EVENT INVESTIGATION REPORT

EIR-2019-021: Investigation of MO579 AOP-015 Event

[redacted] 6/12/2019

Event Investigator Date

[redacted] 6/12/2019

PER Responsible Manager Date

PER No. WRPS-PER-2019-0870

MO579 AOP-015 Event

AOP-015 Summary

Date/Time of Event	April 30, 2019 at ~1030
Location	Adjacent to 241-C-105 Retrieval Control Trailer
Personnel Affected	Four (4) personnel reported odors Evaluated at HPMC: • Three (3)
Odor	• Onion (5) • Body Odor (4)
Symptoms	• Headache (1) • (Potentially pre-existing) allergy-like symptoms (2)
Direct Read Instrumentation (DRI) Monitoring	Ammonia: < detection limit (DL) VOCs: < DL NH_3: < DL H_2S: < DL CO: < DL LFL: 0% O_2: 20.9%
Sampling	1 bag sample was collected, results were not found above background levels.
Potential Source	MO143 toilet and associated septic tank
Wind Speed / Direction	North @ 6 mph
Weather Conditions	Barometric pressure: 29.39 in and falling Temperature @ 57 degrees Humidity 19%
Waste Disturbing or Tank Work in Adjacent Area	None
Other Work in Adjacent Area	None.

Investigation

At approximately 1024hrs on Tuesday, April 30, 2019, four workers observing a Material Storage Container (conex) being relocated encountered odors described as onion, body odor adjacent to MO 579, 241-C-105 Retrieval Control Trailer. One OE did not have any symptoms. Three workers (IHT, NCO and HPT) reported a headache, or allergy-like symptoms.

The three workers were taken to HPMC to be evaluated. All were released without restriction.

Field Response Timeline:

1029: Shift Manager (SM) Contacts Production Operations (PO) Industrial Hygiene (IH) Manager to notify of TF-AOP-015 Entry
1030: PO IH Manager notifies AN Team Field IH, Central Operations and Maintenance (COMs) Team Field IH, Evaporator (EV) Team Field IH, PO Team Field IH, Pacific Northwest National Laboratory (PNNL) Chemist and Chemical Vapors Solutions Team (CVST) Fugitive Emissions Sub-Team (FEST) Engineer of TF-AOP-015 Entry
1031: AN Team Field IH and COMs Team Field IH depart area North of 244-AR for Central Shift Office (CSO) to support response actions
1031: AN Team Field IH contacts PO Shift Industrial Hygiene Technician (IHT) Supervisor to request PO Shift IHT support at CSO
1031: PO IH manager, EV Team Field IH, PO Team Field IH, PNNL Chemist and CVST FEST Engineer head towards event scene with Toxic Vapor Analyzer Flame Ionization Detector (TVA2020), Shinyei OMX-SRM, and Shinyei OMX-ADM instrumentation.
1031: COMs Team Field IH contacts PO IHT Lead to initiate "warm-up" of Ohio Lumex and MIRAN SapphIRe to support response actions.
1034: SOEN: "Entered AOP-015 for strong odor on south side of C Farm. All personnel stay clear of south side of C Farm until further notice. CSM" (central Shift Manager)
1037: AN Team Field IH and COMs Team Field IH arrive at CSO and receive briefing by CSM 1, CSM 2 and S
1037: AY/AZ Team Field IH contacts PO IHT Lead to ensure Ohio Lumex and MIRAN SapphIRe are ready to support response actions
1038: COMs Team Field IH Contacts PO IHT Lead to request Hydrogen Sulfide (H_2S) sensor equipped MulitRAE be prepared and delivered to CSO based on odor description
1038: AY/AZ Team Field IH contacts IH Programs IHT Lead to initiate HAPSITE® startup actions to support response actions
1039: AY/AZ Team Field IH contacts Hanford Weather Station for weather information
1040: Terra Graphics Engineering Technicians (TGETs) and Terra Graphics Industrial Hygiene Response Van (TGIHRV) arrive at CSO and are briefed by AN Team Field IH
1044: CSM 1 requests response actions as per TF-AOP-015 3.1.12
1045: PO Shift IHTs depart CSO to acquire Respiratory Protection Equipment (RPE), instrumentation, and grab sample collection supplies.
1047: PO IHT Lead arrives at CSO and informs COMs Team Field IH that H_2S sensor equipped MultiRAE is in-route from Effluent Treatment Facility (ETF) IHT Lab.
1048: TGETs and TGIHRV depart CSO for event scene to set up and await contact with PO Shift IHTs
1048: Affected employees decline medical evaluation offered by CSM 1 and CSM 2
1050: AN Team Field IH prints Odor Response Cards (ORCs)
1050: ETF Team Field IH arrives at CSO to offer support for response actions
1055: PO IH Manager encounters affected worker adjacent to, and spends approx. 10 minutes discussing, field events. No symptoms reported by affected employee at this time.
1058: Reports of additional odor locations arrive at CSO
1101: Deputy Environmental Safety Health and Quality (ESH&Q) Manager contacts AY/AZ Team Field IH for update
1102: Event Investigation Report (EIR) lead contacts CSM 1
1103: AN Team Field IH confirms with CSM that boundary is being expanded
1104: AN Team Field IH and COMs Team Field IH Brief PO Shift IHTs on response actions:
- RPE will be worn in accordance with Respiratory Protection Form (RPF) TF-AOP-015 Task 2
- Monitoring will be performed in accordance with IHP-09001 (Industrial Hygiene Plan) Revision 6
- Additional monitoring for H_2S will be performed at IH Discretion
- Make contact with TGETs at location of TGIHRV and place sampling hose at location of reported odors
- Collect grab samples of source if identified and in general area of reported odor
- Analyze collected grab samples at Temporary 200E PO IHT Lab (MO511) for H_2S, Elemental Mercury (Hg), Nitrous Oxide (N_2O), Volatile Organic Hydrocarbons (VOCs) and Ammonia (NH_3) then transport grab samples to 2704HV IH Programs IHT Lab for HAPSITE® analysis for VOCs

1104: PO IH Manager contacts Retrieval and Closure (R/C) Supervisor of affected worker to request they report to CSO to populate ORCs

1108: PO Shift IHT Supervisor contacts ETF IHT lead to find out progress of delivery of H_2S equipped MultiRAE

1109: PO Shift IHTs depart CSO

1109: AY/AZ Team Field IH notifies CSM 1 and CSM 2 that a fourth affected person is in route to the CSO to fill out an ORC.

1110: CSM calls R/C Supervisor to make sure the two (2) employees who indicated symptoms on ORCs are evaluated at the On-Site Medical Provider Hollie P. Mooers Corporation (HPMC).

1112: AN Team Field IH prints TFC-ESHQ-S_CMLI-C-02 at request of CSM 2

1116: AY/AZ Team Field IH contacts Deputy ESH&Q Manager on direction related to affected employees refusal of medical evaluation

1119: Additional employees who reported symptoms refuse medical evaluation

1120: AY/AZ Team Field IH contacts Programs Safety Manager for direction related to affected employees refusal of medical evaluation

1123: AY/AZ Team Field IH attempts to contact manager of affected personnel to ensure employee is sent to HPMC for medical evaluation

1127: AY/AZ Team Field IH contacts R/C IH Manager to request support getting employee with symptoms to HPMC for medical evaluation.

1128: AY/AZ Field IH contacts Deputy ESH&Q Manager to update on medical evaluation path forward

1135: Operating Engineer (OE) contacts CSM 2 and reports initial DRI survey:

- VOC: <DL
- NH_3: <DL
- H_2S: <DL

1137: R/C IHT Supervisor Contacts AY/AZ Team Field IH to notify that affected employee is being transported to HPMC for required Medical "check-in"

1146: OE contacts CSM 1 to notify that boundary restriction needs increased robustness.

1152: PO IHTs arrive back at temporary 200E PO IHT Lab (MO511) to post-use-function-check instruments and process grab samples

1157: COMs Team Field IH contacts PO Shift IHT Lead to request ETF IHT Lead Post-Use-Function-Test H2S sensor equipped MultiRAE As-Soon-As-Possible (ASAP)

1201: PO Shift IHT Supervisor contacts COMs Team Field IH to notify that all reading in field were <DL, two grab samples collected during response actions, and field response is complete. COMs Team Field IH requests post-use-function-check ASAP.

1202: OE arrives at CSO and reports access restriction boundary has been re-enforced with rope.

1203: PO Shift IHT Supervisor contacts COMs Field IH to notify that VOC/NH_3 sensor equipped MultiRAE passed post-use-function-test, H_2S sensor equipped MultiRAE is in-route to ETF IHT Lab for post-use-function-check

1206: PO IH Manager, EV Team Field IH, PO Team Field IH arrive at CSO to report findings and observations from Shinyei and TVA2020 test:

- Shinyei-SRM: <DL
- Shinyei-ADM: <DL
- TVA2020: slight instrument response, but consistent with background
- Odor is persistent

1208: EV Team Field IH, PO Team Field IH complete ORCs, voluntary medical evaluation is offered and declined.

1210: COMs Team Field IH Contacts PNNL Chemist to request presence in CSO and to complete an ORC.

1224: PO Shift IHT Supervisor contacts COMs Team Field IH that H_2S sensor equipped MultiRAE has passed post-use-function-test

1224: PNNL Chemist and CVST FEST Engineer arrive at CSO to complete ORCs.

1226: PO Shift IHTs depart MO511 to transport grab samples to 2704HV Programs IHT Lab.

1228: COMs Team Field IH notifies CSM 1 that all instruments passed post-use-function-test

1234: PNNL Chemist and CVST FEST Engineer submit ORCs to CSM 1

1236: PNNL Chemist and CVST FEST Engineer brief SM of observations during Fugitive Emissions Investigation (FEI)

1242: CSM 1 and CSM 2 contact AN Team Field IH to confirm response actions are complete and instrument post-use-function-tests passed.

1258: 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."

Immediate Actions Taken

Employees contacted the CSM. The CSM entered TF-AOP-015. See Attachment 1: Industrial Hygiene Investigation Report for further actions taken.

Discussion of Potential Source

Although the source of the odors is undetermined, the most plausible sources is attributed to the MO143 toilet and associated septic system. See Attachment 2: 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 results of TF-AOP-015 entries at C tank farm in the previous 24 months.

Recommendations/Proposed Corrective Actions

N/A

Attachments:

Attachment 1: Industrial Hygiene Investigation Report (IHIR)
Attachment 2: APGEMS-TF Plume Modeling Report

Attachment 1: Industrial Hygiene Investigation Report (IHIR)

Washington River Protection Solutions **TF-AOP-015 INDUSTRIAL HYGIENE INVESTIGATION REPORT**	**PER Number:** WRPS-PER-2019-0870
Time/Date & Event location: 1007 04/30/2019 Adjacent to the 241-C-105 Retrieval Control Trailer (MO579)	**EIR Number:** EIR-2019-021

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

3 Workers, not involved with, but observing the relocation of a Material Storage Container work evolution encountered a "stronger than normal" "onion, body odor" odor. 2 workers reported allergy-like, or potentially pre-existing allergy-like symptoms. Later, an additional worker who was engaged exercise related activities encounterd an odor of the same description and experienced a headache.

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

IH Monitoring/ Sample Survey Reports:

Event response: 19-03060 "SW C-Farm AOP-015 Response"

Weather Conditions at Time of Event:

Ambient outside conditions:

- Weather station: 6 @ 1000
- Wind Direction and Speed: N @ 6mph
- Barometric Pressure *(steady/rising/falling)*: 29.40" and stable
- Temperature (F°): 55
- Humidity: 20%

Ambient outside conditions:

- Weather station: 6 @ 1030
- Wind Direction and Speed: N @ 8mph
- Barometric Pressure *(steady/rising/falling)*: 29.39" and falling
- Temperature (F°): 57
- Humidity: 19%

Attachment 1: IHIR (Cont.)

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1228: COMs Team Field IH notifies CSM 1 that all instruments passed post-use-function-test

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Glossary:

AOP	Abnormal Operating Procedure
ASAP	As Soon As Possible
CSM	Central Shift Manager
CSO	Central Shift Office (274AW Room 5)
CVST	Chemical Vapors Solutions Team
DL	Detection Limit
EIR	Event Investigation Report
ESH&Q	Environmental Safety Health and Quality
ETF	Effluent Treatment Facility
EV	Evaporator
FEI	Fugitive Emissions Investigation
FEST	Fugitive Emissions Sub-Team
H_2S	Hydrogen Sulfide
Hg	Mercury
HPMC	Hollie P. Mooers Corporation
IH	Industrial Hygiene
IHP	Industrial Hygiene Plan
IHT	Industrial Hygiene Technician
MO	Mobile Office
N_2O	Nitrous Oxide
NH_3	Ammonia
OE	Operating Engineer
ORC	Odor Response Card
PNNL	Pacific Northwest National Laboratories
PO	Production Operations
R/C	Retrieval and Closure
RPE	Respiratory Protection Equipment
RPF	Respiratory Protection Form
SM	Shift Manager
TF	Tank Farms
TGET	Terra Graphics Engineering Technician
TGIHRV	Terra Graphics Industrial Hygiene Response Van
TVA2020	Toxic Vapor Analyzer 2020
VOC	Volatile Organic Compounds

Attachment 1: IHIR (Cont.)

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FEI Team IHs (EV Team Field IH and PO Team IH):

"We arrived at the Southwest corner of C farm around 1040am and met with Rich Rodriguez the onsite Operations representative. There was a noticeable transient onion odor present, which initially seemed to be coming from the direction of the C-farm gate in-between the CONEX box and the Upper-C farm change trailer. Operations was preparing to isolate the area East of the berm and along the Southeast section of C-farms' fence line. We received permission to monitor the perimeter with R&D instrumentation. The wind direction was predominately coming from the Northeast but would shift slightly and come directly from the North; it was at these moments that the onion odor was noticeable. We decided to head further North along the C-farm perimeter to investigate. Traveling to the Northwest corner of C-farm there was a very strong diesel odor making it impossible to differentiate the presence of any other possible odors. Along the North border of C-farm and to the Northeast corner sagebrush, plastic tarps, and weed control spray odors were present with only very faint onion/sour smells."

Fugitive Emissions Investigation Team Field Observations:

PNNL Chemist and CVST FEST Engineer:
"At 10:44 PM, the team members arrived across 7th street from C-Farm. At this point, [redacted] took a TVA 2020 and Shinyei OMX-SRM odor meter and proceeded to walk around the perimeter of C-Farm in a counterclockwise direction. [redacted] did not get any readings from the instruments nor did he detect any odors on the east. [redacted] then proceeded to walk around the perimeter of C-Farm in a clockwise direction. Upon reaching the west side of the tank farm, he did get intermittent detection of body odor smell with his nose. [redacted] continued around the farm to the NE corner, encountering no other clear odor detections, or instrument indications above background. At 11:15, C. Carlson moved to the south side of the barrier around the exclusion zone of the AOP-015 event and detected the body odor smell just to the west of the change trailer in C-Farm and south of the berm. One of the TerraGraphics staff indicated that he smelled a strong sewer odor while entering the MO-143 restrooms just to the west of the AOP-015 site.

At 11:45, the FEI team moved to the nearest source of odorous vapors outside of the tank farm boundary. Just to the west of the incident location is the MO-143 building which is a toilet with an underground holding tank. Upon walking around the toilet, whenever the wind was coming from the direction of the toilet, the team smelled odors, mainly sewer type odors, but they also included others such as body odor. It should be noted that the flags placed around the buildings showed that the wind direction shifted continuously, and the odors were detected only when the wind was coming from the direction of the toilet. On the north side of the toilets, the team noticed that the ground was spongy and it was very wet (also isolated moss growth and calcium/metal oxide coating pebbles, indicating hard water has settled through soil), in contrast to all of the other mobile offices in the area which had dry hard soil on all sides of the building." See Image 1

Attachment 1: IHIR (Cont.)

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Image 1: "Discolored wet soft ground behind MO143 NW Side of C Farm-periodic-puff-like sewer and body odor smells-minor FID detection"

Field IH Author:

[redacted] 05/02/2019

Print First and Last Name Signature Phone No. Date

Attachment 1: IHIR (Cont.)

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2. GCMS Sample Results:

See Attachment 1 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-2019-0870
Time/Date & Event location: 1007 04/30/2019 Adjacent to the 241-C-105 Retrieval Control Trailer (MO579)	**EIR Number:** EIR-2019-021

3. Additional Information:

- Odor Response Cards received:

ODOR RESPONSE CARD - 241-C FARM

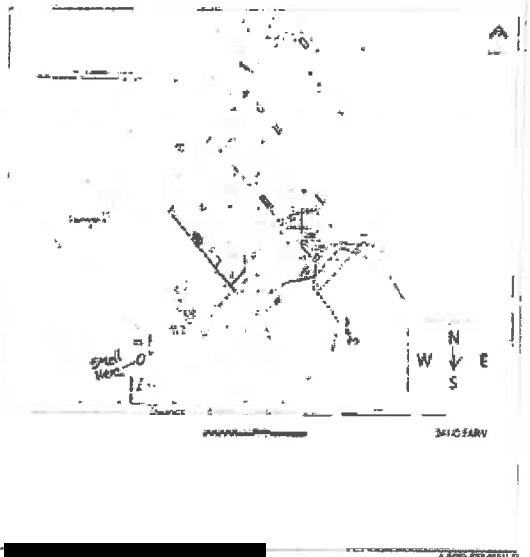
Odors Detected with NO Immediate symptoms

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.

Send this card immediately to the Central Shift Office.



Page 1 of 2 [redacted] A-6005-550 (REV 1)

ODOR RESPONSE CARD - 241-C FARM

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

- Date and time odor was noticed 4/30/2019 10:30 am
- Your name and the work your were performing [redacted] HST
- Location of odors (mark area on map and wind direction) [illegible]
- 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:
- Possible Source [illegible]
- 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 I currently have Allergy Symptoms so could distinguish

2. Send this card to the Central Shift Office

Page 2 of 2 [redacted] A-6005-550 (REV 1)

Attachment 1: IHIR (Cont.)

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TF-AOP-015 INDUSTRIAL HYGIENE INVESTIGATION REPORT

PER Number: WRPS-PER-2019-0870

Time/Date & Event location:
1007 04/30/2019 Adjacent to the 241-C-105 Retrieval Control Trailer (MO579)

EIR Number: EIR-2019-021

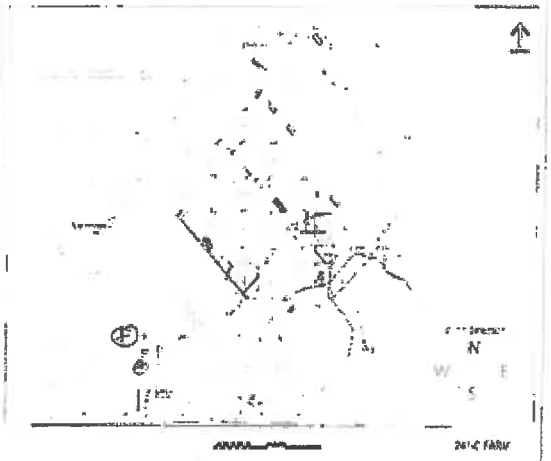
ODOR RESPONSE CARD - 241-C FARM

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.



Page 1 of 2 [redacted] A-6005-744 (REV 5)

ODOR RESPONSE CARD - 241-C FARM

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

- Date and time odor was noticed 4-30-19 10:30 Am
- Your name and the work your were performing [redacted] N/A Storage at MO579
- Location of odors (mark area on map and wind direction) upwind of Canny Mode
- 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:
- 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 ☐ Rash/Itching ☐ Other: Have Been Symptom already

2. Send this card to the Central Shift Office.

Page 2 of 2 [redacted] A-6005-744 (REV 5)

Attachment 1: IHIR (Cont.)

Washington River Protection Solutions **TF-AOP-015 INDUSTRIAL HYGIENE INVESTIGATION REPORT**	**PER Number:** WRPS-PER-2019-0870
Time/Date & Event location: 1007 04/30/2019 Adjacent to the 241-C-105 Retrieval Control Trailer (MO579)	**EIR Number:** EIR-2019-021

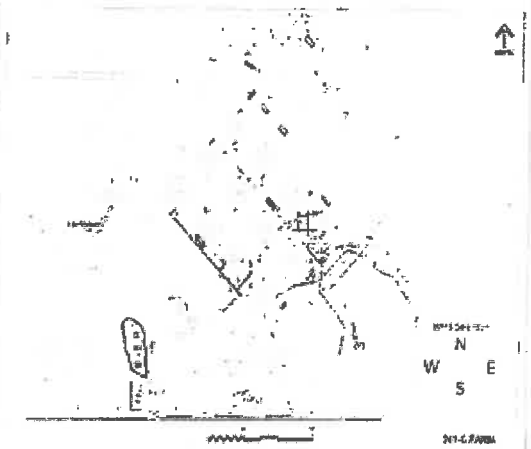
ODOR RESPONSE CARD - 241-C FARM

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.



Page 1 of 2 [redacted]

ODOR RESPONSE CARD - 241-C FARM

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

- Date and time odor was noticed 4-30-19 1030
- Your name and the work your were performing [redacted]
- Location of odors (mark area on map and wind direction) See Back
- 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: B/O
- Possible Source Unknown
- 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: NO Symptoms

2. Send this card to the Central Shift Office

Page 2 of 2 [redacted]

Attachment 1: IHIR (Cont.)

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

PER Number: WRPS-PER-2019-0870

Time/Date & Event location:
1007 04/30/2019 Adjacent to the 241-C-105 Retrieval Control Trailer (MO579)

EIR Number: EIR-2019-021

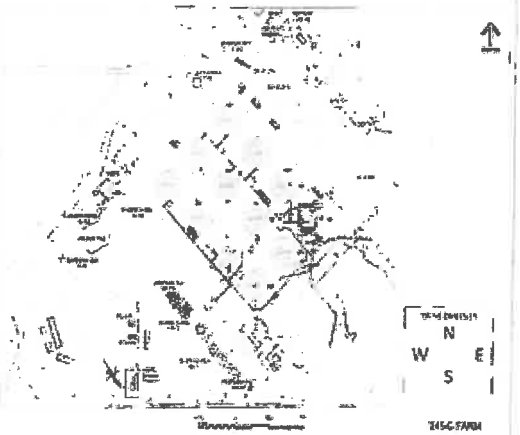
ODOR RESPONSE CARD - 241-C FARM

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 in near the effected 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.



Page 1 of 2 [redacted] A-6005-744 (REV 5)

ODOR RESPONSE CARD - 241-C FARM

1. **Contact CSM, Complete below bulleted information and map.**
   - Date and time odor was noticed 0500 SW C Farm
   - Your name and the work your were performing [illegible]
   - Location of odors (mark area on map and wind direction)
   - Name(s) of others in or near the affected area: [redacted]
   - Was an IHT present? [illegible]
   - Describe the odor ☐ Sweet ☐ Sour ☐ Musty ☐ Earthy ☐ Metallic ☐ Smoky ☐ Rotten ☐ Onion ☐ Cleaning Solution ☐ Ammonia ☑ Other: Body odor
   - Possible Source Outhouse
   - 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: ____
2. **Send this card to the Central Shift Office.**

Page 2 of 2 [redacted] A-6005-744 (REV 5)

Attachment 1: IHIR (Cont.)

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

PER Number: WRPS-PER-2019-0870

Time/Date & Event location: 1007 04/30/2019 Adjacent to the 241-C-105 Retrieval Control Trailer (MO579)

EIR Number: EIR-2019-021

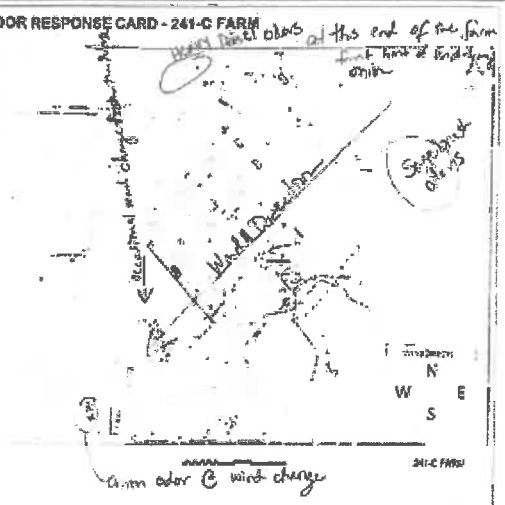
ODOR RESPONSE CARD - 241-C FARM

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.



Page 1 of 2 [redacted] A-8005-744 (REV 5)

ODOR RESPONSE CARD - 241-C FARM

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

- Date and time odor was noticed 4/30/2019 @ 1044 or 1049
- Your name and the work your were performing [redacted]
- Location of odors (mark area on map and wind direction)
- Name(s) of others in or near the affected area [redacted]
- Was an IHT present? none w/ instruments
- Describe the odor ☐ Sweet ☐ Sour ☐ Musty ☐ Earthy ☐ Metallic ☐ Smoky ☐ Rotten ☑ Onion ☐ Cleaning Solution ☐ Ammonia
- 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 ☐ Rash/Itching
  Other:

2. Send this card to the Central Shift Office.

Page 2 of 2 [redacted] A-8005-744 (REV 5)

Attachment 1: IHIR (Cont.)

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

PER Number: WRPS-PER-2019-0870

Time/Date & Event location:
1007 04/30/2019 Adjacent to the 241-C-105 Retrieval Control Trailer (MO579)

EIR Number: EIR-2019-021

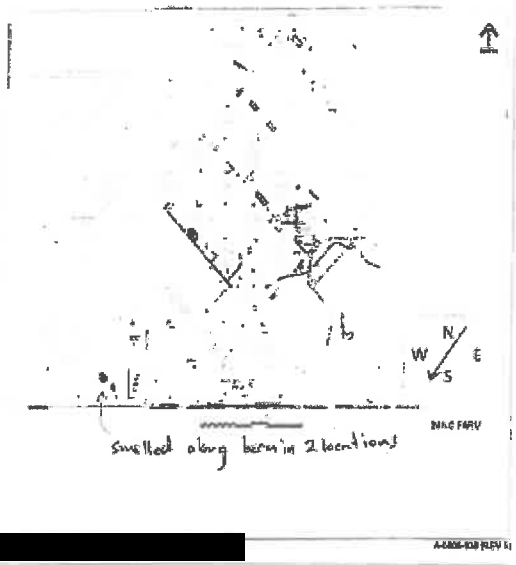
ODOR RESPONSE CARD - 241-C FARM

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 INT present?
   - Possible source
6. Provide information on the back of card.
7. Send this card immediately to the Central Shift Office.



Page 1 of 2 [redacted] A-6005-108 (REV 6)

ODOR RESPONSE CARD - 241-C FARM

1. **Contact CSM, Complete below bulleted information and map.**
   - Date and time odor was noticed 04/30/19 1049
   - Your name and the work you were performing [redacted] (IH R&D investigation)
   - Location of odors (mark area on map and wind direction)
   - Name(s) of others in or near the affected area [redacted]
   - Was an INT present? No
   - Describe the odor ☐ Sweet ☐ Sour ☐ Musty ☐ Earthy ☐ Metallic ☐ Smoky ☐ Rotten ☒ Onion ☐ Cleaning Solution ☐ Ammonia ☐ Other:
   - Possible Source N/A
   - 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: Itch
2. Send this card to the Central Shift Office.

Page 2 of 2 [redacted] A-6005-108 (REV 6)

Attachment 1: IHIR (Cont.)

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

PER Number: WRPS-PER-2019-0870

Time/Date & Event location:
1007 04/30/2019 Adjacent to the 241-C-105 Retrieval Control Trailer (MO579)

EIR Number: EIR-2019-021

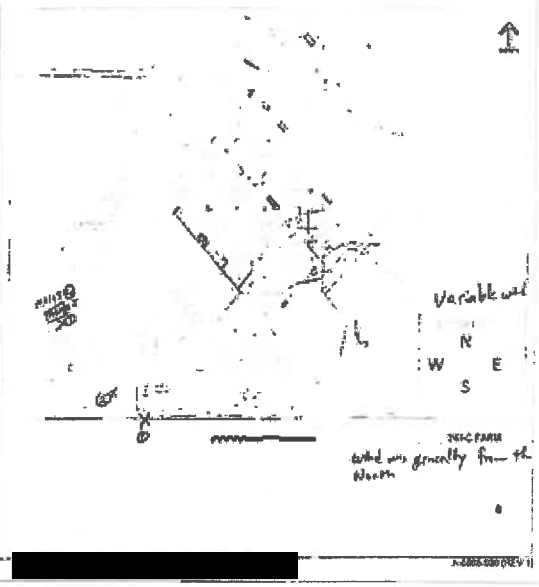
ODOR RESPONSE CARD - 241-C FARM

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.



Page 1 of 2 [redacted]

ODOR RESPONSE CARD - 241-C FARM

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

- Date and time odor was noticed 11
- Your name and the work your were performing [redacted] [illegible]
- Location of odors (mark area on map and wind direction) ~11:10 - [illegible] ① + [illegible] ② ③ [illegible] (b, MO-143) ④ ~11:50
- Name(s) of others in or near the affected area [redacted]
- Was an IHT present? [illegible]
- Describe the odor ☐ Sweet ☐ Sour ☐ Musty ☐ Earthy ☐ Metallic ☐ Smoky ☐ Rotten ☐ Onion
  ☐ Cleaning Solution ☐ Ammonia ☐ Other: [illegible] odor, sewer smell
- Possible Source MO-143 & adjacent holding tank
- Your symptoms (if any) ☐ Headache ☐ Dizziness/Light-Headed ☐ Nausea ☐ Cough none
  ☐ Fatigue/Drowsiness/Weakness ☐ Sore/Burning Throat ☐ Difficulty Breathing
  ☐ Watery/Irritated Eyes/Trouble with Vision ☐ Tingling/Numbness/Paralysis ☐ Rash/Itching
  ☐ Other:

2. Send this card to the Central Shift Office.

Page 2 of 2 [redacted]

Attachment 1: IHIR (Cont.)

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

PER Number: WRPS-PER-2019-0870

Time/Date & Event location:
1007 04/30/2019 Adjacent to the 241-C-105 Retrieval Control Trailer (MO579)

EIR Number: EIR-2019-021

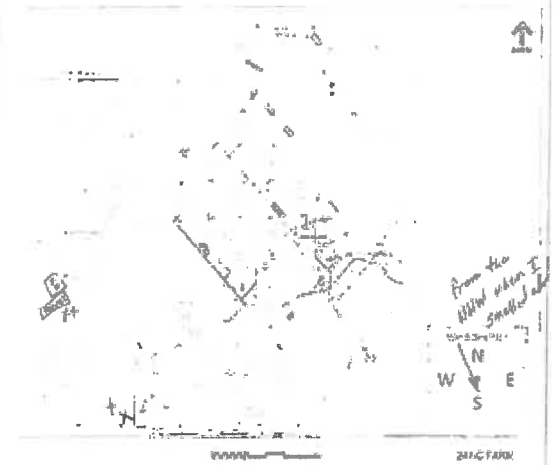
ODOR RESPONSE CARD - 241-C FARM

Odors Detected with NO immediate symptoms

1. Notify immediate Supervisor.
2. Contact Control Shift Manager, [redacted] Provide the bulleted information below.
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 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.



Page 1 of 2 [redacted] A-6005-438 (REV 1)

ODOR RESPONSE CARD - 241-C FARM

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

- Date and time odor was noticed 11:15
- Your name and the work your were performing [redacted] Vapor team Fugitive Emissions Tracking team
- Location of odors (mark area on map and wind direction) people who smelled it came down wind but came from the NW
- Name(s) of others in or near the affected area [redacted]
- Was an IHT present? Nope, just IH
- Describe the odor ☐ Sweet ☐ Sour ☐ Musty ☐ Earthy ☐ Metallic ☐ Smoky ☐ Rotten ☒ Onion
  ☐ Cleaning Solution ☐ Ammonia ☐ Other: body odor, sewer smells when close to MO-143
- Possible Source Septic tank/pump out near MO-143
- 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.

Page 2 of 2 [redacted] A-6005-438 (REV 1)

Page 15 of 16 A-6005-744 (REV 5)

Attachment 1: IHIR (Cont.)

Washington River Protection Solutions **TF-AOP-015 INDUSTRIAL HYGIENE INVESTIGATION REPORT**	**PER Number:** WRPS-PER-2019-0870
Time/Date & Event location: 1007 04/30/2019 Adjacent to the 241-C-105 Retrieval Control Trailer (MO579)	**EIR Number:** EIR-2019-021

- Summary of IH Monitoring and Sampling Data:

  a. Monitoring:

  Event Response: 19-03060 "SW C-Farm AOP-015 Response"

  DRI field readings:

VOC:	<DL
NH_3:	<DL
H_2S:	<DL
CO:	<DL
LFL:	0%
O_2:	20.9%

  Grab samples:

VOC:	<DL
NH_3:	<DL
N_2O:	<DL
Hg:	5ng/m^3
H_2S:	<DL
CO:	<DL
LFL:	0%
O_2:	20.9%

  b. Sampling:
  N/A

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

One employee reported experiencing "headache". 2 employees reported "alergy-like" symptoms, one of which was indicated to be a pre-existing condition.

5. **Recommendations/Conclusions:**

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

6. **Other:**

S&H Program Management:

[redacted] [redacted] [redacted] 5/6/19

Print First and Last Name Phone No. Date

Attachment A

GCMS Laboratory Results

Attachment 1: IHIR (Cont.)

HAPSITE GC-MS Sample Results Survey 19-03060: AOP-15 at C Tank Farm

A bag sample was collected in response to an odor reported at the C-Farm Change Trailer. These samples were analyzed using an Inficon HAPSITE GC-MS on April 30, 2019. Data was interpreted on May 1, 2019, and reported the same day. Results for the Air Blank Sample were satisfactory. The compounds listed below were found in C-Farm Trailer at 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	C-Farm SW	Sample Bag Contaminant	Comments
Internal Standard #1	X	X		Added by Instrument during analysis
Internal Standard #2	X	X		Added by instrument during analysis
Xylene		X	X	Not found above background
D-Limonene		X	X	Not found above background
Silane Compound		X	X	Not found above background
C9-15 Alkane Hydrocarbons		X	X	Not found above background

If you have questions contact [redacted]

Attachment 2: APGEMS-TF Plume Modeling Report

APGEMS-TF Plume Modeling for April, 30, 2019 AOP-015 Event

C. Carlson

An AOP-015 event was reported at 10:07 on April 30, 2019. Two workers and One Health Physics Technician were observing the relocation of a Material Storage Container near MO 579 adjacent to 241-C-105. Initially, the workers reported a "stronger than normal onion odor/body odor" with symptoms (allergy-like or potentially pre-existing allergy-like). Later, a worker engaged in related activities encountered the same odors with a different symptom (headache). During the AOP-015 response initiation, several of the response team noted occasional wisps of odor during the setup of the event boundaries. Four members of the Fugitive Emissions (FE) Investigation team were active outside of the of the AOP-015 boundary, including the area around the perimeter of the 242-C Tank Farm, after 10:30 carrying odor and chemical concentration testing equipment. These staff detected body odor, onion odor and sewer odor to the south and west of the AOP-015 incident, including odors around the MO-143 toilet and its associated sewer holding tank. Figure 1 shows the area of the AOP-015 locations, as well as the wind direction (as reported by the Hanford Meteorological Station - HMS) the during the AOP-015 timeframe and potential odor sources.

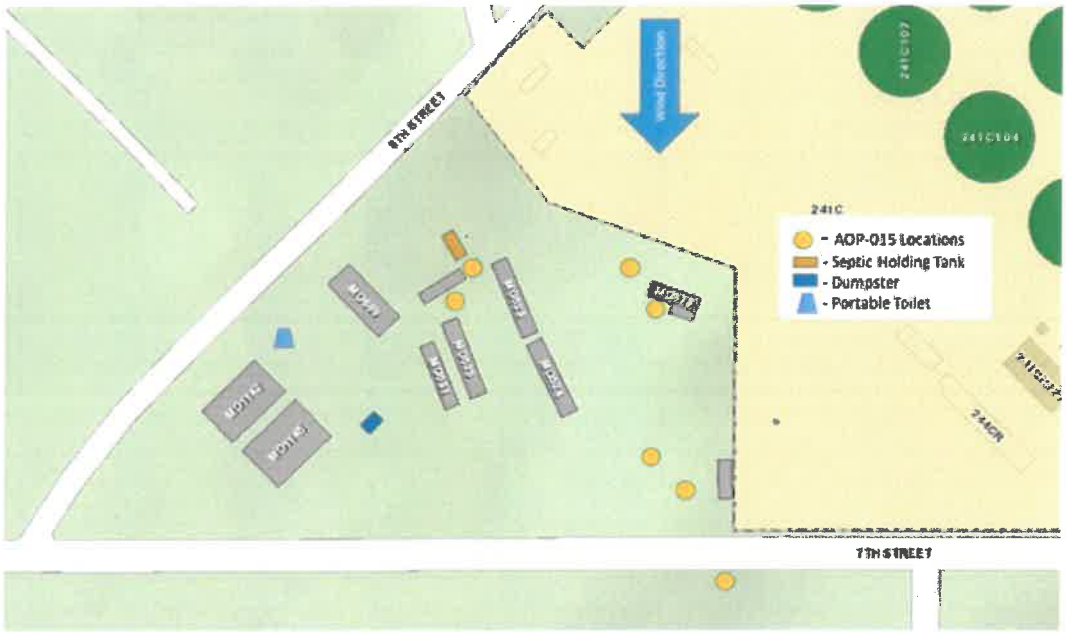


Figure 1. AOP-015 locations on 4/30/2019 in relation to potential vapor/odor sources. Blue arrow at the top indicates the predominant wind direction as reported by the Hanford Meteorological Station.

Potential Vapor Sources

During AOP-015 investigations, the wind direction is generally determined using the Hanford Meteorological Network (HMN) station nearest to the event location, which reports the wind speed and direction at 10 meters. The winds at ground level, particularly when wind speeds are low, can be

[redacted]

Attachment 3: APGEMS-TF Plume Modeling Report (Cont.)

different due to topography in the area of interest. During this event, the FE Investigation team noted the flags in the area, including flags posted around the MO-143 holding tank, were changing, indicating swirling winds around the structures near the AOP-015 incident. All of the individuals preparing odor response cards for this incident reported onion, sewer and body odors that may result from hydrogen sulfide (H_2S), thiols (mercaptans) or other organosulfur compounds. 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 a toilet trailer with an associated sewage holding tank, two portable toilets and a dumpster. The portable toilets are not considered as potential source as they were not serviced on April 30, 2019 and the FE investigation team did not detect odors near these units during the AOP-015 incident nor the subsequent investigation. The dumpster was also evaluated by the FE investigation team and there was no garbage in the unit nor were there any detectable odors. This leaves the only credible sources of the odors to be the toilet trailer and the C Tank Farm.

It should be noted that the odors reported (onion, sewage and body odor) can be from sulfur-containing organic compounds such as H_2S and thiols, and 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. The APGEMS-TF program uses data from the HMN, which may not reflect the wind direction observed at ground level. 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 C Farm 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 ≤0.1% of OEL at the AOP-015 locations.
  - The meteorological conditions at the time of the AOP-015 were consistent with minimal passive breather filter ventilation (material is not exhaling).
- **The MO-143 toilet and associated septic holding tank is a plausible source for the odors.**
  - FE Investigation team members detected odors emanating from around the toilet
  - The ground adjacent to the north side of the MO-143 toilet and to the west of the MO-143 Septic Holding tank was saturated and spongy, indicating a leak from toilet. None of the adjacent buildings had wet spots, further indicating that the MO-143 toilets were leaking.
  - While the general winds were from the north, the flags posted in various locations around the buildings to the west of the event showed the winds to be variable and swirling in many directions around the buildings. These ground level conditions, particularly in light of the cluster of buildings in the area, could cause dispersion in a direction that is not aligned with the mean wind at ten meters.
  - While odors were detected intermittently south of the event location, the only place with more consistent odors in the area was the MO-143 toilets – these odors including sewer and body odor. It should be noted that as the vapors associated with sewers move away from the source, they change due to many factors:
    - Degradation and recombination of organosulfur compounds – providing different odor causing compounds.

[redacted]

Attachment 3: APGEMS-TF Plume Modeling Report (Cont.)

- The concentrations of compounds decrease enough to make some of the mixture of odorants from sewers to fall below their human odor thresholds while others are still detectable, changing the perceived odor.

- **Portable toilets are an unlikely source of the odors.**
  - The portable toilets at the C-Farm event were not serviced on April 30, 2019 and they are further way from the event than the toilets noted above.
- **The dumpster is an unlikely source of the odors.**
  - The dumpster near MO01145 was checked by the FE investigation staff. The team found no odors nor was there any debris in dumpster.

Mechanisms for Vapor Emissions from Passive Breather Filter Tanks:

Passively ventilated tanks in C-Farm periodically emit vapors under certain meteorological conditions. The three mechanisms and corresponding meteorological conditions for vapor emissions from passively ventilated tanks are as follows: 1) equilibration of headspace pressure with outside pressure (falling barometric pressure), 2) buoyancy effect due to differences in headspace gas and outside air density (ambient temperatures cooler than headspace temperatures), and 3) venturi effect around passive breather filters (wind velocity). At the time of this AOP-015 event, the barometric pressure was stable, the ambient air temperature was 57°F and the wind speed was 6 mph. Based on the buoyancy mechanism and a lack of an increasing barometric pressure, which would drive air into the tank, it is possible that the passive breather filters were emitting vapors prior to and during the AOP-015 event.

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.

APGEMS-TF Modeling of C Farm PBFs as Potential Sources

The C Farm passive breather filters were not likely to be emitting headspace gases because the atmospheric pressure was stable, which would limit headspace gas emissions. The winds were low at 6 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 C Farm tanks at the time of the AOP-015 event. 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).

Only chemicals that are found in the C Farm tanks that could result in odors similar to those reported would be 2,2-dimethl propanethiol and Benzene thiazole. The 2,2–dimethyl propanethiol has a human odor threshold of 1.3 ppb in air while the highest concentration detected in the tanks is 80 ppb, making the detection of an odor possible. The Benzene thiazol has a humane odor threshold of 0.6 ppb in air

[redacted]

Attachment 3: APGEMS-TF Plume Modeling Report (Cont.)

while the highest concentration detected in the tanks is 0.5 ppb so it is not likely to be the source of the odors experienced during and immediately after the AOP-015 event.

It should be noted that the ammonia concentration detected in the C Farm tanks headspace at the time that the 2,2–dimethyl propanethiol was detected was about 2 ppm. Since the model values of ammonia are three orders of magnitude lower, it could be assumed that the values of the 2,2 – dimethyl propanethiol would also be three orders of magnitude lower, putting the highest levels one order of magnitude lower than the human odor threshold value. This indicates that the tank farms is not a likely source for the odors from this AOP-015 event.

Figure 2 APGEMS - TF Model Result from C Farm PBFs near the time of the AOP-015 event (AOP-015 locations noted by gold circles).

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

Figure 3 presents APGEMS-TF modeling results from the MO-143 toilet and associated septic holding tank. 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 model shows that the highest concentrations from the MO-143 area are south of the AOP-015 locations, but since the observations of the staff on site showed the winds were swirling, the contours may not be accurately expressed.

[redacted]

Attachment 3: APGEMS-TF Plume Modeling Report (Cont.)

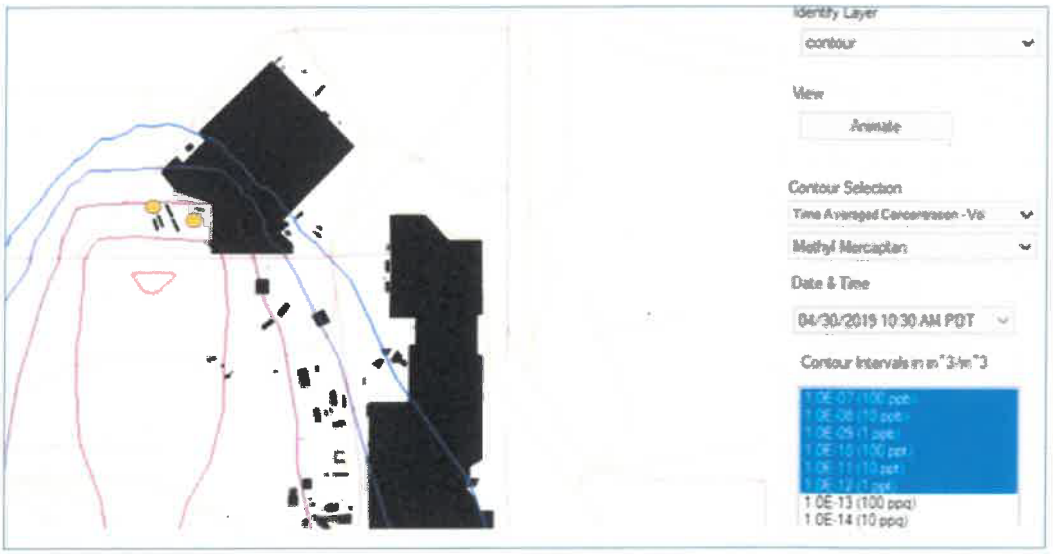


Figure 3 APGEMS-TF Model Results from MO-143 toilet near the time of the AOP-015 event (AOP-015 locations noted by gold circles).

[redacted]

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