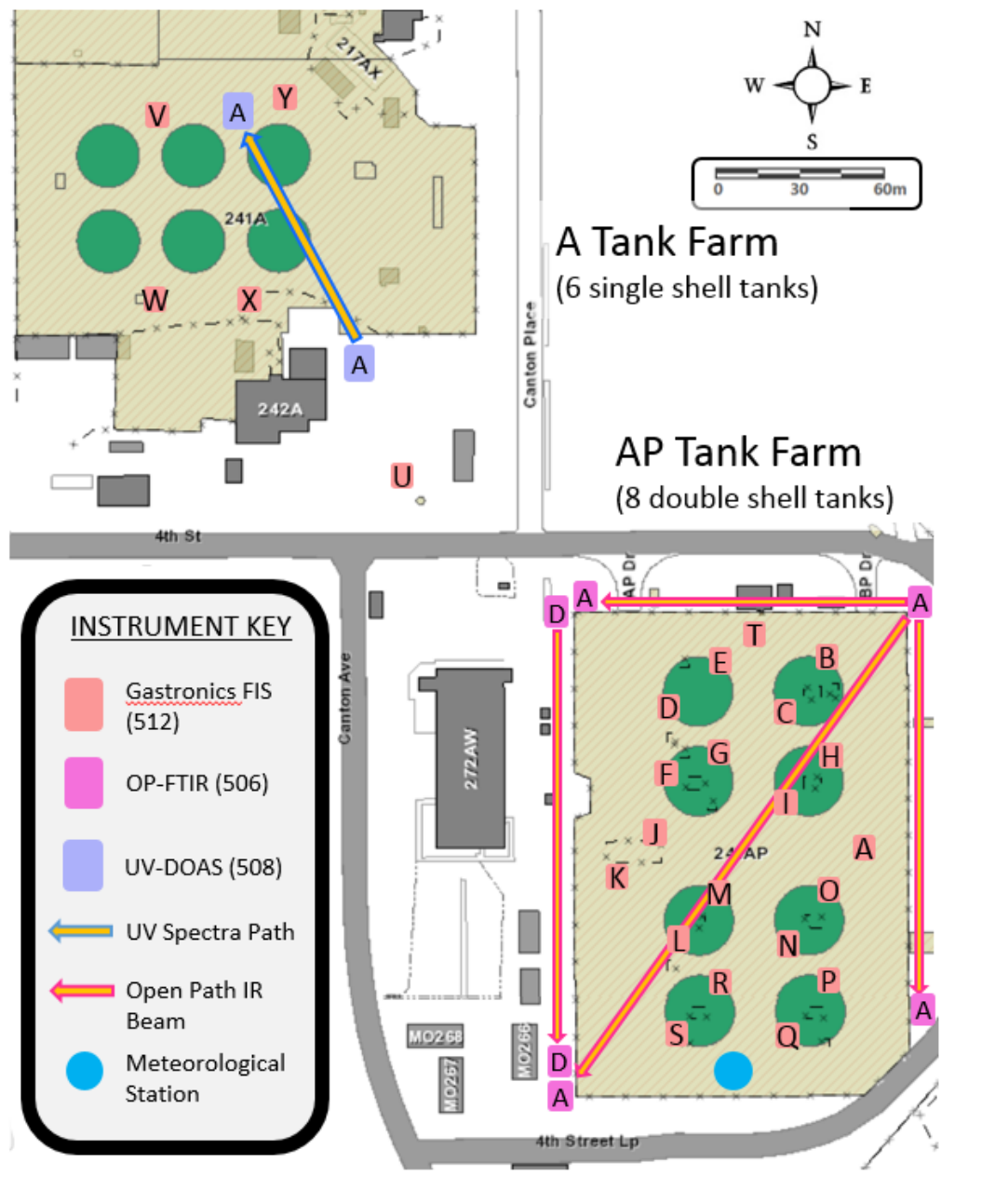


# Vapor Monitoring and Detection System Weekly Report – A and AP Tank Farm Field Instrument Report

## Revision 0 – Initial Release of Report

4/26/2017 6:00 – 5/3/2017 6:00

### Instrument/Sampling Locations – A and AP Tank Farms



# Vapor Monitoring and Detection System Weekly Report

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## **Abbreviations and Units**

CH <sub>4</sub>	=	methane
COPC	=	chemicals of potential concern
DRI	=	direct reading instrument
FIS	=	fixed instrument skid
IR	=	infrared
ND	=	not detected
NH <sub>3</sub>	=	ammonia
NO	=	nitric oxide
N <sub>2</sub> O	=	nitrous oxide
NO <sub>2</sub>	=	nitrogen dioxide
OEL	=	occupational exposure limit
OP-FTIR	=	open path Fourier transform infrared spectrometer <sup>1</sup>
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 <sup>2</sup>
VMDS	=	vapor monitoring and detection system
VOC	=	volatile organic compounds, which include both volatile and semi-volatile compounds

## **VMDS Instruments**

506A	=	OP-FTIR Multi-Path
506D	=	OP-FTIR Single-Path
508A	=	UV-DOAS
512	=	FIS Gastronics Direct Reading Instrument

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<sup>1</sup> OP-FTIR Fact Sheet: <http://hanfordvapors.com/wp-content/uploads/2016/10/OP-FTIR-fact-sheet.pdf>

<sup>2</sup> UV-DOAS Quick Sheet: <http://hanfordvapors.com/wp-content/uploads/2016/10/UV-DOAS-Fact-Sheet.pdf>

# Vapor Monitoring and Detection System Weekly Report

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## Introduction

This summary contains Vapor Monitoring and Detection System (VMDS) pilot-scale data collected over one week (4/26/2017 at 06:00 through 5/3/2017 at 06:00) 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. 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. 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 Fixed Instrument Skid (FIS) Gastronics (512) units with sensors for detecting NH<sub>3</sub> and VOCs. At times, communications between the Gastronics radio and the Wi-Fi receiver were frequently and randomly interrupted resulting in loss of the Wi-Fi signal and data drops.

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## Summary for 4/26/2017 through 5/3/2017

The following sections summarize data reporting for vapor monitoring and detection instruments at AP and A Tank Farms for the 4/26/2017 through 5/3/2017 period. Instruments at AP Tank Farm include open path FTIR instruments (multi-path and single-path) and the FIS Gastronics direct reading instruments. Instruments at A Tank Farm include a UV-DOAS spectrographic instrument and Gastronics direct reading instruments. There were no waste disturbing activities performed during this week in A or AP Tank Farms.

### AP TANK FARM

#### AP Tank Farm OP-FTIR Instruments

Instruments 506A and 506D were not in service this week due to the AP Tank farm electrical outage. No data from these instruments were reported to OSI PI<sup>3</sup> this week (Table 1).

**Table 1. Chemical Species Detected<sup>a</sup> by Open Path FTIRs at AP Tank Farm**

<b>Chemical Compound</b>	<b>506A: OP-FTIR Multi-Path (ppm)</b>	<b>506D: OP-FTIR Single-Path (ppm)</b>
Nitrous Oxide*	NR	NR
Ammonia*	NR	NR
Methane	NR	NR
1,3-Butadiene*	NR	NR
1-Butanol*	NR	NR
2-Hexanone*	NR	NR
3-Buten-2-one*	NR	NR
Acetaldehyde*	NR	NR
Acetonitrile*	NR	NR
Benzene*	NR	NR
Butanal*	NR	NR
Butyl Nitrite*	NR	NR
Ethylamine*	NR	NR
Formaldehyde*	NR	NR
Furan*	NR	NR
Methanol*	NR	NR
Methyl Isocyanate*	NR	NR
Methyl Nitrite*	NR	NR
N-Nitrosodiethylamine*	NR	NR
N-Nitrosodimethylamine*	NR	NR
N-Nitrosomorpholine*	NR	NR
Propanenitrile*	NR	NR

<sup>3</sup> OSI PI System is a data visualization software package from [OSIsoft](http://www.osisoft.com).

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Chemical Compound	506A: OP-FTIR Multi-Path (ppm)	506D: OP-FTIR Single-Path (ppm)
Pyridine*	NR	NR
Tributyl Phosphate*	NR	NR

Notes: (a) Based on data retrieved from OSI PI; OSI PI System is a data visualization software package from OSIsoft.  
\*Chemical is on Chemical of Potential Concern (COPC) list  
NR – Not reported

## **AP Tank Farm Direct Reading Instruments**

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

FIS Gastronics (512 - NH<sub>3</sub>, VOCs, N<sub>2</sub>O): 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. Bump (check) tests were performed on all 512 units this week (4/26/2017 and 4/27/2017) except 512N, O, and S, which were last checked the previous week. Of these instruments, 512H, K, N, and U passed calibration for VOC and 512B, C, D, F, G, H, I, J, K, L, N, O, Q, S, and T passed calibration for NH<sub>3</sub>. All FIS Gastronics instruments in AP Tank Farm, including instrument 512U between A and AP Tank Farms, were calibrated for VOC and NH<sub>3</sub> during the latter part of the week, 5/1/2017 to 5/2/2017. Communication of instruments to OSI PI were down due to a planned power outage in Tank Farms; power was restored at 13:00 on 5/2/2017. For the time reporting to OSI PI, no ammonia was detected by FIS Gastronics instruments that were in calibration and reporting. For 512 units that passed calibration for VOC and reported data, one 512 unit did not detect VOC, two units reported VOC at <2 ppm, and no units reported VOCs ≥2 ppm (Table 2). No VOC or NH<sub>3</sub> data were reported for unit 512N. A total VOC limit of 2 ppm currently is prescribed by Fact Sheet EH-09-001<sup>4</sup>. The N<sub>2</sub>O sensors do not hold calibration and are not reported on. Only instruments that are reporting to OSI PI and pass calibration are reported on here.

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<sup>4</sup> Fact Sheet for Action Limit for Volatile Organic Compounds, Washington River Protection Solutions, Richland, Washington: <https://hanfordvapors.com/wp-content/uploads/2017/12/EH-09-001-Turnback-value-for-VOCs.pdf>

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

Chemical Compound (units)	Comment	OEL	Action Level	Detection Range
NH <sub>3</sub> (ppm)	No ammonia detected on any instrument	25	12	1 – 100
VOC (ppm)	<ul style="list-style-type: none"> <li>Out of Calibration: 512A, B, C, D, E, F, G, I, J, L, M, O, P, Q, R, and T</li> <li>Instruments that reported no VOCs detected: 512H</li> <li>Instruments that reported a maximum value of &lt;2 ppm: 512K and U</li> <li>Instruments that reported maximum values <math>\geq 2</math> ppm: None</li> </ul>	N/A	2	0.005 – 50 <sup>5</sup>

VOC: Only instruments reading within 10% of the calibration gas concentration during their most recent bump/calibration test are reported here<sup>6</sup>.

## A TANK FARM

### A Tank Farm UV-DOAS Instrument

Ammonia and nitric oxide (NO) were detected by the UV-DOAS instrument near the end of the week (Table 3). These compounds are typically found in detectable quantities in air<sup>7</sup> in the same concentration ranges as reported here. During most of the week, the UV-DOAS instrument was down due to the AP Tank Farm electrical outage. At 13:30 on 5/2/2017, power to this instrument was restored and the instrument resumed reporting data to OSI PI. Analyte concentrations are reported in Table 3 and Figure 1 below.

**Table 3. Chemical Species Detected<sup>a</sup> by UV-DOAS at A Tank Farm**

Chemical Compound	508A: UV-DOAS (ppm)	Chemical Compound	508A: UV-DOAS (ppm)
Ammonia*	ND – 0.043	Methyl Nitrite*	ND
Nitric Oxide	ND – 0.058	Pyridine*	ND
1,3-Butadiene*	ND	1,2,4-Trimethylbenzene	ND
2-Methyl-2-butenal*	ND	1,3,5-Trimethylbenzene	ND
2-Methylfuran*	ND	Ethylbenzene	ND
Acetaldehyde*	ND	m-Xylene	ND

<sup>5</sup> One-Page Fact Sheet for Gastronics Fixed Instrument Skid, Tank Farm Vapors Control Team, Version 1.0 2016/7/21 RBC: <https://hanfordvapors.com/wp-content/uploads/2016/11/Gastronics-FIS-Fact-Sheet.pdf>

<sup>6</sup> Calibrating and Testing Direct-Reading Portable Gas Monitors: <https://www.osha.gov/dts/shib/shib093013.html>

<sup>7</sup> Air Composition from "The Engineering ToolBox": [http://www.engineeringtoolbox.com/air-composition-d\\_212.html](http://www.engineeringtoolbox.com/air-composition-d_212.html)

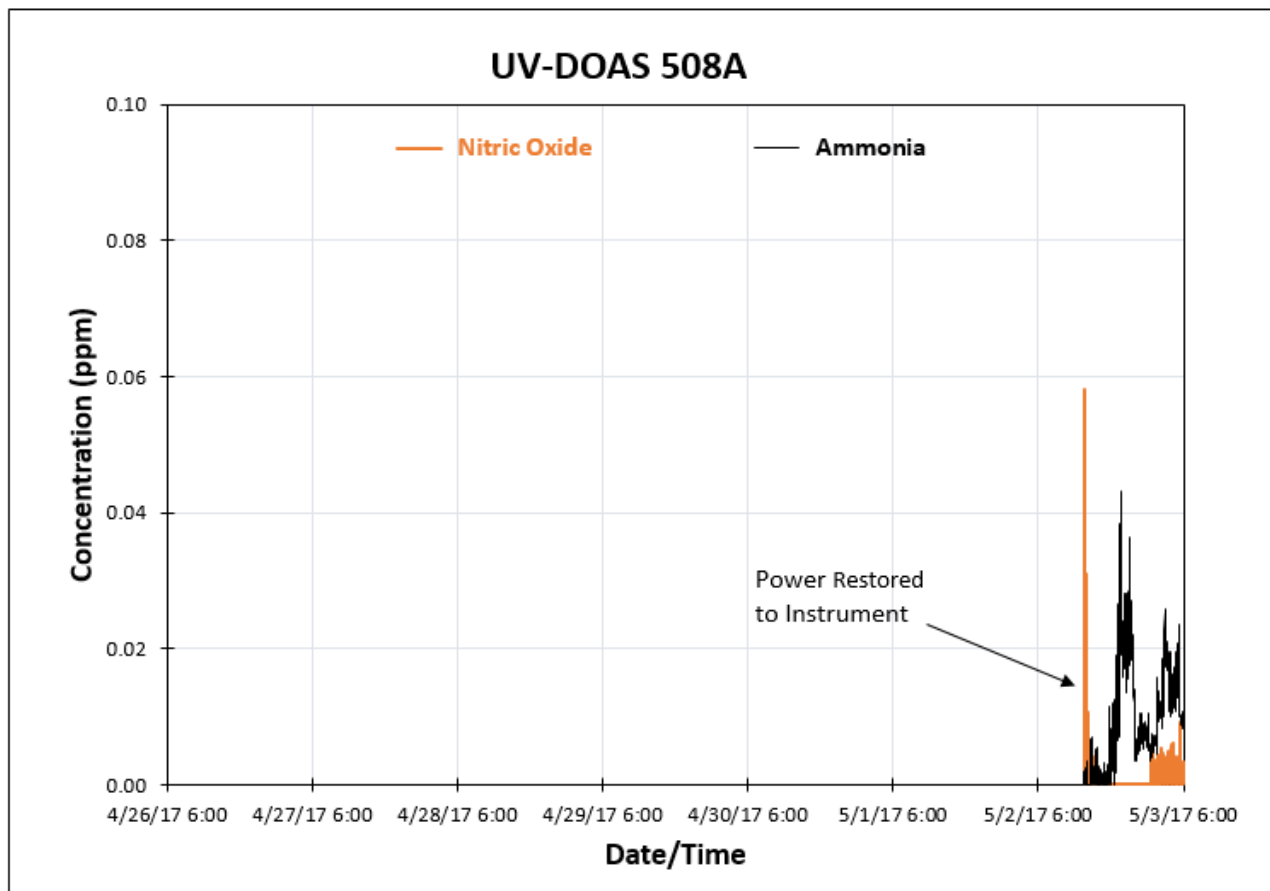
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**Table 3. Chemical Species Detected<sup>a</sup> by UV-DOAS at A Tank Farm**

Chemical Compound	508A: UV-DOAS (ppm)	Chemical Compound	508A: UV-DOAS (ppm)
Benzene*	ND	Nitrogen Dioxide	ND
Butanal*	ND	o-Xylene	ND
Ethylamine*	ND	p-Xylene	ND
Formaldehyde*	ND	Styrene	ND
Furan*	ND	Sulfur Dioxide	ND
Mercury*	ND	Toluene	ND

Notes: (a) Based on data retrieved from OSI PI; OSI PI System is a data visualization software package from OSIsoft.  
 \*Chemical is on COPC list  
 ND – Not detected



**Figure 1. Chemical Compounds Detected by UV-DOAS Instrument 508A**

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## A Tank Farm Direct Reading Instruments

FIS Gastronics (512 - NH<sub>3</sub>, VOCs, N<sub>2</sub>O): Units located in A Tank Farm include: 512V, W, X, and Y. None of these instruments reported data during the week. All of these instruments were bump tested and calibrated this week (4/27/2017 and 5/2/2017, respectively). None of the units passed calibration for VOC and 512W, X, and Y passed calibration for NH<sub>3</sub>.

### **4/26/2017 – 5/3/2017 Instrument Operational Status:**

Time reporting is calculated using the time sensors that report to OSI PI System for each instrument (Tables 4 and 5). For the reasons discussed earlier, none of the FIS Gastronics and spectrometer instruments reported more than 10% of the time this week.

**Table 4. Gastronics Direct Reading Instruments (512) % Time Reporting<sup>a</sup>**

Instrument	% Time Reporting	Instrument	% Time Reporting
512A	9	512N	0
512B	9	512O	0
512C	10	512P	4
512D	9	512Q	0
512E	0	512R	5
512F	<1	512S	0
512G	0	512T	0
512H	10	512U	9
512I	10	512V	0
512J	0	512W	0
512K	10	512X	0
512L	10	512Y	0
512M	0		

(a) % time reporting based on NH<sub>3</sub>.

**Table 5. Spectrometer Instruments Time Reporting**

Instrument	% Time Reporting
506A	0
506D	0
508A	10