EVENT INVESTIGATION REPORT EIR-2019-025 & 026

WRPS-PER-2019-1170 & 1174,

AOP-015 Event Inside 242-A Evaporator, Outside MO-818 AW Change Trailer

[redacted] 6/27/2019

Event Investigation Team Lead Date

[redacted] 6/27/2019

PER Responsible Manager Date

Executive Summary

During the weekend of 07 through 09 June 2019, seven employees at the 242-A Evaporator facility and MO-818 AW Change Trailer noticed an odor described as rotten, sewer, sour, musty, sulfur, and dead animal like. On Sunday, 09 June 2019, the two events were separately reported to the Central Shift Office (CSO) then TF-AOP-015 was entered.

In the 242-A Evaporator facility, five total employees reported smelling odors intermittently between 07 June, Friday and 09 June, Sunday (including the Saturday in between). The odors were only detected by the Day Shift crews. The Odor Response Cards were submitted on 09 June.

In the MO-818 AW Change Trailer facility, two carpenters reported smelling odors during the morning of 09 June, Sunday on Day Shift only.

Employees provided information using Odor Response Cards submitted on 09 June appropriate to the facility and the CSO completed the required notifications. Out of seven employees that smelled and reported odors, only one reported symptoms, and none reported to Occupational Medicine for medical surveillance. Following AOP-015 notifications and actions initiated by Industrial Hygiene, an event investigation was initiated.

Upon evaluation of plausible suspect sources, meteorological conditions, industrial hygiene sampling, personnel interviews, and other investigative techniques, we conclude that the likely source of the odors was one or more of the following nearby sources: an underground septic system, diesel generators, garbage receptacles, a dead animal, and/or portable toilet. The source(s) is not likely from tank waste nor is the odor definitively attributable to any one of the aforementioned suspect sources. The odors were transient over this weekend period and have not persisted since, up to the date of this report's finalization.

Event Investigation

This Event Investigation Report (EIR) number EIR-2019-025 (and EIR-2019-026) is in response to Problem Evaluation Request (PER) PER-2019-1170 for the 242-A Evaporator and PER-2019-1174 for the MO-818 AW Farm Change Trailer, respectively. A meteorological report was generated using APGEMS-TF software to model the weather conditions and their effects on vapors and odors in the area of concern. This report is Attachment A. Industrial Hygiene Investigation Reports (IHIR) 19-04244, (242-A Evaporator event) and IHIR 19-04243(MO-818 AW Farm Change Trailer event), were performed independently. These two reports are Attachment B and C, respectively. EIR-2019-025, 026 investigations were performed by the Production Operations Performance Assurance team. They were initiated on the morning of 10 June 2019.

While these two EIRs were likewise initiated concurrently, upon thorough investigation it was determined that these parallel time and condition odor events were likely caused by the same source. Therefore, EIR-2019-026 will not have a separate report due to these findings.

A formal Event Investigation meeting was not held. Facts were gathered by interviews with individuals involved.

The table below summarizes the relationship of the various reports and data.

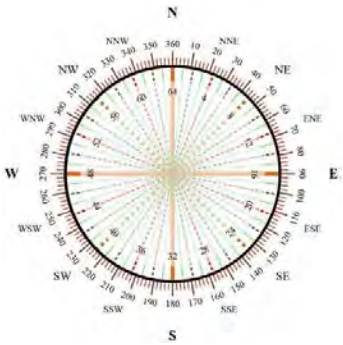
Event Location	PER	APGEMS-TF Report	IHIR	EIR
242-A Evaporator	PER-2019-1170	June 9, 2019 AOP-015 Event	19-04244	EIR-2019-025
MO-818 AW	PER-2019-1174		19-04243	EIR-2019-026

Central to this investigation is: 1) weather conditions at the time, 2) locations of potential source points 3) interviews, and 4) IH findings. Other supporting reports, data, and information were also used, such as input from MSA subject matter experts and septic system schematics.

Weather

There was no rain all weekend and the winds were calm at the times of the reported odors. The wind direction varied as seen below.

Date/Time	Wind Direction (degrees)	Wind Speed (mph)	Temperature (F)	Barometric Pressure (in Hg)	Relative Humidity (%)
6/7/2019 9:30	309.7	7.4	62.2	29.272	28.8
6/7/2019 9:45	278.6	9.9	63.7	29.269	27.7
6/7/2019 10:00	287.0	9.8	64.0	29.277	27.6
6/7/2019 10:15	280.9	11.9	63.8	29.264	28.0
6/7/2019 10:30	266.5	12.1	62.8	29.263	29.0
6/7/2019 10:45	263.0	10.4	62.9	29.279	28.8
6/8/2019 14:00	316.7	5.2	71.5	29.546	22.8
6/8/2019 14:15	215.4	6.6	73.5	29.531	21.5
6/8/2019 14:30	221.6	7.5	73.1	29.534	21.2
6/8/2019 14:45	198.8	6.4	71.1	29.533	22.6
6/8/2019 15:00	104.2	4.7	71.9	29.529	22.2
6/8/2019 15:15	187.2	6.1	74.0	29.534	20.5
6/8/2019 15:30	212.4	7.4	73.4	29.526	20.6
6/8/2019 15:45	181.5	4.7	73.3	29.511	20.5
6/9/2019 7:30	358.2	3.1	62.2	29.662	38.2
6/9/2019 7:45	35.3	2.6	62.8	29.674	36.6
6/9/2019 8:00	7.6	2.9	63.5	29.660	36.3
6/9/2019 8:15	239.6	2.9	64.4	29.672	34.6
6/9/2019 8:30	76.2	2.7	65.2	29.668	33.0
6/9/2019 8:45	171.3	2.9	66.3	29.651	32.5
6/9/2019 9:00	90.9	4.5	67.1	29.654	31.7
6/9/2019 9:15	140.8	4.8	67.3	29.650	31.4
6/9/2019 9:30	136.8	6.1	68.3	29.649	31.0
6/9/2019 9:45	123.9	3.9	69.0	29.654	30.0



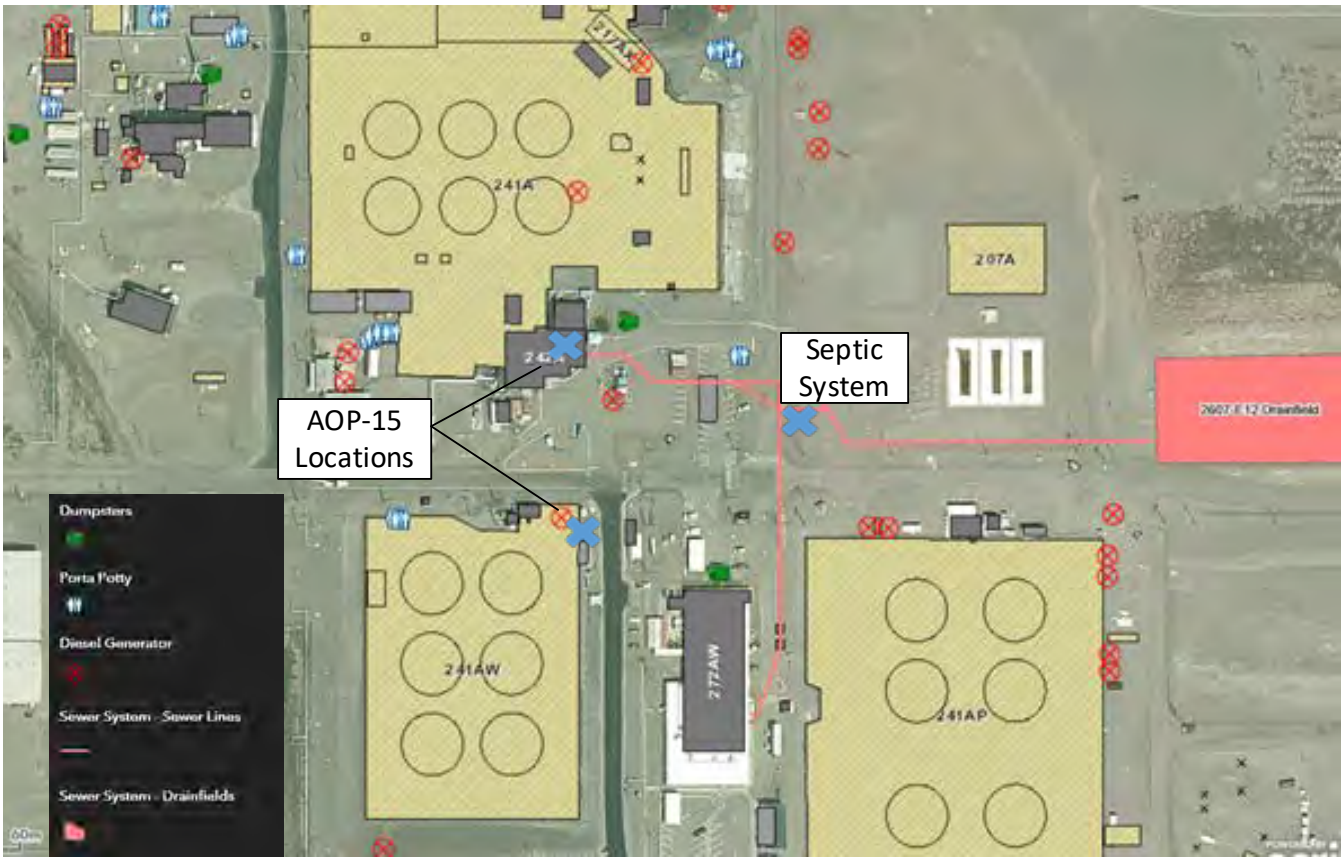
An APGEMS-TF modeling program was employed to recreate conditions at and around the event locations in this EIR during the dates in question. They conclude that:

- Tank waste vapors were found to be below Occupational Exposure Limits.
- Tank waste chemicals that cause odors were below detection thresholds.

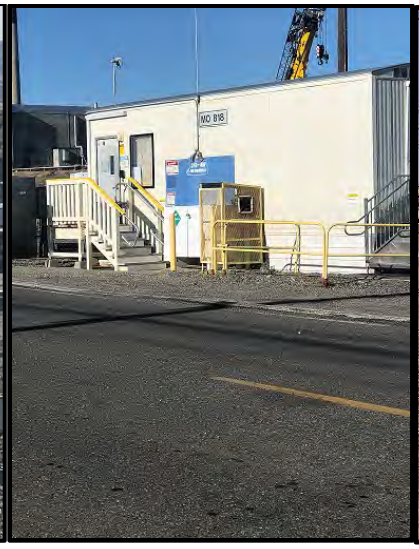
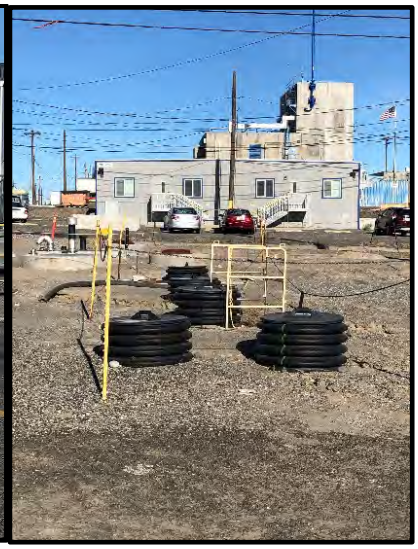
- The underground sewer (2607-E12) was not a likely source.
- Other contributing factors exist as suspect sources but could not be modeled due to model limitations.

Location

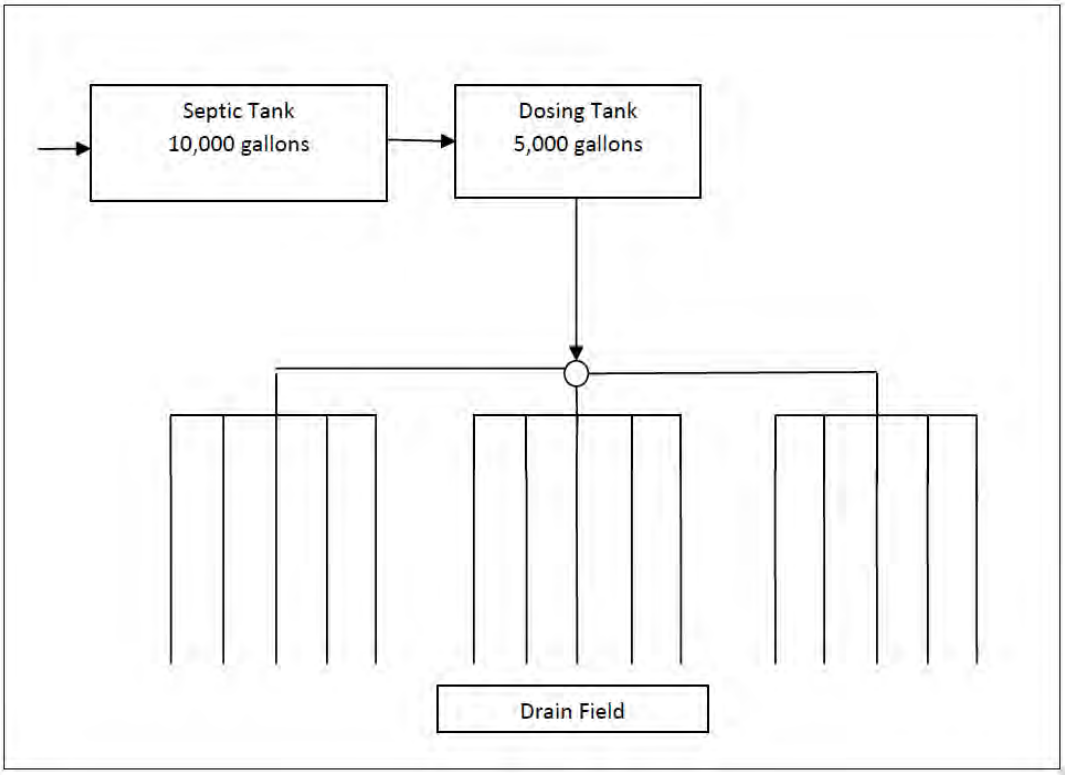
The figure below is an aerial photograph showing the location of the two AOP-015 events plus some select proximal features of interest. Areas of interest have been artificially colored for emphasis. There are three tank farms surrounding the AOP-015 events: 241-A/AW/AP. Also nearby are multiple garbage receptacles, diesel generators, portable toilets, and an underground septic system to the east/northeast of the two AOP-015 events.



The figure below shows three photographed views to depict the proximity of the event locations relative to the septic system (from left to right): east side of MO-818 near the AW Tank Farm looking northeast toward septic system, MO-818 looking southwest from the septic system area, 242-A Evaporator in the background looking west from the septic system.

The figure below is from Operations and Maintenance Manual for Septic System 2607-E12 (from WHC-SD-W172-OMM-001) detailing the underground configuration of sewage SSCs in the area of concern.



Event Timeline

Because of the likely relationship between the two events, the two timelines have been chronicled side by side in the table below. These timelines are based on Odor Response Cards plus other data generated and reporting actions (See Documents Reviewed and Interviews Section at the end of this report).

242-A Evaporator Chronology		MO-818 AW Change Trailer Chronology
07 June 2019		
1000	NCO1 noticed a musty, rotten smell characterized as a sewer smell inside the facility	
1000	NCO2 noticed a musty, rotten smell characterized as a sewer smell in the main hallway, kitchen, and hallway to control room	
No time given	NCO3 noted a dead animal and rotten smell in the kitchen and hallway	
08 June 2019		
1500	NCO2 noted a musty, rotten, and sewer smell in the main hallway, kitchen, and hallway to control room	
1430	NCO1 noted a musty, rotten, and sewer smell inside and outside the facility	
No time given	NCO3 noted a dead animal and rotten smell in the kitchen and hallway	
1500	SOE1 noted a sour, musty, and rotten smell. Felt dizziness and light headed symptoms.	
1730	NCO1 noted a musty, rotten, and sewer smell	
1730	NCO2 noted a musty, rotten, and sewer smell	
09 June 2019		
0810	NCO1 noted a musty, rotten, and sewer smell inside the facility	
0816	NCO2 noted a musty, rotten, and sewer smell in the main hallway, kitchen, and hallway to control room	
AM	SOE1 noted a sour, musty, rotten smell. Felt dizziness and light headed symptoms.	
0833	Notification to the Central Shift Office (CSO), including Odor Response Cards. All workers were instructed to leave the area and the area access was restricted.	

242-A Evaporator Chronology		MO-818 AW Change Trailer Chronology
0913	IH was dispatched and performed IHP-09001 response actions using Direct Read Instruments (DRI): no hazards were detected – below action levels.	
0917		Carpenter 1 noted a musty, rotten, and sulfur smell
0917		Carpenter 2 noted a sulfur smell
1002		Notification to the CSO, including Odor Response Cards. Ammonia smell reported outside by Carpenters. All workers were instructed to leave the area and the area access was restricted.
1009		IH was dispatched and performed IHP-09001 response actions using DRI: no hazards were detected – below action levels.
1033		Notification to the CSO, smell updated/revised to musty, rotten, and sulfur.
1105	EIR-2019-025 for 242-A and EIR-2019-026 for AW Change Trailer were initiated by Performance Assurance upon notification by CSM	
1247	TF-AOP-015 Closed	
1254		TF-AOP-015 Closed
12 June 2019		
1142		PER-2019-1174 Online form completed by CSM
1306	PER-2019-1170 Online form completed by CSM	

An Odor Response Card was submitted by an NCO on-duty in the A-1 Control Room but no smell was noticed.

Immediate Actions

Data was collected on forms per instructions and training on TF-AOP-015.

Management was informed.

Workers were instructed to leave the area and access was restricted. CSO and IH were notified to respond.

Compensatory Measures

There were no compensatory Measures taken.

Preliminary Extent of Condition Review

There are more than 50 similar septic systems across the Hanford site.

Facility Impact

At least eight on-duty employees were distracted from their routine duties and subsequently restricted to enter normal work areas under restricted access to key parts of the building such as certain hallways. On-duty employees had to complete paperwork. Repair work was delayed. Tank Farm and Evaporator facility mangers were required to host IHT response investigation to carryout IHP-09001.

Discussion of Potential Causes

Approximately 90 to 100 meters to the east/southeast of the two event sites there exists an active, semi-dysfunctional septic system. An MSA subject matter expert was consulted regarding the septic system. The septic system collects sewage waste from local facility plumbing in two cascading process tanks (15,000 gal. total capacity) before discharge to a manifold 15-branch drain field. The septic system functions with passive ventilation through shallow vadose zone interaction. Additionally, it is reported that the system has damage between the tanks exit and the branched discharge lines. Periodic tanker truck evacuation of this system is performed to help mitigate malfunctioning conditions until another more permanent fix may be implemented.

Upon on-scene investigation of this general vicinity, on 11 June at approximately 0800 hrs and similar atmospheric conditions, there was a sewage odor proximal to the septic system. However, it was only detectable by the investigators within zero to ten feet of the marked septic system's surface structures and components. At the time it was not evident within 242-A Evaporator or AW Change Trailer areas.

This sewer and more than 50 others like it across the Hanford site have been known to produce or be similar to odors such as sulfur, sewage, musty, rotten, etc.

SOE1 suggested that adjacent AX or AN Farms or 204-AR facility may be a source of the odor per reports from the Odor Response Card. On 19 June SOE1 was interviewed. The employee noted that the odor was stronger outside to the east of the facility (side closest to the septic system) and the odor seemed to diminish after rolling the filters.

There were no waste disturbing activities underway during the period in question according to the CSM. These three aforementioned sources are not known to expel odors, especially related to those described by the seven Odor Response Cards.

An APGEMS-TF modeling program was used to recreate the AOP-15 conditions and concludes that neither tank vapors with established Occupational Exposure Limits nor other odor causing tank chemicals reached any detectable thresholds or were orders of magnitude below set limits. Other factors may have been sources of odors but the software modeling limitations preclude further analysis.

We conclude that the source of the odor for these two TF-AOP-015 events, subsequent PER-2019-1170/1174, are related occurrences and are possibly attributable to nearby source such as portable toilets, dumpsters, a dead animal or Septic System 2607-E12, not tank waste or other waste disturbing activities of health hazard concern. This event is considered a benign odor nuisance.

Discussion of Barriers That Could Have Impacted the Cause

There are several barriers that failed; one or more of which may have prevented these events:

1) Training and Education - Lack of discernment between non-hazardous waste such as septic system odors, especially from known nearby sources.

2) Facility Location and Condition - Septic Systems and other waste disposal areas located too close to high work activity areas; inadequately or malfunctioning septic systems; delays in implementing plans to reroute drain fields to improved sewage treatment processing facilities.
3) Adherence to Procedure – Proper use of AOPs and general procedure compliance.

Discussion of Positive Aspects of the Event

Rapid response from IH staff. Supportive data readily available from meteorology and other sources.

Extent of Condition

There is no Extent of Condition related to this AOP-15 event.

Lessons Learned

Forms not filled in completely or accurately results in a lack of accurate data. Properly completing Odor Response Cards would improve data quality.

Ambiguous data that is contradictory between employees and management. For example, the CSM reported zero symptoms, while SOE1 reported "Dizziness/Light-Headedness", which also consequently requires reporting to Occupational Medicine, Safety Manager, (plus Line, Senior FacRep management…) for medical surveillance per TF-AOP-015, Sec 3.1.8 and Injury and Illness EventsTFC-ESHQ-S_CMLI-C-02.

Recommendations/Proposed Corrective Actions

There are five potential corrective actions:

1) Installation of a passive apparatus that mitigates or subdues septic system odors.

2) Repair the failed aspects of the malfunctioning septic system.

3) Implement the tentative MSA plan to route or plumb the septic tank discharge to the 200 West Area sewage treatment lagoons.

4) Implement an appropriate mode of training (based on best available data) for effected workers on discernment of hazardous radioactive tank waste and associated odors versus non-hazardous odors and sources (such as expectations of active septic system odors and how they may periodically carry into nearby facilities).

5) Provide a guidance or instruction to managers expected to be in receipt of Odor Response Cards that contain sewage or septic system-like smells to inspect known nearby sites to determine if the source is emanating from these locales before entering into TF-AOP-15.

Personnel Interviewed:

242-A Evaporator SOE1 (suspicion of AX and AN Farm and 204-AR sources).

AW Tank Farm MO-818 Carpenters 1 and 2.

Septic System SME from MSA regarding local septic system details.

Collaborate with AW Farm Event Investigator.

Collaborate with 242-A Evaporator Event Investigator.

Documents Reviewed and those Attached for Reference:

APSGEMS-TF Meteorological Report **– *Attachment A***

IHIR 19-04243 – ***Attachment B***

IHIR 19-04244 – ***Attachment C***

TF-AOP-015

TFC-ESHQ-S_CMLI-C-02

Attachments/Forms from TF-AOP-015 used by employees and management pertaining to this event – the primary data source of this EIR.

PER-2019-1170

PER-2019-1174

Meteorological APGEMS-TF Report and 10 June 2019 emails with embedded charts and data tables

Operations and Maintenance Manual for Septic System 2607-E12 (WHC-SD-W172-OMM-001)

Attachment A

APGEMS-TF Report Plume Modeling for AOP-015 Event

APGEMS-TF Plume Modeling for June 9, 2019 AOP-015 Event
Eugene Morrey

An AOP-015 event was reported on June 9, 2019 in and immediately outside the 242-A Evaporator (main hallway, kitchen, hallway leading to the control room, and outside building on 1st and 2nd level) and on the exterior stairs of the MO-818 AW Change Trailer. The odors in the 242-A Evaporator reported at 08:10 - 08:16 were described as musty, wet, sewage, or something had died. The odors at the MO-818 AW Change Trailer reported at 09:17 were described as ammonia/sulfur odor. No symptoms were reported and all workers declined medical evaluation. Workers also reported musty/mold and sewage smells in the 242-A Evaporator hallway in the two days prior to the reported event. See Figure 1 for the AOP-015 locations and a nearby sewer.

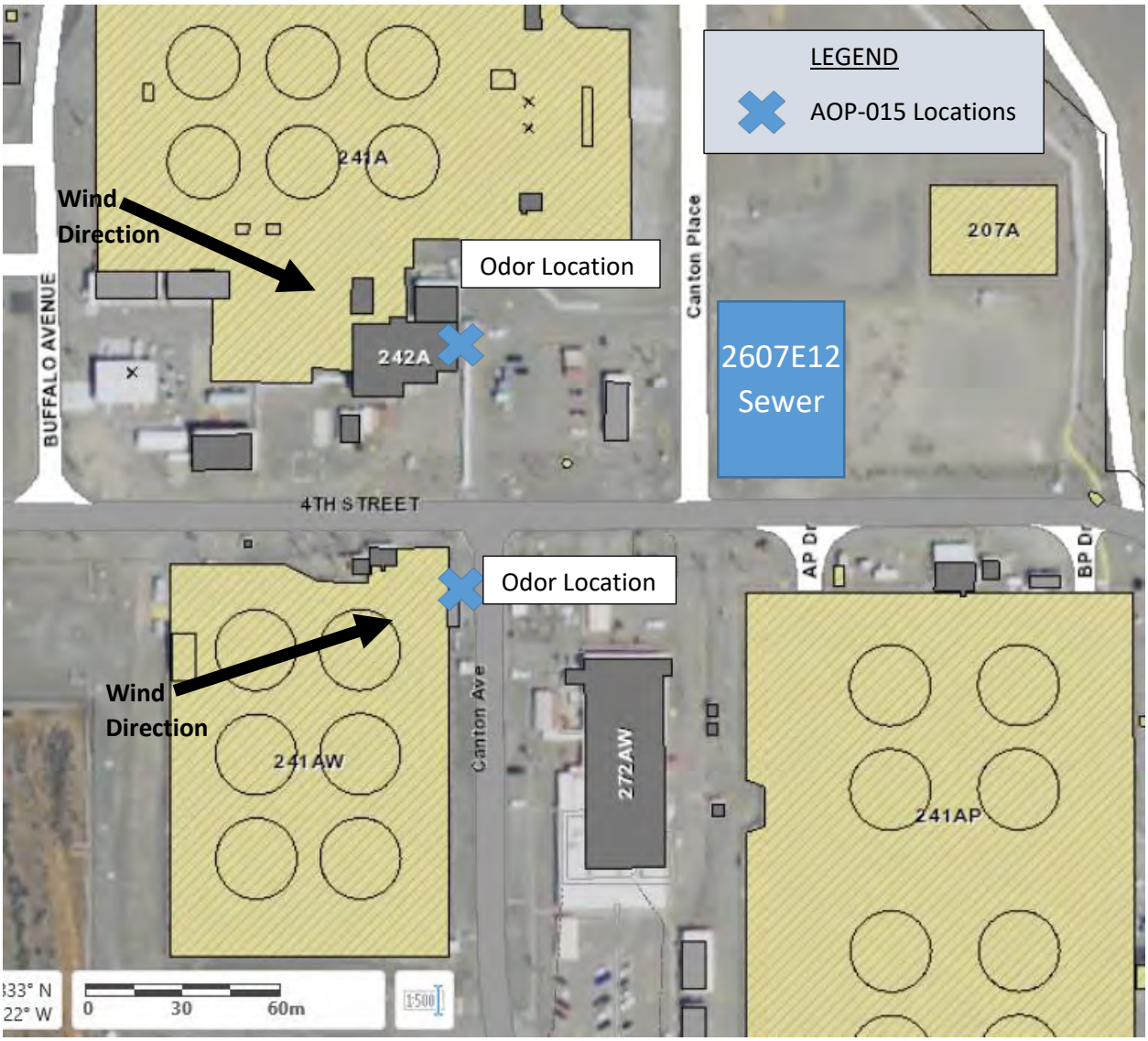


Figure 1. Location of the Odor Events and Nearby Sewer Source.

APGEMS-TF Modeling Results Conclusions:

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

- **Vapors from Tank Waste were well below OEL levels at the AOP-015 receptor sites**. The reasoning for this conclusion is as follows:
    - Per the Central Shift Office no waste disturbing events or other activities that may have led to a vapor event were conducted in the nearby tank farms on the day of the AOP-015 event.
    - The AOP-015 locations were either outside the predicted tank farm vapor plumes or on the periphery.
    - APGEMS-TF modeling predicts that the maximum concentration of ammonia from tank vapors at the AOP-015 locations was between 10 and 100 ppb, which is three orders of magnitude below its OEL and two orders of magnitude below its odor detection threshold.
    - Based on inference from bounding NDMA model results (COPC with highest headspace concentration relative to its OEL), all COPCs at the AOP-015 locations were estimated to be at least 2.5 orders of magnitude below their respective OELs.

- **Odor Causing Chemicals in Tank Vapors are an unlikely source of the AOP-015 odors.** The reasoning for this conclusion is as follows:
    - The tank vapor sources upwind of the AOP-015 locations (A-Farm tanks and AW exhauster) do have odor causing chemicals in concentrations up to 100 times their odor detection thresholds.
    - A-Farm tanks have reported organic sulfur compounds up to 50 times their assumed odor detection thresholds in the headspace. Organic sulfur compounds (e.g., thiols) have odor characteristics similar to those noted in the June 09 AOP-015 reports.
    - After considering dispersion as estimated by APGMES-TF, concentrations of non-sulfur, tank vapor odor compounds are predicted to range between 1 to 5 orders of magnitude below their odor detection thresholds at the AOP-015 locations. In addition, the odors from these compounds are not consistent with those reported in the AOP-015 event.
    - Concentrations of organic sulfur tank vapor compounds are predicted to be at least 3 orders of magnitude below their assumed odor detection thresholds at the AOP-015 locations.

- **The 2607E12 sewer system (90 - 100 meters E/NE of the odor locations) is an unlikely source of the AOP-015 odors**. The reasoning for this conclusion is as follows:
    - APGEMS-TF modeling indicated that the AOP-015 locations were outside or on the periphery of the sewer plumes at the time of the events.
    - The sewer was downwind of the AOP-015 locations at the time of the AOP-015 events.

- **Other potential sources near 242A Evaporator (portable toilets, diesel generator, dumpster) are potential sources but were not modeled due to model limitations**.
    - APGEMS-TF is considered to be valid for distances starting at 100 meters from the source.

Selection of Sources to be Modeled:

Investigation of work activities in the area just prior and during the AOP-015 event indicated no waste disturbing events or other activities within the nearby tank farms that would cause an odor event. However, tank vapors continuously emit from actively ventilated tanks and periodically emit from passively ventilated tanks under certain meteorological conditions.

MSA personnel confirmed that no work was performed on the sewer system or any of the sewer systems in the vicinity on the day of the odor event. ACE Portable Toilet Rental confirmed that no Hanford toilets were pumped or serviced on June 7 – 9. However, septic/sewer systems continuously emit odors to varying degrees based on use and atmospheric conditions. Based on the vicinity and wind conditions at the time, the following sources were investigated using APGEMS-TF modeling to determine likelihood of being the source of the odor event.

- AW Stack
- A-Farm Passive Breather Filters
- 2607E12 (septic sewer system)

APGEMS-TF Modeling:

The APGEMS-TF model generates a 3-D 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.

At 8:15 AM PDT on 6/09/19, the Hanford meteorological tower located at the 200E area (Station 6) had an average wind speed of 3.7 mph and wind direction from the WNW (302 deg from north). At 9:15 AM PDT on 6/09/19, the average wind speed was 2.9 mph and wind direction from the WSW (240 deg from north). One would expect relatively low levels of mixing due to the low wind speeds, and horizontal plume widths would be relatively broad due to light and variable winds. The stability class was neutral, so vertical mixing is expected to be moderate. See Figure 2 for a map of modeled vapor sources around the AOP-015 Location.

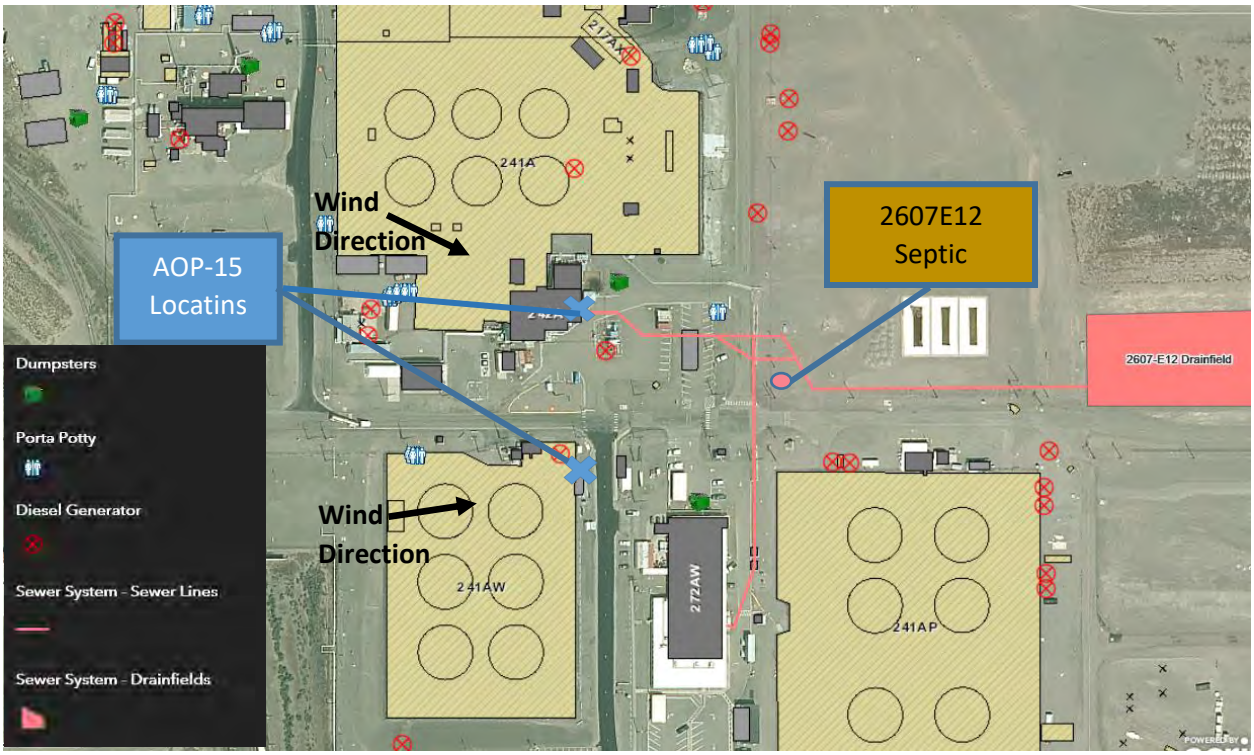


Figure 2. AOP-15 Locations in Relation to Potential Vapor Sources.

<u>Modeling of A-Farm PBFs and AW/AP Stacks as Potential Sources</u>:

Figures 3 - 6 show APGEMS-TF modeling results for the combined release of A-Farm PBFs and AW-Stack. The images include predicted ammonia concentrations at the time of the AOP-015 events as shown by concentration contour lines with the innermost contour line equal to the highest concentration shown in the right-hand legend. Each successive contour line moving out from the center is 1/10 the concentration of the prior. Ammonia and n-nitrosodimethylamine (NDMA) were modeled with APGEMS-TF. The model used pre-populated source terms equal to an upper value headspace concentration for each chemical and each tank and an upper bound emission rate for each tank or exhauster.

Based on the model (see Figures 3 and 4), the highest concentration of ammonia from tank vapors at the AOP-015 locations was between 10 and 100 ppb or 3 orders of magnitude below the OEL. The odor threshold for ammonia is approximately 5 ppm, which is 2 orders of magnitude above predicted ammonia concentration at MO-818, which had reported ammonia odors. Therefore, it is unlikely that the ammonia odors came from tank vapors.

The model results indicate that all COPCs were well below their OEL at the receptor sites, based on estimated emission rates and scaling from the modeled ammonia concentrations. The COPC with the largest concentration in the AW and A-Farm headspaces relative to its OEL (NDMA) was modeled to show bounding concentrations of COPCs at the receptor sites (see Figures 5 and 6). The highest concentration of NDMA predicted at the receptor locations was 2.5 orders of magnitude below its OEL, which demonstrates that the worker breather space was safe relative to all COPCs.

Figure 3. APGEMS-TF Modeling of Combined Release from A-Farm PBFs and AW-Stack at time of 242A Evaporator Vapor Event, Predicted Ammonia Concentration outdoors at AOP-015 Location is below 1 ppt (7 orders of magnitude below its OEL)

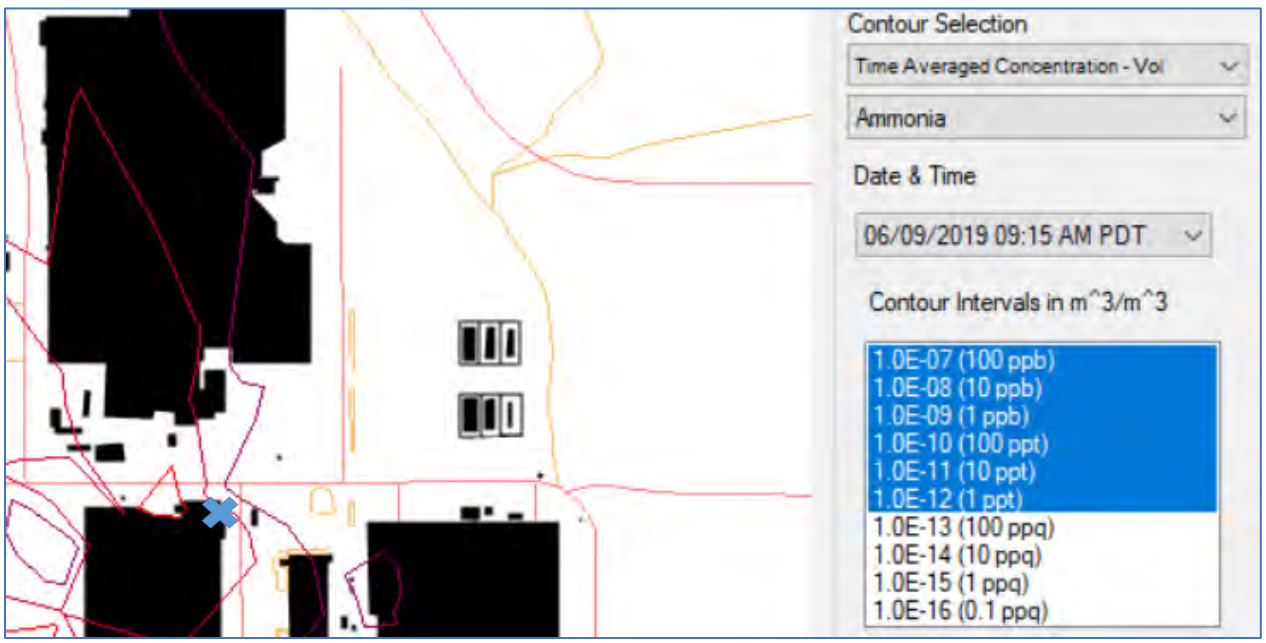


Figure 4. APGEMS-TF Modeling of Combined Release from A-Farm PBFs and AW-Stack at time of MO-818 Vapor Event, Predicted Ammonia Concentration at this AOP-015 Location is between 10 and 100 ppb (3 orders of magnitude below its OEL or 2 orders of magnitude below its odor threshold)

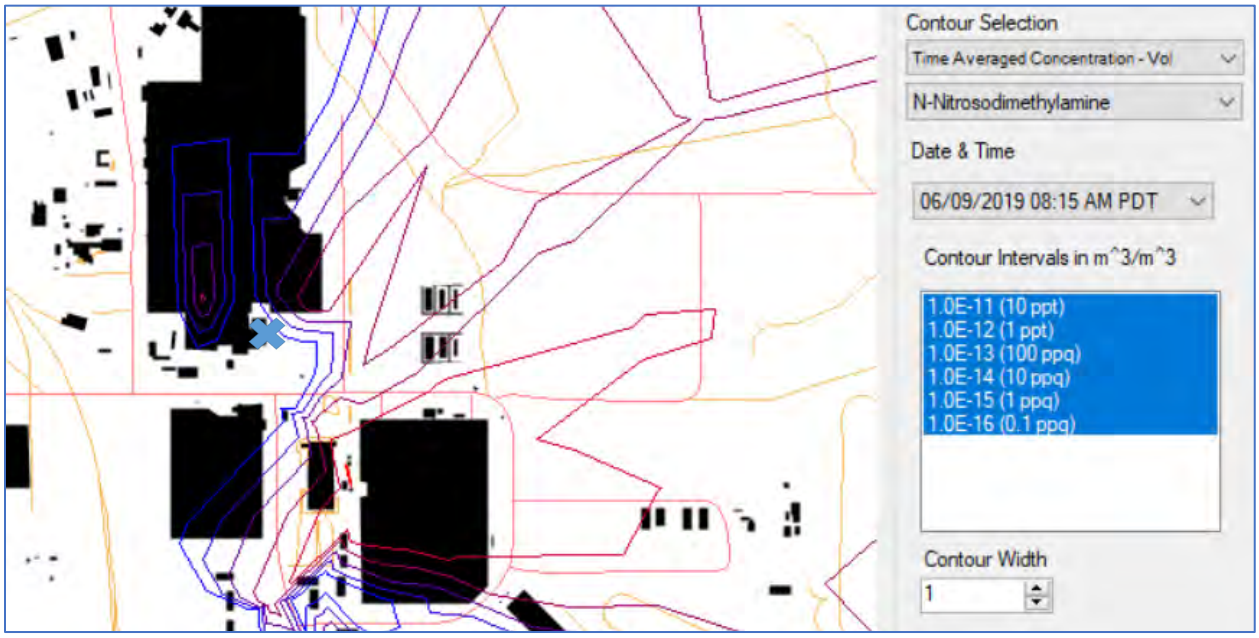


Figure 5. APGEMS-TF Modeling of Combined Release from A-Farm PBFs and AW-Stack at time of 242A Evaporator Vapor Event, Predicted NDMA Concentration outdoors at AOP-015 Location is below 1 ppq (5.5 orders of magnitude below its OEL)

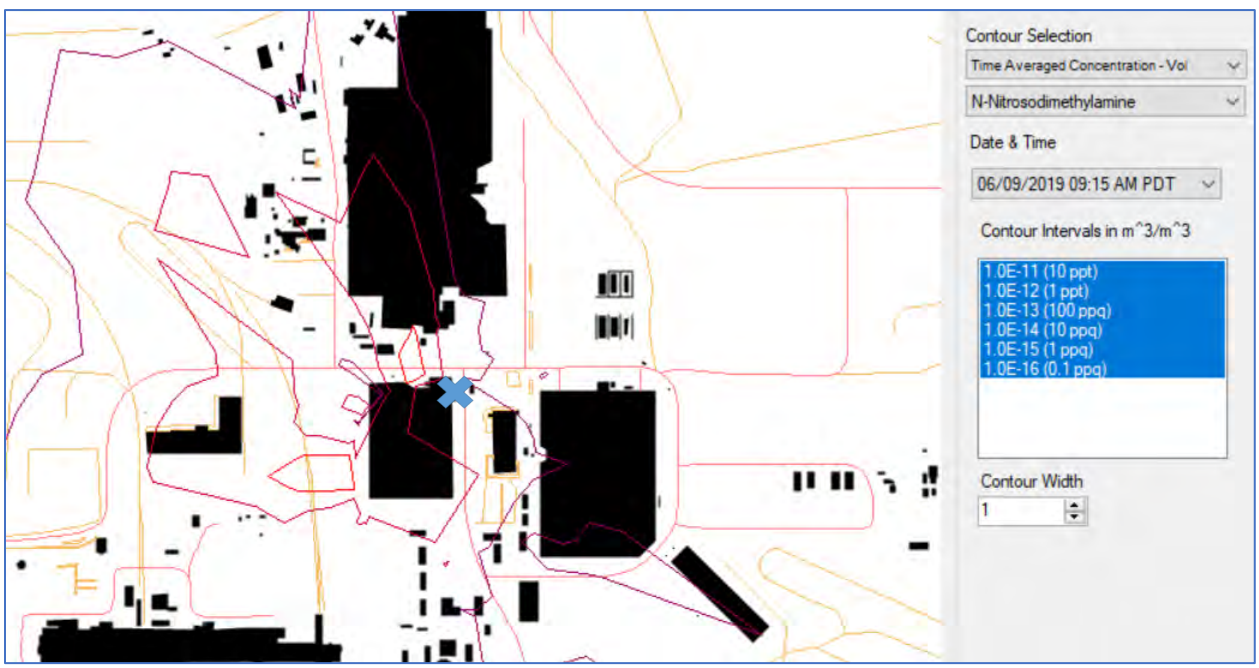


Figure 6. APGEMS-TF Modeling of Combined Release from A-Farm PBFs and AW-Stack at time of MO-818 Vapor Event, Predicted NDMA Concentration at this AOP-015 Location is Between 1 ppt and 0.1 ppt (2.5 orders of magnitude below its OEL)

Modeling of Odor Compounds from A-Farm and AW Farm:

To assess the likelihood of tank vapors being the source of the AOP-015 odors, an assessment of tank vapor constituents and concentrations was performed (both for COPC and non-COPC chemicals). Headspace constituent concentrations were compared to their odor detection threshold (ODT) concentrations to determine which chemicals were above odor detection in the undiluted headspace. Tables 1 and 2 below show the odor compounds found in A-Farm and-AW Farm vapors above ODT concentrations. The Tables also show predicted odor compound concentrations as fraction of ODT at the AOP-015 locations. Odor chemical concentrations at the AOP-015 locations were estimated from ammonia dilution factors predicted by APGEMS-TF. Compounds in concentrations below their ODT or for which ODTs were not available are not included in the Tables.

For tanks upwind of the AOP-15 locations (A farm and AW farm) the predominate odor would likely be ammonia based on the headspace constituents and their respective odor thresholds. Other likely odor descriptions of gases from those two tank farms are fruity, musty and rancid banana. These odors are not consistent with what was reported during the AOP-015 event. At receptor locations, the odor chemical concentrations were predicted to be 1-5 orders of magnitude below their ODTs. Thus, these tank vapors are not expected to be the source of odors during the AOP-015.

The TWINS database yields two sulfur-bearing compounds found in A-Farm headspace that were not included in Table 1 due to a lack of published ODTs. Table 3 shows a list of these sulfur-bearing compounds, which may have odors consistent with those reported at the two AOP-015 locations. If we assume the ODT for these sulfur compounds to be 0.5 ppb (a typical lower bound for thiol compounds), the maximum concentration in the tank headspace is up to 50 times its ODT. Based on applying the dilution factor utilized in Table 1, the predicted concentration of the sulfur-bearing compounds at the receptor locations are at least three orders of magnitude below their assumed odor detection thresholds.

Table 1. Odor Compounds Found in A-Farm Relative to Odor Detection Thresholds

Chemical Name	Chemical ID	Odor Description	Source Concentration (Fraction of ODT)[a]	Maximum Receptor Concentration (Fraction of ODT)[b]
Ammonia	7664-41-7	ammonia, sharp, characteristic	33.1	3.E-04
Butanal	123-72-8	musty, cocoa	18.3	2.E-04
Ethylamine	75-04-7	ammonia-like	17.3	2.E-04
Acetaldehyde	75-07-0	pungent, fruity	16.7	2.E-04
Methylamine	74-89-5	ammonia-like	1.6	2.E-05

[a] All other chemical compounds identified in the tank headspace are below the odor detection threshold (ODT) or do not have a published ODT.
[b] Estimated based on APGEMS-TF modeling. Applied ammonia dilution factor for limiting receptor location (MO-818).

Table 2. Odor Compounds Found in AW-Farm Relative to Odor Detection Thresholds

Chemical Name	Chemical ID	Odor Description	Source Concentration (Fraction of ODT)[a]	Maximum Receptor Concentration (Fraction of ODT)[b]
Ammonia	7664-41-7	ammonia, sharp, characteristic	101.9	1E-01
1-Butanol	71-36-3	rancid banana	81.5	8E-02
Butanal	123-72-8	musty, cocoa	35.9	4E-02
Acetaldehyde	75-07-0	pungent, fruity	20.0	2E-02
Ethylamine	75-04-7	ammonia-like	13.5	1E-02
Methylamine	74-89-5	ammonia-like	9.6	1E-02
o-cresol	95-48-7	tar, medicinal, plastic	5.2	5E-03
Acetophenone	98-86-2	sweet, vanilla, oranges	4.5	4E-03
2-Hepatanone	110-43-0	fruity mushroom	2.3	2E-03

[a] All other chemical compounds identified in the tank headspace are below the odor detection threshold (ODT) or do not have a published ODT.
[b] Estimated based on APGEMS-TF modeling. Applied ammonia dilution factor for limiting receptor location (MO-818).

Table 3. Sulfur Containing Compounds Found in A-Farm and AW-Farm

Tank Name	Chemical Name	Concentration (mg/m3 at 25C)	Concentration (ppb)	Maximum Receptor Concentration (Fraction of Assumed ODT)[a]
241-A-101	Benzenesulfonamide, N-butyl-	0.193	22.2	4E-04
241-A-102	Thiazole and others	0.00861	~2.5	5E-05
241-A-103	Benzenesulfonamide, N-butyl-	0.142	16.3	3E-04

[a] Estimated based on APGEMS-TF modeling. Applied ammonia dilution factor for limiting receptor location (MO-818).

Modeling of 2607 E-12 Sewage System:

The odor response cards for each AOP-015 location indicated several odors consistent with sewer or septic systems (e.g., sewer gas, rotten, musty, sulfur). A nearby sewer system just north of AP-Farm (2607E12) is known to emit odors and has been observed to emit gases that follow the contour of the surrounding area (e.g., V-shape ravine between A-Farm and the 242A Evaporator). The 2607E12 sewer is approximately 90 m away from the 242A vapor event and 100 m away from the MO818 vapor event, which are well within the travel distance for these sewer gases as observed by the fugitive emissions team. The 2607E12 sewer system was inspected on the day following the AOP-015 event and was found to have a strong odor that was wafting (intermittent) at the sewer rope boundary. Additionally, it has been observed that these odors can become stronger and more consistent as one moves away from the source and the vapors disperse from the ground level to nose height.

Figure 7 and 8 provide APGEMS-TF modeling of the 2607E12 sewer system. The sewer vapors were modeled as methyl mercaptan (a common odor causing chemical in sewer gases), but the source term was arbitrarily set at 1 g/s. This is due to the fact there is no source term (chemical type, concentration, and volumetric gas emission rate) available for sewer systems around the Hanford site. APGEMS-TF modeling of sewer gases is qualitative, given the potentially special nature of sewer gases (emits at ground level at different temperature than ambient). The contour lines shown in Figure 8 cannot be

attributed to specific methyl mercaptan concentrations, but may reflect the direction of the sewer vapor plume and relative concentrations.

Contour lines in Figure 7 indicate that meteorological conditions alone do not implicate the 2607E12 sewer system as the source of 242A odor event. It should be noted that the wind speeds were light and variable at the time (3.7 mph average), and that at these low wind speeds winds can change direction or swirl during breaks in the wind.

Contour lines in Figure 8 indicate that plume from 2607E12 sewer did encompass MO-818 at the time of the AOP-015 event, but not at the highest concentration contour (i.e., center of the plume). Again it should be noted that the average wind speed at the time was very low (2.7 mph) and the phenomenon of local wind direction change and swirling applies. Although the wind direction was not coming from the sewer at the time, the plume was broad enough to suggest that sewer gases could reach the MO-818 event location.

Odors were observed several times at the 242A Evaporator and MO-818 during the event and in the days leading to the reported event. Table 4 shows the wind direction and wind speed for time odors were reported at 242A or MO-818 over the three-day period. The wind directions varied between NW and SW, which are in the direction from the receptor to the sewer. This is not conducive to sewer gases traveling to the source.

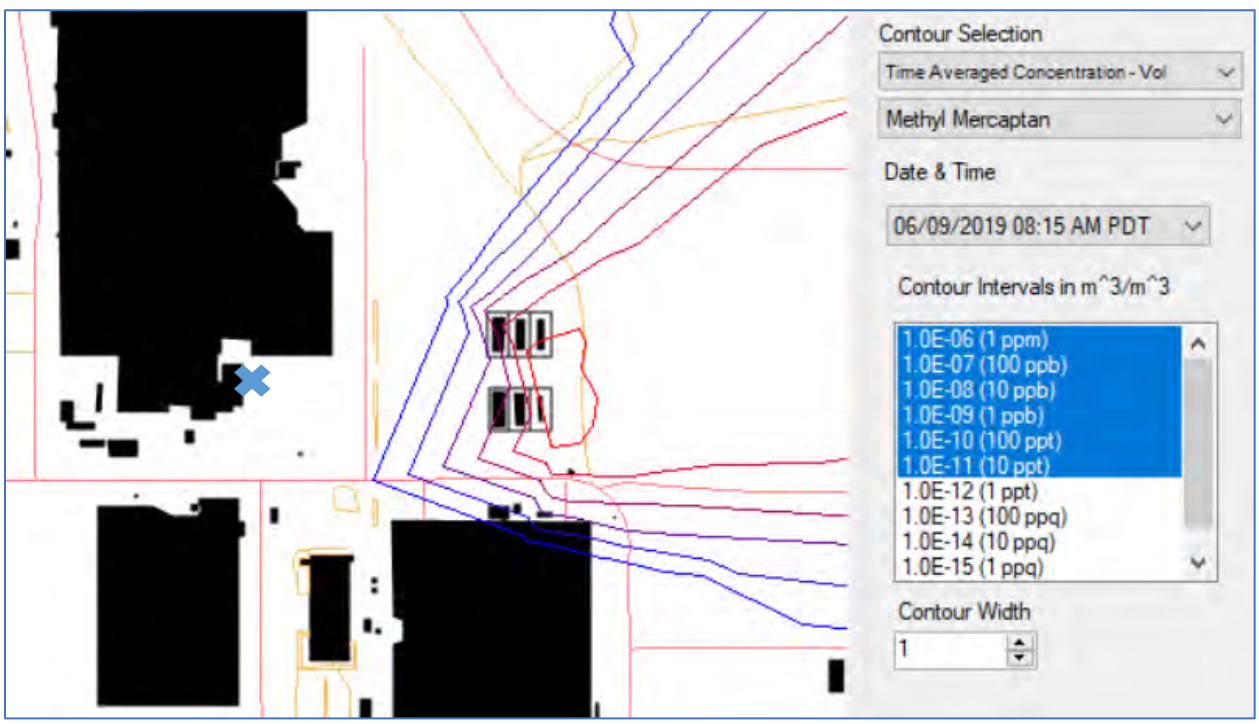


Figure 7. APGEMS Modeling of 2607E12 Sewer System, 242A Evaporator AOP-15 Location is Outside the Predicted Sewer Plume

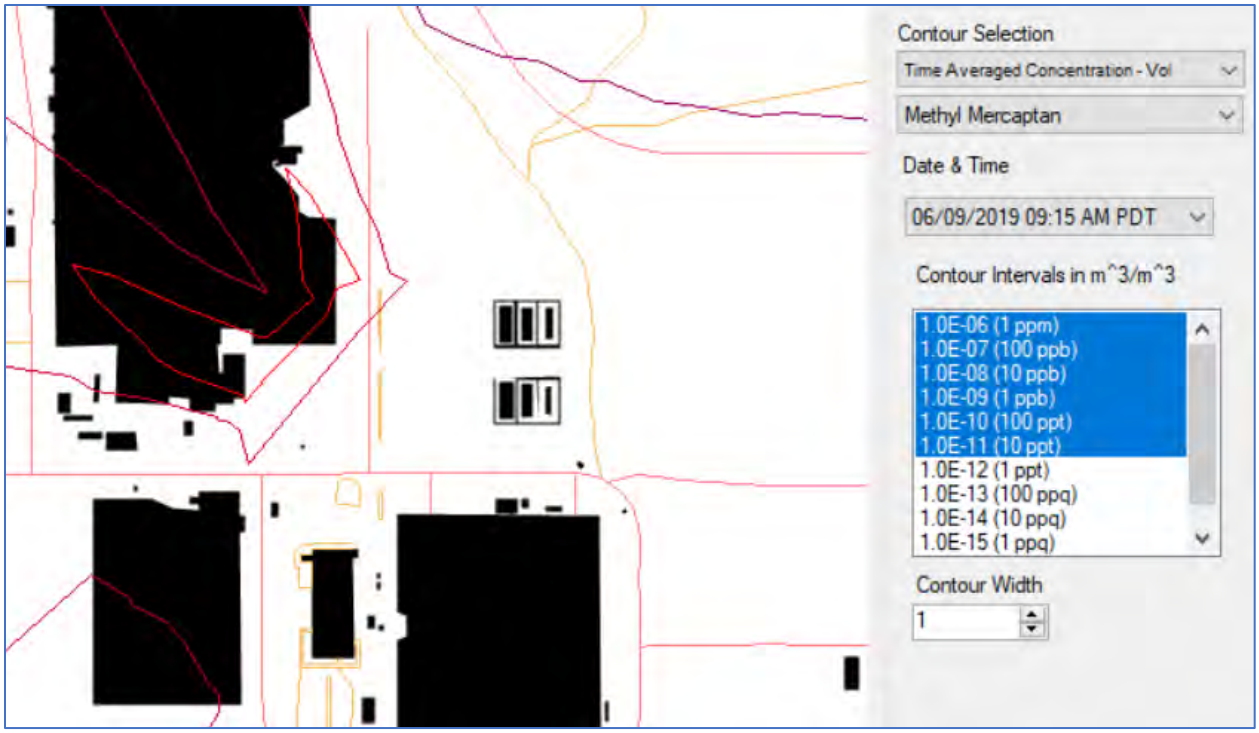


Figure 8. APGEMS Modeling of 2607E12 Sewer System, Methyl Mercaptan Concentrations are Arbitrary. The MO-818 AOP-015 Location is Inside the Predicted Sewer Plume but not within the Highest Concentration Contour

Table 4. Wind Speed and Wind Direction from Hanford Met Station #6 during Times When Odors Were Reported At 242-A and MO-818

	Station 6	Station 6	Station 6
Time Stamp	Wind_Direction	Wind_Speed	Max_Wind_Speed
(PST)	(degree)	(miles per hour)	(miles per hour)
6/7/2019 9:00	262.1	9.9	17.5
6/8/2019 13:30	243.6	6.1	14.4
6/8/2019 14:00	316.7	5.2	12.3
6/8/2019 14:15	215.4	6.6	15.9
6/8/2019 14:30	221.6	7.5	20.1
6/8/2019 16:30	297.6	8.5	15.0
6/9/2019 7:15	302.3	3.7	7.4
6/9/2019 8:15	239.6	2.9	6.2

Attachment B

Industrial Hygiene Investigation Report IHIR 19-04244

For

MO-818 AW Change Trailer event

Washington River Protection Solutions **TF-AOP-015 INDUSTRIAL HYGIENE INVESTIGATION REPORT**	**PER Number:** 2019-1174
Time/Date and Event Location: 1002 06/09/2019 @ MO-818 AW Change Trailer stairs	**EIR Number:** EIR-2019-026

1. **Event Summary** *(including number of workers involved and activity in progress)*:
Two carpenters were performing work on the MO-818 AW Change Trailer stairs and reported stronger than normal "ammonia" odor. Neither worker experienced any symptoms. Both declined medical evaluation.
   - Was an IHT present during initiating event? [ ] Yes [x] No

IH Monitoring/Sample Survey Reports:
19-04243

Weather Conditions at Time of Event:

- Weather Station: 6
- Wind Direction and Speed: South @ 3 mph
- Barometric Pressure *(steady/rising/falling)*: 29.58in/Hg, steady
- Temperature (F°) 68F

Field Response Timeline:
0950 EV IH phoned CSM regarding EV AOP event at 0833 and was informed that a second AOP-015 was being entered for "ammonia odors" outside AW farm. No symptoms were reported. Based upon odor description taking a bag sample was waived.

1002 "SOEN:Entered TF-AOP-015 for odors near AW Farm. All personnel stay clear of AW farm until further notice. CSM"

1009 Shift IHT's dispatched from CSM to perform sampling per IHP-09001 using TF-AOP-015 RPF Task 2.

1141 EV IH phoned CSM for update of event. According to CSM odor details changed from "ammonia" to "sulfur." The drainage field North of AP farm vents continuously and is a known source of sewer/sulfur odors. With no detectable ammonia readings found in the proximity of the change trailer or farm perimeter and a known source of sewer odors in close proximity response actions were completed. CSM was awaiting survey numbers prior to officially exiting the AOP.

1254 "SOEN:Response actions for the TF-AOP-015 events at 242-A and AW Farm have been completed and the results are at or below background levels. Exiting TF-AOP-015. CSM"

IH Author:

[redacted]	[redacted]	6/11/2019
Print First and Last Name	*Signature* *Phone No.*	*Date*

A-6005-744 (REV 5)

2. GCMS Sample Results:

Per IH bag samples not necessary

3. Additional Information:

- Odor Response Cards received

  Odor response cards located in Attachment 1

- Summary of IH Monitoring and Sampling Data:

  a. Monitoring:

  SWIHD Survey 19-04243"

  DRI field readings:

  VOC: <DL
  NH_3: <DL

  Grab samples:
  N/A

  b. Sampling:
  N/A

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

Two workers, working on the stairs of MO-818 AW change trailer. Reported stronger than normal ammonia smell. No symptoms reported. Medical evaluation declined

5. Recommendations/Conclusions:

None at this time

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

6. Other:

S&H Program Management:

[redacted]	[redacted]	[redacted]	6/13/19
Print First and Last Name	*Signature*	*Phone No.*	*Date*

Attachment 1

Odor Response Cards

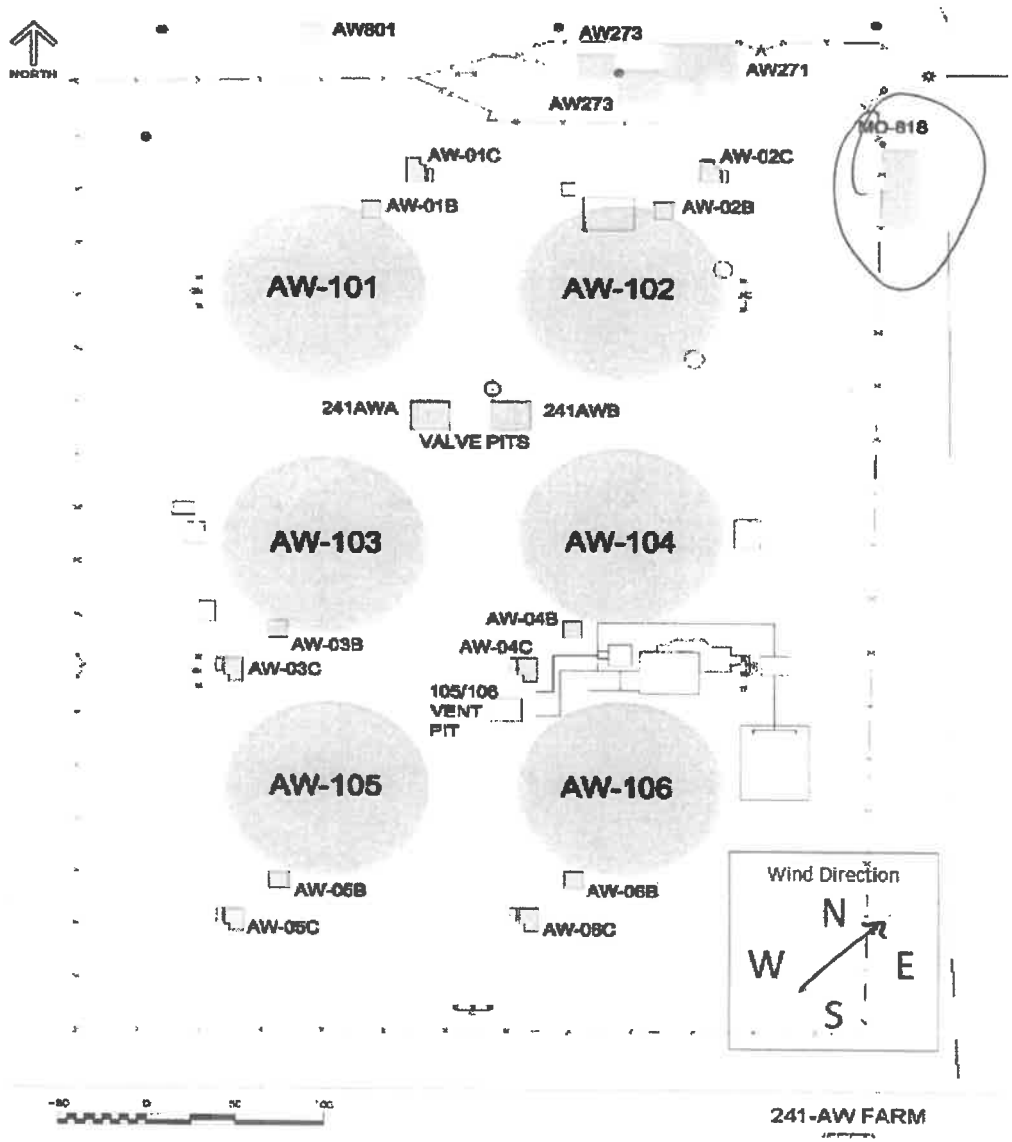
ODOR RESPONSE CARD - 241-AW FARM

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.**



[redacted]

A-6006-930 (REV 1)

ODOR RESPONSE CARD - 241-AW FARM

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

- Date and time odor was noticed 07/09/2019 / 9:17AM
- Your name and the work your were perfoming [redacted] / stair repair
- Location of odors *(mark area on map and wind direction)* 241 AW / MO-818
- 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: Sulfer
- Possible Source Evaporater
- 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.

[redacted]

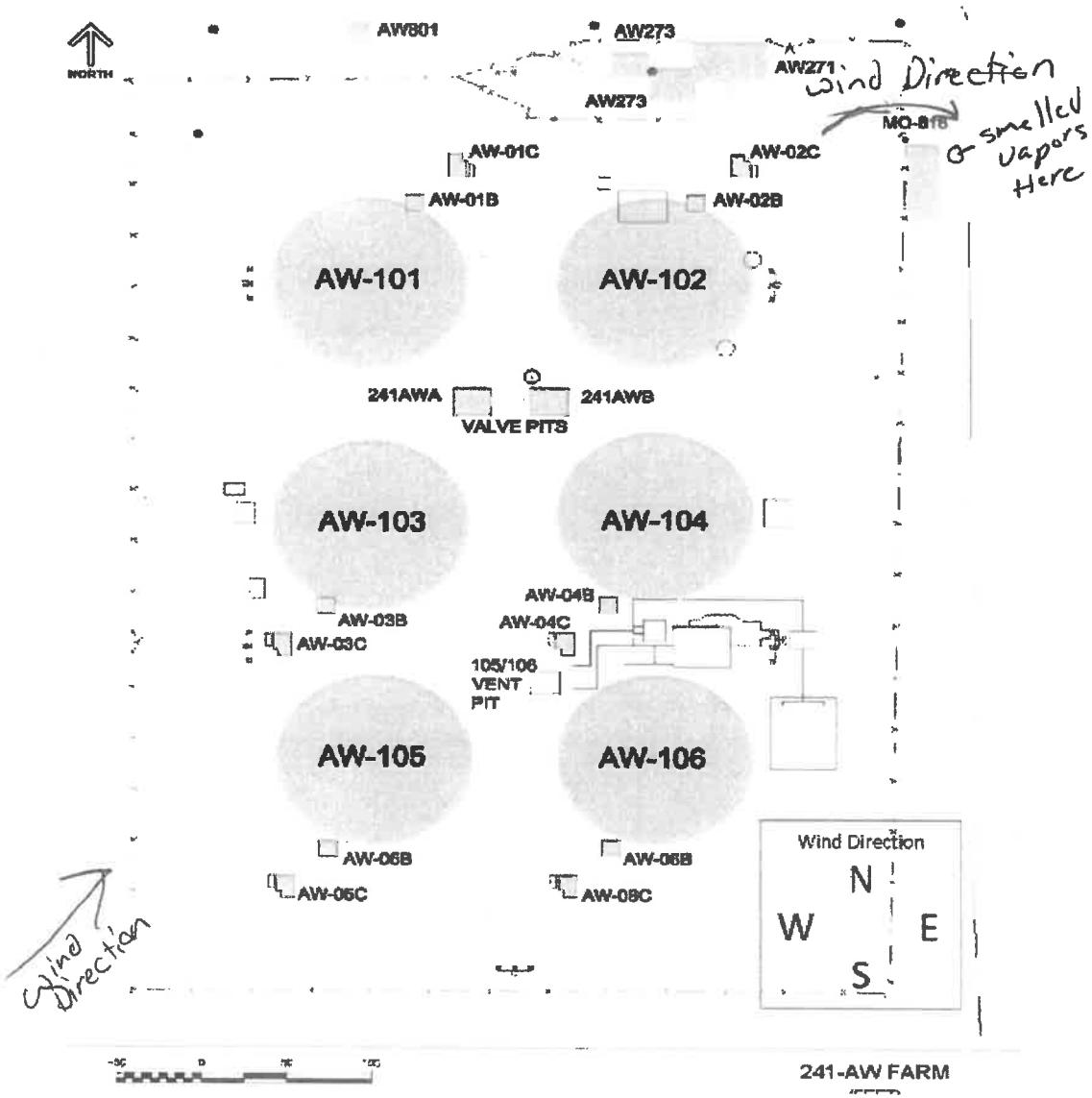
ODOR RESPONSE CARD - 241-AW FARM

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.**



[redacted]

ODOR RESPONSE CARD - 241-AW FARM

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

- Date and time odor was noticed 9:17 am on June 9th 2019
- Your name and the work your were perfoming [redacted], building Stairs
- 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? No
- Describe the odor ☐ Sweet ☐ Sour ☐ Musty ☐ Earthy ☐ Metallic ☐ Smoky ☐ Rotten ☐ Onion
  ☐ Cleaning Solution ☐ Ammonia ☒ Other: Sulfer smell
- 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: None

2. Send this card to the Central Shift Office.

[redacted]

Glossary

Glossary:

AOP	Abnormal Operating Procedure
ANFIHP	AN Team Field Industrial Hygiene Professional
AYAZFIHP	AY/AZ Team Field Industrial Hygiene Professional
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
EVFIHP	EV Team Field Industrial Hygiene Professional
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
IHPIHTL	Industrial Hygiene Programs Industrial Hygiene Technician Lead
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
POIHT	Production Operations Industrial Hygiene Technician
POIHTL	Production Operations Industrial Hygiene Technician Lead
POIHTS	Production Operations Industrial Hygiene Technician Supervisor
POSIHT	Production Operations Shift Industrial Hygiene Technician
POSIHTS	Production Operations Shift Industrial Hygiene Technician Supervisor
POWASHM	Production Operations West Area Safety and Health Manager
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 C

Industrial Hygiene Investigation Report IHIR 19-04243

For

242-A Evaporator event

Washington River Protection Solutions

TF-AOP-015 INDUSTRIAL HYGIENE INVESTIGATION REPORT

PER Number: PER-2019-1170

Time/Date and Event Location: 0910 06/09/2019 @ 242-A Evaporator

EIR Number: EIR-2019-025

1. **Event Summary** *(including number of workers involved and activity in progress)*:
ON 06/09/2019 personnel reported an odor in the 242-A main hallway, kitchen, and hallway leading to the control room. Peronnel described the smell as musty, wet, sewage, or something had died. None of the personnel reported any symptoms and all declined an evaluation at HPMC.
   - Was an IHT present during initiating event? [ ] Yes [x] No

IH Monitoring/Sample Survey Reports:
19-04244, 242 Evaporator AOP 15 Response

Weather Conditions at Time of Event:

- Weather Station: 6
- Wind Direction and Speed: South at 3 mph
- Barometric Pressure *(steady/rising/falling)*: 29.85 in/Hg, steady
- Temperature (F°) ~70 F

Field Response Timeline:
0833 - Entered TF-AOP-015 Response to Reported Odors or Unexpected Changes to Vapor Conditions. A stronger than normal odor is detected by multiple personnel outside of areas where potential or actual vapor concerns are expected. 242-A SM [redacted] reports that on 06/07/19, 242-A personnel noticed a musty/mold type smell in the 242-A hallway. The SOE rolled the exhauster inlet roll filters and the smell dissipated. On 06/08/19, personnel noticed a sewage smell in the 242-A hallway (same location). On 06/09/19, the smell was in the same location, but smelled like something died. None of the personnel reported any symptoms, and all declined evaluation at HPMC. Instructed 242-A personnel to evacuate the facility pending IH sample results. Notified [redacted] for AOP, Entered TF-AOP-015 for odors inside 242-A. All personnel stay clear of 242-A until further notice. at 06/09/2019 08:33

0857 - Personnel reporting odors are: [redacted] (242-A SM), [redacted] (SOE), and NCOs [redacted] and [redacted].

0909 - Spoke with IH On-Call [redacted] per telecom. Confirmed use of IHP-09001 and TF-AOP-015 RPF Task 2. His specific guidance is to look at any nearby garbage receptacles or piping with potential for stagnant water, empty p-traps, etc. based on odors reported. Odors were strongest in vicinity of the 242-A kitchen and the hallway leading to the 242-A control room. However, odors were also noted in the hallway outside of the HVAC room on the second floor.
NCO [redacted] also reported odors at 242-A. No symptoms. Declined HPMC.

0913 - Dispatched IHTs to perform sampling per IHP-09001 using TF-AOP-015 RPF Task 2. Per IH guidance, no bag sample required.

1255 - "SOEN: Response actions for the TF-AOP-015 events at 242-A and AW Farm have been completed and the results are at or below background levels. Exiting TF-AOP-015. CSM"

IH Author:

[redacted]	[redacted]	[redacted]	06/11/2019
Print First and Last Name		*Phone No.*	*Date*

A-6005-744 (REV 5)

Washington River Protection Solutions **TF-AOP-015 INDUSTRIAL HYGIENE INVESTIGATION REPORT** (Continued)	**PER Number:** PER-2019-1170
Time/Date and Event Location: 0910 06/09/2019 @ 242-A Evaporator	**EIR Number:** EIR-2019-025

2. **GCMS Sample Results:**
   Per IH bag samples were not collected. GCMS analysis was not performed.

   IH Author:

   [redacted] [redacted] [redacted] 9/12/19

   Print First and Last Name *Signature* *Phone No.* *Date*

3. **Additional Information:**
   - Odor Response Cards received:
     Yes, see attachements
   - Summary of IH Monitoring and Sampling Data:
     a. Monitoring: No readings above ALs
     b. Sampling: N/A

4. **Summary of Employee Reported Information** *(e.g., symptoms)*
   Five individuals reported a rotten sewer smell in the 242 Evaporator hallway. None of the affected individuals reported symptoms from the odor.

5. **Recommendations/Conclusions:**
   Identification of Source of the Concern: [ ] Yes [x] No

6. **Other:**

   S&H Program Management:

   [redacted] [redacted] [redacted] 6/12/19

   Print First and Last Name *Signature* *Phone No.* *Date*

Odor Response Cards

6-8-19 @ 1730

6-7-19 2=Black
6-9-19 3=Black Circles

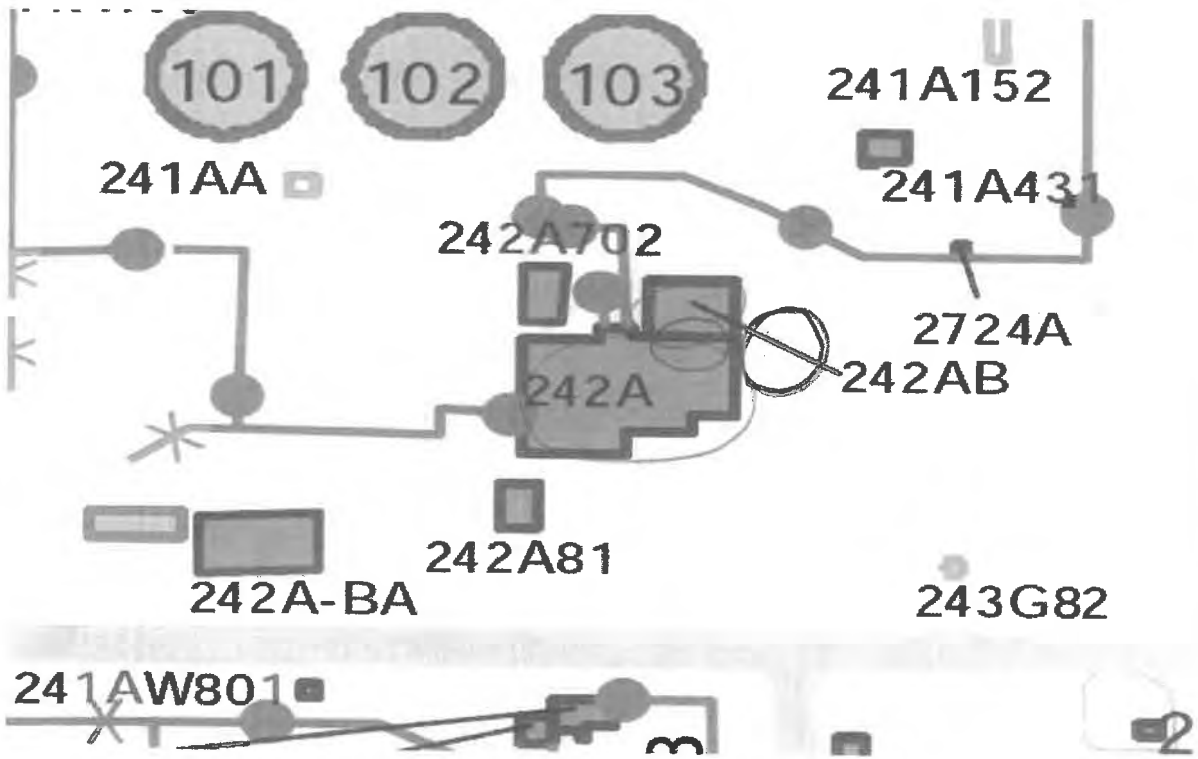
ODOR RESPONSE CARD - 242-A

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.**



Wind Direction
N
W E
S

A-6006-975 (REV 0)

ODOR RESPONSE CARD - 242-A

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

- Date and time odor was noticed 6-7-19 @ 1000 6-8-19 @ 1500, and 6-9-19 @ 0810
- Your name and the work your were perfoming [redacted] - Procedure review
- 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? No
- Describe the odor ☐ Sweet ☐ Sour ☒ Musty ☐ Earthy ☐ Metallic ☐ Smoky ☒ Rotten ☐ Onion ☐ Cleaning Solution ☐ Ammonia ☐ Other: Sewer gas.
- Possible Source Sewer or ?
- 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.

Black circles = 6-7-19 @ 1000 & 6-9-19 @ 0816
Red circles = 6-8-19 @ 1730

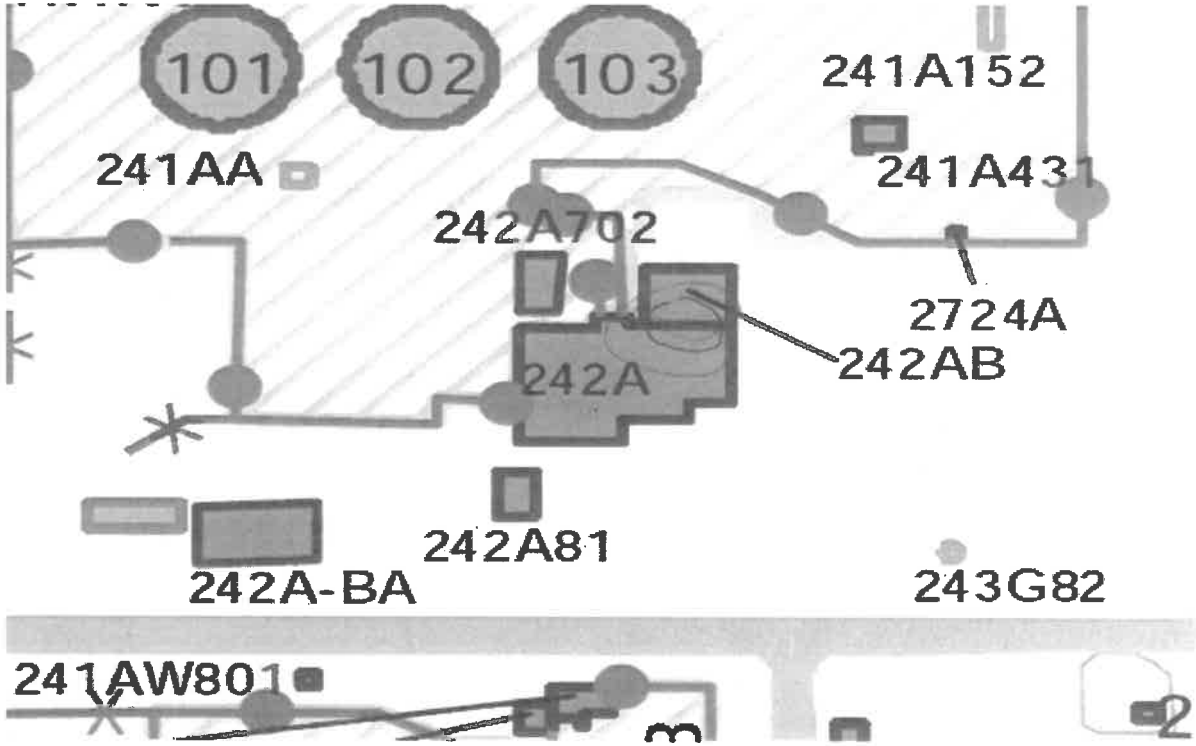
ODOR RESPONSE CARD - 242-A

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.**



Wind Direction
N
W E
S

A-6006-975 (REV 0)

ODOR RESPONSE CARD - 242-A

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

- Date and time odor was noticed @1000 @1430 @0816 6-7-19, 6-8-19, and 6-9-19
- Your name and the work your were perfoming [redacted] – Shift Manager
- Location of odors (mark area on map and wind direction) Main hallway, Kitchen, and hallway heading to control room.
- Name(s) of others in or near the affected area [redacted] 6-9-19
- Was an IHT present? No
- Describe the odor ☐ Sweet ☐ Sour ☑ Musty ☐ Earthy ☐ Metallic ☐ Smoky ☑ Rotten ☐ Onion
  ☐ Cleaning Solution ☐ Ammonia ☐ Other: _____
- Possible Source Sewer or ?
- 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.

A-6006-975 (REV 0)

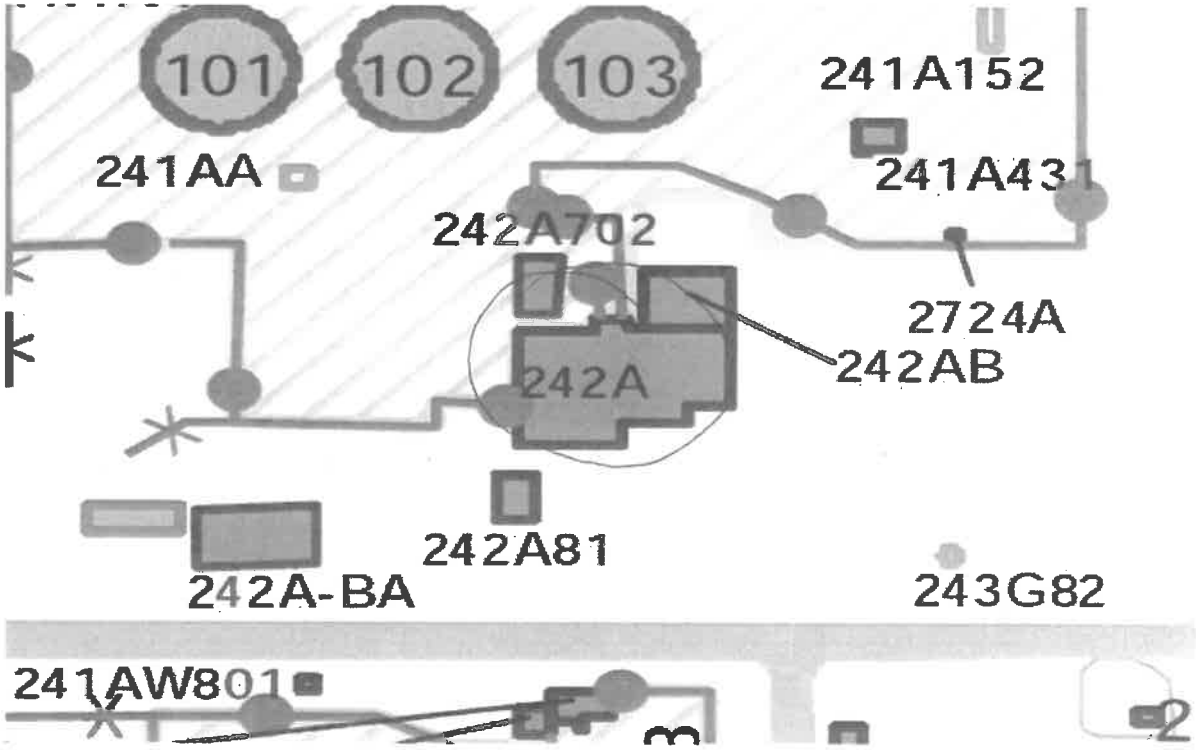
ODOR RESPONSE CARD - 242-A

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.**



Wind Direction
N
W E
S

A-6006-975 (REV 0)

ODOR RESPONSE CARD - 242-A

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

- Date and time odor was noticed 06-7-19 & 6.8.19
- Your name and the work your were perfoming [redacted]
- Location of odors (mark area on map and wind direction) Kitchen, hallway
- 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 Dead animal & rotten,
- 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.

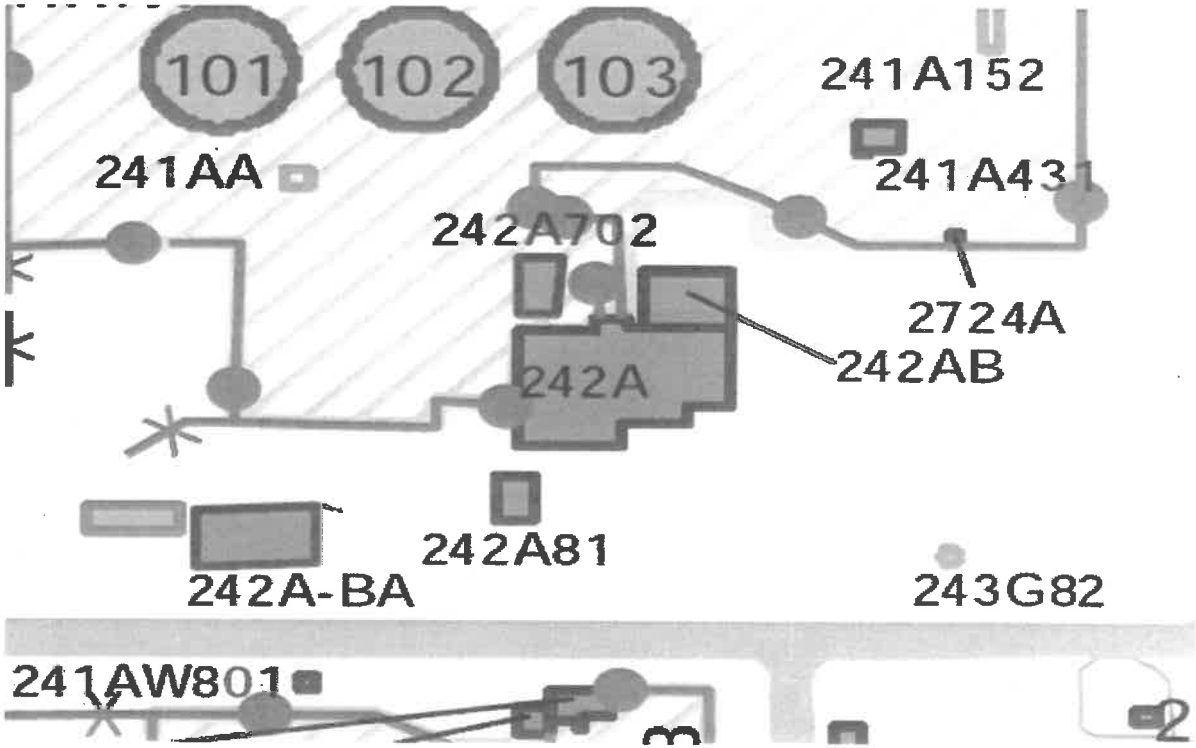
ODOR RESPONSE CARD - 242-A

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.**



Wind Direction
N
W E
S

A-6006-975 (REV 0)

ODOR RESPONSE CARD - 242-A

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

- Date and time odor was noticed I did not notice An odor
- Your name and the work your were perfoming [redacted] NCO, A-1 control Room
- Location of odors (mark area on map and wind direction) _____
- Name(s) of others in or near the affected area _____
- Was an IHT present? _____
- 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: _____

2. Send this card to the Central Shift Office.

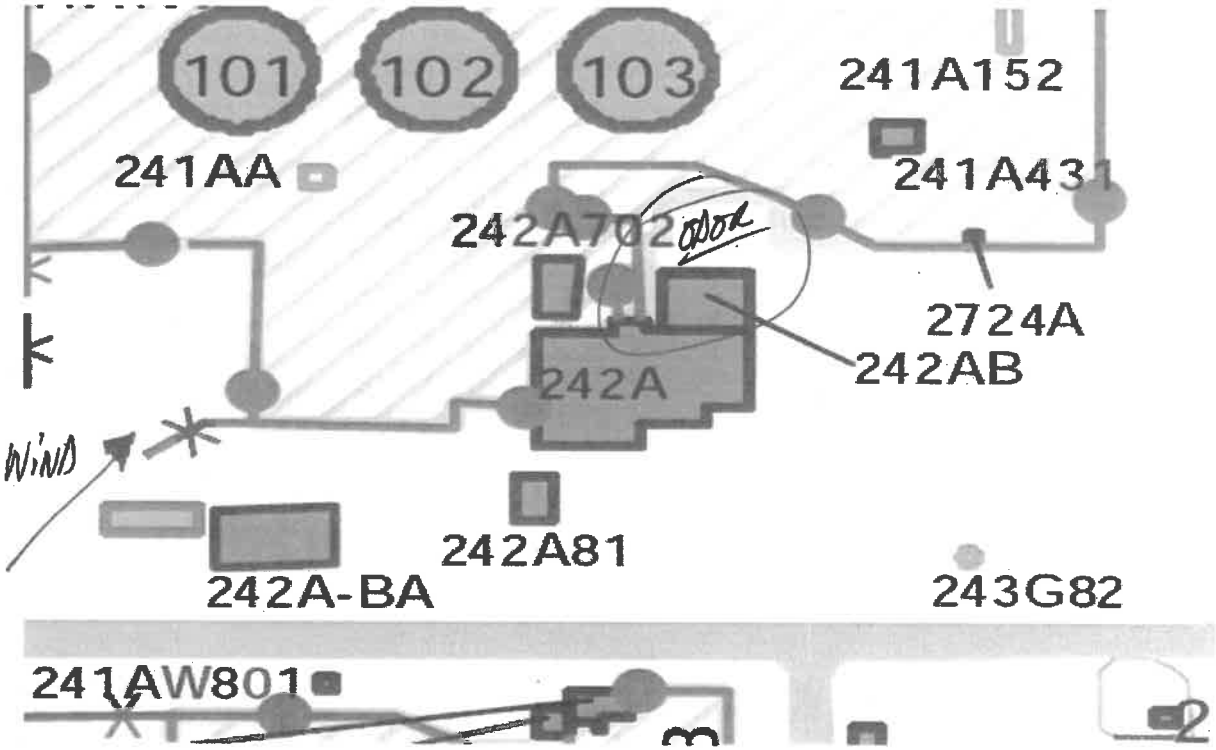
ODOR RESPONSE CARD - 242-A

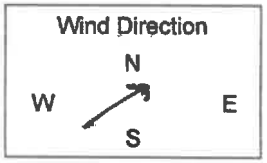
Odors Detected with *NO* Immediate symptoms

1. Notify Immediate Supervisor.
2. Contact Central Shift Manager, 373-2689. 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, 373-2689, 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.**





A-6006-975 (REV 0)

ODOR RESPONSE CARD - 242-A

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

- Date and time odor was noticed 6/8/19 (1500-1530) 6/9/19 - AM
- Your name and the work your were perfoming [redacted] S.O.E. ROUTINES
- Location of odors (mark area on map and wind direction) 242-A EVAPORATOR (NXNE) WINDS FROM SW
- Name(s) of others in or near the affected area 242-A EVAPORATOR A-SHIFT CREW
- Was an IHT present? NO
- Describe the odor ☐ Sweet ☒ Sour ☒ Musty ☐ Earthy ☐ Metallic ☐ Smoky ☒ Rotten ☐ Onion
  ☐ Cleaning Solution ☐ Ammonia ☐ Other:
- Possible Source AX-FARM ACTIVITIES / 204-AR / AN/AX FARMS?
- 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: SMELL WAS FAINT AND FADED QUICKLY. 242-A EVAP INTAKE + VENTILATION CARRIED ODOR THROUGH FILTERS INTO COLD SIDE HABITAT.

2. Send this card to the Central Shift Office.

A-6006-975 (REV 0)

Glossary

Glossary:

AOP	Abnormal Operating Procedure
ANFIHP	AN Team Field Industrial Hygiene Professional
AYAZFIHP	AY/AZ Team Field Industrial Hygiene Professional
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
EVFIHP	EV Team Field Industrial Hygiene Professional
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
IHPIHTL	Industrial Hygiene Programs Industrial Hygiene Technician Lead
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
POIHT	Production Operations Industrial Hygiene Technician
POIHTL	Production Operations Industrial Hygiene Technician Lead
POIHTS	Production Operations Industrial Hygiene Technician Supervisor
POSIHT	Production Operations Shift Industrial Hygiene Technician
POSIHTS	Production Operations Shift Industrial Hygiene Technician Supervisor
POWASHM	Production Operations West Area Safety and Health Manager
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