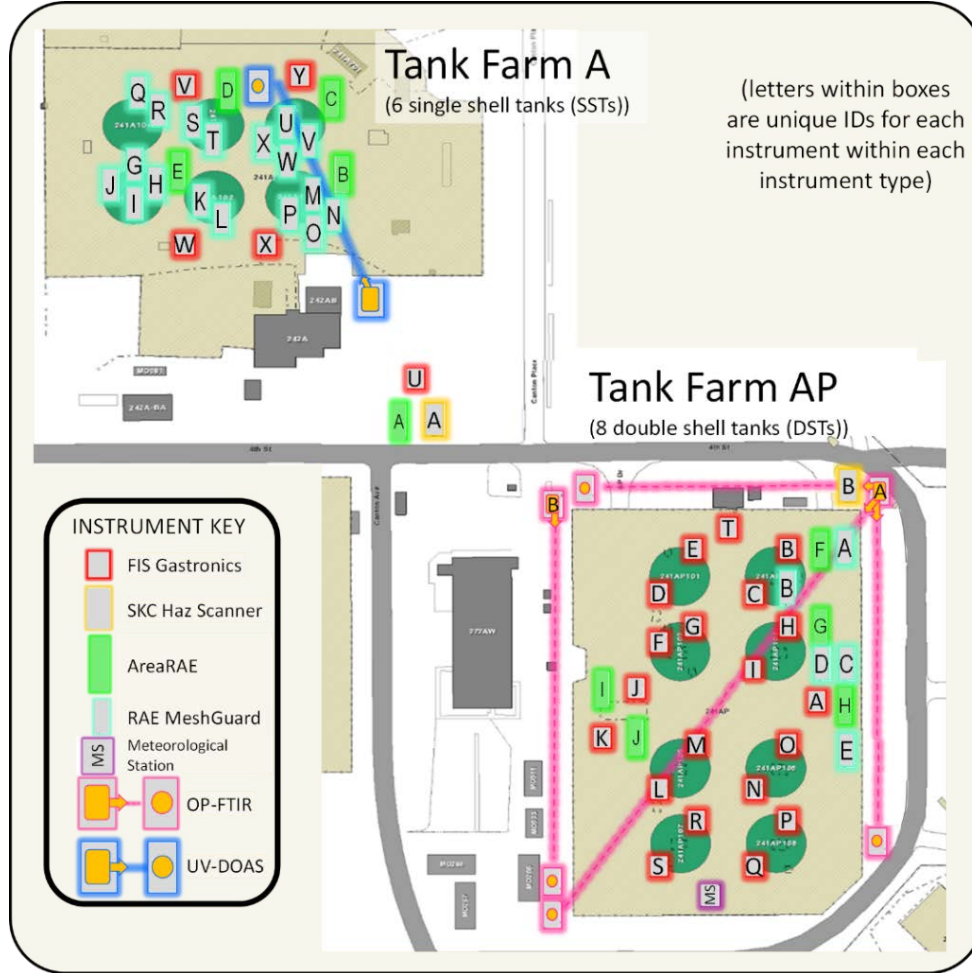


UV-DOAS Weekly Summary

01/11/17 6:00 – 01/18/17 6:00



The following information is for the time period from January 11th at 6:00 a.m. through January 18th at 6:00 a.m. This summary contains Vapor Monitoring and Detection System (VMDS) pilot-scale data collected over one week for the ultraviolet differential optical absorption spectrometer (UV-DOAS). Pilot-scale testing is focused on evaluating component integration and functionality. Data shown may include results from calibration and bump tests performed to verify sensors function. These tests result in data spikes.

- Abbreviations:
- NH₃ = ammonia
 - ND = not detected
 - NO = nitric oxide
 - O₂ = oxygen
 - O₃ = ozone
 - OEL = Occupational Exposure Limit
 - PEL = Permissible Exposure Limit
 - R² = R-squared
 - UV-DOAS = Ultraviolet Differential Optical Absorption Spectrometer
 - VMDS = Vapor Monitoring and Detection System

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Weekly Summary: Even though the instrument is very accurate regarding the quantification of compounds, reported results cannot be directly calculated into a concentration for a specific location. This is because the sample encompasses 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, discussion for these instrument types will not be with regards to Operational Exposure Limits (OELs) and Action Levels.

Each analyte has a specific predetermined UV trace which represents the model for that chemical. The detection and reporting of that chemical is based on evaluation of the R-squared (R^2) values (coefficient of determination) calculated by comparing the detection trace to the model trace for that chemical. R^2 is a statistical value representing the “percent of variance explained” by evaluating the detected trace with the model trace, or an estimate of how well the two traces match. R^2 values range from 0 to 1 with higher values indicating a better fit. R^2 values for UV-DOAS data are dependent on sample concentration, chemical compounds [chemicals present can interfere/overlap with each other at key locations; typically those having the same functional groups (e.g., methane or ketone groups)], and many other factors. Typically the trigger used for reporting is an R^2 value of greater than or equal to 0.5; some compounds may have different trigger levels based on optimization of the analysis method using AP and A Tank Farm data.

The UV-DOAS spectrometer provides real-time multi-gas measurement (qualification and quantification) of gases¹. During the period under review ammonia (NH_3), nitric oxide (NO), ozone (O_3), and toluene (MeC_6H_6) were reported by the instrument. Many of these are typically found in detectable quantities in background air². The toluene peaks generally range from 0.015 to 0.018 ppm (see Figure 1). Toluene has a permissible exposure limit (PEL) of 200 ppm³ and has an ambient concentration in air of approximately 0.003 ppm⁴ in urban areas of the United States. No other chemicals were detected during this monitoring period.

Waste retrieval operations resumed on 1/12/2017 at 11:12 pm and sluicing operations were performed continuously for approximately 12 hours until the system was shut down on 1/13/2017. Operations were shut down due to low temperature measured in a waste transfer pit. Retrieval operations were restarted on 1/14/2017 at 10:36 pm and continued intermittently until 1/15/2017 at 5:10 am, when operations were shut down for a few hours because the material balance exceeded the allowable level. Sluicing operations resumed on 1/15/2017 at 9:42 am and ran

¹ UV-DOAS Quick Sheet: <http://hanfordvapors.com/wp-content/uploads/2016/10/UV-DOAS-Fact-Sheet.pdf>

² Air Composition from “The Engineering ToolBox”: http://www.engineeringtoolbox.com/air-composition-d_212.html

³ OSHA: https://www.osha.gov/SLTC/toluene/exposure_limits.html

⁴ EPA: <https://www.epa.gov/sites/production/files/2016-09/documents/toluene.pdf>

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continuously until the system was intentionally shut down on 1/16/2017 at 3:17 am. No anomalies in response to the waste retrieval activities were observed this week with the UV-DOAS instrument.

January 11th – January 18th 2017 Instrument Notes:

Table 1. Chemical Species Detected on UV-DOAS at A Tank Farm.

Chemical	508A: UV-DOAS	Chemical	508A: UV-DOAS
Ammonia*	ND – 0.025 ppm	Methyl Nitrite*	ND
Nitric Oxide	ND – 0.042 ppm	Pyridine*	ND
Ozone	0.063 – 0.146 ppm ^a	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 – 0.018 ppm
Mercury*	ND		

Notes: *Chemical is on COPC list

ND – Not detected by instrument (either 0 was reported or the R² value was <0.5)

(a) Isolated spikes to zero do not follow the general trend, therefore are not included in the table

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Figure 1. Concentrations of Chemicals Detected by UV-DOAS (508A).

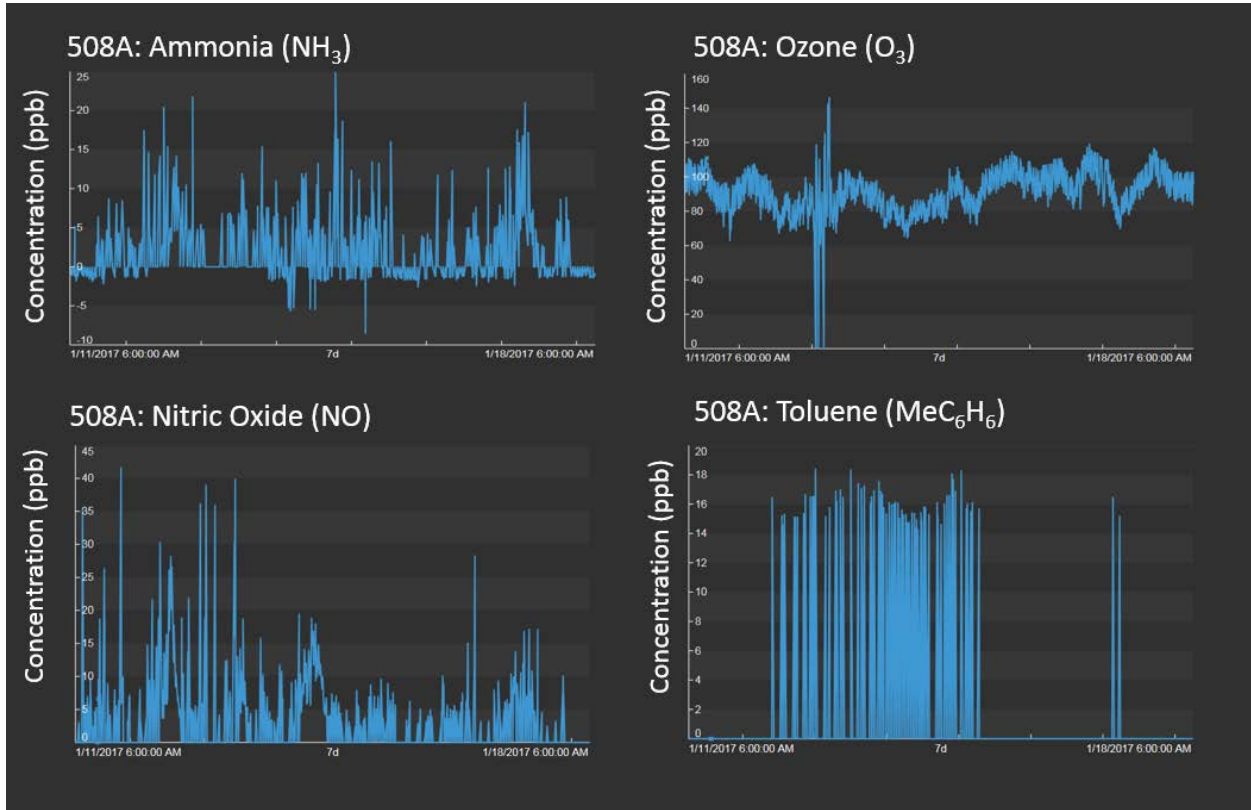


Table 2. UV-DOAS Instrument Time Reporting^a.

Instrument	Comments
508A	The instrument was reporting >99% of the time.

Notes: % time reporting is based on review of OSI PI System⁵ data.

⁵ OSI PI System is a data visualization software package from [OSIsoft](#).