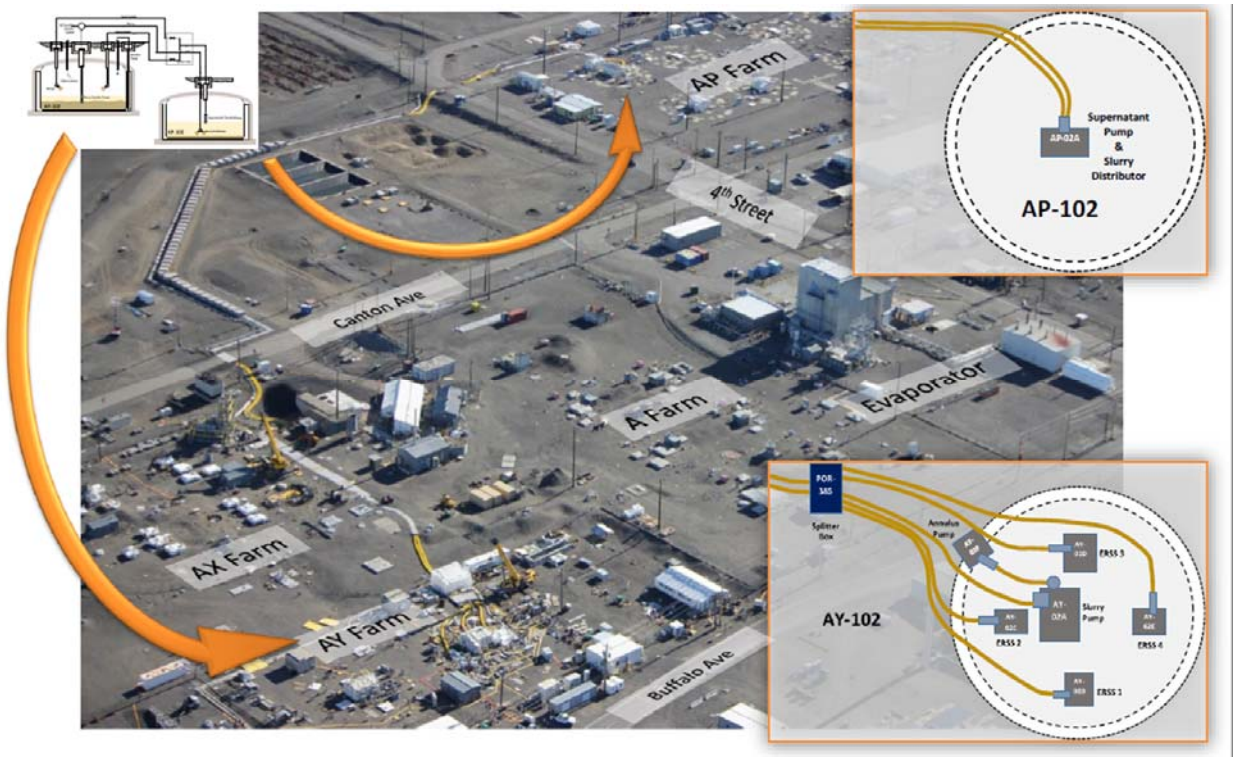
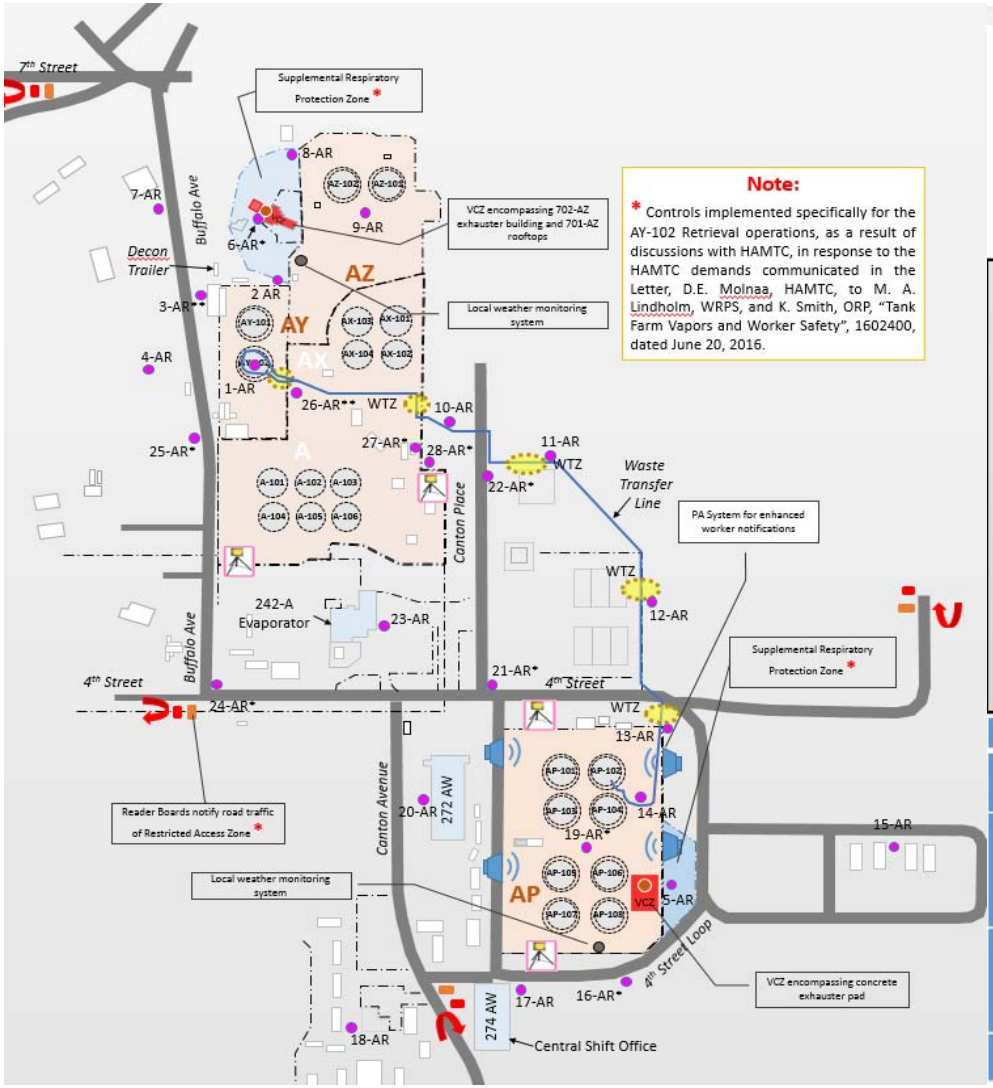
AY-102 to AP-102 Retrievals Summary

AY-102 to AP-102 Retrievals Summary
Retrieval and Transfer Layout



AY-102 to AP-102 Retrievals Summary – Control Strategy



Note:

* Controls implemented specifically for the AY-102 Retrieval operations, as a result of discussions with HAMTC, in response to the HAMTC demands communicated in the Letter, D.E. Molnaa, HAMTC, to M. A. Lindholm, WRPS, and K. Smith, ORP, "Tank Farm Vapors and Worker Safety", 1602400, dated June 20, 2016.

LEGEND

- Location of exhauster
- "Caution: Respiratory Protection Required Beyond this Point"
- Transfer Route with Waste Transfer Zone
- Authorized Access
- NORTH

CONTROLS	
PA System speaker locations	
Warning Sign *	
Reader board *	
Turnaround locations *	
AreaRAE locations (*past AOP-15 locations and/or AreaRAEs to be left out when retrieval is shut down ** required when performing annulus pumping *** only required when the annulus exhauster is operating)	
Vapor Control Zones	
Pilot Scale Vapor Monitoring and Detection System	
Supplemental zone with required respiratory protection *	
Local weather monitoring system	

Hierarchy of Controls	Control
Eliminate the Hazard	Retrieval to be performed on backshifts and weekends only*.
	Access restricted to "Authorized Personnel Only" during retrieval*.
Engineered Systems	Retrieval operations only when AY/AZ and AP Farms ventilation operating.
	AY-102 Annulus exhauster off. Ventilation cross-tie installed between annulus space and primary tank to provide ventilation path thru primary tank exhauster.
Administrative Controls	Establish Vapor Control Zones (VCZ) and Supplemental Protection Zones*
	IH monitoring and sampling.
	AOP-15 response to reported unusual vapor odors/worker vapor exposure symptoms.
PPE	Supplied-air respirators required in AY and AP farms, VCZ's, and supplemental zones*.

WRPS Industrial Hygiene Group Direct Read Instrumentation Data

AY-102 to AP-102 Retrievals Summary – IH Data - DRI
12/8/16 – 12/31/16

Throughout the retrieval operations and during normal operations, the Industrial Hygiene (IH) group collected Direct Reading Instruments (DRI) measurements throughout the A Complex tank farms (A, AN, AW, AX, AY, AZ and AP). This included area, vapor control zone (VCZ), and source readings.

In addition to retrieval sampling, the IH group continued to conduct its monitoring of work occurring outside of the retrieval operations period. The data was compiled for both operations and analyzed to determine if tank farm chemical concentrations increased during and after retrieval.

The analysis of the tank farm data did not show any increase in area or vapor control zone chemical concentrations.

Source readings did show elevated levels of ammonia as expected, however, elevated ammonia levels were not found in the farms during or after retrieval operations.

AY-102 to AP-102 Retrievals Summary – IH Data - DRI 12/8/16 – 12/31/16

AY-102 Retrieval | Source DRI Readings 12/10/2016 to 12/31/2016

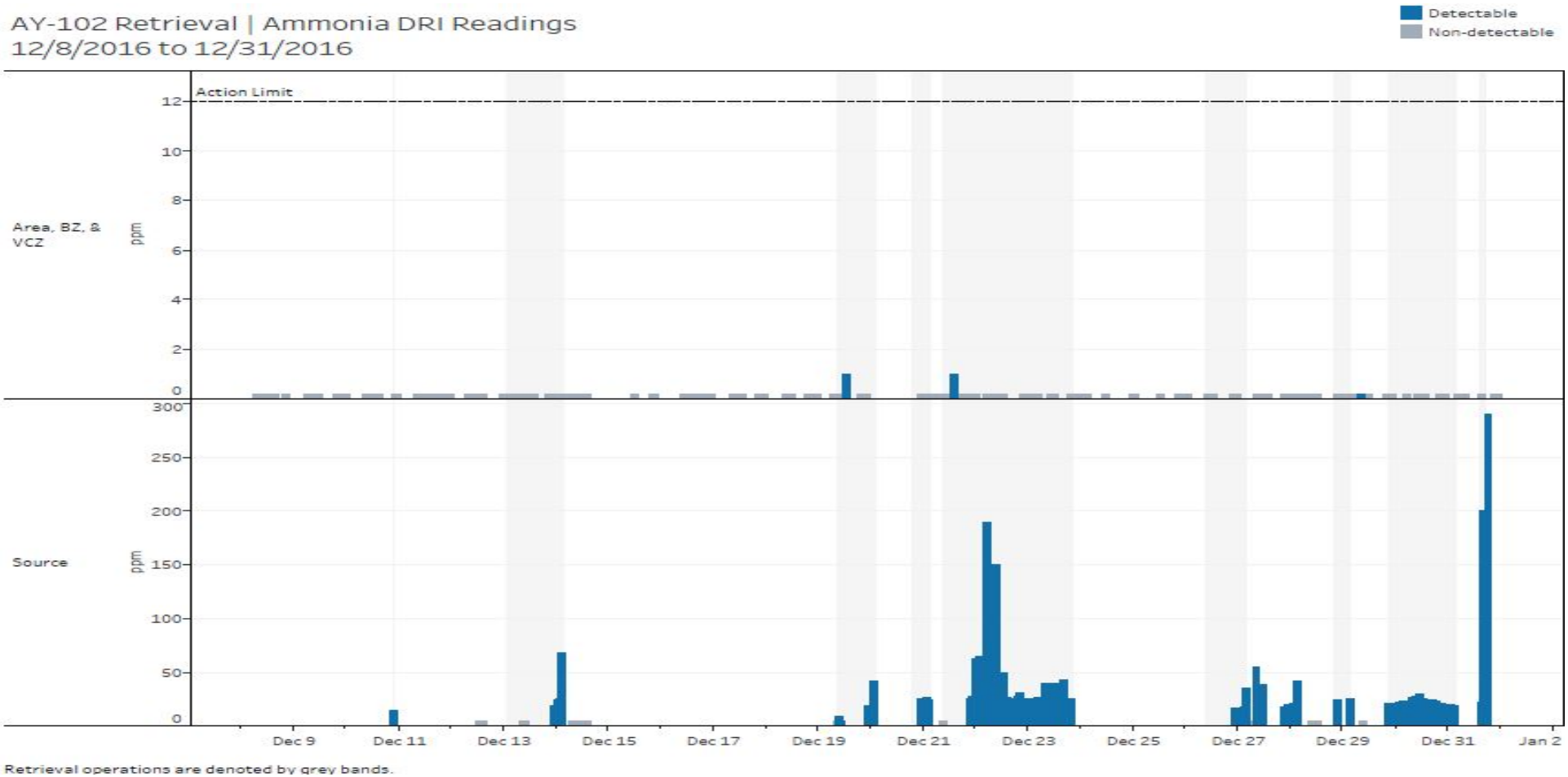
Location	Agent	Peak Value	Total Count of Readings
702-AZ	Ammonia	31 ppm	93
	Volatile Organic Compound	1.18 ppm	44
A Complex	Ammonia	35 ppm	43
	Volatile Organic Compound	0.73 ppm	30
AP FARM	Ammonia	290 ppm	48
	Volatile Organic Compound	1.91 ppm	24
		Total	282

AY-102 Retrieval | Area, BZ, & VCZ DRI Readings 12/8/2016 to 12/31/2016

Location	Agent	Action Limit	Peak Value	Reading Counts		
				Non-detectable	Detected Below AL	Detected Above AL
702-AZ	Ammonia	12 ppm	1 ppm	14	3	-
	Mercury	12,500 ng/m³	1,547 ng/m³	-	4	-
	Volatile Organic Compound	2 ppm	0 ppm	17	-	-
A Complex	Ammonia	12 ppm	1 ppm	439	1	-
	Mercury	12,500 ng/m³	66 ng/m³	8	20	-
	Volatile Organic Compound	2 ppm	6.74 ppm	419	5	1
AP FARM	Ammonia	12 ppm	0 ppm	91	-	-
	Mercury	12,500 ng/m³	9 ng/m³	21	20	-
	Volatile Organic Compound	2 ppm	0.05 ppm	90	1	-
Non-Farm	Ammonia	12 ppm	0.2 ppm	961	1	-
	Mercury	12,500 ng/m³	71 ng/m³	19	27	-
	Volatile Organic Compound	2 ppm	1.5 ppm	939	8	-
			Totals	3018	90	1

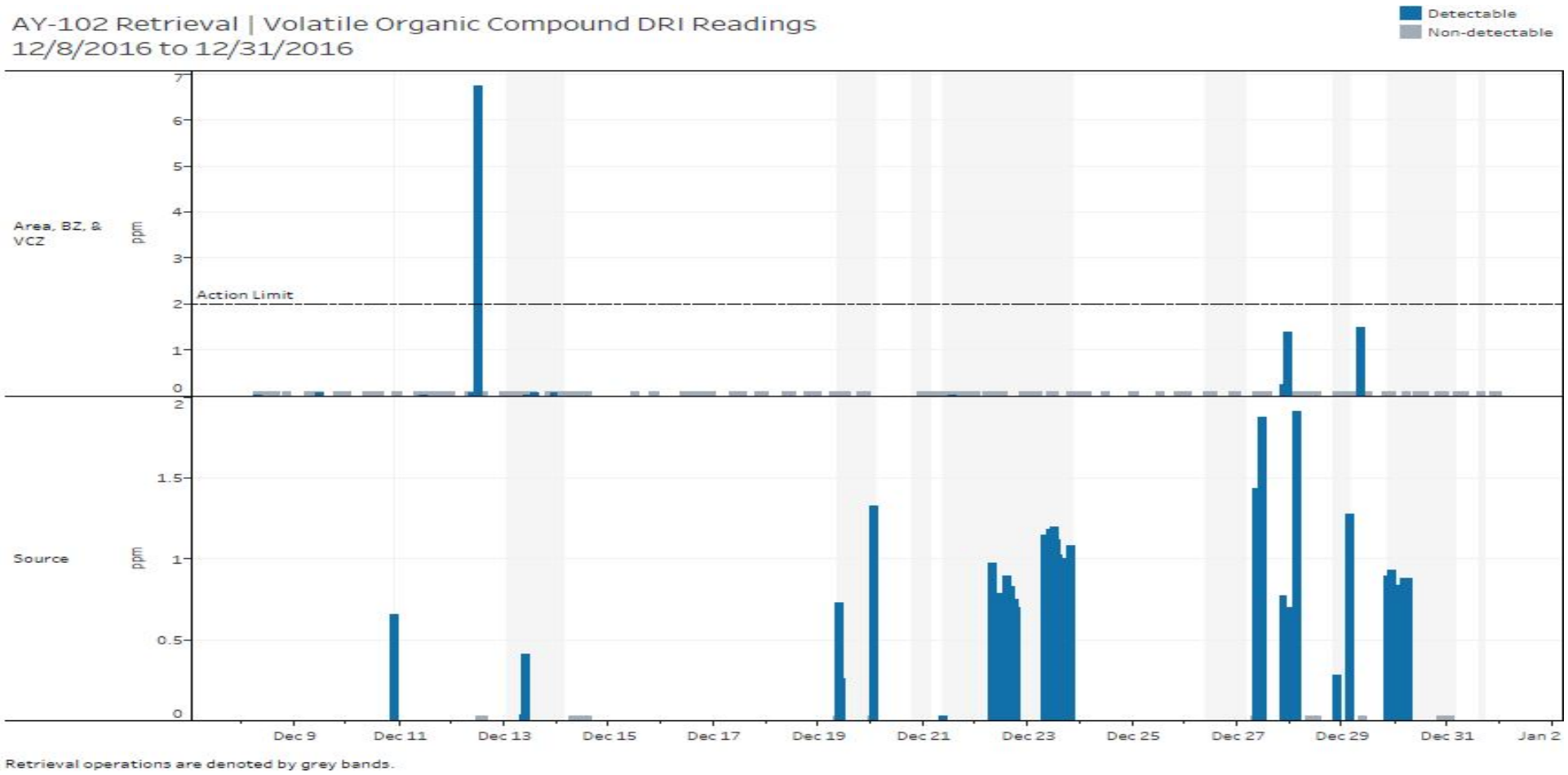
VOC measurement above action level within the A complex occurred during urethane foam scraping operations in the AX-103A pit.

AY-102 to AP-102 Retrievals Summary
IH Ammonia DRI Data Collected During Retrievals 12/8/16 – 12/31/16



Retrieval operations are denoted by grey bands.

AY-102 to AP-102 Retrievals Summary
IH VOC DRI Data Collected During Retrievals 12/8/16 – 12/31/16



Retrieval operations are denoted by grey bands.

RJ Lee Mobile Lab

AY-102 to AP-102 Retrievals Summary
Mobile Lab Data Information – Collected from 12/9/16 – 12/13/16

The RJ Lee Proton Transfer Reaction – Mass Spectrometer or, PTR-MS, Mobile Lab drove from Columbia Basin College (CBC) to the Hanford site taking readings throughout the path of travel to capture data from the surrounding communities (in-town and highway traffic, fueling stations, tire stores, etc.) and at the Hanford site tank farms.

The Mobile Lab takes readings every 2 seconds continuously for:

- **185+ compounds, including 52 of the 59 COPCs**
- **Weather data**
- **GPS location data**

The data is analyzed by software to determine the compound identities and their concentrations.

In Total, over 11,000,000 measurements were recorded from 12/9/16 – 12/13/16 for 185+ compounds.

AY-102 to AP-102 Retrievals Summary
Mobile Lab Data Information – Collected from 12/9/16 – 12/13/16

LOCATION (Includes on and offsite detections)	TOTAL READINGS (All potential analytes)	Total Ammonia Reading	Total Formaldehyde Reading	Total Methanol Reading	Total Furan Reading	Total 2-Methylfuran Reading	Total Ethylamine Reading	Total 1,3-Butadiene Reading
12/9/2016	3,020,125	16,325	16,325	16,325	16,325	16,325	16,325	16,325
12/10/2016	1,257,630	6,798	6,798	6,798	6,798	6,798	6,798	6,798
12/12/2016	3,611,755	19,523	19,523	19,523	19,523	19,523	19,523	19,523
12/13/2016	3,160,170	17,082	17,082	17,082	17,082	17,082	17,082	17,082
Totals	11,049,680	59,728	59,728	59,728	59,728	59,728	59,728	59,728

LOCATION (Includes on and offsite detections)	NH3 Readings > AL	Peak NH3	Formaldehyde Readings > AL	Peak Formaldehyde	Methanol Readings > AL	Peak Methanol	Furan Readings > AL	Peak Furan
12/9/2016	0	585 ppb	0	15 ppb	0	208 ppb	326	1.5 ppb
12/10/2016	0	595 ppb	0	13 ppb	0	296 ppb	59	1 ppb
12/12/2016	0	756 ppb	0	26.4 ppb	0	430 ppb	550	6 ppb
12/13/2016	0	281 ppb	0	13 ppb	0	206 ppb	290	8 ppb
Action Limit	12 ppm		150 ppb		100 ppm		0.5 ppb	

LOCATION (Includes on and offsite detections)	2-Methylfuran Reading > AL	Peak 2-Methylfuran	Ethylamine Reading > AL	Peak Ethylamine	1,3-Butadiene Readings > AL	Peak 1,3-Butadiene
12/9/2016	169	0.8 ppb	0	2.1 ppb	0	4.1 ppb
12/10/2016	108	1 ppb	0	3.3 ppb	0	1.7 ppb
12/12/2016	595	5.3 ppb	0	4.4 ppb	0	9.3 ppb
12/13/2016	277	5.4 ppb	0	49 ppb	0	8.6 ppb
Action Limit	0.5 ppb		2500 ppb		500 ppb	

AY-102 to AP-102 Retrievals Summary
Mobile Lab Data Information – Collected from 12/9/16 – 12/13/16

AY-102 Retrevial | Mobile Lab Results
12/9/2016 to 12/13/2016

		Below AL	Between AL & OEL	Above OEL
COPC Results	Furan	58,503	903	322
	2-methylfuran	58,579	840	309
	2,5-dimethylfuran	58,687	659	382
	MVK / 2,3-dihydrofuran / 2,5-dihydrofuran	59,160	375	193
	2-propylfuran / 2-ethyl-5-methylfuran	59,311	290	127
	N-Nitrosodimethylamine	59,650	78	-
	N-Nitrosodiethylamine	59,662	66	-
	2-ethyl-2-hexenal / 4-(1-methylpropyl)-2,3-dihydrofuran / 3-(1,1-dimethylethyl)-2,3-dihydrofuran	59,717	11	-
	2-pentylfuran	59,717	11	-
	N-Nitrosomorpholine	59,724	4	-
	1,2,3-propanetriol 1,3-dinitrate	59,728	-	-
	1,3-butadiene	59,728	-	-
	2-heptylfuran	59,728	-	-
	2-hexanone (MBK)	59,728	-	-
	2-methylene butanenitrile	59,728	-	-
	2-octylfuran / 1,4-butanediol dinitrate	59,728	-	-
	2,4-dimethylpyridine	59,728	-	-
	3-methyl-3-buten-2-one / 2-methyl-2-butenal	59,728	-	-
	4-methyl-2-hexanone	59,728	-	-
	6-methyl-2-heptanone	59,728	-	-
	Acetaldehyde	59,728	-	-
	Acetonitrile	59,728	-	-
	Ammonia	59,728	-	-
	Benzene	59,728	-	-
	Biphenyl	59,728	-	-
	Butanal	59,728	-	-
	Butanenitrile	59,728	-	-
	Butanol / Butenes	59,728	-	-
	Butyl nitrate	59,728	-	-
	Butyl nitrite / 2-nitro-2-methylpropane	59,728	-	-
	Diethyl phthalate	59,728	-	-
	Ethylamine	59,728	-	-
	Formaldehyde	59,728	-	-
	Heptanenitrile	59,728	-	-
	Hexanenitrile	59,728	-	-
	Methanol	59,728	-	-
	Methyl isocyanate	59,728	-	-
	Methyl nitrite	59,728	-	-
	N-Nitrosomethylethylamine	59,728	-	-
	PCB	59,728	-	-
	Pentanenitrile	59,728	-	-
	Propanenitrile	59,728	-	-
	Pyridine / 2,4-pentadienenitrile	59,728	-	-

Total number of all mobile lab readings (including non-COPCs): 11,049,680

09 December 2016 Detections

AY Shift Office

0630 – 1000: **(LS01a)**

Methanol signature

unknown source – Likely exhaust

0640 – 0645: **(LS01b)**

Exhaust signature

Potential source – generator exhaust

10 December 2016 Detections

SW of AP Farm

09:12 AM (lasted 8 seconds): **(LS02a)**

Potential exhaust signature

unknown source – Likely vehicle exhaust

12 December 2016 Detections

N of AP farm fenceline

15:14 – 15:17 PM (lasted 3 minutes): (**LS03e)**

Exhaust signature

Potential source – MCC003 generator

Parking Lot S of 274 AW

12:33 PM (lasted 6 seconds): (**LS03d)**

Exhaust signature

Potential source – Vehicle exhaust

12 December 2016 Detections (Cont.)

<u>Parking Lot S of 274 AW</u> – (End of the day in 274AW parking lot)

16:00 PM (lasted 30 seconds): (**LS03f)**

Exhaust signature

Potential Source – Vehicle Exhaust

13 December 2016 Detections

E of AP farm – (Period of heavy traffic in front of the stationary monitoring site)*

08:35 (lasted 1 minute): (**LS04b)**

Exhaust signature

potential source – Vehicle exhaust

SE of AP farm – (compounds present indicate local exhaust source)*

15:23 PM (lasted 20 seconds): (**LS04c)**

Exhaust signature

Potential source – Vehicle exhaust

** Similar spikes occurred from 08:15 to 08:45*

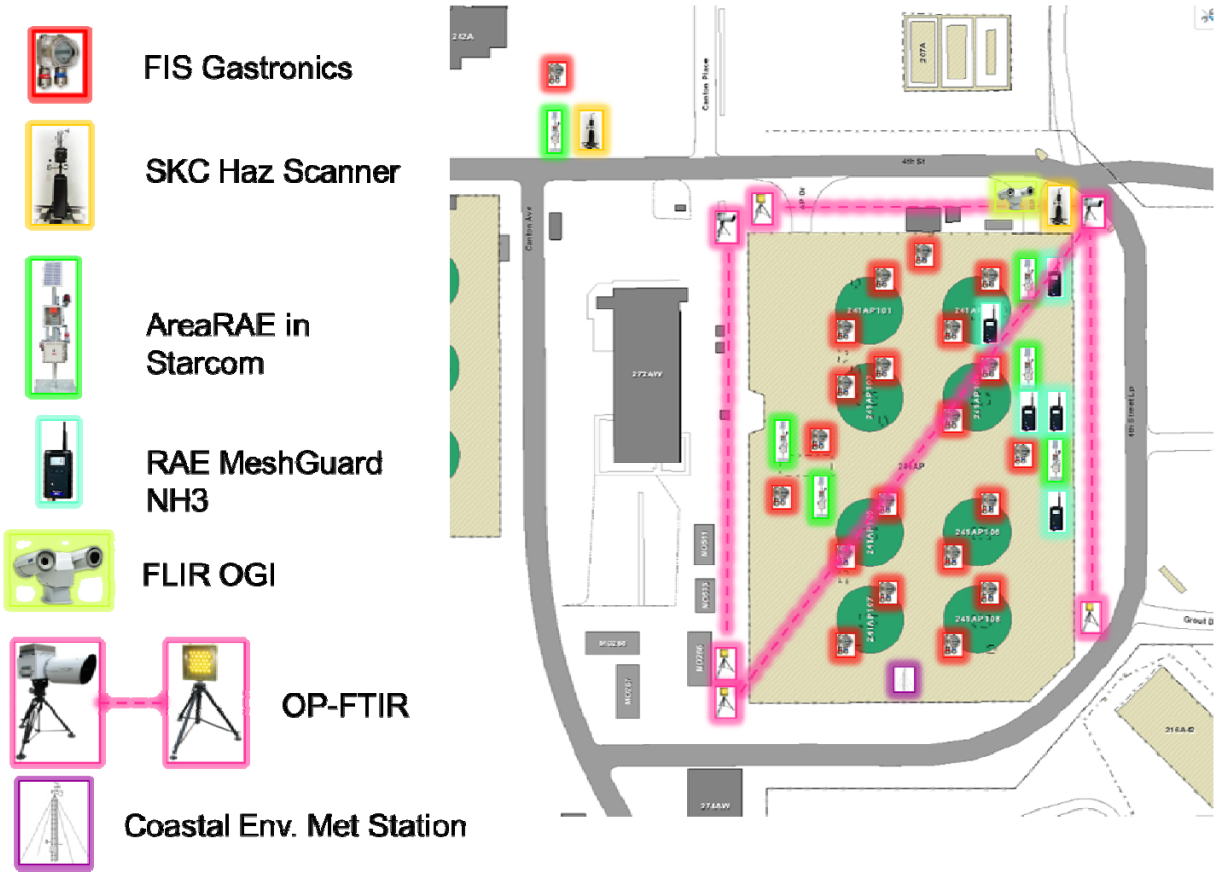
Vapor Monitoring Detection System (VMDS) Data

The Vapor Monitoring Detection System (VMDS) uses a series of detectors installed within A and AP farm to continuously monitor chemical concentrations along the AP farm fenceline, inside of A farm, and AP stack.

These instruments use infrared and/or ultraviolet light to detect chemicals along the path between the emitter and the reflectors.

In Total, over 4 million readings were recorded from 12/8/16 – 12/31/16 of which over 220,000 measurements were for ammonia from the A farm, AP fencelines and AP stack detectors.

AP Farm (DST) VMDS Pilot Program Instrumentation



A Farm (SST) VMDS Pilot Program Instrumentation

UV-DOAS

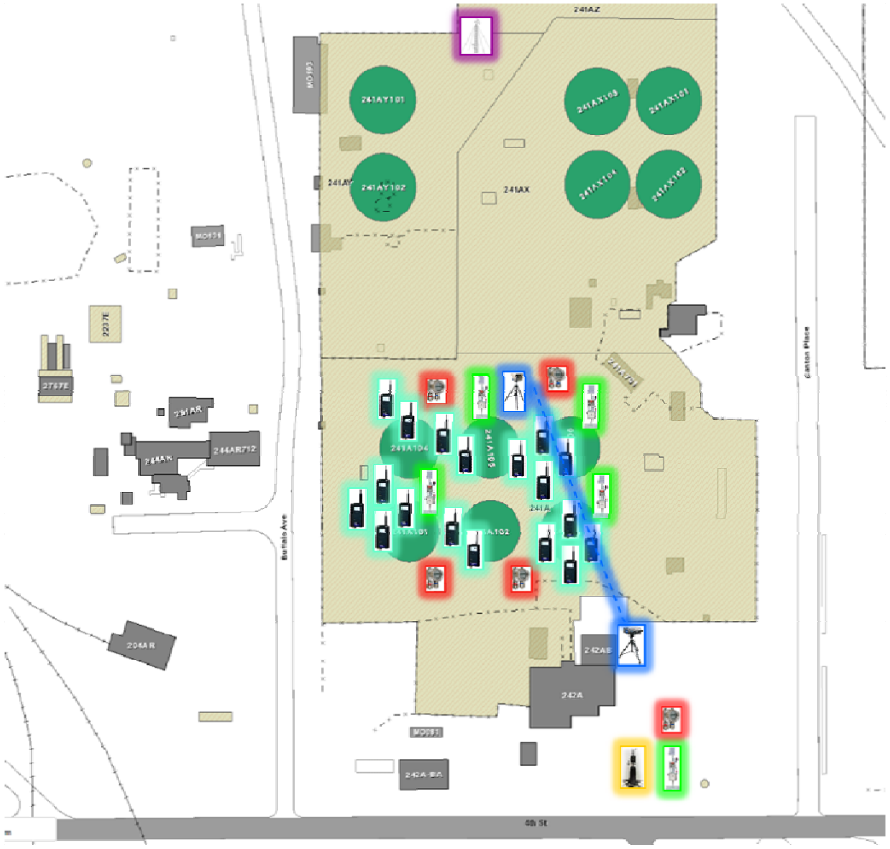
SKC Haz Scanner

FIS Gastronics

AreaRAE in Starcom

RAE MeshGuard NH3

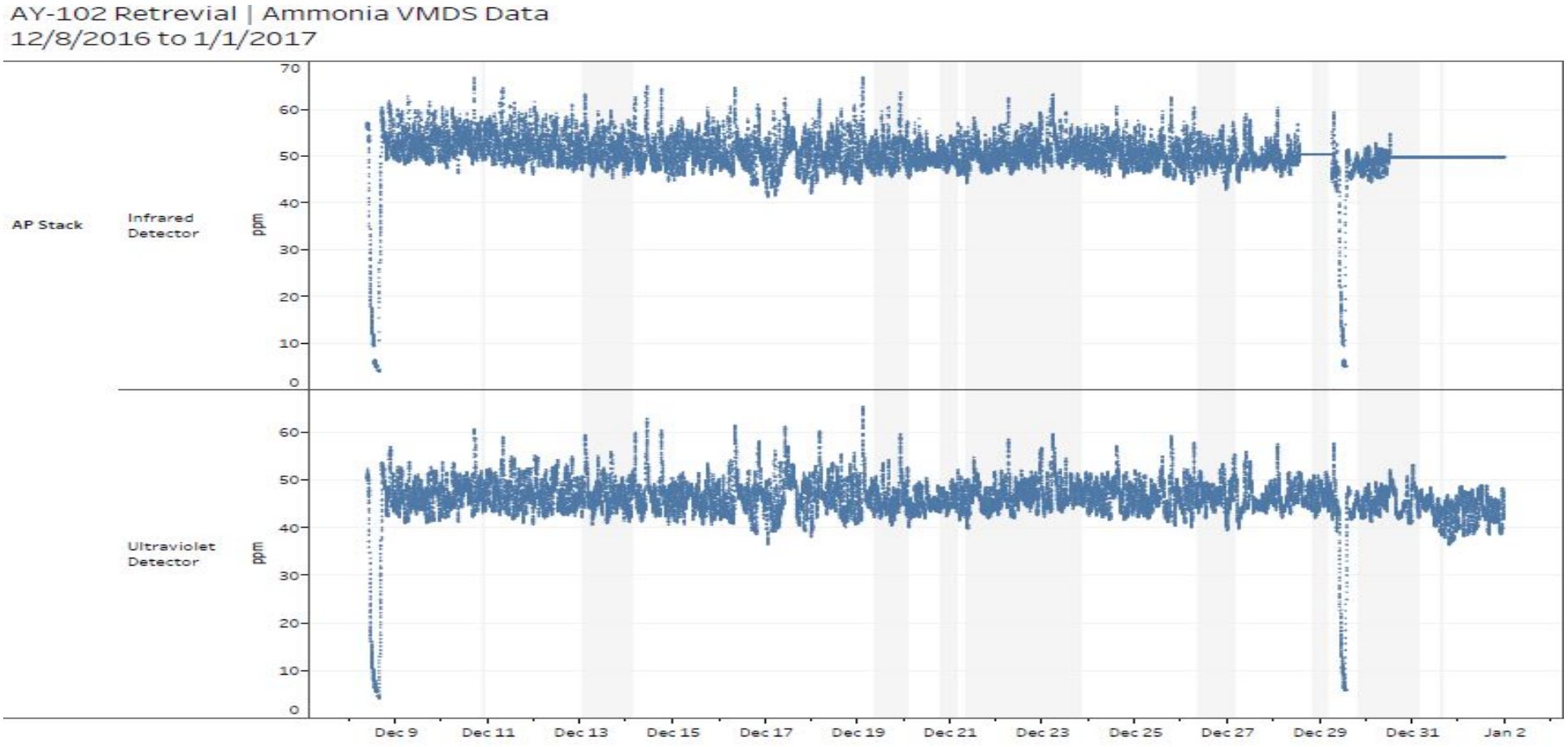
Lufft Met Station



AY-102 to AP-102 Retrievals Summary
VMDS Data Information Collected During Retrievals from 12/8/16 – 12/31/16

LOCATION	INSTRUMENT	TOTAL READINGS (NH3 & N2O)	Total NH3 Reading	Peak NH3	Total N2O Readings	Peak N2O
AP FARM	506A OP-FTIR	56,390	17,479	0	38,911	525 ppb
AP FARM	506B OP-FTIR	92,929	34,598	24 ppb	58,331	453 ppb
A FARM	508A UV-DOAS	72,390	72,390	44 ppb	NA	NA
AP STACK	507I UV-FTIR	93,966	47,061	67 ppm	46,905	7.5 ppm
AP STACK	507U UV-FTIR	49,222	49,222	65 ppm	N/A	N/A
Total Readings		364,897	220,750	N/A	144,147	N/A

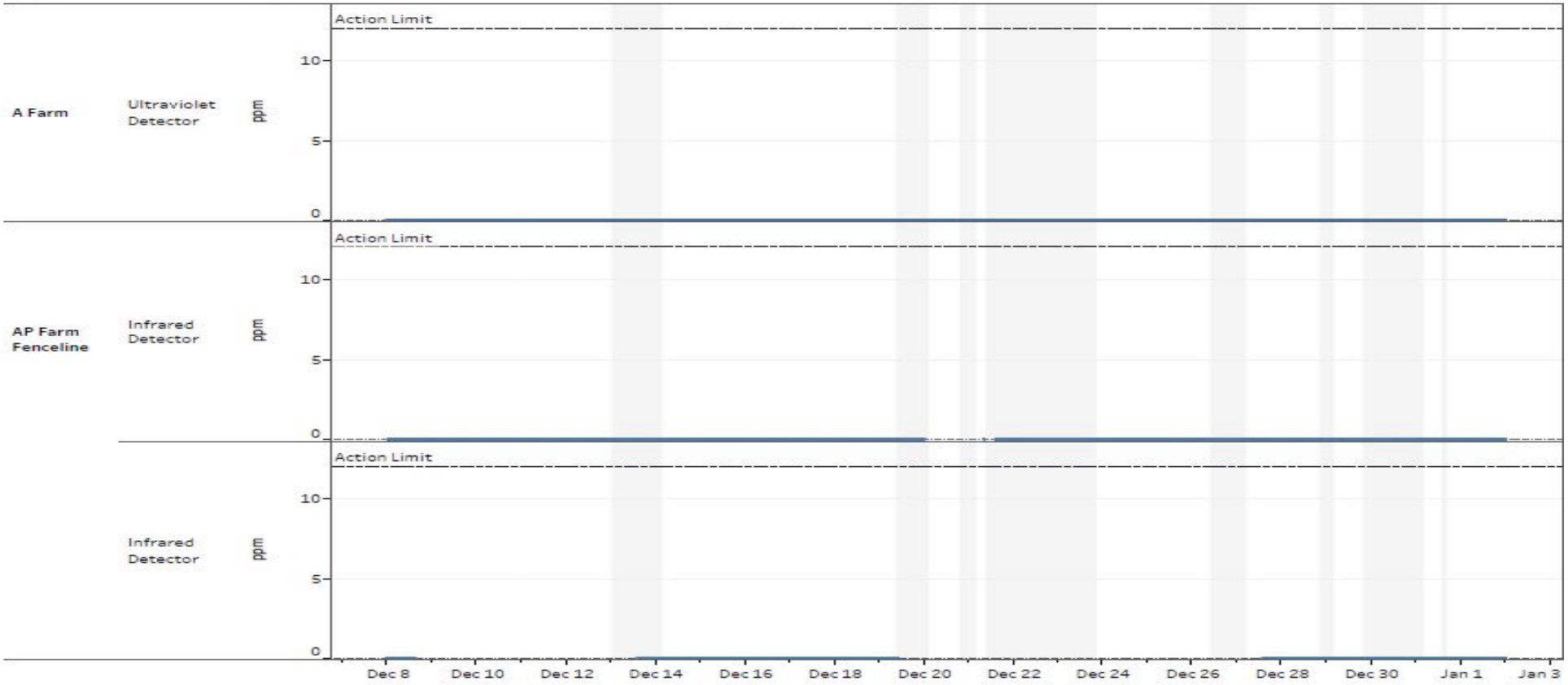
AY-102 to AP-102 Retrievals Summary
VMDS AP Stack Data Collected During Retrievals from 12/8/16 – 12/31/16



Retrieval operations are denoted by grey bands.

AY-102 to AP-102 Retrievals Summary
VMDS A and AP Farm Data Collected During Retrievals from 12/8/16 – 12/31/16

AY-102 Retrevial | Ammonia VMDS Data
12/8/2016 to 1/1/2017



Retrieval operations are denoted by grey bands.

AY-102 to AP-102 Retrievals Summary

The total number of discrete measurements taken throughout the retrieval period includes all IH data collected throughout the A complex, VMDS pilot study spectrometry data from, and the data collected by the RJ Lee mobile PTR-MS.

Data Type	Reading Counts
IH Monitoring Data	3391
VMDS Pilot Data	4,000,518
RJ Lee PTR-MS Data	11,049,680
Total Measurements	**15,053,589**

A total count of over 15 *million* measurements were taken throughout this time period. Taking this data into account, there does not appear to be a measurable increase in tank farm vapor concentrations both during and after the retrieval periods inside the tank farms, along the AP fenceline, or around the A Complex.

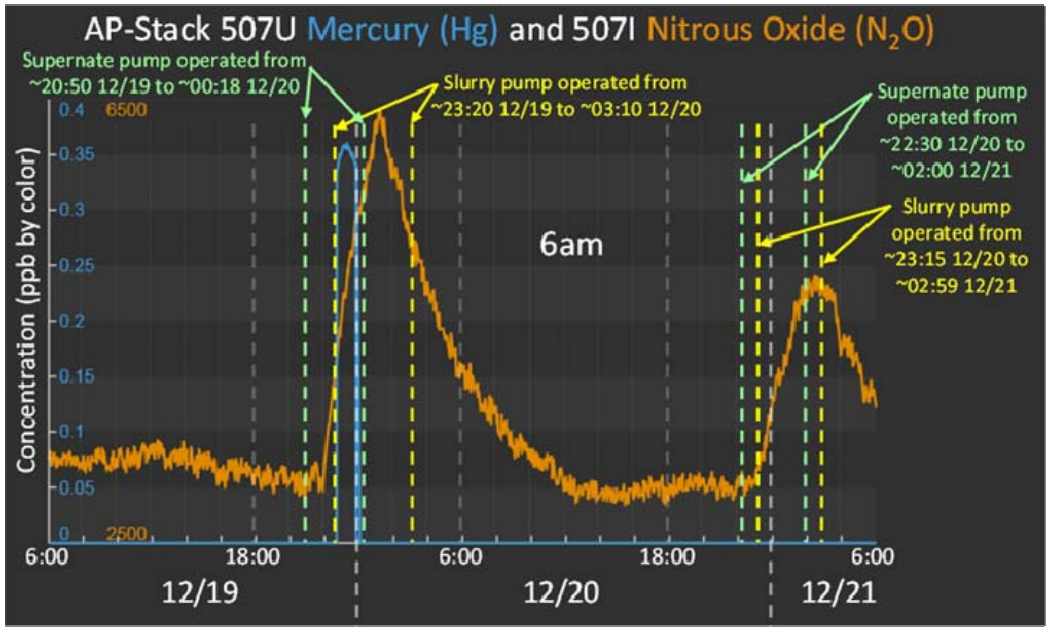
Additional Information

Lining up the VMDS to retrieval operations

The graph shows how the vapor data analysis team looks at the data collected by the spectroscopic detectors by lining up retrieval operations periods to determine what concentration increases can be seen in response to waste disturbances.

It can be seen here that as the supernate pumps are initiated, nitrous oxide levels increase. Additionally, a momentary spike in mercury vapor can be seen. This detection of mercury was found to be at 0.359 ppb or 2950 ng/m^3.

Nitrous oxide was seen to increase during the slurry pump initiation. The peak value during this operation was found to be 6.41 ppm.

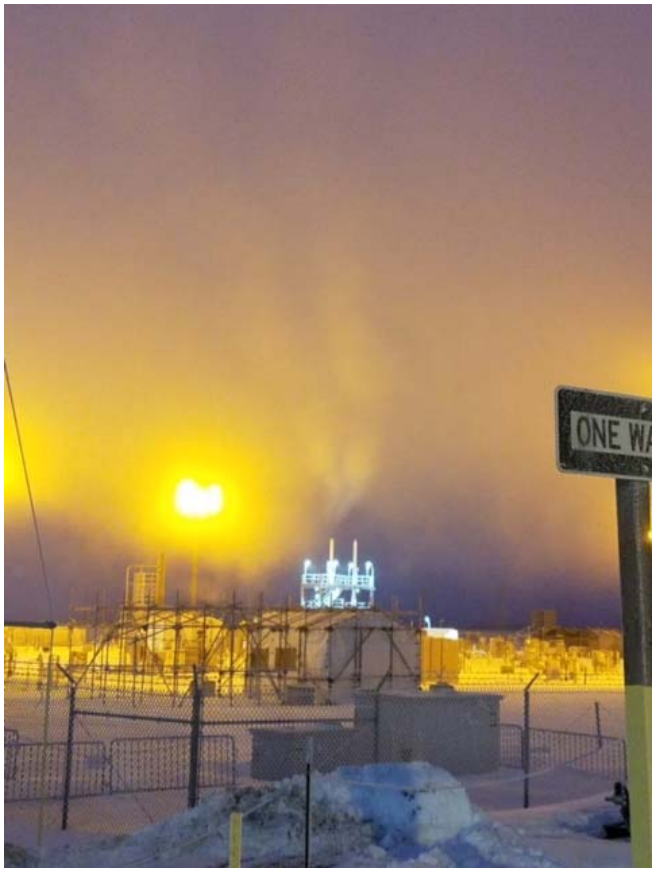


AY-102 to AP-102 Retrievals Summary
Photos of AZ-102 Exhaust During Retrieval

Retrieval operations during dense fog.

Seen here, the exhaust stream can be seen rising over the AP Stack during retrieval on 13 January, 2017 at 07:04 AM. Retrieval operations were started at 11:17 PM on 12 January, 2017 and were ongoing during this time.

The meteorological conditions at this time were as follows:
Temperature @ 2 meters – 1.6°F
Temperature @ 10 meters – 1.8°F
Relative Humidity – 85.313%
Barometric Pressure – 29.98 inHg (761.48 mmHg)
Wind Direction – 124.5 Degrees (Southeast by East)
Wind Speed – 2.553 mph



AY-102 to AP-102 Retrievals Summary
Photos of AZ-102 Exhaust During Retrieval

AZ-102 stack during air stagnation advisory.

Seen here, the exhaust stream can be seen flowing laterally and slightly upward from AZ-102 during retrieval on 15 January 2017 at 06:20 AM. Retrieval operations were secured at 05:36 AM and resumed again at 09:38 AM.

The meteorological conditions at this time were as follows:
Temperature @ 2 meters – 1.6°F
Temperature @ 10 meters – 1.8°F
Relative Humidity – 86.343%
Barometric Pressure – 29.86 inHg (758.44 mmHg)
Wind Direction – 135.18 Degrees (Southeast)
Wind Speed – 7.114 mph