-06-2	Ta	LCSD	9.447	7958234	10.3	10.3	41.7	100	1.0	
Benzene	71-43-2	Ta	LCSD	9.403	25098126	10.4	9.93	31.7	95.5	0.2	
Carbon Tetrachloride	56-23-5	Ta	LCSD	9.146	17373523	10.4	11.6	72.7	111	1.8	
Cyclohexane	110-82-7	Ta	LCSD	9.046	11804299	10.3	10.2	35.2	99.2	3.8	
2,2,4-Trimethylpentane	540-84-1	Ta	LCSD	9.504	32782607	10.6	10.9	50.8	103	0.0	

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Heptane	142-82-5	Ta	LCSD	9.701	12084628	10.4	8.58	35.2	82.5	10.5	
Trichlorethylene	79-01-6	Ta	LCSD	10.269	12098260	10.3	9.74	52.4	94.6	1.4	
1,2-Dichloropropane	78-87-5	Ta	LCSD	10.640	8357056	10.4	10.8	50.0	104	0.0	
Methylmethacrylate	80-62-6	Ta	LCSD	10.600	11887704	10.1	10.5	43.1	104	1.9	
1,4-Dioxane	123-91-1	Ta	LCSD	10.713	6843928	10.3	10.0	36.2	97.5	3.1	
Bromodichloromethane	75-27-4	Ta	LCSD	10.973	15885795	10.3	10.9	72.9	106	0.9	
Methyl isobutyl ketone (MIBK)	108-10-1	Ta	LCSD	11.731	17514955	10.1	11.2	45.8	111	2.7	
cis-1,3-Dichloropropene	10061-01-5	Ta	LCSD	11.581	13774431	11.0	12.2	55.3	111	4.6	
trans-1,3-Dichloropropene	10061-02-6	Ta	LCSD	12.379	12200065	10.9	12.1	55.0	111	7.5	
Toluene-d8	2037-26-5	QA/Surr	LCSD	12.000	63338169	10.0	10.6	43.4	106	1.9	
Toluene	108-88-3	Ta	LCSD	12.104	34288396	10.5	10.6	39.9	101	2.2	
1,1,2-Trichloroethane	79-00-5	Ta	LCSD	12.700	10761067	10.4	10.5	57.5	101	2.6	
2-Hexanone	591-78-6	Ta	LCSD	12.948	18297665	10.7	12.6	56.7	117	3.5	
Dibromochloromethane	124-48-1	Ta	LCSD	13.321	19358665	10.7	11.9	101	111	4.6	
Tetrachloroethylene	127-18-4	Ta	LCSD	12.892	17907688	10.2	10.2	69.1	99.9	3.2	
Chlorobenzene-d5	3114-55-4	Int. Std	LCSD	14.239	59418403	10.0	10.0	46.1	100	0.0	
1,2-Dibromoethane	106-93-4	Ta	LCSD	13.551	17028886	10.4	11.4	87.6	110	6.6	
Chlorobenzene	108-90-7	Ta	LCSD	14.289	28913006	10.5	10.2	47.1	97.3	5.5	
Ethylbenzene	100-41-4	Ta	LCSD	14.398	47520721	10.5	11.9	51.7	113	6.4	
m,p-Xylene	179601-23-1	Ta	LCSD	14.595	73390954	20.4	24.8	108	122	8.5	
Nonane	111-84-2	Ta	LCSD	14.540	20459042	10.5	9.10	47.8	86.7	8.0	
o-Xylene	95-47-6	Ta	LCSD	15.232	38498707	10.5	11.2	48.8	107	10.3	
Styrene	100-42-5	Ta	LCSD	15.256	31899335	10.5	11.1	47.1	105	10.6	
Bromoform	75-25-2	Ta	LCSD	15.616	21208267	10.2	11.2	116	110	16.9	
1,1,2,2-Tetrachloroethane	79-34-5	Ta	LCSD	16.281	26070748	10.5	11.0	75.5	105	23.4	
Cumene	98-82-8	Ta	LCSD	15.812	55896690	10.4	11.1	54.4	106	14.4	
4-Bromofluorobenzene (BFB)	460-00-4	QA/Surr	LCSD	16.139	40380950	10.0	10.3	73.6	103	3.8	
n-Propylbenzene	103-65-1	Ta	LCSD	16.503	16477367	10.3	9.46	46.5	91.8	21.6	
2-Chlorotoluene	95-49-8	Ta	LCSD	16.704	15119159	10.8	10.1	52.5	93.8	23.2	
4-Ethyltoluene	622-96-8	Ta	LCSD	16.695	14440980	10.1	7.73	38.0	76.5	0.9	
1,3,5-Trimethylbenzene	108-67-8	Ta	LCSD	16.779	46307624	10.2	9.53	46.9	93.4	30.6	
1,2,4-Trimethylbenzene	95-63-6	Ta	LCSD	17.427	22851714	10.2	10.6	52.1	104	44.1	
1,3-Dichlorobenzene	541-73-1	Ta	LCSD	17.973	32085983	10.3	9.69	58.3	94.1	56.9	
Benzyl Chloride	100-44-7	Ta	LCSD	18.305	40578370	10.3	10.2	53.0	99.3	81.9	
1,4-Dichlorobenzene	106-46-7	Ta	LCSD	18.142	32272217	10.1	9.76	58.7	96.6	65.7	
1,2-Dichlorobenzene	95-50-1	Ta	LCSD	18.764	30968979	10.1	10.3	61.8	102	90.0	
1,2,4-Trichlorobenzene	120-82-1	PIC	LCSD	21.520	32404048	9.70	12.5	92.6	129	#VALUE!	Z
Naphthalene	91-20-3	PIC	LCSD	22.034	78056837	10.5	16.5	86.6	157	#VALUE!	Z
Hexachloro-1,3-butadiene	87-68-3	PIC	LCSD	21.735	25036191	9.80	17.1	183	175	#VALUE!	Z

Analyte	CAS No.	QC Sample ID		Ret. Time	Peak Area	Expected (ppbv)	Result (ppbv)	Result (ug/m3)	%REC	%RPD	Qualifier
Bromochloromethane	74-97-5	Int. Std	MRL	8.542	14895706	10.0	10.0	52.9	100		
Propene	115-07-1	Ta	MRL	3.348	1062637	0.525	1.32	2.27	251		r
Dichlorodifluoromethane (F12)	75-71-8	Ta	MRL	3.418	679525	0.505	0.500	2.47	99.0		
Chloromethane	74-87-3	Ta	MRL	3.730	294343	0.505	0.420	0.868	83.2		
1,2-Dichloro-tetrarfluoroethane	76-14-2	Ta	MRL	3.632	477344	0.510	0.730	5.11	143		
Chloroethene	75-01-4	Ta	MRL	3.917	508121	0.510	0.550	1.41	108		
1,3-Butadiene	106-99-0	Ta	MRL	3.980	403625	0.510	0.620	1.37	122		
n-Butane	106-97-8	Ta	MRL	3.903	615027	0.520	0.640	1.52	123		
Bromomethane	74-83-9	Ta	MRL	4.488	550318	0.495	0.630	2.45	127		
Chloroethane	75-00-3	Ta	MRL	4.653	242705	0.495	0.530	1.40	107		

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QUALITY CONTROL REPORT
EPA Compendium Method TO-17-Modified
Electrostatic Precipitator Plates

Washington River Protection Solution

Richland, WA 99352

Attn: George Weeks

RJ Lee Group Project: W605131
Samples Received: 5/26/2016
Analysis Date: 6/1/2016
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Ethanol	64-17-5	Ta	MRL	5.267	345230	0.530	0.520	0.980	98.1		
Vinylbromide	593-60-2	Ta	MRL	4.953	635947	0.540	0.560	2.45	104		
Trichlorofluoromethane	75-69-4	Ta	MRL	5.062	1549689	0.520	0.540	3.04	104		
Acrolein	107-02-8	Ta	MRL	5.667	561116	0.505	0.650	1.49	129		
Acetone	67-64-1	Ta	MRL	5.858	695821	0.525	0.380	0.903	72.4		
n-Pentane	109-66-0	Ta	MRL	5.178	587779	0.510	0.420	1.24	82.4		
Isopropanol	67-63-0	Ta	MRL	6.024	763520	0.550	0.120	0.295	21.8		r
1,1-Dichloroethene	75-35-4	Ta	MRL	5.822	723665	0.510	0.380	1.51	74.5		
t-Butyl alcohol	75-65-0	Ta	MRL		811595				#VALUE!		r
1,1,2-Trichloro-1,2,2-trifluoroethane (	76-13-1	Ta	MRL	5.814	1441445	0.500	0.450	3.45	90.0		
3-Chloropropene	107-05-1	Ta	MRL		325397				#VALUE!		r
Methylene Chloride (Dichloromethan	75-09-2	Ta	MRL	6.492	496100	0.510	0.250	0.869	49.0		r
Carbon Disulfide	75-65-0	Ta	MRL	6.190	1440271	0.510	0.210	0.654	41.2		r
trans-1,2-Dichloroethene	156-60-5	Ta	MRL	6.872	676511	0.500	0.330	1.31	66.0		
Methyl-t-butyll ether (MTBE)	1634-04-4	Ta	MRL	6.857	1203511	0.510	0.300	1.08	58.8		
Vinyl Acetate	108-05-4	Ta	MRL	7.406	1743537	0.550	0.890	3.14	162		r
1,1-Dichloroethane	75-34-3	Ta	MRL	7.461	1472276	0.505	0.530	2.15	105		
2-Butanone (MEK)	78-93-3	Ta	MRL	8.168	273692	0.520	0.600	1.77	115		
Hexane	110-54-3	Ta	MRL	7.218	1313433	0.510	0.550	1.94	108		
cis-1,2-Dichloroethene	156-59-2	Ta	MRL	6.873	651379	0.520	0.360	1.43	69.2		
Ethyl Acetate	141-78-6	Ta	MRL	8.177	1568162	0.500	0.560	2.02	112		
Chloroform	540-36-3	Ta	MRL	8.638	739780	0.500	0.520	2.75	104		
Tetrahydrofuran	67-66-3	Ta	MRL	8.586	399375	0.515	0.550	2.69	107		
1,4-Difluorobenzene	71-55-6	Int. Std	MRL	9.900	63747803	10.0	10.0	46.7	100		
1,1,1-Trichloroethane	71-55-6	Ta	MRL	8.920	720915	0.510	0.530	2.89	104		
1,2-Dichloroethane-d4	17060-07-0	QA/Surr	MRL	9.340	13812328	10.0	9.88	41.6	98.8		
1,2-Dichloroethane	107-06-2	Ta	MRL	9.444	431576	0.515	0.560	2.27	109		
Benzene	71-43-2	Ta	MRL	9.401	3720683	0.520	1.23	3.93	237		r
Carbon Tetrachloride	56-23-5	Ta	MRL	9.142	597869	0.520	0.490	3.08	94.2		
Cyclohexane	110-82-7	Ta	MRL	9.040	652090	0.515	0.610	2.10	118		
2,2,4-Trimethylpentane	540-84-1	Ta	MRL	9.502	1620109	0.530	0.510	2.38	96.2		
Heptane	142-82-5	Ta	MRL	9.698	567510	0.520	0.470	1.93	90.4		
Trichlorethylene	79-01-6	Ta	MRL	10.268	860947	0.515	0.730	3.92	142		
1,2-Dichloropropane	78-87-5	Ta	MRL	10.640	431964	0.520	0.550	2.54	106		
Methylmethacrylate	80-62-6	Ta	MRL	10.602	796422	0.505	0.560	2.29	111		
1,4-Dioxane	123-91-1	Ta	MRL	10.713	561300	0.515	0.730	2.63	142		
Bromodichloromethane	75-27-4	Ta	MRL	10.973	754164	0.515	0.540	3.62	105		
Methyl isobutyl ketone (MIBK)	108-10-1	Ta	MRL	11.730	911448	0.505	0.490	2.01	97.0		
cis-1,3-Dichloropropene	10061-01-5	Ta	MRL	11.581	462058	0.550	0.390	1.77	70.9		
trans-1,3-Dichloropropene	10061-02-6	Ta	MRL	12.378	446690	0.545	0.360	1.63	66.1		
Toluene-d8	2037-26-5	QA/Surr	MRL	11.999	57111458	10.0	9.66	39.6	96.6		
Toluene	108-88-3	Ta	MRL	12.104	4228437	0.525	0.980	3.69	187		r
1,1,2-Trichloroethane	79-00-5	Ta	MRL	12.702	661433	0.520	0.570	3.11	110		
2-Hexanone	591-78-6	Ta	MRL	12.947	990694	0.535	0.430	1.94	80.4		
Dibromochloromethane	124-48-1	Ta	MRL	13.321	833583	0.535	0.440	3.75	82.2		
Tetrachloroethylene	127-18-4	Ta	MRL	12.892	1073906	0.510	0.600	4.07	118		
Chlorobenzene-d5	3114-55-4	Int. Std	MRL	14.239	53580708	10.0	10.0	46.1	100		
1,2-Dibromoethane	106-93-4	Ta	MRL	13.550	762118	0.520	0.500	3.84	96.2		
Chlorobenzene	108-90-7	Ta	MRL	14.288	1816208	0.525	0.640	2.95	122		
Ethylbenzene	100-41-4	Ta	MRL	14.397	4169718	0.525	0.710	3.08	135		
m,p-Xylene	179601-23-1	Ta	MRL	14.590	5837226	1.02	1.32	5.73	129		
Nonane	111-84-2	Ta	MRL	14.540	1988324	0.525	0.410	2.15	78.1		
o-Xylene	95-47-6	Ta	MRL	15.232	2916915	0.525	0.790	3.43	150		r

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Washington River Protection Solution

Richland, WA 99352

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Styrene	100-42-5	Ta	MRL	15.256	2187369	0.525	0.720	3.07	137		
Bromoform	75-25-2	Ta	MRL	15.614	870166	0.510	0.500	5.17	98.0		
1,1,2,2-Tetrachloroethane	79-34-5	Ta	MRL	16.281	1268370	0.525	0.440	3.02	83.8		
Cumene	98-82-8	Ta	MRL	15.812	3344385	0.520	0.560	2.75	108		
4-Bromofluorobenzene (BFB)	460-00-4	QA/Surr	MRL	16.139	30820026	10.0	8.70	62.3	87.0		
n-Propylbenzene	103-65-1	Ta	MRL	16.502	1243813	0.515	0.650	3.20	126		
2-Chlorotoluene	95-49-8	Ta	MRL	16.703	1184527	0.540	0.780	4.04	144		
4-Ethyltoluene	622-96-8	Ta	MRL	16.695	525820	0.505	0.140	0.688	27.7		r
1,3,5-Trimethylbenzene	108-67-8	Ta	MRL	16.778	2600100	0.510	0.320	1.57	62.7		
1,2,4-Trimethylbenzene	95-63-6	Ta	MRL						#VALUE!		r
1,3-Dichlorobenzene	541-73-1	Ta	MRL	17.973	3084325	0.515	0.860	5.17	167		r
Benzyl Chloride	100-44-7	Ta	MRL		834963				#VALUE!		r
1,4-Dichlorobenzene	106-46-7	Ta	MRL	18.141	3210986	0.505	0.970	5.83	192		r
1,2-Dichlorobenzene	95-50-1	Ta	MRL	18.764	3060815	0.505	0.900	5.41	178		r
1,2,4-Trichlorobenzene	120-82-1	PIC	MRL	21.518	1392947	0.485	0.760	5.64	157		Z
Naphthalene	91-20-3	PIC	MRL		1895822				#VALUE!		Z
Hexachloro-1,3-butadiene	87-68-3	PIC	MRL	21.735	1937018	0.490	0.380	4.05	77.6		Z

Analyte	CAS No.	QC Sample ID		Ret. Time	Peak Area	Expected (ppbv)	Result (ppbv)	Result (ug/m3)	%REC	%RPD	Qualifier
Bromochloromethane	74-97-5	Int. Std	MBLK	8.550	15015218	10.0	10.0	52.9	100		
Propene	115-07-1	Ta	MBLK		593343						
Dichlorodifluoromethane (F12)	75-71-8	Ta	MBLK		54513						
Chloromethane	74-87-3	Ta	MBLK		72847						
1,2-Dichloro-tetrarfluoroethane	76-14-2	Ta	MBLK								
Chloroethene	75-01-4	Ta	MBLK								
1,3-Butadiene	106-99-0	Ta	MBLK		30908						
n-Butane	106-97-8	Ta	MBLK		121844						
Bromomethane	74-83-9	Ta	MBLK		31734						
Chloroethane	75-00-3	Ta	MBLK								
Ethanol	64-17-5	Ta	MBLK		129866						
Vinylbromide	593-60-2	Ta	MBLK								
Trichlorofluoromethane	75-69-4	Ta	MBLK		79283						
Acrolein	107-02-8	Ta	MBLK		214607						
Acetone	67-64-1	Ta	MBLK		642477						
n-Pentane	109-66-0	Ta	MBLK		95213						
Isopropanol	67-63-0	Ta	MBLK		191230						
1,1-Dichloroethene	75-35-4	Ta	MBLK								
t-Butyl alcohol	75-65-0	Ta	MBLK		57023						
1,1,2-Trichloro-1,2,2-trifluoroethane (	76-13-1	Ta	MBLK		88881						
3-Chloropropene	107-05-1	Ta	MBLK								
Methylene Chloride (Dichloromethan	75-09-2	Ta	MBLK		235872						
Carbon Disulfide	75-65-0	Ta	MBLK		103633						
trans-1,2-Dichloroethene	156-60-5	Ta	MBLK								
Methyl-t-butyll ether (MTBE)	1634-04-4	Ta	MBLK								
Vinyl Acetate	108-05-4	Ta	MBLK		48812						
1,1-Dichloroethane	75-34-3	Ta	MBLK								
2-Butanone (MEK)	78-93-3	Ta	MBLK		38959						
Hexane	110-54-3	Ta	MBLK		42401						
cis-1,2-Dichloroethene	156-59-2	Ta	MBLK								
Ethyl Acetate	141-78-6	Ta	MBLK		146166						
Chloroform	540-36-3	Ta	MBLK						#VALUE!		

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Washington River Protection Solution

Richland, WA 99352
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Tetrahydrofuran	67-66-3	Ta	MBLK		37020						
1,4-Difluorobenzene	71-55-6	Int. Std	MBLK	9.903	65586220	10.0	10.0	46.7			
1,1,1-Trichloroethane	71-55-6	Ta	MBLK								
1,2-Dichloroethane-d4	17060-07-0	QA/Surr	MBLK	9.344	14300678	10.0	9.95	41.9			
1,2-Dichloroethane	107-06-2	Ta	MBLK								
Benzene	71-43-2	Ta	MBLK		1005558				#VALUE!		
Carbon Tetrachloride	56-23-5	Ta	MBLK								
Cyclohexane	110-82-7	Ta	MBLK								
2,2,4-Trimethylpentane	540-84-1	Ta	MBLK		67266						
Heptane	142-82-5	Ta	MBLK		23396						
Trichlorethylene	79-01-6	Ta	MBLK						#VALUE!		
1,2-Dichloropropane	78-87-5	Ta	MBLK								
Methylmethacrylate	80-62-6	Ta	MBLK		104310						
1,4-Dioxane	123-91-1	Ta	MBLK		55242						
Bromodichloromethane	75-27-4	Ta	MBLK								
Methyl isobutyl ketone (MIBK)	108-10-1	Ta	MBLK		50028						
cis-1,3-Dichloropropene	10061-01-5	Ta	MBLK								
trans-1,3-Dichloropropene	10061-02-6	Ta	MBLK								
Toluene-d8	2037-26-5	QA/Surr	MBLK	12.002	59010088	10.0	9.70	39.8	97.0		
Toluene	108-88-3	Ta	MBLK		179809						
1,1,2-Trichloroethane	79-00-5	Ta	MBLK								
2-Hexanone	591-78-6	Ta	MBLK								
Dibromochloromethane	124-48-1	Ta	MBLK								
Tetrachloroethylene	127-18-4	Ta	MBLK								
Chlorobenzene-d5	3114-55-4	Int. Std	MBLK	14.240	58128750	10.0	10.0	46.1			
1,2-Dibromoethane	106-93-4	Ta	MBLK								
Chlorobenzene	108-90-7	Ta	MBLK		48845						
Ethylbenzene	100-41-4	Ta	MBLK		99089						
m,p-Xylene	179601-23-1	Ta	MBLK		152828						
Nonane	111-84-2	Ta	MBLK		43095						
o-Xylene	95-47-6	Ta	MBLK		81459						
Styrene	100-42-5	Ta	MBLK		72909						
Bromoform	75-25-2	Ta	MBLK								
1,1,2,2-Tetrachloroethane	79-34-5	Ta	MBLK		58371						
Cumene	98-82-8	Ta	MBLK		84372				#VALUE!		
4-Bromofluorobenzene (BFB)	460-00-4	QA/Surr	MBLK	16.139	36431194	10.0	9.48	67.9			
n-Propylbenzene	103-65-1	Ta	MBLK								
2-Chlorotoluene	95-49-8	Ta	MBLK								
4-Ethyltoluene	622-96-8	Ta	MBLK								
1,3,5-Trimethylbenzene	108-67-8	Ta	MBLK		98964						
1,2,4-Trimethylbenzene	95-63-6	Ta	MBLK								
1,3-Dichlorobenzene	541-73-1	Ta	MBLK		104970						
Benzyl Chloride	100-44-7	Ta	MBLK		75719						
1,4-Dichlorobenzene	106-46-7	Ta	MBLK		108109						
1,2-Dichlorobenzene	95-50-1	Ta	MBLK		119020						
1,2,4-Trichlorobenzene	120-82-1	PIC	MBLK		368875						
Naphthalene	91-20-3	PIC	MBLK		947455						
Hexachloro-1,3-butadiene	87-68-3	PIC	MBLK		477438						

Analyte	CAS No.	QC Analyte Type	QC Sample Type	Ret. Time	Peak Area	Expected (ppbv)	Result (ppbv)	Result (ug/m3)	%REC	%RPD	Qualifier
Bromochloromethane	74-97-5	Int. Std	CCV2	8.522	12310376	10.0	10.0	52.9	100		

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Propene	115-07-1	Ta	CCV2	3.331	4898197	10.5	13.7	23.6	131		R
Dichlorodifluoromethane (F12)	75-71-8	Ta	CCV2	3.397	13517090	10.1	13.5	66.7	133		R
Chloromethane	74-87-3	Ta	CCV2	3.712	4941811	10.1	12.5	25.8	124		
1,2-Dichloro-tetrafluoroethane	76-14-2	Ta	CCV2	3.615	6807144	10.2	13.2	92.0	129		
Chloroethene	75-01-4	Ta	CCV2	3.898	8472508	10.2	10.8	27.6	106		
1,3-Butadiene	106-99-0	Ta	CCV2	3.965	4236659	10.2	7.86	17.4	77.1		
n-Butane	106-97-8	Ta	CCV2	3.890	8623844	10.4	10.8	25.8	104		
Bromomethane	74-83-9	Ta	CCV2	4.471	3752848	9.90	4.61	17.9	46.6		R
Chloroethane	75-00-3	Ta	CCV2	4.639	3960737	9.90	10.6	27.8	107		
Ethanol	64-17-5	Ta	CCV2	5.253	1541204	10.6	7.95	15.0	75.0		
Vinylbromide	593-60-2	Ta	CCV2	4.938	9875360	10.8	11.4	49.8	105		
Trichlorofluoromethane	75-69-4	Ta	CCV2	5.051	25030199	10.4	11.7	65.5	112		
Acrolein	107-02-8	Ta	CCV2	5.651	1698011	10.1	8.40	19.3	83.2		
Acetone	67-64-1	Ta	CCV2	5.842	4404600	10.5	11.2	26.5	106		
n-Pentane	109-66-0	Ta	CCV2	5.164	9756819	10.2	11.6	34.3	114		
Isopropanol	67-63-0	Ta	CCV2	6.007	7737344	11.0	9.43	23.2	85.7		
1,1-Dichloroethene	75-35-4	Ta	CCV2	5.805	11465330	10.2	11.5	45.5	113		
t-Butyl alcohol	75-65-0	Ta	CCV2	6.586	15780941	11.7	13.8	42.0	118		
1,1,2-Trichloro-1,2,2-trifluoroethane (	76-13-1	Ta	CCV2	5.810	22769967	10.0	12.5	95.8	125		
3-Chloropropene	107-05-1	Ta	CCV2	6.304	3703418	10.8	9.21	28.8	85.3		
Methylene Chloride (Dichloromethan	75-09-2	Ta	CCV2	6.475	6231448	10.2	11.4	39.7	112		
Carbon Disulfide	75-65-0	Ta	CCV2	6.173	21114864	10.2	9.70	30.2	95.1		
trans-1,2-Dichloroethene	156-60-5	Ta	CCV2	6.857	16262969	10.0	8.93	35.4	89.3		
Methyl-t-butyll ether (MTBE)	1634-04-4	Ta	CCV2	6.848	35879112	10.2	9.03	32.6	88.5		
Vinyl Acetate	108-05-4	Ta	CCV2	7.390	15026721	11.0	11.8	41.6	107		
1,1-Dichloroethane	75-34-3	Ta	CCV2	7.444	26702291	10.1	11.9	48.3	118		
2-Butanone (MEK)	78-93-3	Ta	CCV2	8.148	3782271	10.4	13.0	38.3	125		
Hexane	110-54-3	Ta	CCV2	7.202	23441609	10.2	11.9	42.1	117		
cis-1,2-Dichloroethene	156-59-2	Ta	CCV2	6.856	15823565	10.4	10.3	40.9	99.1		
Ethyl Acetate	141-78-6	Ta	CCV2	8.158	22615996	10.0	11.2	40.2	112		
Chloroform	540-36-3	Ta	CCV2	8.617	13377470	10.0	11.9	62.7	119		
Tetrahydrofuran	67-66-3	Ta	CCV2	8.564	5738540	10.3	11.7	57.1	113		
1,4-Difluorobenzene	71-55-6	Int. Std	CCV2	9.877	62417548	10.0	10.0	46.7	100		
1,1,1-Trichloroethane	71-55-6	Ta	CCV2	8.901	14993477	10.2	9.91	54.1	97.2		
1,2-Dichloroethane-d4	17060-07-0	QA/Surr	CCV2	9.318	13133913	10.0	9.60	40.5	96.0		
1,2-Dichloroethane	107-06-2	Ta	CCV2	9.423	7631220	10.3	10.2	41.4	99.2		
Benzene	71-43-2	Ta	CCV2	9.380	24021051	10.4	9.83	31.4	94.5		
Carbon Tetrachloride	56-23-5	Ta	CCV2	9.123	16211049	10.4	11.2	70.2	107		
Cyclohexane	110-82-7	Ta	CCV2	9.023	11038531	10.3	9.89	34.1	96.0		
2,2,4-Trimethylpentane	540-84-1	Ta	CCV2	9.480	31906835	10.6	10.9	51.1	103		
Heptane	142-82-5	Ta	CCV2	9.677	10469035	10.4	7.70	31.6	74.0		
Trichlorethylene	79-01-6	Ta	CCV2	10.244	12327611	10.3	10.3	55.2	99.7		
1,2-Dichloropropane	78-87-5	Ta	CCV2	10.616	8017833	10.4	10.7	49.7	103		
Methylmethacrylate	80-62-6	Ta	CCV2	10.575	11534749	10.1	10.6	43.3	105		
1,4-Dioxane	123-91-1	Ta	CCV2	10.688	6589601	10.3	10.0	36.1	97.1		
Bromodichloromethane	75-27-4	Ta	CCV2	10.947	15323000	10.3	10.9	72.7	105		
Methyl isobutyl ketone (MIBK)	108-10-1	Ta	CCV2	11.704	16613335	10.1	11.0	44.9	109		
cis-1,3-Dichloropropene	10061-01-5	Ta	CCV2	11.553	13526857	11.0	12.4	56.3	113		
trans-1,3-Dichloropropene	10061-02-6	Ta	CCV2	12.351	11926233	10.9	12.3	55.7	112		
Toluene-d8	2037-26-5	QA/Surr	CCV2	11.972	57263429	10.0	9.90	40.6	99.0		
Toluene	108-88-3	Ta	CCV2	12.076	32926829	10.5	10.5	39.6	100		
1,1,2-Trichloroethane	79-00-5	Ta	CCV2	12.671	10402628	10.4	10.5	57.5	101		
2-Hexanone	591-78-6	Ta	CCV2	12.919	17587757	10.7	12.5	56.3	117		

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QUALITY CONTROL REPORT
EPA Compendium Method TO-17-Modified
Electrostatic Precipitator Plates

Washington River Protection Solution

Richland, WA 99352
Attn: George Weeks

RJ Lee Group Project: W605131
Samples Received: 5/26/2016
Analysis Date: 6/1/2016
Report Date: 6/13/2016
Sampling Date:
Purchase Order No.:
Client Project:

Dibromochloromethane	124-48-1	Ta	CCV2	13.292	18455046	10.7	11.7	100.0	110		
Tetrachloroethylene	127-18-4	Ta	CCV2	12.863	17461105	10.2	10.3	69.8	101		
Chlorobenzene-d5	3114-55-4	Int. Std	CCV2	14.211	55768387	10.0	10.0	46.1	100		
1,2-Dibromoethane	106-93-4	Ta	CCV2	13.521	16483504	10.4	11.8	90.4	113		
Chlorobenzene	108-90-7	Ta	CCV2	14.261	27996301	10.5	10.5	48.5	100		
Ethylbenzene	100-41-4	Ta	CCV2	14.369	44972851	10.5	12.0	52.1	114		
m,p-Xylene	179601-23-1	Ta	CCV2	14.567	69289476	20.4	24.9	108	122		
Nonane	111-84-2	Ta	CCV2	14.512	19533378	10.5	9.27	48.6	88.3		
o-Xylene	95-47-6	Ta	CCV2	15.203	35793155	10.5	11.1	48.3	106		
Styrene	100-42-5	Ta	CCV2	15.227	30237745	10.5	11.2	47.6	106		
Bromoform	75-25-2	Ta	CCV2	15.584	20175203	10.2	11.4	117	111		
1,1,2,2-Tetrachloroethane	79-34-5	Ta	CCV2	16.250	24016806	10.5	10.8	74.0	103		
Cumene	98-82-8	Ta	CCV2	15.781	52135719	10.4	11.0	54.1	106		
4-Bromofluorobenzene (BFB)	460-00-4	QA/Surr	CCV2	16.108	38174353	10.0	10.4	74.1	104		
n-Propylbenzene	103-65-1	Ta	CCV2	16.471	15449437	10.3	9.45	46.5	91.7		
2-Chlorotoluene	95-49-8	Ta	CCV2	16.671	14261365	10.8	10.2	52.7	94.3		
4-Ethyltoluene	622-96-8	Ta	CCV2	16.664	15706016	10.1	8.99	44.2	89.0		
1,3,5-Trimethylbenzene	108-67-8	Ta	CCV2	16.747	42943998	10.2	9.41	46.3	92.3		
1,2,4-Trimethylbenzene	95-63-6	Ta	CCV2	17.394	21293037	10.2	10.5	51.7	103		
1,3-Dichlorobenzene	541-73-1	Ta	CCV2	17.939	30501107	10.3	9.82	59.1	95.3		
Benzyl Chloride	100-44-7	Ta	CCV2	18.270	38203274	10.3	10.3	53.1	99.6		
1,4-Dichlorobenzene	106-46-7	Ta	CCV2	18.107	30533314	10.1	9.84	59.2	97.4		
1,2-Dichlorobenzene	95-50-1	Ta	CCV2	18.729	29075017	10.1	10.3	61.9	102		
1,2,4-Trichlorobenzene	120-82-1	PIC	CCV2	21.480	27181676	9.70	11.2	82.9	115		Z
Naphthalene	91-20-3	PIC	CCV2	21.991	67919652	10.5	15.3	80.1	146		Z
Hexachloro-1,3-butadiene	87-68-3	PIC	CCV2	21.694	22120346	9.80	16.1	171	164		Z

Analyte	CAS No.	QC Sample ID		Ret. Time	Peak Area	Expected (ppbv)	Result (ppbv)	Result (ug/m3)	%REC	%RPD	Qualifier
Bromochloromethane	74-97-5	Int. Std	MBLK2	8.531	14045657	10.0	10.0	52.9	100		
Propene	115-07-1	Ta	MBLK2		294344						
Dichlorodifluoromethane (F12)	75-71-8	Ta	MBLK2		302574						
Chloromethane	74-87-3	Ta	MBLK2		69658						
1,2-Dichloro-tetrafluoroethane	76-14-2	Ta	MBLK2		14947						
Chloroethene	75-01-4	Ta	MBLK2								
1,3-Butadiene	106-99-0	Ta	MBLK2								
n-Butane	106-97-8	Ta	MBLK2								
Bromomethane	74-83-9	Ta	MBLK2		88974						
Chloroethane	75-00-3	Ta	MBLK2		34090						
Ethanol	64-17-5	Ta	MBLK2		116591						
Vinylbromide	593-60-2	Ta	MBLK2								
Trichlorofluoromethane	75-69-4	Ta	MBLK2								
Acrolein	107-02-8	Ta	MBLK2		226270						
Acetone	67-64-1	Ta	MBLK2		338132						
n-Pentane	109-66-0	Ta	MBLK2		91766						
Isopropanol	67-63-0	Ta	MBLK2		110273						
1,1-Dichloroethene	75-35-4	Ta	MBLK2								
t-Butyl alcohol	75-65-0	Ta	MBLK2		65965						
1,1,2-Trichloro-1,2,2-trifluoroethane (	76-13-1	Ta	MBLK2								
3-Chloropropene	107-05-1	Ta	MBLK2								
Methylene Chloride (Dichloromethan	75-09-2	Ta	MBLK2		219898						
Carbon Disulfide	75-65-0	Ta	MBLK2		105956						

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QUALITY CONTROL REPORT
EPA Compendium Method TO-17-Modified
Electrostatic Precipitator Plates

Washington River Protection Solution

Richland, WA 99352
Attn: George Weeks

RJ Lee Group Project: W605131
Samples Received: 5/26/2016
Analysis Date: 6/1/2016
Report Date: 6/13/2016
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Client Project:

trans-1,2-Dichloroethene	156-60-5	Ta	MBLK2								
Methyl-t-butyll ether (MTBE)	1634-04-4	Ta	MBLK2		56574						
Vinyl Acetate	108-05-4	Ta	MBLK2								
1,1-Dichloroethane	75-34-3	Ta	MBLK2		34944						
2-Butanone (MEK)	78-93-3	Ta	MBLK2								
Hexane	110-54-3	Ta	MBLK2		134619						
cis-1,2-Dichloroethene	156-59-2	Ta	MBLK2								
Ethyl Acetate	141-78-6	Ta	MBLK2		116451						
Chloroform	540-36-3	Ta	MBLK2						#VALUE!		
Tetrahydrofuran	67-66-3	Ta	MBLK2								
1,4-Difluorobenzene	71-55-6	Int. Std	MBLK2	9.880	62904747	10.0	10.0	46.7			
1,1,1-Trichloroethane	71-55-6	Ta	MBLK2								
1,2-Dichloroethane-d4	17060-07-0	QA/Surr	MBLK2	9.321	13534911	10.0	9.82	41.4			
1,2-Dichloroethane	107-06-2	Ta	MBLK2								
Benzene	71-43-2	Ta	MBLK2		245779				#VALUE!		
Carbon Tetrachloride	56-23-5	Ta	MBLK2								
Cyclohexane	110-82-7	Ta	MBLK2								
2,2,4-Trimethylpentane	540-84-1	Ta	MBLK2		59872						
Heptane	142-82-5	Ta	MBLK2		129958						
Trichlorethylene	79-01-6	Ta	MBLK2						#VALUE!		
1,2-Dichloropropane	78-87-5	Ta	MBLK2								
Methylmethacrylate	80-62-6	Ta	MBLK2		102484						
1,4-Dioxane	123-91-1	Ta	MBLK2								
Bromodichloromethane	75-27-4	Ta	MBLK2								
Methyl isobutyl ketone (MIBK)	108-10-1	Ta	MBLK2		78826						
cis-1,3-Dichloropropene	10061-01-5	Ta	MBLK2								
trans-1,3-Dichloropropene	10061-02-6	Ta	MBLK2		32495						
Toluene-d8	2037-26-5	QA/Surr	MBLK2	11.973	60173151	10.0	10.3	42.3	103		
Toluene	108-88-3	Ta	MBLK2		262305						
1,1,2-Trichloroethane	79-00-5	Ta	MBLK2								
2-Hexanone	591-78-6	Ta	MBLK2		181731						
Dibromochloromethane	124-48-1	Ta	MBLK2								
Tetrachloroethylene	127-18-4	Ta	MBLK2		90326						
Chlorobenzene-d5	3114-55-4	Int. Std	MBLK2	14.205	55926118	10.0	10.0	46.1			
1,2-Dibromoethane	106-93-4	Ta	MBLK2		40001						
Chlorobenzene	108-90-7	Ta	MBLK2		314330						
Ethylbenzene	100-41-4	Ta	MBLK2		749035						
m,p-Xylene	179601-23-1	Ta	MBLK2		1202749						
Nonane	111-84-2	Ta	MBLK2		199130						
o-Xylene	95-47-6	Ta	MBLK2		341615						
Styrene	100-42-5	Ta	MBLK2		861265						
Bromoform	75-25-2	Ta	MBLK2								
1,1,2,2-Tetrachloroethane	79-34-5	Ta	MBLK2		100401						
Cumene	98-82-8	Ta	MBLK2		270381				#VALUE!		
4-Bromofluorobenzene (BFB)	460-00-4	QA/Surr	MBLK2	16.089	35701258	10.0	9.65	69.1			
n-Propylbenzene	103-65-1	Ta	MBLK2		234683						
2-Chlorotoluene	95-49-8	Ta	MBLK2		175012						
4-Ethyltoluene	622-96-8	Ta	MBLK2		155241						
1,3,5-Trimethylbenzene	108-67-8	Ta	MBLK2								
1,2,4-Trimethylbenzene	95-63-6	Ta	MBLK2		149591						
1,3-Dichlorobenzene	541-73-1	Ta	MBLK2		527968						
Benzyl Chloride	100-44-7	Ta	MBLK2		306075						
1,4-Dichlorobenzene	106-46-7	Ta	MBLK2		498128						

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QUALITY CONTROL REPORT
EPA Compendium Method TO-17-Modified
Electrostatic Precipitator Plates

Washington River Protection Solution

Richland, WA 99352
Attn: George Weeks

RJ Lee Group Project:	W605131
Samples Received:	5/26/2016
Analysis Date:	6/1/2016
Report Date:	6/13/2016
Sampling Date:	
Purchase Order No.:	
Client Project:	

1,2-Dichlorobenzene	95-50-1	Ta	MBLK2		393458					
1,2,4-Trichlorobenzene	120-82-1	PIC	MBLK2		598448					
Naphthalene	91-20-3	PIC	MBLK2		1882407					
Hexachloro-1,3-butadiene	87-68-3	PIC	MBLK2		362127					

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LABORATORY REPORT
EPA Compendium Method TO-17-Modified
Electrostatic Precipitator Plates

Client:	Washington River Protection Soh	RJ Lee Group Project:	W605131
Address:		Samples Received:	05/26/16
	Richland, WA 99352	Analysis Date:	06/02/16
Attention:	Attn: George Weeks	Report Date:	06/13/16
Telephone:		Sampling Date:	05/25/16
e-mail:		Purchase Order No.:	
		Client Project:	GAL601096

Sample ID				CAS			QC %	Reporting Limit		
Client	RJLG	Medium ID	Analyte	Number	Matrix	Type	REC	(ng)	Result (ng)	Qualifier
20160525-mACE-AP-2	W605131-07		Bromochloromethane	74-97-5	EP-Plate	Int. Std		1.1	52.9	
20160525-mACE-AP-2	W605131-07		Propene	115-07-1	EP-Plate	Ta		0.34	< 0.34	rB
20160525-mACE-AP-2	W605131-07		Dichlorodifluoromethane (F12)	75-71-8	EP-Plate	Ta		0.99	< 0.99	
20160525-mACE-AP-2	W605131-07		Chloromethane	74-87-3	EP-Plate	Ta		0.41	< 0.41	
20160525-mACE-AP-2	W605131-07		1,2-Dichloro-tetrarfluoroethane	76-14-2	EP-Plate	Ta		1.4	< 1.4	
20160525-mACE-AP-2	W605131-07		Chloroethene	75-01-4	EP-Plate	Ta		0.51	< 0.51	
20160525-mACE-AP-2	W605131-07		1,3-Butadiene	106-99-0	EP-Plate	Ta		0.44	< 0.44	
20160525-mACE-AP-2	W605131-07		n-Butane	106-97-8	EP-Plate	Ta		0.48	< 0.48	
20160525-mACE-AP-2	W605131-07		Bromomethane	74-83-9	EP-Plate	Ta		0.78	< 0.78	
20160525-mACE-AP-2	W605131-07		Chloroethane	75-00-3	EP-Plate	Ta		0.53	< 0.53	
20160525-mACE-AP-2	W605131-07		Ethanol	64-17-5	EP-Plate	Ta		0.38	2.75	r
20160525-mACE-AP-2	W605131-07		Vinylbromide	593-60-2	EP-Plate	Ta		0.88	< 0.88	
20160525-mACE-AP-2	W605131-07		Trichlorofluoromethane	75-69-4	EP-Plate	Ta		1.1	< 1.1	
20160525-mACE-AP-2	W605131-07		Acrolein	107-02-8	EP-Plate	Ta		0.46	< 0.46	r
20160525-mACE-AP-2	W605131-07		Acetone	67-64-1	EP-Plate	Ta		0.48	4.18	r
20160525-mACE-AP-2	W605131-07		n-Pentane	109-66-0	EP-Plate	Ta		0.59	< 0.59	
20160525-mACE-AP-2	W605131-07		Isopropanol	67-63-0	EP-Plate	Ta		0.49	< 0.49	
20160525-mACE-AP-2	W605131-07		1,1-Dichloroethene	75-35-4	EP-Plate	Ta		0.79	< 0.79	
20160525-mACE-AP-2	W605131-07		t-Butyl alcohol	75-65-0	EP-Plate	Ta		0.61	< 0.61	
20160525-mACE-AP-2	W605131-07		1,1,2-Trichloro-1,2,2-trifluoroethane (	76-13-1	EP-Plate	Ta		1.5	< 1.5	
20160525-mACE-AP-2	W605131-07		3-Chloropropene	107-05-1	EP-Plate	Ta		0.63	< 0.63	
20160525-mACE-AP-2	W605131-07		Methylene Chloride (Dichloromethane)	75-09-2	EP-Plate	Ta		0.70	< 0.70	
20160525-mACE-AP-2	W605131-07		Carbon Disulfide	75-65-0	EP-Plate	Ta		0.62	< 0.62	
20160525-mACE-AP-2	W605131-07		trans-1,2-Dichloroethene	156-60-5	EP-Plate	Ta		0.79	< 0.79	R
20160525-mACE-AP-2	W605131-07		Methyl-t-butyll ether (MTBE)	1634-04-4	EP-Plate	Ta		0.72	< 0.72	R

Sample ID										
Client	RJLG	Medium ID	Analyte	CAS Number	Matrix	Type	QC % REC	Reporting Limit (ng)	Result (ng)	Qualifier
20160525-mACE-AP-2	W605131-07		Vinyl Acetate	108-05-4	EP-Plate	Ta		0.70	< 0.70	R
20160525-mACE-AP-2	W605131-07		1,1-Dichloroethane	75-34-3	EP-Plate	Ta		0.81	< 0.81	
20160525-mACE-AP-2	W605131-07		2-Butanone (MEK)	78-93-3	EP-Plate	Ta		0.59	< 0.59	
20160525-mACE-AP-2	W605131-07		Hexane	110-54-3	EP-Plate	Ta		0.71	< 0.71	R
20160525-mACE-AP-2	W605131-07		cis-1,2-Dichloroethene	156-59-2	EP-Plate	Ta		0.79	< 0.79	R
20160525-mACE-AP-2	W605131-07		Ethyl Acetate	141-78-6	EP-Plate	Ta		0.72	< 0.72	
20160525-mACE-AP-2	W605131-07		Chloroform	540-36-3	EP-Plate	Ta		1.1	< 1.1	
20160525-mACE-AP-2	W605131-07		Tetrahydrofuran	67-66-3	EP-Plate	Ta		0.98	< 0.98	
20160525-mACE-AP-2	W605131-07		1,4-Difluorobenzene	71-55-6	EP-Plate	Int. Std		0.93	46.7	
20160525-mACE-AP-2	W605131-07		1,1,1-Trichloroethane	71-55-6	EP-Plate	Ta		1.1	< 1.1	
20160525-mACE-AP-2	W605131-07		1,2-Dichloroethane-d4	17060-07-0	EP-Plate	QA/Surr	99.6	0.84	42.0	
20160525-mACE-AP-2	W605131-07		1,2-Dichloroethane	107-06-2	EP-Plate	Ta		0.81	< 0.81	
20160525-mACE-AP-2	W605131-07		Benzene	71-43-2	EP-Plate	Ta		0.64	< 0.64	
20160525-mACE-AP-2	W605131-07		Carbon Tetrachloride	56-23-5	EP-Plate	Ta		1.3	< 1.3	
20160525-mACE-AP-2	W605131-07		Cyclohexane	110-82-7	EP-Plate	Ta		0.69	< 0.69	
20160525-mACE-AP-2	W605131-07		2,2,4-Trimethylpentane	540-84-1	EP-Plate	Ta		0.93	< 0.93	
20160525-mACE-AP-2	W605131-07		Heptane	142-82-5	EP-Plate	Ta		0.82	< 0.82	R
20160525-mACE-AP-2	W605131-07		Trichlorethylene	79-01-6	EP-Plate	Ta		1.1	< 1.1	
20160525-mACE-AP-2	W605131-07		1,2-Dichloropropane	78-87-5	EP-Plate	Ta		0.92	< 0.92	
20160525-mACE-AP-2	W605131-07		Methylmethacrylate	80-62-6	EP-Plate	Ta		0.82	< 0.82	
20160525-mACE-AP-2	W605131-07		1,4-Dioxane	123-91-1	EP-Plate	Ta		0.72	< 0.72	
20160525-mACE-AP-2	W605131-07		Bromodichloromethane	75-27-4	EP-Plate	Ta		1.3	< 1.3	
20160525-mACE-AP-2	W605131-07		Methyl isobutyl ketone (MIBK)	108-10-1	EP-Plate	Ta		0.82	< 0.82	
20160525-mACE-AP-2	W605131-07		cis-1,3-Dichloropropene	10061-01-5	EP-Plate	Ta		0.91	< 0.91	
20160525-mACE-AP-2	W605131-07		trans-1,3-Dichloropropene	10061-02-6	EP-Plate	Ta		0.91	< 0.91	
20160525-mACE-AP-2	W605131-07		Toluene-d8	2037-26-5	EP-Plate	QA/Surr	96.1	0.82	39.4	
20160525-mACE-AP-2	W605131-07		Toluene	108-88-3	EP-Plate	Ta		0.75	< 0.75	r
20160525-mACE-AP-2	W605131-07		1,1,2-Trichloroethane	79-00-5	EP-Plate	Ta		1.1	< 1.1	
20160525-mACE-AP-2	W605131-07		2-Hexanone	591-78-6	EP-Plate	Ta		0.90	< 0.90	
20160525-mACE-AP-2	W605131-07		Dibromochloromethane	124-48-1	EP-Plate	Ta		1.7	< 1.7	
20160525-mACE-AP-2	W605131-07		Tetrachloroethylene	127-18-4	EP-Plate	Ta		1.4	< 1.4	
20160525-mACE-AP-2	W605131-07		Chlorobenzene-d5	3114-55-4	EP-Plate	Int. Std		0.92	46.1	
20160525-mACE-AP-2	W605131-07		1,2-Dibromoethane	106-93-4	EP-Plate	Ta		1.5	< 1.5	
20160525-mACE-AP-2	W605131-07		Chlorobenzene	108-90-7	EP-Plate	Ta		0.92	< 0.92	
20160525-mACE-AP-2	W605131-07		Ethylbenzene	100-41-4	EP-Plate	Ta		0.87	< 0.87	r

Sample ID				CAS				Reporting		
Client	RJLG	Medium ID	Analyte	Number	Matrix	Type	QC % REC	Limit (ng)	Result (ng)	Qualifier
20160525-mACE-AP-2	W605131-07		m,p-Xylene	179601-23-1	EP-Plate	Ta		0.87	**< 0.87**	**Rr**
20160525-mACE-AP-2	W605131-07		Nonane	111-84-2	EP-Plate	Ta		1.0	**< 1.0**	**Rr**
20160525-mACE-AP-2	W605131-07		o-Xylene	95-47-6	EP-Plate	Ta		0.87	**< 0.87**	**R**
20160525-mACE-AP-2	W605131-07		Styrene	100-42-5	EP-Plate	Ta		0.85	**< 0.85**	**R**
20160525-mACE-AP-2	W605131-07		Bromoform	75-25-2	EP-Plate	Ta		2.1	**< 2.1**	
20160525-mACE-AP-2	W605131-07		1,1,2,2-Tetrachloroethane	79-34-5	EP-Plate	Ta		1.4	**< 1.4**	**R**
20160525-mACE-AP-2	W605131-07		Cumene	98-82-8	EP-Plate	Ta		0.98	**< 0.98**	**R**
20160525-mACE-AP-2	W605131-07		4-Bromofluorobenzene (BFB)	460-00-4	EP-Plate	QA/Surr	114	1.4	**81.6**	
20160525-mACE-AP-2	W605131-07		n-Propylbenzene	103-65-1	EP-Plate	Ta		0.98	**< 0.98**	**Rr**
20160525-mACE-AP-2	W605131-07		2-Chlorotoluene	95-49-8	EP-Plate	Ta		1.0	**< 1.0**	**R**
20160525-mACE-AP-2	W605131-07		4-Ethyltoluene	622-96-8	EP-Plate	Ta		0.98	**< 0.98**	**Rr**
20160525-mACE-AP-2	W605131-07		1,3,5-Trimethylbenzene	108-67-8	EP-Plate	Ta		0.98	**< 0.98**	**Rr**
20160525-mACE-AP-2	W605131-07		1,2,4-Trimethylbenzene	95-63-6	EP-Plate	Ta		0.98	**< 0.98**	**Rr**
20160525-mACE-AP-2	W605131-07		1,3-Dichlorobenzene	541-73-1	EP-Plate	Ta		1.2	**< 1.2**	**RrB**
20160525-mACE-AP-2	W605131-07		Benzyl Chloride	100-44-7	EP-Plate	Ta		1.0	**< 1.0**	**RrB**
20160525-mACE-AP-2	W605131-07		1,4-Dichlorobenzene	106-46-7	EP-Plate	Ta		1.2	**< 1.2**	**RrB**
20160525-mACE-AP-2	W605131-07		1,2-Dichlorobenzene	95-50-1	EP-Plate	Ta		1.2	**< 1.2**	**RrB**
20160525-mACE-AP-2	W605131-07		1,2,4-Trichlorobenzene	120-82-1	EP-Plate	PIC		1.5	**< 1.5**	**Z**
20160525-mACE-AP-2	W605131-07		Naphthalene	91-20-3	EP-Plate	PIC		1.0	**< 1.0**	**Z**
20160525-mACE-AP-2	W605131-07		Hexachloro-1,3-butadiene	87-68-3	EP-Plate	PIC		2.1	**< 2.1**	**Z**

Sample ID Client	RJLG	Medium ID	Analyte	CAS Number	Matrix	Type	QC % REC	Reporting Limit (ng)	Result (ng)	Qualifier
			Tentatively Identified Compounds							
20160525-mACE-AP-2	W605131-07	0	1-Heptanol, 4-methyl-	817-91-4	EP-Plate	TIC		1.1	**21.5**	72,N,T
20160525-mACE-AP-2	W605131-07	0	Nonanal	124-19-6	EP-Plate	TIC		1.2	**9.82**	0,N,T
20160525-mACE-AP-2	W605131-07	0	1-Dodecene	112-41-4	EP-Plate	TIC		1.4	**42.1**	0,N,T
20160525-mACE-AP-2	W605131-07	0	4-Dodecene	2030-84-4	EP-Plate	TIC		1.4	**9.97**	0,N,T
20160525-mACE-AP-2	W605131-07	0	2-Decanone	693-54-9	EP-Plate	TIC		1.3	**19.1**	0,N,T
20160525-mACE-AP-2	W605131-07	0	5-Tridecene	6874-28-8	EP-Plate	TIC		1.5	**24.4**	0,N,T
20160525-mACE-AP-2	W605131-07	0	1-Tridecene	2437-56-1	EP-Plate	TIC		1.5	**64.0**	0,N,T
20160525-mACE-AP-2	W605131-07	0	6-Tridecene, (E)-	41446-57-5	EP-Plate	TIC		1.5	**23.8**	0,N,T
20160525-mACE-AP-2	W605131-07	0	3-Undecanone	2216-87-7	EP-Plate	TIC		1.4	**16.1**	0,N,T
20160525-mACE-AP-2	W605131-07	0	2-Undecanone	112-12-9	EP-Plate	TIC		1.4	**23.2**	0,N,T

Comments: Concentrations of the tentatively identified compounds is based on the comparison of peak area to that of the nearest internal standard.

ng = nanogram
ppbv = parts per billion volume
ug/m3 = micrograms per cubic meter

BDL = Below Detection Limit
N/A = Not Applicable

Qualifiers

B = Compound found in associated laboratory blank above the reporting limit.
D = Diluted sample
E = Report concentration was above the instrumental calibration range
I = Response failure of an internal standard; concentration should be considered an estimate
J = Concentration below reporting limit
N = Identification based on mass spectral library search
P = Library spectrum match, rsd >90% w RT match
Q = Qualitative results for non-target compounds
Ta = Target Analyte

R = Recovery failure in CCV or LCS.
S = Surrogate recovery failure
T = Compound is tentatively identified compound. Includes chemical library matches & chemist identified compounds.
X = Detected but not quantifiable
c = Sample RPD failure
d= Data that exceeds the %RSD criteria set by the method (70-130%)
PIC = Positively identified compound, for non-calibrated compounds
r = Recovery failure in MRL
Z = Positively Identified Compound; Quanlitative data only

Authorized Signature:
Laboratory Technical Manager - Dr. Joe Sears

Date: 06/13/16

RJ LEE GROUP
DELIVERING SCIENTIFIC RESOLUTION

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LABORATORY REPORT

EPA Compendium Method TO-17-Modified
Electrostatic Precipitator Plates

Client: Washington River Protection Solutions
Address: Richland, WA 99352
Attention: Attn: George Weeks
Telephone:
Fax:

RJ Lee Group Project: W605131
Samples Received: 05/26/16
Analysis Prep/Date: 06/02/16
Report Date: 06/13/16
Sampling Date: 05/25/16
CACN: 0
Client Project: GAL601096

Sample ID										
Client	RJLG	Medium ID	Analyte	CAS Number	Matrix	Type	QC % REC	Reporting Limit (ng)	Result (ng)	Qualifier
20160525-ACE-AP-U-2	W605131-08		Bromochloromethane	74-97-5	EP-Plate	Int. Std		1.1	52.9	
20160525-ACE-AP-U-2	W605131-08		Propene	115-07-1	EP-Plate	Ta		0.34	0.878	rB
20160525-ACE-AP-U-2	W605131-08		Dichlorodifluoromethane (F12)	75-71-8	EP-Plate	Ta		0.99	< 0.99	
20160525-ACE-AP-U-2	W605131-08		Chloromethane	74-87-3	EP-Plate	Ta		0.41	< 0.41	
20160525-ACE-AP-U-2	W605131-08		1,2-Dichloro-tetrafluoroethane	76-14-2	EP-Plate	Ta		1.4	< 1.4	
20160525-ACE-AP-U-2	W605131-08		Chloroethene	75-01-4	EP-Plate	Ta		0.51	< 0.51	
20160525-ACE-AP-U-2	W605131-08		1,3-Butadiene	106-99-0	EP-Plate	Ta		0.44	< 0.44	
20160525-ACE-AP-U-2	W605131-08		n-Butane	106-97-8	EP-Plate	Ta		0.48	< 0.48	
20160525-ACE-AP-U-2	W605131-08		Bromomethane	74-83-9	EP-Plate	Ta		0.78	< 0.78	
20160525-ACE-AP-U-2	W605131-08		Chloroethane	75-00-3	EP-Plate	Ta		0.53	< 0.53	
20160525-ACE-AP-U-2	W605131-08		Ethanol	64-17-5	EP-Plate	Ta		0.38	1.23	r
20160525-ACE-AP-U-2	W605131-08		Vinylbromide	593-60-2	EP-Plate	Ta		0.88	< 0.88	
20160525-ACE-AP-U-2	W605131-08		Trichlorofluoromethane	75-69-4	EP-Plate	Ta		1.1	< 1.1	
20160525-ACE-AP-U-2	W605131-08		Acrolein	107-02-8	EP-Plate	Ta		0.46	1.81	r
20160525-ACE-AP-U-2	W605131-08		Acetone	67-64-1	EP-Plate	Ta		0.48	12.0	r
20160525-ACE-AP-U-2	W605131-08		n-Pentane	109-66-0	EP-Plate	Ta		0.59	< 0.59	
20160525-ACE-AP-U-2	W605131-08		Isopropanol	67-63-0	EP-Plate	Ta		0.49	< 0.49	
20160525-ACE-AP-U-2	W605131-08		1,1-Dichloroethene	75-35-4	EP-Plate	Ta		0.79	< 0.79	
20160525-ACE-AP-U-2	W605131-08		t-Butyl alcohol	75-65-0	EP-Plate	Ta		0.61	< 0.61	
20160525-ACE-AP-U-2	W605131-08		1,1,2-Trichloro-1,2,2-trifluoroethane (	76-13-1	EP-Plate	Ta		1.5	< 1.5	
20160525-ACE-AP-U-2	W605131-08		3-Chloropropene	107-05-1	EP-Plate	Ta		0.63	< 0.63	
20160525-ACE-AP-U-2	W605131-08		Methylene Chloride (Dichloromethane)	75-09-2	EP-Plate	Ta		0.70	< 0.70	
20160525-ACE-AP-U-2	W605131-08		Carbon Disulfide	75-65-0	EP-Plate	Ta		0.62	< 0.62	
20160525-ACE-AP-U-2	W605131-08		trans-1,2-Dichloroethene	156-60-5	EP-Plate	Ta		0.79	< 0.79	R
20160525-ACE-AP-U-2	W605131-08		Methyl-t-butyll ether (MTBE)	1634-04-4	EP-Plate	Ta		0.72	< 0.72	R
20160525-ACE-AP-U-2	W605131-08		Vinyl Acetate	108-05-4	EP-Plate	Ta		0.70	< 0.70	R
20160525-ACE-AP-U-2	W605131-08		1,1-Dichloroethane	75-34-3	EP-Plate	Ta		0.81	< 0.81	

Sample ID				CAS			QC %	Reporting Limit		
Client	RJLG	Medium ID	Analyte	Number	Matrix	Type	REC	(ng)	Result (ng)	Qualifier
20160525-ACE-AP-U-2	W605131-08		2-Butanone (MEK)	78-93-3	EP-Plate	Ta		0.59	< 0.59	
20160525-ACE-AP-U-2	W605131-08		Hexane	110-54-3	EP-Plate	Ta		0.71	< 0.71	R
20160525-ACE-AP-U-2	W605131-08		cis-1,2-Dichloroethene	156-59-2	EP-Plate	Ta		0.79	< 0.79	R
20160525-ACE-AP-U-2	W605131-08		Ethyl Acetate	141-78-6	EP-Plate	Ta		0.72	< 0.72	
20160525-ACE-AP-U-2	W605131-08		Chloroform	540-36-3	EP-Plate	Ta		1.1	< 1.1	
20160525-ACE-AP-U-2	W605131-08		Tetrahydrofuran	67-66-3	EP-Plate	Ta		0.98	< 0.98	
20160525-ACE-AP-U-2	W605131-08		1,4-Difluorobenzene	71-55-6	EP-Plate	Int. Std		0.93	46.7	
20160525-ACE-AP-U-2	W605131-08		1,1,1-Trichloroethane	71-55-6	EP-Plate	Ta		1.1	< 1.1	
20160525-ACE-AP-U-2	W605131-08		1,2-Dichloroethane-d4	17060-07-0	EP-Plate	QA/Surr	96.6	0.84	40.7	
20160525-ACE-AP-U-2	W605131-08		1,2-Dichloroethane	107-06-2	EP-Plate	Ta		0.81	< 0.81	
20160525-ACE-AP-U-2	W605131-08		Benzene	71-43-2	EP-Plate	Ta		0.64	1.63	
20160525-ACE-AP-U-2	W605131-08		Carbon Tetrachloride	56-23-5	EP-Plate	Ta		1.3	< 1.3	
20160525-ACE-AP-U-2	W605131-08		Cyclohexane	110-82-7	EP-Plate	Ta		0.69	< 0.69	
20160525-ACE-AP-U-2	W605131-08		2,2,4-Trimethylpentane	540-84-1	EP-Plate	Ta		0.93	< 0.93	
20160525-ACE-AP-U-2	W605131-08		Heptane	142-82-5	EP-Plate	Ta		0.82	< 0.82	R
20160525-ACE-AP-U-2	W605131-08		Trichlorethylene	79-01-6	EP-Plate	Ta		1.1	< 1.1	
20160525-ACE-AP-U-2	W605131-08		1,2-Dichloropropane	78-87-5	EP-Plate	Ta		0.92	< 0.92	
20160525-ACE-AP-U-2	W605131-08		Methylmethacrylate	80-62-6	EP-Plate	Ta		0.82	< 0.82	
20160525-ACE-AP-U-2	W605131-08		1,4-Dioxane	123-91-1	EP-Plate	Ta		0.72	< 0.72	
20160525-ACE-AP-U-2	W605131-08		Bromodichloromethane	75-27-4	EP-Plate	Ta		1.3	< 1.3	
20160525-ACE-AP-U-2	W605131-08		Methyl isobutyl ketone (MIBK)	108-10-1	EP-Plate	Ta		0.82	< 0.82	
20160525-ACE-AP-U-2	W605131-08		cis-1,3-Dichloropropene	10061-01-5	EP-Plate	Ta		0.91	< 0.91	
20160525-ACE-AP-U-2	W605131-08		trans-1,3-Dichloropropene	10061-02-6	EP-Plate	Ta		0.91	< 0.91	
20160525-ACE-AP-U-2	W605131-08		Toluene-d8	2037-26-5	EP-Plate	QA/Surr	96.2	0.82	39.4	
20160525-ACE-AP-U-2	W605131-08		Toluene	108-88-3	EP-Plate	Ta		0.75	< 0.75	r
20160525-ACE-AP-U-2	W605131-08		1,1,2-Trichloroethane	79-00-5	EP-Plate	Ta		1.1	< 1.1	
20160525-ACE-AP-U-2	W605131-08		2-Hexanone	591-78-6	EP-Plate	Ta		0.90	< 0.90	
20160525-ACE-AP-U-2	W605131-08		Dibromochloromethane	124-48-1	EP-Plate	Ta		1.7	< 1.7	
20160525-ACE-AP-U-2	W605131-08		Tetrachloroethylene	127-18-4	EP-Plate	Ta		1.4	< 1.4	
20160525-ACE-AP-U-2	W605131-08		Chlorobenzene-d5	3114-55-4	EP-Plate	Int. Std		0.92	46.1	
20160525-ACE-AP-U-2	W605131-08		1,2-Dibromoethane	106-93-4	EP-Plate	Ta		1.5	< 1.5	
20160525-ACE-AP-U-2	W605131-08		Chlorobenzene	108-90-7	EP-Plate	Ta		0.92	< 0.92	
20160525-ACE-AP-U-2	W605131-08		Ethylbenzene	100-41-4	EP-Plate	Ta		0.87	< 0.87	r
20160525-ACE-AP-U-2	W605131-08		m,p-Xylene	179601-23-1	EP-Plate	Ta		0.87	< 0.87	Rr
20160525-ACE-AP-U-2	W605131-08		Nonane	111-84-2	EP-Plate	Ta		1.0	< 1.0	Rr
20160525-ACE-AP-U-2	W605131-08		o-Xylene	95-47-6	EP-Plate	Ta		0.87	< 0.87	R

Sample ID										
Client	RJLG	Medium ID	Analyte	CAS Number	Matrix	Type	QC % REC	Reporting Limit (ng)	Result (ng)	Qualifier
20160525-ACE-AP-U-2	W605131-08		Styrene	100-42-5	EP-Plate	Ta		0.85	**< 0.85**	**R**
20160525-ACE-AP-U-2	W605131-08		Bromoform	75-25-2	EP-Plate	Ta		2.1	**< 2.1**	
20160525-ACE-AP-U-2	W605131-08		1,1,2,2-Tetrachloroethane	79-34-5	EP-Plate	Ta		1.4	**< 1.4**	**R**
20160525-ACE-AP-U-2	W605131-08		Cumene	98-82-8	EP-Plate	Ta		0.98	**< 0.98**	**R**
20160525-ACE-AP-U-2	W605131-08		4-Bromofluorobenzene (BFB)	460-00-4	EP-Plate	QA/Surr	96.4	1.4	**69.0**	
20160525-ACE-AP-U-2	W605131-08		n-Propylbenzene	103-65-1	EP-Plate	Ta		0.98	**< 0.98**	**Rr**
20160525-ACE-AP-U-2	W605131-08		2-Chlorotoluene	95-49-8	EP-Plate	Ta		1.0	**< 1.0**	**R**
20160525-ACE-AP-U-2	W605131-08		4-Ethyltoluene	622-96-8	EP-Plate	Ta		0.98	**< 0.98**	**Rr**
20160525-ACE-AP-U-2	W605131-08		1,3,5-Trimethylbenzene	108-67-8	EP-Plate	Ta		0.98	**< 0.98**	**Rr**
20160525-ACE-AP-U-2	W605131-08		1,2,4-Trimethylbenzene	95-63-6	EP-Plate	Ta		0.98	**< 0.98**	**Rr**
20160525-ACE-AP-U-2	W605131-08		1,3-Dichlorobenzene	541-73-1	EP-Plate	Ta		1.2	**< 1.2**	**RrB**
20160525-ACE-AP-U-2	W605131-08		Benzyl Chloride	100-44-7	EP-Plate	Ta		1.0	**< 1.0**	**RrB**
20160525-ACE-AP-U-2	W605131-08		1,4-Dichlorobenzene	106-46-7	EP-Plate	Ta		1.2	**< 1.2**	**RrB**
20160525-ACE-AP-U-2	W605131-08		1,2-Dichlorobenzene	95-50-1	EP-Plate	Ta		1.2	**< 1.2**	**RrB**
20160525-ACE-AP-U-2	W605131-08		1,2,4-Trichlorobenzene	120-82-1	EP-Plate	PIC		1.5	**4.68**	**Z**
20160525-ACE-AP-U-2	W605131-08		Naphthalene	91-20-3	EP-Plate	PIC		1.0	**< 1.0**	**Z**
20160525-ACE-AP-U-2	W605131-08		Hexachloro-1,3-butadiene	87-68-3	EP-Plate	PIC		2.1	**< 2.1**	**Z**

Client	Sample ID RJLG	Medium ID	Analyte	CAS Number	Matrix	Type	QC % REC	Reporting Limit (ng)	Result (ng)	Qualifier
			Tentatively Identified Compounds							
20160525-ACE-AP-U-2	W605131-08		Norflurane	811-97-2	EP-Plate	TIC		0.83	**2.90**	9,N,T
20160525-ACE-AP-U-2	W605131-08		Acetaldehyde	75-07-0	EP-Plate	TIC		0.36	**1.39**	64,N,T
20160525-ACE-AP-U-2	W605131-08		Pentane, 2-methyl-	107-83-5	EP-Plate	TIC		0.70	**4.15**	76,N,T
20160525-ACE-AP-U-2	W605131-08		Nonane	111-84-2	EP-Plate	TIC		1.0	**3.01**	95,N,T
20160525-ACE-AP-U-2	W605131-08		2-Undecanone	112-12-9	EP-Plate	TIC		1.4	**6.60**	87,N,T

Comments: Concentrations of the tentatively identified compounds is based on the comparison of peak area to that of the nearest internal standard.

ng = nanogram
ppbv = parts per billion volume
ug/m3 = micrograms per cubic meter

BDL = Below Detection Limit
N/A = Not Applicable

Qualifiers

B = Compound found in associated laboratory blank above the reporting limit.
D = Diluted sample
E = Report concentration was above the instrumental calibration range
I = Response failure of an internal standard; concentration should be considered an estimate
J = Concentration below reporting limit
N = Identification based on mass spectral library search
P = Library spectrum match, rsd >90% w RT match
Q = Qualitative results for non-target compounds
Ta = Target Analyte

R = Recovery failure in CCV or LCS.
S = Surrogate recovery failure
T = Compound is tentatively identified compound. Includes chemical library matches & chemist identified compounds.
X = Detected but not quantifiable
c = Sample RPD failure
d= Data that exceeds the %RSD criteria set by the method (70-130%)
PIC = Positively identified compound, for non-calibrated compounds
r = Recovery failure in MRL
Z = Positively Identified Compound; Quanlitative data only

Authorized Signature: L Joseph Sears
Laboratory Technical Manager - Dr. Joe Sears

Date: 06/13/16

RJ LEE GROUP
DELIVERING SCIENTIFIC RESOLUTION

RJ LeeGroup, Inc. | Columbia Basin Analytical Laboratory
2710 North 20th Avenue, Pasco WA 99301
Tel: (509) 545-4989 | Fax: (509) 544-6010

LABORATORY REPORT
EPA Compendium Method TO-17-Modified
Electrostatic Precipitator Plates

Client: Washington River Protection Solutions
Address: Richland, WA 99352
Attention: Attn: George Weeks
Telephone:
Fax:

RJ Lee Group Project: W605131
Samples Received: 05/26/16
Analysis Prep/Date: 06/02/16
Report Date: 06/13/16
Sampling Date: 05/25/16
Purchase Order No.: 0
Client Project: GAL601096

Sample ID				CAS			QC %	Reporting Limit		
Client	RJLG	Medium ID	Analyte	Number	Matrix	Type	REC	(ng)	Result (ng)	Qualifier
20160525-ACE-A-N-2	W605131-09		Bromochloromethane	74-97-5	EP-Plate	Int. Std		1.1	52.9	
20160525-ACE-A-N-2	W605131-09		Propene	115-07-1	EP-Plate	Ta		0.34	< 0.34	rB
20160525-ACE-A-N-2	W605131-09		Dichlorodifluoromethane (F12)	75-71-8	EP-Plate	Ta		0.99	< 0.99	
20160525-ACE-A-N-2	W605131-09		Chloromethane	74-87-3	EP-Plate	Ta		0.41	< 0.41	
20160525-ACE-A-N-2	W605131-09		1,2-Dichloro-tetrafluoroethane	76-14-2	EP-Plate	Ta		1.4	< 1.4	
20160525-ACE-A-N-2	W605131-09		Chloroethene	75-01-4	EP-Plate	Ta		0.51	< 0.51	
20160525-ACE-A-N-2	W605131-09		1,3-Butadiene	106-99-0	EP-Plate	Ta		0.44	< 0.44	
20160525-ACE-A-N-2	W605131-09		n-Butane	106-97-8	EP-Plate	Ta		0.48	< 0.48	
20160525-ACE-A-N-2	W605131-09		Bromomethane	74-83-9	EP-Plate	Ta		0.78	< 0.78	
20160525-ACE-A-N-2	W605131-09		Chloroethane	75-00-3	EP-Plate	Ta		0.53	< 0.53	
20160525-ACE-A-N-2	W605131-09		Ethanol	64-17-5	EP-Plate	Ta		0.38	0.999	r
20160525-ACE-A-N-2	W605131-09		Vinylbromide	593-60-2	EP-Plate	Ta		0.88	< 0.88	
20160525-ACE-A-N-2	W605131-09		Trichlorofluoromethane	75-69-4	EP-Plate	Ta		1.1	< 1.1	
20160525-ACE-A-N-2	W605131-09		Acrolein	107-02-8	EP-Plate	Ta		0.46	< 0.46	r
20160525-ACE-A-N-2	W605131-09		Acetone	67-64-1	EP-Plate	Ta		0.48	5.47	r
20160525-ACE-A-N-2	W605131-09		n-Pentane	109-66-0	EP-Plate	Ta		0.59	< 0.59	
20160525-ACE-A-N-2	W605131-09		Isopropanol	67-63-0	EP-Plate	Ta		0.49	< 0.49	
20160525-ACE-A-N-2	W605131-09		1,1-Dichloroethene	75-35-4	EP-Plate	Ta		0.79	< 0.79	
20160525-ACE-A-N-2	W605131-09		t-Butyl alcohol	75-65-0	EP-Plate	Ta		0.61	< 0.61	
20160525-ACE-A-N-2	W605131-09		1,1,2-Trichloro-1,2,2-trifluoroethane (	76-13-1	EP-Plate	Ta		1.5	< 1.5	
20160525-ACE-A-N-2	W605131-09		3-Chloropropene	107-05-1	EP-Plate	Ta		0.63	< 0.63	
20160525-ACE-A-N-2	W605131-09		Methylene Chloride (Dichloromethane)	75-09-2	EP-Plate	Ta		0.70	< 0.70	
20160525-ACE-A-N-2	W605131-09		Carbon Disulfide	75-65-0	EP-Plate	Ta		0.62	< 0.62	
20160525-ACE-A-N-2	W605131-09		trans-1,2-Dichloroethene	156-60-5	EP-Plate	Ta		0.79	< 0.79	R
20160525-ACE-A-N-2	W605131-09		Methyl-t-butyll ether (MTBE)	1634-04-4	EP-Plate	Ta		0.72	< 0.72	R
20160525-ACE-A-N-2	W605131-09		Vinyl Acetate	108-05-4	EP-Plate	Ta		0.70	< 0.70	R
20160525-ACE-A-N-2	W605131-09		1,1-Dichloroethane	75-34-3	EP-Plate	Ta		0.81	< 0.81	

Sample ID				CAS			QC %	Reporting Limit		
Client	RJLG	Medium ID	Analyte	Number	Matrix	Type	REC	(ng)	Result (ng)	Qualifier
20160525-ACE-A-N-2	W605131-09		2-Butanone (MEK)	78-93-3	EP-Plate	Ta		0.59	< 0.59	
20160525-ACE-A-N-2	W605131-09		Hexane	110-54-3	EP-Plate	Ta		0.71	< 0.71	R
20160525-ACE-A-N-2	W605131-09		cis-1,2-Dichloroethene	156-59-2	EP-Plate	Ta		0.79	< 0.79	R
20160525-ACE-A-N-2	W605131-09		Ethyl Acetate	141-78-6	EP-Plate	Ta		0.72	< 0.72	
20160525-ACE-A-N-2	W605131-09		Chloroform	540-36-3	EP-Plate	Ta		1.1	< 1.1	
20160525-ACE-A-N-2	W605131-09		Tetrahydrofuran	67-66-3	EP-Plate	Ta		0.98	< 0.98	
20160525-ACE-A-N-2	W605131-09		1,4-Difluorobenzene	71-55-6	EP-Plate	Int. Std		0.93	46.7	
20160525-ACE-A-N-2	W605131-09		1,1,1-Trichloroethane	71-55-6	EP-Plate	Ta		1.1	< 1.1	
20160525-ACE-A-N-2	W605131-09		1,2-Dichloroethane-d4	17060-07-0	EP-Plate	QA/Surr	97.7	0.84	41.2	
20160525-ACE-A-N-2	W605131-09		1,2-Dichloroethane	107-06-2	EP-Plate	Ta		0.81	< 0.81	
20160525-ACE-A-N-2	W605131-09		Benzene	71-43-2	EP-Plate	Ta		0.64	< 0.64	
20160525-ACE-A-N-2	W605131-09		Carbon Tetrachloride	56-23-5	EP-Plate	Ta		1.3	< 1.3	
20160525-ACE-A-N-2	W605131-09		Cyclohexane	110-82-7	EP-Plate	Ta		0.69	< 0.69	
20160525-ACE-A-N-2	W605131-09		2,2,4-Trimethylpentane	540-84-1	EP-Plate	Ta		0.93	< 0.93	
20160525-ACE-A-N-2	W605131-09		Heptane	142-82-5	EP-Plate	Ta		0.82	< 0.82	R
20160525-ACE-A-N-2	W605131-09		Trichlorethylene	79-01-6	EP-Plate	Ta		1.1	< 1.1	
20160525-ACE-A-N-2	W605131-09		1,2-Dichloropropane	78-87-5	EP-Plate	Ta		0.92	< 0.92	
20160525-ACE-A-N-2	W605131-09		Methylmethacrylate	80-62-6	EP-Plate	Ta		0.82	< 0.82	
20160525-ACE-A-N-2	W605131-09		1,4-Dioxane	123-91-1	EP-Plate	Ta		0.72	< 0.72	
20160525-ACE-A-N-2	W605131-09		Bromodichloromethane	75-27-4	EP-Plate	Ta		1.3	< 1.3	
20160525-ACE-A-N-2	W605131-09		Methyl isobutyl ketone (MIBK)	108-10-1	EP-Plate	Ta		0.82	< 0.82	
20160525-ACE-A-N-2	W605131-09		cis-1,3-Dichloropropene	10061-01-5	EP-Plate	Ta		0.91	< 0.91	
20160525-ACE-A-N-2	W605131-09		trans-1,3-Dichloropropene	10061-02-6	EP-Plate	Ta		0.91	< 0.91	
20160525-ACE-A-N-2	W605131-09		Toluene-d8	2037-26-5	EP-Plate	QA/Surr	96.2	0.82	39.4	
20160525-ACE-A-N-2	W605131-09		Toluene	108-88-3	EP-Plate	Ta		0.75	< 0.75	r
20160525-ACE-A-N-2	W605131-09		1,1,2-Trichloroethane	79-00-5	EP-Plate	Ta		1.1	< 1.1	
20160525-ACE-A-N-2	W605131-09		2-Hexanone	591-78-6	EP-Plate	Ta		0.90	< 0.90	
20160525-ACE-A-N-2	W605131-09		Dibromochloromethane	124-48-1	EP-Plate	Ta		1.7	< 1.7	
20160525-ACE-A-N-2	W605131-09		Tetrachloroethylene	127-18-4	EP-Plate	Ta		1.4	< 1.4	
20160525-ACE-A-N-2	W605131-09		Chlorobenzene-d5	3114-55-4	EP-Plate	Int. Std		0.92	46.1	
20160525-ACE-A-N-2	W605131-09		1,2-Dibromoethane	106-93-4	EP-Plate	Ta		1.5	< 1.5	
20160525-ACE-A-N-2	W605131-09		Chlorobenzene	108-90-7	EP-Plate	Ta		0.92	< 0.92	
20160525-ACE-A-N-2	W605131-09		Ethylbenzene	100-41-4	EP-Plate	Ta		0.87	< 0.87	r
20160525-ACE-A-N-2	W605131-09		m,p-Xylene	179601-23-1	EP-Plate	Ta		0.87	< 0.87	Rr
20160525-ACE-A-N-2	W605131-09		Nonane	111-84-2	EP-Plate	Ta		1.0	< 1.0	Rr
20160525-ACE-A-N-2	W605131-09		o-Xylene	95-47-6	EP-Plate	Ta		0.87	< 0.87	R

Sample ID										
Client	RJLG	Medium ID	Analyte	CAS Number	Matrix	Type	QC % REC	Reporting Limit (ng)	Result (ng)	Qualifier
20160525-ACE-A-N-2	W605131-09		Styrene	100-42-5	EP-Plate	Ta		0.85	**< 0.85**	**R**
20160525-ACE-A-N-2	W605131-09		Bromoform	75-25-2	EP-Plate	Ta		2.1	**< 2.1**	
20160525-ACE-A-N-2	W605131-09		1,1,2,2-Tetrachloroethane	79-34-5	EP-Plate	Ta		1.4	**< 1.4**	**R**
20160525-ACE-A-N-2	W605131-09		Cumene	98-82-8	EP-Plate	Ta		0.98	**< 0.98**	**R**
20160525-ACE-A-N-2	W605131-09		4-Bromofluorobenzene (BFB)	460-00-4	EP-Plate	QA/Surr	109	1.4	**78.1**	
20160525-ACE-A-N-2	W605131-09		n-Propylbenzene	103-65-1	EP-Plate	Ta		0.98	**< 0.98**	**Rr**
20160525-ACE-A-N-2	W605131-09		2-Chlorotoluene	95-49-8	EP-Plate	Ta		1.0	**< 1.0**	**R**
20160525-ACE-A-N-2	W605131-09		4-Ethyltoluene	622-96-8	EP-Plate	Ta		0.98	**< 0.98**	**Rr**
20160525-ACE-A-N-2	W605131-09		1,3,5-Trimethylbenzene	108-67-8	EP-Plate	Ta		0.98	**< 0.98**	**Rr**
20160525-ACE-A-N-2	W605131-09		1,2,4-Trimethylbenzene	95-63-6	EP-Plate	Ta		0.98	**< 0.98**	**Rr**
20160525-ACE-A-N-2	W605131-09		1,3-Dichlorobenzene	541-73-1	EP-Plate	Ta		1.2	**< 1.2**	**RrB**
20160525-ACE-A-N-2	W605131-09		Benzyl Chloride	100-44-7	EP-Plate	Ta		1.0	**< 1.0**	**RrB**
20160525-ACE-A-N-2	W605131-09		1,4-Dichlorobenzene	106-46-7	EP-Plate	Ta		1.2	**< 1.2**	**RrB**
20160525-ACE-A-N-2	W605131-09		1,2-Dichlorobenzene	95-50-1	EP-Plate	Ta		1.2	**< 1.2**	**RrB**
20160525-ACE-A-N-2	W605131-09		1,2,4-Trichlorobenzene	120-82-1	EP-Plate	PIC		1.5	**< 1.5**	**Z**
20160525-ACE-A-N-2	W605131-09		Naphthalene	91-20-3	EP-Plate	PIC		1.0	**< 1.0**	**Z**
20160525-ACE-A-N-2	W605131-09		Hexachloro-1,3-butadiene	87-68-3	EP-Plate	PIC		2.1	**< 2.1**	**Z**

Client	Sample ID RJLG	Medium ID	Analyte	CAS Number	Matrix	Type	QC % REC	Reporting Limit (ng)	Result (ng)	Qualifier
			Tentatively Identified Compounds							
20160525-ACE-A-N-2	W605131-09		Propene	115-07-1	EP-Plate	TIC		0.34	**1.26**	74,N,T
20160525-ACE-A-N-2	W605131-09		Acetonitrile	75-05-8	EP-Plate	TIC		0.34	**1.46**	45,N,T
20160525-ACE-A-N-2	W605131-09		Pentane, 2-methyl-	107-83-5	EP-Plate	TIC		0.70	**4.22**	74,N,T
20160525-ACE-A-N-2	W605131-09		Octane, 4-methyl-	2216-34-4	EP-Plate	TIC		1.0	**2.72**	94,N,T
20160525-ACE-A-N-2	W605131-09		Nonanal	124-19-6	EP-Plate	TIC		1.2	**4.31**	91,N,T
20160525-ACE-A-N-2	W605131-09		2-Undecanone	112-12-9	EP-Plate	TIC		1.4	**7.51**	94,N,T

Comments: Concentrations of the tentatively identified compounds is based on the comparison of peak area to that of the nearest internal standard.

ng = nanogram
ppbv = parts per billion volume
ug/m3 = micrograms per cubic meter

BDL = Below Detection Limit
N/A = Not Applicable

Qualifiers

B = Compound found in associated laboratory blank above the reporting limit.
D = Diluted sample
E = Report concentration was above the instrumental calibration range
I = Response failure of an internal standard; concentration should be considered an estimate
J = Concentration below reporting limit
N = Identification based on mass spectral library search
P = Library spectrum match, rsd >90% w RT match
Q = Qualitative results for non-target compounds
Ta = Target Analyte
R = Recovery failure in CCV or LCS.
S = Surrogate recovery failure
T = Compound is tentatively identified compound. Includes chemical library matches & chemist identified compounds.
X = Detected but not quantifiable
c = Sample RPD failure
d= Data that exceeds the %RSD criteria set by the method (70-130%)
PIC = Positively identified compound, for non-calibrated compounds
r = Recovery failure in MRL
Z = Positively Identified Compound; Quantitative data only

Authorized Signature: L Joseph Sears
Laboratory Technical Manager - Dr. Joe Sears

Date: 06/13/16

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LABORATORY REPORT

EPA Compendium Method TO-17-Modified
Electrostatic Precipitator Plates

Client:	Washington River Protection Solutions	RJ Lee Group Project:	W605131
Address:		Samples Received:	05/26/16
	Richland, WA 99352	Analysis Prep/Date:	06/02/16
Attention:	Attn: George Weeks	Report Date:	06/13/16
Telephone:		Sampling Date:	
Fax:		Purchase Order No.:	0
		Client Project:	GAL601096

Sample ID										
Client	RJLG	Medium ID	Analyte	CAS Number	Matrix	Type	QC % REC	Reporting Limit (ng)	Result (ng)	Qualifier
20160525-ACE-C-N-2	W605131-10		Bromochloromethane	74-97-5	EP-Plate	Int. Std		1.1	**52.9**	
20160525-ACE-C-N-2	W605131-10		Propene	115-07-1	EP-Plate	Ta		0.34	**3.03**	**rB**
20160525-ACE-C-N-2	W605131-10		Dichlorodifluoromethane (F12)	75-71-8	EP-Plate	Ta		0.99	**< 0.99**	
20160525-ACE-C-N-2	W605131-10		Chloromethane	74-87-3	EP-Plate	Ta		0.41	**< 0.41**	
20160525-ACE-C-N-2	W605131-10		1,2-Dichloro-tetrarfluoroethane	76-14-2	EP-Plate	Ta		1.4	**4.90**	
20160525-ACE-C-N-2	W605131-10		Chloroethene	75-01-4	EP-Plate	Ta		0.51	**< 0.51**	
20160525-ACE-C-N-2	W605131-10		1,3-Butadiene	106-99-0	EP-Plate	Ta		0.44	**< 0.44**	
20160525-ACE-C-N-2	W605131-10		n-Butane	106-97-8	EP-Plate	Ta		0.48	**< 0.48**	
20160525-ACE-C-N-2	W605131-10		Bromomethane	74-83-9	EP-Plate	Ta		0.78	**< 0.78**	
20160525-ACE-C-N-2	W605131-10		Chloroethane	75-00-3	EP-Plate	Ta		0.53	**< 0.53**	
20160525-ACE-C-N-2	W605131-10		Ethanol	64-17-5	EP-Plate	Ta		0.38	**1.68**	**r**
20160525-ACE-C-N-2	W605131-10		Vinylbromide	593-60-2	EP-Plate	Ta		0.88	**< 0.88**	
20160525-ACE-C-N-2	W605131-10		Trichlorofluoromethane	75-69-4	EP-Plate	Ta		1.1	**< 1.1**	
20160525-ACE-C-N-2	W605131-10		Acrolein	107-02-8	EP-Plate	Ta		0.46	**5.48**	**r**
20160525-ACE-C-N-2	W605131-10		Acetone	67-64-1	EP-Plate	Ta		0.48	**8.70**	**r**
20160525-ACE-C-N-2	W605131-10		n-Pentane	109-66-0	EP-Plate	Ta		0.59	**< 0.59**	
20160525-ACE-C-N-2	W605131-10		Isopropanol	67-63-0	EP-Plate	Ta		0.49	**1.48**	
20160525-ACE-C-N-2	W605131-10		1,1-Dichloroethene	75-35-4	EP-Plate	Ta		0.79	**< 0.79**	
20160525-ACE-C-N-2	W605131-10		t-Butyl alcohol	75-65-0	EP-Plate	Ta		0.61	**< 0.61**	
20160525-ACE-C-N-2	W605131-10		1,1,2-Trichloro-1,2,2-trifluoroethane (	76-13-1	EP-Plate	Ta		1.5	**< 1.5**	
20160525-ACE-C-N-2	W605131-10		3-Chloropropene	107-05-1	EP-Plate	Ta		0.63	**< 0.63**	
20160525-ACE-C-N-2	W605131-10		Methylene Chloride (Dichloromethane)	75-09-2	EP-Plate	Ta		0.70	**< 0.70**	
20160525-ACE-C-N-2	W605131-10		Carbon Disulfide	75-65-0	EP-Plate	Ta		0.62	**< 0.62**	
20160525-ACE-C-N-2	W605131-10		trans-1,2-Dichloroethene	156-60-5	EP-Plate	Ta		0.79	**< 0.79**	**R**
20160525-ACE-C-N-2	W605131-10		Methyl-t-butyll ether (MTBE)	1634-04-4	EP-Plate	Ta		0.72	**< 0.72**	**R**
20160525-ACE-C-N-2	W605131-10		Vinyl Acetate	108-05-4	EP-Plate	Ta		0.70	**< 0.70**	**R**
20160525-ACE-C-N-2	W605131-10		1,1-Dichloroethane	75-34-3	EP-Plate	Ta		0.81	**< 0.81**	
20160525-ACE-C-N-2	W605131-10		2-Butanone (MEK)	78-93-3	EP-Plate	Ta		0.59	**< 0.59**	
20160525-ACE-C-N-2	W605131-10		Hexane	110-54-3	EP-Plate	Ta		0.71	**< 0.71**	**R**
20160525-ACE-C-N-2	W605131-10		cis-1,2-Dichloroethene	156-59-2	EP-Plate	Ta		0.79	**< 0.79**	**R**
20160525-ACE-C-N-2	W605131-10		Ethyl Acetate	141-78-6	EP-Plate	Ta		0.72	**< 0.72**	

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LABORATORY REPORT

EPA Compendium Method TO-17-Modified
Electrostatic Precipitator Plates

Client: Washington River Protection Solutions
Address: Richland, WA 99352
Attention: Attn: George Weeks
Telephone:
Fax:

RJ Lee Group Project: W605131
Samples Received: 05/26/16
Analysis Prep/Date: 06/02/16
Report Date: 06/13/16
Sampling Date:
Purchase Order No.: 0
Client Project: GAL601096

Sample ID Client	RJLG	Medium ID	Analyte	CAS Number	Matrix	Type	QC % REC	Reporting Limit (ng)	Result (ng)	Qualifier
20160525-ACE-C-N-2	W605131-10		Bromochloromethane	74-97-5	EP-Plate	Int. Std		1.1	**52.9**	
20160525-ACE-C-N-2	W605131-10		Propene	115-07-1	EP-Plate	Ta		0.34	**3.03**	**rB**
20160525-ACE-C-N-2	W605131-10		Dichlorodifluoromethane (F12)	75-71-8	EP-Plate	Ta		0.99	**< 0.99**	
20160525-ACE-C-N-2	W605131-10		Chloromethane	74-87-3	EP-Plate	Ta		0.41	**< 0.41**	
20160525-ACE-C-N-2	W605131-10		1,2-Dichloro-tetrafluoroethane	76-14-2	EP-Plate	Ta		1.4	**4.90**	
20160525-ACE-C-N-2	W605131-10		Chloroethene	75-01-4	EP-Plate	Ta		0.51	**< 0.51**	
20160525-ACE-C-N-2	W605131-10		1,3-Butadiene	106-99-0	EP-Plate	Ta		0.44	**< 0.44**	
20160525-ACE-C-N-2	W605131-10		n-Butane	106-97-8	EP-Plate	Ta		0.48	**< 0.48**	
20160525-ACE-C-N-2	W605131-10		Bromomethane	74-83-9	EP-Plate	Ta		0.78	**< 0.78**	
20160525-ACE-C-N-2	W605131-10		Chloroethane	75-00-3	EP-Plate	Ta		0.53	**< 0.53**	
20160525-ACE-C-N-2	W605131-10		Ethanol	64-17-5	EP-Plate	Ta		0.38	**1.68**	**r**
20160525-ACE-C-N-2	W605131-10		Vinylbromide	593-60-2	EP-Plate	Ta		0.88	**< 0.88**	
20160525-ACE-C-N-2	W605131-10		Trichlorofluoromethane	75-69-4	EP-Plate	Ta		1.1	**< 1.1**	
20160525-ACE-C-N-2	W605131-10		Acrolein	107-02-8	EP-Plate	Ta		0.46	**5.48**	**r**
20160525-ACE-C-N-2	W605131-10		Acetone	67-64-1	EP-Plate	Ta		0.48	**8.70**	**r**
20160525-ACE-C-N-2	W605131-10		n-Pentane	109-66-0	EP-Plate	Ta		0.59	**< 0.59**	
20160525-ACE-C-N-2	W605131-10		Isopropanol	67-63-0	EP-Plate	Ta		0.49	**1.48**	
20160525-ACE-C-N-2	W605131-10		1,1-Dichloroethene	75-35-4	EP-Plate	Ta		0.79	**< 0.79**	
20160525-ACE-C-N-2	W605131-10		t-Butyl alcohol	75-65-0	EP-Plate	Ta		0.61	**< 0.61**	
20160525-ACE-C-N-2	W605131-10		1,1,2-Trichloro-1,2,2-trifluoroethane (	76-13-1	EP-Plate	Ta		1.5	**< 1.5**	
20160525-ACE-C-N-2	W605131-10		3-Chloropropene	107-05-1	EP-Plate	Ta		0.63	**< 0.63**	
20160525-ACE-C-N-2	W605131-10		Methylene Chloride (Dichloromethane)	75-09-2	EP-Plate	Ta		0.70	**< 0.70**	
20160525-ACE-C-N-2	W605131-10		Carbon Disulfide	75-65-0	EP-Plate	Ta		0.62	**< 0.62**	
20160525-ACE-C-N-2	W605131-10		trans-1,2-Dichloroethene	156-60-5	EP-Plate	Ta		0.79	**< 0.79**	**R**
20160525-ACE-C-N-2	W605131-10		Methyl-t-butyll ether (MTBE)	1634-04-4	EP-Plate	Ta		0.72	**< 0.72**	**R**
20160525-ACE-C-N-2	W605131-10		Vinyl Acetate	108-05-4	EP-Plate	Ta		0.70	**< 0.70**	**R**

RJ LEE GROUP
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RJ Lee*Group*, Inc.|Columbia Basin Analytical Laboratory
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Tel: (509) 545-4989 | Fax: (509) 544-6010

LABORATORY REPORT
EPA Compendium Method TO-17-Modified
Electrostatic Precipitator Plates

Client: Washington River Protection Solutions
Address: Richland, WA 99352
Attention: Attn: George Weeks
Telephone:
Fax:

RJ Lee Group Project: W605131
Samples Received: 05/26/16
Analysis Prep/Date: 06/02/16
Report Date: 06/13/16
Sampling Date:
Purchase Order No.: 0
Client Project: GAL601096

20160525-ACE-C-N-2	W605131-10		1,1-Dichloroethane	75-34-3	EP-Plate	Ta		0.81	**< 0.81**	
20160525-ACE-C-N-2	W605131-10		2-Butanone (MEK)	78-93-3	EP-Plate	Ta		0.59	**< 0.59**	
20160525-ACE-C-N-2	W605131-10		Hexane	110-54-3	EP-Plate	Ta		0.71	**< 0.71**	**R**
20160525-ACE-C-N-2	W605131-10		cis-1,2-Dichloroethene	156-59-2	EP-Plate	Ta		0.79	**< 0.79**	**R**
20160525-ACE-C-N-2	W605131-10		Ethyl Acetate	141-78-6	EP-Plate	Ta		0.72	**< 0.72**	
20160525-ACE-C-N-2	W605131-10		Chloroform	540-36-3	EP-Plate	Ta		1.1	**< 1.1**	
20160525-ACE-C-N-2	W605131-10		Tetrahydrofuran	67-66-3	EP-Plate	Ta		0.98	**< 0.98**	
20160525-ACE-C-N-2	W605131-10		1,4-Difluorobenzene	71-55-6	EP-Plate	Int. Std		0.93	**46.7**	
20160525-ACE-C-N-2	W605131-10		1,1,1-Trichloroethane	71-55-6	EP-Plate	Ta		1.1	**< 1.1**	
20160525-ACE-C-N-2	W605131-10		1,2-Dichloroethane-d4	17060-07-0	EP-Plate	QA/Surr	95	0.84	**40.0**	
20160525-ACE-C-N-2	W605131-10		1,2-Dichloroethane	107-06-2	EP-Plate	Ta		0.81	**< 0.81**	
20160525-ACE-C-N-2	W605131-10		Benzene	71-43-2	EP-Plate	Ta		0.64	**1.73**	
20160525-ACE-C-N-2	W605131-10		Carbon Tetrachloride	56-23-5	EP-Plate	Ta		1.3	**< 1.3**	
20160525-ACE-C-N-2	W605131-10		Cyclohexane	110-82-7	EP-Plate	Ta		0.69	**< 0.69**	
20160525-ACE-C-N-2	W605131-10		2,2,4-Trimethylpentane	540-84-1	EP-Plate	Ta		0.93	**< 0.93**	
20160525-ACE-C-N-2	W605131-10		Heptane	142-82-5	EP-Plate	Ta		0.82	**4.51**	**R**
20160525-ACE-C-N-2	W605131-10		Trichlorethylene	79-01-6	EP-Plate	Ta		1.1	**< 1.1**	
20160525-ACE-C-N-2	W605131-10		1,2-Dichloropropane	78-87-5	EP-Plate	Ta		0.92	**< 0.92**	
20160525-ACE-C-N-2	W605131-10		Methylmethacrylate	80-62-6	EP-Plate	Ta		0.82	**< 0.82**	
20160525-ACE-C-N-2	W605131-10		1,4-Dioxane	123-91-1	EP-Plate	Ta		0.72	**< 0.72**	
20160525-ACE-C-N-2	W605131-10		Bromodichloromethane	75-27-4	EP-Plate	Ta		1.3	**< 1.3**	
20160525-ACE-C-N-2	W605131-10		Methyl isobutyl ketone (MIBK)	108-10-1	EP-Plate	Ta		0.82	**< 0.82**	
20160525-ACE-C-N-2	W605131-10		cis-1,3-Dichloropropene	10061-01-5	EP-Plate	Ta		0.91	**< 0.91**	
20160525-ACE-C-N-2	W605131-10		trans-1,3-Dichloropropene	10061-02-6	EP-Plate	Ta		0.91	**< 0.91**	
20160525-ACE-C-N-2	W605131-10		Toluene-d8	2037-26-5	EP-Plate	QA/Surr	95.4	0.82	**39.1**	
20160525-ACE-C-N-2	W605131-10		Toluene	108-88-3	EP-Plate	Ta		0.75	**< 0.75**	**r**
20160525-ACE-C-N-2	W605131-10		1,1,2-Trichloroethane	79-00-5	EP-Plate	Ta		1.1	**< 1.1**	
20160525-ACE-C-N-2	W605131-10		2-Hexanone	591-78-6	EP-Plate	Ta		0.90	**< 0.90**	
20160525-ACE-C-N-2	W605131-10		Dibromochloromethane	124-48-1	EP-Plate	Ta		1.7	**< 1.7**	

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LABORATORY REPORT
EPA Compendium Method TO-17-Modified
Electrostatic Precipitator Plates

Client: Washington River Protection Solutions
Address: Richland, WA 99352
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20160525-ACE-C-N-2	W605131-10		Tetrachloroethylene	127-18-4	EP-Plate	Ta		1.4	< 1.4	
20160525-ACE-C-N-2	W605131-10		Chlorobenzene-d5	3114-55-4	EP-Plate	Int. Std		0.92	46.1	
20160525-ACE-C-N-2	W605131-10		1,2-Dibromoethane	106-93-4	EP-Plate	Ta		1.5	< 1.5	
20160525-ACE-C-N-2	W605131-10		Chlorobenzene	108-90-7	EP-Plate	Ta		0.92	3.45	
20160525-ACE-C-N-2	W605131-10		Ethylbenzene	100-41-4	EP-Plate	Ta		0.87	5.95	r
20160525-ACE-C-N-2	W605131-10		m,p-Xylene	179601-23-1	EP-Plate	Ta		0.87	15.6	Rr
20160525-ACE-C-N-2	W605131-10		Nonane	111-84-2	EP-Plate	Ta		1.0	3.15	Rr
20160525-ACE-C-N-2	W605131-10		o-Xylene	95-47-6	EP-Plate	Ta		0.87	7.47	R
20160525-ACE-C-N-2	W605131-10		Styrene	100-42-5	EP-Plate	Ta		0.85	7.88	R
20160525-ACE-C-N-2	W605131-10		Bromoform	75-25-2	EP-Plate	Ta		2.1	< 2.1	
20160525-ACE-C-N-2	W605131-10		1,1,2,2-Tetrachloroethane	79-34-5	EP-Plate	Ta		1.4	< 1.4	R
20160525-ACE-C-N-2	W605131-10		Cumene	98-82-8	EP-Plate	Ta		0.98	< 0.98	R
20160525-ACE-C-N-2	W605131-10		4-Bromofluorobenzene (BFB)	460-00-4	EP-Plate	QA/Surr	97	1.4	69.5	
20160525-ACE-C-N-2	W605131-10		n-Propylbenzene	103-65-1	EP-Plate	Ta		0.98	< 0.98	Rr
20160525-ACE-C-N-2	W605131-10		2-Chlorotoluene	95-49-8	EP-Plate	Ta		1.0	< 1.0	R
20160525-ACE-C-N-2	W605131-10		4-Ethyltoluene	622-96-8	EP-Plate	Ta		0.98	< 0.98	Rr
20160525-ACE-C-N-2	W605131-10		1,3,5-Trimethylbenzene	108-67-8	EP-Plate	Ta		0.98	< 0.98	Rr
20160525-ACE-C-N-2	W605131-10		1,2,4-Trimethylbenzene	95-63-6	EP-Plate	Ta		0.98	< 0.98	Rr
20160525-ACE-C-N-2	W605131-10		1,3-Dichlorobenzene	541-73-1	EP-Plate	Ta		1.2	< 1.2	RrB
20160525-ACE-C-N-2	W605131-10		Benzyl Chloride	100-44-7	EP-Plate	Ta		1.0	< 1.0	RrB
20160525-ACE-C-N-2	W605131-10		1,4-Dichlorobenzene	106-46-7	EP-Plate	Ta		1.2	< 1.2	RrB
20160525-ACE-C-N-2	W605131-10		1,2-Dichlorobenzene	95-50-1	EP-Plate	Ta		1.2	< 1.2	RrB
20160525-ACE-C-N-2	W605131-10		1,2,4-Trichlorobenzene	120-82-1	EP-Plate	PIC		1.5	< 1.5	Z
20160525-ACE-C-N-2	W605131-10		Naphthalene	91-20-3	EP-Plate	PIC		1.0	< 1.0	Z
20160525-ACE-C-N-2	W605131-10		Hexachloro-1,3-butadiene	87-68-3	EP-Plate	PIC		2.1	< 2.1	Z

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LABORATORY REPORT

EPA Compendium Method TO-17-Modified
Electrostatic Precipitator Plates

Client: Washington River Protection Solutions
Address: Richland, WA 99352
Attention: Attn: George Weeks
Telephone:
Fax:

RJ Lee Group Project: W605131
Samples Received: 05/26/16
Analysis Prep/Date: 06/02/16
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Client Project: GAL601096

			Tentatively Identified Compounds							
20160525-ACE-C-N-2	W605131-10		1-Propene, 2-methyl-	115-11-7	EP-Plate	TIC		0.46	**1.62**	86,N,T
20160525-ACE-C-N-2	W605131-10		Acetaldehyde	375-07-0	EP-Plate	TIC		0.36	**1.80**	74,N,T
20160525-ACE-C-N-2	W605131-10		Acetonitrole	75-08-8	EP-Plate	TIC		0.34	**1.74**	9,N,T
20160525-ACE-C-N-2	W605131-10		Propane, 2-methoxy-2-methyl-	1634-04-4	EP-Plate	TIC		0.72	**1.96**	72,N,T
20160525-ACE-C-N-2	W605131-10		Acetic acid	64-19-7	EP-Plate	TIC		0.49	**1.45**	86,N,T

Comments: Concentrations of the tentatively identified compounds is based on the comparison of peak area to that of the nearest internal standard.

ng = nanogram
ppbv = parts per billion volume
ug/m3 = micrograms per cubic meter

Qualifiers

B = Compound found in associated laboratory blank above the reporting limit.
D = Diluted sample
E = Report concentration was above the instrumental calibration range
I = Response failure of an internal standard; concentration should be considered an estimate
J = Concentration below reporting limit
N = Identification based on mass spectral library search
P = Library spectrum match, rsd >90% w RT match
Q = Qualitative results for non-target compounds
Ta = Target Analyte
R = Recovery failure in CCV or LCS.
S = Surrogate recovery failure
T = Compound is tentatively identified compound. Includes chemical library matches & chemist identified compounds.
X = Detected but not quantifiable
c = Sample RPD failure
d= Data that exceeds the %RSD criteria set by the method (70-130%)
PIC = Positively identified compound, for non-calibrated compounds
r = Recovery failure in MRL
Z = Positively Identified Compound; Quanlitative data only

Authorized Signature: L Joseph Sears
Laboratory Technical Manager - Joe Sears, Ph.D.

Date: 06/13/16

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LABORATORY REPORT
EPA Compendium Method TO-17-Modified
Electrostatic Precipitator Plates

Client:	Washington River Protection Solu	RJ Lee Group Project:	W605131
Address:		Samples Received:	05/26/16
	Richland, WA 99352	Analysis Date:	06/02/16
Attention:	Attn: George Weeks	Report Date:	06/13/16
Telephone:		Sampling Date:	05/25/16
e-mail:		Purchase Order No.:	
		Client Project:	GAL601096

Sample ID				CAS			QC %	Reporting Limit		
Client	RJLG	Medium ID	Analyte	Number	Matrix	Type	REC	(ng)	Result (ng)	Qualifier
20160525-ACE-AP-D-2	W605131-11		Bromochloromethane	74-97-5	EP-Plate	Int. Std		1.1	52.9	
20160525-ACE-AP-D-2	W605131-11		Propene	115-07-1	EP-Plate	Ta		0.34	< 0.34	rB
20160525-ACE-AP-D-2	W605131-11		Dichlorodifluoromethane (F12)	75-71-8	EP-Plate	Ta		0.99	< 0.99	
20160525-ACE-AP-D-2	W605131-11		Chloromethane	74-87-3	EP-Plate	Ta		0.41	< 0.41	
20160525-ACE-AP-D-2	W605131-11		1,2-Dichloro-tetrafluoroethane	76-14-2	EP-Plate	Ta		1.4	< 1.4	
20160525-ACE-AP-D-2	W605131-11		Chloroethene	75-01-4	EP-Plate	Ta		0.51	< 0.51	
20160525-ACE-AP-D-2	W605131-11		1,3-Butadiene	106-99-0	EP-Plate	Ta		0.44	< 0.44	
20160525-ACE-AP-D-2	W605131-11		n-Butane	106-97-8	EP-Plate	Ta		0.48	< 0.48	
20160525-ACE-AP-D-2	W605131-11		Bromomethane	74-83-9	EP-Plate	Ta		0.78	< 0.78	
20160525-ACE-AP-D-2	W605131-11		Chloroethane	75-00-3	EP-Plate	Ta		0.53	< 0.53	
20160525-ACE-AP-D-2	W605131-11		Ethanol	64-17-5	EP-Plate	Ta		0.38	< 0.38	r
20160525-ACE-AP-D-2	W605131-11		Vinylbromide	593-60-2	EP-Plate	Ta		0.88	< 0.88	
20160525-ACE-AP-D-2	W605131-11		Trichlorofluoromethane	75-69-4	EP-Plate	Ta		1.1	< 1.1	
20160525-ACE-AP-D-2	W605131-11		Acrolein	107-02-8	EP-Plate	Ta		0.46	< 0.46	r
20160525-ACE-AP-D-2	W605131-11		Acetone	67-64-1	EP-Plate	Ta		0.48	2.50	r
20160525-ACE-AP-D-2	W605131-11		n-Pentane	109-66-0	EP-Plate	Ta		0.59	< 0.59	
20160525-ACE-AP-D-2	W605131-11		Isopropanol	67-63-0	EP-Plate	Ta		0.49	< 0.49	
20160525-ACE-AP-D-2	W605131-11		1,1-Dichloroethene	75-35-4	EP-Plate	Ta		0.79	< 0.79	
20160525-ACE-AP-D-2	W605131-11		t-Butyl alcohol	75-65-0	EP-Plate	Ta		0.61	< 0.61	
20160525-ACE-AP-D-2	W605131-11		1,1,2-Trichloro-1,2,2-trifluoroethane (	76-13-1	EP-Plate	Ta		1.5	< 1.5	
20160525-ACE-AP-D-2	W605131-11		3-Chloropropene	107-05-1	EP-Plate	Ta		0.63	< 0.63	
20160525-ACE-AP-D-2	W605131-11		Methylene Chloride (Dichloromethane)	75-09-2	EP-Plate	Ta		0.70	< 0.70	
20160525-ACE-AP-D-2	W605131-11		Carbon Disulfide	75-65-0	EP-Plate	Ta		0.62	< 0.62	
20160525-ACE-AP-D-2	W605131-11		trans-1,2-Dichloroethene	156-60-5	EP-Plate	Ta		0.79	< 0.79	R
20160525-ACE-AP-D-2	W605131-11		Methyl-t-butyll ether (MTBE)	1634-04-4	EP-Plate	Ta		0.72	< 0.72	R

Sample ID				CAS			QC %	Reporting Limit		
Client	RJLG	Medium ID	Analyte	Number	Matrix	Type	REC	(ng)	Result (ng)	Qualifier
20160525-ACE-AP-D-2	W605131-11		Vinyl Acetate	108-05-4	EP-Plate	Ta		0.70	< 0.70	R
20160525-ACE-AP-D-2	W605131-11		1,1-Dichloroethane	75-34-3	EP-Plate	Ta		0.81	< 0.81	
20160525-ACE-AP-D-2	W605131-11		2-Butanone (MEK)	78-93-3	EP-Plate	Ta		0.59	< 0.59	
20160525-ACE-AP-D-2	W605131-11		Hexane	110-54-3	EP-Plate	Ta		0.71	< 0.71	R
20160525-ACE-AP-D-2	W605131-11		cis-1,2-Dichloroethene	156-59-2	EP-Plate	Ta		0.79	< 0.79	R
20160525-ACE-AP-D-2	W605131-11		Ethyl Acetate	141-78-6	EP-Plate	Ta		0.72	< 0.72	
20160525-ACE-AP-D-2	W605131-11		Chloroform	540-36-3	EP-Plate	Ta		1.1	< 1.1	
20160525-ACE-AP-D-2	W605131-11		Tetrahydrofuran	67-66-3	EP-Plate	Ta		0.98	< 0.98	
20160525-ACE-AP-D-2	W605131-11		1,4-Difluorobenzene	71-55-6	EP-Plate	Int. Std		0.93	46.7	
20160525-ACE-AP-D-2	W605131-11		1,1,1-Trichloroethane	71-55-6	EP-Plate	Ta		1.1	< 1.1	
20160525-ACE-AP-D-2	W605131-11		1,2-Dichloroethane-d4	17060-07-0	EP-Plate	QA/Surr	97.6	0.84	41.1	
20160525-ACE-AP-D-2	W605131-11		1,2-Dichloroethane	107-06-2	EP-Plate	Ta		0.81	< 0.81	
20160525-ACE-AP-D-2	W605131-11		Benzene	71-43-2	EP-Plate	Ta		0.64	< 0.64	
20160525-ACE-AP-D-2	W605131-11		Carbon Tetrachloride	56-23-5	EP-Plate	Ta		1.3	< 1.3	
20160525-ACE-AP-D-2	W605131-11		Cyclohexane	110-82-7	EP-Plate	Ta		0.69	< 0.69	
20160525-ACE-AP-D-2	W605131-11		2,2,4-Trimethylpentane	540-84-1	EP-Plate	Ta		0.93	< 0.93	
20160525-ACE-AP-D-2	W605131-11		Heptane	142-82-5	EP-Plate	Ta		0.82	< 0.82	R
20160525-ACE-AP-D-2	W605131-11		Trichlorethylene	79-01-6	EP-Plate	Ta		1.1	< 1.1	
20160525-ACE-AP-D-2	W605131-11		1,2-Dichloropropane	78-87-5	EP-Plate	Ta		0.92	< 0.92	
20160525-ACE-AP-D-2	W605131-11		Methylmethacrylate	80-62-6	EP-Plate	Ta		0.82	< 0.82	
20160525-ACE-AP-D-2	W605131-11		1,4-Dioxane	123-91-1	EP-Plate	Ta		0.72	< 0.72	
20160525-ACE-AP-D-2	W605131-11		Bromodichloromethane	75-27-4	EP-Plate	Ta		1.3	< 1.3	
20160525-ACE-AP-D-2	W605131-11		Methyl isobutyl ketone (MIBK)	108-10-1	EP-Plate	Ta		0.82	< 0.82	
20160525-ACE-AP-D-2	W605131-11		cis-1,3-Dichloropropene	10061-01-5	EP-Plate	Ta		0.91	< 0.91	
20160525-ACE-AP-D-2	W605131-11		trans-1,3-Dichloropropene	10061-02-6	EP-Plate	Ta		0.91	< 0.91	
20160525-ACE-AP-D-2	W605131-11		Toluene-d8	2037-26-5	EP-Plate	QA/Surr	98.8	0.82	40.5	
20160525-ACE-AP-D-2	W605131-11		Toluene	108-88-3	EP-Plate	Ta		0.75	< 0.75	r
20160525-ACE-AP-D-2	W605131-11		1,1,2-Trichloroethane	79-00-5	EP-Plate	Ta		1.1	< 1.1	
20160525-ACE-AP-D-2	W605131-11		2-Hexanone	591-78-6	EP-Plate	Ta		0.90	< 0.90	
20160525-ACE-AP-D-2	W605131-11		Dibromochloromethane	124-48-1	EP-Plate	Ta		1.7	< 1.7	
20160525-ACE-AP-D-2	W605131-11		Tetrachloroethylene	127-18-4	EP-Plate	Ta		1.4	< 1.4	
20160525-ACE-AP-D-2	W605131-11		Chlorobenzene-d5	3114-55-4	EP-Plate	Int. Std		0.92	46.1	
20160525-ACE-AP-D-2	W605131-11		1,2-Dibromoethane	106-93-4	EP-Plate	Ta		1.5	< 1.5	
20160525-ACE-AP-D-2	W605131-11		Chlorobenzene	108-90-7	EP-Plate	Ta		0.92	< 0.92	
20160525-ACE-AP-D-2	W605131-11		Ethylbenzene	100-41-4	EP-Plate	Ta		0.87	< 0.87	Rf

Sample ID				CAS				Reporting		
Client	RJLG	Medium ID	Analyte	Number	Matrix	Type	QC % REC	Limit (ng)	Result (ng)	Qualifier
20160525-ACE-AP-D-2	W605131-11		m,p-Xylene	179601-23-1	EP-Plate	Ta		0.87	**< 0.87**	**Rr**
20160525-ACE-AP-D-2	W605131-11		Nonane	111-84-2	EP-Plate	Ta		1.0	**< 1.0**	**Rr**
20160525-ACE-AP-D-2	W605131-11		o-Xylene	95-47-6	EP-Plate	Ta		0.87	**< 0.87**	**R**
20160525-ACE-AP-D-2	W605131-11		Styrene	100-42-5	EP-Plate	Ta		0.85	**< 0.85**	**R**
20160525-ACE-AP-D-2	W605131-11		Bromoform	75-25-2	EP-Plate	Ta		2.1	**< 2.1**	
20160525-ACE-AP-D-2	W605131-11		1,1,2,2-Tetrachloroethane	79-34-5	EP-Plate	Ta		1.4	**< 1.4**	**R**
20160525-ACE-AP-D-2	W605131-11		Cumene	98-82-8	EP-Plate	Ta		0.98	**< 0.98**	**R**
20160525-ACE-AP-D-2	W605131-11		4-Bromofluorobenzene (BFB)	460-00-4	EP-Plate	QA/Surr	105	1.4	**75.2**	
20160525-ACE-AP-D-2	W605131-11		n-Propylbenzene	103-65-1	EP-Plate	Ta		0.98	**< 0.98**	**Rr**
20160525-ACE-AP-D-2	W605131-11		2-Chlorotoluene	95-49-8	EP-Plate	Ta		1.0	**< 1.0**	**R**
20160525-ACE-AP-D-2	W605131-11		4-Ethyltoluene	622-96-8	EP-Plate	Ta		0.98	**< 0.98**	**Rr**
20160525-ACE-AP-D-2	W605131-11		1,3,5-Trimethylbenzene	108-67-8	EP-Plate	Ta		0.98	**< 0.98**	**Rr**
20160525-ACE-AP-D-2	W605131-11		1,2,4-Trimethylbenzene	95-63-6	EP-Plate	Ta		0.98	**< 0.98**	**Rr**
20160525-ACE-AP-D-2	W605131-11		1,3-Dichlorobenzene	541-73-1	EP-Plate	Ta		1.2	**< 1.2**	**RBr**
20160525-ACE-AP-D-2	W605131-11		Benzyl Chloride	100-44-7	EP-Plate	Ta		1.0	**< 1.0**	**RBr**
20160525-ACE-AP-D-2	W605131-11		1,4-Dichlorobenzene	106-46-7	EP-Plate	Ta		1.2	**< 1.2**	**RBr**
20160525-ACE-AP-D-2	W605131-11		1,2-Dichlorobenzene	95-50-1	EP-Plate	Ta		1.2	**< 1.2**	**RBr**
20160525-ACE-AP-D-2	W605131-11		1,2,4-Trichlorobenzene	120-82-1	EP-Plate	PIC		1.5	**< 1.5**	**Z**
20160525-ACE-AP-D-2	W605131-11		Naphthalene	91-20-3	EP-Plate	PIC		1.0	**< 1.0**	**Z**
20160525-ACE-AP-D-2	W605131-11		Hexachloro-1,3-butadiene	87-68-3	EP-Plate	PIC		2.1	**< 2.1**	**Z**

Client	Sample ID RJLG	Medium ID	Analyte	CAS Number	Matrix	Type	QC % REC	Reporting Limit (ng)	Result (ng)	Qualifier
			Tentatively Identified Compounds							
20160525-ACE-AP-D-2	W605131-11		Propene	115-07-1	EP-Plate	TIC		0.34	**1.28**	90,N,T
20160525-ACE-AP-D-2	W605131-11		Acetontrile	75-05-8	EP-Plate	TIC		0.34	**1.52**	45,N,T
20160525-ACE-AP-D-2	W605131-11		Pentane, 2-methyl-	107-83-5	EP-Plate	TIC		0.70	**3.20**	74,N,T

Comments: Concentrations of the tentatively identified compounds is based on the comparison of peak area to that of the nearest internal standard.

ng = nanogram
ppbv = parts per billion volume
ug/m3 = micrograms per cubic meter

BDL = Below Detection Limit
N/A = Not Applicable

Qualifiers

B = Compound found in associated laboratory blank above the reporting limit.
D = Diluted sample
E = Report concentration was above the instrumental calibration range
I = Response failure of an internal standard; concentration should be considered an estimate
J = Concentration below reporting limit
N = Identification based on mass spectral library search
P = Library spectrum match, rsd >90% w RT match
Q = Qualitative results for non-target compounds
Ta = Target Analyte

R = Recovery failure in CCV or LCS.
S = Surrogate recovery failure
T = Compound is tentatively identified compound. Includes chemical library matches & chemist identified compounds.
X = Detected but not quantifiable
c = Sample RPD failure
d= Data that exceeds the %RSD criteria set by the method (70-130%)
PIC = Positively identified compound, for non-calibrated compounds
r = Recovery failure in MRL
Z = Positively Identified Compound; Quanlitative data only

Authorized Signature: J Joseph Sears
Laboratory Technical Manager - Dr. Joe Sears

Date: 06/13/16

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DELIVERING SCIENTIFIC RESOLUTION

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2710 North 20th Avenue, Pasco WA 99301
Tel: (509) 545-4989 | Fax: (509) 544-6010

LABORATORY REPORT
EPA Compendium Method TO-17-Modified
Electrostatic Precipitator Plates

Client: Washington River Protection Solutions
Address: Richland, WA 99352
Attention: Attn: George Weeks
Telephone:
Fax:

RJ Lee Group Project: W605131
Samples Received: 05/26/16
Analysis Prep/Date: 06/02/16
Report Date: 06/13/16
Sampling Date: 05/26/16
CACN: 0
Client Project: GAL601096

Sample ID				CAS			QC %	Reporting Limit		
Client	RJLG	Medium ID	Analyte	Number	Matrix	Type	REC	(ng)	Result (ng)	Qualifier
20160526-ACE-B-W-2	W605131-12		Bromochloromethane	74-97-5	EP-Plate	Int. Std		1.1	**52.9**	
20160526-ACE-B-W-2	W605131-12		Propene	115-07-1	EP-Plate	Ta		0.34	**< 0.34**	**rB**
20160526-ACE-B-W-2	W605131-12		Dichlorodifluoromethane (F12)	75-71-8	EP-Plate	Ta		0.99	**< 0.99**	
20160526-ACE-B-W-2	W605131-12		Chloromethane	74-87-3	EP-Plate	Ta		0.41	**< 0.41**	
20160526-ACE-B-W-2	W605131-12		1,2-Dichloro-tetrarfluoroethane	76-14-2	EP-Plate	Ta		1.4	**< 1.4**	
20160526-ACE-B-W-2	W605131-12		Chloroethene	75-01-4	EP-Plate	Ta		0.51	**< 0.51**	
20160526-ACE-B-W-2	W605131-12		1,3-Butadiene	106-99-0	EP-Plate	Ta		0.44	**< 0.44**	
20160526-ACE-B-W-2	W605131-12		n-Butane	106-97-8	EP-Plate	Ta		0.48	**< 0.48**	
20160526-ACE-B-W-2	W605131-12		Bromomethane	74-83-9	EP-Plate	Ta		0.78	**< 0.78**	
20160526-ACE-B-W-2	W605131-12		Chloroethane	75-00-3	EP-Plate	Ta		0.53	**< 0.53**	
20160526-ACE-B-W-2	W605131-12		Ethanol	64-17-5	EP-Plate	Ta		0.38	**< 0.38**	**r**
20160526-ACE-B-W-2	W605131-12		Vinylbromide	593-60-2	EP-Plate	Ta		0.88	**< 0.88**	
20160526-ACE-B-W-2	W605131-12		Trichlorofluoromethane	75-69-4	EP-Plate	Ta		1.1	**< 1.1**	
20160526-ACE-B-W-2	W605131-12		Acrolein	107-02-8	EP-Plate	Ta		0.46	**< 0.46**	**r**
20160526-ACE-B-W-2	W605131-12		Acetone	67-64-1	EP-Plate	Ta		0.48	**9.43**	**r**
20160526-ACE-B-W-2	W605131-12		n-Pentane	109-66-0	EP-Plate	Ta		0.59	**< 0.59**	
20160526-ACE-B-W-2	W605131-12		Isopropanol	67-63-0	EP-Plate	Ta		0.49	**< 0.49**	
20160526-ACE-B-W-2	W605131-12		1,1-Dichloroethene	75-35-4	EP-Plate	Ta		0.79	**< 0.79**	
20160526-ACE-B-W-2	W605131-12		t-Butyl alcohol	75-65-0	EP-Plate	Ta		0.61	**< 0.61**	
20160526-ACE-B-W-2	W605131-12		1,1,2-Trichloro-1,2,2-trifluoroethane (	76-13-1	EP-Plate	Ta		1.5	**< 1.5**	
20160526-ACE-B-W-2	W605131-12		3-Chloropropene	107-05-1	EP-Plate	Ta		0.63	**< 0.63**	
20160526-ACE-B-W-2	W605131-12		Methylene Chloride (Dichloromethane)	75-09-2	EP-Plate	Ta		0.70	**< 0.70**	
20160526-ACE-B-W-2	W605131-12		Carbon Disulfide	75-65-0	EP-Plate	Ta		0.62	**< 0.62**	
20160526-ACE-B-W-2	W605131-12		trans-1,2-Dichloroethene	156-60-5	EP-Plate	Ta		0.79	**< 0.79**	**R**
20160526-ACE-B-W-2	W605131-12		Methyl-t-butyll ether (MTBE)	1634-04-4	EP-Plate	Ta		0.72	**< 0.72**	**R**
20160526-ACE-B-W-2	W605131-12		Vinyl Acetate	108-05-4	EP-Plate	Ta		0.70	**< 0.70**	**R**

Client	Sample ID RJLG	Medium ID	Analyte	CAS Number	Matrix	Type	QC % REC	Reporting Limit (ng)	Result (ng)	Qualifier
20160526-ACE-B-W-2	W605131-12		1,1-Dichloroethane	75-34-3	EP-Plate	Ta		0.81	< 0.81	
20160526-ACE-B-W-2	W605131-12		2-Butanone (MEK)	78-93-3	EP-Plate	Ta		0.59	< 0.59	
20160526-ACE-B-W-2	W605131-12		Hexane	110-54-3	EP-Plate	Ta		0.71	< 0.71	R
20160526-ACE-B-W-2	W605131-12		cis-1,2-Dichloroethene	156-59-2	EP-Plate	Ta		0.79	< 0.79	R
20160526-ACE-B-W-2	W605131-12		Ethyl Acetate	141-78-6	EP-Plate	Ta		0.72	< 0.72	
20160526-ACE-B-W-2	W605131-12		Chloroform	540-36-3	EP-Plate	Ta		1.1	< 1.1	
20160526-ACE-B-W-2	W605131-12		Tetrahydrofuran	67-66-3	EP-Plate	Ta		0.98	< 0.98	
20160526-ACE-B-W-2	W605131-12		1,4-Difluorobenzene	71-55-6	EP-Plate	Int. Std		0.93	46.7	
20160526-ACE-B-W-2	W605131-12		1,1,1-Trichloroethane	71-55-6	EP-Plate	Ta		1.1	< 1.1	
20160526-ACE-B-W-2	W605131-12		1,2-Dichloroethane-d4	17060-07-0	EP-Plate	QA/Surr	97.2	0.84	41.0	
20160526-ACE-B-W-2	W605131-12		1,2-Dichloroethane	107-06-2	EP-Plate	Ta		0.81	< 0.81	
20160526-ACE-B-W-2	W605131-12		Benzene	71-43-2	EP-Plate	Ta		0.64	< 0.64	
20160526-ACE-B-W-2	W605131-12		Carbon Tetrachloride	56-23-5	EP-Plate	Ta		1.3	< 1.3	
20160526-ACE-B-W-2	W605131-12		Cyclohexane	110-82-7	EP-Plate	Ta		0.69	< 0.69	
20160526-ACE-B-W-2	W605131-12		2,2,4-Trimethylpentane	540-84-1	EP-Plate	Ta		0.93	< 0.93	
20160526-ACE-B-W-2	W605131-12		Heptane	142-82-5	EP-Plate	Ta		0.82	< 0.82	R
20160526-ACE-B-W-2	W605131-12		Trichlorethylene	79-01-6	EP-Plate	Ta		1.1	< 1.1	
20160526-ACE-B-W-2	W605131-12		1,2-Dichloropropane	78-87-5	EP-Plate	Ta		0.92	< 0.92	
20160526-ACE-B-W-2	W605131-12		Methylmethacrylate	80-62-6	EP-Plate	Ta		0.82	< 0.82	
20160526-ACE-B-W-2	W605131-12		1,4-Dioxane	123-91-1	EP-Plate	Ta		0.72	< 0.72	
20160526-ACE-B-W-2	W605131-12		Bromodichloromethane	75-27-4	EP-Plate	Ta		1.3	< 1.3	
20160526-ACE-B-W-2	W605131-12		Methyl isobutyl ketone (MIBK)	108-10-1	EP-Plate	Ta		0.82	< 0.82	
20160526-ACE-B-W-2	W605131-12		cis-1,3-Dichloropropene	10061-01-5	EP-Plate	Ta		0.91	< 0.91	
20160526-ACE-B-W-2	W605131-12		trans-1,3-Dichloropropene	10061-02-6	EP-Plate	Ta		0.91	< 0.91	
20160526-ACE-B-W-2	W605131-12		Toluene-d8	2037-26-5	EP-Plate	QA/Surr	101	0.82	41.4	
20160526-ACE-B-W-2	W605131-12		Toluene	108-88-3	EP-Plate	Ta		0.75	< 0.75	r
20160526-ACE-B-W-2	W605131-12		1,1,2-Trichloroethane	79-00-5	EP-Plate	Ta		1.1	< 1.1	
20160526-ACE-B-W-2	W605131-12		2-Hexanone	591-78-6	EP-Plate	Ta		0.90	< 0.90	
20160526-ACE-B-W-2	W605131-12		Dibromochloromethane	124-48-1	EP-Plate	Ta		1.7	< 1.7	
20160526-ACE-B-W-2	W605131-12		Tetrachloroethylene	127-18-4	EP-Plate	Ta		1.4	< 1.4	
20160526-ACE-B-W-2	W605131-12		Chlorobenzene-d5	3114-55-4	EP-Plate	Int. Std		0.92	46.1	
20160526-ACE-B-W-2	W605131-12		1,2-Dibromoethane	106-93-4	EP-Plate	Ta		1.5	< 1.5	
20160526-ACE-B-W-2	W605131-12		Chlorobenzene	108-90-7	EP-Plate	Ta		0.92	< 0.92	
20160526-ACE-B-W-2	W605131-12		Ethylbenzene	100-41-4	EP-Plate	Ta		0.87	< 0.87	Rf
20160526-ACE-B-W-2	W605131-12		m,p-Xylene	179601-23-1	EP-Plate	Ta		0.87	< 0.87	Rr
20160526-ACE-B-W-2	W605131-12		Nonane	111-84-2	EP-Plate	Ta		1.0	< 1.0	Rr

Sample ID										
Client	RJLG	Medium ID	Analyte	CAS Number	Matrix	Type	QC % REC	Reporting Limit (ng)	Result (ng)	Qualifier
20160526-ACE-B-W-2	W605131-12		o-Xylene	95-47-6	EP-Plate	Ta		0.87	**< 0.87**	**R**
20160526-ACE-B-W-2	W605131-12		Styrene	100-42-5	EP-Plate	Ta		0.85	**< 0.85**	**R**
20160526-ACE-B-W-2	W605131-12		Bromoform	75-25-2	EP-Plate	Ta		2.1	**< 2.1**	
20160526-ACE-B-W-2	W605131-12		1,1,2,2-Tetrachloroethane	79-34-5	EP-Plate	Ta		1.4	**< 1.4**	**R**
20160526-ACE-B-W-2	W605131-12		Cumene	98-82-8	EP-Plate	Ta		0.98	**< 0.98**	**R**
20160526-ACE-B-W-2	W605131-12		4-Bromofluorobenzene (BFB)	460-00-4	EP-Plate	QA/Sur	88.4	1.4	**63.3**	
20160526-ACE-B-W-2	W605131-12		n-Propylbenzene	103-65-1	EP-Plate	Ta		0.98	**< 0.98**	**Rr**
20160526-ACE-B-W-2	W605131-12		2-Chlorotoluene	95-49-8	EP-Plate	Ta		1.0	**< 1.0**	**R**
20160526-ACE-B-W-2	W605131-12		4-Ethyltoluene	622-96-8	EP-Plate	Ta		0.98	**< 0.98**	**Rr**
20160526-ACE-B-W-2	W605131-12		1,3,5-Trimethylbenzene	108-67-8	EP-Plate	Ta		0.98	**< 0.98**	**Rr**
20160526-ACE-B-W-2	W605131-12		1,2,4-Trimethylbenzene	95-63-6	EP-Plate	Ta		0.98	**< 0.98**	**Rr**
20160526-ACE-B-W-2	W605131-12		1,3-Dichlorobenzene	541-73-1	EP-Plate	Ta		1.2	**< 1.2**	**RBr**
20160526-ACE-B-W-2	W605131-12		Benzyl Chloride	100-44-7	EP-Plate	Ta		1.0	**< 1.0**	**RBr**
20160526-ACE-B-W-2	W605131-12		1,4-Dichlorobenzene	106-46-7	EP-Plate	Ta		1.2	**< 1.2**	**RBr**
20160526-ACE-B-W-2	W605131-12		1,2-Dichlorobenzene	95-50-1	EP-Plate	Ta		1.2	**< 1.2**	**RBr**
20160526-ACE-B-W-2	W605131-12		1,2,4-Trichlorobenzene	120-82-1	EP-Plate	PIC		1.5	**< 1.5**	**Z**
20160526-ACE-B-W-2	W605131-12		Naphthalene	91-20-3	EP-Plate	PIC		1.0	**< 1.0**	**Z**
20160526-ACE-B-W-2	W605131-12		Hexachloro-1,3-butadiene	87-68-3	EP-Plate	PIC		2.1	**< 2.1**	**Z**

Client	Sample ID RJLG	Medium ID	Analyte	CAS Number	Matrix	Type	QC % REC	Reporting Limit (ng)	Result (ng)	Qualifier
			Tentatively Identified Compounds							
20160526-ACE-B-W-2	W605131-12		Norflurane	811-97-2	EP-Plate	TIC		0.83	**3.33**	83,N,T
20160526-ACE-B-W-2	W605131-12		Acetaldehyde	75-07-0	EP-Plate	TIC		0.36	**1.28**	9,N,T
20160526-ACE-B-W-2	W605131-12		Acetonitrile	75-05-8	EP-Plate	TIC		0.34	**1.73**	42,N,T
20160526-ACE-B-W-2	W605131-12		Pentane, 2-methyl-	107-83-5	EP-Plate	TIC		0.70	**3.49**	72,N,T
20160526-ACE-B-W-2	W605131-12		2,5-Cyclohexadiene-1,4-dione, 2,6-bis(1,1-dimethylethyl)-	719-22-2	EP-Plate	TIC		1.8	**5.33**	96,N,T
20160526-ACE-B-W-2	W605131-12		acid, 2-methyl-, 1-(1,1-dimethylethyl)-2-methyl-1,3-propan	74381-40-1	EP-Plate	TIC		2.3	**13.6**	64,N,T

Comments: Concentrations of the tentatively identified compounds is based on the comparison of peak area to that of the nearest internal standard.

ng – nanogram
ppbv = parts per billion volume
ug/m3 = micrograms per cubic meter

BDL = Below Detection Limit
N/A = Not Applicable

Qualifiers

B = Compound found in associated laboratory blank above the reporting limit.
D = Diluted sample
E = Report concentration was above the instrumental calibration range
I = Response failure of an internal standard; concentration should be considered an estimate
J = Concentration below reporting limit
N = Identification based on mass spectral library search
P = Library spectrum match, rsd >90% w RT match
Q = Qualitative results for non-target compounds
Ta = Target Analyte

R = Recovery failure in CCV or LCS.
S = Surrogate recovery failure
T = Compound is tentatively identified compound. Includes chemical library matches & chemist identified compounds.
X = Detected but not quantifiable
c = Sample RPD failure
d= Data that exceeds the %RSD criteria set by the method (70-130%)
PIC = Positively identified compound, for non-calibrated compounds
r = Recovery failure in MRL
Z = Positively Identified Compound; Quanlitative data only

Authorized Signature:
Laboratory Technical Manager - Dr. Joe Sears

Date: 06/13/16

RJ LEE GROUP
DELIVERING SCIENTIFIC RESOLUTION

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Tel: (509) 545-4989 | Fax: (509) 544-6010

LABORATORY REPORT
EPA Compendium Method TO-17-Modified
Electrostatic Precipitator Plates

Client:	Washington River Protection Solutions	RJ Lee Group Project:	W605131
Address:	Richland, WA 99352	Samples Received:	05/26/16
Attention:	Attn: George Weeks	Analysis Prep/Date:	06/02/16
Telephone:		Report Date:	06/13/16
Fax:		Sampling Date:	05/26/16
		Purchase Order No.:	0
		Client Project:	GAL601096

Client	Sample ID RJLG	Medium ID	Analyte	CAS Number	Matrix	Type	QC % REC	Reporting Limit (ng)	Result (ng)	Qualifier
20160526-ACE-AP-SE-2	W605131-13		Bromochloromethane	74-97-5	EP-Plate	Int. Std		1.1	52.9	
20160526-ACE-AP-SE-2	W605131-13		Propene	115-07-1	EP-Plate	Ta		0.34	< 0.34	rB
20160526-ACE-AP-SE-2	W605131-13		Dichlorodifluoromethane (F12)	75-71-8	EP-Plate	Ta		0.99	< 0.99	
20160526-ACE-AP-SE-2	W605131-13		Chloromethane	74-87-3	EP-Plate	Ta		0.41	< 0.41	
20160526-ACE-AP-SE-2	W605131-13		1,2-Dichloro-tetrarfluoroethane	76-14-2	EP-Plate	Ta		1.4	< 1.4	
20160526-ACE-AP-SE-2	W605131-13		Chloroethene	75-01-4	EP-Plate	Ta		0.51	< 0.51	
20160526-ACE-AP-SE-2	W605131-13		1,3-Butadiene	106-99-0	EP-Plate	Ta		0.44	< 0.44	
20160526-ACE-AP-SE-2	W605131-13		n-Butane	106-97-8	EP-Plate	Ta		0.48	< 0.48	
20160526-ACE-AP-SE-2	W605131-13		Bromomethane	74-83-9	EP-Plate	Ta		0.78	< 0.78	
20160526-ACE-AP-SE-2	W605131-13		Chloroethane	75-00-3	EP-Plate	Ta		0.53	< 0.53	
20160526-ACE-AP-SE-2	W605131-13		Ethanol	64-17-5	EP-Plate	Ta		0.38	< 0.38	r
20160526-ACE-AP-SE-2	W605131-13		Vinylbromide	593-60-2	EP-Plate	Ta		0.88	< 0.88	
20160526-ACE-AP-SE-2	W605131-13		Trichlorofluoromethane	75-69-4	EP-Plate	Ta		1.1	< 1.1	
20160526-ACE-AP-SE-2	W605131-13		Acrolein	107-02-8	EP-Plate	Ta		0.46	< 0.46	r
20160526-ACE-AP-SE-2	W605131-13		Acetone	67-64-1	EP-Plate	Ta		0.48	6.39	r
20160526-ACE-AP-SE-2	W605131-13		n-Pentane	109-66-0	EP-Plate	Ta		0.59	< 0.59	
20160526-ACE-AP-SE-2	W605131-13		Isopropanol	67-63-0	EP-Plate	Ta		0.49	< 0.49	
20160526-ACE-AP-SE-2	W605131-13		1,1-Dichloroethene	75-35-4	EP-Plate	Ta		0.79	< 0.79	
20160526-ACE-AP-SE-2	W605131-13		t-Butyl alcohol	75-65-0	EP-Plate	Ta		0.61	< 0.61	
20160526-ACE-AP-SE-2	W605131-13		1,1,2-Trichloro-1,2,2-trifluoroethane (	76-13-1	EP-Plate	Ta		1.5	< 1.5	
20160526-ACE-AP-SE-2	W605131-13		3-Chloropropene	107-05-1	EP-Plate	Ta		0.63	< 0.63	
20160526-ACE-AP-SE-2	W605131-13		Methylene Chloride (Dichloromethane)	75-09-2	EP-Plate	Ta		0.70	< 0.70	
20160526-ACE-AP-SE-2	W605131-13		Carbon Disulfide	75-65-0	EP-Plate	Ta		0.62	< 0.62	
20160526-ACE-AP-SE-2	W605131-13		trans-1,2-Dichloroethene	156-60-5	EP-Plate	Ta		0.79	< 0.79	R
20160526-ACE-AP-SE-2	W605131-13		Methyl-t-butyll ether (MTBE)	1634-04-4	EP-Plate	Ta		0.72	< 0.72	R
20160526-ACE-AP-SE-2	W605131-13		Vinyl Acetate	108-05-4	EP-Plate	Ta		0.70	< 0.70	R

Sample ID										
Client	RJLG	Medium ID	Analyte	CAS Number	Matrix	Type	QC % REC	Reporting Limit (ng)	Result (ng)	Qualifier
20160526-ACE-AP-SE-2	W605131-13		1,1-Dichloroethane	75-34-3	EP-Plate	Ta		0.81	< 0.81	
20160526-ACE-AP-SE-2	W605131-13		2-Butanone (MEK)	78-93-3	EP-Plate	Ta		0.59	< 0.59	
20160526-ACE-AP-SE-2	W605131-13		Hexane	110-54-3	EP-Plate	Ta		0.71	< 0.71	R
20160526-ACE-AP-SE-2	W605131-13		cis-1,2-Dichloroethene	156-59-2	EP-Plate	Ta		0.79	< 0.79	R
20160526-ACE-AP-SE-2	W605131-13		Ethyl Acetate	141-78-6	EP-Plate	Ta		0.72	< 0.72	
20160526-ACE-AP-SE-2	W605131-13		Chloroform	540-36-3	EP-Plate	Ta		1.1	< 1.1	
20160526-ACE-AP-SE-2	W605131-13		Tetrahydrofuran	67-66-3	EP-Plate	Ta		0.98	< 0.98	
20160526-ACE-AP-SE-2	W605131-13		1,4-Difluorobenzene	71-55-6	EP-Plate	Int. Std		0.93	46.7	
20160526-ACE-AP-SE-2	W605131-13		1,1,1-Trichloroethane	71-55-6	EP-Plate	Ta		1.1	< 1.1	
20160526-ACE-AP-SE-2	W605131-13		1,2-Dichloroethane-d4	17060-07-0	EP-Plate	QA/Surr	94.7	0.84	39.9	
20160526-ACE-AP-SE-2	W605131-13		1,2-Dichloroethane	107-06-2	EP-Plate	Ta		0.81	< 0.81	
20160526-ACE-AP-SE-2	W605131-13		Benzene	71-43-2	EP-Plate	Ta		0.64	< 0.64	
20160526-ACE-AP-SE-2	W605131-13		Carbon Tetrachloride	56-23-5	EP-Plate	Ta		1.3	< 1.3	
20160526-ACE-AP-SE-2	W605131-13		Cyclohexane	110-82-7	EP-Plate	Ta		0.69	< 0.69	
20160526-ACE-AP-SE-2	W605131-13		2,2,4-Trimethylpentane	540-84-1	EP-Plate	Ta		0.93	< 0.93	
20160526-ACE-AP-SE-2	W605131-13		Heptane	142-82-5	EP-Plate	Ta		0.82	< 0.82	R
20160526-ACE-AP-SE-2	W605131-13		Trichlorethylene	79-01-6	EP-Plate	Ta		1.1	< 1.1	
20160526-ACE-AP-SE-2	W605131-13		1,2-Dichloropropane	78-87-5	EP-Plate	Ta		0.92	< 0.92	
20160526-ACE-AP-SE-2	W605131-13		Methylmethacrylate	80-62-6	EP-Plate	Ta		0.82	< 0.82	
20160526-ACE-AP-SE-2	W605131-13		1,4-Dioxane	123-91-1	EP-Plate	Ta		0.72	< 0.72	
20160526-ACE-AP-SE-2	W605131-13		Bromodichloromethane	75-27-4	EP-Plate	Ta		1.3	< 1.3	
20160526-ACE-AP-SE-2	W605131-13		Methyl isobutyl ketone (MIBK)	108-10-1	EP-Plate	Ta		0.82	< 0.82	
20160526-ACE-AP-SE-2	W605131-13		cis-1,3-Dichloropropene	10061-01-5	EP-Plate	Ta		0.91	< 0.91	
20160526-ACE-AP-SE-2	W605131-13		trans-1,3-Dichloropropene	10061-02-6	EP-Plate	Ta		0.91	< 0.91	
20160526-ACE-AP-SE-2	W605131-13		Toluene-d8	2037-26-5	EP-Plate	QA/Surr	98.4	0.82	40.3	
20160526-ACE-AP-SE-2	W605131-13		Toluene	108-88-3	EP-Plate	Ta		0.75	< 0.75	r
20160526-ACE-AP-SE-2	W605131-13		1,1,2-Trichloroethane	79-00-5	EP-Plate	Ta		1.1	< 1.1	
20160526-ACE-AP-SE-2	W605131-13		2-Hexanone	591-78-6	EP-Plate	Ta		0.90	< 0.90	
20160526-ACE-AP-SE-2	W605131-13		Dibromochloromethane	124-48-1	EP-Plate	Ta		1.7	< 1.7	
20160526-ACE-AP-SE-2	W605131-13		Tetrachloroethylene	127-18-4	EP-Plate	Ta		1.4	< 1.4	
20160526-ACE-AP-SE-2	W605131-13		Chlorobenzene-d5	3114-55-4	EP-Plate	Int. Std		0.92	46.1	
20160526-ACE-AP-SE-2	W605131-13		1,2-Dibromoethane	106-93-4	EP-Plate	Ta		1.5	< 1.5	
20160526-ACE-AP-SE-2	W605131-13		Chlorobenzene	108-90-7	EP-Plate	Ta		0.92	< 0.92	
20160526-ACE-AP-SE-2	W605131-13		Ethylbenzene	100-41-4	EP-Plate	Ta		0.87	< 0.87	Rf
20160526-ACE-AP-SE-2	W605131-13		m,p-Xylene	179601-23-1	EP-Plate	Ta		0.87	< 0.87	Rr
20160526-ACE-AP-SE-2	W605131-13		Nonane	111-84-2	EP-Plate	Ta		1.0	< 1.0	Rr

Sample ID										
Client	RJLG	Medium ID	Analyte	CAS Number	Matrix	Type	QC % REC	Reporting Limit (ng)	Result (ng)	Qualifier
20160526-ACE-AP-SE-2	W605131-13		o-Xylene	95-47-6	EP-Plate	Ta		0.87	**< 0.87**	**R**
20160526-ACE-AP-SE-2	W605131-13		Styrene	100-42-5	EP-Plate	Ta		0.85	**< 0.85**	**R**
20160526-ACE-AP-SE-2	W605131-13		Bromoform	75-25-2	EP-Plate	Ta		2.1	**< 2.1**	
20160526-ACE-AP-SE-2	W605131-13		1,1,2,2-Tetrachloroethane	79-34-5	EP-Plate	Ta		1.4	**< 1.4**	**R**
20160526-ACE-AP-SE-2	W605131-13		Cumene	98-82-8	EP-Plate	Ta		0.98	**< 0.98**	**R**
20160526-ACE-AP-SE-2	W605131-13		4-Bromofluorobenzene (BFB)	460-00-4	EP-Plate	QA/Surr	122	1.4	**87.4**	
20160526-ACE-AP-SE-2	W605131-13		n-Propylbenzene	103-65-1	EP-Plate	Ta		0.98	**< 0.98**	**Rr**
20160526-ACE-AP-SE-2	W605131-13		2-Chlorotoluene	95-49-8	EP-Plate	Ta		1.0	**< 1.0**	**R**
20160526-ACE-AP-SE-2	W605131-13		4-Ethyltoluene	622-96-8	EP-Plate	Ta		0.98	**< 0.98**	**Rr**
20160526-ACE-AP-SE-2	W605131-13		1,3,5-Trimethylbenzene	108-67-8	EP-Plate	Ta		0.98	**< 0.98**	**Rr**
20160526-ACE-AP-SE-2	W605131-13		1,2,4-Trimethylbenzene	95-63-6	EP-Plate	Ta		0.98	**< 0.98**	**Rr**
20160526-ACE-AP-SE-2	W605131-13		1,3-Dichlorobenzene	541-73-1	EP-Plate	Ta		1.2	**< 1.2**	**RBr**
20160526-ACE-AP-SE-2	W605131-13		Benzyl Chloride	100-44-7	EP-Plate	Ta		1.0	**< 1.0**	**RBr**
20160526-ACE-AP-SE-2	W605131-13		1,4-Dichlorobenzene	106-46-7	EP-Plate	Ta		1.2	**< 1.2**	**RBr**
20160526-ACE-AP-SE-2	W605131-13		1,2-Dichlorobenzene	95-50-1	EP-Plate	Ta		1.2	**< 1.2**	**RBr**
20160526-ACE-AP-SE-2	W605131-13		1,2,4-Trichlorobenzene	120-82-1	EP-Plate	PIC		1.5	**< 1.5**	**Z**
20160526-ACE-AP-SE-2	W605131-13		Naphthalene	91-20-3	EP-Plate	PIC		1.0	**< 1.0**	**Z**
20160526-ACE-AP-SE-2	W605131-13		Hexachloro-1,3-butadiene	87-68-3	EP-Plate	PIC		2.1	**< 2.1**	**Z**

Client	Sample ID RJLG	Medium ID	Analyte	CAS Number	Matrix	Type	QC % REC	Reporting Limit (ng)	Result (ng)	Qualifier
			Tentatively Identified Compounds							
20160526-ACE-AP-SE-2	W605131-13		Norflurane	811-97-2	EP-Plate	TIC		0.83	**2.63**	90,N,T
20160526-ACE-AP-SE-2	W605131-13		Acetonitrile	75-05-8	EP-Plate	TIC		0.34	**1.25**	50,N,T
20160526-ACE-AP-SE-2	W605131-13		Pentane, 2-methyl-	107-83-5	EP-Plate	TIC		0.70	**2.33**	74,N,T
20160526-ACE-AP-SE-2	W605131-13		Nonanal	124-19-6	EP-Plate	TIC		#VALUE!	**3.16**	91,N,T
20160526-ACE-AP-SE-2	W605131-13		Decanal	112-31-2	EP-Plate	TIC		#VALUE!	**3.48**	91,N,T
20160526-ACE-AP-SE-2	W605131-13		panoic acid, 2-methyl-, 2-(hydroxymethyl)-1-propylbutyl es	74367-32-1	EP-Plate	TIC		#VALUE!	**11.5**	53,N,T

Comments: Concentrations of the tentatively identified compounds is based on the comparison of peak area to that of the nearest internal standard.

ng = nanogram
ppbv = parts per billion volume
ug/m3 = micrograms per cubic meter

BDL = Below Detection Limit
N/A = Not Applicable

Qualifiers

B = Compound found in associated laboratory blank above the reporting limit.
D = Diluted sample
E = Report concentration was above the instrumental calibration range
I = Response failure of an internal standard; concentration should be considered an estimate
J = Concentration below reporting limit
N = Identification based on mass spectral library search
P = Library spectrum match, rsd >90% w RT match
Q = Qualitative results for non-target compounds
Ta = Target Analyte

R = Recovery failure in CCV or LCS.
S = Surrogate recovery failure
T = Compound is tentatively identified compound. Includes chemical library matches & chemist identified compounds.
X = Detected but not quantifiable
c = Sample RPD failure
d= Data that exceeds the %RSD criteria set by the method (70-130%)
PIC = Positively identified compound, for non-calibrated compounds
r = Recovery failure in MRL
Z = Positively Identified Compound; Quanlitative data only

Authorized Signature: L Joseph Sears
Laboratory Technical Manager - Dr. Joe Sears

Date: 06/13/16

RJ LEE GROUP
DELIVERING SCIENTIFIC RESOLUTION

RJ Lee*Group*, Inc.|Columbia Basin Analytical Laboratory
2710 North 20th Avenue, Pasco WA 99301
Tel: (509) 545-4989 | Fax: (509) 544-6010

LABORATORY REPORT
EPA Compendium Method TO-17-Modified
Electrostatic Precipitator Plates

Client:	Washington River Protection Solutions	RJ Lee Group Project:	W605131
Address:	Richland, WA 99352	Samples Received:	05/26/16
		Analysis Prep/Date:	06/02/16
Attention:	Attn: George Weeks	Report Date:	06/13/16
Telephone:		Sampling Date:	
Fax:		Purchase Order No.:	0
		Client Project:	GAL601096

Sample ID				CAS			QC %	Reporting		
Client	RJLG	Medium ID	Analyte	Number	Matrix	Type	REC	Limit (ng)	Result (ng)	Qualifier
20160526-ACE-A-SE-2	W605131-14		Bromochloromethane	74-97-5	EP-Plate	Int. Std		1.1	**52.9**	
20160526-ACE-A-SE-2	W605131-14		Propene	115-07-1	EP-Plate	Ta		0.34	**< 0.34**	**rB**
20160526-ACE-A-SE-2	W605131-14		Dichlorodifluoromethane (F12)	75-71-8	EP-Plate	Ta		0.99	**4.55**	
20160526-ACE-A-SE-2	W605131-14		Chloromethane	74-87-3	EP-Plate	Ta		0.41	**< 0.41**	
20160526-ACE-A-SE-2	W605131-14		1,2-Dichloro-tetrarfluoroethane	76-14-2	EP-Plate	Ta		1.4	**< 1.4**	
20160526-ACE-A-SE-2	W605131-14		Chloroethene	75-01-4	EP-Plate	Ta		0.51	**< 0.51**	
20160526-ACE-A-SE-2	W605131-14		1,3-Butadiene	106-99-0	EP-Plate	Ta		0.44	**< 0.44**	
20160526-ACE-A-SE-2	W605131-14		n-Butane	106-97-8	EP-Plate	Ta		0.48	**< 0.48**	
20160526-ACE-A-SE-2	W605131-14		Bromomethane	74-83-9	EP-Plate	Ta		0.78	**< 0.78**	
20160526-ACE-A-SE-2	W605131-14		Chloroethane	75-00-3	EP-Plate	Ta		0.53	**< 0.53**	
20160526-ACE-A-SE-2	W605131-14		Ethanol	64-17-5	EP-Plate	Ta		0.38	**< 0.38**	**r**
20160526-ACE-A-SE-2	W605131-14		Vinylbromide	593-60-2	EP-Plate	Ta		0.88	**< 0.88**	
20160526-ACE-A-SE-2	W605131-14		Trichlorofluoromethane	75-69-4	EP-Plate	Ta		1.1	**< 1.1**	
20160526-ACE-A-SE-2	W605131-14		Acrolein	107-02-8	EP-Plate	Ta		0.46	**< 0.46**	**r**
20160526-ACE-A-SE-2	W605131-14		Acetone	67-64-1	EP-Plate	Ta		0.48	**41.3**	**r**
20160526-ACE-A-SE-2	W605131-14		n-Pentane	109-66-0	EP-Plate	Ta		0.59	**< 0.59**	
20160526-ACE-A-SE-2	W605131-14		Isopropanol	67-63-0	EP-Plate	Ta		0.49	**< 0.49**	
20160526-ACE-A-SE-2	W605131-14		1,1-Dichloroethene	75-35-4	EP-Plate	Ta		0.79	**< 0.79**	
20160526-ACE-A-SE-2	W605131-14		t-Butyl alcohol	75-65-0	EP-Plate	Ta		0.61	**< 0.61**	
20160526-ACE-A-SE-2	W605131-14		1,1,2-Trichloro-1,2,2-trifluoroethane (	76-13-1	EP-Plate	Ta		1.5	**< 1.5**	
20160526-ACE-A-SE-2	W605131-14		3-Chloropropene	107-05-1	EP-Plate	Ta		0.63	**< 0.63**	
20160526-ACE-A-SE-2	W605131-14		Methylene Chloride (Dichloromethane)	75-09-2	EP-Plate	Ta		0.70	**< 0.70**	
20160526-ACE-A-SE-2	W605131-14		Carbon Disulfide	75-65-0	EP-Plate	Ta		0.62	**< 0.62**	
20160526-ACE-A-SE-2	W605131-14		trans-1,2-Dichloroethene	156-60-5	EP-Plate	Ta		0.79	**< 0.79**	**R**

RJ LEE GROUP
DELIVERING SCIENTIFIC RESOLUTION

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LABORATORY REPORT

EPA Compendium Method TO-17-Modified
Electrostatic Precipitator Plates

Client: Washington River Protection Solutions
Address: Richland, WA 99352
Attention: Attn: George Weeks
Telephone:
Fax:

RJ Lee Group Project: W605131
Samples Received: 05/26/16
Analysis Prep/Date: 06/02/16
Report Date: 06/13/16
Sampling Date:
Purchase Order No.: 0
Client Project: GAL601096

20160526-ACE-A-SE-2	W605131-14		Methyl-t-butyll ether (MTBE)	1634-04-4	EP-Plate	Ta		0.72	< 0.72	R
20160526-ACE-A-SE-2	W605131-14		Vinyl Acetate	108-05-4	EP-Plate	Ta		0.70	< 0.70	R
20160526-ACE-A-SE-2	W605131-14		1,1-Dichloroethane	75-34-3	EP-Plate	Ta		0.81	< 0.81	
20160526-ACE-A-SE-2	W605131-14		2-Butanone (MEK)	78-93-3	EP-Plate	Ta		0.59	< 0.59	
20160526-ACE-A-SE-2	W605131-14		Hexane	110-54-3	EP-Plate	Ta		0.71	< 0.71	R
20160526-ACE-A-SE-2	W605131-14		cis-1,2-Dichloroethene	156-59-2	EP-Plate	Ta		0.79	< 0.79	R
20160526-ACE-A-SE-2	W605131-14		Ethyl Acetate	141-78-6	EP-Plate	Ta		0.72	< 0.72	
20160526-ACE-A-SE-2	W605131-14		Chloroform	540-36-3	EP-Plate	Ta		1.1	< 1.1	
20160526-ACE-A-SE-2	W605131-14		Tetrahydrofuran	67-66-3	EP-Plate	Ta		0.98	< 0.98	
20160526-ACE-A-SE-2	W605131-14		1,4-Difluorobenzene	71-55-6	EP-Plate	Int. Std		0.93	46.7	
20160526-ACE-A-SE-2	W605131-14		1,1,1-Trichloroethane	71-55-6	EP-Plate	Ta		1.1	< 1.1	
20160526-ACE-A-SE-2	W605131-14		1,2-Dichloroethane-d4	17060-07-0	EP-Plate	QA/Surr	97.4	0.84	41.0	
20160526-ACE-A-SE-2	W605131-14		1,2-Dichloroethane	107-06-2	EP-Plate	Ta		0.81	< 0.81	
20160526-ACE-A-SE-2	W605131-14		Benzene	71-43-2	EP-Plate	Ta		0.64	< 0.64	
20160526-ACE-A-SE-2	W605131-14		Carbon Tetrachloride	56-23-5	EP-Plate	Ta		1.3	< 1.3	
20160526-ACE-A-SE-2	W605131-14		Cyclohexane	110-82-7	EP-Plate	Ta		0.69	< 0.69	
20160526-ACE-A-SE-2	W605131-14		2,2,4-Trimethylpentane	540-84-1	EP-Plate	Ta		0.93	< 0.93	
20160526-ACE-A-SE-2	W605131-14		Heptane	142-82-5	EP-Plate	Ta		0.82	< 0.82	R
20160526-ACE-A-SE-2	W605131-14		Trichlorethylene	79-01-6	EP-Plate	Ta		1.1	< 1.1	
20160526-ACE-A-SE-2	W605131-14		1,2-Dichloropropane	78-87-5	EP-Plate	Ta		0.92	< 0.92	
20160526-ACE-A-SE-2	W605131-14		Methylmethacrylate	80-62-6	EP-Plate	Ta		0.82	< 0.82	
20160526-ACE-A-SE-2	W605131-14		1,4-Dioxane	123-91-1	EP-Plate	Ta		0.72	< 0.72	
20160526-ACE-A-SE-2	W605131-14		Bromodichloromethane	75-27-4	EP-Plate	Ta		1.3	< 1.3	
20160526-ACE-A-SE-2	W605131-14		Methyl isobutyl ketone (MIBK)	108-10-1	EP-Plate	Ta		0.82	< 0.82	
20160526-ACE-A-SE-2	W605131-14		cis-1,3-Dichloropropene	10061-01-5	EP-Plate	Ta		0.91	< 0.91	
20160526-ACE-A-SE-2	W605131-14		trans-1,3-Dichloropropene	10061-02-6	EP-Plate	Ta		0.91	< 0.91	
20160526-ACE-A-SE-2	W605131-14		Toluene-d8	2037-26-5	EP-Plate	QA/Surr	96	0.82	39.4	
20160526-ACE-A-SE-2	W605131-14		Toluene	108-88-3	EP-Plate	Ta		0.75	< 0.75	r

RJ LEE GROUP
DELIVERING SCIENTIFIC RESOLUTION

RJ Lee*Group*, Inc.|Columbia Basin Analytical Laboratory
2710 North 20th Avenue, Pasco WA 99301
Tel: (509) 545-4989 | Fax: (509) 544-6010

LABORATORY REPORT
EPA Compendium Method TO-17-Modified
Electrostatic Precipitator Plates

Client: Washington River Protection Solutions
Address: Richland, WA 99352
Attention: Attn: George Weeks
Telephone:
Fax:

RJ Lee Group Project: W605131
Samples Received: 05/26/16
Analysis Prep/Date: 06/02/16
Report Date: 06/13/16
Sampling Date:
Purchase Order No.: 0
Client Project: GAL601096

20160526-ACE-A-SE-2	W605131-14		1,1,2-Trichloroethane	79-00-5	EP-Plate	Ta		1.1	**< 1.1**	
20160526-ACE-A-SE-2	W605131-14		2-Hexanone	591-78-6	EP-Plate	Ta		0.90	**< 0.90**	
20160526-ACE-A-SE-2	W605131-14		Dibromochloromethane	124-48-1	EP-Plate	Ta		1.7	**< 1.7**	
20160526-ACE-A-SE-2	W605131-14		Tetrachloroethylene	127-18-4	EP-Plate	Ta		1.4	**< 1.4**	
20160526-ACE-A-SE-2	W605131-14		Chlorobenzene-d5	3114-55-4	EP-Plate	Int. Std		0.92	**46.1**	
20160526-ACE-A-SE-2	W605131-14		1,2-Dibromoethane	106-93-4	EP-Plate	Ta		1.5	**< 1.5**	
20160526-ACE-A-SE-2	W605131-14		Chlorobenzene	108-90-7	EP-Plate	Ta		0.92	**< 0.92**	
20160526-ACE-A-SE-2	W605131-14		Ethylbenzene	100-41-4	EP-Plate	Ta		0.87	**< 0.87**	**Rf**
20160526-ACE-A-SE-2	W605131-14		m,p-Xylene	179601-23-1	EP-Plate	Ta		0.87	**< 0.87**	**Rr**
20160526-ACE-A-SE-2	W605131-14		Nonane	111-84-2	EP-Plate	Ta		1.0	**< 1.0**	**Rr**
20160526-ACE-A-SE-2	W605131-14		o-Xylene	95-47-6	EP-Plate	Ta		0.87	**< 0.87**	**R**
20160526-ACE-A-SE-2	W605131-14		Styrene	100-42-5	EP-Plate	Ta		0.85	**< 0.85**	**R**
20160526-ACE-A-SE-2	W605131-14		Bromoform	75-25-2	EP-Plate	Ta		2.1	**< 2.1**	
20160526-ACE-A-SE-2	W605131-14		1,1,2,2-Tetrachloroethane	79-34-5	EP-Plate	Ta		1.4	**< 1.4**	**R**
20160526-ACE-A-SE-2	W605131-14		Cumene	98-82-8	EP-Plate	Ta		0.98	**< 0.98**	**R**
20160526-ACE-A-SE-2	W605131-14		4-Bromofluorobenzene (BFB)	460-00-4	EP-Plate	QA/Surr	106	1.4	**75.9**	
20160526-ACE-A-SE-2	W605131-14		n-Propylbenzene	103-65-1	EP-Plate	Ta		0.98	**< 0.98**	**Rr**
20160526-ACE-A-SE-2	W605131-14		2-Chlorotoluene	95-49-8	EP-Plate	Ta		1.0	**< 1.0**	**R**
20160526-ACE-A-SE-2	W605131-14		4-Ethyltoluene	622-96-8	EP-Plate	Ta		0.98	**< 0.98**	**Rr**
20160526-ACE-A-SE-2	W605131-14		1,3,5-Trimethylbenzene	108-67-8	EP-Plate	Ta		0.98	**< 0.98**	**Rr**
20160526-ACE-A-SE-2	W605131-14		1,2,4-Trimethylbenzene	95-63-6	EP-Plate	Ta		0.98	**< 0.98**	**Rr**
20160526-ACE-A-SE-2	W605131-14		1,3-Dichlorobenzene	541-73-1	EP-Plate	Ta		1.2	**< 1.2**	**RBr**
20160526-ACE-A-SE-2	W605131-14		Benzyl Chloride	100-44-7	EP-Plate	Ta		1.0	**< 1.0**	**RBr**
20160526-ACE-A-SE-2	W605131-14		1,4-Dichlorobenzene	106-46-7	EP-Plate	Ta		1.2	**< 1.2**	**RBr**
20160526-ACE-A-SE-2	W605131-14		1,2-Dichlorobenzene	95-50-1	EP-Plate	Ta		1.2	**< 1.2**	**RBr**
20160526-ACE-A-SE-2	W605131-14		1,2,4-Trichlorobenzene	120-82-1	EP-Plate	PIC		1.5	**< 1.5**	**Z**
20160526-ACE-A-SE-2	W605131-14		Naphthalene	91-20-3	EP-Plate	PIC		1.0	**< 1.0**	**Z**
20160526-ACE-A-SE-2	W605131-14		Hexachloro-1,3-butadiene	87-68-3	EP-Plate	PIC		2.1	**< 2.1**	**Z**

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Tel: (509) 545-4989 | Fax: (509) 544-6010

LABORATORY REPORT

EPA Compendium Method TO-17-Modified
Electrostatic Precipitator Plates

Client: Washington River Protection Solutions
Address: Richland, WA 99352
Attention: Attn: George Weeks
Telephone:
Fax:

RJ Lee Group Project: W605131
Samples Received: 05/26/16
Analysis Prep/Date: 06/02/16
Report Date: 06/13/16
Sampling Date:
Purchase Order No.: 0
Client Project: GAL601096

			Tentatively Identified Compounds							
20160526-ACE-A-SE-2	W605131-14		Acetonitrile	75-05-8	EP-Plate	TIC		0.34	**1.69**	56,N,T
20160526-ACE-A-SE-2	W605131-14		Pentane, 2-methyl-	107-83-5	EP-Plate	TIC		0.70	**2.97**	74,N,T
20160526-ACE-A-SE-2	W605131-14		2-Pentanone, 4-hydroxy-4-methyl-	123-42-2	EP-Plate	TIC		0.95	**2.42**	83,N,T
20160526-ACE-A-SE-2	W605131-14		Nonanal	124-19-6	EP-Plate	TIC		1.2	**4.06**	91,N,T
20160526-ACE-A-SE-2	W605131-14		Decanal	112-31-2	EP-Plate	TIC		1.3	**3.67**	91,N,T
20160526-ACE-A-SE-2	W605131-14		ntanoic acid, 2,2,4-trimethyl-3-carboxyisopropyl, isobutyl e	1000140-77-5	EP-Plate	TIC		2.3	**20.0**	74,N,T

Comments: Concentrations of the tentatively identified compounds is based on the comparison of peak area to that of the nearest internal standard.

ng – nanogram
ppbv = parts per billion volume
ug/m3 = micrograms per cubic meter

Qualifiers

B = Compound found in associated laboratory blank above the reporting limit.
D = Diluted sample
E = Report concentration was above the instrumental calibration range
I = Response failure of an internal standard; concentration should be considered an estimate
J = Concentration below reporting limit
N = Identification based on mass spectral library search
P = Library spectrum match, rsd >90% w RT match
Q = Qualitative results for non-target compounds
Ta = Target Analyte
R = Recovery failure in CCV or LCS
S = Surrogate recovery failure
T = Compound is tentatively identified compound. Includes chemical library matches & chemist identified compounds.
X = Detected but not quantifiable
c = Sample RPD failure
d= Data that exceeds the %RSD criteria set by the method (70-130%)
PIC = Positively identified compound, for non-calibrated compounds
r = Recovery failure in MRL
Z = Positively Identified Compound; Quanlitative data only

Authorized Signature: L Joseph Sears
Laboratory Technical Manager - Joe Sears, Ph.D.

Date: 06/13/16

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Tel: (509) 545-4989 | Fax: (509) 544-6010

LABORATORY REPORT
EPA Compendium Method TO-17-Modified
Electrostatic Precipitator Plates

Client:	Washington River Protection Solt	RJ Lee Group Project:	W605131
Address:		Samples Received:	05/26/16
	Richland, WA 99352	Analysis Date:	06/02/16
Attention:	Attn: George Weeks	Report Date:	06/13/16
Telephone:		Sampling Date:	05/25/16
e-mail:		Purchase Order No.:	
		Client Project:	GAL601096

Sample ID				CAS			QC %	Reporting Limit		
Client	RJLG	Medium ID	Analyte	Number	Matrix	Type	REC	(ng)	Result (ng)	Qualifier
20160525-ACE-AP-D-2	W605131-11		Bromochloromethane	74-97-5	EP-Plate	Int. Std		1.1	**52.9**	
20160525-ACE-AP-D-2	W605131-11		Propene	115-07-1	EP-Plate	Ta		0.34	**< 0.34**	**rB**
20160525-ACE-AP-D-2	W605131-11		Dichlorodifluoromethane (F12)	75-71-8	EP-Plate	Ta		0.99	**< 0.99**	
20160525-ACE-AP-D-2	W605131-11		Chloromethane	74-87-3	EP-Plate	Ta		0.41	**< 0.41**	
20160525-ACE-AP-D-2	W605131-11		1,2-Dichloro-tetrafluoroethane	76-14-2	EP-Plate	Ta		1.4	**< 1.4**	
20160525-ACE-AP-D-2	W605131-11		Chloroethene	75-01-4	EP-Plate	Ta		0.51	**< 0.51**	
20160525-ACE-AP-D-2	W605131-11		1,3-Butadiene	106-99-0	EP-Plate	Ta		0.44	**< 0.44**	
20160525-ACE-AP-D-2	W605131-11		n-Butane	106-97-8	EP-Plate	Ta		0.48	**< 0.48**	
20160525-ACE-AP-D-2	W605131-11		Bromomethane	74-83-9	EP-Plate	Ta		0.78	**< 0.78**	
20160525-ACE-AP-D-2	W605131-11		Chloroethane	75-00-3	EP-Plate	Ta		0.53	**< 0.53**	
20160525-ACE-AP-D-2	W605131-11		Ethanol	64-17-5	EP-Plate	Ta		0.38	**< 0.38**	**r**
20160525-ACE-AP-D-2	W605131-11		Vinylbromide	593-60-2	EP-Plate	Ta		0.88	**< 0.88**	
20160525-ACE-AP-D-2	W605131-11		Trichlorofluoromethane	75-69-4	EP-Plate	Ta		1.1	**< 1.1**	
20160525-ACE-AP-D-2	W605131-11		Acrolein	107-02-8	EP-Plate	Ta		0.46	**< 0.46**	**r**
20160525-ACE-AP-D-2	W605131-11		Acetone	67-64-1	EP-Plate	Ta		0.48	**18.3**	**r**
20160525-ACE-AP-D-2	W605131-11		n-Pentane	109-66-0	EP-Plate	Ta		0.59	**< 0.59**	
20160525-ACE-AP-D-2	W605131-11		Isopropanol	67-63-0	EP-Plate	Ta		0.49	**< 0.49**	
20160525-ACE-AP-D-2	W605131-11		1,1-Dichloroethene	75-35-4	EP-Plate	Ta		0.79	**< 0.79**	
20160525-ACE-AP-D-2	W605131-11		t-Butyl alcohol	75-65-0	EP-Plate	Ta		0.61	**< 0.61**	
20160525-ACE-AP-D-2	W605131-11		1,1,2-Trichloro-1,2,2-trifluoroethane (	76-13-1	EP-Plate	Ta		1.5	**< 1.5**	
20160525-ACE-AP-D-2	W605131-11		3-Chloropropene	107-05-1	EP-Plate	Ta		0.63	**< 0.63**	
20160525-ACE-AP-D-2	W605131-11		Methylene Chloride (Dichloromethane)	75-09-2	EP-Plate	Ta		0.70	**< 0.70**	
20160525-ACE-AP-D-2	W605131-11		Carbon Disulfide	75-65-0	EP-Plate	Ta		0.62	**< 0.62**	
20160525-ACE-AP-D-2	W605131-11		trans-1,2-Dichloroethene	156-60-5	EP-Plate	Ta		0.79	**< 0.79**	**R**
20160525-ACE-AP-D-2	W605131-11		Methyl-t-butyll ether (MTBE)	1634-04-4	EP-Plate	Ta		0.72	**< 0.72**	**R**
20160525-ACE-AP-D-2	W605131-11		Vinyl Acetate	108-05-4	EP-Plate	Ta		0.70	**< 0.70**	**R**

Sample ID										
Client	RJLG	Medium ID	Analyte	CAS Number	Matrix	Type	QC % REC	Reporting Limit (ng)	Result (ng)	Qualifier
20160525-ACE-AP-D-2	W605131-11		1,1-Dichloroethane	75-34-3	EP-Plate	Ta		0.81	< 0.81	
20160525-ACE-AP-D-2	W605131-11		2-Butanone (MEK)	78-93-3	EP-Plate	Ta		0.59	< 0.59	
20160525-ACE-AP-D-2	W605131-11		Hexane	110-54-3	EP-Plate	Ta		0.71	< 0.71	R
20160525-ACE-AP-D-2	W605131-11		cis-1,2-Dichloroethene	156-59-2	EP-Plate	Ta		0.79	< 0.79	R
20160525-ACE-AP-D-2	W605131-11		Ethyl Acetate	141-78-6	EP-Plate	Ta		0.72	< 0.72	
20160525-ACE-AP-D-2	W605131-11		Chloroform	540-36-3	EP-Plate	Ta	#VALUE!	1.1	< 1.1	
20160525-ACE-AP-D-2	W605131-11		Tetrahydrofuran	67-66-3	EP-Plate	Ta		0.98	< 0.98	
20160525-ACE-AP-D-2	W605131-11		1,4-Difluorobenzene	71-55-6	EP-Plate	Int. Std		0.93	46.7	
20160525-ACE-AP-D-2	W605131-11		1,1,1-Trichloroethane	71-55-6	EP-Plate	Ta		1.1	< 1.1	
20160525-ACE-AP-D-2	W605131-11		1,2-Dichloroethane-d4	17060-07-0	EP-Plate	QA/Surr	97.4	0.84	41.0	
20160525-ACE-AP-D-2	W605131-11		1,2-Dichloroethane	107-06-2	EP-Plate	Ta		0.81	< 0.81	
20160525-ACE-AP-D-2	W605131-11		Benzene	71-43-2	EP-Plate	Ta		0.64	< 0.64	
20160525-ACE-AP-D-2	W605131-11		Carbon Tetrachloride	56-23-5	EP-Plate	Ta		1.3	< 1.3	
20160525-ACE-AP-D-2	W605131-11		Cyclohexane	110-82-7	EP-Plate	Ta		0.69	< 0.69	
20160525-ACE-AP-D-2	W605131-11		2,2,4-Trimethylpentane	540-84-1	EP-Plate	Ta		0.93	< 0.93	
20160525-ACE-AP-D-2	W605131-11		Heptane	142-82-5	EP-Plate	Ta		0.82	< 0.82	R
20160525-ACE-AP-D-2	W605131-11		Trichlorethylene	79-01-6	EP-Plate	Ta		1.1	< 1.1	
20160525-ACE-AP-D-2	W605131-11		1,2-Dichloropropane	78-87-5	EP-Plate	Ta		0.92	< 0.92	
20160525-ACE-AP-D-2	W605131-11		Methylmethacrylate	80-62-6	EP-Plate	Ta		0.82	< 0.82	
20160525-ACE-AP-D-2	W605131-11		1,4-Dioxane	123-91-1	EP-Plate	Ta		0.72	< 0.72	
20160525-ACE-AP-D-2	W605131-11		Bromodichloromethane	75-27-4	EP-Plate	Ta		1.3	< 1.3	
20160525-ACE-AP-D-2	W605131-11		Methyl isobutyl ketone (MIBK)	108-10-1	EP-Plate	Ta		0.82	< 0.82	
20160525-ACE-AP-D-2	W605131-11		cis-1,3-Dichloropropene	10061-01-5	EP-Plate	Ta		0.91	< 0.91	
20160525-ACE-AP-D-2	W605131-11		trans-1,3-Dichloropropene	10061-02-6	EP-Plate	Ta		0.91	< 0.91	
20160525-ACE-AP-D-2	W605131-11		Toluene-d8	2037-26-5	EP-Plate	QA/Surr	96.1	0.82	39.4	
20160525-ACE-AP-D-2	W605131-11		Toluene	108-88-3	EP-Plate	Ta		0.75	< 0.75	r
20160525-ACE-AP-D-2	W605131-11		1,1,2-Trichloroethane	79-00-5	EP-Plate	Ta		1.1	< 1.1	
20160525-ACE-AP-D-2	W605131-11		2-Hexanone	591-78-6	EP-Plate	Ta		0.90	< 0.90	
20160525-ACE-AP-D-2	W605131-11		Dibromochloromethane	124-48-1	EP-Plate	Ta		1.7	< 1.7	
20160525-ACE-AP-D-2	W605131-11		Tetrachloroethylene	127-18-4	EP-Plate	Ta		1.4	< 1.4	
20160525-ACE-AP-D-2	W605131-11		Chlorobenzene-d5	3114-55-4	EP-Plate	Int. Std		0.92	46.1	
20160525-ACE-AP-D-2	W605131-11		1,2-Dibromoethane	106-93-4	EP-Plate	Ta		1.5	< 1.5	
20160525-ACE-AP-D-2	W605131-11		Chlorobenzene	108-90-7	EP-Plate	Ta		0.92	< 0.92	
20160525-ACE-AP-D-2	W605131-11		Ethylbenzene	100-41-4	EP-Plate	Ta		0.87	< 0.87	Rr
20160525-ACE-AP-D-2	W605131-11		m,p-Xylene	179601-23-1	EP-Plate	Ta		0.87	< 0.87	Rr

Sample ID				CAS				Reporting		
Client	RJLG	Medium ID	Analyte	Number	Matrix	Type	QC % REC	Limit (ng)	Result (ng)	Qualifier
20160525-ACE-AP-D-2	W605131-11		Nonane	111-84-2	EP-Plate	Ta		1.0	**< 1.0**	**Rr**
20160525-ACE-AP-D-2	W605131-11		o-Xylene	95-47-6	EP-Plate	Ta		0.87	**< 0.87**	**R**
20160525-ACE-AP-D-2	W605131-11		Styrene	100-42-5	EP-Plate	Ta		0.85	**< 0.85**	**R**
20160525-ACE-AP-D-2	W605131-11		Bromoform	75-25-2	EP-Plate	Ta		2.1	**< 2.1**	
20160525-ACE-AP-D-2	W605131-11		1,1,2,2-Tetrachloroethane	79-34-5	EP-Plate	Ta		1.4	**< 1.4**	**R**
20160525-ACE-AP-D-2	W605131-11		Cumene	98-82-8	EP-Plate	Ta		0.98	**< 0.98**	**R**
20160525-ACE-AP-D-2	W605131-11		4-Bromofluorobenzene (BFB)	460-00-4	EP-Plate	QA/Surr	105	1.4	**75.2**	
20160525-ACE-AP-D-2	W605131-11		n-Propylbenzene	103-65-1	EP-Plate	Ta		0.98	**< 0.98**	**Rr**
20160525-ACE-AP-D-2	W605131-11		2-Chlorotoluene	95-49-8	EP-Plate	Ta		1.0	**< 1.0**	**R**
20160525-ACE-AP-D-2	W605131-11		4-Ethyltoluene	622-96-8	EP-Plate	Ta		0.98	**< 0.98**	**Rr**
20160525-ACE-AP-D-2	W605131-11		1,3,5-Trimethylbenzene	108-67-8	EP-Plate	Ta		0.98	**< 0.98**	**Rr**
20160525-ACE-AP-D-2	W605131-11		1,2,4-Trimethylbenzene	95-63-6	EP-Plate	Ta		0.98	**< 0.98**	**Rr**
20160525-ACE-AP-D-2	W605131-11		1,3-Dichlorobenzene	541-73-1	EP-Plate	Ta		1.2	**< 1.2**	**RrB**
20160525-ACE-AP-D-2	W605131-11		Benzyl Chloride	100-44-7	EP-Plate	Ta		1.0	**< 1.0**	**RrB**
20160525-ACE-AP-D-2	W605131-11		1,4-Dichlorobenzene	106-46-7	EP-Plate	Ta		1.2	**< 1.2**	**RrB**
20160525-ACE-AP-D-2	W605131-11		1,2-Dichlorobenzene	95-50-1	EP-Plate	Ta		1.2	**< 1.2**	**RrB**
20160525-ACE-AP-D-2	W605131-11		1,2,4-Trichlorobenzene	120-82-1	EP-Plate	PIC		1.5	**< 1.5**	**Z**
20160525-ACE-AP-D-2	W605131-11		Naphthalene	91-20-3	EP-Plate	PIC		1.0	**< 1.0**	**Z**
20160525-ACE-AP-D-2	W605131-11		Hexachloro-1,3-butadiene	87-68-3	EP-Plate	PIC		2.1	**< 2.1**	**Z**

Sample ID Client	RJLG	Medium ID	Analyte	CAS Number	Matrix	Type	QC % REC	Reporting Limit (ng)	Result (ng)	Qualifier
			Tentatively Identified Compounds							
20160525-ACE-AP-D-2	W605131-11	0	Acetonitrile	75-05-8	EP-Plate	TIC		0.34	**1.31**	50,N,T
20160525-ACE-AP-D-2	W605131-11	0	Pentane, 2-methyl-	107-83-5	EP-Plate	TIC		0.70	**2.66**	74,N,T
20160525-ACE-AP-D-2	W605131-11	0	2-Pentanone, 4-hydroxy-4-methyl-	123-42-2	EP-Plate	TIC		0.95	**3.45**	83,N,T
20160525-ACE-AP-D-2	W605131-11	0	Nonanal	124-19-6	EP-Plate	TIC		1.2	**4.51**	91,N,T
20160525-ACE-AP-D-2	W605131-11	0	Decanal	112-31-2	EP-Plate	TIC		1.3	**3.82**	91,N,T
20160525-ACE-AP-D-2	W605131-11	0	acid, 2-methyl-, 1-(1,1-dimethylethyl)-2-methyl-1,3-propar	74381-40-1	EP-Plate	TIC		2.3	**26.3**	78,N,T

Comments: Concentrations of the tentatively identified compounds is based on the comparison of peak area to that of the nearest internal standard.

ng = nanogram
ppbv = parts per billion volume
ug/m3 = micrograms per cubic meter

BDL = Below Detection Limit
N/A = Not Applicable

Qualifiers

B = Compound found in associated laboratory blank above the reporting limit.
D = Diluted sample
E = Report concentration was above the instrumental calibration range
I = Response failure of an internal standard; concentration should be considered an estimate
J = Concentration below reporting limit
N = Identification based on mass spectral library search
P = Library spectrum match, rsd >90% w RT match
Q = Qualitative results for non-target compounds
Ta = Target Analyte
R = Recovery failure in CCV or LCS.
S = Surrogate recovery failure
T = Compound is tentatively identified compound. Includes chemical library matches & chemist identified compounds.
X = Detected but not quantifiable
c = Sample RPD failure
d= Data that exceeds the %RSD criteria set by the method (70-130%)
PIC = Positively identified compound, for non-calibrated compounds
r = Recovery failure in MRL
Z = Positively Identified Compound; Quantitative data only

Authorized Signature:
Laboratory Technical Manager - Dr. Joe Sears

Date: 06/13/16

RJ LEE GROUP
DELIVERING SCIENTIFIC RESOLUTION

RJ LeeGroup, Inc. | Columbia Basin Analytical Laboratory
2710 North 20th Avenue, Pasco WA 99301
Tel: (509) 545-4989 | Fax: (509) 544-6010

LABORATORY REPORT
EPA Compendium Method TO-17-Modified
Electrostatic Precipitator Plates

Client: Washington River Protection Solutions
Address:
Richland, WA 99352
Attention: Attn: George Weeks
Telephone:
Fax:

RJ Lee Group Project: W605131
Samples Received: 05/26/16
Analysis Prep/Date: 06/02/16
Report Date: 06/13/16
Sampling Date: 05/26/16
CACN: 0
Client Project: GAL601096

Sample ID								Reporting		
Client	RJLG	Medium ID	Analyte	CAS Number	Matrix	Type	QC % REC	Limit (ng)	Result (ng)	Qualifier
20160526-ACE-B-W-2	W605131-12		Bromochloromethane	74-97-5	EP-Plate	Int. Std		1.1	52.9	
20160526-ACE-B-W-2	W605131-12		Propene	115-07-1	EP-Plate	Ta		0.34	< 0.34	rB
20160526-ACE-B-W-2	W605131-12		Dichlorodifluoromethane (F12)	75-71-8	EP-Plate	Ta		0.99	< 0.99	
20160526-ACE-B-W-2	W605131-12		Chloromethane	74-87-3	EP-Plate	Ta		0.41	< 0.41	
20160526-ACE-B-W-2	W605131-12		1,2-Dichloro-tetrarfluoroethane	76-14-2	EP-Plate	Ta		1.4	< 1.4	
20160526-ACE-B-W-2	W605131-12		Chloroethene	75-01-4	EP-Plate	Ta		0.51	< 0.51	
20160526-ACE-B-W-2	W605131-12		1,3-Butadiene	106-99-0	EP-Plate	Ta		0.44	< 0.44	
20160526-ACE-B-W-2	W605131-12		n-Butane	106-97-8	EP-Plate	Ta		0.48	< 0.48	
20160526-ACE-B-W-2	W605131-12		Bromomethane	74-83-9	EP-Plate	Ta		0.78	< 0.78	
20160526-ACE-B-W-2	W605131-12		Chloroethane	75-00-3	EP-Plate	Ta		0.53	< 0.53	
20160526-ACE-B-W-2	W605131-12		Ethanol	64-17-5	EP-Plate	Ta		0.38	< 0.38	r
20160526-ACE-B-W-2	W605131-12		Vinylbromide	593-60-2	EP-Plate	Ta		0.88	< 0.88	
20160526-ACE-B-W-2	W605131-12		Trichlorofluoromethane	75-69-4	EP-Plate	Ta		1.1	< 1.1	
20160526-ACE-B-W-2	W605131-12		Acrolein	107-02-8	EP-Plate	Ta		0.46	< 0.46	r
20160526-ACE-B-W-2	W605131-12		Acetone	67-64-1	EP-Plate	Ta		0.48	3.59	r
20160526-ACE-B-W-2	W605131-12		n-Pentane	109-66-0	EP-Plate	Ta		0.59	< 0.59	
20160526-ACE-B-W-2	W605131-12		Isopropanol	67-63-0	EP-Plate	Ta		0.49	< 0.49	
20160526-ACE-B-W-2	W605131-12		1,1-Dichloroethene	75-35-4	EP-Plate	Ta		0.79	< 0.79	
20160526-ACE-B-W-2	W605131-12		t-Butyl alcohol	75-65-0	EP-Plate	Ta		0.61	< 0.61	
20160526-ACE-B-W-2	W605131-12		1,1,2-Trichloro-1,2,2-trifluoroethane (	76-13-1	EP-Plate	Ta		1.5	< 1.5	
20160526-ACE-B-W-2	W605131-12		3-Chloropropene	107-05-1	EP-Plate	Ta		0.63	< 0.63	
20160526-ACE-B-W-2	W605131-12		Methylene Chloride (Dichloromethane)	75-09-2	EP-Plate	Ta		0.70	< 0.70	
20160526-ACE-B-W-2	W605131-12		Carbon Disulfide	75-65-0	EP-Plate	Ta		0.62	< 0.62	
20160526-ACE-B-W-2	W605131-12		trans-1,2-Dichloroethene	156-60-5	EP-Plate	Ta		0.79	< 0.79	R
20160526-ACE-B-W-2	W605131-12		Methyl-t-butyll ether (MTBE)	1634-04-4	EP-Plate	Ta		0.72	< 0.72	R
20160526-ACE-B-W-2	W605131-12		Vinyl Acetate	108-05-4	EP-Plate	Ta		0.70	< 0.70	R
20160526-ACE-B-W-2	W605131-12		1,1-Dichloroethane	75-34-3	EP-Plate	Ta		0.81	< 0.81	

Client	Sample ID RJLG	Medium ID	Analyte	CAS Number	Matrix	Type	QC % REC	Reporting Limit (ng)	Result (ng)	Qualifier
20160526-ACE-B-W-2	W605131-12		2-Butanone (MEK)	78-93-3	EP-Plate	Ta		0.59	< 0.59	
20160526-ACE-B-W-2	W605131-12		Hexane	110-54-3	EP-Plate	Ta		0.71	< 0.71	R
20160526-ACE-B-W-2	W605131-12		cis-1,2-Dichloroethene	156-59-2	EP-Plate	Ta		0.79	< 0.79	R
20160526-ACE-B-W-2	W605131-12		Ethyl Acetate	141-78-6	EP-Plate	Ta		0.72	< 0.72	
20160526-ACE-B-W-2	W605131-12		Chloroform	540-36-3	EP-Plate	Ta	#VALUE!	1.1	< 1.1	
20160526-ACE-B-W-2	W605131-12		Tetrahydrofuran	67-66-3	EP-Plate	Ta		0.98	< 0.98	
20160526-ACE-B-W-2	W605131-12		1,4-Difluorobenzene	71-55-6	EP-Plate	Int. Std		0.93	46.7	
20160526-ACE-B-W-2	W605131-12		1,1,1-Trichloroethane	71-55-6	EP-Plate	Ta		1.1	< 1.1	
20160526-ACE-B-W-2	W605131-12		1,2-Dichloroethane-d4	17060-07-0	EP-Plate	QA/Surr	98.2	0.84	41.4	
20160526-ACE-B-W-2	W605131-12		1,2-Dichloroethane	107-06-2	EP-Plate	Ta		0.81	< 0.81	
20160526-ACE-B-W-2	W605131-12		Benzene	71-43-2	EP-Plate	Ta		0.64	< 0.64	
20160526-ACE-B-W-2	W605131-12		Carbon Tetrachloride	56-23-5	EP-Plate	Ta		1.3	< 1.3	
20160526-ACE-B-W-2	W605131-12		Cyclohexane	110-82-7	EP-Plate	Ta		0.69	< 0.69	
20160526-ACE-B-W-2	W605131-12		2,2,4-Trimethylpentane	540-84-1	EP-Plate	Ta		0.93	< 0.93	
20160526-ACE-B-W-2	W605131-12		Heptane	142-82-5	EP-Plate	Ta		0.82	< 0.82	R
20160526-ACE-B-W-2	W605131-12		Trichlorethylene	79-01-6	EP-Plate	Ta		1.1	< 1.1	
20160526-ACE-B-W-2	W605131-12		1,2-Dichloropropane	78-87-5	EP-Plate	Ta		0.92	< 0.92	
20160526-ACE-B-W-2	W605131-12		Methylmethacrylate	80-62-6	EP-Plate	Ta		0.82	< 0.82	
20160526-ACE-B-W-2	W605131-12		1,4-Dioxane	123-91-1	EP-Plate	Ta		0.72	< 0.72	
20160526-ACE-B-W-2	W605131-12		Bromodichloromethane	75-27-4	EP-Plate	Ta		1.3	< 1.3	
20160526-ACE-B-W-2	W605131-12		Methyl isobutyl ketone (MIBK)	108-10-1	EP-Plate	Ta		0.82	< 0.82	
20160526-ACE-B-W-2	W605131-12		cis-1,3-Dichloropropene	10061-01-5	EP-Plate	Ta		0.91	< 0.91	
20160526-ACE-B-W-2	W605131-12		trans-1,3-Dichloropropene	10061-02-6	EP-Plate	Ta		0.91	< 0.91	
20160526-ACE-B-W-2	W605131-12		Toluene-d8	2037-26-5	EP-Plate	QA/Surr	96.6	0.82	39.6	
20160526-ACE-B-W-2	W605131-12		Toluene	108-88-3	EP-Plate	Ta		0.75	< 0.75	r
20160526-ACE-B-W-2	W605131-12		1,1,2-Trichloroethane	79-00-5	EP-Plate	Ta		1.1	< 1.1	
20160526-ACE-B-W-2	W605131-12		2-Hexanone	591-78-6	EP-Plate	Ta		0.90	< 0.90	
20160526-ACE-B-W-2	W605131-12		Dibromochloromethane	124-48-1	EP-Plate	Ta		1.7	< 1.7	
20160526-ACE-B-W-2	W605131-12		Tetrachloroethylene	127-18-4	EP-Plate	Ta		1.4	< 1.4	
20160526-ACE-B-W-2	W605131-12		Chlorobenzene-d5	3114-55-4	EP-Plate	Int. Std		0.92	46.1	
20160526-ACE-B-W-2	W605131-12		1,2-Dibromoethane	106-93-4	EP-Plate	Ta		1.5	< 1.5	
20160526-ACE-B-W-2	W605131-12		Chlorobenzene	108-90-7	EP-Plate	Ta		0.92	< 0.92	
20160526-ACE-B-W-2	W605131-12		Ethylbenzene	100-41-4	EP-Plate	Ta		0.87	< 0.87	Rr
20160526-ACE-B-W-2	W605131-12		m,p-Xylene	179601-23-1	EP-Plate	Ta		0.87	< 0.87	Rr
20160526-ACE-B-W-2	W605131-12		Nonane	111-84-2	EP-Plate	Ta		1.0	< 1.0	Rr
20160526-ACE-B-W-2	W605131-12		o-Xylene	95-47-6	EP-Plate	Ta		0.87	< 0.87	R

Sample ID										
Client	RJLG	Medium ID	Analyte	CAS Number	Matrix	Type	QC % REC	Reporting Limit (ng)	Result (ng)	Qualifier
20160526-ACE-B-W-2	W605131-12		Styrene	100-42-5	EP-Plate	Ta		0.85	< 0.85	R
20160526-ACE-B-W-2	W605131-12		Bromoform	75-25-2	EP-Plate	Ta		2.1	< 2.1	
20160526-ACE-B-W-2	W605131-12		1,1,2,2-Tetrachloroethane	79-34-5	EP-Plate	Ta		1.4	< 1.4	R
20160526-ACE-B-W-2	W605131-12		Cumene	98-82-8	EP-Plate	Ta		0.98	< 0.98	R
20160526-ACE-B-W-2	W605131-12		4-Bromofluorobenzene (BFB)	460-00-4	EP-Plate	QA/Sur	107	1.4	76.6	
20160526-ACE-B-W-2	W605131-12		n-Propylbenzene	103-65-1	EP-Plate	Ta		0.98	< 0.98	Rr
20160526-ACE-B-W-2	W605131-12		2-Chlorotoluene	95-49-8	EP-Plate	Ta		1.0	< 1.0	R
20160526-ACE-B-W-2	W605131-12		4-Ethyltoluene	622-96-8	EP-Plate	Ta		0.98	< 0.98	Rr
20160526-ACE-B-W-2	W605131-12		1,3,5-Trimethylbenzene	108-67-8	EP-Plate	Ta		0.98	< 0.98	Rr
20160526-ACE-B-W-2	W605131-12		1,2,4-Trimethylbenzene	95-63-6	EP-Plate	Ta		0.98	< 0.98	Rr
20160526-ACE-B-W-2	W605131-12		1,3-Dichlorobenzene	541-73-1	EP-Plate	Ta		1.2	< 1.2	RrB
20160526-ACE-B-W-2	W605131-12		Benzyl Chloride	100-44-7	EP-Plate	Ta		1.0	< 1.0	RrB
20160526-ACE-B-W-2	W605131-12		1,4-Dichlorobenzene	106-46-7	EP-Plate	Ta		1.2	< 1.2	RrB
20160526-ACE-B-W-2	W605131-12		1,2-Dichlorobenzene	95-50-1	EP-Plate	Ta		1.2	< 1.2	RrB
20160526-ACE-B-W-2	W605131-12		1,2,4-Trichlorobenzene	120-82-1	EP-Plate	PIC		1.5	< 1.5	Z
20160526-ACE-B-W-2	W605131-12		Naphthalene	91-20-3	EP-Plate	PIC		1.0	< 1.0	Z
20160526-ACE-B-W-2	W605131-12		Hexachloro-1,3-butadiene	87-68-3	EP-Plate	PIC		2.1	< 2.1	Z

Client	Sample ID RJLG	Medium ID	Analyte	CAS Number	Matrix	Type	QC % REC	Reporting Limit (ng)	Result (ng)	Qualifier
			Tentatively Identified Compounds							
20160526-ACE-B-W-2	W605131-12		Acetonitrile	75-05-8	EP-Plate	TIC		0.34	**1.20**	50,N,T
20160526-ACE-B-W-2	W605131-12		Pentane, 2-methyl-	107-83-5	EP-Plate	TIC		0.70	**2.21**	72,N,T
20160526-ACE-B-W-2	W605131-12		Acetic acid	64-19-7	EP-Plate	TIC		0.49	**1.37**	90,N,T
20160526-ACE-B-W-2	W605131-12		Nonanal	124-19-6	EP-Plate	TIC		1.2	**4.55**	91,N,T
20160526-ACE-B-W-2	W605131-12		Decanal	112-31-2	EP-Plate	TIC		1.3	**4.74**	91,N,T
20160526-ACE-B-W-2	W605131-12		ntanoic acid, 2,2,4-trimethyl-3-carboxyisopropyl, isobutyl e	1000140-77-5	EP-Plate	TIC		2.3	**24.0**	64,N,T

Comments: Concentrations of the tentatively identified compounds is based on the comparison of peak area to that of the nearest internal standard.

ng - nanogram
ppbv = parts per billion volume
ug/m3 - micrograms per cubic meter

BDL = Below Detection Limit
N/A = Not Applicable

Qualifiers

B = Compound found in associated laboratory blank above the reporting limit.
D = Diluted sample
E = Report concentration was above the instrumental calibration range
I = Response failure of an internal standard; concentration should be considered an estimate
J = Concentration below reporting limit
N = Identification based on mass spectral library search
P = Library spectrum match, rsd >90% w RT match
Q = Qualitative results for non-target compounds
Ta = Target Analyte

R = Recovery failure in CCV or LCS.
S = Surrogate recovery failure
T = Compound is tentatively identified compound. Includes chemical library matches & chemist identified compounds.
X = Detected but not quantifiable
c = Sample RPD failure
d= Data that exceeds the %RSD criteria set by the method (70-130%)
PIC = Positively identified compound, for non-calibrated compounds
r = Recovery failure in MRL
Z = Positively Identified Compound; Quanlitative data only

Authorized Signature:
Laboratory Technical Manager - Dr. Joe Sears

Date: 06/13/16

RJ LEE GROUP
DELIVERING SCIENTIFIC RESOLUTION

RJ LeeGroup, Inc.|Columbia Basin Analytical Laboratory
2710 North 20th Avenue, Pasco WA 99301
Tel: (509) 545-4989 | Fax: (509) 544-6010

LABORATORY REPORT
EPA Compendium Method TO-17-Modified
Electrostatic Precipitator Plates

Client:	Washington River Protection Solutions	RJ Lee Group Project:	W605131
Address:	Richland, WA 99352	Samples Received:	05/26/16
		Analysis Prep/Date:	06/02/16
Attention:	Attn: George Weeks	Report Date:	06/13/16
Telephone:		Sampling Date:	05/26/16
Fax:		Purchase Order No.:	0
		Client Project:	GAL601096

Sample ID								Reporting		
Client	RJLG	Medium ID	Analyte	CAS Number	Matrix	Type	QC % REC	Limit (ng)	Result (ng)	Qualifier
20160526-ACE-AP-SE-2	W605131-13		Bromochloromethane	74-97-5	EP-Plate	Int. Std		1.1	**52.9**	
20160526-ACE-AP-SE-2	W605131-13		Propene	115-07-1	EP-Plate	Ta		0.34	**1.31**	**rB**
20160526-ACE-AP-SE-2	W605131-13		Dichlorodifluoromethane (F12)	75-71-8	EP-Plate	Ta		0.99	**< 0.99**	
20160526-ACE-AP-SE-2	W605131-13		Chloromethane	74-87-3	EP-Plate	Ta		0.41	**< 0.41**	
20160526-ACE-AP-SE-2	W605131-13		1,2-Dichloro-tetrarfluoroethane	76-14-2	EP-Plate	Ta		1.4	**< 1.4**	
20160526-ACE-AP-SE-2	W605131-13		Chloroethene	75-01-4	EP-Plate	Ta		0.51	**< 0.51**	
20160526-ACE-AP-SE-2	W605131-13		1,3-Butadiene	106-99-0	EP-Plate	Ta		0.44	**< 0.44**	
20160526-ACE-AP-SE-2	W605131-13		n-Butane	106-97-8	EP-Plate	Ta		0.48	**< 0.48**	
20160526-ACE-AP-SE-2	W605131-13		Bromomethane	74-83-9	EP-Plate	Ta		0.78	**< 0.78**	
20160526-ACE-AP-SE-2	W605131-13		Chloroethane	75-00-3	EP-Plate	Ta		0.53	**< 0.53**	
20160526-ACE-AP-SE-2	W605131-13		Ethanol	64-17-5	EP-Plate	Ta		0.38	**< 0.38**	**r**
20160526-ACE-AP-SE-2	W605131-13		Vinylbromide	593-60-2	EP-Plate	Ta		0.88	**< 0.88**	
20160526-ACE-AP-SE-2	W605131-13		Trichlorofluoromethane	75-69-4	EP-Plate	Ta		1.1	**< 1.1**	
20160526-ACE-AP-SE-2	W605131-13		Acrolein	107-02-8	EP-Plate	Ta		0.46	**1.49**	**r**
20160526-ACE-AP-SE-2	W605131-13		Acetone	67-64-1	EP-Plate	Ta		0.48	**2.95**	**r**
20160526-ACE-AP-SE-2	W605131-13		n-Pentane	109-66-0	EP-Plate	Ta		0.59	**< 0.59**	
20160526-ACE-AP-SE-2	W605131-13		Isopropanol	67-63-0	EP-Plate	Ta		0.49	**< 0.49**	
20160526-ACE-AP-SE-2	W605131-13		1,1-Dichloroethene	75-35-4	EP-Plate	Ta		0.79	**< 0.79**	
20160526-ACE-AP-SE-2	W605131-13		t-Butyl alcohol	75-65-0	EP-Plate	Ta		0.61	**< 0.61**	
20160526-ACE-AP-SE-2	W605131-13		1,1,2-Trichloro-1,2,2-trifluoroethane (	76-13-1	EP-Plate	Ta		1.5	**< 1.5**	
20160526-ACE-AP-SE-2	W605131-13		3-Chloropropene	107-05-1	EP-Plate	Ta		0.63	**< 0.63**	
20160526-ACE-AP-SE-2	W605131-13		Methylene Chloride (Dichloromethane)	75-09-2	EP-Plate	Ta		0.70	**< 0.70**	
20160526-ACE-AP-SE-2	W605131-13		Carbon Disulfide	75-65-0	EP-Plate	Ta		0.62	**< 0.62**	
20160526-ACE-AP-SE-2	W605131-13		trans-1,2-Dichloroethene	156-60-5	EP-Plate	Ta		0.79	**< 0.79**	**R**
20160526-ACE-AP-SE-2	W605131-13		Methyl-t-butyll ether (MTBE)	1634-04-4	EP-Plate	Ta		0.72	**< 0.72**	**R**
20160526-ACE-AP-SE-2	W605131-13		Vinyl Acetate	108-05-4	EP-Plate	Ta		0.70	**< 0.70**	**R**
20160526-ACE-AP-SE-2	W605131-13		1,1-Dichloroethane	75-34-3	EP-Plate	Ta		0.81	**< 0.81**	

Sample ID										
Client	RJLG	Medium ID	Analyte	CAS Number	Matrix	Type	QC % REC	Reporting Limit (ng)	Result (ng)	Qualifier
20160526-ACE-AP-SE-2	W605131-13		2-Butanone (MEK)	78-93-3	EP-Plate	Ta		0.59	< 0.59	
20160526-ACE-AP-SE-2	W605131-13		Hexane	110-54-3	EP-Plate	Ta		0.71	< 0.71	R
20160526-ACE-AP-SE-2	W605131-13		cis-1,2-Dichloroethene	156-59-2	EP-Plate	Ta		0.79	< 0.79	R
20160526-ACE-AP-SE-2	W605131-13		Ethyl Acetate	141-78-6	EP-Plate	Ta		0.72	< 0.72	
20160526-ACE-AP-SE-2	W605131-13		Chloroform	540-36-3	EP-Plate	Ta	#VALUE!	1.1	< 1.1	
20160526-ACE-AP-SE-2	W605131-13		Tetrahydrofuran	67-66-3	EP-Plate	Ta		0.98	< 0.98	
20160526-ACE-AP-SE-2	W605131-13		1,4-Difluorobenzene	71-55-6	EP-Plate	Int. Std		0.93	46.7	
20160526-ACE-AP-SE-2	W605131-13		1,1,1-Trichloroethane	71-55-6	EP-Plate	Ta		1.1	< 1.1	
20160526-ACE-AP-SE-2	W605131-13		1,2-Dichloroethane-d4	17060-07-0	EP-Plate	QA/Surr	96	0.84	40.5	
20160526-ACE-AP-SE-2	W605131-13		1,2-Dichloroethane	107-06-2	EP-Plate	Ta		0.81	< 0.81	
20160526-ACE-AP-SE-2	W605131-13		Benzene	71-43-2	EP-Plate	Ta		0.64	1.98	
20160526-ACE-AP-SE-2	W605131-13		Carbon Tetrachloride	56-23-5	EP-Plate	Ta		1.3	< 1.3	
20160526-ACE-AP-SE-2	W605131-13		Cyclohexane	110-82-7	EP-Plate	Ta		0.69	< 0.69	
20160526-ACE-AP-SE-2	W605131-13		2,2,4-Trimethylpentane	540-84-1	EP-Plate	Ta		0.93	< 0.93	
20160526-ACE-AP-SE-2	W605131-13		Heptane	142-82-5	EP-Plate	Ta		0.82	< 0.82	R
20160526-ACE-AP-SE-2	W605131-13		Trichlorethylene	79-01-6	EP-Plate	Ta		1.1	< 1.1	
20160526-ACE-AP-SE-2	W605131-13		1,2-Dichloropropane	78-87-5	EP-Plate	Ta		0.92	< 0.92	
20160526-ACE-AP-SE-2	W605131-13		Methylmethacrylate	80-62-6	EP-Plate	Ta		0.82	< 0.82	
20160526-ACE-AP-SE-2	W605131-13		1,4-Dioxane	123-91-1	EP-Plate	Ta		0.72	< 0.72	
20160526-ACE-AP-SE-2	W605131-13		Bromodichloromethane	75-27-4	EP-Plate	Ta		1.3	< 1.3	
20160526-ACE-AP-SE-2	W605131-13		Methyl isobutyl ketone (MIBK)	108-10-1	EP-Plate	Ta		0.82	< 0.82	
20160526-ACE-AP-SE-2	W605131-13		cis-1,3-Dichloropropene	10061-01-5	EP-Plate	Ta		0.91	< 0.91	
20160526-ACE-AP-SE-2	W605131-13		trans-1,3-Dichloropropene	10061-02-6	EP-Plate	Ta		0.91	< 0.91	
20160526-ACE-AP-SE-2	W605131-13		Toluene-d8	2037-26-5	EP-Plate	QA/Surr	102	0.82	41.8	
20160526-ACE-AP-SE-2	W605131-13		Toluene	108-88-3	EP-Plate	Ta		0.75	< 0.75	r
20160526-ACE-AP-SE-2	W605131-13		1,1,2-Trichloroethane	79-00-5	EP-Plate	Ta		1.1	< 1.1	
20160526-ACE-AP-SE-2	W605131-13		2-Hexanone	591-78-6	EP-Plate	Ta		0.90	< 0.90	
20160526-ACE-AP-SE-2	W605131-13		Dibromochloromethane	124-48-1	EP-Plate	Ta		1.7	< 1.7	
20160526-ACE-AP-SE-2	W605131-13		Tetrachloroethylene	127-18-4	EP-Plate	Ta		1.4	< 1.4	
20160526-ACE-AP-SE-2	W605131-13		Chlorobenzene-d5	3114-55-4	EP-Plate	Int. Std		0.92	46.1	
20160526-ACE-AP-SE-2	W605131-13		1,2-Dibromoethane	106-93-4	EP-Plate	Ta		1.5	< 1.5	
20160526-ACE-AP-SE-2	W605131-13		Chlorobenzene	108-90-7	EP-Plate	Ta		0.92	< 0.92	
20160526-ACE-AP-SE-2	W605131-13		Ethylbenzene	100-41-4	EP-Plate	Ta		0.87	< 0.87	Rr
20160526-ACE-AP-SE-2	W605131-13		m,p-Xylene	179601-23-1	EP-Plate	Ta		0.87	< 0.87	Rr
20160526-ACE-AP-SE-2	W605131-13		Nonane	111-84-2	EP-Plate	Ta		1.0	< 1.0	Rr
20160526-ACE-AP-SE-2	W605131-13		o-Xylene	95-47-6	EP-Plate	Ta		0.87	< 0.87	R

Sample ID										
Client	RJLG	Medium ID	Analyte	CAS Number	Matrix	Type	QC % REC	Reporting Limit (ng)	Result (ng)	Qualifier
20160526-ACE-AP-SE-2	W605131-13		Styrene	100-42-5	EP-Plate	Ta		0.85	< 0.85	R
20160526-ACE-AP-SE-2	W605131-13		Bromoform	75-25-2	EP-Plate	Ta		2.1	< 2.1	
20160526-ACE-AP-SE-2	W605131-13		1,1,2,2-Tetrachloroethane	79-34-5	EP-Plate	Ta		1.4	< 1.4	R
20160526-ACE-AP-SE-2	W605131-13		Cumene	98-82-8	EP-Plate	Ta		0.98	< 0.98	R
20160526-ACE-AP-SE-2	W605131-13		4-Bromofluorobenzene (BFB)	460-00-4	EP-Plate	QA/Surr	105	1.4	75.2	
20160526-ACE-AP-SE-2	W605131-13		n-Propylbenzene	103-65-1	EP-Plate	Ta		0.98	< 0.98	Rr
20160526-ACE-AP-SE-2	W605131-13		2-Chlorotoluene	95-49-8	EP-Plate	Ta		1.0	< 1.0	R
20160526-ACE-AP-SE-2	W605131-13		4-Ethyltoluene	622-96-8	EP-Plate	Ta		0.98	< 0.98	Rr
20160526-ACE-AP-SE-2	W605131-13		1,3,5-Trimethylbenzene	108-67-8	EP-Plate	Ta		0.98	< 0.98	Rr
20160526-ACE-AP-SE-2	W605131-13		1,2,4-Trimethylbenzene	95-63-6	EP-Plate	Ta		0.98	< 0.98	Rr
20160526-ACE-AP-SE-2	W605131-13		1,3-Dichlorobenzene	541-73-1	EP-Plate	Ta		1.2	< 1.2	RrB
20160526-ACE-AP-SE-2	W605131-13		Benzyl Chloride	100-44-7	EP-Plate	Ta		1.0	< 1.0	RrB
20160526-ACE-AP-SE-2	W605131-13		1,4-Dichlorobenzene	106-46-7	EP-Plate	Ta		1.2	< 1.2	RrB
20160526-ACE-AP-SE-2	W605131-13		1,2-Dichlorobenzene	95-50-1	EP-Plate	Ta		1.2	< 1.2	RrB
20160526-ACE-AP-SE-2	W605131-13		1,2,4-Trichlorobenzene	120-82-1	EP-Plate	PIC		1.5	4.90	Z
20160526-ACE-AP-SE-2	W605131-13		Naphthalene	91-20-3	EP-Plate	PIC		1.0	< 1.0	Z
20160526-ACE-AP-SE-2	W605131-13		Hexachloro-1,3-butadiene	87-68-3	EP-Plate	PIC		2.1	< 2.1	Z

Client	Sample ID RJLG	Medium ID	Analyte	CAS Number	Matrix	Type	QC % REC	Reporting Limit (ng)	Result (ng)	Qualifier
			Tentatively Identified Compounds							
20160526-ACE-AP-SE-2	W605131-13		Acetaldehyde	75-07-0	EP-Plate	TIC		0.36	**1.47**	50,N,T
20160526-ACE-AP-SE-2	W605131-13		Acetonitrile	75-05-8	EP-Plate	TIC		0.34	**1.21**	42,N,T
20160526-ACE-AP-SE-2	W605131-13		Pentane, 2-methyl-	107-83-5	EP-Plate	TIC		0.70	**2.46**	83,N,T
20160526-ACE-AP-SE-2	W605131-13		Nonane	111-84-2	EP-Plate	TIC		1.0	**4.14**	95,N,T

Comments: Concentrations of the tentatively identified compounds is based on the comparison of peak area to that of the nearest internal standard.

ng = nanogram
ppbv = parts per billion volume
ug/m3 = micrograms per cubic meter

BDL = Below Detection Limit
N/A = Not Applicable

Qualifiers

B = Compound found in associated laboratory blank above the reporting limit.
D = Diluted sample
E = Report concentration was above the instrumental calibration range
I = Response failure of an internal standard; concentration should be considered an estimate
J = Concentration below reporting limit
N = Identification based on mass spectral library search
P = Library spectrum match, rsd >90% w RT match
Q = Qualitative results for non-target compounds
Ta = Target Analyte

R = Recovery failure in CCV or LCS.
S = Surrogate recovery failure
T = Compound is tentatively identified compound. Includes chemical library matches & chemist identified compounds.
X = Detected but not quantifiable
c = Sample RPD failure
d= Data that exceeds the %RSD criteria set by the method (70-130%)
PIC = Positively identified compound, for non-calibrated compounds
r = Recovery failure in MRL
Z = Positively Identified Compound; Quantitative data only

Authorized Signature: L Joseph Sears
Laboratory Technical Manager - Dr. Joe Sears

Date: 06/13/16

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QUALITY CONTROL REPORT
EPA Compendium Method TO-17-Modified
Electrostatic Precipitator Plates

Washington River Protection Solution

Richland, WA 99352
Attn: George Weeks

RJ Lee Group Project: W605131
Samples Received: 5/26/2016
Analysis Date: 6/2/2016
Report Date: 6/13/2016
Sampling Date:
Purchase Order No.:
Client Project:

Analyte	CAS No.	QC Analyte Type	QC Sample Type	Ret. Time	Peak Area	Expected (ppbv)	Result (ppbv)	Result (ug/m3)	%REC	%RPD	Qualifier
Bromochloromethane	74-97-5	Int. Std	CCV	8.505	14329409	10.0	10.0	52.9	100		
Propene	115-07-1	Ta	CCV	3.324	5133656	10.5	12.2	21.0	116		
Dichlorodifluoromethane (F12)	75-71-8	Ta	CCV	3.388	12144689	10.1	10.4	51.4	103		
Chloromethane	74-87-3	Ta	CCV	3.707	4803161	10.1	10.4	21.5	103		
1,2-Dichloro-tetrarfluoroethane	76-14-2	Ta	CCV	3.605	5990193	10.2	9.94	69.5	97.5		
Chloroethene	75-01-4	Ta	CCV	3.890	9244071	10.2	10.1	25.9	99.1		
1,3-Butadiene	106-99-0	Ta	CCV	3.954	5806489	10.2	9.25	20.5	90.7		
n-Butane	106-97-8	Ta	CCV	3.879	9173223	10.4	9.91	23.6	95.3		
Bromomethane	74-83-9	Ta	CCV	4.463	10447067	9.90	10.9	42.4	110		
Chloroethane	75-00-3	Ta	CCV	4.628	4401707	9.90	10.1	26.6	102		
Ethanol	64-17-5	Ta	CCV	5.242	2277916	10.6	10.4	19.6	98.3		
Vinylbromide	593-60-2	Ta	CCV	4.926	11215800	10.8	11.1	48.6	103		
Trichlorofluoromethane	75-69-4	Ta	CCV	5.037	26607028	10.4	10.6	59.8	102		
Acrolein	107-02-8	Ta	CCV	5.638	2713808	10.1	12.4	28.4	123		
Acetone	67-64-1	Ta	CCV	5.829	5090142	10.5	11.1	26.3	105		
n-Pentane	109-66-0	Ta	CCV	5.151	9772508	10.2	9.97	29.4	97.7		
Isopropanol	67-63-0	Ta	CCV	5.993	9793406	11.0	10.3	25.4	93.7		
1,1-Dichloroethene	75-35-4	Ta	CCV	5.792	12396842	10.2	10.7	42.2	104		
t-Butyl alcohol	75-65-0	Ta	CCV	6.572	14419442	11.7	10.7	32.6	91.8		
1,1,2-Trichloro-1,2,2-trifluoroethane (	76-13-1	Ta	CCV	5.794	22218438	10.0	10.4	80.0	104		
3-Chloropropene	107-05-1	Ta	CCV	6.290	4612907	10.8	9.91	31.0	91.8		
Methylene Chloride (Dichloromethan	75-09-2	Ta	CCV	6.461	6602384	10.2	10.4	36.0	101		
Carbon Disulfide	75-65-0	Ta	CCV	6.159	25657684	10.2	10.1	31.6	99.4		
trans-1,2-Dichloroethene	156-60-5	Ta	CCV	6.838	9295536	10.0	4.40	17.5	44.0		R
Methyl-t-butyll ether (MTBE)	1634-04-4	Ta	CCV	6.825	19356482	10.2	4.21	15.2	41.3		R
Vinyl Acetate	108-05-4	Ta	CCV	7.374	32802916	11.0	22.4	78.9	204		R
1,1-Dichloroethane	75-34-3	Ta	CCV	7.427	27633343	10.1	10.6	43.0	105		
2-Butanone (MEK)	78-93-3	Ta	CCV	8.133	3587834	10.4	10.5	31.1	101		
Hexane	110-54-3	Ta	CCV	7.184	23175398	10.2	10.1	35.7	99.3		
cis-1,2-Dichloroethene	156-59-2	Ta	CCV	6.838	7494506	10.4	4.20	16.7	40.4		R
Ethyl Acetate	141-78-6	Ta	CCV	8.143	21970756	10.0	9.30	33.5	93.0		
Chloroform	540-36-3	Ta	CCV	8.600	13804751	10.0	10.5	55.6	105		
Tetrahydrofuran	67-66-3	Ta	CCV	8.548	5854699	10.3	10.2	50.0	99.3		
1,4-Difluorobenzene	71-55-6	Int. Std	CCV	9.860	61765445	10.0	10.0	46.7	100		
1,1,1-Trichloroethane	71-55-6	Ta	CCV	8.883	14292034	10.2	9.55	52.1	93.6		
1,2-Dichloroethane-d4	17060-07-0	QA/Surr	CCV	9.301	13449528	10.0	9.93	41.8	99.3		
1,2-Dichloroethane	107-06-2	Ta	CCV	9.406	7802031	10.3	10.6	42.8	103		
Benzene	71-43-2	Ta	CCV	9.362	26248038	10.4	10.9	34.8	105		
Carbon Tetrachloride	56-23-5	Ta	CCV	9.105	14220534	10.4	9.90	62.3	95.2		
Cyclohexane	110-82-7	Ta	CCV	9.004	10653001	10.3	9.65	33.2	93.7		
2,2,4-Trimethylpentane	540-84-1	Ta	CCV	9.462	30448763	10.6	10.6	49.3	99.5		
Heptane	142-82-5	Ta	CCV	9.659	8750174	10.4	6.51	26.7	62.6		R
Trichlorethylene	79-01-6	Ta	CCV	10.226	13495183	10.3	11.4	61.1	110		
1,2-Dichloropropane	78-87-5	Ta	CCV	10.597	7891804	10.4	10.7	49.4	103		
Methylmethacrylate	80-62-6	Ta	CCV	10.558	11072680	10.1	10.3	42.0	101		
1,4-Dioxane	123-91-1	Ta	CCV	10.671	6665016	10.3	10.2	36.8	99.2		
Bromodichloromethane	75-27-4	Ta	CCV	10.929	14514955	10.3	10.4	69.6	101		
Methyl isobutyl ketone (MIBK)	108-10-1	Ta	CCV	11.686	14244134	10.1	9.48	38.9	93.9		
cis-1,3-Dichloropropene	10061-01-5	Ta	CCV	11.536	12028783	11.0	11.1	50.5	101		
trans-1,3-Dichloropropene	10061-02-6	Ta	CCV	12.333	10115912	10.9	10.5	47.6	96.2		

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QUALITY CONTROL REPORT
EPA Compendium Method TO-17-Modified
Electrostatic Precipitator Plates

Washington River Protection Solution

Richland, WA 99352
Attn: George Weeks

RJ Lee Group Project: W605131
Samples Received: 5/26/2016
Analysis Date: 6/2/2016
Report Date: 6/13/2016
Sampling Date:
Purchase Order No.:
Client Project:

Toluene-d8	2037-26-5	QA/Surr	CCV	11.954	56251495	10.0	9.82	40.3	98.2		
Toluene	108-88-3	Ta	CCV	12.058	31397469	10.5	10.1	38.2	96.4		
1,1,2-Trichloroethane	79-00-5	Ta	CCV	12.653	10087360	10.4	10.3	56.4	99.3		
2-Hexanone	591-78-6	Ta	CCV	12.901	12497842	10.7	8.90	40.1	83.2		
Dibromochloromethane	124-48-1	Ta	CCV	13.272	16301241	10.7	10.5	89.1	97.8		
Tetrachloroethylene	127-18-4	Ta	CCV	12.844	16660585	10.2	9.91	67.2	97.2		
Chlorobenzene-d5	3114-55-4	Int. Std	CCV	14.191	56359111	10.0	10.0	46.1	100		
1,2-Dibromoethane	106-93-4	Ta	CCV	13.502	13288666	10.4	9.37	72.0	90.1		
Chlorobenzene	108-90-7	Ta	CCV	14.241	25133488	10.5	9.36	43.1	89.1		
Ethylbenzene	100-41-4	Ta	CCV	14.350	29264577	10.5	7.55	32.8	71.9		
m,p-Xylene	179601-23-1	Ta	CCV	14.545	38309168	20.4	13.2	57.4	64.8		R
Nonane	111-84-2	Ta	CCV	14.492	2474279	10.5	0.610	3.20	5.81		R
o-Xylene	95-47-6	Ta	CCV	15.183	18828907	10.5	5.71	24.8	54.4		R
Styrene	100-42-5	Ta	CCV	15.206	14463568	10.5	5.22	22.2	49.7		R
Bromoform	75-25-2	Ta	CCV	15.564	14737914	10.2	8.20	84.8	80.4		
1,1,2,2-Tetrachloroethane	79-34-5	Ta	CCV	16.229	16037099	10.5	7.07	48.6	67.3		R
Cumene	98-82-8	Ta	CCV	15.760	23858438	10.4	4.88	24.0	46.9		R
4-Bromofluorobenzene (BFB)	460-00-4	QA/Surr	CCV	16.087	42599248	10.0	11.4	81.8	114		
n-Propylbenzene	103-65-1	Ta	CCV	16.450	3418846	10.3	1.95	9.59	18.9		R
2-Chlorotoluene	95-49-8	Ta	CCV	16.649	5649772	10.8	3.92	20.3	36.3		R
4-Ethyltoluene	622-96-8	Ta	CCV	16.642	2863697	10.1	1.47	7.23	14.6		R
1,3,5-Trimethylbenzene	108-67-8	Ta	CCV	16.725	13766282	10.2	2.78	13.7	27.3		R
1,2,4-Trimethylbenzene	95-63-6	Ta	CCV	17.372	2788492	10.2	1.03	5.07	10.1		R
1,3-Dichlorobenzene	541-73-1	Ta	CCV	17.917	7570773	10.3	2.26	13.6	21.9		R
Benzyl Chloride	100-44-7	Ta	CCV	18.247	5850344	10.3	1.41	7.30	13.7		R
1,4-Dichlorobenzene	106-46-7	Ta	CCV	18.085	5943250	10.1	1.80	10.8	17.8		R
1,2-Dichlorobenzene	95-50-1	Ta	CCV	18.706	5041451	10.1	1.55	9.32	15.3		R
1,2,4-Trichlorobenzene	120-82-1	PIC	CCV		200059				#VALUE!		Z
Naphthalene	91-20-3	PIC	CCV		271390				#VALUE!		Z
Hexachloro-1,3-butadiene	87-68-3	PIC	CCV		399075				#VALUE!		Z

Analyte	CAS No.	QC Sample ID		Ret. Time	Peak Area	Expected (ppbv)	Result (ppbv)	Result (ug/m3)	%REC	%RPD	Qualifier
Bromochloromethane	74-97-5	Int. Std	LCS	8.505	14329409	10.0	10.0	52.9	100		
Propene	115-07-1	Ta	LCS	3.324	5133656	10.5	12.2	21.0	116		
Dichlorodifluoromethane (F12)	75-71-8	Ta	LCS	3.388	12144689	10.1	10.4	51.4	103		
Chloromethane	74-87-3	Ta	LCS	3.707	4803161	10.1	10.4	21.5	103		
1,2-Dichloro-tetrarfluoroethane	76-14-2	Ta	LCS	3.605	5990193	10.2	9.94	69.5	97.5		
Chloroethene	75-01-4	Ta	LCS	3.890	9244071	10.2	10.1	25.9	99.1		
1,3-Butadiene	106-99-0	Ta	LCS	3.954	5806489	10.2	9.25	20.5	90.7		
n-Butane	106-97-8	Ta	LCS	3.879	9173223	10.4	9.91	23.6	95.3		
Bromomethane	74-83-9	Ta	LCS	4.463	10447067	9.90	10.9	42.4	110		
Chloroethane	75-00-3	Ta	LCS	4.628	4401707	9.90	10.1	26.6	102		
Ethanol	64-17-5	Ta	LCS	5.242	2277916	10.6	10.4	19.6	98.3		
Vinylbromide	593-60-2	Ta	LCS	4.926	11215800	10.8	11.1	48.6	103		
Trichlorofluoromethane	75-69-4	Ta	LCS	5.037	26607028	10.4	10.6	59.8	102		
Acrolein	107-02-8	Ta	LCS	5.638	2713808	10.1	12.4	28.4	123		
Acetone	67-64-1	Ta	LCS	5.829	5090142	10.5	11.1	26.3	105		
n-Pentane	109-66-0	Ta	LCS	5.151	9772508	10.2	9.97	29.4	97.7		
Isopropanol	67-63-0	Ta	LCS	5.993	9793406	11.0	10.3	25.4	93.7		
1,1-Dichloroethene	75-35-4	Ta	LCS	5.792	12396842	10.2	10.7	42.2	104		
t-Butyl alcohol	75-65-0	Ta	LCS	6.572	14419442	11.7	10.7	32.6	91.8		

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Attn: George Weeks

RJ Lee Group Project: W605131
Samples Received: 5/26/2016
Analysis Date: 6/2/2016
Report Date: 6/13/2016
Sampling Date:
Purchase Order No.:
Client Project:

1,1,2-Trichloro-1,2,2-trifluoroethane (	76-13-1	Ta	LCS	5.794	22218438	10.0	10.4	80.0	104		
3-Chloropropene	107-05-1	Ta	LCS	6.290	4612907	10.8	9.91	31.0	91.8		
Methylene Chloride (Dichloromethan	75-09-2	Ta	LCS	6.461	6602384	10.2	10.4	36.0	101		
Carbon Disulfide	75-65-0	Ta	LCS	6.159	25657684	10.2	10.1	31.6	99.4		
trans-1,2-Dichloroethene	156-60-5	Ta	LCS	6.838	9295536	10.0	4.40	17.5	44.0		R
Methyl-t-butyll ether (MTBE)	1634-04-4	Ta	LCS	6.825	19356482	10.2	4.21	15.2	41.3		R
Vinyl Acetate	108-05-4	Ta	LCS	7.374	32802916	11.0	22.4	78.9	204		R
1,1-Dichloroethane	75-34-3	Ta	LCS	7.427	27633343	10.1	10.6	43.0	105		
2-Butanone (MEK)	78-93-3	Ta	LCS	8.133	3587834	10.4	10.5	31.1	101		
Hexane	110-54-3	Ta	LCS	7.184	23175398	10.2	10.1	35.7	99.3		
cis-1,2-Dichloroethene	156-59-2	Ta	LCS	6.838	7494506	10.4	4.20	16.7	40.4		R
Ethyl Acetate	141-78-6	Ta	LCS	8.143	21970756	10.0	9.30	33.5	93.0		
Chloroform	540-36-3	Ta	LCS	8.600	13804751	10.0	10.5	55.6	105		
Tetrahydrofuran	67-66-3	Ta	LCS	8.548	5854699	10.3	10.2	50.0	99.3		
1,4-Difluorobenzene	71-55-6	Int. Std	LCS	9.860	61765445	10.0	10.0	46.7	100		
1,1,1-Trichloroethane	71-55-6	Ta	LCS	8.883	14292034	10.2	9.55	52.1	93.6		
1,2-Dichloroethane-d4	17060-07-0	QA/Surr	LCS	9.301	13449528	10.0	9.93	41.8	99.3		
1,2-Dichloroethane	107-06-2	Ta	LCS	9.406	7802031	10.3	10.6	42.8	103		
Benzene	71-43-2	Ta	LCS	9.362	26248038	10.4	10.9	34.8	105		
Carbon Tetrachloride	56-23-5	Ta	LCS	9.105	14220534	10.4	9.90	62.3	95.2		
Cyclohexane	110-82-7	Ta	LCS	9.004	10653001	10.3	9.65	33.2	93.7		
2,2,4-Trimethylpentane	540-84-1	Ta	LCS	9.462	30448763	10.6	10.6	49.3	99.5		
Heptane	142-82-5	Ta	LCS	9.659	8750174	10.4	6.51	26.7	62.6		R
Trichlorethylene	79-01-6	Ta	LCS	10.226	13495183	10.3	11.4	61.1	110		
1,2-Dichloropropane	78-87-5	Ta	LCS	10.597	7891804	10.4	10.7	49.4	103		
Methylmethacrylate	80-62-6	Ta	LCS	10.558	11072680	10.1	10.3	42.0	101		
1,4-Dioxane	123-91-1	Ta	LCS	10.671	6665016	10.3	10.2	36.8	99.2		
Bromodichloromethane	75-27-4	Ta	LCS	10.929	14514955	10.3	10.4	69.6	101		
Methyl isobutyl ketone (MIBK)	108-10-1	Ta	LCS	11.686	14244134	10.1	9.48	38.9	93.9		
cis-1,3-Dichloropropene	10061-01-5	Ta	LCS	11.536	12028783	11.0	11.1	50.5	101		
trans-1,3-Dichloropropene	10061-02-6	Ta	LCS	12.333	10115912	10.9	10.5	47.6	96.2		
Toluene-d8	2037-26-5	QA/Surr	LCS	11.954	56251495	10.0	9.82	40.3	98.2		
Toluene	108-88-3	Ta	LCS	12.058	31397469	10.5	10.1	38.2	96.4		
1,1,2-Trichloroethane	79-00-5	Ta	LCS	12.653	10087360	10.4	10.3	56.4	99.3		
2-Hexanone	591-78-6	Ta	LCS	12.901	12497842	10.7	8.90	40.1	83.2		
Dibromochloromethane	124-48-1	Ta	LCS	13.272	16301241	10.7	10.5	89.1	97.8		
Tetrachloroethylene	127-18-4	Ta	LCS	12.844	16660585	10.2	9.91	67.2	97.2		
Chlorobenzene-d5	3114-55-4	Int. Std	LCS	14.191	56359111	10.0	10.0	46.1	100		
1,2-Dibromoethane	106-93-4	Ta	LCS	13.502	13288666	10.4	9.37	72.0	90.1		
Chlorobenzene	108-90-7	Ta	LCS	14.241	25133488	10.5	9.36	43.1	89.1		
Ethylbenzene	100-41-4	Ta	LCS	14.350	29264577	10.5	7.55	32.8	71.9		
m,p-Xylene	179601-23-1	Ta	LCS	14.545	38309168	20.4	13.2	57.4	64.8		R
Nonane	111-84-2	Ta	LCS	14.492	2474279	10.5	0.610	3.20	5.81		R
o-Xylene	95-47-6	Ta	LCS	15.183	18828907	10.5	5.71	24.8	54.4		R
Styrene	100-42-5	Ta	LCS	15.206	14463568	10.5	5.22	22.2	49.7		R
Bromoform	75-25-2	Ta	LCS	15.564	14737914	10.2	8.20	84.8	80.4		
1,1,2,2-Tetrachloroethane	79-34-5	Ta	LCS	16.229	16037099	10.5	7.07	48.6	67.3		R
Cumene	98-82-8	Ta	LCS	15.760	23858438	10.4	4.88	24.0	46.9		R
4-Bromofluorobenzene (BFB)	460-00-4	QA/Surr	LCS	16.087	42599248	10.0	11.4	81.8	114		
n-Propylbenzene	103-65-1	Ta	LCS	16.450	3418846	10.3	1.95	9.59	18.9		R
2-Chlorotoluene	95-49-8	Ta	LCS	16.649	5649772	10.8	3.92	20.3	36.3		R
4-Ethyltoluene	622-96-8	Ta	LCS	16.642	2863697	10.1	1.47	7.23	14.6		R
1,3,5-Trimethylbenzene	108-67-8	Ta	LCS	16.725	13766282	10.2	2.78	13.7	27.3		R

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QUALITY CONTROL REPORT
EPA Compendium Method TO-17-Modified
Electrostatic Precipitator Plates

Washington River Protection Solution

Richland, WA 99352
Attn: George Weeks

RJ Lee Group Project: W605131
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1,2,4-Trimethylbenzene	95-63-6	Ta	LCS	17.372	2788492	10.2	1.03	5.07	10.1		R
1,3-Dichlorobenzene	541-73-1	Ta	LCS	17.917	7570773	10.3	2.26	13.6	21.9		R
Benzyl Chloride	100-44-7	Ta	LCS	18.247	5850344	10.3	1.41	7.30	13.7		R
1,4-Dichlorobenzene	106-46-7	Ta	LCS	18.085	5943250	10.1	1.80	10.8	17.8		R
1,2-Dichlorobenzene	95-50-1	Ta	LCS	18.706	5041451	10.1	1.55	9.32	15.3		R
1,2,4-Trichlorobenzene	120-82-1	PIC	LCS		200059				#VALUE!		Z
Naphthalene	91-20-3	PIC	LCS		271390				#VALUE!		Z
Hexachloro-1,3-butadiene	87-68-3	PIC	LCS		399075				#VALUE!		Z

Analyte	CAS No.	QC Sample ID		Ret. Time	Peak Area	Expected (ppbv)	Result (ppbv)	Result (ug/m3)	%REC	%RPD	Qualifier
Bromochloromethane	74-97-5	Int. Std	LCSD	8.506	14071425	10.0	10.0	52.9	100	0.0	
Propene	115-07-1	Ta	LCSD	3.323	4069583	10.5	9.60	16.5	91.4	23.7	
Dichlorodifluoromethane (F12)	75-71-8	Ta	LCSD	3.387	11907343	10.1	10.4	51.4	103	0.0	
Chloromethane	74-87-3	Ta	LCSD	3.705	4550859	10.1	10.0	20.7	99.4	3.6	
1,2-Dichloro-tetrarfluoroethane	76-14-2	Ta	LCSD	3.605	6676196	10.2	11.3	79.0	111	12.9	
Chloroethene	75-01-4	Ta	LCSD	3.889	8943835	10.2	9.96	25.5	97.6	1.5	
1,3-Butadiene	106-99-0	Ta	LCSD	3.953	5496209	10.2	8.92	19.7	87.5	3.6	
n-Butane	106-97-8	Ta	LCSD	3.877	8691792	10.4	9.56	22.7	91.9	3.6	
Bromomethane	74-83-9	Ta	LCSD	4.461	10141484	9.90	10.8	41.9	109	0.9	
Chloroethane	75-00-3	Ta	LCSD	4.626	4279207	9.90	9.97	26.3	101	1.0	
Ethanol	64-17-5	Ta	LCSD	5.241	2148045	10.6	9.96	18.8	94.0	4.5	
Vinylbromide	593-60-2	Ta	LCSD	4.925	11175445	10.8	11.3	49.3	104	1.0	
Trichlorofluoromethane	75-69-4	Ta	LCSD	5.037	26262416	10.4	10.7	60.1	103	1.0	
Acrolein	107-02-8	Ta	LCSD	5.637	2471082	10.1	11.3	25.9	112	9.4	
Acetone	67-64-1	Ta	LCSD	5.827	4275667	10.5	9.29	22.1	88.5	17.1	
n-Pentane	109-66-0	Ta	LCSD	5.150	9473277	10.2	9.84	29.0	96.5	1.2	
Isopropanol	67-63-0	Ta	LCSD	5.992	10038879	11.0	10.8	26.6	98.2	4.7	
1,1-Dichloroethene	75-35-4	Ta	LCSD	5.790	12283193	10.2	10.8	42.6	105	1.0	
t-Butyl alcohol	75-65-0	Ta	LCSD	6.572	15403251	11.7	11.7	35.6	100	8.6	
1,1,2-Trichloro-1,2,2-trifluoroethane (	76-13-1	Ta	LCSD	5.792	21663093	10.0	10.4	79.4	104	0.0	
3-Chloropropene	107-05-1	Ta	LCSD	6.288	4470023	10.8	9.77	30.6	90.5	1.4	
Methylene Chloride (Dichloromethan	75-09-2	Ta	LCSD	6.460	6479595	10.2	10.3	35.9	101	0.0	
Carbon Disulfide	75-65-0	Ta	LCSD	6.158	25365741	10.2	10.2	31.8	100	0.6	
trans-1,2-Dichloroethene	156-60-5	Ta	LCSD	6.843	20443216	10.0	9.82	39.0	98.2	76.2	
Methyl-t-butyll ether (MTBE)	1634-04-4	Ta	LCSD	6.829	40416478	10.2	8.90	32.1	87.3	71.5	
Vinyl Acetate	108-05-4	Ta	LCSD	7.376	31509466	11.0	21.9	77.1	199	2.5	R
1,1-Dichloroethane	75-34-3	Ta	LCSD	7.431	26708586	10.1	10.4	42.3	103	1.9	
2-Butanone (MEK)	78-93-3	Ta	LCSD	8.131	3600257	10.4	10.8	31.8	104	2.9	
Hexane	110-54-3	Ta	LCSD	7.190	22367003	10.2	9.96	35.1	97.6	1.7	
cis-1,2-Dichloroethene	156-59-2	Ta	LCSD	6.843	18677466	10.4	10.7	42.2	102	86.5	
Ethyl Acetate	141-78-6	Ta	LCSD	8.142	21763685	10.0	9.38	33.8	93.8	0.9	
Chloroform	540-36-3	Ta	LCSD	8.601	13485497	10.0	10.5	55.3	105	0.0	
Tetrahydrofuran	67-66-3	Ta	LCSD	8.547	5720873	10.3	10.2	49.7	98.8	0.5	
1,4-Difluorobenzene	71-55-6	Int. Std	LCSD	9.859	60853114	10.0	10.0	46.7	100	0.0	
1,1,1-Trichloroethane	71-55-6	Ta	LCSD	8.884	13491245	10.2	9.15	49.9	89.7	4.3	
1,2-Dichloroethane-d4	17060-07-0	QA/Surr	LCSD	9.300	13135997	10.0	9.85	41.5	98.5	0.8	
1,2-Dichloroethane	107-06-2	Ta	LCSD	9.405	7593611	10.3	10.4	42.2	101	2.0	
Benzene	71-43-2	Ta	LCSD	9.362	25438602	10.4	10.7	34.2	103	1.9	
Carbon Tetrachloride	56-23-5	Ta	LCSD	9.106	13128836	10.4	9.28	58.4	89.2	6.5	
Cyclohexane	110-82-7	Ta	LCSD	9.005	10226706	10.3	9.40	32.4	91.3	2.6	
2,2,4-Trimethylpentane	540-84-1	Ta	LCSD	9.463	28923987	10.6	10.2	47.5	95.9	3.7	

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Heptane	142-82-5	Ta	LCSD	9.658	9447210	10.4	7.13	29.2	68.6	9.1	R
Trichlorethylene	79-01-6	Ta	LCSD	10.225	13163097	10.3	11.2	60.4	109	0.9	
1,2-Dichloropropane	78-87-5	Ta	LCSD	10.596	7630897	10.4	10.5	48.5	101	2.0	
Methylmethacrylate	80-62-6	Ta	LCSD	10.556	10914300	10.1	10.3	42.0	101	0.0	
1,4-Dioxane	123-91-1	Ta	LCSD	10.667	6515625	10.3	10.1	36.6	98.4	0.8	
Bromodichloromethane	75-27-4	Ta	LCSD	10.928	14259054	10.3	10.4	69.4	100	1.0	
Methyl isobutyl ketone (MIBK)	108-10-1	Ta	LCSD	11.682	14014635	10.1	9.47	38.8	93.8	0.1	
cis-1,3-Dichloropropene	10061-01-5	Ta	LCSD	11.534	11260764	11.0	10.6	48.0	96.1	5.0	
trans-1,3-Dichloropropene	10061-02-6	Ta	LCSD	12.330	9518421	10.9	10.0	45.5	91.9	4.6	
Toluene-d8	2037-26-5	QA/Surr	LCSD	11.952	57673715	10.0	10.2	41.9	102	3.8	
Toluene	108-88-3	Ta	LCSD	12.056	30461900	10.5	9.96	37.5	94.9	1.6	
1,1,2-Trichloroethane	79-00-5	Ta	LCSD	12.651	9924785	10.4	10.3	56.3	99.2	0.1	
2-Hexanone	591-78-6	Ta	LCSD	12.898	12773660	10.7	9.24	41.6	86.4	3.8	
Dibromochloromethane	124-48-1	Ta	LCSD	13.270	16082831	10.7	10.5	89.3	97.9	0.1	
Tetrachloroethylene	127-18-4	Ta	LCSD	12.843	16367827	10.2	9.89	67.1	97.0	0.2	
Chlorobenzene-d5	3114-55-4	Int. Std	LCSD	14.190	56794768	10.0	10.0	46.1	100	0.0	
1,2-Dibromoethane	106-93-4	Ta	LCSD	13.500	13000018	10.4	9.09	69.9	87.4	3.0	
Chlorobenzene	108-90-7	Ta	LCSD	14.240	24746078	10.5	9.14	42.1	87.0	2.4	
Ethylbenzene	100-41-4	Ta	LCSD	14.348	27897110	10.5	7.12	30.9	67.8	5.9	R
m,p-Xylene	179601-23-1	Ta	LCSD	14.543	35707582	20.4	12.2	52.8	59.6	8.4	R
Nonane	111-84-2	Ta	LCSD		2096059				#VALUE!	#VALUE!	R
o-Xylene	95-47-6	Ta	LCSD	15.181	17906127	10.5	5.38	23.4	51.2	6.1	R
Styrene	100-42-5	Ta	LCSD	15.205	14357078	10.5	5.14	21.9	49.0	1.4	R
Bromoform	75-25-2	Ta	LCSD	15.562	15598621	10.2	8.61	89.0	84.4	4.9	
1,1,2,2-Tetrachloroethane	79-34-5	Ta	LCSD	16.228	19159024	10.5	8.41	57.8	80.1	17.4	
Cumene	98-82-8	Ta	LCSD	15.759	23302640	10.4	4.72	23.2	45.4	3.3	R
4-Bromofluorobenzene (BFB)	460-00-4	QA/Surr	LCSD	16.086	38623900	10.0	10.3	73.6	103	10.1	
n-Propylbenzene	103-65-1	Ta	LCSD	16.448	3540952	10.3	2.01	9.88	19.5	3.1	R
2-Chlorotoluene	95-49-8	Ta	LCSD	16.648	6011811	10.8	4.15	21.5	38.4	5.6	R
4-Ethyltoluene	622-96-8	Ta	LCSD	16.641	3087498	10.1	1.59	7.82	15.7	7.3	R
1,3,5-Trimethylbenzene	108-67-8	Ta	LCSD	16.724	13922494	10.2	2.80	13.8	27.5	0.7	R
1,2,4-Trimethylbenzene	95-63-6	Ta	LCSD	17.372	3316221	10.2	1.28	6.29	12.5	21.2	R
1,3-Dichlorobenzene	541-73-1	Ta	LCSD	17.916	11150919	10.3	3.40	20.5	33.0	40.4	R
Benzyl Chloride	100-44-7	Ta	LCSD	18.247	10921403	10.3	2.76	14.3	26.8	64.7	R
1,4-Dichlorobenzene	106-46-7	Ta	LCSD	18.084	9686244	10.1	2.98	17.9	29.5	49.5	R
1,2-Dichlorobenzene	95-50-1	Ta	LCSD	18.705	10125129	10.1	3.35	20.2	33.2	73.8	R
1,2,4-Trichlorobenzene	120-82-1	PIC	LCSD	21.455	937459	9.70	0.550	4.08	5.67	#VALUE!	Z
Naphthalene	91-20-3	PIC	LCSD		903329				#VALUE!	#VALUE!	Z
Hexachloro-1,3-butadiene	87-68-3	PIC	LCSD	21.669	2645180	9.80	0.840	8.96	8.57	#VALUE!	Z

Analyte	CAS No.	QC Sample ID		Ret. Time	Peak Area	Expected (ppbv)	Result (ppbv)	Result (ug/m3)	%REC	%RPD	Qualifier
Bromochloromethane	74-97-5	Int. Std	MRL	8.511	14081552	10.0	10.0	52.9	100		
Propene	115-07-1	Ta	MRL	3.318	857683	0.525	0.930	1.60	177		r
Dichlorodifluoromethane (F12)	75-71-8	Ta	MRL	3.387	688533	0.505	0.540	2.67	107		
Chloromethane	74-87-3	Ta	MRL	3.702	324858	0.505	0.530	1.09	105		
1,2-Dichloro-tetrarfluoroethane	76-14-2	Ta	MRL	3.611	269853	0.510	0.420	2.94	82.4		
Chloroethene	75-01-4	Ta	MRL	3.888	407402	0.510	0.470	1.20	92.2		
1,3-Butadiene	106-99-0	Ta	MRL	3.956	289588	0.510	0.470	1.04	92.2		
n-Butane	106-97-8	Ta	MRL	3.880	502900	0.520	0.550	1.31	106		
Bromomethane	74-83-9	Ta	MRL	4.461	357391	0.495	0.460	1.79	92.9		
Chloroethane	75-00-3	Ta	MRL	4.630	193631	0.495	0.450	1.19	90.9		

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Ethanol	64-17-5	Ta	MRL		201513				#VALUE!		r
Vinylbromide	593-60-2	Ta	MRL	4.927	524364	0.540	0.480	2.10	88.9		
Trichlorofluoromethane	75-69-4	Ta	MRL	5.040	1259324	0.520	0.450	2.53	86.5		
Acrolein	107-02-8	Ta	MRL		289665				#VALUE!		r
Acetone	67-64-1	Ta	MRL		458752				#VALUE!		r
n-Pentane	109-66-0	Ta	MRL	5.150	441263	0.510	0.300	0.886	58.8		
Isopropanol	67-63-0	Ta	MRL	5.997	988554	0.550	0.430	1.06	78.2		
1,1-Dichloroethene	75-35-4	Ta	MRL	5.794	589978	0.510	0.300	1.19	58.8		
t-Butyl alcohol	75-65-0	Ta	MRL	6.577	1497645	0.585	0.630	1.91	108		
1,1,2-Trichloro-1,2,2-trifluoroethane (	76-13-1	Ta	MRL	5.789	1064159	0.500	0.300	2.30	60.0		
3-Chloropropene	107-05-1	Ta	MRL	6.298	671911	0.540	0.800	2.50	148		
Methylene Chloride (Dichloromethan	75-09-2	Ta	MRL	6.473	740900	0.510	0.700	2.43	137		
Carbon Disulfide	75-65-0	Ta	MRL	6.165	2206349	0.510	0.560	1.74	110		
trans-1,2-Dichloroethene	156-60-5	Ta	MRL	6.855	975296	0.500	0.490	1.94	98.0		
Methyl-t-butyll ether (MTBE)	1634-04-4	Ta	MRL	6.835	2020470	0.510	0.500	1.80	98.0		
Vinyl Acetate	108-05-4	Ta	MRL	7.383	835918	0.550	0.320	1.13	58.2		
1,1-Dichloroethane	75-34-3	Ta	MRL	7.439	1260686	0.505	0.480	1.94	95.0		
2-Butanone (MEK)	78-93-3	Ta	MRL	8.132	211603	0.520	0.450	1.33	86.5		
Hexane	110-54-3	Ta	MRL	7.201	1070309	0.510	0.470	1.66	92.2		
cis-1,2-Dichloroethene	156-59-2	Ta	MRL	6.857	878523	0.520	0.510	2.02	98.1		
Ethyl Acetate	141-78-6	Ta	MRL	8.141	1267195	0.500	0.460	1.66	92.0		
Chloroform	540-36-3	Ta	MRL	8.605	637696	0.500	0.470	2.49	94.0		
Tetrahydrofuran	67-66-3	Ta	MRL	8.547	312860	0.515	0.430	2.10	83.5		
1,4-Difluorobenzene	71-55-6	Int. Std	MRL	9.861	60704433	10.0	10.0	46.7	100		
1,1,1-Trichloroethane	71-55-6	Ta	MRL	8.886	640663	0.510	0.490	2.67	96.1		
1,2-Dichloroethane-d4	17060-07-0	QA/Surr	MRL	9.303	13149430	10.0	9.88	41.6	98.8		
1,2-Dichloroethane	107-06-2	Ta	MRL	9.407	373582	0.515	0.510	2.07	99.0		
Benzene	71-43-2	Ta	MRL	9.365	1996970	0.520	0.560	1.79	108		
Carbon Tetrachloride	56-23-5	Ta	MRL	9.109	311729	0.520	0.310	1.95	59.6		
Cyclohexane	110-82-7	Ta	MRL	9.010	483740	0.515	0.480	1.65	93.2		
2,2,4-Trimethylpentane	540-84-1	Ta	MRL	9.466	1474315	0.530	0.480	2.24	90.6		
Heptane	142-82-5	Ta	MRL	9.663	503109	0.520	0.450	1.84	86.5		
Trichlorethylene	79-01-6	Ta	MRL	10.228	536674	0.515	0.490	2.63	95.1		
1,2-Dichloropropane	78-87-5	Ta	MRL	10.597	368087	0.520	0.490	2.27	94.2		
Methylmethacrylate	80-62-6	Ta	MRL	10.556	608258	0.505	0.420	1.72	83.2		
1,4-Dioxane	123-91-1	Ta	MRL	10.665	326264	0.515	0.410	1.48	79.6		
Bromodichloromethane	75-27-4	Ta	MRL	10.929	648571	0.515	0.490	3.28	95.1		
Methyl isobutyl ketone (MIBK)	108-10-1	Ta	MRL	11.680	721212	0.505	0.390	1.60	77.2		
cis-1,3-Dichloropropene	10061-01-5	Ta	MRL	11.534	583010	0.550	0.530	2.41	96.4		
trans-1,3-Dichloropropene	10061-02-6	Ta	MRL	12.330	529396	0.545	0.470	2.13	86.2		
Toluene-d8	2037-26-5	QA/Surr	MRL	11.953	55479802	10.0	9.86	40.4	98.6		
Toluene	108-88-3	Ta	MRL	12.057	1691611	0.525	0.190	0.716	36.2		r
1,1,2-Trichloroethane	79-00-5	Ta	MRL	12.650	474732	0.520	0.400	2.18	76.9		
2-Hexanone	591-78-6	Ta	MRL	12.895	867281	0.535	0.370	1.67	69.2		
Dibromochloromethane	124-48-1	Ta	MRL	13.271	706091	0.535	0.380	3.24	71.0		
Tetrachloroethylene	127-18-4	Ta	MRL	12.843	757625	0.510	0.440	2.99	86.3		
Chlorobenzene-d5	3114-55-4	Int. Std	MRL	14.190	55400479	10.0	10.0	46.1	100		
1,2-Dibromoethane	106-93-4	Ta	MRL	13.499	724555	0.520	0.450	3.46	86.5		
Chlorobenzene	108-90-7	Ta	MRL	14.239	1269211	0.525	0.410	1.89	78.1		
Ethylbenzene	100-41-4	Ta	MRL	14.348	2193630	0.525	0.120	0.521	22.9		r
m,p-Xylene	179601-23-1	Ta	MRL	14.544	3295355	1.02	0.280	1.22	27.5		r
Nonane	111-84-2	Ta	MRL		1082708				#VALUE!		r
o-Xylene	95-47-6	Ta	MRL	15.180	1568397	0.525	0.330	1.43	62.9		

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QUALITY CONTROL REPORT
EPA Compendium Method TO-17-Modified
Electrostatic Precipitator Plates

Washington River Protection Solution

Richland, WA 99352
Attn: George Weeks

RJ Lee Group Project: W605131
Samples Received: 5/26/2016
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Styrene	100-42-5	Ta	MRL	15.205	1318254	0.525	0.370	1.58	70.5		
Bromoform	75-25-2	Ta	MRL	15.562	684198	0.510	0.380	3.93	74.5		
1,1,2,2-Tetrachloroethane	79-34-5	Ta	MRL	16.227	1015455	0.525	0.310	2.13	59.0		
Cumene	98-82-8	Ta	MRL	15.759	2256293	0.520	0.300	1.48	57.7		
4-Bromofluorobenzene (BFB)	460-00-4	QA/Surr	MRL	16.086	41397754	10.0	11.3	80.9	113		
n-Propylbenzene	103-65-1	Ta	MRL	16.451	632830	0.515	0.240	1.18	46.6		r
2-Chlorotoluene	95-49-8	Ta	MRL	16.648	544644	0.540	0.280	1.45	51.9		
4-Ethyltoluene	622-96-8	Ta	MRL	16.641	676433	0.505	0.220	1.08	43.6		r
1,3,5-Trimethylbenzene	108-67-8	Ta	MRL	16.722	1755792	0.510	0.110	0.541	21.6		r
1,2,4-Trimethylbenzene	95-63-6	Ta	MRL		780879				#VALUE!		r
1,3-Dichlorobenzene	541-73-1	Ta	MRL	17.915	1021816	0.515	0.140	0.842	27.2		r
Benzyl Chloride	100-44-7	Ta	MRL	18.246	1027940	0.515	0.110	0.570	21.4		r
1,4-Dichlorobenzene	106-46-7	Ta	MRL	18.084	980977	0.505	0.200	1.20	39.6		r
1,2-Dichlorobenzene	95-50-1	Ta	MRL		786165				#VALUE!		r
1,2,4-Trichlorobenzene	120-82-1	PIC	MRL	21.453	188568	0.485	0.250	1.86	51.5		Z
Naphthalene	91-20-3	PIC	MRL		689441				#VALUE!		Z
Hexachloro-1,3-butadiene	87-68-3	PIC	MRL		99600				#VALUE!		Z

Analyte	CAS No.	QC Sample ID		Ret. Time	Peak Area	Expected (ppbv)	Result (ppbv)	Result (ug/m3)	%REC	%RPD	Qualifier
Bromochloromethane	74-97-5	Int. Std	MBLK	8.519	13571142	10.0	10.0	52.9	100		
Propene	115-07-1	Ta	MBLK	3.320	682013		0.520	0.895			B
Dichlorodifluoromethane (F12)	75-71-8	Ta	MBLK		66302						
Chloromethane	74-87-3	Ta	MBLK		42295						
1,2-Dichloro-tetrarfluoroethane	76-14-2	Ta	MBLK		291384						
Chloroethene	75-01-4	Ta	MBLK								
1,3-Butadiene	106-99-0	Ta	MBLK		58981						
n-Butane	106-97-8	Ta	MBLK								
Bromomethane	74-83-9	Ta	MBLK		241706						
Chloroethane	75-00-3	Ta	MBLK								
Ethanol	64-17-5	Ta	MBLK		195334						
Vinylbromide	593-60-2	Ta	MBLK								
Trichlorofluoromethane	75-69-4	Ta	MBLK		191845						
Acrolein	107-02-8	Ta	MBLK		277200						
Acetone	67-64-1	Ta	MBLK		515261						
n-Pentane	109-66-0	Ta	MBLK		136339						
Isopropanol	67-63-0	Ta	MBLK								
1,1-Dichloroethene	75-35-4	Ta	MBLK		35692						
t-Butyl alcohol	75-65-0	Ta	MBLK		262982						
1,1,2-Trichloro-1,2,2-trifluoroethane (	76-13-1	Ta	MBLK		68499						
3-Chloropropene	107-05-1	Ta	MBLK								
Methylene Chloride (Dichloromethan	75-09-2	Ta	MBLK		108469						
Carbon Disulfide	75-65-0	Ta	MBLK		170663						
trans-1,2-Dichloroethene	156-60-5	Ta	MBLK		57469						
Methyl-t-butyll ether (MTBE)	1634-04-4	Ta	MBLK		142643						
Vinyl Acetate	108-05-4	Ta	MBLK		43113						
1,1-Dichloroethane	75-34-3	Ta	MBLK		67324						
2-Butanone (MEK)	78-93-3	Ta	MBLK		41973						
Hexane	110-54-3	Ta	MBLK		158981						
cis-1,2-Dichloroethene	156-59-2	Ta	MBLK		57128						
Ethyl Acetate	141-78-6	Ta	MBLK		191652						
Chloroform	540-36-3	Ta	MBLK		47097				#VALUE!		

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Washington River Protection Solution

Richland, WA 99352
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RJ Lee Group Project: W605131
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Tetrahydrofuran	67-66-3	Ta	MBLK		58126						
1,4-Difluorobenzene	71-55-6	Int. Std	MBLK	9.867	59410348	10.0	10.0	46.7			
1,1,1-Trichloroethane	71-55-6	Ta	MBLK		40285						
1,2-Dichloroethane-d4	17060-07-0	QA/Surr	MBLK	9.307	12694286	10.0	9.75	41.1			
1,2-Dichloroethane	107-06-2	Ta	MBLK		39923						
Benzene	71-43-2	Ta	MBLK		340799				#VALUE!		
Carbon Tetrachloride	56-23-5	Ta	MBLK		39795						
Cyclohexane	110-82-7	Ta	MBLK								
2,2,4-Trimethylpentane	540-84-1	Ta	MBLK		124359						
Heptane	142-82-5	Ta	MBLK		61114						
Trichlorethylene	79-01-6	Ta	MBLK		70364				#VALUE!		
1,2-Dichloropropane	78-87-5	Ta	MBLK		41842						
Methylmethacrylate	80-62-6	Ta	MBLK		154172						
1,4-Dioxane	123-91-1	Ta	MBLK		86716						
Bromodichloromethane	75-27-4	Ta	MBLK		91984						
Methyl isobutyl ketone (MIBK)	108-10-1	Ta	MBLK		168074						
cis-1,3-Dichloropropene	10061-01-5	Ta	MBLK		98439						
trans-1,3-Dichloropropene	10061-02-6	Ta	MBLK		131548						
Toluene-d8	2037-26-5	QA/Surr	MBLK	11.958	53783014	10.0	9.76	40.0	97.6		
Toluene	108-88-3	Ta	MBLK		307109						
1,1,2-Trichloroethane	79-00-5	Ta	MBLK		127037						
2-Hexanone	591-78-6	Ta	MBLK		255406						
Dibromochloromethane	124-48-1	Ta	MBLK		232252						
Tetrachloroethylene	127-18-4	Ta	MBLK		169517						
Chlorobenzene-d5	3114-55-4	Int. Std	MBLK	14.194	52004140	10.0	10.0	46.1			
1,2-Dibromoethane	106-93-4	Ta	MBLK		216563						
Chlorobenzene	108-90-7	Ta	MBLK		481886						
Ethylbenzene	100-41-4	Ta	MBLK		776341						
m,p-Xylene	179601-23-1	Ta	MBLK		1283728						
Nonane	111-84-2	Ta	MBLK		341036						
o-Xylene	95-47-6	Ta	MBLK		862787						
Styrene	100-42-5	Ta	MBLK		742293						
Bromoform	75-25-2	Ta	MBLK		566385						
1,1,2,2-Tetrachloroethane	79-34-5	Ta	MBLK		1308296						
Cumene	98-82-8	Ta	MBLK		1597470				#VALUE!		
4-Bromofluorobenzene (BFB)	460-00-4	QA/Surr	MBLK	16.088	31884458	10.0	9.27	66.4			
n-Propylbenzene	103-65-1	Ta	MBLK		579066						
2-Chlorotoluene	95-49-8	Ta	MBLK		575902						
4-Ethyltoluene	622-96-8	Ta	MBLK		667402						
1,3,5-Trimethylbenzene	108-67-8	Ta	MBLK		2078659						
1,2,4-Trimethylbenzene	95-63-6	Ta	MBLK		1253822						
1,3-Dichlorobenzene	541-73-1	Ta	MBLK	17.919	2122625		0.550	3.31			B
Benzyl Chloride	100-44-7	Ta	MBLK	18.250	3348495		0.810	4.20			B
1,4-Dichlorobenzene	106-46-7	Ta	MBLK	18.087	2234909		0.660	3.97			B
1,2-Dichlorobenzene	95-50-1	Ta	MBLK	18.709	2981010		0.900	5.41			B
1,2,4-Trichlorobenzene	120-82-1	PIC	MBLK	21.458	9602679		4.34	32.2			B
Naphthalene	91-20-3	PIC	MBLK	21.968	24418502		5.58	29.3			B
Hexachloro-1,3-butadiene	87-68-3	PIC	MBLK	21.672	8142290		5.62	60.0			B

Analyte	CAS No.	QC Analyte Type	QC Sample Type	Ret. Time	Peak Area	Expected (ppbv)	Result (ppbv)	Result (ug/m3)	%REC	%RPD	Qualifier
Bromochloromethane	74-97-5	Int. Std	CCV2	8.511	14624606	10.0	10.0	52.9	100		

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Richland, WA 99352

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Propene	115-07-1	Ta	CCV2	3.331	4701327	10.5	10.8	18.6	103		
Dichlorodifluoromethane (F12)	75-71-8	Ta	CCV2	3.395	12663452	10.1	10.6	52.5	105		
Chloromethane	74-87-3	Ta	CCV2	3.712	4480568	10.1	9.50	19.6	94.1		
1,2-Dichloro-tetrarfluoroethane	76-14-2	Ta	CCV2	3.613	7267866	10.2	11.8	82.7	116		
Chloroethene	75-01-4	Ta	CCV2	3.896	9083747	10.2	9.74	24.9	95.5		
1,3-Butadiene	106-99-0	Ta	CCV2	3.959	5488326	10.2	8.57	19.0	84.0		
n-Butane	106-97-8	Ta	CCV2	3.885	8845223	10.4	9.36	22.3	90.0		
Bromomethane	74-83-9	Ta	CCV2	4.468	9549309	9.90	9.78	38.0	98.8		
Chloroethane	75-00-3	Ta	CCV2	4.634	4256080	9.90	9.55	25.2	96.5		
Ethanol	64-17-5	Ta	CCV2	5.249	2228541	10.6	9.94	18.7	93.8		
Vinylbromide	593-60-2	Ta	CCV2	4.933	11005909	10.8	10.7	46.7	98.9		
Trichlorofluoromethane	75-69-4	Ta	CCV2	5.045	26719858	10.4	10.5	58.8	101		
Acrolein	107-02-8	Ta	CCV2	5.646	2502442	10.1	11.0	25.1	109		
Acetone	67-64-1	Ta	CCV2	5.836	4804899	10.5	10.1	24.1	96.6		
n-Pentane	109-66-0	Ta	CCV2	5.158	9397117	10.2	9.38	27.7	92.0		
Isopropanol	67-63-0	Ta	CCV2	6.001	10293831	11.0	10.6	26.2	96.7		
1,1-Dichloroethene	75-35-4	Ta	CCV2	5.799	12481850	10.2	10.5	41.7	103		
t-Butyl alcohol	75-65-0	Ta	CCV2	6.578	13450902	11.7	9.77	29.6	83.5		
1,1,2-Trichloro-1,2,2-trifluoroethane (	76-13-1	Ta	CCV2	5.802	22126018	10.0	10.2	78.0	102		
3-Chloropropene	107-05-1	Ta	CCV2	6.297	4583713	10.8	9.63	30.2	89.2		
Methylene Chloride (Dichloromethan	75-09-2	Ta	CCV2	6.469	6503642	10.2	9.97	34.6	97.7		
Carbon Disulfide	75-65-0	Ta	CCV2	6.167	25324673	10.2	9.80	30.5	96.1		
trans-1,2-Dichloroethene	156-60-5	Ta	CCV2	6.845	8971780	10.0	4.16	16.5	41.6		R
Methyl-t-butyll ether (MTBE)	1634-04-4	Ta	CCV2	6.832	18466093	10.2	3.94	14.2	38.6		R
Vinyl Acetate	108-05-4	Ta	CCV2	7.376	33418540	11.0	22.4	78.8	203		R
1,1-Dichloroethane	75-34-3	Ta	CCV2	7.429	27770350	10.1	10.5	42.3	103		
2-Butanone (MEK)	78-93-3	Ta	CCV2	8.140	3796438	10.4	10.9	32.2	105		
Hexane	110-54-3	Ta	CCV2	7.186	9832177	10.2	4.21	14.8	41.3		R
cis-1,2-Dichloroethene	156-59-2	Ta	CCV2	6.846	7227572	10.4	3.97	15.7	38.2		R
Ethyl Acetate	141-78-6	Ta	CCV2	8.150	22369990	10.0	9.28	33.5	92.8		
Chloroform	540-36-3	Ta	CCV2	8.607	14025232	10.0	10.5	55.4	105		
Tetrahydrofuran	67-66-3	Ta	CCV2	8.557	5982142	10.3	10.2	50.0	99.4		
1,4-Difluorobenzene	71-55-6	Int. Std	CCV2	9.868	63773897	10.0	10.0	46.7	100		
1,1,1-Trichloroethane	71-55-6	Ta	CCV2	8.890	14318668	10.2	9.26	50.5	90.8		
1,2-Dichloroethane-d4	17060-07-0	QA/Surr	CCV2	9.310	13284990	10.0	9.50	40.0	95.0		
1,2-Dichloroethane	107-06-2	Ta	CCV2	9.414	7783689	10.3	10.2	41.3	99.0		
Benzene	71-43-2	Ta	CCV2	9.370	27407009	10.4	11.0	35.2	106		
Carbon Tetrachloride	56-23-5	Ta	CCV2	9.112	12921493	10.4	8.72	54.9	83.8		
Cyclohexane	110-82-7	Ta	CCV2	9.011	11280957	10.3	9.89	34.1	96.0		
2,2,4-Trimethylpentane	540-84-1	Ta	CCV2	9.469	30298205	10.6	10.2	47.5	95.9		
Heptane	142-82-5	Ta	CCV2	9.666	10315867	10.4	7.43	30.5	71.4		
Trichlorethylene	79-01-6	Ta	CCV2	10.235	13898407	10.3	11.3	60.9	110		
1,2-Dichloropropane	78-87-5	Ta	CCV2	10.608	8024928	10.4	10.5	48.6	101		
Methylmethacrylate	80-62-6	Ta	CCV2	10.570	11232744	10.1	10.1	41.2	99.6		
1,4-Dioxane	123-91-1	Ta	CCV2	10.684	7078344	10.3	10.5	37.9	102		
Bromodichloromethane	75-27-4	Ta	CCV2	10.940	14814863	10.3	10.3	68.8	99.6		
Methyl isobutyl ketone (MIBK)	108-10-1	Ta	CCV2	11.700	15287180	10.1	9.86	40.4	97.6		
cis-1,3-Dichloropropene	10061-01-5	Ta	CCV2	11.547	10932277	11.0	9.79	44.5	89.0		
trans-1,3-Dichloropropene	10061-02-6	Ta	CCV2	12.345	9359391	10.9	9.39	42.6	86.1		
Toluene-d8	2037-26-5	QA/Surr	CCV2	11.965	60079898	10.0	10.2	41.7	102		
Toluene	108-88-3	Ta	CCV2	12.069	34351467	10.5	10.7	40.5	102		
1,1,2-Trichloroethane	79-00-5	Ta	CCV2	12.666	10609892	10.4	10.5	57.5	101		
2-Hexanone	591-78-6	Ta	CCV2	12.914	14686043	10.7	10.2	45.8	95.0		

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2710 North 20th Avenue, Pasco WA 99301
Tel: (509) 545-4989 | Fax: (509) 544-6010

QUALITY CONTROL REPORT
EPA Compendium Method TO-17-Modified
Electrostatic Precipitator Plates

Washington River Protection Solution

Richland, WA 99352
Attn: George Weeks

RJ Lee Group Project: W605131
Samples Received: 5/26/2016
Analysis Date: 6/2/2016
Report Date: 6/13/2016
Sampling Date:
Purchase Order No.:
Client Project:

Dibromochloromethane	124-48-1	Ta	CCV2	13.285	16804929	10.7	10.4	89.0	97.6		
Tetrachloroethylene	127-18-4	Ta	CCV2	12.857	18490751	10.2	10.7	72.3	105		
Chlorobenzene-d5	3114-55-4	Int. Std	CCV2	14.203	60646718	10.0	10.0	46.1	100		
1,2-Dibromoethane	106-93-4	Ta	CCV2	13.515	13687681	10.4	8.96	68.9	86.2		
Chlorobenzene	108-90-7	Ta	CCV2	14.253	29643629	10.5	10.3	47.3	97.7		
Ethylbenzene	100-41-4	Ta	CCV2	14.362	41211350	10.5	10.0	43.6	95.6		
m,p-Xylene	179601-23-1	Ta	CCV2	14.559	60168249	20.4	19.7	85.7	96.7		
Nonane	111-84-2	Ta	CCV2	14.504	4372040	10.5	1.40	7.35	13.3		R
o-Xylene	95-47-6	Ta	CCV2	15.195	28891997	10.5	8.22	35.7	78.3		
Styrene	100-42-5	Ta	CCV2	15.219	26141969	10.5	8.85	37.7	84.3		
Bromoform	75-25-2	Ta	CCV2	15.577	16403559	10.2	8.48	87.7	83.1		
1,1,2,2-Tetrachloroethane	79-34-5	Ta	CCV2	16.244	21614186	10.5	8.90	61.1	84.8		
Cumene	98-82-8	Ta	CCV2	15.774	34706796	10.4	6.66	32.8	64.0		R
4-Bromofluorobenzene (BFB)	460-00-4	QA/Surr	CCV2	16.101	42272910	10.0	10.5	75.5	105		
n-Propylbenzene	103-65-1	Ta	CCV2	16.464	7304611	10.3	4.02	19.8	39.0		R
2-Chlorotoluene	95-49-8	Ta	CCV2	16.664	10845552	10.8	7.08	36.7	65.6		R
4-Ethyltoluene	622-96-8	Ta	CCV2	16.656	6386496	10.1	3.25	16.0	32.2		R
1,3,5-Trimethylbenzene	108-67-8	Ta	CCV2	16.739	23209828	10.2	4.53	22.3	44.4		R
1,2,4-Trimethylbenzene	95-63-6	Ta	CCV2	17.387	6870529	10.2	2.85	14.0	27.9		R
1,3-Dichlorobenzene	541-73-1	Ta	CCV2	17.932	22856868	10.3	6.70	40.3	65.0		R
Benzyl Chloride	100-44-7	Ta	CCV2	18.263	13439403	10.3	3.20	16.6	31.1		R
1,4-Dichlorobenzene	106-46-7	Ta	CCV2	18.100	21262555	10.1	6.26	37.7	62.0		R
1,2-Dichlorobenzene	95-50-1	Ta	CCV2	18.722	19987577	10.1	6.41	38.6	63.5		R
1,2,4-Trichlorobenzene	120-82-1	PIC	CCV2	21.472	4611210	9.70	1.89	14.0	19.5		Z
Naphthalene	91-20-3	PIC	CCV2	21.983	5003103	10.5	0.570	2.99	5.43		Z
Hexachloro-1,3-butadiene	87-68-3	PIC	CCV2	21.686	8760165	9.80	5.09	54.3	51.9		Z

Analyte	CAS No.	QC Sample ID		Ret. Time	Peak Area	Expected (ppbv)	Result (ppbv)	Result (ug/m3)	%REC	%RPD	Qualifier
Bromochloromethane	74-97-5	Int. Std	MBLK2	8.524	13958938	10.0	10.0	52.9	100		
Propene	115-07-1	Ta	MBLK2		344936						
Dichlorodifluoromethane (F12)	75-71-8	Ta	MBLK2		47345						
Chloromethane	74-87-3	Ta	MBLK2		53948						
1,2-Dichloro-tetrarfluoroethane	76-14-2	Ta	MBLK2								
Chloroethene	75-01-4	Ta	MBLK2								
1,3-Butadiene	106-99-0	Ta	MBLK2								
n-Butane	106-97-8	Ta	MBLK2								
Bromomethane	74-83-9	Ta	MBLK2		138052						
Chloroethane	75-00-3	Ta	MBLK2								
Ethanol	64-17-5	Ta	MBLK2		100692						
Vinylbromide	593-60-2	Ta	MBLK2								
Trichlorofluoromethane	75-69-4	Ta	MBLK2		49766						
Acrolein	107-02-8	Ta	MBLK2		245896						
Acetone	67-64-1	Ta	MBLK2		385724						
n-Pentane	109-66-0	Ta	MBLK2		95013						
Isopropanol	67-63-0	Ta	MBLK2		131615						
1,1-Dichloroethene	75-35-4	Ta	MBLK2								
t-Butyl alcohol	75-65-0	Ta	MBLK2		115855						
1,1,2-Trichloro-1,2,2-trifluoroethane (	76-13-1	Ta	MBLK2								
3-Chloropropene	107-05-1	Ta	MBLK2								
Methylene Chloride (Dichloromethan	75-09-2	Ta	MBLK2		182138						
Carbon Disulfide	75-65-0	Ta	MBLK2		127678						

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QUALITY CONTROL REPORT
EPA Compendium Method TO-17-Modified
Electrostatic Precipitator Plates

Washington River Protection Solution

Richland, WA 99352

Attn: George Weeks

RJ Lee Group Project: W605131
Samples Received: 5/26/2016
Analysis Date: 6/2/2016
Report Date: 6/13/2016
Sampling Date:
Purchase Order No.:
Client Project:

trans-1,2-Dichloroethene	156-60-5	Ta	MBLK2								
Methyl-t-butyll ether (MTBE)	1634-04-4	Ta	MBLK2		93680						
Vinyl Acetate	108-05-4	Ta	MBLK2		57903						
1,1-Dichloroethane	75-34-3	Ta	MBLK2		42173						
2-Butanone (MEK)	78-93-3	Ta	MBLK2								
Hexane	110-54-3	Ta	MBLK2		95339						
cis-1,2-Dichloroethene	156-59-2	Ta	MBLK2		34472						
Ethyl Acetate	141-78-6	Ta	MBLK2		128379						
Chloroform	540-36-3	Ta	MBLK2						#VALUE!		
Tetrahydrofuran	67-66-3	Ta	MBLK2		37966						
1,4-Difluorobenzene	71-55-6	Int. Std	MBLK2	9.874	63802416	10.0	10.0	46.7			
1,1,1-Trichloroethane	71-55-6	Ta	MBLK2								
1,2-Dichloroethane-d4	17060-07-0	QA/Surr	MBLK2	9.315	13180862	10.0	9.42	39.7			
1,2-Dichloroethane	107-06-2	Ta	MBLK2								
Benzene	71-43-2	Ta	MBLK2		326279				#VALUE!		
Carbon Tetrachloride	56-23-5	Ta	MBLK2								
Cyclohexane	110-82-7	Ta	MBLK2								
2,2,4-Trimethylpentane	540-84-1	Ta	MBLK2		64934						
Heptane	142-82-5	Ta	MBLK2		41297						
Trichlorethylene	79-01-6	Ta	MBLK2						#VALUE!		
1,2-Dichloropropane	78-87-5	Ta	MBLK2								
Methylmethacrylate	80-62-6	Ta	MBLK2		105235						
1,4-Dioxane	123-91-1	Ta	MBLK2		35267						
Bromodichloromethane	75-27-4	Ta	MBLK2								
Methyl isobutyl ketone (MIBK)	108-10-1	Ta	MBLK2		58503						
cis-1,3-Dichloropropene	10061-01-5	Ta	MBLK2								
trans-1,3-Dichloropropene	10061-02-6	Ta	MBLK2		43544						
Toluene-d8	2037-26-5	QA/Surr	MBLK2	11.966	62694351	10.0	10.6	43.5	106		
Toluene	108-88-3	Ta	MBLK2		109035						
1,1,2-Trichloroethane	79-00-5	Ta	MBLK2		33595						
2-Hexanone	591-78-6	Ta	MBLK2		105789						
Dibromochloromethane	124-48-1	Ta	MBLK2		45368						
Tetrachloroethylene	127-18-4	Ta	MBLK2		40173						
Chlorobenzene-d5	3114-55-4	Int. Std	MBLK2	14.197	64433150	10.0	10.0	46.1			
1,2-Dibromoethane	106-93-4	Ta	MBLK2		51313						
Chlorobenzene	108-90-7	Ta	MBLK2		113099						
Ethylbenzene	100-41-4	Ta	MBLK2		167431						
m,p-Xylene	179601-23-1	Ta	MBLK2		281784						
Nonane	111-84-2	Ta	MBLK2		77035						
o-Xylene	95-47-6	Ta	MBLK2		165536						
Styrene	100-42-5	Ta	MBLK2		165621						
Bromoform	75-25-2	Ta	MBLK2		89438						
1,1,2,2-Tetrachloroethane	79-34-5	Ta	MBLK2		218219						
Cuméne	98-82-8	Ta	MBLK2		263812				#VALUE!		
4-Bromofluorobenzene (BFB)	460-00-4	QA/Surr	MBLK2	16.082	44814136	10.0	10.5	75.3			
n-Propylbenzene	103-65-1	Ta	MBLK2		94229						
2-Chlorotoluene	95-49-8	Ta	MBLK2		95969						
4-Ethyltoluene	622-96-8	Ta	MBLK2		105954						
1,3,5-Trimethylbenzene	108-67-8	Ta	MBLK2		310021						
1,2,4-Trimethylbenzene	95-63-6	Ta	MBLK2		195304						
1,3-Dichlorobenzene	541-73-1	Ta	MBLK2		355312						
Benzyl Chloride	100-44-7	Ta	MBLK2		426398						
1,4-Dichlorobenzene	106-46-7	Ta	MBLK2		359616						

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QUALITY CONTROL REPORT

EPA Compendium Method TO-17-Modified
Electrostatic Precipitator Plates

Washington River Protection Solution

Richland, WA 99352
Attn: George Weeks

RJ Lee Group Project: W605131
Samples Received: 5/26/2016
Analysis Date: 6/2/2016
Report Date: 6/13/2016
Sampling Date:
Purchase Order No.:
Client Project:

1,2-Dichlorobenzene	95-50-1	Ta	MBLK2		443062						
1,2,4-Trichlorobenzene	120-82-1	PIC	MBLK2	21.434	2146972		0.930	6.90			B
Naphthalene	91-20-3	PIC	MBLK2	21.943	7526383		1.01	5.30			B
Hexachloro-1,3-butadiene	87-68-3	PIC	MBLK2	21.646	2560901		0.540	5.76			B

Comments: MDLs and RLs have been adjusted for analysis volumes and dilution factors.

ng = nanogram
ppbv = parts per billion volume
ug/m3 = micrograms per cubic meter

BDL = Below Detection Limit
N/A = Not Applicable

* *no TIC above the reporting threshold*

Qualifiers

B = Compound found in associated laboratory blank above the reporting limit.
D = Diluted sample
E = Report concentration was above the instrumental calibration range
I = Response failure of an internal standard; concentration should be considered an estimate
J = Concentration below reporting limit
N = Identification based on mass spectral library search
P = Library spectrum match, rsd >90% w RT match
Q = Qualitative results for non-target compounds
R = Recovery failure in CCV or LCS.
S = Surrogate recovery failure
T = Compound is tentatively identified compound. Includes chemical library matches & chemist identified compounds.
X = Detected but not quantifiable
c = Sample RPD failure
d= Data that exceeds the %RSD criteria set by the method (70-130%)
p = Positively identified compound, for non-calibrated compounds
r = Recovery failure in MRL

Authorized Signature:
Laboratory Technical Manager - Dr. Joe Sears

Date: 06/13/16

RJ LEE GROUP

W605131

RJ LeeGroup, Inc.
Columbia Basin Analytical Laboratories
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Request for Laboratory Analytical Services
Chain of Custody

CC06004 Rev 02

Purchase Order No.:		Client Job No.:	
Lab Use Only	Project No.:	Client No.:	
	Date Logged In:	Logged In By:	

Report Results To
Name: George Weeks
Company: WRPS
Address:
City, State, Zip: GAL 001096
Phone:
Call with Verbal Results: PTMRS
Email Results To:
Fax Results To:

Send Invoice To
Name:
Company:
Address:
City, State, Zip:
Phone: Fax:

Special Instructions

Turnaround Request
Standard: (Yes) No Rush 24hr 3 day 5 day

Drinking Water Sample Only
Sample Purpose: Information ☐ Regulatory ☐
System ID No.:
DOH Source No.:
Multiple Sources Nos.:
Sample Purpose: A ☐ B ☐ Other ☐

Chemistry Analysis Key
Preservation: Unpres, 4°C, HNO_3, Other, Date; H_2SO_4, HCl, NaOH, Na_2SO_4, Time
Matrix: WW=Wastewater, GW=Groudwater, S=Soil/Sludge, E=Extract, SW=Surface Water, DW=Drinking Water, O=Oil, X=Other
Container: P=Plastic, G=Glass, W=Wipe, A=Air (filter or tube)

Sample Identification	Sample Description	Sample Date	Sample Time Start	Sample Time Stop	Wipe Area? Air Volume	Pres. Upon Receipt (Y/N)	Preservation	Matrix	Container Type	pH	No. Containers
20160523-mACE	- A103-2	5/23/16	11:57	3:05pm				S			
20160524-mACE	- A103-2	5/24/16	8:35 am	2:55pm							
20160524-mACE	- AD-2	5/24/16	10:08	2:21pm							
20160524-ACE	- B-D-2	5/24/16	12:57	2:00pm							
20160524-ACE	- B-U-2	5/24/16	12:47	1:44pm							
20160525-mACE	- A103-2	5/25	8:57	2:55pm							
20160525-mACE	- AD-2	5/25	8:35	2:19pm							
20160525-ACE	- AD-U-2	5-25	9:45	1:30pm							
20160525-ACE	- A-N-2	5/25	10:39	2:08pm							
20160525-ACE	- C-N-2	5/25	10:15	1:55pm							
20160525-ACE	- AD-D-2	5/25	9:33	1:20pm							

Chain of Custody
Relinquished By (Signature): Date: 5/26/2016 Time: 1600
Relinquished By (Print Name): Relinquished To:
Company Name: Method of Shipment:

Chain of Custody
Received By (Signature): Date: 5-26-16 Time: 4:05
Received By (Print Name): Todd Rogers Relinquished To:
Company Name: Method of Shipment:

Chain of Custody
Relinquished By (Signature): Date: Time:
Relinquished By (Print Name): Relinquished To:
Company Name: Method of Shipment:

Chain of Custody
Received By (Signature): Date: Time:
Received By (Print Name): Relinquished To:
Company Name: Method of Shipment:

Questions? Contact Client Services (724) 387-1833

350 Hochberg Road, Monroeville, PA 15146, Tel: (724) 325-1776, Fax: (724) 733-1799

3583 Investment Blvd., Ste 7, Hayward, CA 94545, Tel: (510) 567-0488, Fax: (510) 567-0488

10503 Battleview Parkway, Manassas, VA 20109, Tel: (703) 368-7880, Fax: (703) 368-7761

2710 North 20th Avenue, Pasco, WA 99301, Tel: (509) 545-4989, Fax: (509) 544-6010

Samples Consumed in process
JS 06/13/16

APPENDIX G

TO15 SAMPLE ANALYSIS IN SUPPORT OF PTR-MS ACTIVITIES

RJ LEE GROUP
DELIVERING SCIENTIFIC RESOLUTION

June 7, 2016

Washington River Protection Solutions, LLC.
Attention: George Weeks
Cc.
Richland, WA 99352

Subject: TO-15 Sample Analysis in Support of PTR-MS Activities

Enclosed is the report for two air canister samples obtained in support of the Proton Transfer Reaction Mass Spectrometry measurement activities at the Hanford 200E tank farm location. The samples have been assigned a login order number of W606001. This report consists of a report of the two samples and a copy of the chain of custody.

General Set Comments
Columbia Basin Analytical Laboratory (CBAL) received two samples on June 1, 2016 to be tested for volatile organic compounds. The samples were collected in support of the VOC plume chasing activities being performed by the CBAL Mobile Laboratory at the Hanford 200E area.

Sample W606001-01 was collected during a static PTRMS measurement located on the north side of the 244AR building. The sample was obtained on May 25, 2016 at 10:14 AM (PTRMS cycle time; 11,190). The purpose of the first sample collection was to attempt the capture of VOCs that may be associated with an 'onion' odor that could be periodically detected by human smell. The odor was intermittent, probably due to the variability in the prevailing air movement at the site, and never reached an olfactory response that would be considered noxious.

Sample W606001-02 was obtained during a static PTRMS measurement at the northeast corner of the 241A Evaporator Unit. This sample was collected slowly over a period of approximately 6 minutes on May 26, 2016 in the afternoon. The sample corresponds to an increase in PTRMS signal observed at that time (PTRMS cycle time; 30,735 – 31,110).

The samples were analyzed in accordance with EPA Compendium Method TO-15. The results of the TO-15 analyses will be compared to the PTRMS data and will be used to facilitate the processing of the real-time sampling events by the PTRMS. These results will be delivered at a later date.

Results
Both canister samples were processed against our standard TO-15 compound list of ~74 compounds. The reporting limit for each of these target compounds is 0.5 ppbv.

Each sample was evaluated for 'Tentatively Identified Compounds' (TICs) with a search criteria of the 50 most abundant compounds that exceeded a 5% response threshold of the nearest internal standard. Each of these compounds was further evaluated by an experienced chemist to determine the 'reasonableness' of the computer generated report. Note that these compounds are estimated in concentration which may vary by +/- 50%, or more. This is due to the unknown response factors of the specific compound under electron ionization as compared to the internal standard.

Recovery Failures in the CCV, MRL, LCS and LCSD

Any failures in recovery or response of the continuing calibration verification standard, the method detection limit sample, and the laboratory control samples for each analyte are indicated in the report as alpha/numeric flags. A listing of the description of each qualification flag can be found at the bottom of the report.

RSD Failures in the LCS and LCSD's

There were no RSD failures between the laboratory control samples.

Calibration Curves

The calibration curves for the 74 target compounds generally had R^2 values that were 0.990 or better, over a range of 0.2 ppbv to 25 ppbv.

This report has been prepared primarily as an internal document for the support of the Proton Transfer Reaction Mass Spectrometry measurements being conducted at the 200E and 200W tank farm locations on the Hanford Site. Data within this report will be used as a guide for the processing and evaluation of the associated PTRMS data. It is not intended for the support of either environmental or industrial hygiene related activities. Release of the data contained in this hard copy report has been authorized by the Laboratory Director or a designee as verified by the following signature. This test report shall not be reproduced, except in full, without written approval of CBAL.

Joe Sears

June 7, 2016

Senior Scientist; Joe Sears, Ph.D. Date

If you have any questions, please feel free to contact Dr. Joe Sears at 509-545-4989 or email at jsears@rjleegroup.com.

RJ LEE GROUP
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LABORATORY REPORT
EPA Compendium Method TO-15
Canister Air Samples

Internal Use Only - Support of PTR-MS Data

Client:	RJ Lee Group
Address:	2710 N. 20th Avenue
	Pasco, WA 99301
Attention:	Joe Sears
Telephone:	509-545-4989
Fax:	509-544-6010

RJ Lee Group Project:	W606001
Samples Received:	06/01/16
Report Date:	06/06/16
Sampling Date:	See Report
Purchase Order No.:	
Client Project:	GAL601096

Client	Sample ID RJLG	Canister ID	Sampling Date	Analysis Date	Analyte	CAS Number	Matrix	Type	Result (ppbv)	Reporting Limit (ppbv)	Result (ug/m3)	Reporting Limit (ug/m3)	Surrogate %REC	Qualifier
N. of 244AR	W606001-01	CBAL170	5/25/2016	6/1/2016	Bromochloromethane	74-97-5	Air & Emissions	Int. Std	10	0.50	53	2.6		
N. of 244AR	W606001-01	CBAL170	5/25/2016	6/1/2016	Propene	115-07-1	Air & Emissions	Ta	1.6	0.50	2.8	0.86		QR
N. of 244AR	W606001-01	CBAL170	5/25/2016	6/1/2016	Dichlorodifluoromethane (F12)	75-71-8	Air & Emissions	Ta	< 0.50	0.50	< 2.5	2.5		R
N. of 244AR	W606001-01	CBAL170	5/25/2016	6/1/2016	Chloromethane	74-87-3	Air & Emissions	Ta	0.59	0.50	1.2	1.0		R
N. of 244AR	W606001-01	CBAL170	5/25/2016	6/1/2016	1,2-Dichloro-tetrafluoroethane	76-14-2	Air & Emissions	Ta	< 0.50	0.50	< 3.5	3.5		R
N. of 244AR	W606001-01	CBAL170	5/25/2016	6/1/2016	Chloroethene	75-01-4	Air & Emissions	Ta	< 0.50	0.50	< 1.3	1.3		
N. of 244AR	W606001-01	CBAL170	5/25/2016	6/1/2016	1,3-Butadiene	106-99-0	Air & Emissions	Ta	< 0.50	0.50	< 1.1	1.1		R
N. of 244AR	W606001-01	CBAL170	5/25/2016	6/1/2016	n-Butane	106-97-8	Air & Emissions	Ta	< 0.50	0.50	< 1.2	1.2		
N. of 244AR	W606001-01	CBAL170	5/25/2016	6/1/2016	Bromomethane	74-83-9	Air & Emissions	Ta	< 0.50	0.50	< 1.9	1.9		R
N. of 244AR	W606001-01	CBAL170	5/25/2016	6/1/2016	Chloroethane	75-00-3	Air & Emissions	Ta	< 0.50	0.50	< 1.3	1.3		
N. of 244AR	W606001-01	CBAL170	5/25/2016	6/1/2016	Ethanol	64-17-5	Air & Emissions	Ta	2.5	0.50	4.7	0.94		R
N. of 244AR	W606001-01	CBAL170	5/25/2016	6/1/2016	Vinylbromide	593-60-2	Air & Emissions	Ta	< 0.50	0.50	< 2.2	2.2		
N. of 244AR	W606001-01	CBAL170	5/25/2016	6/1/2016	Trichlorofluoromethane	75-69-4	Air & Emissions	Ta	< 0.50	0.50	< 2.8	2.8		
N. of 244AR	W606001-01	CBAL170	5/25/2016	6/1/2016	Acrolein	107-02-8	Air & Emissions	Ta	5.0	0.50	11	1.1		
N. of 244AR	W606001-01	CBAL170	5/25/2016	6/1/2016	Acetone	67-64-1	Air & Emissions	Ta	11	0.50	26	1.2		
N. of 244AR	W606001-01	CBAL170	5/25/2016	6/1/2016	n-Pentane	109-66-0	Air & Emissions	Ta	< 0.50	0.50	< 1.5	1.5		
N. of 244AR	W606001-01	CBAL170	5/25/2016	6/1/2016	Isopropanol	67-63-0	Air & Emissions	Ta	0.77	0.50	1.9	1.2		Q
N. of 244AR	W606001-01	CBAL170	5/25/2016	6/1/2016	1,1-Dichloroethene	75-35-4	Air & Emissions	Ta	< 0.50	0.50	< 2.0	2.0		
N. of 244AR	W606001-01	CBAL170	5/25/2016	6/1/2016	t-Butyl alcohol	75-65-0	Air & Emissions	Ta	0.54	0.50	1.6	1.5		Q
N. of 244AR	W606001-01	CBAL170	5/25/2016	6/1/2016	1,1,2-Trichloro-1,2,2-trifluoroethane (	76-13-1	Air & Emissions	Ta	< 0.50	0.50	< 3.8	3.8		R
N. of 244AR	W606001-01	CBAL170	5/25/2016	6/1/2016	3-Chloropropene	107-05-1	Air & Emissions	Ta	< 0.50	0.50	< 1.6	1.6		Q
N. of 244AR	W606001-01	CBAL170	5/25/2016	6/1/2016	Methylene Chloride (Dichloromethane)	75-09-2	Air & Emissions	Ta	< 0.50	0.50	< 1.7	1.7		Q
N. of 244AR	W606001-01	CBAL170	5/25/2016	6/1/2016	Carbon Disulfide	75-65-0	Air & Emissions	Ta	< 0.50	0.50	< 1.6	1.6		Q
N. of 244AR	W606001-01	CBAL170	5/25/2016	6/1/2016	trans-1,2-Dichloroethene	156-60-5	Air & Emissions	Ta	< 0.50	0.50	< 2.0	2.0		R
N. of 244AR	W606001-01	CBAL170	5/25/2016	6/1/2016	Methyl-t-butyll ether (MTBE)	1634-04-4	Air & Emissions	Ta	< 0.50	0.50	< 1.8	1.8		R
N. of 244AR	W606001-01	CBAL170	5/25/2016	6/1/2016	Vinyl Acetate	108-05-4	Air & Emissions	Ta	< 0.50	0.50	< 1.8	1.8		RQ
N. of 244AR	W606001-01	CBAL170	5/25/2016	6/1/2016	1,1-Dichloroethane	75-34-3	Air & Emissions	Ta	< 0.50	0.50	< 2.0	2.0		
N. of 244AR	W606001-01	CBAL170	5/25/2016	6/1/2016	2-Butanone (MEK)	78-93-3	Air & Emissions	Ta	2.6	0.50	7.7	1.5		R
N. of 244AR	W606001-01	CBAL170	5/25/2016	6/1/2016	Hexane	110-54-3	Air & Emissions	Ta	< 0.50	0.50	< 1.8	1.8		RS
N. of 244AR	W606001-01	CBAL170	5/25/2016	6/1/2016	cis-1,2-Dichloroethene	156-59-2	Air & Emissions	Ta	< 0.50	0.50	< 2.0	2.0		R
N. of 244AR	W606001-01	CBAL170	5/25/2016	6/1/2016	Ethyl Acetate	141-78-6	Air & Emissions	Ta	1.8	0.50	6.5	1.8		
N. of 244AR	W606001-01	CBAL170	5/25/2016	6/1/2016	Chloroform	540-36-3	Air & Emissions	Ta	< 0.50	0.50	< 2.6	2.6		
N. of 244AR	W606001-01	CBAL170	5/25/2016	6/1/2016	Tetrahydrofuran	67-66-3	Air & Emissions	Ta	0.91	0.50	4.4	2.4		
N. of 244AR	W606001-01	CBAL170	5/25/2016	6/1/2016	1,4-Difluorobenzene	71-55-6	Air & Emissions	Int. Std	10	0.50	47	2.3		
N. of 244AR	W606001-01	CBAL170	5/25/2016	6/1/2016	1,1,1-Trichloroethane	71-55-6	Air & Emissions	Ta	< 0.50	0.50	< 2.7	2.7		
N. of 244AR	W606001-01	CBAL170	5/25/2016	6/1/2016	1,2-Dichloroethane-d4	17060-07-0	Air & Emissions	QA/Surr	10	0.50	42	2.1	101	

Client	Sample ID RJLG	Canister ID	Sampling Date	Analysis Date	Analyte	CAS Number	Matrix	Type	Result (ppbv)	Reporting Limit (ppbv)	Result (ug/m3)	Reporting Limit (ug/m3)	Surrogate %REC	Qualifier
N. of 244AR	W606001-01	CBAL170	5/25/2016	6/1/2016	1,2-Dichloroethane	107-06-2	Air & Emissions	Ta	< 0.50	0.50	< 2.0	2.0		
N. of 244AR	W606001-01	CBAL170	5/25/2016	6/1/2016	Benzene	71-43-2	Air & Emissions	Ta	2.7	0.50	8.6	1.6		Q
N. of 244AR	W606001-01	CBAL170	5/25/2016	6/1/2016	Carbon Tetrachloride	56-23-5	Air & Emissions	Ta	< 0.50	0.50	< 3.1	3.1		
N. of 244AR	W606001-01	CBAL170	5/25/2016	6/1/2016	Cyclohexane	110-82-7	Air & Emissions	Ta	< 0.50	0.50	< 1.7	1.7		
N. of 244AR	W606001-01	CBAL170	5/25/2016	6/1/2016	2,2,4-Trimethylpentane	540-84-1	Air & Emissions	Ta	< 0.50	0.50	< 2.3	2.3		
N. of 244AR	W606001-01	CBAL170	5/25/2016	6/1/2016	Heptane	142-82-5	Air & Emissions	Ta	0.62	0.50	2.5	2.0		R
N. of 244AR	W606001-01	CBAL170	5/25/2016	6/1/2016	Trichlorethylene	79-01-6	Air & Emissions	Ta	< 0.50	0.50	< 2.7	2.7		
N. of 244AR	W606001-01	CBAL170	5/25/2016	6/1/2016	1,2-Dichloropropane	78-87-5	Air & Emissions	Ta	< 0.50	0.50	< 2.3	2.3		
N. of 244AR	W606001-01	CBAL170	5/25/2016	6/1/2016	Methylmethacrylate	80-62-6	Air & Emissions	Ta	1.2	0.50	4.9	2.0		
N. of 244AR	W606001-01	CBAL170	5/25/2016	6/1/2016	1,4-Dioxane	123-91-1	Air & Emissions	Ta	2.0	0.50	7.2	1.8		
N. of 244AR	W606001-01	CBAL170	5/25/2016	6/1/2016	Bromodichloromethane	75-27-4	Air & Emissions	Ta	< 0.50	0.50	< 3.4	3.4		
N. of 244AR	W606001-01	CBAL170	5/25/2016	6/1/2016	Methyl isobutyl ketone (MIBK)	108-10-1	Air & Emissions	Ta	1.2	0.50	4.9	2.0		
N. of 244AR	W606001-01	CBAL170	5/25/2016	6/1/2016	cis-1,3-Dichloropropene	10061-01-5	Air & Emissions	Ta	< 0.50	0.50	< 2.3	2.3		
N. of 244AR	W606001-01	CBAL170	5/25/2016	6/1/2016	trans-1,3-Dichloropropene	10061-02-6	Air & Emissions	Ta	< 0.50	0.50	< 2.3	2.3		
N. of 244AR	W606001-01	CBAL170	5/25/2016	6/1/2016	Toluene-d8	2037-26-5	Air & Emissions	QA/Surr	10	0.50	41	2.1	103	
N. of 244AR	W606001-01	CBAL170	5/25/2016	6/1/2016	Toluene	108-88-3	Air & Emissions	Ta	3.5	0.50	13	1.9		Q
N. of 244AR	W606001-01	CBAL170	5/25/2016	6/1/2016	1,1,2-Trichloroethane	79-00-5	Air & Emissions	Ta	< 0.50	0.50	< 2.7	2.7		
N. of 244AR	W606001-01	CBAL170	5/25/2016	6/1/2016	2-Hexanone	591-78-6	Air & Emissions	Ta	2.8	0.50	13	2.3		
N. of 244AR	W606001-01	CBAL170	5/25/2016	6/1/2016	Dibromochloromethane	124-48-1	Air & Emissions	Ta	< 0.50	0.50	< 4.3	4.3		
N. of 244AR	W606001-01	CBAL170	5/25/2016	6/1/2016	Tetrachloroethylene	127-18-4	Air & Emissions	Ta	< 0.50	0.50	< 3.4	3.4		
N. of 244AR	W606001-01	CBAL170	5/25/2016	6/1/2016	Chlorobenzene-d5	3114-55-4	Air & Emissions	Int. Std	10	0.50	46	2.3		
N. of 244AR	W606001-01	CBAL170	5/25/2016	6/1/2016	1,2-Dibromoethane	106-93-4	Air & Emissions	Ta	< 0.50	0.50	< 3.8	3.8		
N. of 244AR	W606001-01	CBAL170	5/25/2016	6/1/2016	Chlorobenzene	108-90-7	Air & Emissions	Ta	< 0.50	0.50	< 2.3	2.3		
N. of 244AR	W606001-01	CBAL170	5/25/2016	6/1/2016	Ethylbenzene	100-41-4	Air & Emissions	Ta	2.7	0.50	12	2.2		
N. of 244AR	W606001-01	CBAL170	5/25/2016	6/1/2016	m,p-Xylene	179601-23-1	Air & Emissions	Ta	3.9	0.50	17	2.2		R
N. of 244AR	W606001-01	CBAL170	5/25/2016	6/1/2016	Nonane	111-84-2	Air & Emissions	Ta	4.7	0.50	25	2.6		R
N. of 244AR	W606001-01	CBAL170	5/25/2016	6/1/2016	o-Xylene	95-47-6	Air & Emissions	Ta	0.89	0.50	3.9	2.2		Q
N. of 244AR	W606001-01	CBAL170	5/25/2016	6/1/2016	Styrene	100-42-5	Air & Emissions	Ta	< 0.50	0.50	< 2.1	2.1		
N. of 244AR	W606001-01	CBAL170	5/25/2016	6/1/2016	Bromoform	75-25-2	Air & Emissions	Ta	< 0.50	0.50	< 5.2	5.2		
N. of 244AR	W606001-01	CBAL170	5/25/2016	6/1/2016	1,1,2,2-Tetrachloroethane	79-34-5	Air & Emissions	Ta	< 0.50	0.50	< 3.4	3.4		
N. of 244AR	W606001-01	CBAL170	5/25/2016	6/1/2016	Cumene	98-82-8	Air & Emissions	Ta	0.93	0.50	4.6	2.5		
N. of 244AR	W606001-01	CBAL170	5/25/2016	6/1/2016	4-Bromofluorobenzene (BFB)	460-00-4	Air & Emissions	QA/Surr	12	0.50	86	3.6	123	
N. of 244AR	W606001-01	CBAL170	5/25/2016	6/1/2016	n-Propylbenzene	103-65-1	Air & Emissions	Ta	0.53	0.50	2.6	2.5		R
N. of 244AR	W606001-01	CBAL170	5/25/2016	6/1/2016	2-Chlorotoluene	95-49-8	Air & Emissions	Ta	< 0.50	0.50	< 2.6	2.6		R
N. of 244AR	W606001-01	CBAL170	5/25/2016	6/1/2016	4-Ethyltoluene	622-96-8	Air & Emissions	Ta	< 0.50	0.50	< 2.5	2.5		RQ
N. of 244AR	W606001-01	CBAL170	5/25/2016	6/1/2016	1,3,5-Trimethylbenzene	108-67-8	Air & Emissions	Ta	0.62	0.50	3.0	2.5		R
N. of 244AR	W606001-01	CBAL170	5/25/2016	6/1/2016	1,2,4-Trimethylbenzene	95-63-6	Air & Emissions	Ta	0.97	0.50	4.8	2.5		RQ
N. of 244AR	W606001-01	CBAL170	5/25/2016	6/1/2016	1,3-Dichlorobenzene	541-73-1	Air & Emissions	Ta	< 0.50	0.50	< 3.0	3.0		RQ
N. of 244AR	W606001-01	CBAL170	5/25/2016	6/1/2016	Benzyl Chloride	100-44-7	Air & Emissions	Ta	< 0.50	0.50	< 2.6	2.6		RQ
N. of 244AR	W606001-01	CBAL170	5/25/2016	6/1/2016	1,4-Dichlorobenzene	106-46-7	Air & Emissions	Ta	< 0.50	0.50	< 3.0	3.0		RQ
N. of 244AR	W606001-01	CBAL170	5/25/2016	6/1/2016	1,2-Dichlorobenzene	95-50-1	Air & Emissions	Ta	< 0.50	0.50	< 3.0	3.0		RQ
N. of 244AR	W606001-01	CBAL170	5/25/2016	6/1/2016	1,2,4-Trichlorobenzene	120-82-1	Air & Emissions	PIC	< 0.50	0.50	< 3.7	3.7		Z
N. of 244AR	W606001-01	CBAL170	5/25/2016	6/1/2016	Naphthalene	91-20-3	Air & Emissions	PIC	< 0.50	0.50	< 2.6	2.6		Z
N. of 244AR	W606001-01	CBAL170	5/25/2016	6/1/2016	Hexachloro-1,3-butadiene	87-68-3	Air & Emissions	PIC	< 0.50	0.50	< 5.3	5.3		Z

Client	Sample ID RJLG	Canister ID	Sampling Date	Analysis Date	Analyte	CAS Number	Matrix	Type	Result (ppbv)	Reporting Limit (ppbv)	Result (ug/m3)	Reporting Limit (ug/m3)	Surrogate %REC	Qualifier
					Tentatively Identified Compounds									
N. of 244AR	W606001-01	CBAL170	5/25/2016	6/1/2016	Acetonitrile	75-05-8	Air & Emissions	TIC	**0.90**	0.50	**1.5**	0.84		56,N,T
N. of 244AR	W606001-01	CBAL170	5/25/2016	6/1/2016	Octane	111-65-9	Air & Emissions	TIC	**1.2**	0.50	**5.6**	2.3		94,N,T
N. of 244AR	W606001-01	CBAL170	5/25/2016	6/1/2016	1-Nonene	124-11-8	Air & Emissions	TIC	**3.5**	0.50	**18**	2.6		97,N,T
N. of 244AR	W606001-01	CBAL170	5/25/2016	6/1/2016	Octane, 2,6-dimethyl-	2051-30-1	Air & Emissions	TIC	**0.72**	0.50	**4.2**	2.9		81,N,T
N. of 244AR	W606001-01	CBAL170	5/25/2016	6/1/2016	1-Decene	872-05-9	Air & Emissions	TIC	**7.0**	0.50	**40**	2.9		95,N,T
N. of 244AR	W606001-01	CBAL170	5/25/2016	6/1/2016	1-Heptanol, 6-methyl-	1653-40-3	Air & Emissions	TIC	**1.8**	0.50	**9.6**	2.7		80,N,T
N. of 244AR	W606001-01	CBAL170	5/25/2016	6/1/2016	Octanal	124-13-0	Air & Emissions	TIC	**0.88**	0.50	**4.6**	2.6		91,N,T
N. of 244AR	W606001-01	CBAL170	5/25/2016	6/1/2016	Decane, 2-methyl-	6975-98-0	Air & Emissions	TIC	**0.89**	0.50	**5.7**	3.2		93,N,T
N. of 244AR	W606001-01	CBAL170	5/25/2016	6/1/2016	Benzonitrile	104-76-7	Air & Emissions	TIC	**0.57**	0.50	**2.4**	2.1		70,N,T
N. of 244AR	W606001-01	CBAL170	5/25/2016	6/1/2016	4-Methyl-1-heptanol	100-47-0	Air & Emissions	TIC	**2.9**	0.50	**15**	2.7		78,N,T
N. of 244AR	W606001-01	CBAL170	5/25/2016	6/1/2016	Phenol	817-91-4	Air & Emissions	TIC	**1.7**	0.50	**6.5**	1.9		78,N,T
N. of 244AR	W606001-01	CBAL170	5/25/2016	6/1/2016	1-Undecene	108-95-2	Air & Emissions	TIC	**3.4**	0.50	**21**	3.2		95,N,T
N. of 244AR	W606001-01	CBAL170	5/25/2016	6/1/2016	1-Octanol	821-95-4	Air & Emissions	TIC	**2.0**	0.50	**11**	2.7		90,N,T
N. of 244AR	W606001-01	CBAL170	5/25/2016	6/1/2016	2-Nonanone	111-87-5	Air & Emissions	TIC	**0.59**	0.50	**3.4**	2.9		92,N,T
N. of 244AR	W606001-01	CBAL170	5/25/2016	6/1/2016	Acetophenone	821-55-6	Air & Emissions	TIC	**1.0**	0.50	**4.9**	2.5		87,N,T
N. of 244AR	W606001-01	CBAL170	5/25/2016	6/1/2016	Nonanal	98-86-2	Air & Emissions	TIC	**0.97**	0.50	**5.6**	2.9		87,N,T
N. of 244AR	W606001-01	CBAL170	5/25/2016	6/1/2016	1-Dodecene	124-19-6	Air & Emissions	TIC	**4.4**	0.50	**30**	3.4		96,N,T
N. of 244AR	W606001-01	CBAL170	5/25/2016	6/1/2016	Dodecane	112-41-4	Air & Emissions	TIC	**0.53**	0.50	**3.7**	3.5		83,N,T
N. of 244AR	W606001-01	CBAL170	5/25/2016	6/1/2016	2-Decanone	112-40-3	Air & Emissions	TIC	**1.2**	0.50	**7.7**	3.2		97,N,T
N. of 244AR	W606001-01	CBAL170	5/25/2016	6/1/2016	Naphthalene	693-54-9	Air & Emissions	TIC	**3.2**	0.50	**17**	2.6		89,N,T
N. of 244AR	W606001-01	CBAL170	5/25/2016	6/1/2016	1-Tridecene	91-20-3	Air & Emissions	TIC	**0.57**	0.50	**4.2**	3.7		96,N,T
N. of 244AR	W606001-01	CBAL170	5/25/2016	6/1/2016	Benzothiazole	2437-56-1	Air & Emissions	TIC	**1.8**	0.50	**9.9**	2.8		95,N,T
N. of 244AR	W606001-01	CBAL170	5/25/2016	6/1/2016	2-Undecanone	95-16-9	Air & Emissions	TIC	**0.88**	0.50	**6.1**	3.5		91,N,T
N. of 244AR	W606001-01	CBAL170	5/25/2016	6/1/2016	2(3H)-Furanone, 5-butyldihydro-	112-12-9	Air & Emissions	TIC	**1.1**	0.50	**6.4**	2.9		87,N,T

Comments: Results & Reporting Limits have been adjusted for analysis volumes and dilution factors

ng = nanogram
ppbv = parts per billion volume
ug/m3 = micrograms per cubic meter

BDL = Below Detection Limit
N/A = Not Applicable
Int. STD = Internal Standard

** = no TIC above the reporting threshold*
Ta = Target Analyte
QC/Surr = Quality Control Analyte

Qualifiers

B = Compound found in associated laboratory blank above the MDL
D = Diluted sample
E = Report concentration was above the instrumental calibration range
I = Response failure of an internal standard; concentration should be considered an estimate
J = Reported concentration was estimated
N = Identification based on mass spectral library search
P = Library spectrum match, rsd >90% w RT match
Q = Qualitative results for non detects
X = Detected but not quantifiable
S = Surrogate recovery failure; concentration should be considered an estimate
T = Compound is tentatively identified compound. Includes both chemical library matches, chemist identified compounds, and unknowns (Library spectrum match w/o RT match)
a = Failed percent recovery criteria for the target analyte in the CV standard and/or LCS
c = Sample RPD failure
d= Data that exceeds the RSD criteria set by the method (70-130%) - 2 analytes are allowed to be +/-40%
p = Positively identified compound, for non-calibrated
z = Positively identified compound; qualitative only

Authorized Signature:
Laboratory Technical Manager - Dr. Joe Sears

Date: 06/06/16

RJ LEE GROUP
DELIVERING SCIENTIFIC RESOLUTION

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LABORATORY REPORT
EPA Compendium Method TO-15
Canister Air Samples

Internal Use Only - Support of PTR-MS Data

Client:	RJ Lee Group
Address:	2710 N. 20th Avenue Pasco, WA 99301
Attention:	Joe Sears
Telephone:	509-545-4989
Fax:	509-544-6010

RJ Lee Group Project:	W606001
Samples Received:	06/01/16
Report Date:	06/06/16
Sampling Date:	See Report
Purchase Order No.:	
Client Project:	GAL601096

Sample ID														
Client	RJLG	Canister ID	Sampling Date	Analysis Date	Analyte	CAS Number	Matrix	Type	Result (ppbv)	Reporting Limit (ppbv)	Result (ug/m3)	Reporting Limit (ug/m3)	Surrogate %REC	Qualifier
NE Corner of Evaporator	W606001-02	CBAL161	5/26/2016	6/1/2016	Bromochloromethane	74-97-5	Air & Emissions	Int. Std	10	0.50	53	2.6		
NE Corner of Evaporator	W606001-02	CBAL161	5/26/2016	6/1/2016	Propene	115-07-1	Air & Emissions	Ta	1.9	0.50	3.3	0.86		QR
NE Corner of Evaporator	W606001-02	CBAL161	5/26/2016	6/1/2016	Dichlorodifluoromethane (F12)	75-71-8	Air & Emissions	Ta	< 0.50	0.50	< 2.5	2.5		R
NE Corner of Evaporator	W606001-02	CBAL161	5/26/2016	6/1/2016	Chloromethane	74-87-3	Air & Emissions	Ta	< 0.50	0.50	< 1.0	1.0		R
NE Corner of Evaporator	W606001-02	CBAL161	5/26/2016	6/1/2016	1,2-Dichloro-tetrarfluoroethane	76-14-2	Air & Emissions	Ta	< 0.50	0.50	< 3.5	3.5		R
NE Corner of Evaporator	W606001-02	CBAL161	5/26/2016	6/1/2016	Chloroethene	75-01-4	Air & Emissions	Ta	< 0.50	0.50	< 1.3	1.3		
NE Corner of Evaporator	W606001-02	CBAL161	5/26/2016	6/1/2016	1,3-Butadiene	106-99-0	Air & Emissions	Ta	< 0.50	0.50	< 1.1	1.1		R
NE Corner of Evaporator	W606001-02	CBAL161	5/26/2016	6/1/2016	n-Butane	106-97-8	Air & Emissions	Ta	< 0.50	0.50	< 1.2	1.2		
NE Corner of Evaporator	W606001-02	CBAL161	5/26/2016	6/1/2016	Bromomethane	74-83-9	Air & Emissions	Ta	< 0.50	0.50	< 1.9	1.9		R
NE Corner of Evaporator	W606001-02	CBAL161	5/26/2016	6/1/2016	Chloroethane	75-00-3	Air & Emissions	Ta	< 0.50	0.50	< 1.3	1.3		
NE Corner of Evaporator	W606001-02	CBAL161	5/26/2016	6/1/2016	Ethanol	64-17-5	Air & Emissions	Ta	79	0.50	150	0.94		R
NE Corner of Evaporator	W606001-02	CBAL161	5/26/2016	6/1/2016	Vinylbromide	593-60-2	Air & Emissions	Ta	< 0.50	0.50	< 2.2	2.2		
NE Corner of Evaporator	W606001-02	CBAL161	5/26/2016	6/1/2016	Trichlorofluoromethane	75-69-4	Air & Emissions	Ta	< 0.50	0.50	< 2.8	2.8		
NE Corner of Evaporator	W606001-02	CBAL161	5/26/2016	6/1/2016	Acrolein	107-02-8	Air & Emissions	Ta	6.1	0.50	14	1.1		
NE Corner of Evaporator	W606001-02	CBAL161	5/26/2016	6/1/2016	Acetone	67-64-1	Air & Emissions	Ta	19	0.50	45	1.2		
NE Corner of Evaporator	W606001-02	CBAL161	5/26/2016	6/1/2016	n-Pentane	109-66-0	Air & Emissions	Ta	< 0.50	0.50	< 1.5	1.5		
NE Corner of Evaporator	W606001-02	CBAL161	5/26/2016	6/1/2016	Isopropanol	67-63-0	Air & Emissions	Ta	5.2	0.50	13	1.2		Q
NE Corner of Evaporator	W606001-02	CBAL161	5/26/2016	6/1/2016	1,1-Dichloroethene	75-35-4	Air & Emissions	Ta	< 0.50	0.50	< 2.0	2.0		
NE Corner of Evaporator	W606001-02	CBAL161	5/26/2016	6/1/2016	t-Butyl alcohol	75-65-0	Air & Emissions	Ta	1.6	0.50	4.9	1.5		Q
NE Corner of Evaporator	W606001-02	CBAL161	5/26/2016	6/1/2016	1,1,2-Trichloro-1,2,2-trifluoroethane (	76-13-1	Air & Emissions	Ta	< 0.50	0.50	< 3.8	3.8		R
NE Corner of Evaporator	W606001-02	CBAL161	5/26/2016	6/1/2016	3-Chloropropene	107-05-1	Air & Emissions	Ta	< 0.50	0.50	< 1.6	1.6		Q
NE Corner of Evaporator	W606001-02	CBAL161	5/26/2016	6/1/2016	Methylene Chloride (Dichloromethane)	75-09-2	Air & Emissions	Ta	< 0.50	0.50	< 1.7	1.7		Q
NE Corner of Evaporator	W606001-02	CBAL161	5/26/2016	6/1/2016	Carbon Disulfide	75-65-0	Air & Emissions	Ta	< 0.50	0.50	< 1.6	1.6		Q
NE Corner of Evaporator	W606001-02	CBAL161	5/26/2016	6/1/2016	trans-1,2-Dichloroethene	156-60-5	Air & Emissions	Ta	< 0.50	0.50	< 2.0	2.0		R
NE Corner of Evaporator	W606001-02	CBAL161	5/26/2016	6/1/2016	Methyl-t-butyll ether (MTBE)	1634-04-4	Air & Emissions	Ta	< 0.50	0.50	< 1.8	1.8		R
NE Corner of Evaporator	W606001-02	CBAL161	5/26/2016	6/1/2016	Vinyl Acetate	108-05-4	Air & Emissions	Ta	< 0.50	0.50	< 1.8	1.8		RQ
NE Corner of Evaporator	W606001-02	CBAL161	5/26/2016	6/1/2016	1,1-Dichloroethane	75-34-3	Air & Emissions	Ta	< 0.50	0.50	< 2.0	2.0		
NE Corner of Evaporator	W606001-02	CBAL161	5/26/2016	6/1/2016	2-Butanone (MEK)	78-93-3	Air & Emissions	Ta	2.8	0.50	8.3	1.5		R
NE Corner of Evaporator	W606001-02	CBAL161	5/26/2016	6/1/2016	Hexane	110-54-3	Air & Emissions	Ta	< 0.50	0.50	< 1.8	1.8		RS
NE Corner of Evaporator	W606001-02	CBAL161	5/26/2016	6/1/2016	cis-1,2-Dichloroethene	156-59-2	Air & Emissions	Ta	< 0.50	0.50	< 2.0	2.0		R
NE Corner of Evaporator	W606001-02	CBAL161	5/26/2016	6/1/2016	Ethyl Acetate	141-78-6	Air & Emissions	Ta	< 0.50	0.50	< 1.8	1.8		
NE Corner of Evaporator	W606001-02	CBAL161	5/26/2016	6/1/2016	Chloroform	540-36-3	Air & Emissions	Ta	< 0.50	0.50	< 2.6	2.6		
NE Corner of Evaporator	W606001-02	CBAL161	5/26/2016	6/1/2016	Tetrahydrofuran	67-66-3	Air & Emissions	Ta	< 0.50	0.50	< 2.4	2.4		
NE Corner of Evaporator	W606001-02	CBAL161	5/26/2016	6/1/2016	1,4-Difluorobenzene	71-55-6	Air & Emissions	Int. Std	10	0.50	47	2.3		

Sample ID														
Client	RJLG	Canister ID	Sampling Date	Analysis Date	Analyte	CAS Number	Matrix	Type	Result (ppbv)	Reporting Limit (ppbv)	Result (ug/m3)	Reporting Limit (ug/m3)	Surrogate %REC	Qualifier
NE Corner of Evaporator	W606001-02	CBAL161	5/26/2016	6/1/2016	1,1,1-Trichloroethane	71-55-6	Air & Emissions	Ta	< 0.50	0.50	< 2.7	2.7		
NE Corner of Evaporator	W606001-02	CBAL161	5/26/2016	6/1/2016	1,2-Dichloroethane-d4	17060-07-0	Air & Emissions	QA/Surr	10	0.50	42	2.1		
NE Corner of Evaporator	W606001-02	CBAL161	5/26/2016	6/1/2016	1,2-Dichloroethane	107-06-2	Air & Emissions	Ta	< 0.50	0.50	< 2.0	2.0		
NE Corner of Evaporator	W606001-02	CBAL161	5/26/2016	6/1/2016	Benzene	71-43-2	Air & Emissions	Ta	2.6	0.50	8.3	1.6		Q
NE Corner of Evaporator	W606001-02	CBAL161	5/26/2016	6/1/2016	Carbon Tetrachloride	56-23-5	Air & Emissions	Ta	< 0.50	0.50	< 3.1	3.1		
NE Corner of Evaporator	W606001-02	CBAL161	5/26/2016	6/1/2016	Cyclohexane	110-82-7	Air & Emissions	Ta	< 0.50	0.50	< 1.7	1.7		
NE Corner of Evaporator	W606001-02	CBAL161	5/26/2016	6/1/2016	2,2,4-Trimethylpentane	540-84-1	Air & Emissions	Ta	< 0.50	0.50	< 2.3	2.3		
NE Corner of Evaporator	W606001-02	CBAL161	5/26/2016	6/1/2016	Heptane	142-82-5	Air & Emissions	Ta	1.1	0.50	4.5	2.0		R
NE Corner of Evaporator	W606001-02	CBAL161	5/26/2016	6/1/2016	Trichlorethylene	79-01-6	Air & Emissions	Ta	< 0.50	0.50	< 2.7	2.7		
NE Corner of Evaporator	W606001-02	CBAL161	5/26/2016	6/1/2016	1,2-Dichloropropane	78-87-5	Air & Emissions	Ta	< 0.50	0.50	< 2.3	2.3		
NE Corner of Evaporator	W606001-02	CBAL161	5/26/2016	6/1/2016	Methylmethacrylate	80-62-6	Air & Emissions	Ta	< 0.50	0.50	< 2.0	2.0		
NE Corner of Evaporator	W606001-02	CBAL161	5/26/2016	6/1/2016	1,4-Dioxane	123-91-1	Air & Emissions	Ta	< 0.50	0.50	< 1.8	1.8		
NE Corner of Evaporator	W606001-02	CBAL161	5/26/2016	6/1/2016	Bromodichloromethane	75-27-4	Air & Emissions	Ta	< 0.50	0.50	< 3.4	3.4		
NE Corner of Evaporator	W606001-02	CBAL161	5/26/2016	6/1/2016	Methyl isobutyl ketone (MIBK)	108-10-1	Air & Emissions	Ta	0.83	0.50	3.4	2.0		
NE Corner of Evaporator	W606001-02	CBAL161	5/26/2016	6/1/2016	cis-1,3-Dichloropropene	10061-01-5	Air & Emissions	Ta	< 0.50	0.50	< 2.3	2.3		
NE Corner of Evaporator	W606001-02	CBAL161	5/26/2016	6/1/2016	trans-1,3-Dichloropropene	10061-02-6	Air & Emissions	Ta	< 0.50	0.50	< 2.3	2.3		
NE Corner of Evaporator	W606001-02	CBAL161	5/26/2016	6/1/2016	Toluene-d8	2037-26-5	Air & Emissions	QA/Surr	11	0.50	45	2.1	107	
NE Corner of Evaporator	W606001-02	CBAL161	5/26/2016	6/1/2016	Toluene	108-88-3	Air & Emissions	Ta	2.9	0.50	11	1.9		Q
NE Corner of Evaporator	W606001-02	CBAL161	5/26/2016	6/1/2016	1,1,2-Trichloroethane	79-00-5	Air & Emissions	Ta	< 0.50	0.50	< 2.7	2.7		
NE Corner of Evaporator	W606001-02	CBAL161	5/26/2016	6/1/2016	2-Hexanone	591-78-6	Air & Emissions	Ta	1.4	0.50	6.3	2.3		
NE Corner of Evaporator	W606001-02	CBAL161	5/26/2016	6/1/2016	Dibromochloromethane	124-48-1	Air & Emissions	Ta	< 0.50	0.50	< 4.3	4.3		
NE Corner of Evaporator	W606001-02	CBAL161	5/26/2016	6/1/2016	Tetrachloroethylene	127-18-4	Air & Emissions	Ta	< 0.50	0.50	< 3.4	3.4		
NE Corner of Evaporator	W606001-02	CBAL161	5/26/2016	6/1/2016	Chlorobenzene-d5	3114-55-4	Air & Emissions	Int. Std	10	0.50	46	2.3		
NE Corner of Evaporator	W606001-02	CBAL161	5/26/2016	6/1/2016	1,2-Dibromoethane	106-93-4	Air & Emissions	Ta	< 0.50	0.50	< 3.8	3.8		
NE Corner of Evaporator	W606001-02	CBAL161	5/26/2016	6/1/2016	Chlorobenzene	108-90-7	Air & Emissions	Ta	< 0.50	0.50	< 2.3	2.3		
NE Corner of Evaporator	W606001-02	CBAL161	5/26/2016	6/1/2016	Ethylbenzene	100-41-4	Air & Emissions	Ta	2.4	0.50	10	2.2		
NE Corner of Evaporator	W606001-02	CBAL161	5/26/2016	6/1/2016	m,p-Xylene	179601-23-1	Air & Emissions	Ta	3.5	0.50	15	2.2		R
NE Corner of Evaporator	W606001-02	CBAL161	5/26/2016	6/1/2016	Nonane	111-84-2	Air & Emissions	Ta	4.5	0.50	24	2.6		R
NE Corner of Evaporator	W606001-02	CBAL161	5/26/2016	6/1/2016	o-Xylene	95-47-6	Air & Emissions	Ta	0.76	0.50	3.3	2.2		Q
NE Corner of Evaporator	W606001-02	CBAL161	5/26/2016	6/1/2016	Styrene	100-42-5	Air & Emissions	Ta	< 0.50	0.50	< 2.1	2.1		
NE Corner of Evaporator	W606001-02	CBAL161	5/26/2016	6/1/2016	Bromoform	75-25-2	Air & Emissions	Ta	< 0.50	0.50	< 5.2	5.2		
NE Corner of Evaporator	W606001-02	CBAL161	5/26/2016	6/1/2016	1,1,2,2-Tetrachloroethane	79-34-5	Air & Emissions	Ta	< 0.50	0.50	< 3.4	3.4		
NE Corner of Evaporator	W606001-02	CBAL161	5/26/2016	6/1/2016	Cumene	98-82-8	Air & Emissions	Ta	0.79	0.50	3.9	2.5		
NE Corner of Evaporator	W606001-02	CBAL161	5/26/2016	6/1/2016	4-Bromofluorobenzene (BFB)	460-00-4	Air & Emissions	QA/Surr	13	0.50	93	3.6	126	
NE Corner of Evaporator	W606001-02	CBAL161	5/26/2016	6/1/2016	n-Propylbenzene	103-65-1	Air & Emissions	Ta	< 0.50	0.50	< 2.5	2.5		R
NE Corner of Evaporator	W606001-02	CBAL161	5/26/2016	6/1/2016	2-Chlorotoluene	95-49-8	Air & Emissions	Ta	< 0.50	0.50	< 2.6	2.6		R
NE Corner of Evaporator	W606001-02	CBAL161	5/26/2016	6/1/2016	4-Ethyltoluene	622-96-8	Air & Emissions	Ta	< 0.50	0.50	< 2.5	2.5		RQ
NE Corner of Evaporator	W606001-02	CBAL161	5/26/2016	6/1/2016	1,3,5-Trimethylbenzene	108-67-8	Air & Emissions	Ta	< 0.50	0.50	< 2.5	2.5		R
NE Corner of Evaporator	W606001-02	CBAL161	5/26/2016	6/1/2016	1,2,4-Trimethylbenzene	95-63-6	Air & Emissions	Ta	0.77	0.50	3.8	2.5		RQ
NE Corner of Evaporator	W606001-02	CBAL161	5/26/2016	6/1/2016	1,3-Dichlorobenzene	541-73-1	Air & Emissions	Ta	< 0.50	0.50	< 3.0	3.0		RQ
NE Corner of Evaporator	W606001-02	CBAL161	5/26/2016	6/1/2016	Benzyl Chloride	100-44-7	Air & Emissions	Ta	< 0.50	0.50	< 2.6	2.6		RQ
NE Corner of Evaporator	W606001-02	CBAL161	5/26/2016	6/1/2016	1,4-Dichlorobenzene	106-46-7	Air & Emissions	Ta	< 0.50	0.50	< 3.0	3.0		RQ
NE Corner of Evaporator	W606001-02	CBAL161	5/26/2016	6/1/2016	1,2-Dichlorobenzene	95-50-1	Air & Emissions	Ta	< 0.50	0.50	< 3.0	3.0		RQ
NE Corner of Evaporator	W606001-02	CBAL161	5/26/2016	6/1/2016	1,2,4-Trichlorobenzene	120-82-1	Air & Emissions	PIC	< 0.50	0.50	< 3.7	3.7		Z

Sample ID														
Client	RJLG	Canister ID	Sampling Date	Analysis Date	Analyte	CAS Number	Matrix	Type	Result (ppbv)	Reporting Limit (ppbv)	Result (ug/m3)	Reporting Limit (ug/m3)	Surrogate %REC	Qualifier
NE Corner of Evaporator	W606001-02	CBAL161	5/26/2016	6/1/2016	Naphthalene	91-20-3	Air & Emissions	PIC	< 0.50	0.50	< 2.6	2.6		z
NE Corner of Evaporator	W606001-02	CBAL161	5/26/2016	6/1/2016	Hexachloro-1,3-butadiene	87-68-3	Air & Emissions	PIC	< 0.50	0.50	< 5.3	5.3		z
					Tentatively Identified Compounds									
NE Corner of Evaporator	W606001-02	CBAL161	5/26/2016	6/1/2016	Acetonitrile	000075-05-8	Air & Emissions	TIC	0.77	0.50	1.3	0.84		45,N,T
NE Corner of Evaporator	W606001-02	CBAL161	5/26/2016	6/1/2016	Furan	110-00-9	Air & Emissions	TIC	0.30	0.20	0.83	0.56		64,N,T
NE Corner of Evaporator	W606001-02	CBAL161	5/26/2016	6/1/2016	Propanal	123-38-6	Air & Emissions	TIC	1.0	0.50	2.4	1.2		72,N,T
NE Corner of Evaporator	W606001-02	CBAL161	5/26/2016	6/1/2016	2-Methyl-1-pentene	763-29-1	Air & Emissions	TIC	1.0	0.50	3.4	1.7		68,N,T
NE Corner of Evaporator	W606001-02	CBAL161	5/26/2016	6/1/2016	Methacrolein	78-85-3	Air & Emissions	TIC	0.80	0.50	2.3	1.4		86,N,T
NE Corner of Evaporator	W606001-02	CBAL161	5/26/2016	6/1/2016	Butanal	000123-72-8	Air & Emissions	TIC	1.8	0.50	5.3	1.5		87,N,T
NE Corner of Evaporator	W606001-02	CBAL161	5/26/2016	6/1/2016	Acetic acid	000064-19-7	Air & Emissions	TIC	2.6	0.50	6.4	1.2		90,N,T
NE Corner of Evaporator	W606001-02	CBAL161	5/26/2016	6/1/2016	1-Heptene	592-76-7	Air & Emissions	TIC	1.0	0.50	4.0	2.0		93,N,T
NE Corner of Evaporator	W606001-02	CBAL161	5/26/2016	6/1/2016	1-Butanol	71-36-3	Air & Emissions	TIC	1.0	0.50	3.0	1.5		87,N,T
NE Corner of Evaporator	W606001-02	CBAL161	5/26/2016	6/1/2016	Formic acid, butyl ester	592-84-7	Air & Emissions	TIC	1.0	0.50	4.2	2.1		78,N,T
NE Corner of Evaporator	W606001-02	CBAL161	5/26/2016	6/1/2016	Heptane, 2-methyl-	000592-27-8	Air & Emissions	TIC	0.63	0.50	2.9	2.3		76,N,T
NE Corner of Evaporator	W606001-02	CBAL161	5/26/2016	6/1/2016	Octane	000111-65-9	Air & Emissions	TIC	1.4	0.50	6.5	2.3		93,N,T
NE Corner of Evaporator	W606001-02	CBAL161	5/26/2016	6/1/2016	Heptane, 2,4-dimethyl-	002213-23-2	Air & Emissions	TIC	0.87	0.50	4.6	2.6		72,N,T
NE Corner of Evaporator	W606001-02	CBAL161	5/26/2016	6/1/2016	Octane, 3-methyl-	002216-33-3	Air & Emissions	TIC	1.7	0.50	8.9	2.6		90,N,T
NE Corner of Evaporator	W606001-02	CBAL161	5/26/2016	6/1/2016	1-Nonene	127-11-8	Air & Emissions	TIC	2.0	0.50	10	2.6		76,N,T
NE Corner of Evaporator	W606001-02	CBAL161	5/26/2016	6/1/2016	Ethanol, 2-butoxy-	000111-76-2	Air & Emissions	TIC	0.84	0.50	4.1	2.4		87,N,T
NE Corner of Evaporator	W606001-02	CBAL161	5/26/2016	6/1/2016	Heptane, 2,3-dimethyl-	003074-71-3	Air & Emissions	TIC	0.61	0.50	3.2	2.6		49,N,T
NE Corner of Evaporator	W606001-02	CBAL161	5/26/2016	6/1/2016	4-Methyl-nonane	17301-94-9	Air & Emissions	TIC	1.1	0.50	6.4	2.9		87,N,T
NE Corner of Evaporator	W606001-02	CBAL161	5/26/2016	6/1/2016	Undecane, 3,9-dimethyl-	017301-31-4	Air & Emissions	TIC	1.5	0.50	8.7	2.9		53,N,T
NE Corner of Evaporator	W606001-02	CBAL161	5/26/2016	6/1/2016	1-Decene	000872-05-9	Air & Emissions	TIC	5.3	0.50	30	2.9		98,N,T
NE Corner of Evaporator	W606001-02	CBAL161	5/26/2016	6/1/2016	Decane	124-18-5	Air & Emissions	TIC	4.5	0.50	26	2.9		86,N,T
NE Corner of Evaporator	W606001-02	CBAL161	5/26/2016	6/1/2016	Isooctanol	026952-21-6	Air & Emissions	TIC	1.8	0.50	9.6	2.7		78,N,T
NE Corner of Evaporator	W606001-02	CBAL161	5/26/2016	6/1/2016	Octanal	000124-13-0	Air & Emissions	TIC	0.75	0.50	3.9	2.6		86,N,T
NE Corner of Evaporator	W606001-02	CBAL161	5/26/2016	6/1/2016	Benzene, 1-methyl-2-(1-methylethyl)-	000527-84-4	Air & Emissions	TIC	1.5	0.50	8.2	2.7		93,N,T
NE Corner of Evaporator	W606001-02	CBAL161	5/26/2016	6/1/2016	(S)-3-Ethyl-4-methylpentanol	1000144-07-1	Air & Emissions	TIC	5.1	0.50	27	2.7		72,N,T
NE Corner of Evaporator	W606001-02	CBAL161	5/26/2016	6/1/2016	Phenol	000108-95-2	Air & Emissions	TIC	1.2	0.50	4.6	1.9		64,N,T
NE Corner of Evaporator	W606001-02	CBAL161	5/26/2016	6/1/2016	5-Methyl-1-heptanol	007212-53-5	Air & Emissions	TIC	1.4	0.50	7.4	2.7		45,N,T
NE Corner of Evaporator	W606001-02	CBAL161	5/26/2016	6/1/2016	1-Undecene	000821-95-4	Air & Emissions	TIC	3.5	0.50	22	3.2		95,N,T
NE Corner of Evaporator	W606001-02	CBAL161	5/26/2016	6/1/2016	Undecane	001120-21-4	Air & Emissions	TIC	2.6	0.50	17	3.2		97,N,T
NE Corner of Evaporator	W606001-02	CBAL161	5/26/2016	6/1/2016	1-Octanol	000111-87-5	Air & Emissions	TIC	1.3	0.50	6.9	2.7		90,N,T
NE Corner of Evaporator	W606001-02	CBAL161	5/26/2016	6/1/2016	2-Nonanone	821-55-6	Air & Emissions	TIC	0.62	0.50	3.6	2.9		70,N,T
NE Corner of Evaporator	W606001-02	CBAL161	5/26/2016	6/1/2016	1-Dodecene	112-41-4	Air & Emissions	TIC	2.7	0.50	19	3.4		91,N,T
NE Corner of Evaporator	W606001-02	CBAL161	5/26/2016	6/1/2016	Dodecane	000112-40-3	Air & Emissions	TIC	1.5	0.50	10	3.5		87,N,T
NE Corner of Evaporator	W606001-02	CBAL161	5/26/2016	6/1/2016	Benzothiazole	000095-16-9	Air & Emissions	TIC	1.9	0.50	10	2.8		95,N,T
NE Corner of Evaporator	W606001-02	CBAL161	5/26/2016	6/1/2016	2-Undecanone	000112-12-9	Air & Emissions	TIC	0.82	0.50	5.7	3.5		91,N,T
NE Corner of Evaporator	W606001-02	CBAL161	5/26/2016	6/1/2016	2(3H)-Furanone, 5-butyldihydro-	000104-50-7	Air & Emissions	TIC	1.1	0.50	6.4	2.9		74,N,T

Comments: Results & Reporting Limits have been adjusted for analysis volumes and dilution factors

ng – nanogram
ppbv – parts per billion volume
ug/m3 – micrograms per cubic meter

BDL = Below Detection Limit
N/A – Not Applicable
Int. STD – Internal Standard

** no TIC above the reporting threshold*
Ta = Target Analyte
QC/Surr = Quality Control Analyte

Client	Sample ID RJLG	Canister ID	Sampling Date	Analysis Date	Analyte	CAS Number	Matrix	Type	Result (ppbv)	Reporting Limit (ppbv)	Result (ug/m3)	Reporting Limit (ug/m3)	Surrogate %REC	Qualifier

Qualifiers

B = Compound found in associated laboratory blank above the MDL
D = Diluted sample
E = Report concentration was above the instrumental calibration range
I = Response failure of an internal standard; concentration should be considered an estimate
J = Reported concentration was estimated
N = Identification based on mass spectral library search
P = Library spectrum match, rsd >90% w RT match
Q = Qualitative results for non detects
X = Detected but not quantifiable
S = Surrogate recovery failure: concentration should be considered an estimate
T = Compound is tentatively identified compound. Includes both chemical library matches, chemist identified compounds, and unknowns. (Library spectrum match w/o RT match)
a = Failed percent recovery criteria for the target analyte in the CV standard and/or LCS
c = Sample RPD failure
d= Data that exceeds the RSD criteria set by the method (70-130%) - 2 analytes are allowed to be +/-40%.
p = Positively identified compound, for non-calibrated

Authorized Signature: 
Laboratory Technical Manager - Dr. Joe Sears

Date: 06/06/16

RJ LEE GROUP

W6006001

RJ Lee*Group*, Inc.
Columbia Basin Analytical Laboratories
2710 North 20th Avenue, Pasco, WA 99301
Tel: (509) 545-4989 | Fax: (509) 544-6010

Request for Laboratory Analytical Services
Chain of Custody

CC06004 Rev. 02

Lab Use Only	Purchase Order No.:	Client Job No.:
	Project No.:	Client No.:
	Date Logged In:	Logged In By:
Report Results To	Name: Joe Sears / Todd Rogers	
	Company: RJLG	
	Address:	
	City, State, Zip:	
	Phone:	
	Call with Verbal Results:	
	Email Results To:	
	Fax Results To:	
Send Invoice To	Name: WRPS Tank Farm Project	
	Company:	
	Address:	
	City, State, Zip:	
	Phone:	Fax:
Special Instructions		

Turnaround Request: Standard: Yes No Rush 24hr. 3 day 5 day

Drinking Water Sample Only:
- Sample Purpose: Information ☐ Regulatory ☐
- System ID No.:
- DOH Source No.:
- Multiple Sources Nos.:
- Sample Purpose: A ☐ B ☐ Other ☐

Chemistry Analysis Key:

Preservation:		Matrix:		Container:
Unpres	H_2SO_4	WW=Wastewater	SW=Surface Water	P=Plastic
4°C	HCl	GW=Groudwater	DW=Drinking Water	G=Glass
HNO_3	NaOH	S=Soil/Sludge	O=Oil	W=Wipe
Other	Na_2SO_3	E=Extract	X=Other	A=Air (filter or tube)
Date	Time			

Sample Identification	Sample Description	Sample Date	Sample Time Start	Sample Time Stop	Wipe Area / Air Volume	Analysis Requested: Tc-99	Pres. Upon Receipt (Y/N)	Preservation	Matrix	Container Type	pH	No. Containers
CBAL170	N. of 244AR	5/25/16	10:14	Cycle 1	1190	✓						
CBAL161	NE Corner of Evaporator	5/26/16		Cycle	30,735 ± 110							

COPY

Chain of Custody	Relinquished By (Signature): T.D. Sears	Date: 06/01/16	Time: 0900
	Relinquished By (Print Name): Joe Sears	Relinquished To:	
	Company Name: RJLG	Method of Shipment:	
Chain of Custody	Relinquished By (Signature):	Date:	Time:
	Relinquished By (Print Name):	Relinquished To:	
	Company Name:	Method of Shipment:	

Chain of Custody	Received By (Signature):	Date: 6/1/16	Time: 0900
	Received By (Print Name): G. LOPEZ RJLEE GROUP	Relinquished To:	
	Company Name:	Method of Shipment:	
Chain of Custody	Received By (Signature):	Date:	Time:
	Received By (Print Name):	Relinquished To:	
	Company Name:	Method of Shipment:	

Questions?
Contact Client Services
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APPENDIX H

COMPOUNDS THAT MAY INTERFERE WITH THE MEASUREMENT OF THE COPC ION OF INTEREST

Compound Name	Composition	Proton Affinity (kJ/mol)	Protonated Mass
Nitric oxide	(NO)	1090	31
Ethane	(C2H6)	1425	31
Formaldehyde	(CH2O)	1704	31
Diimide	(H2N2)	1919	31
Silylene	(H2Si)	2002	31
CH2NH2	(CH4N)	2030	31
HCOH (hydroxymethylene)	(CH2O)	2309	31
Dilithium monoxide	(Li2O)	2882	31
Oxygen	(O2)	1006	33
Silane	(H4Si)	1529	33
Sulfur atom	(S)	1588	33
Phosphinidene	(HP)	1602	33
Methyl alcohol	(CH4O)	1803	33
Fluoromethylene	(CHF)	1904	33
Hydrazine	(H4N2)	2039	33
Cyclopropyl radical	(C3H5)	1758	42
Allyl radical	(C3H5)	1759	42
Acetonitrile	(C2H3N)	1862	42
Methane, isocyano	(C2H3N)	1990	42
Carbon dioxide	(CO2)	1292	45
Nitrous oxide	(N2O)	1375	45
Propane	(C3H8)	1505	45
Ethyne, fluoro	(C2HF)	1640	45
Methinophosphide	(CHP)	1671	45
Boron oxide hydroxide	(HBO2)	1824	45
Acetaldehyde	(C2H4O)	1838	45
Ethylene oxide	(C2H4O)	1849	45
Silicon monoxide	(OSi)	1857	45
Carbon monosulfide	(CS)	1892	45
Methyl diazene	(CH4N2)	2020	45

Hydrocarboxyl radical	(CHO2)	1490	46
Cyanogen fluoride	(CFN)	1511	46
CH2CH2OH	(C2H5O)	1781	46
SiOH	(HOSi)	1853	46
Phosphorus mononitride	(NP)	1886	46
HSiO	(HOSi)	1936	46
Formamide	(CH3NO)	1965	46
Ethylamine	(C2H7N)	2179	46
Scandium	(Sc)	2185	46
Methanamine, N-methyl	(C2H7N)	2222	46

Tetraborane(10)	(H10B4)	1446	55
2-Butyne	(C4H6)	1856	55
1,2-Butadiene	(C4H6)	1863	55
1,3-Butadiene	(C4H6)	1871	55
Cyclobutene	(C4H6)	1903	55
1-Methylcyclopropene	(C4H6)	2049	55

2-Methylallyl radical	(C4H7)	1859	56
Propanenitrile	(C3H5N)	1898	56
Manganese	(Mn)	1906	56
Ethane, isocyano	(C3H5N)	2036	56
1-Azabicyclo[1.1.0]butane	(C3H5N)	2115	56
Propargylamine	(C3H5N)	2122	56
vinylimine	(C3H5N)	2181	56

2-Butene, (E)	(C4H8)	1785	57
Iron	(Fe)	1802	57
2-Propenal	(C3H4O)	1905	57
1-Propene, 2-methyl	(C4H8)	1917	57
NCCH2NH2	(C2H4N2)	1972	57
Methylketene	(C3H4O)	1994	57
C2S	(C2S)	2078	57
Potassium hydroxide	(HKO)	2630	57
Calcium monoxide	(CaO)	2846	57

Methane, isocyanato	(C2H3NO)	1827	58
CH2COCH3	(C3H5O)	1960	58
Methyl azide	(CH3N3)	1991	58
Cyclopropylamine	(C3H7N)	2164	58
2-Propen-1-amine	(C3H7N)	2175	58
Aziridine, 2-methyl	(C3H7N)	2192	58
Aziridine, 1-methyl	(C3H7N)	2221	58
2-Propanimine	(C3H7N)	2232	58
1-Methylethenylamine	(C3H7N)	2251	58
Azetidine	(C3H7N)	2258	58

Cyanogen chloride	(CClN)	1726	62
Methane, nitro	(CH3NO2)	1799	62
Methyl nitrite	(CH3NO2)	1910	62
HCOONH2	(CH3NO2)	1996	62
Ethanolamine	(C2H7NO)	2223	62

Cyclopentene	(C5H8)	1830	69
Furan	(C4H4O)	1904	69
2-Pentyne	(C5H8)	1938	69
Ethenylcyclopropane	(C5H8)	1952	69
1-Butyne, 3-methyl	(C5H8)	1965	69
1,3-Butadiene, 2-methyl	(C5H8)	1989	69
1,3-Pentadiene, (E)	(C5H8)	2005	69
Cyclobutene, 1-methyl	(C5H8)	2022	69
Cyclopropene, 3,3-dimethyl	(C5H8)	2033	69
1H-Pyrazole	(C3H4N2)	2134	69
C3S	(C3S)	2230	69
1H-Imidazole	(C3H4N2)	2252	69

CH3COCN propanenitrile, 2-oxo	(C3H3NO)	1785	70
Butanenitrile	(C4H7N)	1912	70
Propanenitrile, 2-methyl	(C4H7N)	1921	70
Isoxazole	(C3H3NO)	2028	70
Propane, 1-isocyano	(C4H7N)	2047	70

Oxazole	(C3H3NO)	2095	70
1H-1,2,3-Triazole	(C2H3N3)	2100	70
1H-1,2,4-Triazole	(C2H3N3)	2118	70

Methane, trifluoro	(CHF3)	1479	71
Cyclobutanone	(C4H6O)	1918	71
2-Propenal, 2-methyl	(C4H6O)	1933	71
2-Butene, 2-methyl	(C5H10)	1933	71
Furan, 2,5-dihydro	(C4H6O)	1968	71
2-Butenal	(C4H6O)	1987	71
Methyl vinyl ketone	(C4H6O)	1995	71
Cyanamide, dimethyl	(C3H6N2)	2037	71
CH3NHCH2CN	(C3H6N2)	2065	71
H2NCH2CH2CN	(C3H6N2)	2072	71
Furan, 2,3-dihydro	(C4H6O)	2073	71
Iron, methylene	(CH2Fe)	2228	71

Butanal	(C4H8O)	1895	73
Propanal, 2-methyl	(C4H8O)	1907	73
Furan, tetrahydro	(C4H8O)	1964	73
2-Butanone	(C4H8O)	1978	73
Ethene, ethoxy	(C4H8O)	2079	73
1-Propene, 2-methoxy	(C4H8O)	2139	73
Iron monoxide	(FeO)	2168	73
2-Silaisobutene	(C3H8Si)	2270	73

1-Butanol	(C4H10O)	1887	75
1-Propanol, 2-methyl	(C4H10O)	1897	75
Propanoic acid	(C3H6O2)	1906	75
Formic acid, ethyl ester	(C3H6O2)	1913	75
Ethanol, 1,1-dimethyl	(C4H10O)	1929	75
2-Butanol	(C4H10O)	1948	75
Methyl propyl ether	(C4H10O)	1949	75
Acetic acid, methyl ester	(C3H6O2)	1967	75
Propane, 2-methoxy	(C4H10O)	1976	75
Ethoxy ethane	(C4H10O)	1980	75

Thietane	(C3H6S)	1991	75
Thiirane, methyl	(C3H6S)	2004	75
Methyl vinyl sulfide	(C3H6S)	2051	75
1,6-Dicarbahexaborane(6)	(C2H6B4)	2065	75
1,3-Propanediamine	(C3H10N2)	2358	75

Germane	(H4Ge)	1705	79
Arsine	(H3As)	1788	79
Disiloxane	(H6OSi2)	1790	79
Benzene	(C6H6)	1793	79
Acetic acid, fluoro	(C2H3FO2)	1830	79
Dimethyl sulfoxide	(C2H6OS)	2114	79

Pyridine	(C5H5N)	2223	80

Hydrogen bromide	(HBr)	1396	82
NCC(CH3)CO	(C4H3NO)	1907	82
Borazine	(H6B3N3)	1918	82
1,3,5-Triazine	(C3H3N3)	2029	82
Ethylamine, 2,2-difluoro	(C2H5F2N)	2081	82
CH3NCCCO	(C4H3NO)	2199	82

Ethene, trifluoro	(C2HF3)	1673	83
Hydrogen selenide	(H2Se)	1704	83
CF2HCH2OH	(C2H4F2O)	1740	83
Cyclohexene	(C6H10)	1875	83
Cyclopentene, 1-methyl	(C6H10)	1946	83
H3PO3	(H3O3P)	1963	83
Cyclopentane, methylene	(C6H10)	1990	83
1,3-Butadiene, 2,3-dimethyl	(C6H10)	2006	83
1,2-Dimethylcyclobutene	(C6H10)	2014	83
Furan, 3-methyl	(C5H6O)	2036	83
CH3CH=C(CH3)CH=CH2	(C6H10)	2042	83
Cyclopropane, 1-ethenyl-1-methyl	(C6H10)	2049	83
Dichloromethylene	(CCl2)	2058	83
1,3-Pentadiene, 2-methyl	(C6H10)	2067	83

Furan, 2-methyl	(C5H6O)	2069	83
Cyclopropane, (1-methylethenyl)	(C6H10)	2086	83
1,3,3-Trimethylcyclopropene	(C6H10)	2131	83
3(5)-methylpyrazole	(C4H6N2)	2168	83
4-methylpyrazole	(C4H6N2)	2170	83
1-methylpyrazole	(C4H6N2)	2179	83
4-Methylimidazole	(C4H6N2)	2278	83
1H-Imidazole, 1-methyl	(C4H6N2)	2293	83
1H-Imidazole, 2-methyl	(C4H6N2)	2303	83

Pentanenitrile	(C5H9N)	1918	84
Propanenitrile, 2,2-dimethyl	(C5H9N)	1935	84
Tert-butyl isocyanide	(C5H9N)	2080	84
4-NH2-pyrazole	(C3H5N3)	2172	84
3(5)-aminopyrazole	(C3H5N3)	2201	84
2-Propyn-1-amine, N,N-dimethyl	(C5H9N)	2248	84

Krypton	(Kr)	1015	85
Cyclohexane	(C6H12)	1643	85
2-Pentene, 2-methyl	(C6H12)	1941	85
CH3CH=C(CH3)C2H5	(C6H12)	1943	85
2-Butene, 2,3-dimethyl	(C6H12)	1945	85
Thiophene	(C4H4S)	1949	85
Cyclopentanone	(C5H8O)	1969	85
2-pentenal(E)	(C5H8O)	2007	85
3-Buten-2-one, 3-methyl	(C5H8O)	2015	85
2-Butenal,2-methyl-(Z)	(C5H8O)	2016	85
2-Butenal,2-methyl-(Z)	(C5H8O)	2016	85
Ethanone, 1-cyclopropyl	(C5H8O)	2043	85
3-methyl-2-butenal	(C5H8O)	2046	85
3-Penten-2-one	(C5H8O)	2066	85
2H-Pyran, 3,4-dihydro	(C5H8O)	2070	85
4-Methyl-2,3-dihydrofuran	(C5H8O)	2075	85
Acetonitrile, (dimethylamino)	(C4H8N2)	2115	85
Furan, 2,3-dihydro-5-methyl	(C5H8O)	2167	85
1,4,5,6-tetrahydropyrimdine	(C4H8N2)	2394	85

Carbon tetrafluoride	(CF4)	1262	89
Phosphorus trifluoride	(F3P)	1665	89
1-Propanol, 2,2-dimethyl	(C5H12O)	1901	89
1,4-Dioxane	(C4H8O2)	1907	89
Formic acid, propyl ester	(C4H8O2)	1933	89
Formic acid, 1-methylethyl ester	(C4H8O2)	1939	89
Ethylene carbonate	(C3H4O3)	1947	89
Butane, 1-methoxy	(C5H12O)	1962	89
1,3-Dioxane	(C4H8O2)	1964	89
Propanoic acid, methyl ester	(C4H8O2)	1985	89
Ethyl acetate	(C4H8O2)	1997	89
Propane, 2-methoxy-2-methyl	(C5H12O)	2006	89
Propane, 2-ethoxy	(C5H12O)	2014	89
Thiophene, tetrahydro	(C4H8S)	2030	89
CH2=C(CH3)-SCH3	(C4H8S)	2124	89
Urea, N,N'-dimethyl	(C3H8N2O)	2161	89
Tetramethylhydrazine	(C4H12N2)	2268	89
Ethene, 1,1-dimethoxy	(C4H8O2)	2288	89
1,4-butanediamine	(C4H12N2)	2401	89

Benzene, fluoro	(C6H5F)	1807	97
Methanesulfonic acid	(CH4O3S)	1820	97
Phosphabenzene	(C5H5P)	1956	97
Cyclopentene, 1,2-dimethyl	(C7H12)	1967	97
Cyclohexene, 1-methyl	(C7H12)	1973	97
Bicyclo[2.2.1]hept-2-ene, 7-oxa	(C6H8O)	2002	97
Furan, 2,5-dimethyl	(C6H8O)	2080	97
3,4-dimethylfuran	(C6H8O)	2081	97
2(1H)-Pyrimidinone	(C4H4N2O)	2089	97
(CH3)2C=CHC(CH3)=CH2	(C7H12)	2112	97
2,4-Dimethylfuran	(C6H8O)	2136	97
trans-dimethylamino acrylonitrile	(C5H8N2)	2144	97
3(5),4-dimethylpyrazole	(C5H8N2)	2216	97
1,4-Dimethylpyrazole	(C5H8N2)	2220	97
1,3-Dimethylpyrazole	(C5H8N2)	2233	97

1,5-Dimethylpyrazole	(C5H8N2)	2234	97
1H-Pyrazole, 3,5-dimethyl	(C5H8N2)	2235	97
1,4-Dimethylimidazole	(C5H8N2)	2334	97
1,5-Dimethylimidazole	(C5H8N2)	2337	97
1H-Imidazole, 1,2-dimethyl	(C5H8N2)	2353	97

4-NO2-pyrazole	(C3H3N3O)	1967	98
2-Fluoropyridine	(C5H4FN)	2115	98
N'-cyano-N,N-dimethyl formamidine	(C4H7N3)	2123	98
3-F-pyridine	(C5H4FN)	2157	98
4-F-pyridine	(C5H4FN)	2180	98
1-methyl-3-aminopyrazole	(C4H7N3)	2245	98
1-methyl-5-aminopyrazole	(C4H7N3)	2269	98
2-Propen-1-amine, N-2-propenyl	(C6H11N)	2270	98

Ethanol, 2,2,2-trifluoro	(C2H3F3O)	1678	101
CF3OCH3	(C2H3F3O)	1729	101
Cyclobutane carboxylic acid	(C5H8O2)	1955	101
2-methyl-2-butenoic acid(Z)	(C5H8O2)	1966	101
2-Butenoic acid, 3-methyl	(C5H8O2)	1967	101
trans-Alpha,beta-penteneoic acid	(C5H8O2)	1969	101
2-Propenoic acid, 2-methyl-, methyl ester	(C5H8O2)	1989	101
Oxepane	(C6H12O)	1989	101
Silane, ethenyltrimethyl	(C5H12Si)	1991	101
2-Butanone, 3,3-dimethyl	(C6H12O)	2008	101
3-Hexanone	(C6H12O)	2015	101
Cyclopropanecarboxylic acid, methyl ester	(C5H8O2)	2017	101
2,2-Dimethyltetrahydrofuran	(C6H12O)	2026	101
2-Butenoic acid, methyl ester, (E)	(C5H8O2)	2035	101
Acetylacetone	(C5H8O2)	2087	101
2-Aminothiazole	(C3H4N2S)	2225	101
Pyrazolidine, 1,2-dimethyl	(C5H12N2)	2294	101
(CH3)2N-CH=N-C2H5	(C5H12N2)	2411	101
(CH3)2N-C(CH3)=NCH3	(C5H12N2)	2445	101

Sulfuryl fluoride	(F2O2S)	1446	103
SiF3OH	(F3HOSi)	1533	103
Ruthenium	(Ru)	1850	103
Formic acid, butyl ester	(C5H10O2)	1924	103
Propane, 1-methoxy-2,2-dimethyl	(C6H14O)	1975	103
Phenylacetylene	(C8H6)	1996	103
Butanoic acid, methyl ester	(C5H10O2)	2000	103
Acetic acid, 1-methylethyl ester	(C5H10O2)	2000	103
Propanoic acid, 2-methyl-, methyl ester	(C5H10O2)	2000	103
n-Propyl acetate	(C5H10O2)	2002	103
Di-n-propyl ether	(C6H14O)	2003	103
2H-Thiopyran, tetrahydro	(C5H10S)	2046	103
Diisopropyl ether	(C6H14O)	2047	103
Propane, 2-ethoxy-2-methyl	(C6H14O)	2047	103
4-Cl-pyrazole	(C3H3ClN2)	2078	103
cis-1,2-Cyclopentanediol	(C5H10O2)	2118	103
2-Imidazolidinethione	(C3H6N2S)	2209	103
(CH3)2N-CH=N-OCH3	(C4H10N2O)	2267	103
Methanediamine, N,N,N',N'-tetramethyl	(C5H14N2)	2276	103
1,5-Diaminopentane	(C5H14N2)	2393	103
1,3-Propanediamine, N,N-dimethyl	(C5H14N2)	2453	103

Rhodium	(Rh)	1836	104
Benzonitrile	(C7H5N)	1938	104
(CH3)3CONO	(C4H9NO2)	2065	104
Benzene, isocyano	(C7H5N)	2076	104
(CH3)2NCOOCH3	(C4H9NO2)	2104	104
CH3NHCOOC2H5	(C4H9NO2)	2125	104
Dimethyl thioacetamide	(C4H9NS)	2211	104
1,2-Ethanediamine, N-(2-aminoethyl)	(C4H13N3)	2232	104

ClCON(CH3)2	(C3H6ClNO)	2022	108

Benzene, nitroso	(C6H5NO)	2043	108
2-Me-phenoxy	(C7H7O)	2090	108
3-Me-phenoxy	(C7H7O)	2097	108
2-OH-benzyl	(C7H7O)	2100	108
4-Me-phenoxy	(C7H7O)	2114	108
3-OH-benzyl	(C7H7O)	2116	108
Benzenamine, 2-methyl	(C7H9N)	2130	108
Benzenamine, 3-methyl	(C7H9N)	2142	108
4-OH-benzyl	(C7H7O)	2143	108
p-Toluidine	(C7H9N)	2144	108
4-Pyridinecarboxaldehyde	(C6H5NO)	2150	108
Benzylamine	(C7H9N)	2184	108
Aniline, N-methyl	(C7H9N)	2192	108
(iso-C5H11)3N	(C5H33N)	2230	108
Pyridine, 2,5-dimethyl	(C7H9N)	2258	108
Pyridine, 2,3-dimethyl	(C7H9N)	2261	108
3-(C2H5)-pyridine	(C7H9N)	2265	108
Pyridine, 2,4-dimethyl	(C7H9N)	2272	108
4-(C2H5)-pyridine	(C7H9N)	2272	108
Pyridine, 2-ethyl	(C7H9N)	2276	108
Pyridine, 3,5-dimethyl	(C7H9N)	2281	108
Pyridine, 2,6-dimethyl	(C7H9N)	2301	108

Benzene, 1-fluoro-4-methyl	(C7H7F)	1826	111
Benzene, 1-fluoro-2-methyl	(C7H7F)	1848	111
Benzene, 1-fluoro-3-methyl	(C7H7F)	1877	111
Norbornan-7-one	(C7H10O)	1990	111
2-Norbornanone	(C7H10O)	2026	111
(CH3)2C=C(CH3)C(CH3)=CH2	(C8H14)	2087	111
Piperidine, 1-carbonitrile	(C6H10N2)	2093	111
Methanone, dicyclopropyl	(C7H10O)	2107	111
Phosphonic acid, dimethyl ester	(C2H7O3P)	2141	111
4-Cyanopiperidine	(C6H10N2)	2181	111
3,4,5-Trimethylpyrazole	(C6H10N2)	2265	111
1,3,5-Trimethylpyrazole	(C6H10N2)	2269	111
(CH3)2N-CH=N-(2-propynyl)	(C6H10N2)	2374	111

4-F-phenoxy	(C6H4FO)	2042	112
Benzenamine, 3-fluoro	(C6H6FN)	2072	112
p-Fluoroaniline	(C6H6FN)	2084	112
Exo-2-aminonorbornane	(C7H13N)	2214	112
Endo-2-aminonorbornane	(C7H13N)	2214	112
(CH3)2N-CH=N-CH2CN	(C5H9N3)	2267	112
2(1H)-Pyrimidinone, 4-amino	(C4H5N3O)	2270	112
Quinuclidine	(C7H13N)	2353	112
Histamine	(C5H9N3)	2388	112

Acetic acid, trifluoro	(C2HF3O2)	1700	115
Benzene, 1,4-difluoro	(C6H4F2)	1721	115
Benzene, 1,2-difluoro	(C6H4F2)	1748	115
2,2,2-Trifluoroethyl methyl ether	(C3H5F3O)	1788	115
Benzene, 1,3-difluoro	(C6H4F2)	1792	115
Carbonothioic dichloride	(CCl2S)	1799	115
Cyclohexanemethanol	(C7H14O)	1918	115
cyclopentane carboxylic acic	(C6H10O2)	1955	115
1-Methoxycyclohexane	(C7H14O)	2010	115
4-Heptanone	(C7H14O)	2021	115
3-Pentanone, 2,4-dimethyl	(C7H14O)	2032	115
CH3COCH2CH2COCH3	(C6H10O2)	2132	115
1,3-Dimethyl-2-imidazolidinone	(C5H10N2O)	2196	115
Pyridazine hexahydro-1,2-dimethyl	(C6H14N2)	2310	115
(CH3)2N-CH=N-(n-propyl)	(C6H14N2)	2419	115
(CH3)2N-CH=N-(1-methylethyl)	(C6H14N2)	2425	115
(CH3)2N-C(CH3)=NC2H5	(C6H14N2)	2459	115

CF3CFO	(C2F4O)	1599	117
4-Hydroxy-4-methylpentan-2-one	(C6H12O2)	1967	117
trans-1,3-cyclohexanol	(C6H12O2)	1980	117
3-Methylphenylacetylene	(C9H8)	2018	117
Propanoic acid, 2,2-dimethyl-, methyl ester	(C6H12O2)	2024	117

Indene	(C9H8)	2031	117
Benzene, 1-ethynyl-4-methyl	(C9H8)	2046	117
Propane, 2-methyl-2-(1-methylethoxy)	(C7H16O)	2080	117
cis-1,3-cyclohexandiol	(C6H12O2)	2105	117
Urea, tetramethyl	(C5H12N2O)	2225	117
N,N'-Diethyl-N,N'-dimethylhydrazine	(C6H16N2)	2304	117
Propyltrimethylhydrazine	(C6H16N2)	2312	117
(CH2)5PCH3	(C6H13P)	2317	117
1,6-Hexanediamine	(C6H16N2)	2369	117
1,2-Ethanediamine, N,N,N',N'-tetramethyl	(C6H16N2)	2423	117

2-Phenyl-2-propyl radical	(C9H11)	2010	120
C6H5(CHC2H5) radical	(C9H11)	2010	120
Benzoxazole	(C7H5NO)	2131	120
CH3OC(S)N(CH3)2	(C4H9NOS)	2149	120
Threonine	(C4H9NO3)	2206	120
Aziridine, 1-phenyl	(C8H9N)	2214	120
5H-1-Pyrindine, 6,7-dihydro	(C8H9N)	2256	120
5H-2-Pyrindine, 6,7-dihydro	(C8H9N)	2266	120
1H-Indole, 2,3-dihydro	(C8H9N)	2287	120

Benzene, 1-chloro-4-methyl	(C7H7Cl)	1823	127
Benzene, 1-chloro-2-methyl	(C7H7Cl)	1842	127
Benzene, 1-chloro-3-methyl	(C7H7Cl)	1874	127
c-C6H11COCH3	(C8H14O)	2011	127
Cyclooctanone	(C8H14O)	2031	127
Thymine	(C5H6N2O2)	2105	127
(c-C3H5)2CS	(C7H10S)	2169	127
3-Amino-1-azabicyclo[2.2.2]octane	(C7H14N2)	2313	127
1,2-Diazabicyclo[2.2.2]octane, 2-methyl	(C7H14N2)	2316	127
2,3-Diazabicyclo[2.2.1]heptane, 2,3-dimethyl	(C7H14N2)	2338	127
(CH3)2N-C(CH3)=N(c-C3H5)	(C7H14N2)	2447	127

Hydrogen iodide	(HI)	1500	129
CF3C(O)OCH3	(C3H3F3O2)	1771	129
2,2,2-Trifluoroethyl formate	(C3H3F3O2)	1784	129
Ether, ethyl 2,2,2-trifluoroethyl	(C4H7F3O)	1823	129
1,4-Benzenedicarbonitrile	(C8H4N2)	1862	129
1,3-Benzenedicarbonitrile	(C8H4N2)	1863	129
Naphthalene	(C10H8)	1919	129
Cyclohexanecarboxylic acid	(C7H12O2)	1973	129
C6H11CH2OCH3	(C8H16O)	1986	129
2,2,4-Trimethyl-3-pentanone	(C8H16O)	2049	129
Azulene	(C10H8)	2211	129
1H-1,2-Diazepine, hexahydro-1,2-dimethyl	(C7H16N2)	2312	129
(CH3)2N-CH=N-(n-butyl)	(C7H16N2)	2422	129
(CH3)2N-CH=N-(2-methylpropyl)	(C7H16N2)	2427	129
(CH3)2N-CH=N-(1-methylpropyl)	(C7H16N2)	2435	129
(CH3)2N-CH=N(t-C4H9)	(C7H16N2)	2442	129
(CH3)2N-C(CH3)=N(n-C3H7)	(C7H16N2)	2462	129
(CH3)2N-C(CH3)=N(i-C3H7)	(C7H16N2)	2465	129

3-ClC6H4CH=CH2	(C8H7Cl)	2012	139
Ethanone, 1-(3-fluorophenyl)	(C8H7FO)	2022	139
Ethanone, 1-(4-fluorophenyl)	(C8H7FO)	2053	139
p-Nitroaniline	(C6H6N2O2)	2068	139
2-Cyclohexen-1-one, 3,5,5-trimethyl	(C9H14O)	2136	139
1-methyl-5-t-butylpyrazole	(C8H14N2)	2250	139
1-methyl-3-t-butylpyrazole	(C8H14N2)	2258	139
3(5)-methyl-5(3)-t-butylpyrazole	(C8H14N2)	2260	139
3,5-diethyl-4-methylpyrazole	(C8H14N2)	2277	139
Dimethylphenylphosphine	(C8H11P)	2318	139
1,5-diazabicyclo[4.4.0]dec-6-ene (DBD)	(C8H14N2)	2501	139

Biphenyl	(C12H10)	1945	155
3-F-C6H4-COOCH3	(C8H7FO2)	1989	155

4-F-C6H4-COOCH3	(C8H7FO2)	2010	155
Acetophenone, 3'-chloro	(C8H7ClO)	2025	155
Acenaphthene	(C12H10)	2037	155
Ethanone, 1-(4-chlorophenyl)	(C8H7ClO)	2049	155
6-Chloropurine	(C5H3ClN4)	2089	155
3(5)-methyl-5(3)-ethoxycarbonylpyrazole	(C7H10N2O2)	2159	155
(CH3)2(C6H5)PO	(C8H11OP)	2174	155
2-Cyclohexen-1-one,3-methoxy,5,5-dimethyl	(C9H14O2)	2206	155
1,5-Diazabicyclo[3.3.3]undecane	(C9H18N2)	2322	155
1-Azabicyclo[2.2.2]octane,4-N,N-dimethylamino	(C9H18N2)	2352	155
(CH3)2N-CH=N-(c-hexyl)	(C9H18N2)	2440	155
Barium monoxide	(BaO)	2905	155

2-Propanone, 1,1,1,3,3,3-hexafluoro	(C3F6O)	1602	167
Fluorene	(C13H10)	1996	167
Benzamide, 4-nitro	(C7H6N2O3)	2021	167
Benzamide, 3-nitro	(C7H6N2O3)	2043	167
3-CH3O-C6H4-COOCH3	(C9H10O3)	2046	167
Adamantylmethylether	(C11H18O)	2057	167
4-Methylcamphor	(C11H18O)	2064	167
3-CH3S-C6H4-COCH3	(C9H10OS)	2072	167
Benzoic acid, 4-methoxy-, methyl ester	(C9H10O3)	2079	167
3-Cl-4-CH3O-C6H3-CCH	(C9H7ClO)	2087	167
4-CH3S-C6H4-COCH3	(C9H10OS)	2121	167
Benzenamine, N,N-dimethyl-4-nitro	(C8H10N2O2)	2137	167
Benzenamine, N,N-dimethyl-3-nitro	(C8H10N2O2)	2138	167

Stannane, tetramethyl	(C4H12Sn)	1967	181
4-Ethylcamphor	(C12H20O)	2069	181
Ethylene, 1,1-diphenyl	(C14H12)	2116	181
Furan, 2,5-bis(1,1-dimethylethyl)	(C12H20O)	2140	181
Phenazine	(C12H8N2)	2243	181

3,5-di-t-butylpyrazole	(C11H20N2)	2274	181

(CF3)2C(CH3)OH	(C4H4F6O)	1655	183
(CF3CH2)2O	(C4H4F6O)	1689	183
Bibenzyl	(C14H14)	1917	183
3-CH3S-C6H4-COOCH3	(C9H10O2S)	2038	183
4-CH3S-C6H4-COOCH3	(C9H10O2S)	2065	183
3-Cl-4-CH3S-C6H3-CCH	(C9H7ClS)	2079	183
Benzophenone	(C13H10O)	2109	183
Triethyl phosphate	(C6H15O4P)	2174	183

4-CF3-C6H4-COCH3	(C9H7F3O)	1995	189
3-CF3-C6H4-COCH3	(C9H7F3O)	1998	189
t-butylstyrene,3,5-dimethyl	(C14H20)	2088	189
Nickelocene	(C10H10Ni)	2240	189

t-butylstyrene,3-Cl	(C12H15Cl)	2005	195
1,4-Benzenedicarboxylic acid dimethyl ester	(C10H10O4)	2016	195
1,4-Benzenedicarboxylic acid dimethyl ester	(C10H10O4)	2016	195
1,3-Benzenedicarboxylic acid dimethyl ester	(C10H10O4)	2018	195
4-F-C6H4-C(Si(CH3)3)=CH2	(C11H15FSi)	2052	195
Tricyclo[3.3.1.13,7]decane-1-carboxylic acid, methyl ester	(C12H18O2)	2066	195
Benzamide, N,N-dimethyl-4-nitro	(C9H10N2O3)	2147	195
3-NO2-C6H4CON(CH3)2	(C9H10N2O3)	2147	195
N,N,2,6-Tetramethyl-4-nitroaniline	(C10H14N2O2)	2196	195
3,5-di-t-butyl-4-methylpyrazole	(C12H22N2)	2312	195
1-methyl-3,5-di-t-butylpyrazole	(C12H22N2)	2321	195

Azulene, 1,4-dimethyl-7-(1-methylethyl)	(C15H18)	2350	199

C6H5COCCl3	(C8H5Cl3O)	1958	223
CH3O[CH2CH2O]4CH3	(C10H22O5)	2280	223

APPENDIX I

TABLE OF COPCs

COPC	m/z	Evaluated in Data Sets	No STD	Low Vapor Pressure	Interfer.	Low Proton Affinity	Reference Spectrum	Sample Line Study
Ammonia	18				X			
Formaldehyde	31	X	X					
Methanol	33	X					X	X
Acetonitrile	42	X					X	X
Nitrous Oxide						X		
Acetaldehyde	45	X					X	
Ethylamine	46	X	X					
1,3-Butadiene	55	X	X					
Propanenitrile	56	X					X	X
1-Butanol	57	X					X	X
Methyl isocyanate	58	X	X					
Methyl nitrite	62	X	X					
Furan	69	X					X	X
butanenitrile	70	X					X	X
3-buten-2-one (MVK)	71	X			X		X	X
2,3-dihydrofuran	71	X			X		X	X
2,5-dihydrofuran	71	X			X		X	
butanal	73	X					X	
N-nitrosodimethylamine (NDMA)	75	X					X	X
benzene	79	X					X	X
2,4-pentadienenitrile	80	X	X		X			
pyridine	80	X			X		X	
2-methylene butanenitrile	82	X	X					
2-methylfuran	83	X					X	X
pentanenitrile	84	X					X	X
3-methyl-3-buten-2-one	85	X					X	X
2-methyl-2-butenal	85	X					X	X
N-nitrosomethylethylamine (NMEA)	89	X					X	X
2,5-dimethylfuran	97	X					X	X
hexanenitrile	98	X					X	X
2-hexanone (MBK)	101	X					X	X
N-nitrosodiethylamine (NDEA)	103	X					X	X
butyl nitrite	104, 57	X					X	X
2-nitro-2-methylpropane	104	X					X	
2,4-dimethylpyridine	108	X					X	

2-ethyl-5-methylfuran	111	X	X		X			
2-propylfuran	111	X			X		X	X
heptanenitrile	112	X					X	
4-methyl-2-hexanone	115	X	X					
N-nitrosomorpholine (NMOR)	117	X					X	X
butyl nitrate	120	X	X					
2-ethyl-2-hexenal	127	X			X		X	
4-(1-methylpropyl)-2,3-dihydrofuran	127	X	X		X			
3-(1,1-dimethylethyl)-2,3-dihydrofuran	127	X	X		X			
6-methyl-2-heptanone	129	X					X	X
2-pentylfuran	139	X					X	X
biphenyl	155	X		X			X	
2-heptylfuran	167	X					X	
2-octylfuran	181	X	X	X	X			
1,4-butanediol, dinitrate	181	X	X		X			
1,2,3-propanetriol, 1,3-dinitrate	183	X	X	X				
PCB, 1 Cl	189	X	X	X				
6-(2-furanyl)-6-methyl-2-heptanone	195	X	X	X				
furfural acetophenone (3-(2-furanyl)-1-pheynyl-2-propen-1-one)	199	X	X	X				
Mercury	202					X		
Ethyl phthalate, PCB 2-Cl	223	X		X	X			
Dibutylbutylphosphonate	251	X		X				
Tributylphosphate	267	X		X				
2-Fluoropropene	61	X	X					