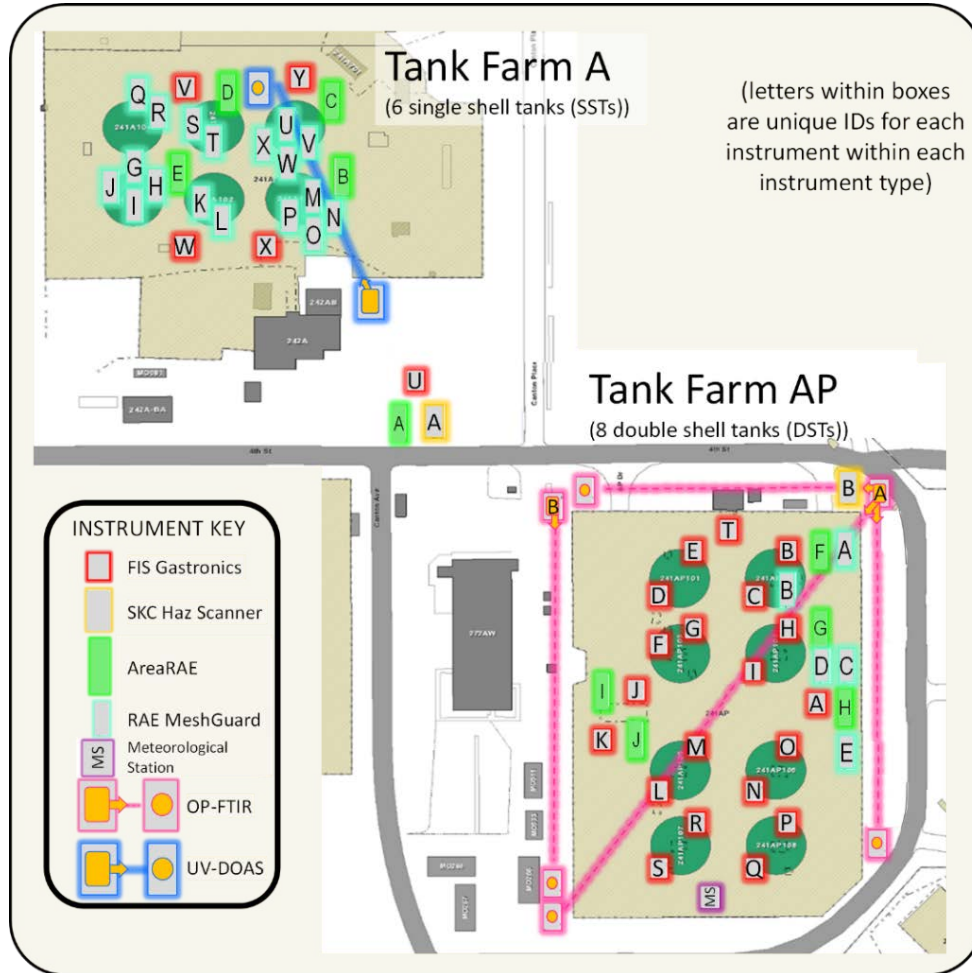


# UV-DOAS Weekly Summary

01/04/17 6:00 – 01/11/17 6:00



The following information is for the time period from January 4<sup>th</sup> at 6:00 a.m. through January 11<sup>th</sup> 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:
- NH<sub>3</sub> = ammonia
  - ND = not detected
  - NO = nitric oxide
  - O<sub>2</sub> = oxygen
  - O<sub>3</sub> = ozone
  - OEL = Occupational Exposure Limit
  - PEL = Permissible Exposure Limit
  - R<sup>2</sup> = 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 accurate regarding the quantification of compounds, reported results cannot be directly calculated into a concentration for a specific location because the sample represents 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 Occupational Safety and Health Administration (OSHA) Occupational Exposure Limits (OELs) and Action Levels, but used to determine concentrations of compounds along the path of the instrument's beam.

Each analyte configured for detection by the UV-DOAS 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 gases<sup>1</sup>. During the period under review, ammonia ( $\text{NH}_3$ ), nitric oxide (NO), ozone ( $\text{O}_3$ ), and toluene were reported and detected by the instrument. Many of these compounds are typically found in detectable quantities in background air<sup>2</sup>. Toluene was detected several times at levels below 0.02 ppm (Figure 1). It has a permissible exposure limit (PEL) of 200 ppm<sup>3</sup>. Toluene in ambient air is approximately 0.003 ppm<sup>4</sup> in urban areas of the United States. No other chemicals except oxygen were detected during this monitoring period.

Waste retrieval activities resumed on 1/6/2017 at 9:30 pm. Sluicing operations were performed for approximately 2 hours before operations shut down because temperature of a waste transfer pit fell below the required minimum temperature. Retrieval operations were not performed much of the week due to adverse winter

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

<sup>2</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)

<sup>3</sup> OSHA: [https://www.osha.gov/SLTC/toluene/exposure\\_limits.html](https://www.osha.gov/SLTC/toluene/exposure_limits.html)

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

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weather. Retrieval operations did not restart until the early morning of 1/11/2017, when the supernate and slurry pumps operated between 2:00 am and 4:30 am. No anomalies in response to the waste retrieval activities were observed this week with the UV-DOAS instrument.

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## January 4<sup>th</sup> – January 11<sup>th</sup> 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 – 0.028 ppm                 | Methyl Nitrite*           | ND             |
| Nitric Oxide        | ND – 0.089 ppm                 | Pyridine*                 | ND             |
| Ozone               | 0.066 – 0.129 ppm <sup>a</sup> | 1-2-4<br>Trimethylbenzene | ND             |
| 1-3 Butadiene*      | ND                             | 1-3-5<br>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 – 0.017 ppm |
| Mercury*            | ND                             |                           |                |

Notes: \*Chemical is on COPC list

ND – Not detected by instrument (either 0 was reported or the R<sup>2</sup> 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).

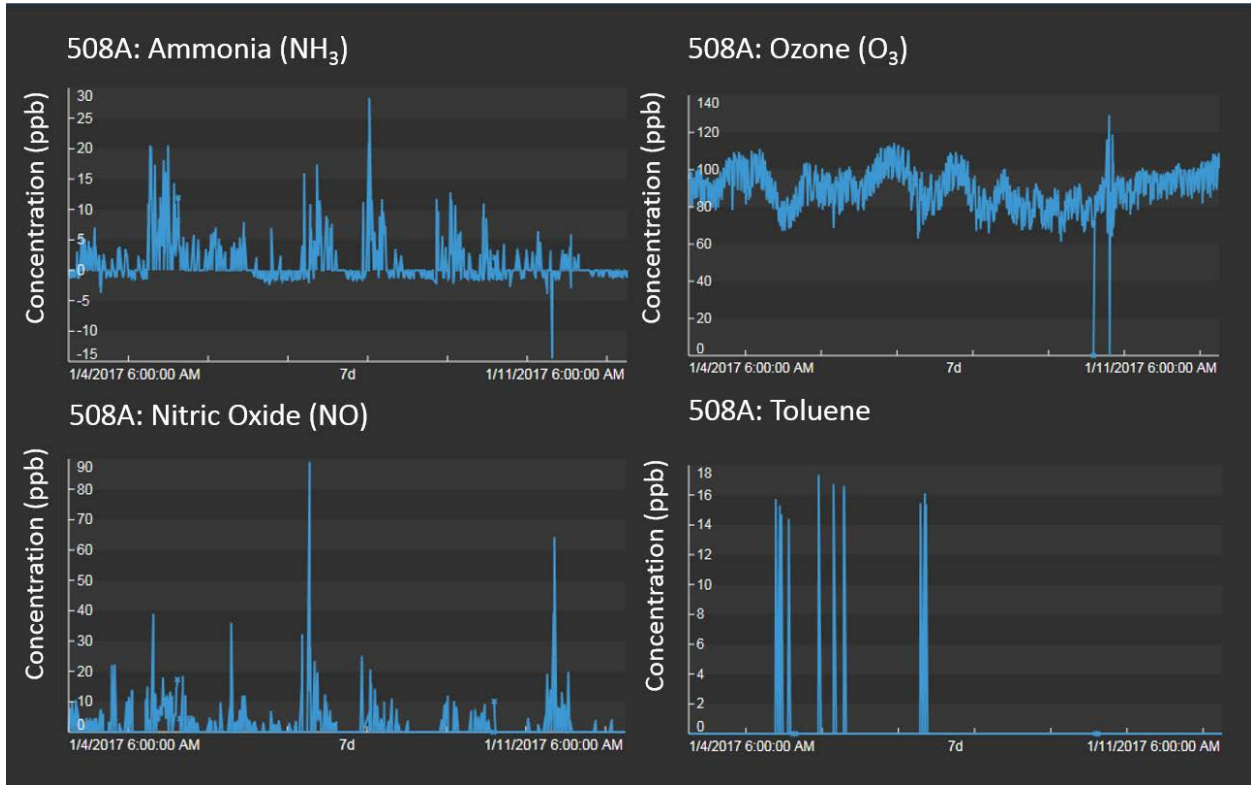


Table 2. UV-DOAS Instrument Time Reporting<sup>a</sup>.

| Instrument | Comments  |
|------------|---|
| 508A       | The instrument was reporting 100% of the time during this week. |

Notes: % time reporting is based on review of OSI PI System<sup>5</sup> data.

<sup>5</sup> OSI PI System is a data visualization software package from [OSIsoft](http://www.osisoft.com).