EVENT INVESTIGATION REPORT

EIR-2019-018: Investigation of AX Tent AOP-015 Event

[redacted]

Event Investigator

5/23/19

Date

[redacted]

PER Responsible Manager

5/23/19

Date

PER No. WRPS-PER-2019-0743

AX Tent AOP-015 Event

TF-AOP-015 Summary

Date/Time of Event	April 16, 2019 at ~1230
Location	East of 241-AX Ingress/Egress (Change) Tent
Personnel Affected	Five (5) personnel reported odors: One (1) Evaluated at HPMC
Odor	• Sweet, sour, musty, metallic, onion • Sweet, musty, earthy, rotten • Sulfur, propane, blue room, rotten • Fecal matter (2)
Symptoms	• Headache , dizziness/light-headed, nausea, metallic taste in mouth, frontal headache, tingling in sinus
Direct Read Instrumentation (DRI) Monitoring	Ammonia: 1 part per million (ppm) VOCs: 140 part per billion (ppb)
Sampling	2 bag samples collected with results at or below background levels.
Potential Source	Undetermined
Wind Speed / Direction	South @ 6 mph
Weather Conditions	Barometric pressure: 29.2 inHg and rising Temperature @ 60 degrees Humidity: 41%
Waste Disturbing or Tank Work in Adjacent Area	None known
Other Work in Adjacent Area	None known

Investigation

At approximately 1230hrs on Tuesday, April 16, 2019, five workers (four construction subcontractors and one WRPS health physics technicians [HPTs]) encountered odors described as sweet, musty, earthy, rotten, onion, blue room, and fecal matter smell outside of the AX change tent.

Around 1240 hours a WRPS HPT reported to the Central Shift office (CSO) stronger than normal odors on the east side of AX tank farm. The HPT did not report symptoms. The CSO contacted a Retrieval Industrial Hygienist (IH) and requested an IH Supervisor and Industrial Health Technicians (IHTs) perform surveys on the hill at the east side of AX. During follow up conversations, the worker reported a metallic taste and tingling in the sinuses. The worker reported to HPMC (onsite medical provider) for medical evaluation. The Central Shift Manager (CSM) entered TF-AOP-015. At 1254 hours a radio announcement was made instructing workers inside AX change tent to shelter in place and for other workers outside to evacuate the area. A Shift Office Event Notification (SOEN) was issued at 1305 hours.

Around 1336 hours, a construction field work supervisor (FWS) contacts the CSO to inform that two construction subcontractors which were performing work outside AX change tent between 1230-1245 recalled smelling odors. They did not report the odor earlier because they attributed the odors to the "blue-rooms" or porta-potties or a septic drain field. Both workers declined medical evaluation at HPMC.

At 1356 Shift IHTs completed response actions, sweeps using direct reading instruments monitoring for VOCs, Ammonia, Carbon monoxide, lower explosive limit, Oxygen, and Mercury. Two bag samples, or grab samples, were also collected. The bag samples identified 50 ppb of VOCs (200 ppm is the action level).

A SOEN message was sent at 1435 "Response actions for the TF-AOP-015 event have been completed and the results are at or below background levels. Exiting TF-AOP-015 CSM."

At approximately 1500, two other construction subcontractors recalled when they were parking a truck downwind from AX tank farm they encountered odors. Again, the odors were not reported at the immediate time due to correlating the odors from "blue-rooms" and a septic drain field. The workers also declined medical evaluation.

Immediate Actions Taken

Employees contacted the CSM. The CSM entered TF-AOP-015. Personnel in 241-AX change tent were instructed to take cover, workers inside AX tank farm exited through AY-2 change trailer.

Discussion of Potential Source

Although the source of the odors is undetermined, the most plausible sources are attributed to the sewer system 2607 E12 and associated operations, or the portable toilets. See Attachment 3: APGEMS TF Plume Modeling Report.

Preliminary Extent of Condition Review/Historical Review

A search of the Problem Evaluation Request (PER) database did not find any result of a TF-AOP-015 at AX tank farm in the previous 24 months.

Recommendations/Proposed Corrective Actions

N/A

Attachments:

Attachment 1: IHIR
Attachment 2: Remaining Odor Response Cards
Attachment 3: APGEMS-TF Plume Modeling Report

Attachment 1: IHIR

Washington River Protection Solutions **TF-AOP-015 INDUSTRIAL HYGIENE INVESTIGATION REPORT**	**PER Number:** WRPS-PER-2019-0743
Time/Date & Event location: 1230 04/16/2019 E of 241-AX Ingress/Egress Tent	**EIR Number:** EIR-2019-018

1. **Event Summary** *(including number of workers involved and activity in progress):*

1 HPT who was walking down the hill for the 241-AX Ingress/Egress Tent encountered a "sweet, sour, musty, metallic, onion" odor and later developed symptoms of "frontal" headache, dizziness/light-headedness, nausea, metallic taste, and "tingling in sinus." 2 Electricians later reported encountering a "sweet, musty, earth, rotten, propane, Sulphur, blue-room-pump-truck" odor, but did not report any symptoms.

- Was an IHT Present during initiating event? [ ] Yes [X] No

IH Monitoring/ Sample Survey Reports:

Initial and 2nd sweep: 19-00242 "Sweep of AX farm prior to AOP"
Event response: 19-02740 "AX Tent (AOP 15) Odor response"

Weather Conditions at Time of Event:

Ambient outside conditions:

- Weather station: 6 @ 1200
- Wind Direction and Speed: S @ 6mph
- Barometric Pressure *(steady/rising/falling)*: 29.2 and rising
- Temperature (F°): 60
- Humidity: 41%

Attachment 1: IHIR (Cont.)

Washington River Protection Solutions **TF-AOP-015 INDUSTRIAL HYGIENE INVESTIGATION REPORT**	**PER Number:** WRPS-PER-2019-0743
Time/Date & Event location: 1230 04/16/2019 E of 241-AX Ingress/Egress Tent	**EIR Number:** EIR-2019-018

Field Response Timeline:

1253: AN Field IH and ETF Field IH arrive at CSO
1254: Radio announcement. TF-AOP-015 entered by CSM
- Personnel in 241-AX take cover
- All other personnel evacuate area

1256: AY/AZ Field IH arrives at CSO
1257: AY/AZ Field IH makes 2 attempts to contact IH Mobile Response Van (IHMRV) to support field response actions
1258: PO Shift IHT Supervisor arrives at CSO and contacts PO Shift IHTs to support response actions
1301: PO S&H Manager arrives at CSO
1301: PH Shift IHT Supervisor reports that IH Programs has been contacted and Hapsite is being prepared to support analysis
1302: PO Shift IHT support is requested to perform access restriction actions
1303: PO S&H Manager contacts R/C IH Manager regarding sweeps performed prior to TF-AOP-015 declaration
1303: AY/AZ Field IH contacts IHMRV and requests presence at CSO for briefing before supporting response actions
1303: PO Shift IHT arrives at CSO for briefing
1304: R/C IH and R/C IS arrive at CSO to offer support for response actions.
1305: SOEN: "Entering AOP-015 for Canton Pl, east of AX Farm. All personnel stay clear of the area CSM"
1305: Terra Graphics Engineering Technician (TGET) arrives at CSO for briefing
1306: Radio announcement to remind personnel in AX tent to stay put.
1307: IHTs leave CSO to acquire instrumentation and RPE
1309: CSM initiates response actions as per TF-AOP-015 3.1.12
1314: TGET is briefed and is dispatched to event scene
1322: AN Field IH Briefs PO Shift IHTs on response actions:
- RPE in accordance with RFF TF-AOP-015 Task 2
- Make contact with TGET at access restriction boundary and support placement of IHMRV sampling equipment as close to event scene as possible
- Monitoring as per IHP-09001
- Perform sweep of event scene with MultiRAE (NH3 and VOC) and Ohio Lumex (Hg)
- Collect grab samples of sources if found, general area if no sources found
- Analyze grab samples with MIRAN SapphiRe (N2O), MultiRAE (H2S).
- Deliver grab samples to 2704HV IHT Lab for analysis by HAPSITE (VOC)

1322: SOEN: "All personnel in AX Tent, remain in place. All personnel in AX Farm, exit through AY2 change trailer. CSM"
1322: PO Shift IHT Supervisor contacts ETF IHT to prepare H2S sensor equipped MultiRAE to support response actions
1324: PO Shift IHTs are dispatched to event scene
1329: Personnel in 241-AX Tent with appropriate RPE are given permission by CSM to exit the tent through AX Farm to AY-2 change trailer
1333: CSM Contacts DOE Fac. Rep.
1336: AE FWS 1 contacts CSM to notify 2 other personnel detected odors, no symptoms reported, voluntary medical evaluation declined. AE FWS 1 and Affected personnel in route to CSO with ORCs
1340: AE FWS 2 contacts CSM to ask timeframe for egress of remaining employees taking cover in 241-AX Tent. CSM reiterates to stay in place until further notice.
1346: AE FWS 3 contacts CSM to ask ETA on removal of access restriction form 241-AX Farm to continue work activities
1347: The 2 additional affected AE employees and AE FWS 1 arrive at CSO with ORCs and brief CSM:
- Odor was consistent with propane and sewage pump truck activities
- Odor only occured in afternoon
- No symptoms, voluntary medical evaluation declined
- De-energized panel was left open inside of access restriction boundary, but is posted

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Attachment 1: IHIR (Cont.)

Washington River Protection Solutions **TF-AOP-015 INDUSTRIAL HYGIENE INVESTIGATION REPORT**	**PER Number:** WRPS-PER-2019-0743
Time/Date & Event location: 1230 04/16/2019 E of 241-AX Ingress/Egress Tent	**EIR Number:** EIR-2019-018

1349: PO IHT lead reports to CSO to offer support for response actions

1355: AE FWS 2 contacts CSM to ask timeframe for egress of remaining employees taking cover in 241-AX tent. Urgent biological needs require haste.

1356: PO Shift IHT Supervisor reports that PO Shift IHTs have completed response actions at event scene and are in route to PO IHT Lab.

1357: CSM Contacts AE FWS 2 to notify that IHT response actions and Instrument post-use function test should be complete in "about 10 minutes" and then employees will be released.

1407: CSM requests update on status of field readings from PO Shift IHT Supervisor. No update is available

1410: PO Shift IHT Supervisor contacts PO Shift IHTs to facilitate expedition of Instrument Post-Use test use so TF-AOP-015 can be exited as soon as possible

1418: CSM contacts AE FWS 2 and releases personnel with urgent biological needs from restricted access area

1419: PO Shift IHT Supervisor briefs CSM with preliminary field response readings:

Area Readings:

- VOCs: 140ppb
- NH3: 1ppm
- CO: <DL
- LEL: 0%
- O2: 20.9%
- Hg: <DL

Grab samples:

- VOCs: 50ppb
- NH3: <DL
- Hg: <DL
- H2S: <DL
- NO2: <DL

1423: AE FWS 2 contacts CSM to notify all personnel have exited 241-AX Tent

1423: R/C IH contacts R/C IH Manager for information about pre TF-AOP-015 entry events

1426: R/C IH reports that during the initiating event an AreaRAE had alarmed necessitating a sweep by R/C IHTs and no readings >DL were found. After knowledge of the event a 2nd sweep was performed and no readings >DL were found.

1432: CSM makes radio announcement exiting TF-AOP-015

1435: SOEN: "Response actions for the TF-AOP-015 event have been completed and the results are at or below background levels. Exiting TF-AOP-015. CSM"

Field IH Author:

[redacted]

Print First and Last Name — Signature — Phone No. — 05/01/2019 Date

Attachment 1: IHIR (Cont.)

Washington River Protection Solutions **TF-AOP-015 INDUSTRIAL HYGIENE INVESTIGATION REPORT**	**PER Number:** WRPS-PER-2019-0743
Time/Date & Event location: 1230 04/18/2019 E of 241-AX Ingress/Egress Tent	**EIR Number:** EIR-2019-018

2. GCMS Sample Results:

See Attachment A for HAPSITE (GCMS) results

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Attachment 1: IHIR (Cont.)

Washington River Protection Solutions TF-AOP-015 INDUSTRIAL HYGIENE INVESTIGATION REPORT	PER Number: WRPS-PER-2019-0743
Time/Date & Event location: 1230 04/16/2019 E of 241-AX Ingress/Egress Tent	EIR Number: EIR-2019-018

3. Additional Information:
   - Odor Response Cards received:

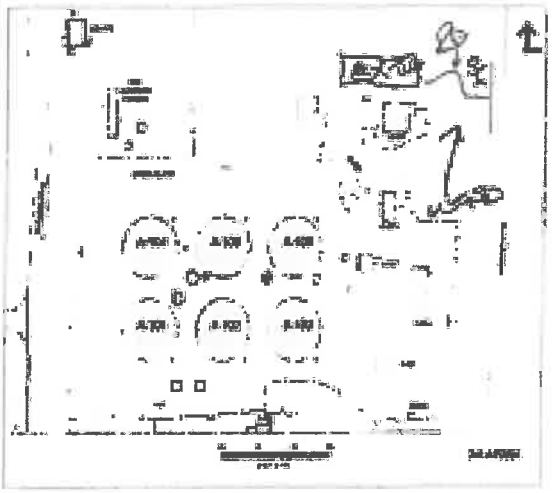
ODOR RESPONSE CARD - 241-A FARM

Odors Detected with SO Associated symptoms

1. Notify Immediate Supervisor.
2. Contact Control Shift Manager [redacted] Provide the federal information listed.
3. Complete map, return to Control Shift Office as soon as practicable.

Odors Detected WITH Symptoms

4. Notify Immediate Supervisor.
5. Contact CSM, [redacted] complete below federal information and map.
   - Your name and the work you were performing
   - Your symptoms (if any)
   - Date and time odor was noticed
   - Location of odor (point area on map and wind direction)
   - Identify the odor
   - Name(s) of others in or near the affected area
   - Was an SIT present?
   - Possible source
6. Provide information on the back of card.
7. Send this card immediately to the Control Shift Office.



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ODOR RESPONSE CARD - 241-A FARM

1. Contact CSM. Complete below federal information and map. [redacted]
   - Date and time odor was noticed 4/16/19
   - Your name and the work you were performing [redacted]
   - Location of odor (point area on map and wind direction) [illegible]
   - Name(s) of others in or near the affected area N/A
   - Was an SIT present? NO
   - Describe the odor ☑ Sweet ☑ Sour ☑ Musty ☐ Earthy ☑ Metallic ☐ Smoky ☐ Rotten ☑ Other
     ☐ Cleaning Solution ☐ Ammonia ☐ Other:
   - Possible Source: [illegible] 241-A
   - Your symptoms (if any) ☑ Headache ☑ Dizziness/Lightheaded ☑ Nausea ☐ Cough
     ☐ Fatigue/Drowsiness/Weakness ☐ Sore/Burning Throat ☐ Difficulty Breathing
     ☐ Watery/Irritated Eyes/Trouble with Vision ☐ Tingling/Numbness/Paralysis ☐ Rash/Itching
     ☑ Other: metallic taste in mouth, frontal headache, tingling in sinus
   - Is this

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Attachment 1: IHIR (Cont.)

Washington River Protection Solutions
TF-AOP-015 INDUSTRIAL HYGIENE INVESTIGATION REPORT

PER Number: WRPS-PER-2019-0743

Time/Date & Event location: 1230 04/16/2019 E of 241-AX Ingress/Egress Tent

EIR Number: EIR-2019-018

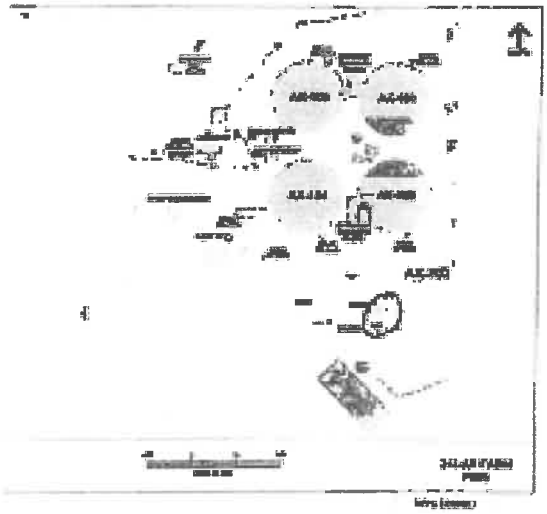
ODOR RESPONSE CARD - 241-AX FARM

Odors Detected with NO immediate symptoms

1. Notify immediate Supervisor.
2. Contact Central Shift Manager, [redacted] Provide the bulleted information below.
3. Complete map, indicate Central that odor is over or nearby.

Odors Detected WITH Symptoms

4. Notify immediate Supervisor.
5. Contact CSM, [redacted] complete below bulleted information and map.
   - Your name and the work you were performing
   - Your symptoms (if any)
   - Date and time odor was noticed
   - Location of odors (point area on map and wind direction)
   - Duration the odor
   - Name(s) of others in or near the affected area
   - Was an RIT present?
   - Describe the odor
6. Provide information on the back of card.
7. Send this card immediately to the Central Shift Office.



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ODOR RESPONSE CARD - 241-AX FARM

1. Contact CSM, Complete below bulleted information and map.
   - Date and time odor was noticed 4/16/19 12:30
   - Your name and the work you were performing [redacted] for
   - Location of odors (point area on map and wind direction)
   - Name(s) of others in or near the affected area
   - Was an RIT present? n/a
   - Describe the odor ☐ Sweet ☐ Sour ☐ Musty ☐ Earthy ☐ Metallic ☐ Smoky ☐ Rotten ☐ Other
     ☐ Cleaning Solution ☐ Ammonia ☐ Other:
   - Possible Source
   - Your symptoms (if any) ☐ Headache ☐ Dizziness/Light-headed ☐ Nausea ☐ Cough
     ☐ Fatigue/Drowsiness/Weakness ☐ Sore/Burning Throat ☐ Difficulty Breathing
     ☐ Watery/Irritated Eyes/Trouble with Vision ☐ Tingling/Numbness/Paralysis ☐ Rashes/Itching
     ☐ Other:
2. Send this card to the Central Shift Office.

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Attachment 1: IHIR (Cont.)

Washington River Protection Solutions
TF-AOP-015 INDUSTRIAL HYGIENE INVESTIGATION REPORT

PER Number: WRPS-PER-2019-0743

Time/Date & Event location:
1230 04/16/2019 E of 241-AX Ingress/Egress Tent

EIR Number: EIR-2019-018

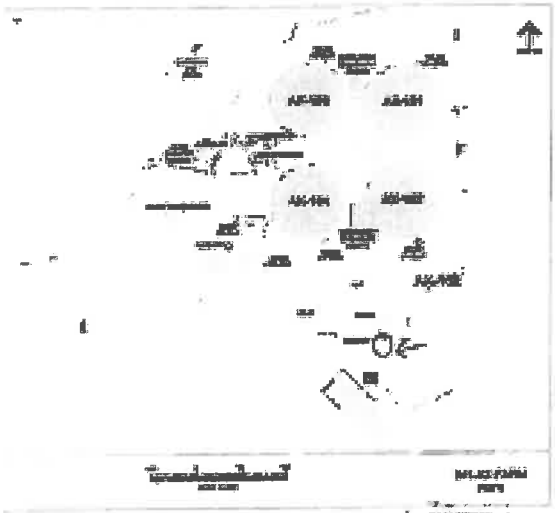
ODOR RESPONSE CARD - 241-AX FARM

Odors Detected with NO Immediate symptoms

1. Notify Immediate Supervisor.
2. Contact Control Shift Manager: [redacted]
3. Complete map, return to Control Shift Office as soon as practicable.

Odors Detected WITH Symptoms

4. Notify Immediate Supervisor.
5. Contact CSM, [redacted] complete below requested information and map.
   - Your name and the work you were performing
   - Your symptoms (if any)
   - Date and time odor was noticed
   - Location of odors (mark area on map and the other side only)
   - Describe the odor
   - Name of others in or near the affected area
   - Was an HIT present?
   - Possible source
6. Provide information on the back of card.
7. Send this card immediately to the Control Shift Office.



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ODOR RESPONSE CARD - 241-AX FARM

1. Contact CSM, Complete below requested information and map.
   - Date and time odor was noticed [illegible] 1124
   - Your name and the work you were performing [redacted] [illegible]
   - Location of odors (mark area on map and wind direction)
   - Name(s) of others in or near the affected area [redacted]
   - Was an HIT present? [illegible]
   - Describe the odor ☐ Sweet ☐ Sour ☐ Musty ☐ Earthy ☐ Metallic ☒ Smoky ☐ Rotten ☐ Onion ☐ Cleaning Solution ☐ Ammonia ☐ Other: [illegible]
   - Possible Source [illegible]
   - Feel symptoms (if any) ☐ Headache ☐ Dizziness/Light Headed ☐ Nausea ☐ Cough ☐ Fatigue/Drowsiness/Weakness ☐ Sore/Burning Throat ☐ Difficulty Breathing ☐ Watery/Irritated Eyes/Trouble with Vision ☐ Tingling/Numbness/Paralysis ☐ Rash/Itching ☐ Other: [illegible]
2. Sign: [illegible] Control

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Attachment 1: IHIR (Cont.)

Washington River Protection Solutions **TF-AOP-015 INDUSTRIAL HYGIENE INVESTIGATION REPORT**	**PER Number:** WRPS-PER-2019-0743
Time/Date & Event location: 1230 04/16/2019 E of 241-AX Ingress/Egress Tent	**EIR Number:** EIR-2019-018

- Summary of IH Monitoring and Sampling Data:

  a. Monitoring:

  Initial and 2nd sweep survey: 19-02742 "Sweep of AX farm prior to AOP"

  VOC: <DL
  NH3: <DL

  Event Response: 19-02740 "AX Tent (AOP 15) Odor response"
  DRI field readings:

  VOC: 140ppb
  NH3: 1ppm
  Hg: <DL
  LEL: 0%
  O2: 20.9%
  CO: <DL

  Grab samples:

  VOC: 50 ppb
  NH3: <DL
  N2O: <DL
  Hg: <DL
  H2S: <DL

  b. Sampling:
  N/A

4. Summary of Employee Reported Information (e.g., symptoms):

   Symptoms of "frontal" headache, dizziness/light-headedness, nausea, metallic taste, and "tingling in sinus" were reported by the HPT. No symptoms were reported by the 2 Electricians.

5. Recommendations/Conclusions:

   Identification of Source of the Concern: [ ] Yes [ ] No

6. Other:

   S&H Program Management:

   [redacted]
   Print First and Last Name | Signature | Phone No. | 4/30/19 Date

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Attachment 1: IHIR (Cont.)

Attachment A

GCMS Laboratory Results

Attachment 1: IHIR (Cont.)

HAPSITE GC-MS Bag Sample Results Survey 19-02740: AOP-15 at AX Tank Farm Tent

Two bag samples were collected in response to an odor reported at the AX Tank Farm Tent. These samples were analyzed using an Inficon HAPSITE GC-MS on April 17, 2019, 2019. Data was interpreted on April 17, 2019, and reported the same day Results for the Air Blank Sample were satisfactory. The same compounds were found in 19-02740 Bag #1 and 19-02740 Bag #2at concentrations consistent with sample bag contaminants. **No compounds were found at concentrations of concern. No compounds were found at concentrations above background.**

Compounds Found in Samples

Compound	Clean Air Blank	19-02740 Bag #1	19-02740 Bag #2	Sample Bag Contaminant	Comments
Internal Standard #1	X	X	X		Added by instrument during analysis
Toluene		X	X	X	Not found above background
Internal Standard #2	X	X	X		Added by instrument during analysis
Xylene		X		X	Not found above background
C9 Alkane Hydrocarbon		X	X	X	Not found above background
D-Limonene		X	X	X	Not found above background
Silane Compound		X	X	X	Not found above background
C11-15 Alkane Hydrocarbons		X	X	X	Not found above background

If you have questions contact [redacted]

[redacted]

Attachment 2: Remaining Odor Response Cards

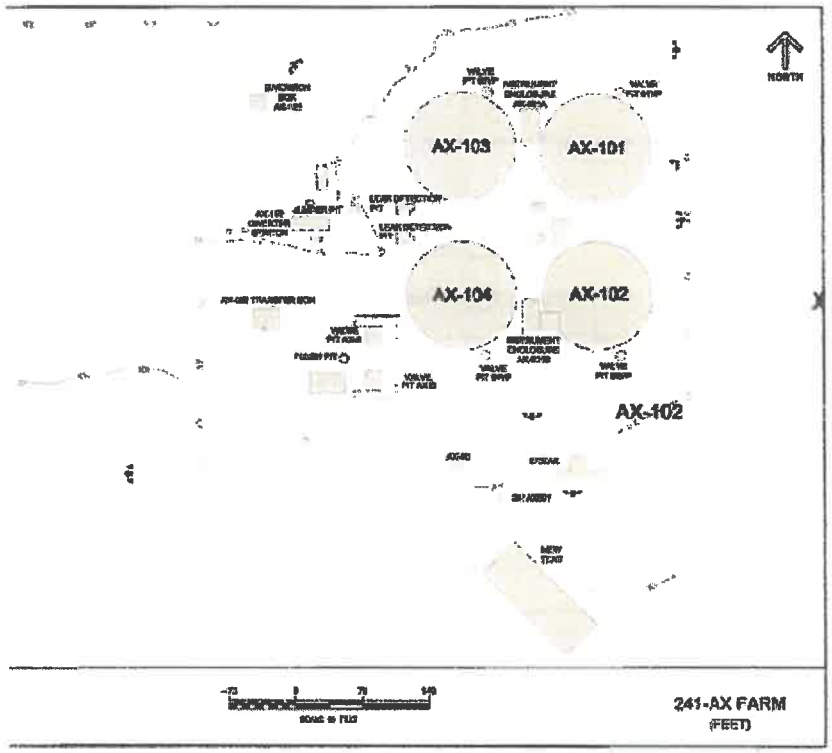
ODOR RESPONSE CARD - 241-AX FARM

Odors Detected with *NO* Immediate symptoms

1. Notify Immediate Supervisor.
2. Contact Central Shift Manager, [redacted]. Provide the bulleted information below.
3. Complete map, return to Central Shift Office as soon as practicable.

Odors Detected *WITH* Symptoms

4. Notify Immediate Supervisor.
5. Contact CSM, [redacted] complete below bulleted information and map.
   - Your name and the work you were performing
   - Your symptoms *(if any)*
   - Date and time odor was noticed
   - Location of odors *(mark area on map and the wind direction)*
   - Describe the odor
   - Name of other in or near the affected area
   - Was an IHT present?
   - Possible source
6. Provide information on the back of card.
7. **Send this card immediately to the Central Shift Office.**



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Attachment 2: Remaining Odor Response Cards

ODOR RESPONSE CARD - 241-AX FARM

1. Contact CSM, Complete below bulleted information and map.

- Date and time odor was noticed 4-16-19 12:45 p.m
- Your name and the work your were perfoming [redacted] riding in truck
- Location of odors *(mark area on map and wind direction)* North east
- Name(s) of others in or near the affected area [redacted]
- Was an IHT present? NO
- Describe the odor ☐ Sweet ☐ Sour ☐ Musty ☐ Earthy ☐ Metallic ☐ Smoky ☐ Rotten ☐ Onion
  ☐ Cleaning Solution ☐ Ammonia ☐ Other: Poop
- Possible Source Not Sure
- Your symptoms *(if any)* ☐ Headache ☐ Dizziness/Light-Headed ☐ Nausea ☐ Cough
  ☐ Fatigue/Drowsiness/Weakness ☐ Sore/Burning Throat ☐ Difficulty Breathing
  ☐ Watery/Irritated Eyes/Trouble with Vision ☐ Tingling/Numbness/Paralysis ☐ Rash/Itching
  ☐ Other: NONE

2. Send this card to the Central Shift Office.

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Attachment 2: Remaining Odor Response Cards

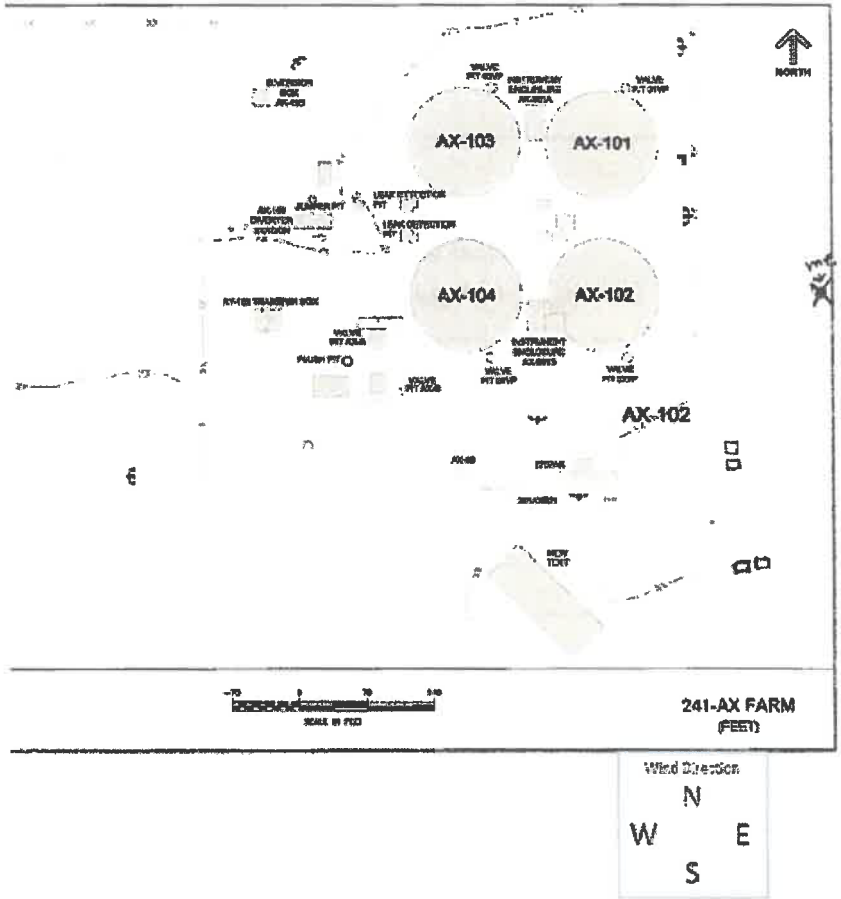
ODOR RESPONSE CARD - 241-AX FARM

Odors Detected with *NO* Immediate symptoms

1. Notify Immediate Supervisor.
2. Contact Central Shift Manager, [redacted] Provide the bulleted information below.
3. Complete map, return to Central Shift Office as soon as practicable.

Odors Detected *WITH* Symptoms

4. Notify Immediate Supervisor.
5. Contact CSM, [redacted], complete below bulleted information and map.
   - Your name and the work you were performing
   - Your symptoms *(if any)*
   - Date and time odor was noticed
   - Location of odors *(mark area on map and the wind direction)*
   - Describe the odor
   - Name of other in or near the affected area
   - Was an IHT present?
   - Possible source
6. Provide information on the back of card.
7. **Send this card immediately to the Central Shift Office.**



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Attachment 2: Remaining Odor Response Cards

ODOR RESPONSE CARD - 241-AX FARM

1. **Contact CSM, Complete below bulleted information and map.**

- Date and time odor was noticed 12:45 4-16-2019
- Your name and the work your were perfoming [redacted], Parking Truck
- Location of odors *(mark area on map and wind direction)* North East
- Name(s) of others in or near the affected area [redacted]
- Was an IHT present? No
- Describe the odor ☐ Sweet ☐ Sour ☐ Musty ☐ Earthy ☐ Metallic ☐ Smoky ☐ Rotten ☐ Onion
  ☐ Cleaning Solution ☐ Ammonia ☐ Other: Poopy
- Possible Source 4th St
- Your symptoms *(if any)* ☐ Headache ☐ Dizziness/Light-Headed ☐ Nausea ☐ Cough
  ☐ Fatigue/Drowsiness/Weakness ☐ Sore/Burning Throat ☐ Difficulty Breathing
  ☐ Watery/Irritated Eyes/Trouble with Vision ☐ Tingling/Numbness/Paralysis ☐ Rash/Itching
  ☐ Other: None

2. **Send this card to the Central Shift Office.**

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Attachment 3: APGEMS-TF Plume Modeling Report

APGEMS-TF Plume Modeling for April, 16, 2019 AOP-015 Event

[redacted]

An AOP-015 event was reported at 12:30 and 12:45 on April 16, 2019. One Health Physics Technician was walking down the hill for the 241-AX Ingress/Egress Tent (located near the SE corner of the AX Tank Farm) at 12:30 and encountered odors (sweet, sour, musty, metallic, onion) and later reported symptoms ("frontal headache," dizziness/light-headedness, nausea, metallic taste, and "tingling in sinus"). Two Electricians were at A241-EDS-DP-001 building to perform electrical testing at 12:45 and also encountered odors (sweet, musty, earthy, rotten, propane, sulfur, "blue-room-pump-truck") but no symptoms. Figure 1 shows the area of the AOP-015 locations, as well as the wind direction during the AOP-015 timeframe and potential odor sources.

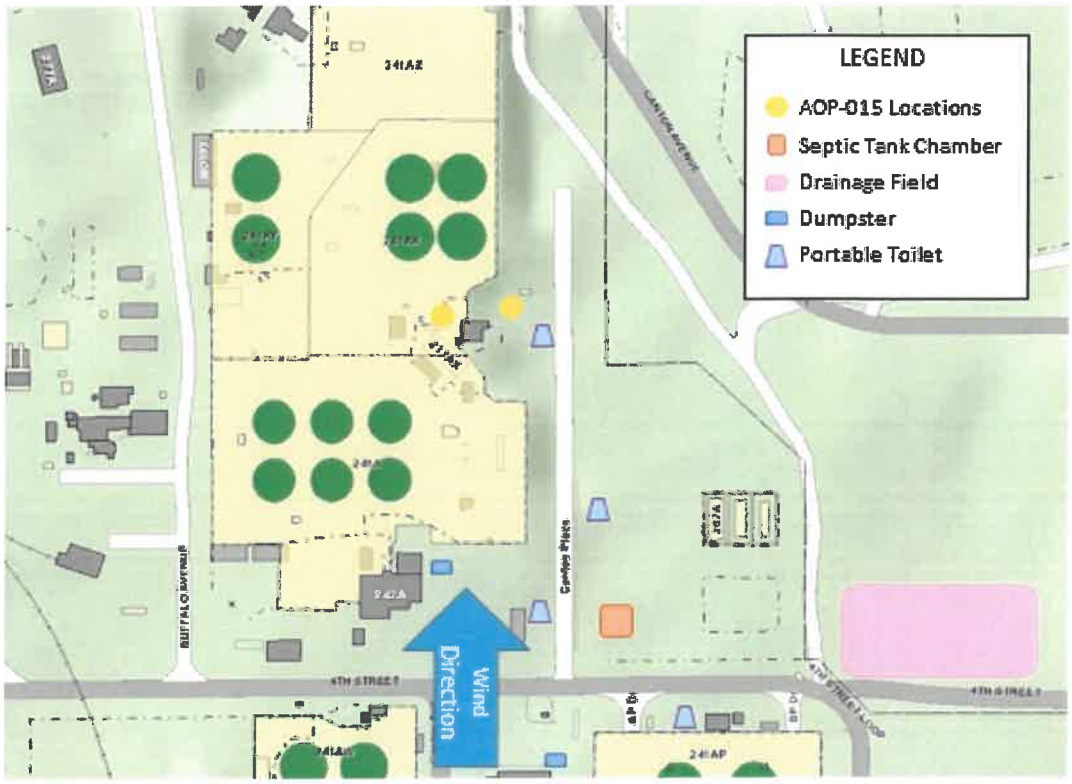

Figure 1. AOP-015 Locations on 4/16/2019 in Relation to Potential Vapors Sources. Blue arrow at the bottom of the image indicates the predominant wind direction.

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Potential Vapor Sources

The electricians reported a rotten odor, which may result from hydrogen sulfide (H_2S) or mercaptans. These compounds are products of microbial decomposition of organic matter found in sewers, portable toilets, and dumpsters. The area near and upwind of the AOP-015 event contains several portable toilets as well as several dumpsters, a septic tank dosing chamber, and a septic/sewer drain field. Portable toilets were not serviced on April 16, 2019 so although the odor level may not have been as significant as it would be during service, the proximity of three portable toilets makes this a reasonable odor source. The state of the dumpsters on the day of the AOP-015 event has not been determined (recently emptied or full); however, dumpsters were included as a potential source of these odors. Additionally, the dosing chamber, when open, releases a noticeable amount of odor when standing directly downstream of the chamber.

Sweet Metallic odors, which was reported by the HPT, may be from aldehydes and ketones. The HPT also reported an onion odor, which can be from sulfur-containing organic compounds such as H_2S and thiols. Thiols have very low human odor thresholds that can be detected at concentrations orders of magnitude below hazardous limits.

APGEMS-TF Modeling Results Conclusions

The APGEMS Tank Farm plume model (APGEMS-TF) was used to support the investigation of the AOP-015 event and evaluate nearby sources as potential causes. Results of the modeling are summarized as follows:

- **Tank waste vapors were an unlikely source of these AOP-015 odors.** The reasoning behind this conclusion is as follows:
  - Odiferous compounds in the tank were a minimum of one order of magnitude below their odor thresholds at the AOP-015 locations
  - Modeling results indicated that all COPCs were ≤0.001% of OEL at the AOP-015 locations.
  - The A Farm tanks do not contain H_2S or thiols that would lead to a rotten smell. Most of the odiferous compounds in the tank are associated with "chemical" smells and some that are used in the flavor/fragrance industry (e.g. fruity, floral).
  - The meteorological conditions at the time of the AOP-015 were consistent with minimal passive breather filter ventilation (material is not exhaling).
- The sewer system 2607 E12 and associated operations (septic tank dosing chamber, septic tanks with associated risers, and the septic drain field) is a plausible source for the odors.
  - This area is still undergoing upgrades to modernize the system, but has had numerous odor events associated with operations.
  - The system is upwind of the incident and is the source of H_2S and thiols (organosulfur compounds) associated with rotten smells – including body odor, onion smell and skunky smells.

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- Portable toilets are a potential source.
  - The portable toilets in the east area were not serviced on April 16, 2019. However, electricians described the odor as "blue room odors," so it is possible that the three portable toilets near the AOP-015 location was a source.
- The dumpsters near 2442-A Evaporator and 272AW are potential sources, but due to the regularity of emptying these, there is little probability of any rotting of organic matter to the extent of causing odors downwind.

APGEMS-TF Modeling Overview

The APGEMS-TF model generates a 3-dimensional wind field utilizing meteorological data from 30 weather stations on the Hanford site. The model then utilizes measured mixing heights and stability classes to estimate mixing and dispersion of contaminants within the wind field. The model estimates dispersion of chemical contaminants from a source and estimated concentrations downwind of the source, but does not estimate a source location based on a receptor location.

Wind speeds during the AOP-015 period were typical of when AOP-015 events are normally reported. The 200E meteorological station (nearest to this AOP-015 event) measured 9 mph at 12:30 and 12:45, and winds were generally from the south (154 and 200 degrees). The temperature was 60 degrees, pressure was 29.2 in Hg (and rising slightly) and the stability class was slightly unstable (Class C). Based on these conditions, dispersion from sources are expected to be moderate, and emissions from passively ventilated sources are expected to be minimal.

APGEMS-TF Modeling of A Farm PBFs as Potential Sources

The A Farm passive breather filters were not likely to be emitting headspace gases because the atmospheric pressure was rising slightly, which would prevent headspace gas emissions. However, the winds were a moderate 9 mph, which could act to draw some headspace gas up through the risers.

APGEMS-TF modeling was performed to predict the release of ammonia from the A Farm tanks at the time of the AOP-015 event. AX farms was not included in the model since the farm is directly west of the exposure and the odiferous chemicals are found in both AX tank farm are also found in the A Tank farm at similar concentrations. Results from the AGEMS-TF modeling for ammonia are provided in Figure 2. The image includes predicted ammonia concentrations at the time of the AOP-015 event as shown by concentration contour lines with the innermost contour line equal to the highest concentration shown in the legend (on the right side of the figure). Each successive contour line moving out from the center is 1/10 the concentration of the prior. The highest contour line shown in Figure 2 is 1 ppb, indicating that worker exposure to ammonia was at most 3 orders of magnitude below the odor threshold (about 2-20 ppm).

Other chemicals that are found in the A Farm tanks that could result in odor detections at sufficient concentrations include 2-Hexanone, which is associated with an acetone-like odor, acetonitrile, which is associated with an ether-like odor, and formaldehyde, which has a strong odor. These chemicals have been measured at concentrations within the headspace at levels as high as 41% of the OEL. This is a significantly lower concentration than ammonia, which is nearly 710% of the OEL (177 ppm). None of these chemicals align well with the reported odors from this AOP-015 event.

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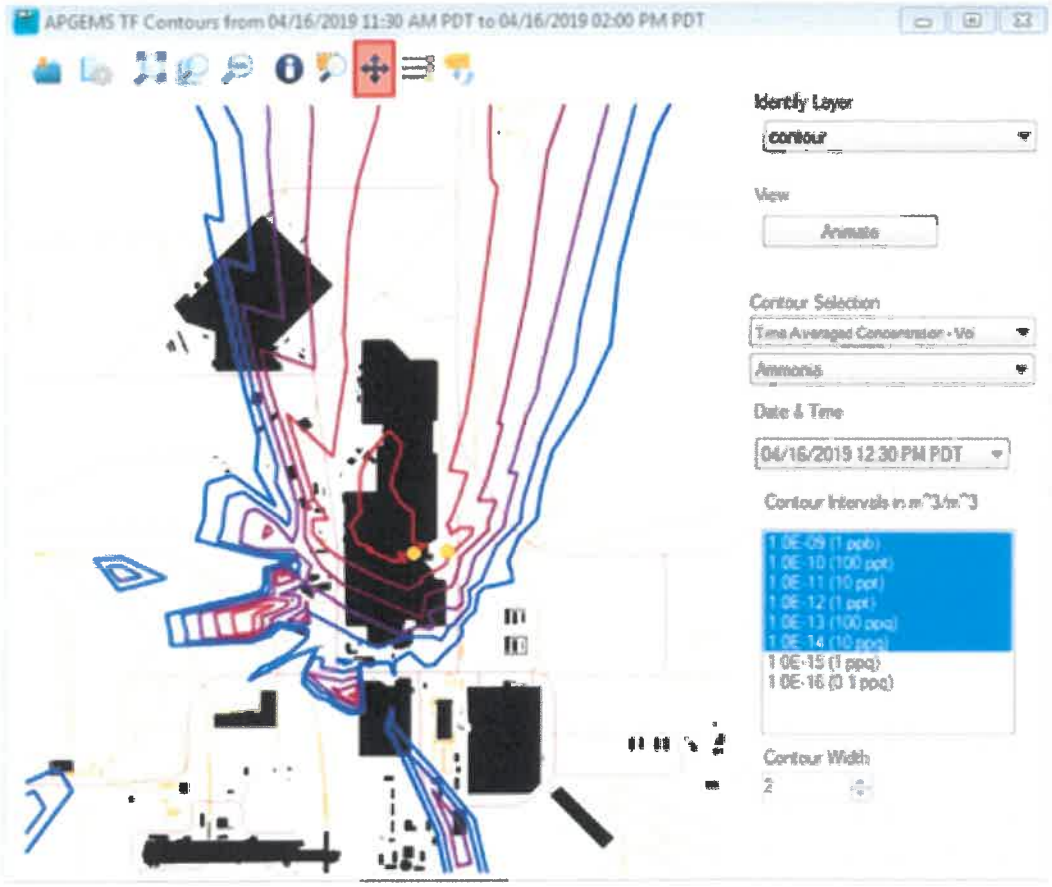

Figure 2. APGEMS-TF Model result from the A Farm PBFs near the time of the AOP-015 Event. Ammonia source was 5.68E-4 g/s for each of the 6 PBFs.

APGEMS-TF Modeling of Septic Tank Dosing Chamber (2607E12)

Figure 3 presents APGEMS-TF modeling results from the septic tank dosing chamber located near the northeast corner of 4th and Canton. This location is the closest part of the 2607 E12 sewer system and provides a reasonable location for odors emanating from any part of this system. Due to the lack of source measurement data, methyl mercaptan (a surrogate for many organic thiols associated with organic matter decay) was modeled with an emission rate of 1 g/s. The contour lines shown in Figure 3 should not be interpreted as estimated concentration levels, but rather relative concentration levels given an assumed emission, and the general extent of the plume resulting from the prescribed source location. As was described for the previous figure, each concentration contour line represents 1/10 the concentration of the previous contour line (moving from the center, outward).

The AOP-015 locations were near the higher concentration areas of this plume, which indicates that this is a plausible source of this AOP-015 event.

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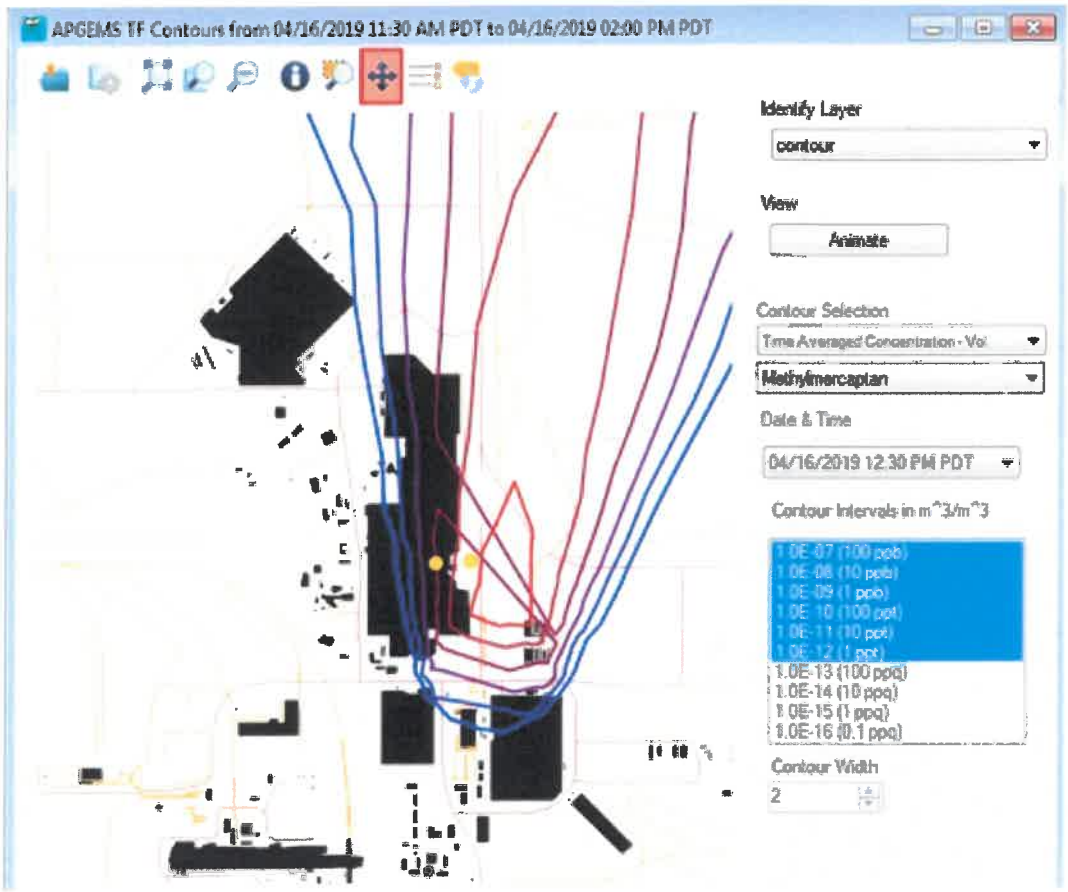

Figure 3. APGEMS-TF Model result from the septic tank dosing chamber location near the corner of 4th and Canton near the time of the AOP-015 Event. Methyl mercaptan emission rate was 1 g/s.

APGEMS-TF Modeling of Drain Field

Figure 4 presents the results of APGEMS-TF modeling with a sewage drain field used as the source. The drain field located to the east of the rest of the 2607 E12 and provided a slightly different location as a source term. This drain field is located to the northeast of the AP Tank Farm. Due to the lack of source measurement data, hydrogen sulfide (a common odor causing chemical associated with waste that also results in a rotten smell) was modeled with an emission rate of 1 g/s. The contour lines shown in Figure 4 should not be interpreted as estimated concentration levels, but rather relative concentration levels given an assumed emission, and the general extent of the plume resulting from the prescribed source location. As was described for the previous figures, each concentration contour line represents 1/10 the concentration of the previous contour line (moving from the center, outward).

At the time of the AOP-015 event, the plume resulting from the drainage field was located primarily to the east of the AOP-015 location. This indicates that the drainage field was not a likely source of the AOP-015 event.

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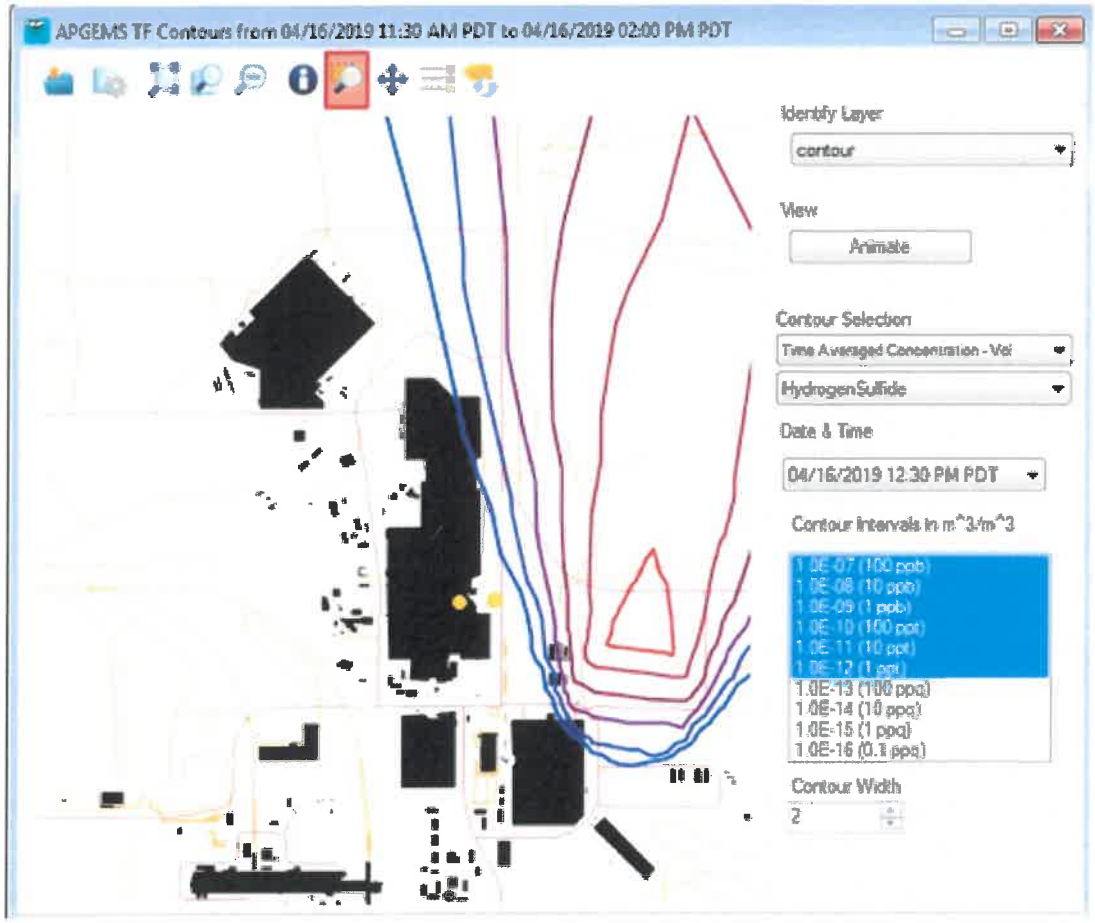

Figure 4. APGEMS-TF Model result from a sewage drain field located NE of the AP Tank Farm near the time of the AOP-015 Event. Hydrogen sulfide emission rate was 1 g/s.

APGEMS-TF Modeling of Portable Toilets

Figure 5 presents the results of APGEMS-TF modeling with nearby portable toilets used as sources. Four locations were identified as portable toilet locations that may contribute to odors at the AOP-015 location. From the south, these are (1) a large handicap-accessible portable toilet located north of the AP Tank Farm, (2) a standard portable toilet located approximately 45m north of the 4th and Canton intersection, on the west side of the street, (3) a standard portable toilet located approximately 85m north of the 4th and Canton intersection, on the east side of the street, and (4) three standard portable toilets, arranged side-by-side located approximately 30m east of the 241A401 Tank Farm Condenser House. This Tank Farm Condenser House is very near the location of the AOP-015 events, and these three portable toilets seem like a plausible source for the odors experienced during this AOP-015.

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Portable toilet vapors were modeled as hydrogen sulfide, a common odor causing chemical associated with waste that also results in a rotten smell. Due to the absence of source term information, a unit emission rate (1 g/s) was used at each portable toilet location. The contour lines shown in Figure 5 cannot be attributed to specific hydrogen sulfide concentrations, but indicate the direction of the portable toilet vapor plume and relative concentrations.

Figure 5. APGEMS-TF Model result from four portable toilet locations within the A Corridor near the time of the AOP-015 Event. Hydrogen sulfide emission rate was 1 g/s at each location.

APGEMS-TF Modeling of Dumpster

Decomposition of waste such as that in dumpsters often creates sulfides (e.g., hydrogen sulfide, mercaptans) and ammonia, which are odor-causing chemicals. Ammonia has a distinct odor, noticeably different from a rotten odor, so sulfides or mercaptans are more likely to be attributable to the rotten smell reported during this AOP-015 event. Figure 6 presents the results of APGEMS-TF modeling with nearby dumpsters used as sources. Two dumpster locations generally south of the odor incident and could be the cause of the odors at the AOP-015 location. From the south, these are (1) on the west side of Canton, across the street from the NW corner of the AP Tank Farm, and (2) east of the 242-A

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Evaporator. As was the case with the portable toilet, the source term for these dumpsters are not available, so a unit release (1 g/s) was prescribed for each of the two dumpsters.

Due to the absence of source term information, a unit emission rate (1 g/s) was used at each dumpster location. The contour lines shown in Figure 6 cannot be attributed to specific mercaptan concentrations, but indicate the direction of the dumpster vapor plume and relative concentrations. The contours do indicate that the dumpsters are potential sources for the odors detected during the AOP-015.

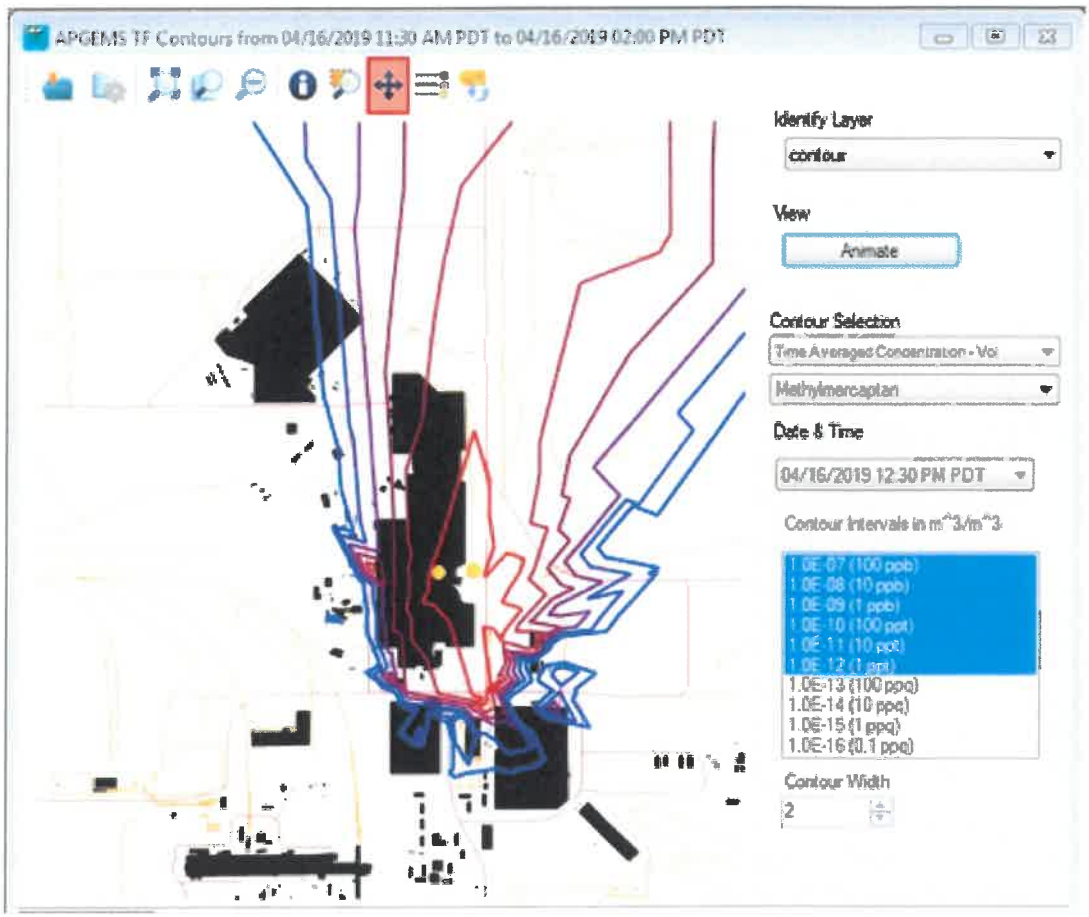

Figure 6. APGEMS-TF Model result from the two dumpster locations near the 242A Evaporator and 272AW near the time of the AOP-015 Event. Methyl mercaptan emission rate was 1 g/s from each of the two dumpsters.