Vapor Monitoring Detection System Weekly Report – AP Tank Farm Stack Monitoring

3/1/2017 6:00 – 3/8/2017
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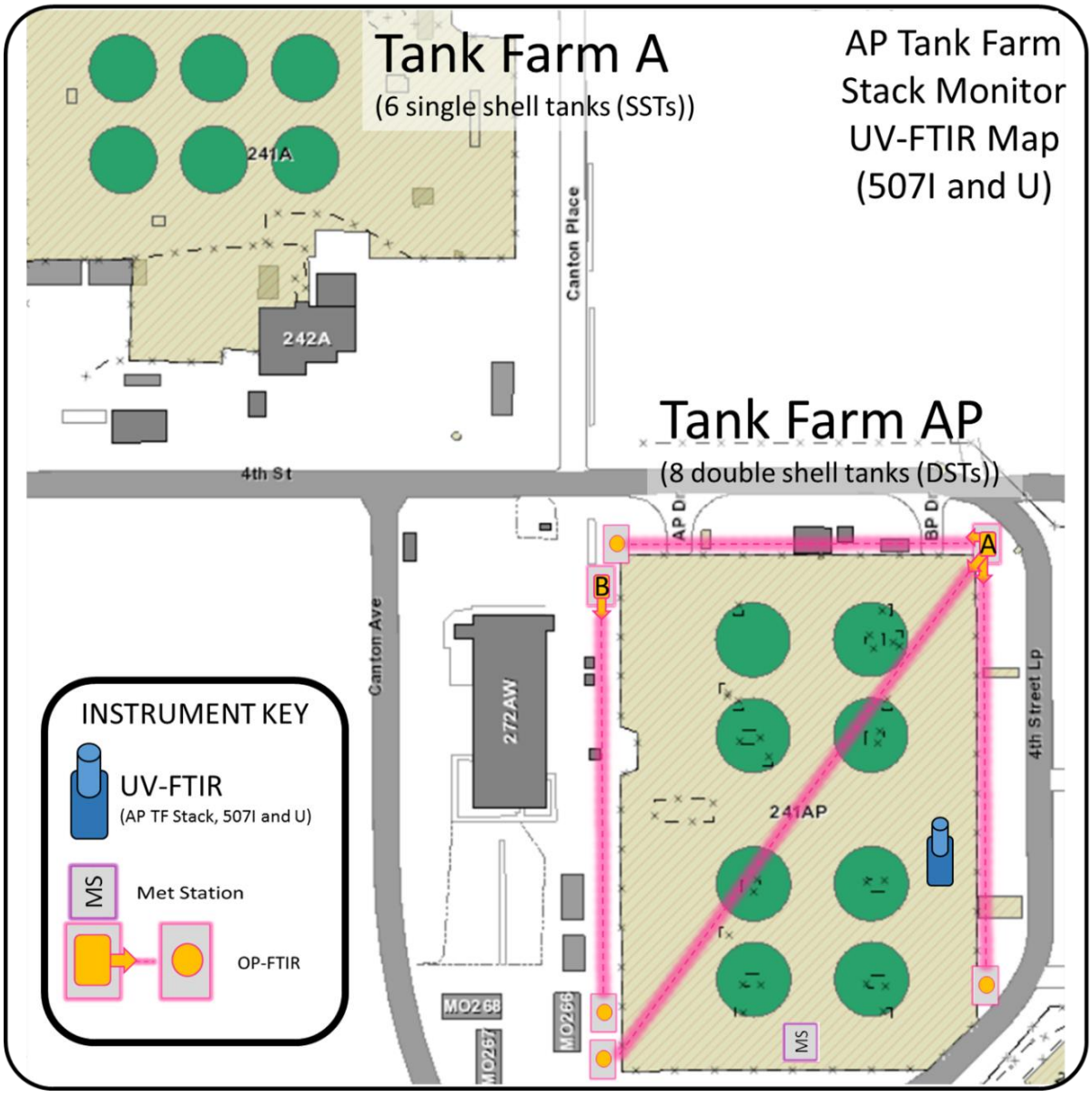
AP-Tank Farm Stack Monitor (north is up)



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Abbreviations and Units

CH_4	=	methane
CO	=	carbon monoxide
CO_2	=	carbon dioxide
COPC	=	chemicals of potential concern
LEL	=	lower explosive limit
ND	=	not detected
NH_3	=	ammonia
NO	=	nitric oxide
N_2O	=	nitrous oxide
NO_2	=	nitrogen dioxide
O_3	=	ozone
OEL	=	occupational exposure limit
FTIR	=	Fourier transform infrared spectrometer
OSHA	=	Occupational Safety and Health Administration
PEL	=	permissible exposure limit
ppb	=	parts per billion
ppm	=	parts per million
UV-DOAS	=	ultraviolet differential optical absorption spectrometer
VMDS	=	vapor monitoring detection system

VMDS Instruments

507I	=	FTIR AP Farm Stack
507U	=	UV-DOAS AP Farm Stack

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Introduction

This summary contains Vapor Monitoring and Detection System (VMDS) pilot-scale data collected over one week (3/1/2017 at 6:00 a.m. through 3/8/2017 at 6:00 a.m.) using the AP-Farm stack monitor[1]. This instrument is a dual channel FTIR/UV-DOAS spectrometer that provides real-time multi-gas measurement (qualitative and quantitative) of gases. The implementation method for this instrument allows for very accurate identification and quantification of compounds found in the AP-Farm exhauster stack.

Since chemical compounds are found in the stack are not representative of what is found in the work environment, their concentrations will not be reviewed against Occupational Exposure Limits (OELs) or other limits implemented in work environments. The review here will focus on chemicals present, patterns, and what is observed during waste disturbing activities.

Pilot-scale testing is focused on evaluating component integration and functionality. Data shown may include results for calibration and calibration check (bump test) tests performed to verify sensors are functioning; these tests are visible in the data as spikes. Any alarms occurring during pilot-scale testing are taken to be actual events and the appropriate actions/notifications are undertaken.

For the stack monitor, each analyte has a specific reference spectrum, which represents the absorption characteristics for that chemical in the IR or UV spectral regions. Reference spectra for each analyte are stored in a library that specifies which absorption features are analyzed, how that analysis is performed, and reporting threshold values. Revisions to the library are periodically performed to improve accuracy of analysis for analytes; spectrographic instruments reporting for the VMDS project are still in the iterative optimization process and periodic changes to the library are being performed. Revisions to the library may result in the identification of a compound not previously thought to be present, or conversely determine that a previously reported analyte was not actually present. Identification of an analyte is dependent on the analytical method (UV or IR), library used, concentration, other chemical compounds present [chemicals present can interfere/overlap with each other at key locations; typically those having the same functional groups (e.g., methane or ketone groups) – the library is optimized to minimize these interferences], and many other factors.

3/1/2017 through 3/8/2017 Summary

The FTIR and UV-DOAS instruments were interrupted by several power failures during this week. The FTIR 507I and UV-DOAS 507U sampled from A-train until power was interrupted to perform maintenance on 3/2 at approximately 09:30 and was restored at approximately 14:30 on 3/3. Another power outage occurred starting at approximately 09:00 and ending at 15:00 on 3/6. There were no retrieval or waste disturbing activities performed during the

[1] AP-Farm Stack Monitor Fact Sheet: https://hanfordvapors.com/wp-content/uploads/2016/11/UV-FTIR-Fact-Sheet.pdf

reporting period. Figure 1 and 2 below shows the concentrations of ammonia and nitrous oxide, respectively, which were observed in the AP Farm stack during the reporting period as well as the power outages. A calibration was performed by introducing 200 ppb of ammonia into FTIR 507I and UV-DOAS 507U between 13:00 and 14:30 on 3/7. Table 1 shows that ammonia concentrations ranged from 35 to 56 ppm, and nitrous oxide concentrations ranged from 1.7 to 3.1 ppm. These are typical ranges observed when no waste disturbing activities have occurred. Figure 3 shows the data obtained from 507U of the concentrations of ethyl benzene, ethylamine, ammonia and a reading of methyl furan at 14:30 on 3/3 during the reporting period – this is an anomaly due to restarting the instrument. Table 2 shows the reporting time of the stack monitors. Both the FTIR 507I and the UV-DOAS 507U monitored for 66% of the reporting period.

Figure 1. FTIR (507I) N_2O Data recorded from AP Farm Exhauster (Note that concentration units are ppb)

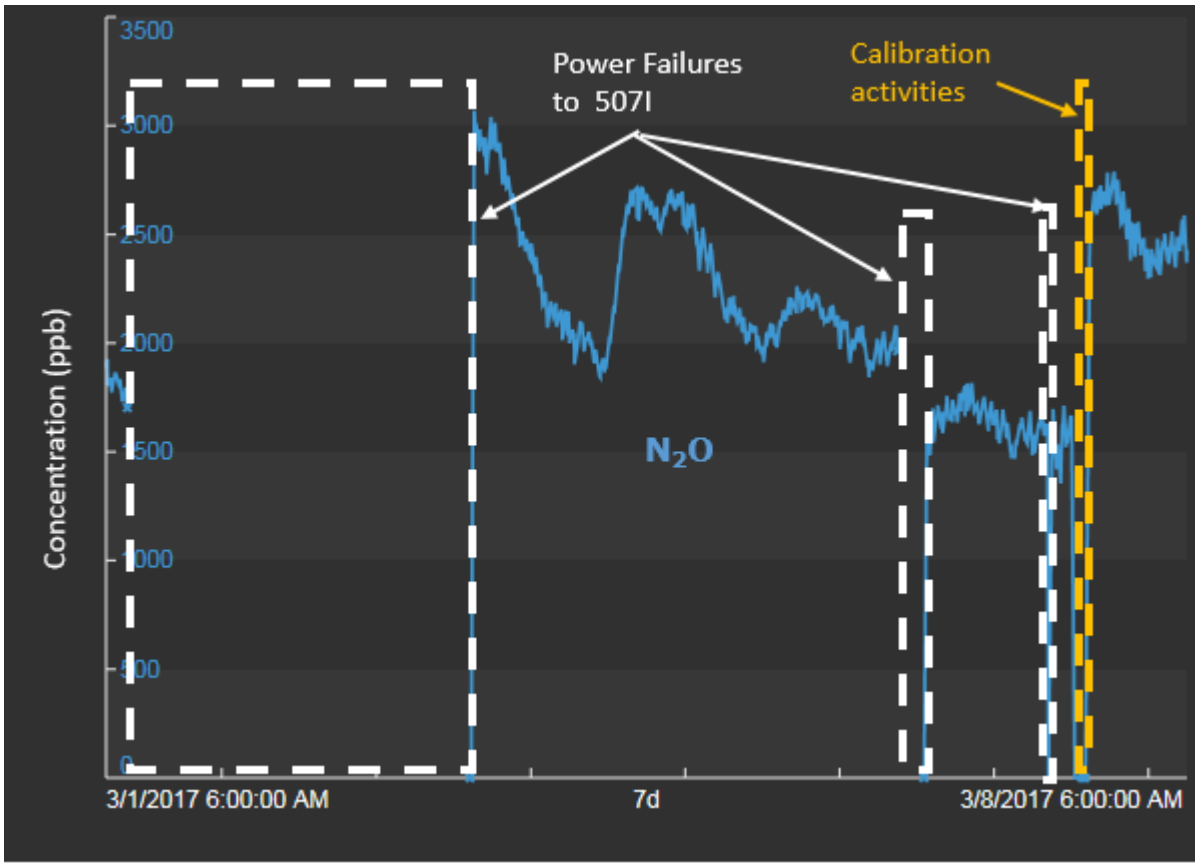

Figure 2. FTIR (507I) NH_3 Data recorded from AP Farm Exhauster (Note that concentration units are ppb)

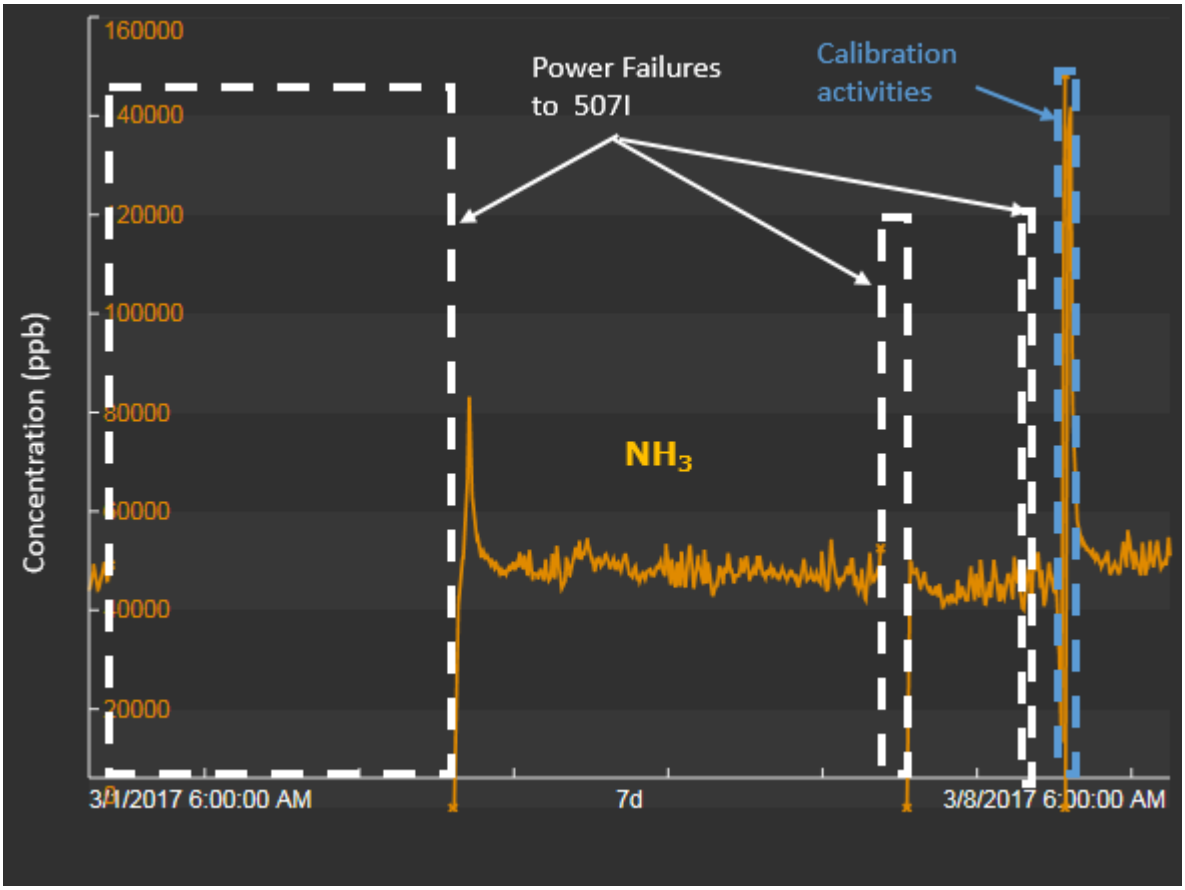

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Table 1. Chemical Species Detected in the AP Tank Farm Stack by Method (2 Pages)

Chemical	UV-FTIR (507I) ppm		Chemical	UV-DOAS (507U) ppm
Nitrous Oxide*	1.7 – 3.1		Ammonia*	35 – 47
Ammonia*	39 – 56		Nitric Oxide	ND
Methane	ND		Oxygen	ND
1-3-Butadiene*	ND		Ozone	ND
1-Butanol*	61 – 64		1-3 Butadiene*	ND
2-Hexanone*	ND		2-Methyl-2-butenal*	ND
3-Buten-2-one*	ND		2-Methylfuran*	ND – 0.032
Acetaldehyde*	ND		Acetaldehyde*	ND
Acetonitrile*	ND		Benzene*	ND – 0.25
Benzene*	ND		Butanal*	ND
Butanal*	ND		Ethylamine*	ND –0.069
Butyl Nitrite*	ND		Formaldehyde*	ND
Ethylamine*	ND		Furan*	ND
Formaldehyde*	ND		Mercury*	ND
Furan*	ND		Methyl Nitrite*	ND
Methanol*	ND		Pyridine*	ND
Methyl Isocyanate*	ND		1-2-4 Trimethylbenzene	ND
Methyl Nitrite*	ND		1-3-5 Trimethylbenzene	ND
N-Nitrosodiethylamine*	ND		Ethylbenzene	ND – 0.17
N-Nitrosodimethylamine*	ND		m-Xylene	ND
N-Nitrosomorpholine*	ND		Nitrogen Dioxide	ND
Propanenitrile*	ND		o-Xylene	ND
Pyridine*	ND		p-Xylene	ND
Tributyl Phosphate*	ND		Styrene	ND
			Sulfur dioxide	ND
			Toluene	ND

Notes: *Chemical is on COPC list
ND – Not detected by instrument ()

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Figure 3. UV-DOAS (507U) Data Review.
(Note that concentration units are ppb)

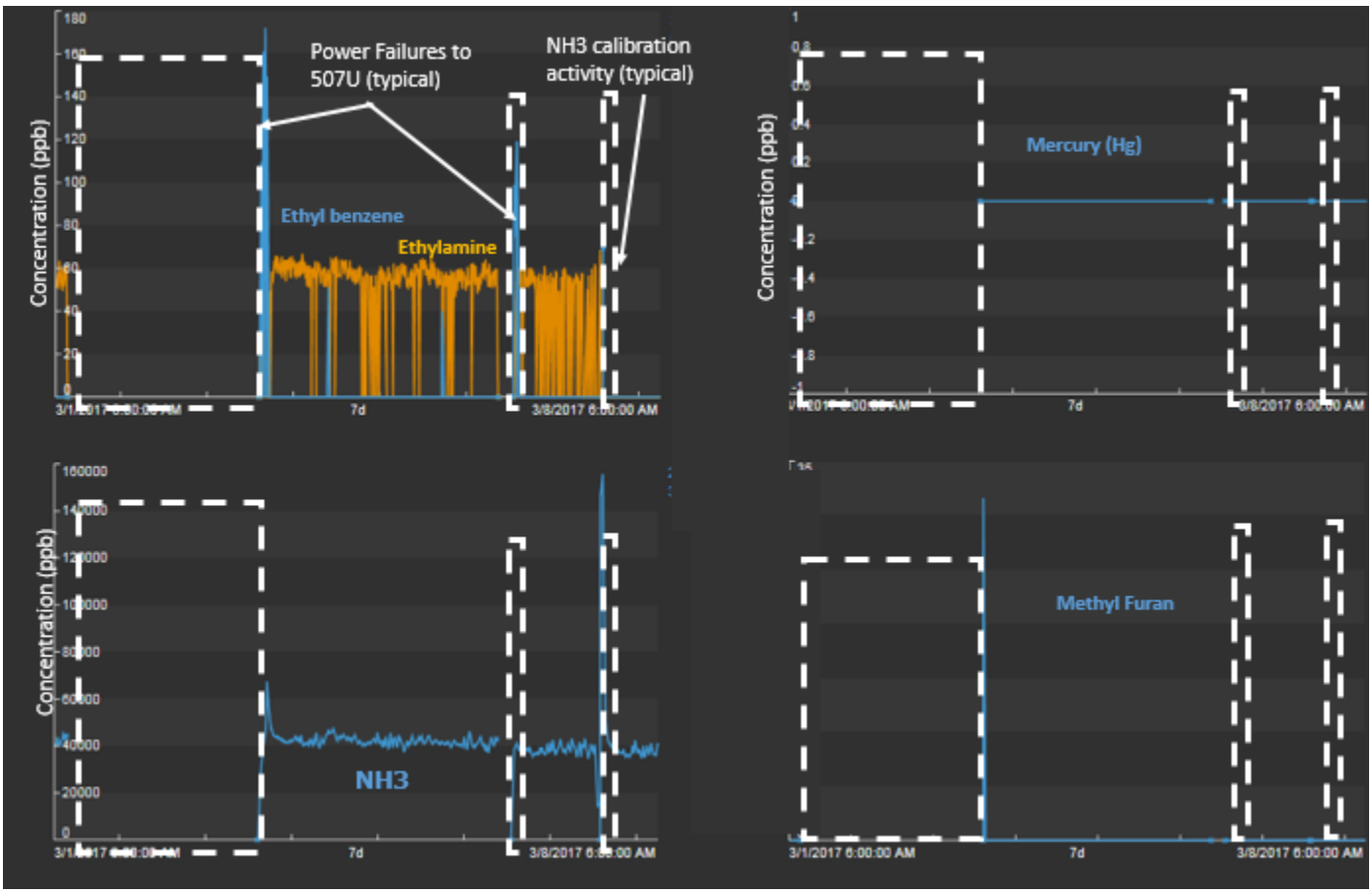

Table 2. Stack Monitor Time Reporting.

Instrument	% Time Reporting
507I	66%
507U	66%

Notes: % time reporting is based on data reported to OSI PI System[2]

[2] OSI PI System is a data visualization software package from OSIsoft.