Vapor Monitoring Detection System Weekly Report – AP Tank Farm Stack Monitoring

Revision 0: Initial Release of Report

12/28/2016 6:00 – 1/4/2017
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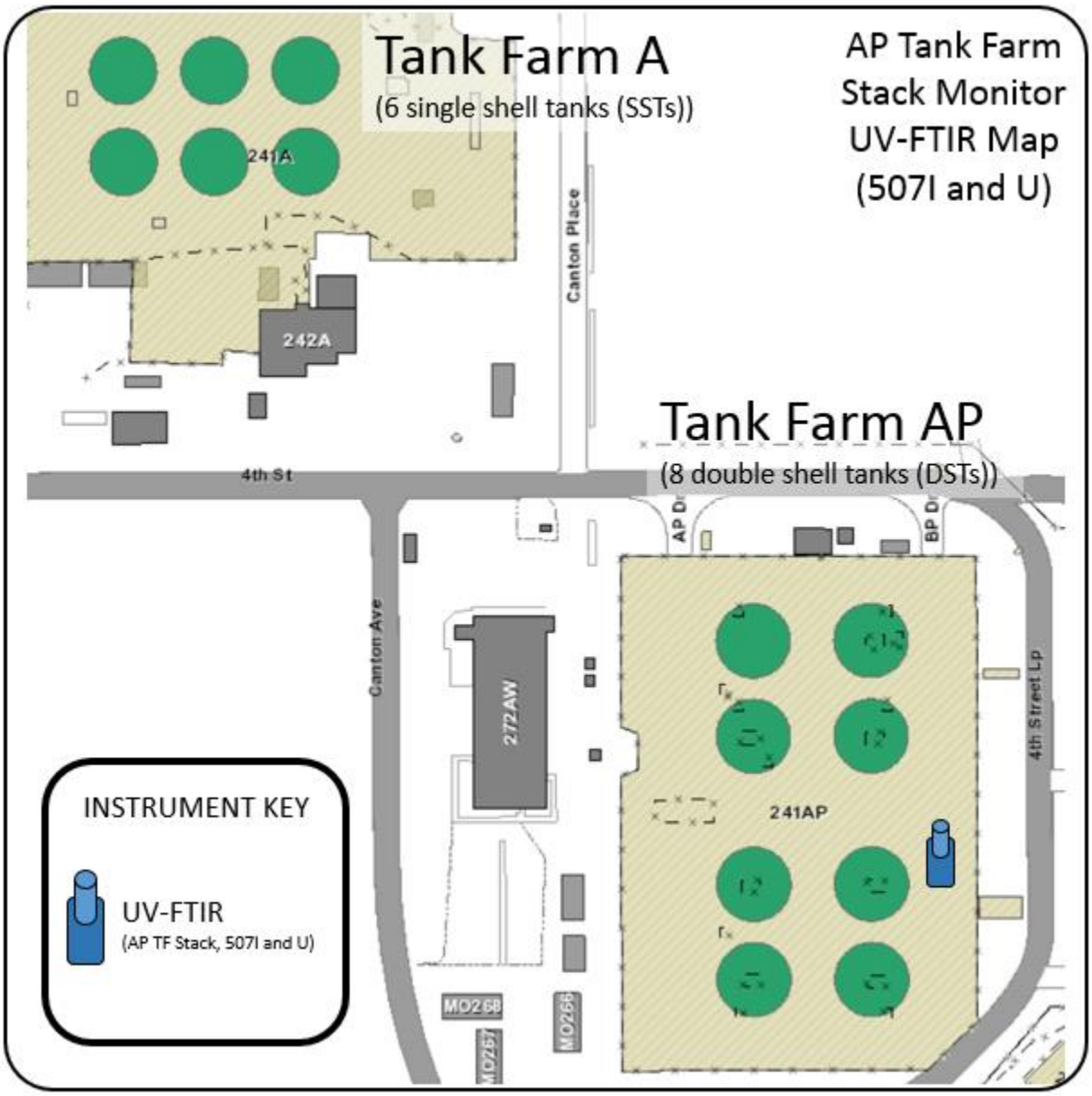
AP-Tank Farm Stack Monitor (north is up)



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Abbreviations and Units

CH_4	=	methane
CO	=	carbon monoxide
CO_2	=	carbon dioxide
COPC	=	chemicals of potential concern
IDMS	=	Integrated Document Management System
FTIR	=	Fourier transform infrared spectrometer
IR	=	infrared
ND	=	not detected
NH_3	=	ammonia
NO	=	nitric oxide
N_2O	=	nitrous oxide
NO_2	=	nitrogen dioxide
O_3	=	ozone
OEL	=	occupational exposure limit
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
UV-FTIR	=	ultraviolet - Fourier transform infrared (representing both analytical elements of the instrument, the UV and IR modules)
VMDS	=	vapor monitoring detection system

VMDS Instruments

507	=	ultraviolet - Fourier transform infrared (UV-FTIR) AP Farm Stack
507I	=	FTIR AP Farm Stack
507U	=	UV-DOAS AP Farm Stack

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Introduction

This summary contains Vapor Monitoring and Detection System (VMDS) pilot-scale data collected over one week (12/28/2016 at 6:00 a.m. through 1/4/2017 at 6:00 a.m.) using the AP-Farm stack monitor[1]. This instrument is a dual channel FTIR/UV-DOAS spectrometer that provides real-time multi-gas measurement (qualitative and quantitative) of gases. The concentrations detected for the 507I (FTIR) and 507U (UV-DOAS) shall be reported separately. The implementation method for this instrument allows for very accurate identification and quantification of compounds found in the AP-Farm exhauster stack.

Chemical compounds found in the stack are not representative of what is found in the work environment, so their concentrations are not reviewed against Occupational Exposure Limits (OELs) or other limits implemented in work environments. This review focuses on chemicals present, patterns, and observations during waste disturbing activities.

Pilot-scale testing is focused on evaluating component integration and functionality. Data shown may include results for calibration and calibration check (bump test) 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.

For the stack monitor, 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.

[1] AP-Farm Stack Monitor Fact Sheet: https://hanfordvapors.com/wp-content/uploads/2016/11/UV-FTIR-Fact-Sheet.pdf

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12/28/2016 through 1/4/2017 Summary

There were several waste disturbing activities performed during the reporting period, which supported the retrieval of waste from tank AY-102 to tank AP-102. The waste disturbing activities included three supernate pump starts and stops. The first supernate pump start and stop was at 20:00 on 12/28/2016 and 03:16 on 12/29/2016, respectively. The second supernate pump start and stop was at 20:15 on 12/29/2016 and 03:03 12/31/2016, respectively. The final supernate pump start during the reporting period was at 14:44 on 12/31/2016 and was stopped at 16:28 on 12/31/2016. Figure 1 shows the concentrations of ammonia detected by the FTIR 507I in the AP Farm stack during the reporting period, as well as the time intervals when data were not collected (software or reporting was locked on the last reported value). Figure 2 shows the concentrations of nitrous oxide detected in the AP Farm stack during the reporting period. Figures 1 and 2 also show when there were communication issues starting at about 06:00 until about 14:20 on 12/29/2016 and when the instrument software locked up and did not report new data. Table 1 shows that ammonia concentrations ranged from 35 to 59 ppm (507I and 507U), and nitrous oxide concentrations ranged from 2.7 to 3.9 ppm (507I). The ammonia and nitrous oxide are typical ranges observed when no waste disturbing activities have occurred. Figure 3 shows ammonia concentrations measured with the UV-DOAS, 507U, during the reporting period. Table 1 also shows the concentrations detected for mercury were from non-detect to 0.000075 ppm and for m-xylene were from non-detect to 0.093 ppm. Figure 4 shows mercury concentrations measured with the UV-DOAS during the reporting period. Figure 5 shows m-xylene concentrations measured with the UV-DOAS during the reporting period. Figures 3, 4 and 5 show the period of time when communication issues affected the collection of data. Table 2 shows the reporting time of the stack monitors. The FTIR 507I monitored for >99% and the UV-DOAS 507U monitored for >99% of the reporting period.

The collection of 507U data for this reporting week preceded library changes performed on 3/8/2017, so data were reprocessed to determine if compounds were correctly detected by the instrument. The reprocessed data with the optimized library eliminates false-positive readings of compounds that showed as detections and reported in OSI PI[2]. The data were reprocessed and the output data can be obtained from Integrated Document Management System (IDMS).

[2] OSI PI System is a data visualization software package from OSIsoft.

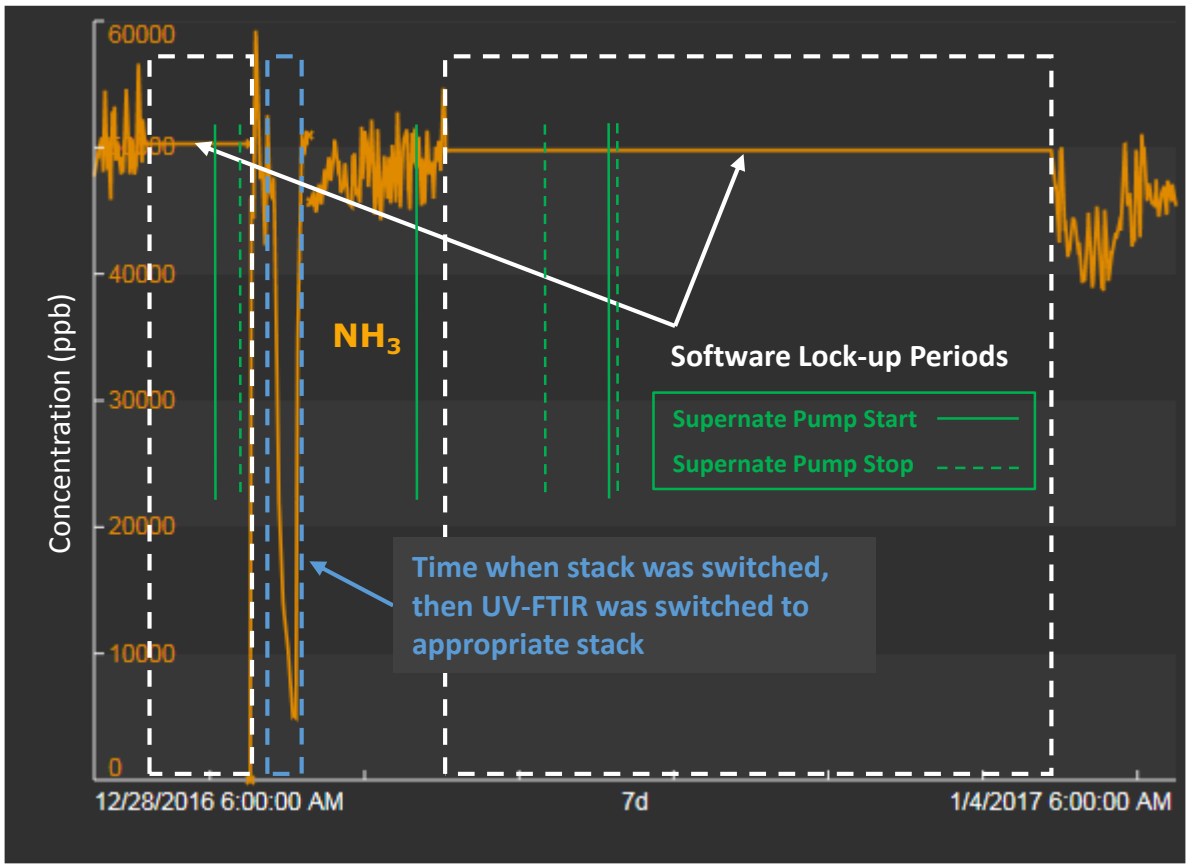

Figure 1. FTIR (507I) NH_3 Data recorded from AP Farm Exhauster (Note that concentration units are ppb)

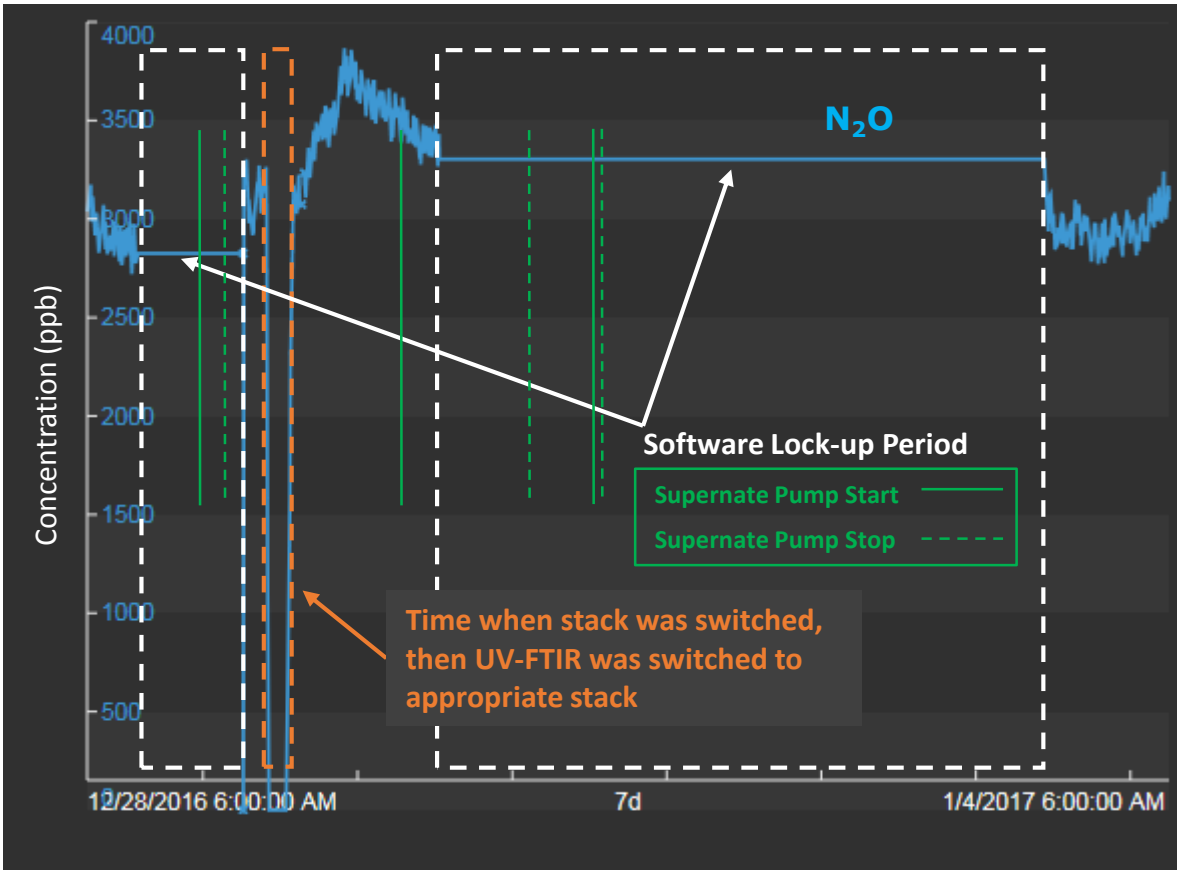

Figure 2. FTIR (507I) N_2O Data recorded from AP Farm Exhauster (Note that concentration units are ppb)

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Table 1. Chemical Species Detected[a] in the AP Tank Farm Stack by Method[c]

Chemical	507I[c] FTIR (ppm)	Chemical	507U[b] UV-DOAS (ppm)
Ammonia*	40- 59	Ammonia*	35 - 57
Nitrous Oxide*	2.7 – 3.9	Nitric Oxide	ND
Methane	ND	1,3-Butadiene*	ND
1,3-Butadiene*	ND	2-Methyl-2-butenal*	ND
1-Butanol*	ND	2-Methylfuran*	ND
2-Hexanone*	ND	Acetaldehyde*	ND
3-Buten-2-one*	ND	Benzene*	ND
Acetaldehyde*	ND	Butanal*	ND
Acetonitrile*	ND	Ethylamine*	ND
Benzene*	ND	Formaldehyde*	ND
Butanal*	ND	Furan*	ND
Butyl Nitrite*	ND	Mercury*	ND – 0.000075
Ethylamine*	ND	Methyl Nitrite*	ND
Formaldehyde*	ND	Pyridine*	ND
Furan*	ND	1,2,4 Trimethylbenzene	ND
Methanol*	ND	1,3,5 Trimethylbenzene	ND
Methyl Isocyanate*	ND	Ethylbenzene	ND
Methyl Nitrite*	ND	m-Xylene	ND – 0.093
N-Nitrosodiethylamine*	ND	Nitrogen Dioxide	ND
N-Nitrosodimethylamine*	ND	o-Xylene	ND
N-Nitrosomorpholine*	ND	p-Xylene	ND
Propanenitrile*	ND	Styrene	ND
Pyridine*	ND	Sulfur dioxide	ND
Tributyl Phosphate*	ND	Toluene	ND

Notes: a) Based on data retrieved from OSI PI; OSI PI System is a data visualization software package from OSIsoft.
b) Chemical concentration data was reprocessed to eliminate false-positive data
c) The low concentration readings from the UV-DOAS 507U did not include the low readings taken during the time when there was a potential sampling error.
* Chemical is on COPC list
ND – Not detected

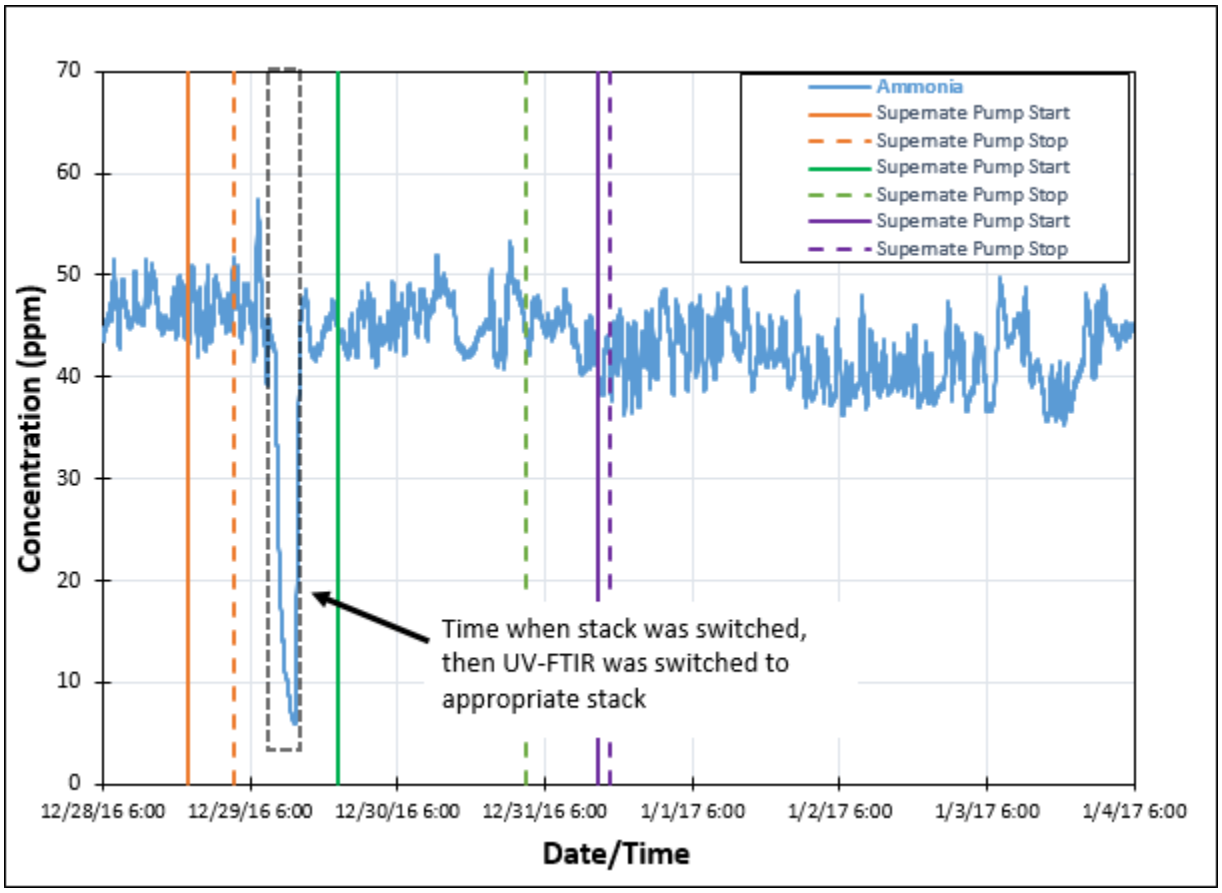

Figure 3. 507U Ammonia Data Review.
(Note that concentration units are ppm)

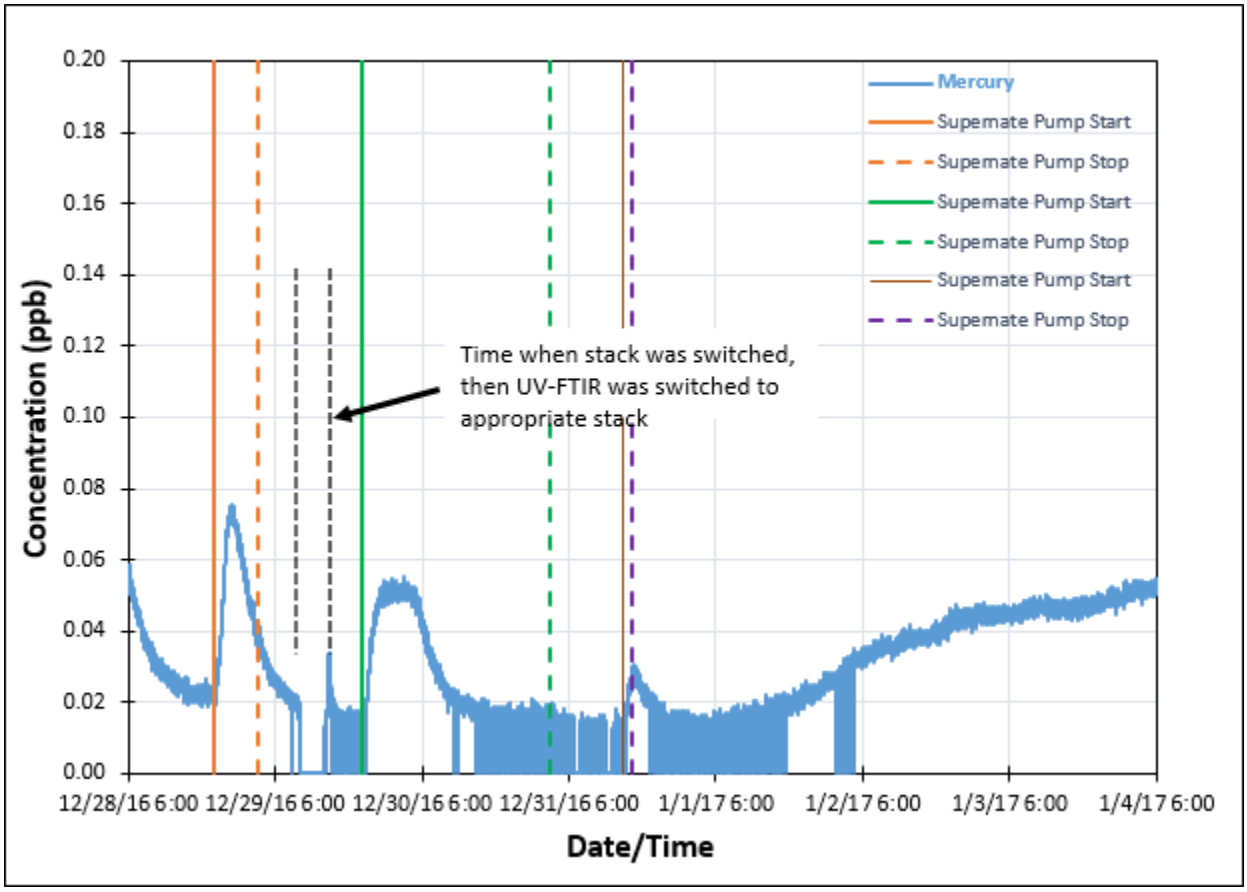

Figure 4. 507U Mercury Data Review.
(Note that concentration units are ppb)

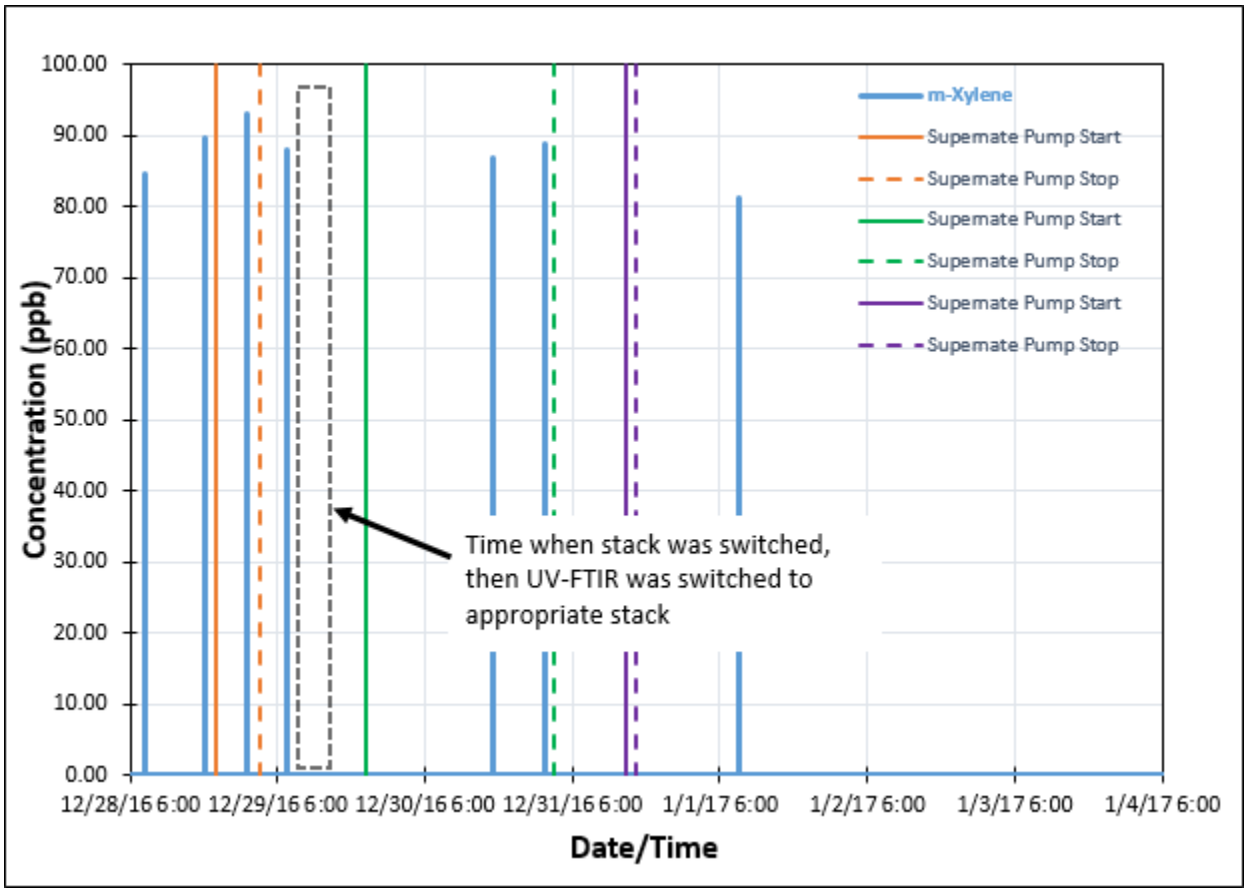

Figure 5. 507U m-Xylene Data Review.
(Note that concentration units are ppb)

Table 2. Stack Monitor Time Reporting.

Instrument	% Time Reporting
507I	>99%
507U	>99%

Notes: % time reporting is based on data reported to OSI PI System[3]

[3] OSI PI System is a data visualization software package from OSIsoft.