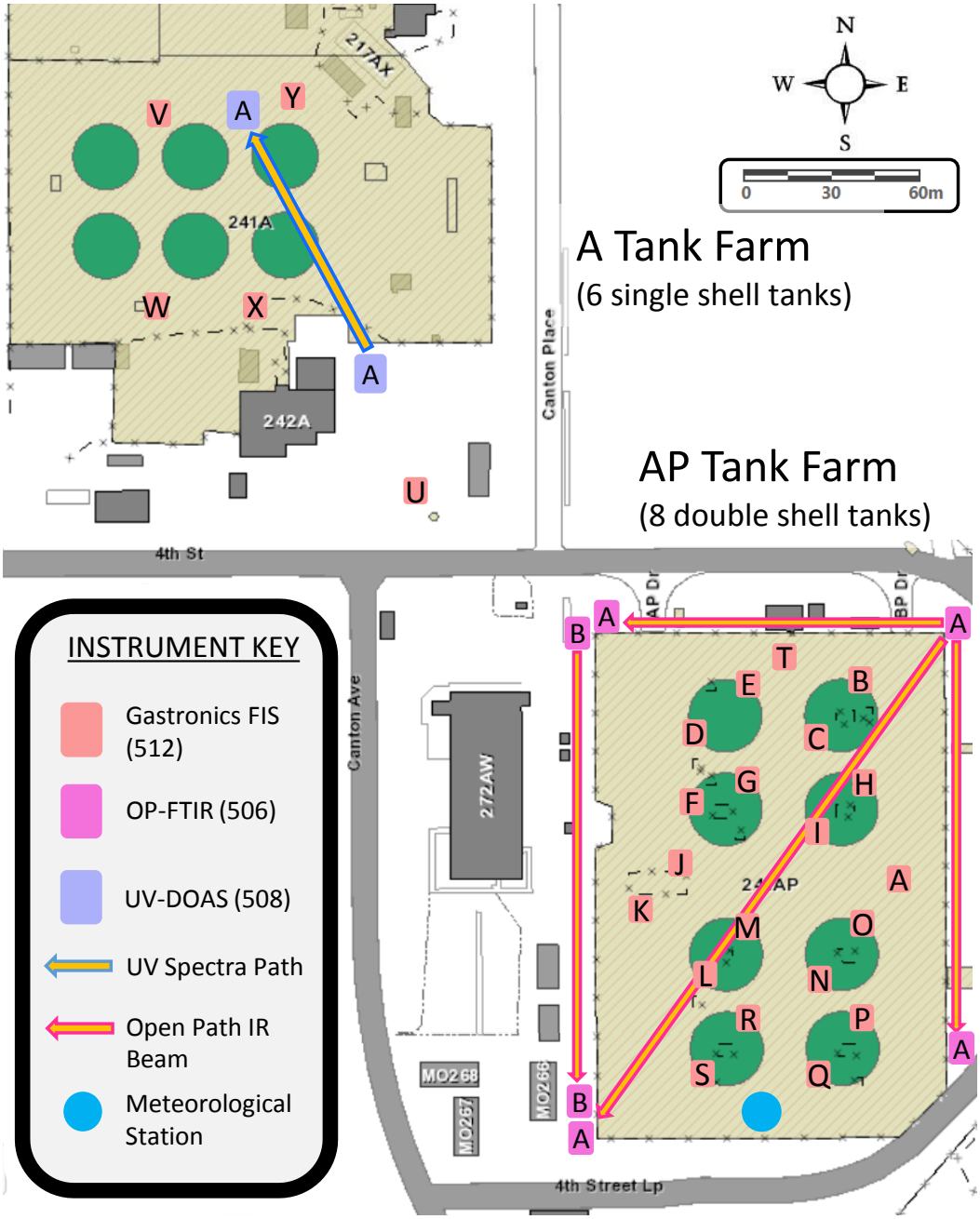
Vapor Monitoring Detection System Weekly Report - A and AP Tank Farm Field Instrument Report

Revision 0 – Initial Release of Report

2/22/2017 6:00 – 3/1/2017 6:00

Instrument/Sampling Locations –A & AP-Tank Farms



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Abbreviations and Units

CH_4	=	methane
COPC	=	chemicals of potential concern
IR	=	infrared
ND	=	not detected
NH_3	=	ammonia
NO	=	nitric oxide
N_2O	=	nitrous oxide
NO_2	=	nitrogen dioxide
OEL	=	occupational exposure limit
OP-FTIR	=	open path Fourier transform infrared spectrometer[1]
OSHA	=	Occupational Safety and Health Administration
PEL	=	permissible exposure limit
ppb	=	parts per billion
ppm	=	parts per million
UV	=	ultraviolet
UV-DOAS	=	ultraviolet differential optical absorption spectrometer[2]
VMDS	=	vapor monitoring and detection system
VOC	=	volatile organic compounds, which include both volatile and semi-volatile compounds

VMDS Instruments

506A	=	OP-FTIR Multipath
506B	=	OP-FTIR Single-path
508A	=	UV-DOAS
512	=	FIS Gastronics Direct Reading Instrument

[1] OP-FTIR Fact Sheet: http://hanfordvapors.com/wp-content/uploads/2016/10/OP-FTIR-fact-sheet.pdf
[2] UV-DOAS Quick Sheet: http://hanfordvapors.com/wp-content/uploads/2016/10/UV-DOAS-Fact-Sheet.pdf

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Introduction

This summary contains Vapor Monitoring and Detection System (VMDS) pilot-scale data collected over one week (2/22/2017 at 6:00 a.m. through 3/1/2017 at 6:00 a.m.) using direct reading vapor detection instruments, the open path Fourier transform infrared spectrometer (OP-FTIR), and the ultraviolet differential optical absorption spectrometer (UV-DOAS).

Pilot-scale testing is focused on evaluating component integration and functionality. Raw spectra (data) may need to be reprocessed and reviewed as understanding of the particular instruments being used as part of the VMDS pilot test are deployed and the company's ability to align the instruments with the overall objectives of the pilot test improves.

The spectrometer instruments—OP-FTIR and UV-DOAS—provide real-time multi-gas measurement (qualitative and quantitative) of gases. Even though the instrument is very accurate regarding the quantification of chemical compounds, reported results cannot be directly calculated into a concentration for a specific location, this is due to its sample size – an open path between two points. The sample path is defined by the location of the emitter and the reflector which may be tens to hundreds of meters apart. Therefore data from these instrument types will not be directly compared to the Occupational Exposure Limits (OELs) and Action Levels, but used to determine concentrations of compounds along the path of the instrument's beam.

For the spectrographic instruments (OP-FTIR and UV-DOAS), 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 an instrument software library (library) that specifies which absorption features are analyzed, how analysis is performed, and reporting criteria. Revisions to the library are periodically performed to improve accuracy of analysis for analytes; the optimization of the library is iterative 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 depends on the analytical method (UV or IR), the library used, analyte concentration, other chemical compounds present, and other factors. The compounds present can interfere/overlap with the analyte spectral signature, especially for compounds having the same functional groups (e.g., methyl or ketone groups). Work is ongoing to optimize the library and minimize these interferences.

The direct read instruments located within AP and A Tank Farms include the Gastronics (512) units with sensors for detecting NH_3 and VOCs.

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Summary for 2/22/2017 through 3/1/2017

The following sections summarize data reporting for vapor monitoring and detection instruments at AP and A Tank Farms for the 2/22/2017 through 3/1/2017 period. Instruments at AP Tank Farm include open path FTIR instruments (multi-path and single path) and the Gastronics direct reading instruments. A Tank Farm includes the UV-DOAS spectrographic instrument and the Gastronics direct reading instruments. No waste retrieval activities occurred during this reporting period.

AP TANK FARM

AP Tank Farm OP-FTIR Instruments

During the week in review, instrument 506A detected nitrous oxide (N_2O) and methane (CH_4). Nitrous oxide and CH_4 are typically found in the atmosphere at background levels of approximately 0.33 ppm for N_2O and 1.8 ppm for CH_4[3]. Instrument 506A did not report to the OSI PI system during most of the week due to power interruptions. During the latter part of the week, system power was restored and this instrument began reporting data to OSI PI for a few minutes during the morning of 2/28/2017 (Figure 1). Following this, the software locked up and did not report new data, but only reported the last value to the end of the reporting period. Instrument 506B did not report data to the OSI PI system during this week due to power interruption. Specific instrument information is reported in Table 1 and Figure 1 below.

[3] Climate Change Indicators: Atmospheric Concentration of Greenhouse Gases: https://www.epa.gov/climate-indicators/climate-change-indicators-atmospheric-concentrations-greenhouse-gases

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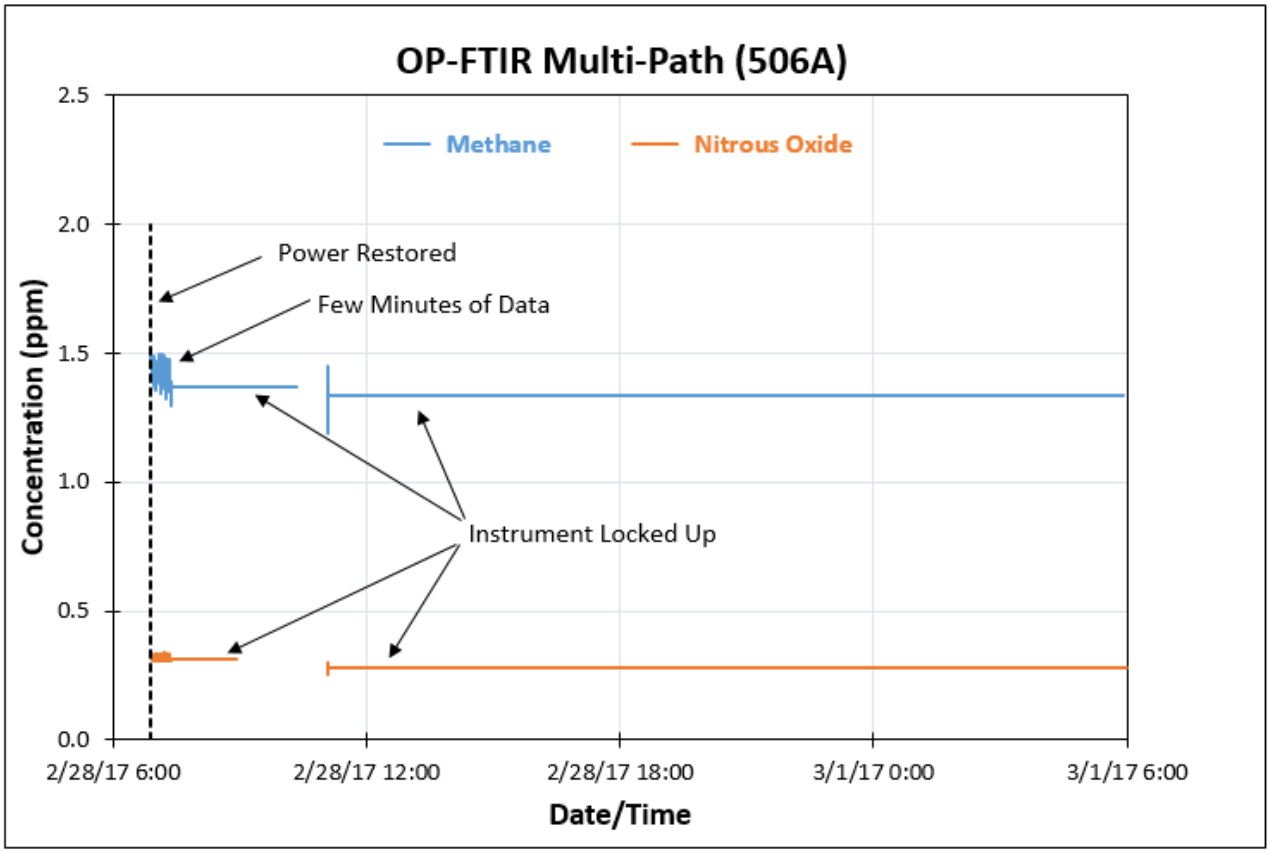
Table 1. Chemical Species Detected[a] on Open Path FTIRs at AP Tank Farm.

Chemical	506A: OP-FTIR Multi-Path (ppm)	506B: OP-FTIR Single-Path (ppm)
Nitrous Oxide*	0.30 – 0.34[b]	NR
Ammonia*	ND	NR
Methane	1.4 - 1.5[b]	NR
1-3-Butadiene*	ND	NR
1-Butanol*	ND	NR
2-Hexanone*	ND	NR
3-Buten-2-one*	ND	NR
Acetaldehyde*	ND	NR
Acetonitrile*	ND	NR
Benzene*	ND	NR
Butanal*	ND	NR
Butyl Nitrite*	ND	NR
Ethylamine*	ND	NR
Formaldehyde*	ND	NR
Furan*	ND	NR
Methanol*	ND	NR
Methyl Isocyanate*	ND	NR
Methyl Nitrite*	ND	NR
N-Nitrosodiethylamine*	ND	NR
N-Nitrosodimethylamine*	ND	NR
N-Nitrosomorpholine*	ND	NR
Propanenitrile*	ND	NR
Pyridine*	ND	NR
Tributyl Phosphate*	ND	NR

Notes: a – Based on data retrieved from OSI PI; OSI PI System is a data visualization software package from OSIsoft.
b – Reported data for only a few minutes on 2/28/2017
*Chemical is on COPC list
ND – Not detected
NR – Did not report to the OSI PI System

Figure 1. Chemical Compounds Detected by the OP-FTIR (506A) Instrument



AP Tank Farm Direct Reading Instruments

Instruments located between A and AP Tank Farm, are included.

Gastronics (512 - NH_3, VOCs, N_2O): Units located in AP Tank Farm include: 512A, B, C, D, E, F, G, H, I, J, K, L, M, N, O, P, Q, R, S, and T. Unit 512U is located between AP Tank Farm and the A Tank farm. Calibration checks were performed on instruments 512A, C, D, E, F, G, H, I, J, K, L, M, N, O, P, Q, R, T, and U during this week (2/27/2017). All of these instruments passed the checks for NH_3 except 512Q. No ammonia was detected by Gastronics instruments that were in calibration and reporting this week. Only instruments 512C, I, and N passed the calibration checks for VOC. Of the instruments that passed the calibration checks, only unit 512N reported, and VOC concentrations were below detection limit of 5 ppb (Table 2). A total VOC action limit of 2 ppm currently is prescribed by Fact Sheet EH-09-001.[4]

[4] Fact Sheet for Action Limit for Volatile Organic Compounds, Washington River Protection Solutions, Richland, Washington: \\ap014\EnvironmentalHealth\Fact Sheets\EH-09-001 Turnback value for VOCs.pdf

Table 2. AP Tank Farm Gastronics (512) Comments.

Compound (units)	Comment	OEL	Action Level	Detection Range
NH_3 (ppm)	No ammonia reported on any instrument	25	12	1 – 100
VOC (ppm)	• Out of Calibration*: 512A, D, E, F, G, H, J, K, L, M, O, P, Q, R, T, and U • Instruments that reported no VOCs detected: 512N • Instruments that reported a maximum value of <2 ppm: None • Instruments that reported maximum values ≥2 ppm: None	N/A	2	0.005 – 50.0[5]

*VOC: Only instruments reading within 10% of the calibration gas concentration during their most recent bump/calibration test are reported here.

[5] One-Page Fact Sheet for Gastronics Fixed Instrument Skid, Tank Farm Vapors Control Team, Version 1.0 2016/7/21 RBC.

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A TANK FARM

A Tank Farm UV-DOAS Instrument

Ammonia, nitric oxide (NO), and ozone (O_3) were reported by the instrument during the period under review (Table 3). These chemicals are typically found in detectable quantities in background air[6] at concentrations similar to those reported in A Tank Farm. Analyte concentrations are reported in Table 3 and Figure 1 below.

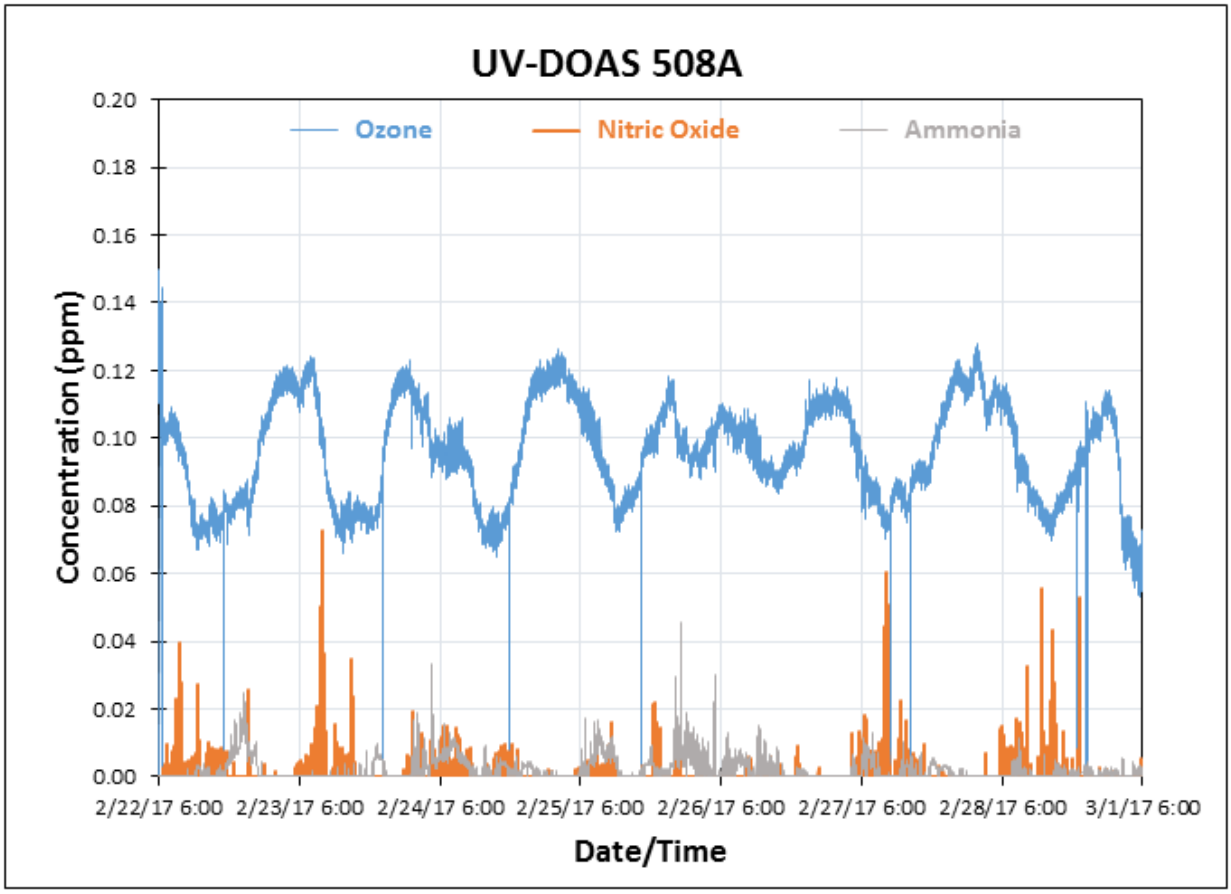
Table 3. Chemical Species Detected[a] on UV-DOAS at A Tank Farm

Chemical	508A: UV-DOAS (ppm)	Chemical	508A: UV-DOAS (ppm)
Ammonia*	ND – 0.045	Methyl Nitrite*	ND
Nitric Oxide	ND – 0.072	Pyridine*	ND
Ozone	0.053 – 0.16[b]	1-2-4 Trimethylbenzene	ND
1-3 Butadiene*	ND	1-3-5 Trimethylbenzene	ND
2-Methyl-2-butenal*	ND	Ethylbenzene	ND
2-Methylfuran*	ND	m-Xylene	ND
Acetaldehyde*	ND	Nitrogen Dioxide	ND
Benzene*	ND	o-Xylene	ND
Butanal*	ND	p-Xylene	ND
Ethylamine*	ND	Styrene	ND
Formaldehyde*	ND	Sulfur Dioxide	ND
Furan*	ND	Toluene	ND
Mercury*	ND		

Notes: a – Based on data retrieved from OSI PI; OSI PI System is a data visualization software package from OSIsoft.
b – Isolated spikes equal to zero do not follow the general trend for ozone, and therefore were not included in the table
*Chemical is on COPC list
ND – Not detected

[6] Air Composition from "The Engineering ToolBox": http://www.engineeringtoolbox.com/air-composition-d_212.html

Figure 1. Chemical Species Detected by UV-DOAS (508A).



A Tank Farm Direct Reading Instruments

Gastronics (512 - NH_3, VOCs, N_2O): Units located in A Tank Farm include: 512V, W, X, and Y (Table 4). None of these instruments reported data during the week. Calibrations were performed on 512V, W, X, and Y (2/22/2017) and all of them were within 10% of the test gas concentration for VOC. Only 512X passed VOC calibration checks performed on these instruments on 2/27/2017.

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Table 4. A Tank Farm Gastronics (512) Comments.

Compound (units)	Comment	OEL	Action Level	Detection Range
NH_3 (ppm)	No data reported on any instrument	25	12	1 – 100
VOC (ppm)	• Out of Calibration*: None (as of 2/22/2017); 512V, W, and Y (as of 2/27/2017) • No data reported.	N/A	2	0.005 – 50.0[7]

* VOC: Only instruments reading within 10% of the calibration gas concentration during their most recent bump/calibration test are reported here.

2/22/2017 – 3/1/2017 Instrument Operational Status:

Time reporting is calculated using the time sensors are reporting to OSI PI System[8] for each instrument (Tables 5 and 6).

Table 5. Gastronics Direct Reading Instruments (512) % Time Reporting[a].

Instrument	% Time Reporting	Instrument	% Time Reporting
512A	92	512N	31
512B	96	512O	90
512C	0	512P	0
512D	83	512Q	5
512E	0	512R	13
512F	79	512S	0
512G	0	512T	95
512H	85	512U	>99
512I	0	512V	0
512J	0	512W	0
512K	97	512X	0
512L	94	512Y	0
512M	88		

a) % time reporting based on NH_3.

Table 6. Spectrometer Instruments Time Reporting.

Instrument	% Time Reporting
506A	13
506B	0
508A	>99

[7] One-Page Fact Sheet for Gastronics Fixed Instrument Skid, Tank Farm Vapors Control Team, Version 1.0 2016/7/21 RBC.
[8] OSI PI System is a data visualization software package from OSIsoft.