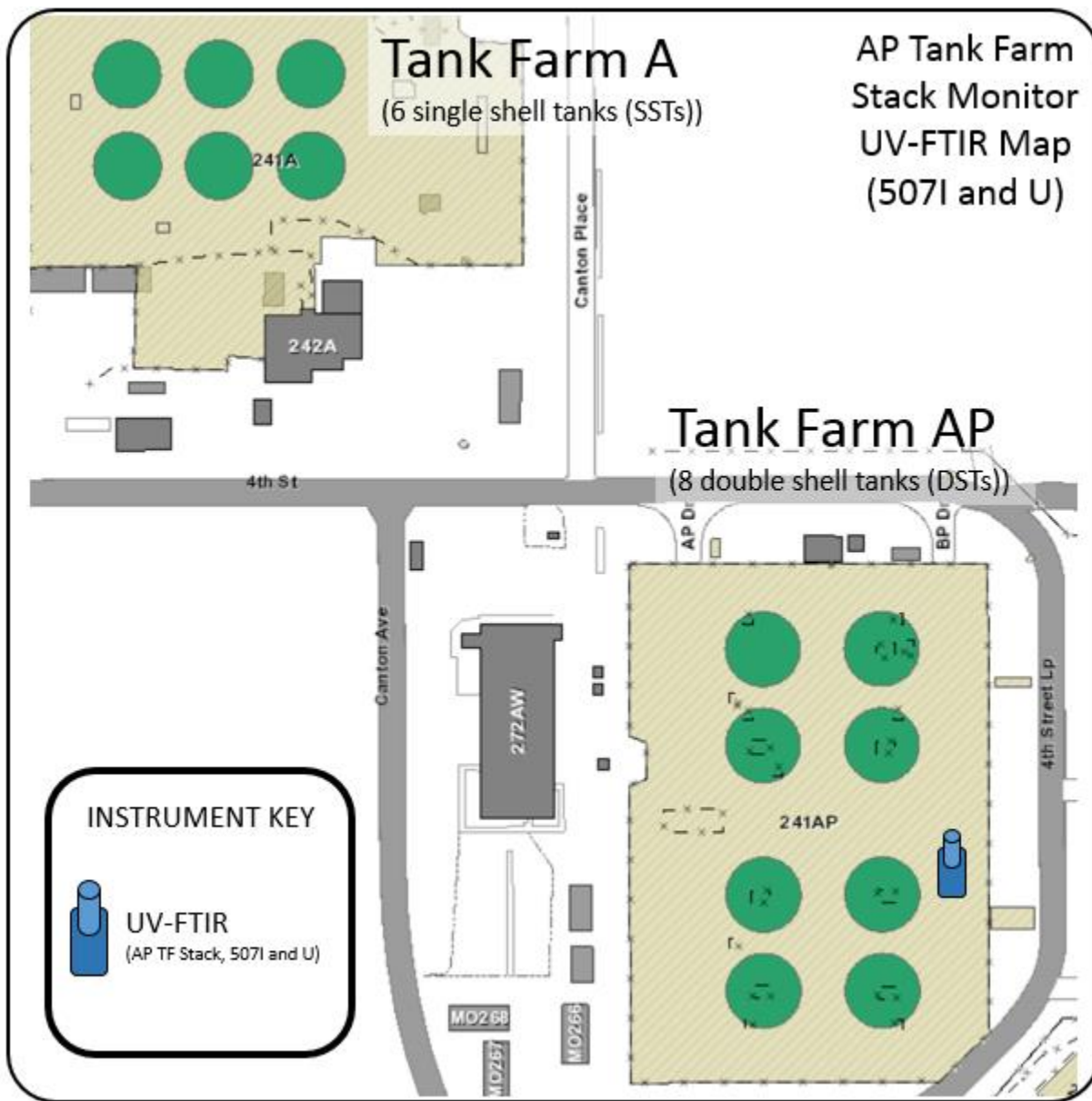


Vapor Monitoring Detection System Weekly Report – AP Tank Farm Stack Monitoring

Revision 0: Initial Release of Report

3/22/2017 6:00 – 3/29/2017 6:00

AP-Tank Farm Stack Monitor (north is up)



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Abbreviations and Units

CH ₄	=	methane
COPC	=	chemicals of potential concern
FTIR	=	Fourier transform infrared spectrometer
IDMS	=	Integrated Document Management System
IR	=	infrared
ND	=	not detected
NH ₃	=	ammonia
NO	=	nitric oxide
N ₂ O	=	nitrous oxide
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 (3/22/2017 at 6:00 a.m. through 3/29/2017 at 6:00 a.m.) using the AP-Farm stack monitor¹. 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 exhaust 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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3/22/2017 through 3/29/2017 Summary

There were no retrieval or waste disturbing activities during the reporting period. The FTIR, 507I, data were collected from the beginning of the reporting period until about 02:45 on 3/28/2017. The FTIR reported constant values, or stale data, after this time. Stale data is a communication issue, likely the result of an instrument being offline (e.g., a computer crash), or a network outage (previously we have flagged this data as due to instrument software locking up).

The UV-DOAS, 507U, data were collected during the entire reporting period. Table 1 shows that ammonia concentrations detected by the 507I ranged from 59 to 72 ppm and 507U from 58 to 71 ppm, nitrous oxide concentrations ranged from 2.8 to 4.0 ppm, and mercury ranged from 0.11 to 0.13 ppb. Figures 1 and 2 show the 507I concentrations of ammonia and nitrous oxide detected, respectively, in the AP Farm stack during the reporting period – as well as the time when data reported by OSI PI² for 507I was stale. Ammonia and mercury concentrations from 507U are shown in Figures 3 and 4 respectively. The ammonia, nitrous oxide, and mercury concentrations reported by both stack monitors during this reporting period are typical ranges observed when no waste disturbing activities have occurred.

Table 2 shows the reporting time of the stack monitors. The FTIR 507I monitored for 84% and the UV-DOAS 507U monitored for 100% of the reporting period. 507I data are considered invalid due to instrument error (reported constant values) starting at 02:45 on 3/28/2017.

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

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Table 1. Chemical Species Detected^a in the AP Tank Farm Stack by Method

Chemical	507I ^b FTIR (ppm)	Chemical	507U UV-DOAS (ppm)
Ammonia*	59 - 72	Ammonia*	58 - 71
Nitrous Oxide*	2.8 - 4.0	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*	0.00011 – 0.00013
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
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.

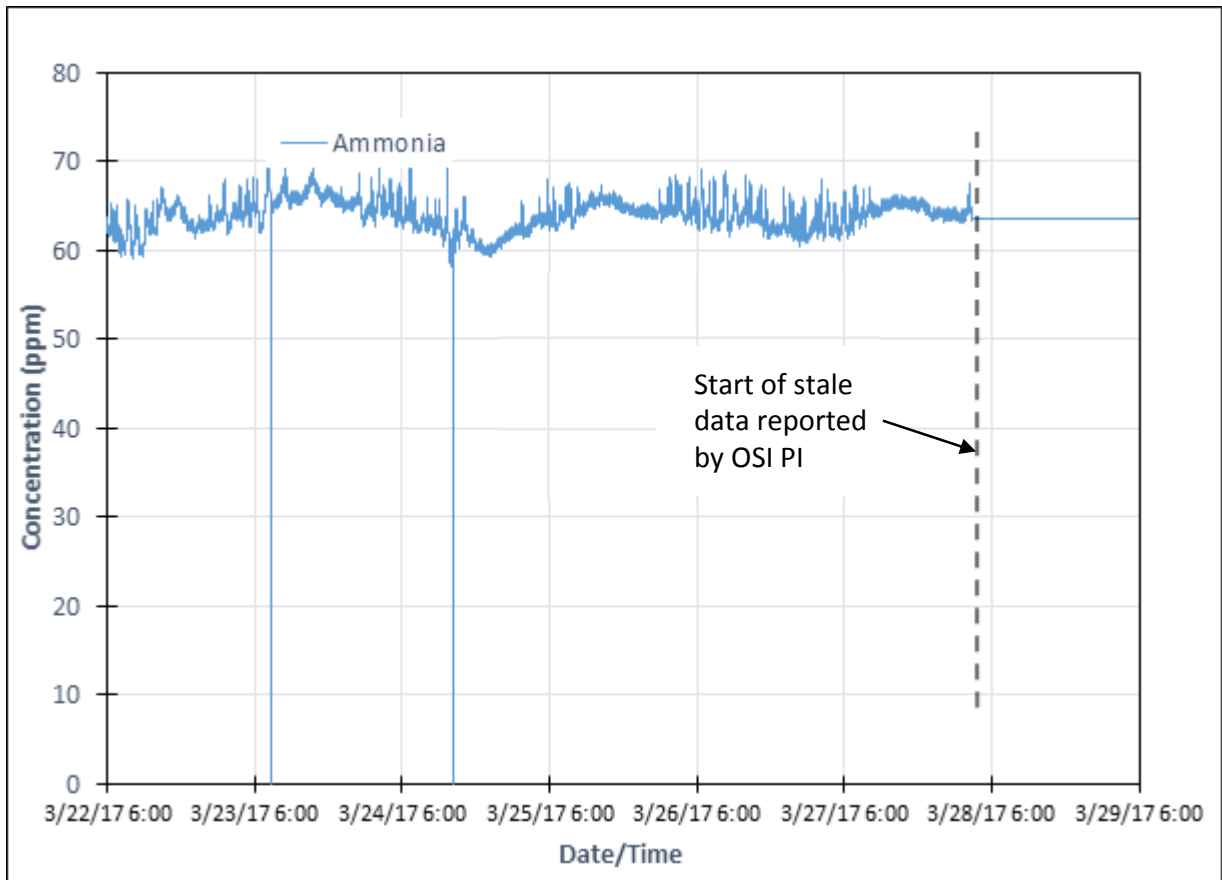
b) Reported data considered to be invalid due to instrument error (reported constant value) from 02:45 on 3/28/2017 to the end of the reporting period.

* Chemical is on COPC list

ND – Not detected

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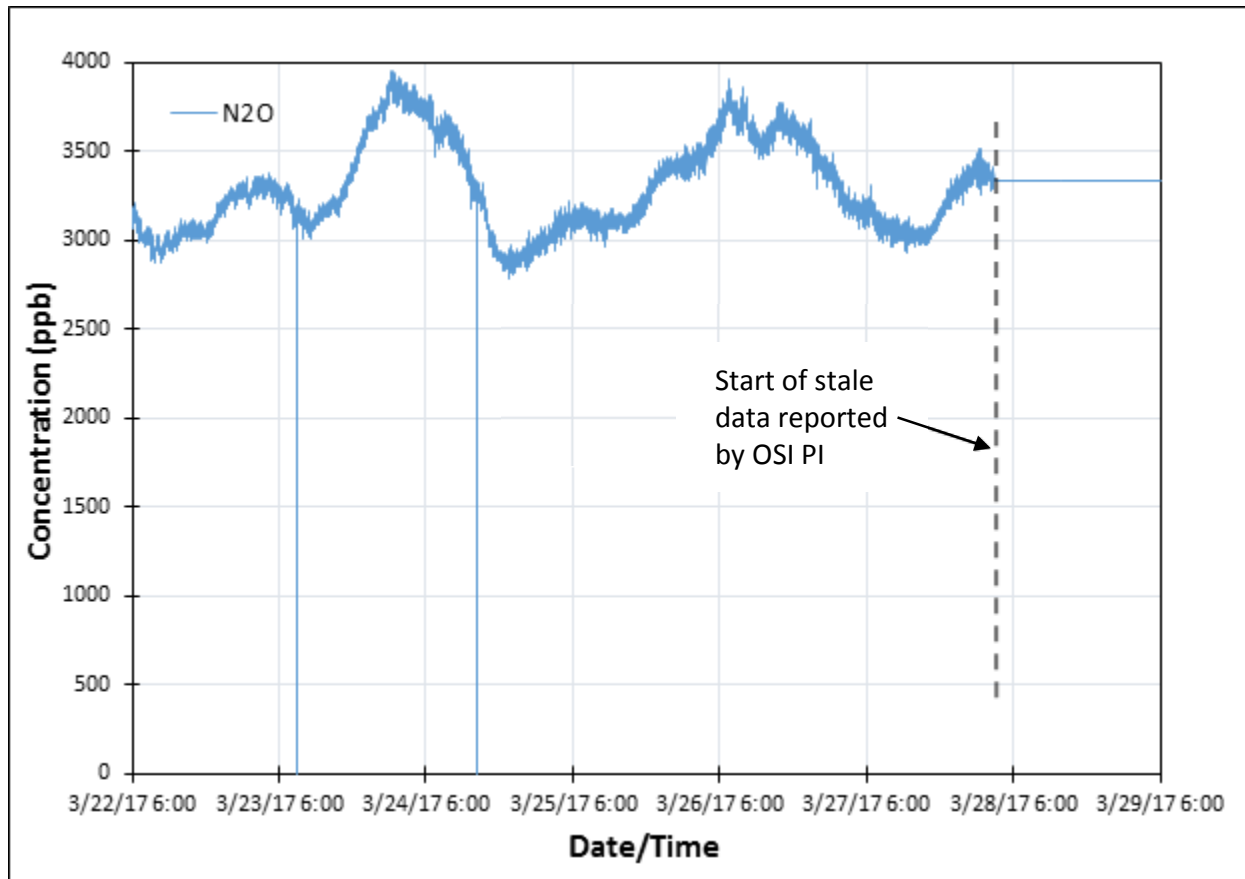
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**Figure 1. FTIR (507I) NH₃ Data recorded from AP Farm Exhauster.
(Note that concentration units are ppm)**

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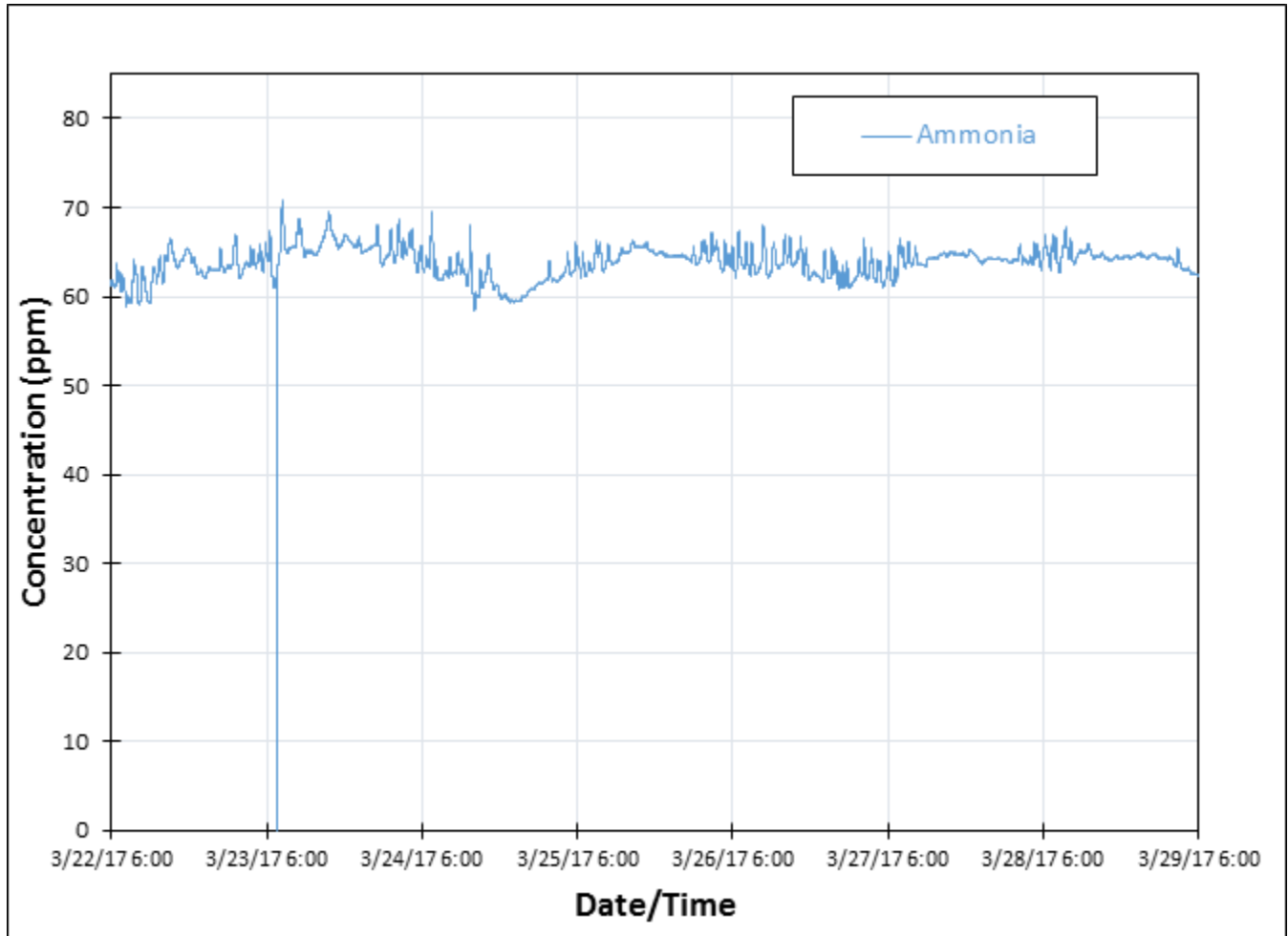
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**Figure 2. FTIR (507I) N₂O Data recorded from AP Farm Exhauster.
(Note that concentration units are ppb)**

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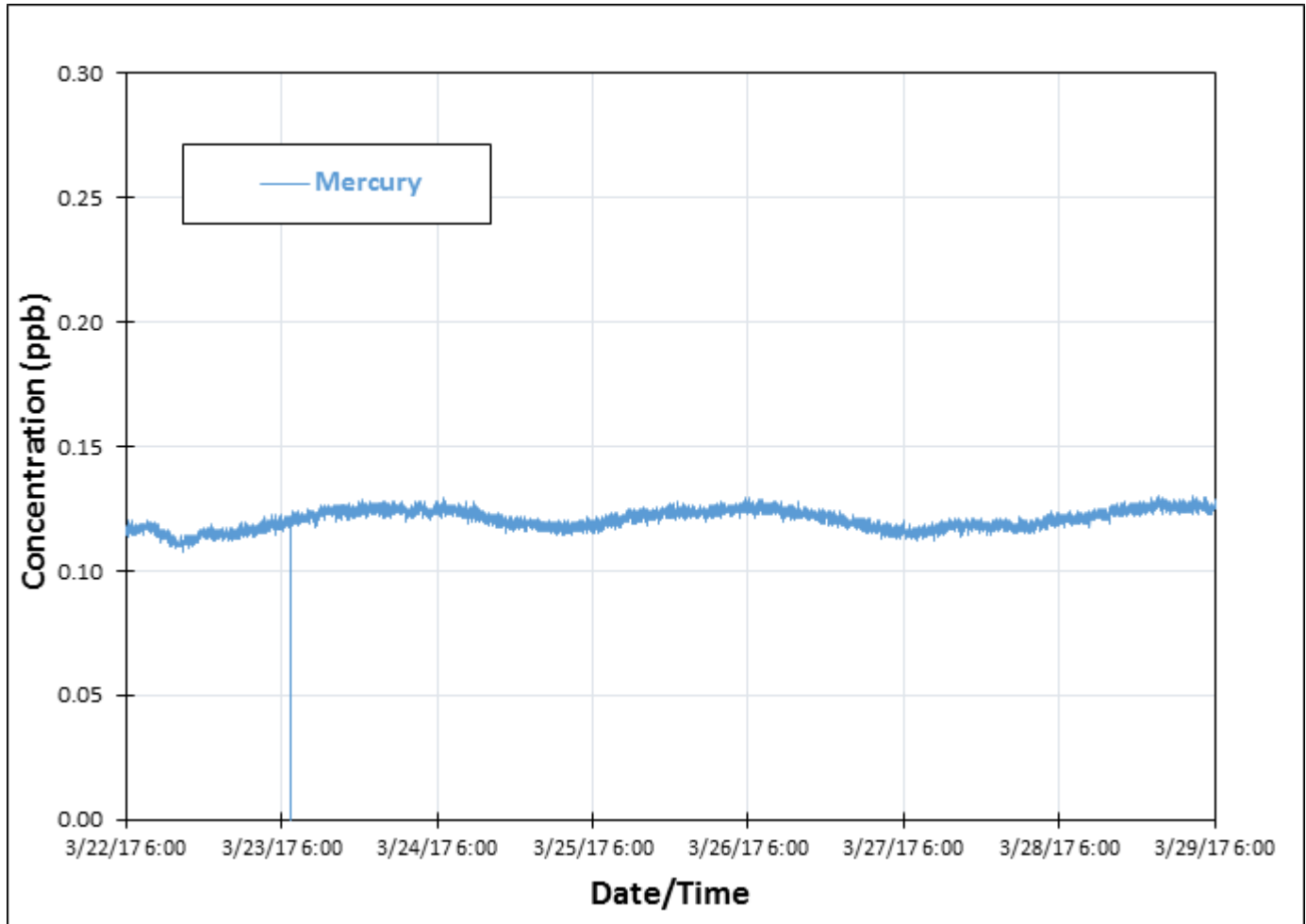
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**Figure 3. UV-DOAS (507U) NH₃ Data recorded from AP Farm Exhauster.
(Note that concentration units are ppm)**

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**Figure 4. UV-DOAS (507U) Hg Data recorded from AP Farm Exhauster .
(Note that concentration units are ppb)**

Table 2. Stack Monitor Time Reporting.

Instrument	% Time Reporting
507I	84% ^a
507U	100%

Notes: % time reporting is based on data reported to OSI PI System
a) Reported data considered to be invalid (stale) from 02:45 on 3/28/2017 to the end of the reporting period.