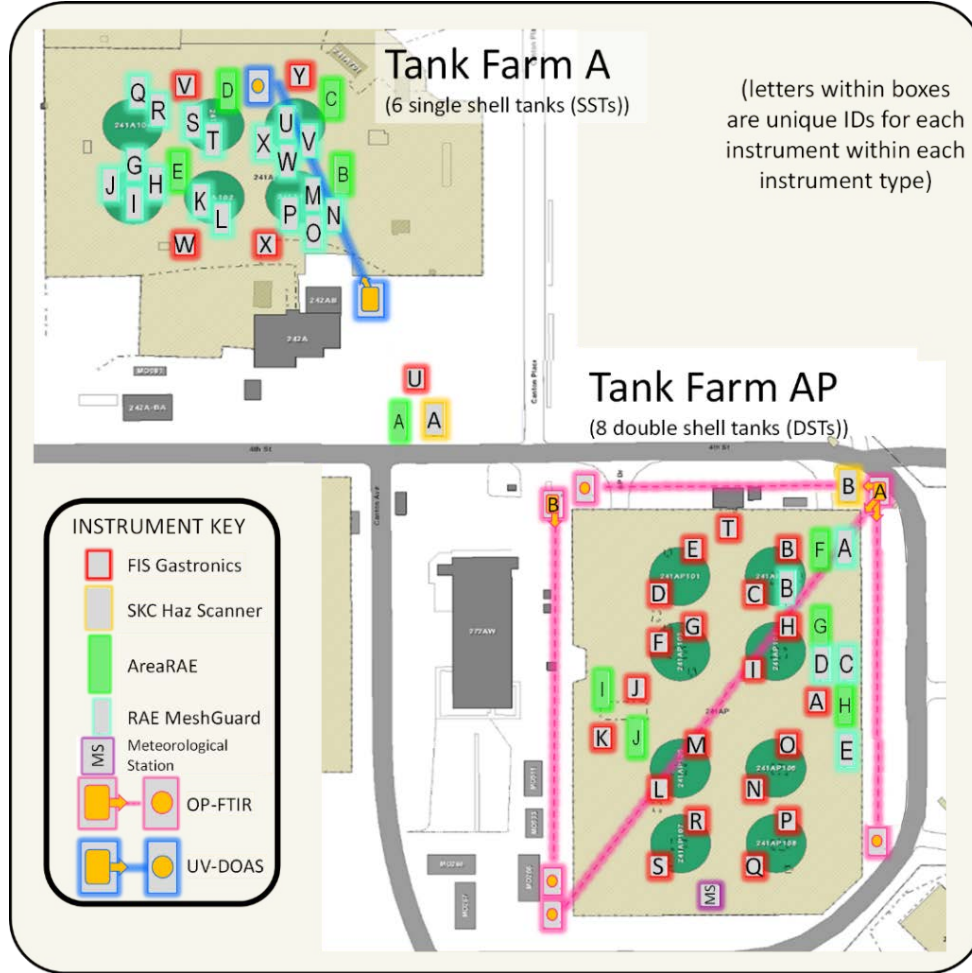


UV-DOAS Weekly Summary

12/14/16 6:00 – 12/21/16 6:00



The following information is for the time period from December 14th at 6:00 a.m. through December 21st 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

UV-DOAS Weekly Summary

12/14/16 6:00 – 12/21/16 6:00

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 threshold used for reporting is an R^2 value of greater than or equal to 0.5; some compounds may have different reporting thresholds 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. While sampling during the period under review ammonia (NH_3), nitric oxide (NO), ozone (O_3), toluene, ethylbenzene, and p-xylene were reported by the instrument. Many of these are typically found in detectable quantities in air². Toluene has a permissible exposure limit (PEL) of 200 ppm³ and is in ambient air concentrations in urban areas of the United States at approximately 0.003 ppm⁴. Ethylbenzene and p-xylene were only reported during periods when negative concentration spikes were reported for ammonia, and values reported for them are suspect. The PEL for ethylbenzene⁵ and p-xylene⁶ are 20 ppm and 100 ppm respectively.

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>

⁵ OSHA: https://www.osha.gov/dts/chemicalsampling/data/CH_240000.html

⁶ OSHA: https://www.osha.gov/dts/chemicalsampling/data/CH_276400.html

UV-DOAS Weekly Summary

12/14/16 6:00 – 12/21/16 6:00

December 14th – December 21st 2016 Instrument Notes:

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

Chemical	508A: UV-DOAS	Chemical	508A: UV-DOAS
Ammonia*	ND – 0.028 ppm	Methyl Nitrite*	ND
Nitric Oxide	ND – 0.056 ppm	Pyridine*	ND
Ozone	ND – 0.126 ppm	1-2-4 Trimethylbenzene	ND
1-3 Butadiene*	ND	1-3-5 Trimethylbenzene	ND
2-Methyl-2-butenal*	ND	Ethylbenzene	ND – 0.107 ppm
2-Methylfuran*	ND	m-Xylene	ND
Acetaldehyde*	ND	Nitrogen Dioxide	ND
Benzene*	ND	o-Xylene	ND
Butanal*	ND	p-Xylene	ND – 0.032 ppm
Ethylamine*	ND	Styrene	ND
Formaldehyde*	ND	Sulfur Dioxide	ND
Furan*	ND	Toluene	ND – 0.019 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)

UV-DOAS Weekly Summary

12/14/16 6:00 – 12/21/16 6:00

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

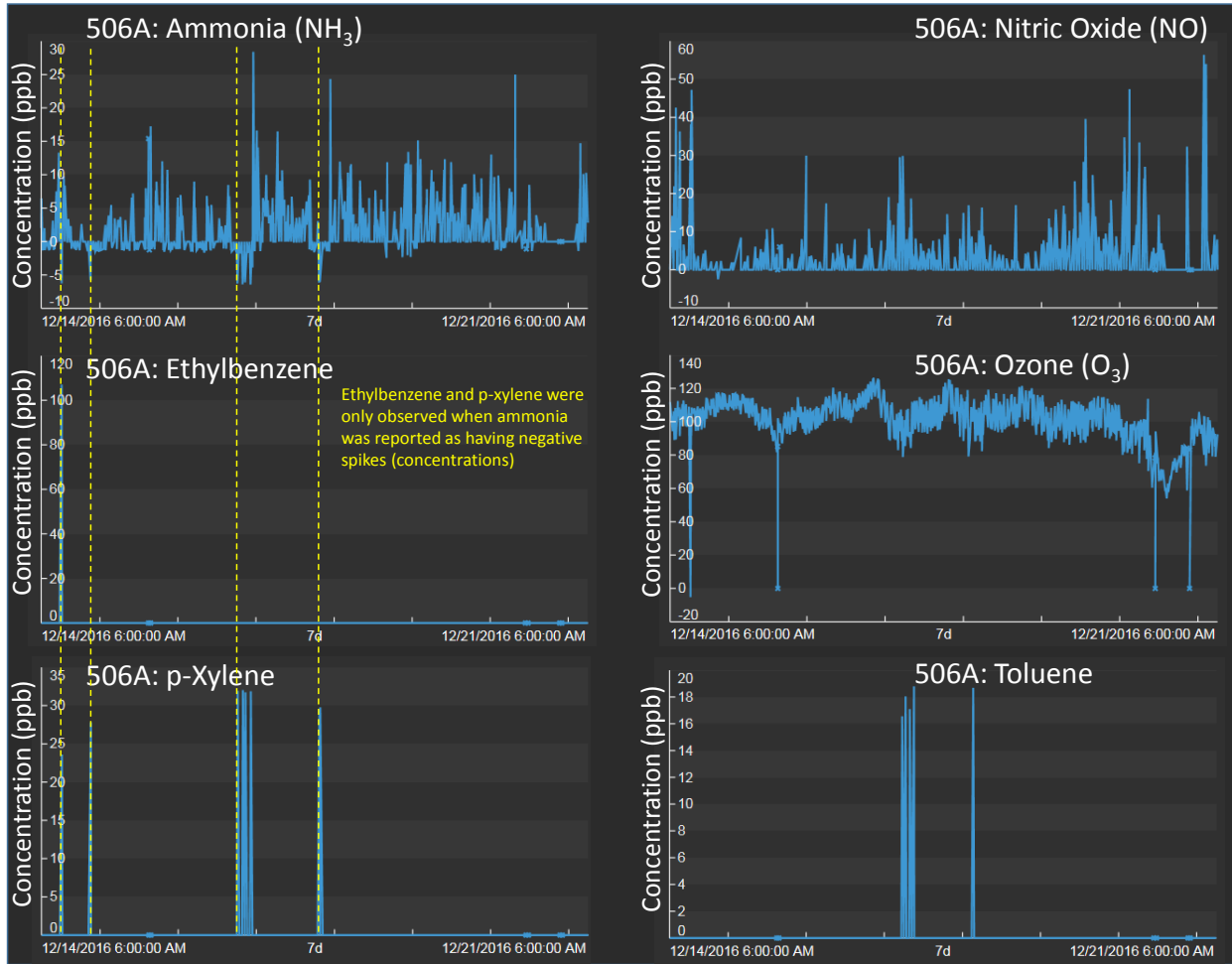


Table 2. UV-DOAS Instrument Time Reporting^a.

Instrument	Comments
508A	The instrument was reporting 100% of the time.

Notes: % time reporting is based on review of OSI PI System⁷ data.

⁷ OSI PI System is a data visualization software package from [OSIsoft](http://www.osisoft.com).