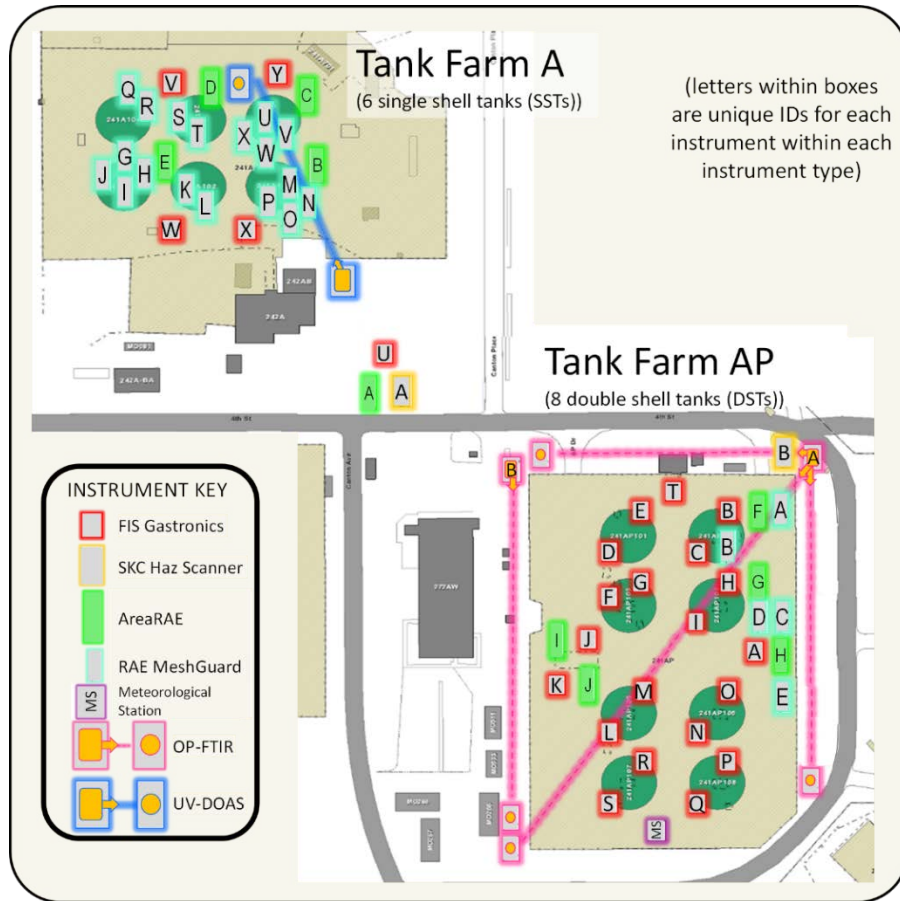


UV-DOAS Weekly Summary

10/12/16 6:00 – 10/19/16 6:00



The following information is for the time period from October 12th at 6:00 a.m. through October 19th 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 10s to 100s of meters apart. Therefore data from these instrument types will not be directly compared to Occupational Exposure Limits (OELs) and Action Levels, but used to determine concentrations of compounds along the path of the instrument's beam.

Each analyte has a specific predetermined ultraviolet (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. Results presented here are for compounds having an R^2 value of greater than or equal to 0.5.

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), oxygen (O_2), ozone (O_3), toluene and p-xylene were detected by the sensor. 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. P-xylene has a PEL of 100 ppm⁵ and is in ambient air concentrations (as mixed xylenes) in urban areas of the United States range from 0.001 to 0.088 ppm⁶. No events of particular interest were noted.

¹ UV-DOAS Quick Sheet: http://hanfordvapors.com/wp-content/uploads/2016/09/Cerex_Sentry_MS_Brochure.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_276400.html

⁶ EPA: <https://www.epa.gov/sites/production/files/2016-09/documents/xylenes.pdf>

UV-DOAS Weekly Summary

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October 12th – October 19th 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 – 0.023 ppm	Methyl Nitrite*	ND
Nitric Oxide	ND – 0.042 ppm	Pyridine*	ND
Ozone	ND – 0.043 ppm	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 – 0.007 ppm
Ethylamine*	ND	Styrene	ND
Formaldehyde*	ND	Sulfur Dioxide	ND
Furan*	ND	Toluene	ND – 0.013 ppm
Mercury*	ND		

*Chemical is on COPC list

Notes:

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

UV-DOAS Weekly Summary

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

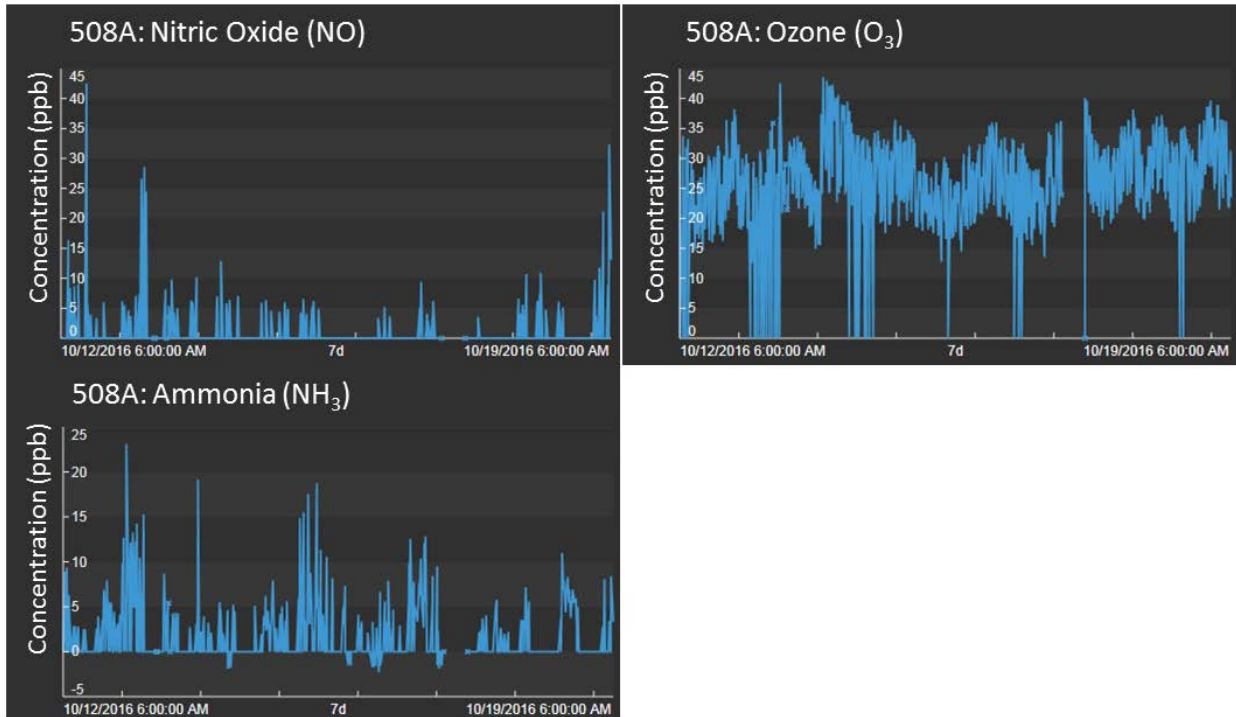
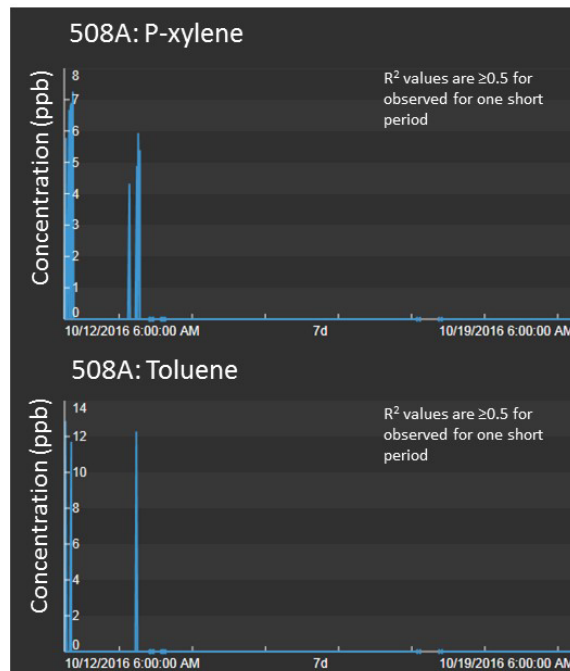


Figure 2. Concentrations of Chemicals Detected by UV-DOAS (508A).



UV-DOAS Weekly Summary

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

Instrument	Comments
508A	The instrument was reporting 95% of the time.

Notes: % down is based on review of OSI PI⁷ graph.

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