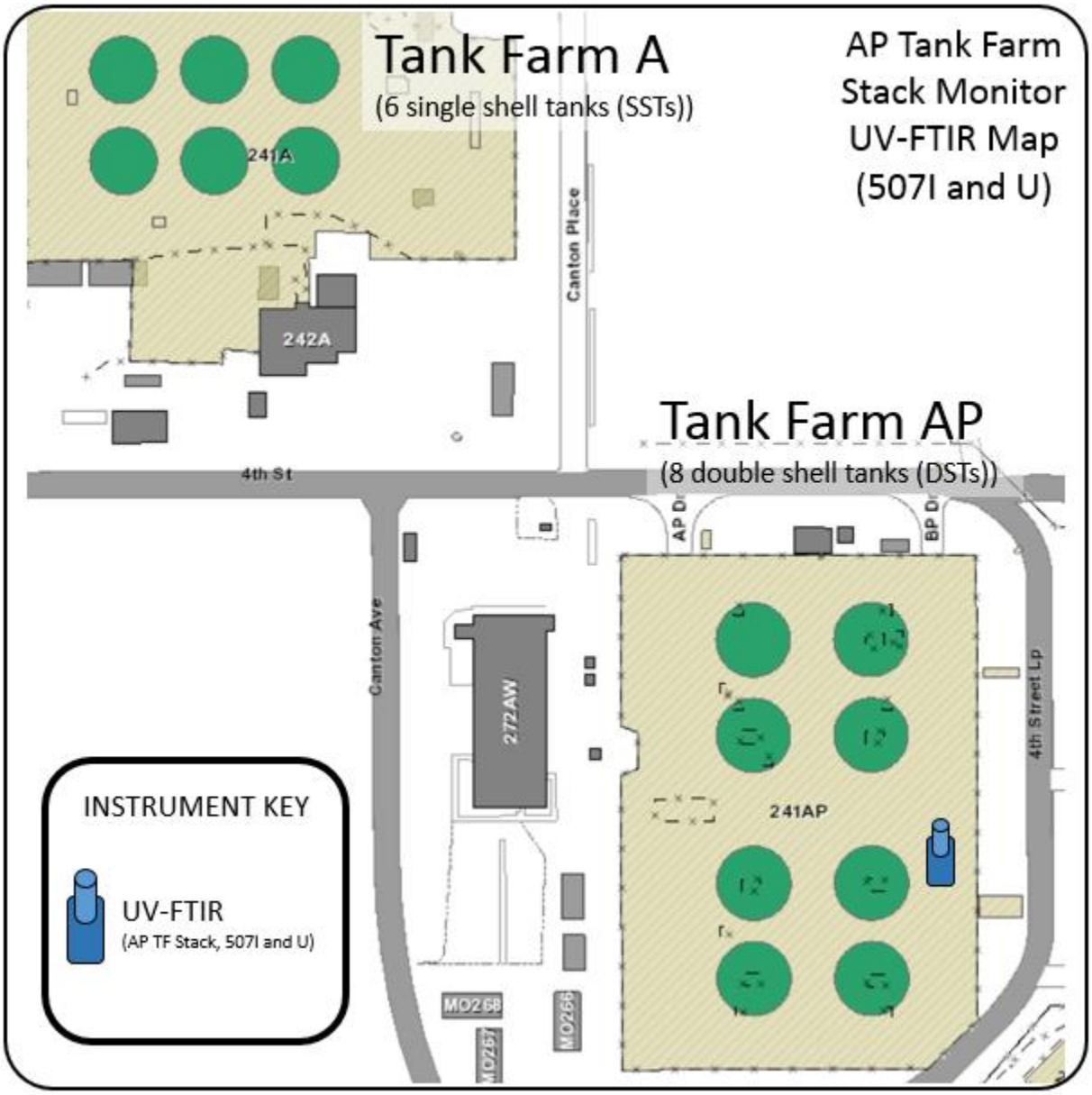
Vapor Monitoring Detection System Weekly Report – AP Tank Farm Stack Monitoring

Revision 0: Initial Release of Report

3/15/2017 6:00 – 3/22/2017 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_2O	=	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 (3/15/2017 at 6:00 a.m. through 3/22/2017 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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3/15/2017 through 3/22/2017 Summary

There were no retrieval or waste disturbing activities during the reporting period. The FTIR (507I) data did not report to OSI PI[2] from the beginning of the reporting period until about 16:00 on 3/20/2017 due to software issues and sampling the wrong stack following a stack change by operations.

The UV-DOAS (507U) reported to OSI PI from about 14:00 3/15/2017 until approximately 09:30 on 3/16/2017 when software issues and sampling the wrong stack impeded reporting to OSI PI until approximately 16:00 on 3/20/2017.

Table 1 shows that ammonia concentrations ranged from 55 to 68 ppm (from 507I and U), nitrous oxide concentrations ranged from 3.0 to 3.9 ppm (507I), and mercury ranged from 0.057 to 0.12 ppb (507U). Figures 1 and 3 show the concentrations of ammonia detected in the AP Farm stack during the reporting period, as well as the time intervals where data were not collected. Figure 2 shows the concentrations of nitrous oxide detected in the AP Farm stack during the reporting period, also with the time intervals where data were not collected. Figure 4 shows mercury concentrations measured with the UV-DOAS 507U during the times when the instrument was reporting to OSI PI. The concentrations of all reported compounds, ammonia, nitrous oxide, and mercury, 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 27% and the UV-DOAS 507U monitored for 39% of the reporting period.

[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 FTIR (ppm)	Chemical	507U UV-DOAS (ppm)
Ammonia*	59 - 68	Ammonia*	55 - 67
Nitrous Oxide*	3.0 – 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[b]
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*	0.000057 – 0.00012
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) Concentration values detected for 2-methylfuran are suspect readings of the instrumentation when sampling the wrong train on 3/15/2017.
* Chemical is on COPC list
ND – Not detected

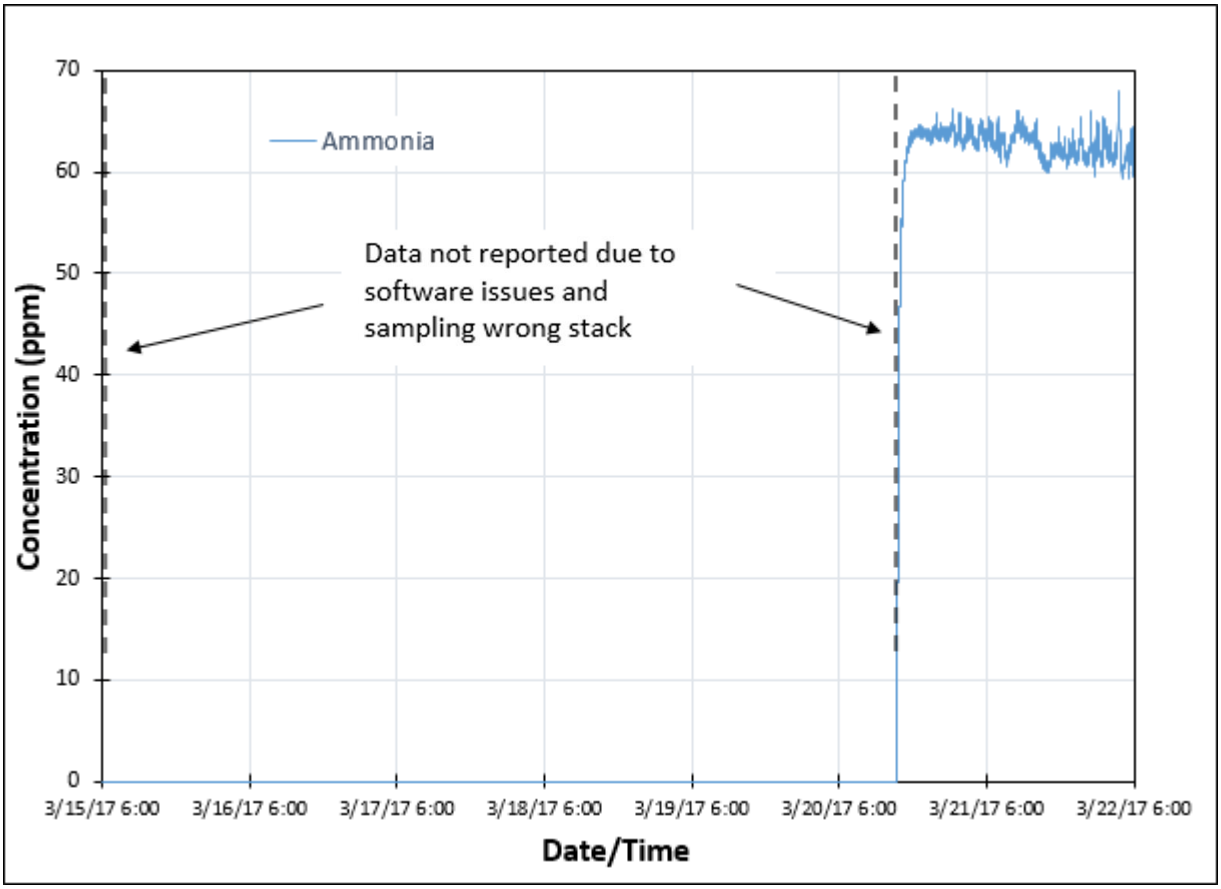

Figure 1. FTIR (507I) NH_3 Data recorded from AP Farm Exhauster (Note that concentration units are ppm)

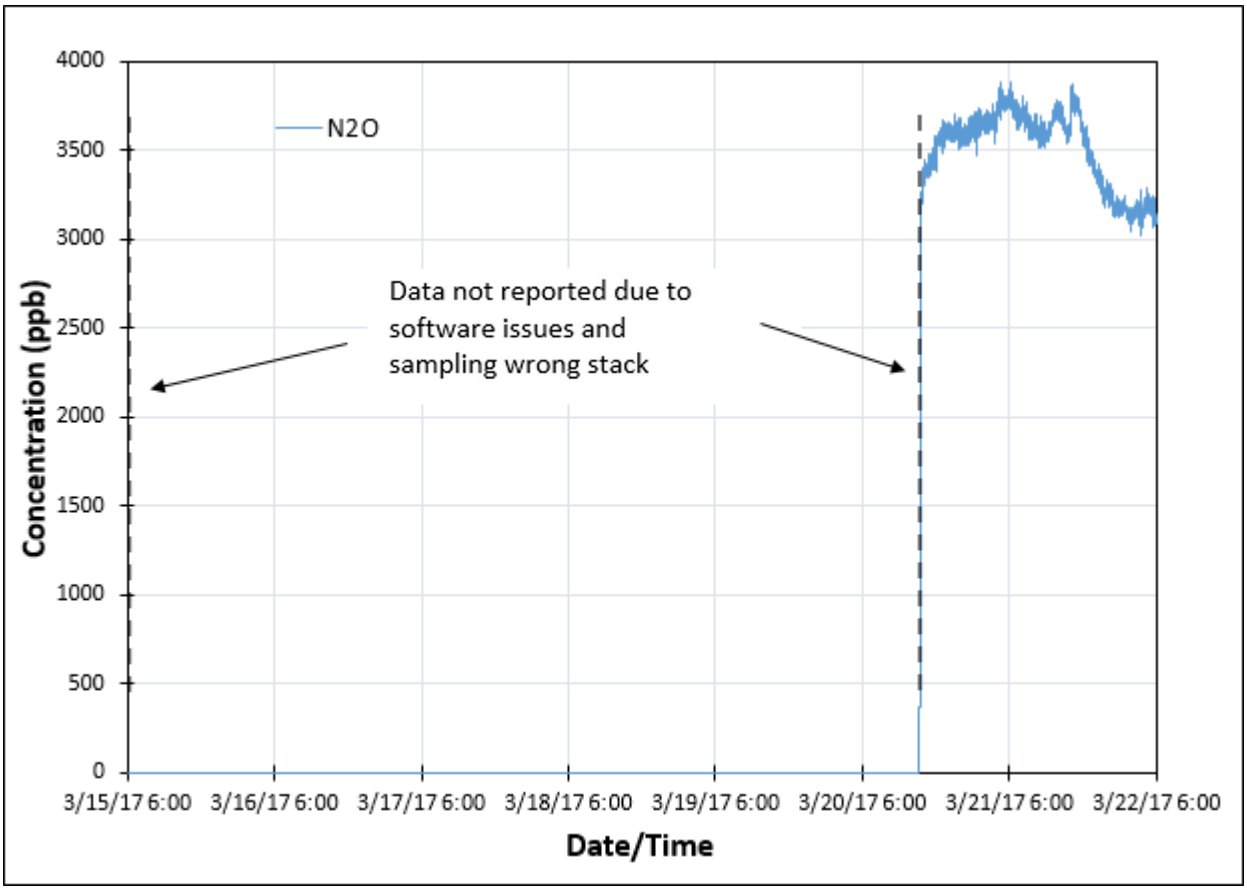

Figure 2. FTIR (507I) N_2O Data recorded from AP Farm Exhauster (Note that concentration units are ppb)

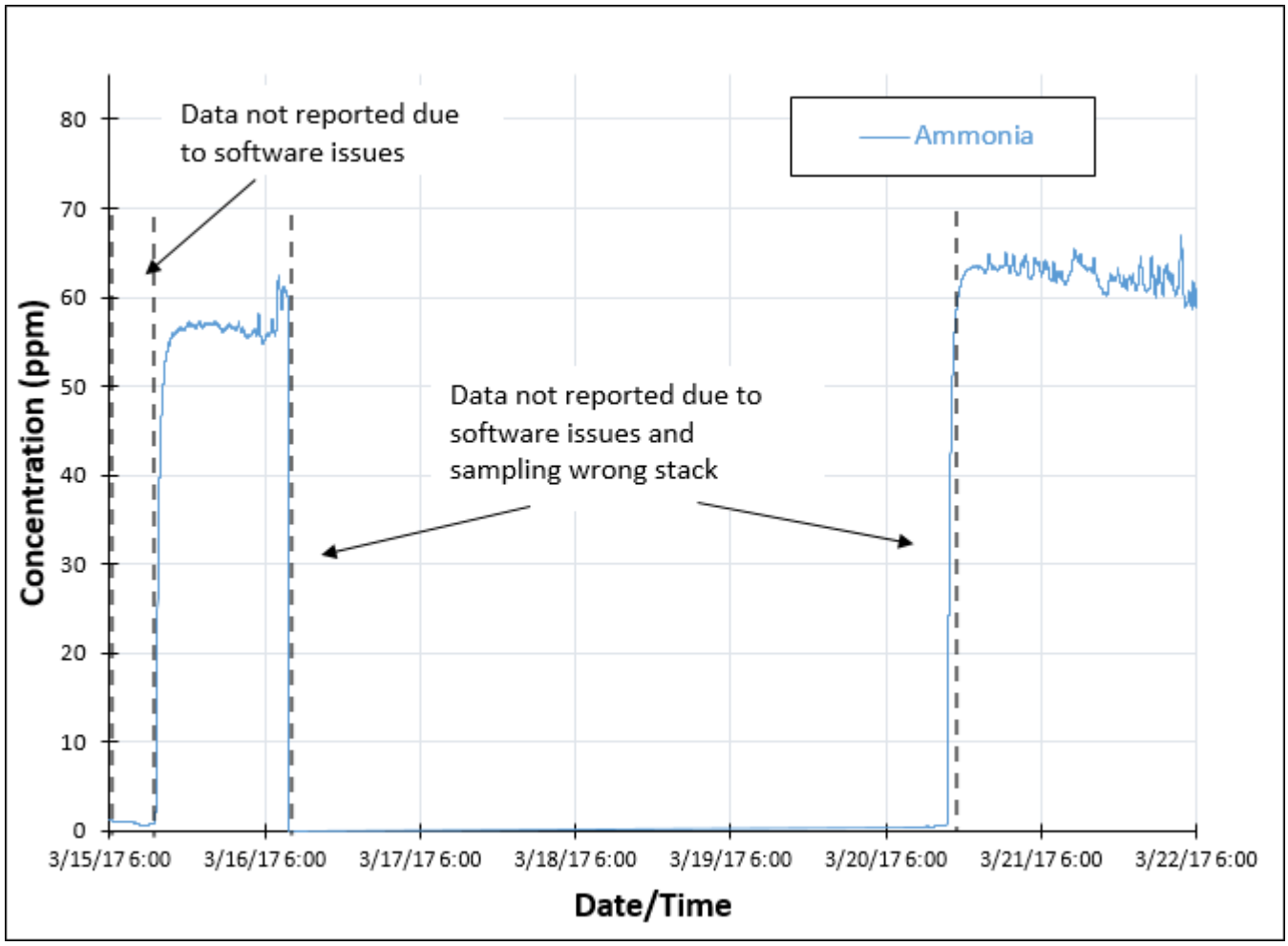

Figure 3. UV-DOAS (507U) NH3 Data recorded from AP Farm Exhauster. (Note that concentration units are ppm)

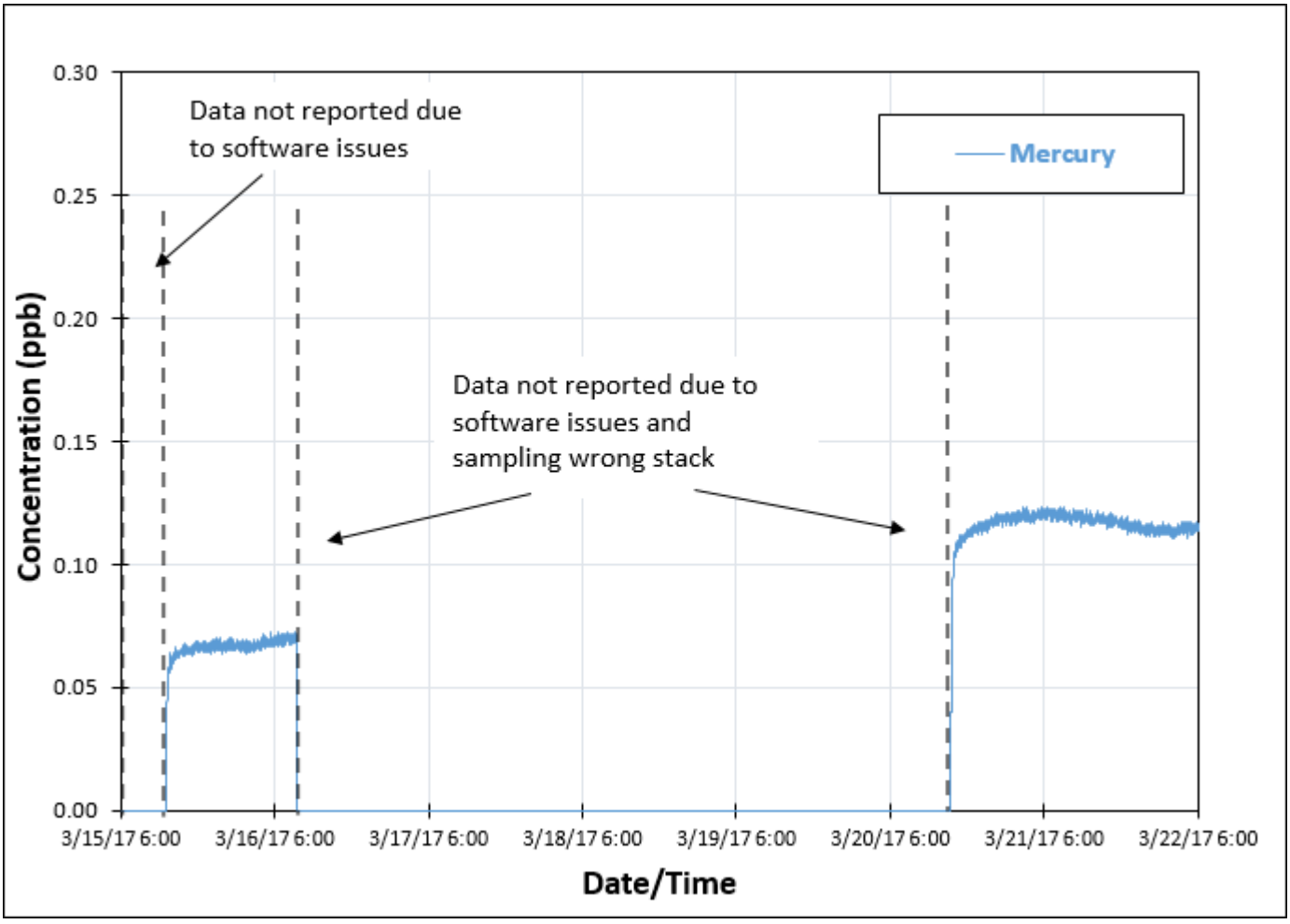

Figure 4. UV-DOAS (507U) Hg Data recorded from AP Farm Exhauster. (Note that concentration units are ppb)

Table 2. Stack Monitor Time Reporting.

Instrument	% Time Reporting
507I	27%
507U	39%

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