

C-67 Event Investigation Reports (Redacted) EIR-2024-013 C-67 (02/14/2024)

(Settlement Agreement Deliverable)

Prepared for the U.S. Department of Energy
Assistant Secretary for Environmental Management

Contractor for the U.S. Department of Energy
Office of River Protection under Contract DE-AC27-08RV14800



**P.O. Box 850
Richland, Washington 99352**

C-67 Event Investigation Reports (Redacted) EIR-2024-013 C-67 (02/14/2024)

(Settlement Agreement Deliverable)

J. L. Nelson

Washington River Protection Solutions

Date Published
March 2024

WRPS

Prepared for the U.S. Department of Energy
Assistant Secretary for Environmental Management

Contractor for the U.S. Department of Energy
Office of River Protection under Contract DE-AC27-08RV14800



P.O. Box 850
Richland, Washington 99352

Copyright License

By acceptance of this article, the publisher and/or recipient acknowledges the U.S. Government's right to retain a non exclusive, royalty-free license in and to any copyright covering this paper.

APPROVED

By Lynn M Ayers at 9:30 am, Mar 13, 2024

Release Approval

Date

Approved for Public Release;
Further Dissemination Unlimited

LEGAL DISCLAIMER

This report was prepared as an account of work sponsored by an agency of the United States Government. Neither the United States Government nor any agency thereof, nor any of their employees, makes any warranty, express or implied, or assumes any legal liability or responsibility for the accuracy, completeness, or any third party's use or the results of such use of any information, apparatus, product, or process disclosed, or represents that its use would not infringe privately owned rights. Reference herein to any specific commercial product, process, or service by trade name, trademark, manufacturer, or otherwise, does not necessarily constitute or imply its endorsement, recommendation, or favoring by the United States Government or any agency thereof or its contractors or subcontractors. The views and opinions of authors expressed herein do not necessarily state or reflect those of the United States Government or any agency thereof.

This report has been reproduced from the best available copy.

Printed in the United States of America

Washington River Protection Solutions
EVENT SUMMARY

NOTE: This form provides timely notification to management and documents preliminary information of an event that may require a more formal investigation. Details may change upon further examination and analysis. The following is a current status of available information:

1. **Project:** Maintenance 2. **Report Date:** 02/14/2024

3. **Investigation Title:** C-67 Odor Response on 4th St.

4. **Investigation Report Number:** EIR-2024-013

5. **Responsible Manager:** [REDACTED]

6. **Event Investigator:** [REDACTED]

7. **Area / Building / Location:** Intersection of 4th St. and Buffalo Ave.

8. **Date and Approximate Time of Event:** Date: 02/14/2024 Time (military): 0950 hours

9. **Associated Action Request (AR) Number:** WRPS-AR-2024-0963

10. **Associated Occurrence Report Number (if applicable):** N/A

11. **Event Investigation Meeting Held:** Yes [] or No [X] Date: Time (military):

12. Activity in Progress: (What activity was under way, include procedures and work order numbers, as applicable)

Three workers were driving to multiple locations checking salt buckets for snow removal. Two workers outside of the 217AW Change Tent were performing personnel noise monitoring. Both activities are considered Level 4 activities, therefore, procedures and/or work order numbers are not applicable.

13. Personnel Involved: (Job positions, number of personnel, identify any support organizations or subcontractors)

Personnel driving between locations to check salt buckets:
3 - WRPS Teamsters

Personnel outside of the 217AW Tent performing noise monitoring:
2 - WRPS Industrial Hygiene Technicians (IHTs)

14. What Happened: (Provide a short discussion of what happened)

On 02/14/2024, at approximately 0950 hours, three workers driving east to west on 4th St. reported smelling a stronger than normal "slight sulfur and strong chemical-like" odor when between the 242-BA Boiler Annex building and the railroad tracks located west of Buffalo Avenue, near Purex. Affected personnel further provided odor descriptors of "musty and solvent" on the Odor/Vapor Response Cards and indicated experiencing symptoms of lightheadedness, breathlessness, and sore throat. Affected personnel were directed to report to the on-site medical provider for precautionary medical evaluations.

At approximately 1048 hours, two workers outside of the west entrance of the AW change tent (217-AW) reported smelling a stronger than normal "smoky and burnt plastic-like" odor. Affected personnel reported experiencing symptoms of headache, sore throat, nausea, numb/tingling tongue, weakness, dizziness, and taste. Affected personnel were directed to report to the on-site medical provider for precautionary medical evaluations.

The five individuals were evaluated by the on-site medical provider and were returned to work with no restriction.

15. Where Did It Happen: (Description of work area and working conditions. Include information on weather conditions, PPE, Postings, etc.)

On 4th Street, between the Buffalo Avenue and Canton Avenue the intersections, and outside the west entrance of the AW change tent. Both locations are north of AW Farm.

Washington River Protection Solutions EVENT SUMMARY

At the time the odors were reported, workers were wearing standard street clothing (which is considered Level D PPE) and were in a work location that is not posted as a radiologically controlled area. Workers were not in areas requiring the use of respiratory protection or a personal ammonia monitor (e.g., ToxiRAE or VentisPro).

The Hanford Site Meteorological Station #6 and Data Fusion and Advisory System (DFAS) application, powered by SmartSite™, were utilized for outdoor weather details at the time odors were reported. The Hanford Site Meteorological Station #6 and DFAS dashboard indicated the following weather conditions at 0955 hours on 02/14/2024:

- Wind Speed: 10 mph
- Wind Direction: 20° (from North Northeast)
- Mixing Height: 1200 feet above grade
- Stability Class: D (stable conditions)
- Barometric Pressure: 29.26 inches Hg and steady.

16. Impact to Facility: *(Caused by the event or a description of known consequences)*

No impacts to facility safety status, operational capabilities, or facility reliability occurred.

Shift Operations Engineer (OE) and Nuclear Chemical Operators (NCOs) placed roadblocks on 4th St. along the west side of Canton and 4th St. intersection, the 4th St. and Buffalo Ave. intersection, and west of the Purex cut railroad tracks. Access to the area was restricted for approximately three hours.

17. Immediate Actions Taken: *(List immediate actions taken to stabilize the scene or respond to the event)*

- CSM directed workers who reported experiencing symptoms to report to the on-site medical provider for precautionary medical evaluations.
- CSM initiated TFC-OPS-OPER-C-67 response actions for reported stronger than normal odors.
- CSM issued SOEN that directed personnel to stay clear of area located from Canton and 4th to just west of 4th and Buffalo.
- Restricted access roadblocks placed on 4th St. along the west side of Canton and 4th St. intersection, the 4th St. and Buffalo Ave. intersection, and west of the Purex cut railroad tracks.
- CSM made required TFC-OPS-OPER-C-67 notifications.
- Production Operations shift IHT initiated TFC-OPS-OPER-C-67 response actions and monitoring per Industrial Hygiene Sample Plan (IHSP) POE-MULTI-TFCOPSOPER67.
- Event Investigation EIR-2024-013, "C-67 Odor Response on 4th St." was initiated.

18. Compensatory Actions Taken:

None.

19. Remedial Actions Taken:

None.

20. Key Elements of the Investigation: *(Key investigation points)*

To summarize the conclusion of IHIR-00089, "TFC-OPS-OPER-C-67 Response 4th St. and Buffalo Ave", investigation and DRI monitoring could not readily identify the the source of the reported odors. However, it was determined the potential odor source(s) were most likely resultant of:

- 6 portable restrooms/"blue rooms" located ~200 feet northeast of the affected area.
- Bleach utilized to disinfect the WRPS-RMA-188 laundry trailer located ~225 feet north/northeast of the affected area.

Direct reading instrument (DRI) monitoring performed during TFC-OPS-OPER-C-67 response actions did not indicate further action was necessary with regard to a worker safety and health occupational exposure limit standpoint. As a result, the area was released from restricted access.

Washington River Protection Solutions
EVENT SUMMARY

The following considerations support the IHIR-00089 conclusions:

- (1) Six portable restrooms/"blue rooms" were located ~200 feet upwind of the affected area at the time of the reported odors. Due to the proximity to the affected area and wind direction at the time of the reported odors (out of North/Northeast), in addition to utilization of standard cleaning chemicals (including deodorizers and blue dye bacterial inhibitors); the six portable restrooms/"blue rooms" located north of the 242-A Boiler Annex were determined to be a potential odor source. A portable restroom maintenance truck was observed driving south on Canton Ave shortly before the reported odors, however, the maintenance subcontractor confirmed the 6 portable restrooms/"blue rooms" located north of the 242-A Boiler Annex were not serviced prior to the event occurrence. Nonetheless, IHTs noted an observable odor in the general areas north of the 242-A Boiler Annex during TFC-OPS-OPER-C-67 response. Observed odors were described as "sweet/cologne-like" and being "similar to blue room additives".
- (2) On 02/13/2024, bleach was used to clean and disinfect the inside of the WRPS-RMA-188 laundry trailer to remedy Mold growth and preparation for painting activities. Following bleach application, a door was left open to ventilate the WRPS-RMA-188 laundry trailer which remained open at the time odors were reported. The WRPS-RMA-188 laundry trailer was located ~250 feet upwind of the affected area at the time of the reported odors. Due to the proximity to the affected area and wind direction at the time of the reported odors, the WRPS-RMA-188 laundry trailer was determined to be a potential odor source. In addition, IHTs noted the WRPS-RMA-188 laundry trailer still contained an observable "fresh and bleach-like" odor during TFC-OPS-OPER-C-67 response.
- (3) Several diesel heaters and generators were in the general area odors were reported. One operating diesel heater (near the 241-A "warm up tent") was located ~275 feet north of the affected area at the time of the reported odors. Due to the proximity to the affected area and wind direction at the time of the reported odors, the operating diesel heater was considered as a potential odor source. However, diesel combustion type odors did not correspond with the odor descriptors provided by affected personnel. In addition, IHTs did not observe diesel odors at or around the 241-A "warm up tent" during TFC-OPS-OPER-C-67 response. Further, DRI monitoring within the 241-A "warm up tent" was occurring at the time of the reported odor. DRI monitoring indicated 0.1 ppm Nitrogen Dioxide and 0.05 ppm Volatile Organic Compounds (VOCs), which were consistent with anticipated levels and indicated the operating diesel heater was unlikely to be the source of the reported odors.
- (4) The DFAS dashboard provides a Exhauster Potential Exposure Zone (PEZ) Model of exhaust plumes at the reported time of the event based on wind speed, wind direction, mixing height, and atmospheric stability class. While the affected area appeared to be within the PEZ of the AN, POR-126, POR-127, POR-518/POR-519 exhaust emission plumes (Refer to Attachment 1), the approximate distance the affected area is located from the exhausters are:
 - AN Exhauster: 1200 feet
 - POR-127 Exhauster: 850 feet
 - POR-126 Exhauster: 725 feet
 - POR-518/POR-519 Exhauster: 450 feet

Evaluation of the weather details determined the cause of the odor event was unlikely to be resultant of Tank Farms exhauster emissions based on the mixing height (1100 feet above grade) and atmospheric stability class (neutral conditions).

Washington River Protection Solutions
EVENT SUMMARY

- (5) At 0931 hours, approximately 20 minutes prior to the reported odors, the routine enhanced monitoring walkdown obtained DRI monitoring from the affected area along the 4th St. and Buffalo Ave intersection. DRI monitoring results indicated less than detectable concentrations for ammonia (< 1 ppm) and Volatile Organic Compounds (VOCs) (<0.010 ppm). DRI monitoring comments from the enhanced monitoring walkdown indicated no abnormal odors were observed.
- (6) While the reported odor descriptions are inconsistent with Tank Waste Chemical Vapors, due to the location odors were reported being in proximity to the Tank Farms, monitoring for Tank Waste Chemical Vapors was still conducted during the TFC-OPS-OPER-C-67 response.

Because nitric acid was utilized in nearly all production processes that generated tank waste, and the most common by-product of those processes was reduction of nitrate ion to ammonia during the dissolution (oxidation) of irradiated fuel, ammonia is the most prevalent chemical of potential concern (COPC) found in all tanks. Therefore, ammonia is utilized as a sentinel indicator for Tank Waste Chemical Vapor COPCs and DRIs equipped with an ammonia sensor are utilized at a minimum when monitoring for tank waste chemical vapors/COPCs. Monitoring for VOCs utilizing DRIs equipped with 10.6 eV and 11.7 eV photoionization detectors provides further indication for Tank Waste Chemical Vapors/COPCs.

Investigative TFC-OPS-OPER-C-67 DRI area monitoring was performed along 4th Street (between the intersections of Canton Ave and Buffalo Ave) and around the 241-AW-271 Instrument Building, 217-AW Change Tent, 242-A Boiler Annex, 241-A-285 A/AX Farm Retrieval Water Service Building, WRPS-RMA-188 laundry storage trailer, and AX-151 Diverter Station. Investigative TFC-OPS-OPER-C-67 DRI area monitoring indicated less than detectable concentrations for ammonia (< 1 ppm) and VOCs (<0.010 ppm), which are below anticipated background levels. Therefore, providing further indication the cause of the reported odors was unlikely to be resultant of Tank Farm exhauster emissions.

- (7) A grab air sample was collected to be evaluated by VOC laboratory analysis at the intersection of 4th Street and Buffalo Ave (where the odor was most consistently noted during TFC-OPS-OPER-C-67 response actions). Detectable VOC results indicated 0.003 ppm Acetonitrile (TWA OEL- 20 ppm), 0.006 ppm Ethanol (TWA OEL- 1000 ppm), 0.004 Acetone (TWA OEL-250 ppm), and 0.001 ppm Ethyl Acetate (TWA OEL-400 ppm). Grab air sampling results were consistent with anticipated background levels of VOCs and corroborated TFC-OPS-OPER-C-67 response DRI monitoring results.
- (8) DRI monitoring for hydrogen sulfide was conducted during the TFC-OPS-OPER-C-67 response based on a "sulfur" odor descriptor provided by affected personnel. "Sulfur" odors can be indicative of organic sulfur-based compounds (e.g., hydrogen sulfide) resultant of nearby septic related systems or equipment. In addition, the affected area has a long history of similar odors that have been found to be associated with sources other than Tank Farm exhauster emissions, such as septic tank gaseous emissions.

Hydrogen sulfide gas has an offensive distinct rotten egg odor that is perceived by the human olfactory sense at very low concentrations, with the lower range of the odor threshold value being 0.00004 ppm. While the resolution of the DRI is insufficient to detect concentrations at the lower range of the odor threshold value, they are sufficient to detect hydrogen sulfide at concentrations below their established action level and occupational exposure limit (OEL). Investigative TFC-OPS-OPER-C-67 DRI monitoring indicated less than detectable concentrations of hydrogen sulfide (<0.1 ppm), therefore, concentrations were below the established action level and OEL.

**Washington River Protection Solutions
EVENT SUMMARY**

- (9) A work crew performing activities at the 241-AW Valve Pit A (located ~300 feet southeast of the affected area) were utilizing water and Simple Green around the time odors were reported. DRI monitoring at the 241-AW Valve Pit A was occurring at the time of the reported odor and indicated less than detectable concentrations of ammonia and VOCs. Due to the wind direction at the time of the reported odors (out of North/Northeast), DRI monitoring results, and the "sassafras" odor of Simple Green not corresponding with the odor descriptors provided by affected personnel; Simple Green usage at the 241-AW Valve Pit A was determined to be an unlikely source of the reported odors.
- (10) The 241-AX-151 diverter station catch tank was considered as a potential odor source due to the proximity of the affected area at the time of the reported odors (~160 feet North/Northwest), in addition to potential odors that could result when the passively ventilated 241-AX-151 catch tank undergoes barometric breathing. Due to the wind direction at the time of the reported odors (out of North/Northeast) and a steady barometric pressure (therefore, barometric breathing of passively ventilated tanks unlikely to occur); the 241-AX-151 catch tank was determined to be an unlikely source of the reported odors.
- (11) Though reported herbicide application was occurring around Trench 94; it was determined to be an unlikely potential source of the reported odors due to the significant distance between Trench 94 and the affected area (~1 mile).
- (12) Memo WRPS-1904672.1, "TANK FARM EXHAUST STACK CONCENTRATION ALARM/ACTION LEVELS FOR AMMONIA" establishes ammonia concentration stack alarm/action set points for tank farm exhausters based on the predicated ammonia concentration at unspecified ground receptors utilizing the Quantitative Risk Assessment (QRA) model. The exhauster high level alarm was established at concentrations where the predicted ground receptor ammonia concentration of 2.5 ppm (or 10% of the established Occupational Exposure Limit for ammonia) could be observed.

The exhauster high level alarm conservatively established for A Complex (excluding A farm) is 460 ppm. According to the Vapor Monitoring and Detection System (VMDS), the ammonia concentration observed at the time of event occurrence was 0 ppm at the 241-AW exhauster, -2.09 ppm at the AN exhauster, 0 ppm at the POR-126 exhauster, 2.505 ppm at the POR-127, and 7.823 ppm at 702-AZ exhauster. The AP exhauster is not currently connected to VMDS; therefore, readings are acquired once per calendar day in accordance with TF-OPS-IHT-037 when ammonia stack monitoring via VMDS is unavailable. The highest ammonia concentrations observed between 02/08/2024 and 02/14/2024 was 8 ppm at the AP Exhauster. Conservatively utilizing the higher ammonia concentration observed in the AP exhauster, a predicted ground receptor ammonia concentration of 0.043 ppm (or 0.17% of the established Occupational Exposure Limit for ammonia) would be expected if AP, AN, AY/AZ, AX, or AW farm exhauster emissions were present.

The exhauster high level alarm conservatively established for A farm is 160 ppm. According to the Vapor Monitoring and Detection System (VMDS), the ammonia concentration observed at the time of event occurrence was 1.285 ppm at the POR-518 exhauster and 0.338 ppm at the POR-519 exhauster. Conservatively utilizing the higher ammonia concentration observed in the POR-518 exhauster, a predicted ground receptor ammonia concentration of 0.020 ppm (or 0.08% of the established Occupational Exposure Limit for ammonia) would be expected if A tank farm exhauster emissions were present.

Therefore, providing additional indication the reported odor was unlikely to be resultant of Tank Farms exhauster emissions.

21. Positive Aspects Identified:

Personnel responded promptly to the event, implementing the applicable TFC-OPS-OPER-C-67 procedure and response actions.

Washington River Protection Solutions
EVENT SUMMARY

22. Key Take Aways / Learning Opportunities:

None.

23. Event Investigation:

- ☐ An Event Investigation will be completed per [TFC-OPS-OPER-C-14](#).
- ☐ This event will be managed by another process, i.e., Operability Evaluation, Engineering Technical Evaluation, etc.
- ☒ This event does not require continuation of the Event Investigation process.

Responsible Manager Approval:



Name (First, Middle Initial, Last)

 Digitally signed by 
Date: 2024.02.28 13:57:52 -08'00'

Signature / Date

CAS Manager Approval:



Name (First, Middle Initial, Last)

 Digitally signed by 
Date: 2024.02.28 14:52:05 -08'00'

Signature / Date

Attachment 1- DFAS Exhauster Potential Exposure Zones, Reported Odor Locations, and Potential Odor Sources



Washington River Protection Solutions
INDUSTRIAL HYGIENE EVENT INVESTIGATION REPORT (IHIR)

Event Title: TFC-OPS-OPER-C-67 Response 4th St. and Buffalo Ave		IHIR Number: IHIR-00089
		IHEI Number: N/A
Date: 02/14/2024	Time: 0950	Location: 4th St. and Buffalo Ave

Event Summary and Timeline:

Event Summary:

At approximately 0950 on 02/14/2024 three Teamsters encountered stronger than normal "chemical" odor while driving through the intersection of 4th St. and Buffalo Ave. Three of the workers reported symptoms (lightheadedness, breathlessness, and sore throat) and all three were transported to the on-site medical provider for precautionary medical evaluation. All workers were instructed to leave the area, and access to the area was restricted. After access restriction was in place two Industrial Hygiene Technicians outside of the 217AW Tent reported smelling stronger than normal odors and symptoms. Both employees were transported to the on-site medical provider for precautionary medical evaluation.

Field Response Timeline:

NOTE: All electronic communication time stamps adjusted to match the clock utilized to record the timeline [Central Shift Office (CSO) clock] which runs approximately 2 minutes fast (e.g., electronic communication time of 0803 = CSO clock time of 0805).

1007 Shift Office Event Notification (SOEN): "Initiating TFC-OPS-OPER-C-67 response for odors from Canton and 4th to just west of 4th and Buffalo for stronger than normal odor. Stay clear of this area. CSM"

1010 Production Operations East (POE) Industrial Hygienist (IH) 1 arrives at Central Shift Office (CSO)

1010 Central Shift Manager (CSM) discusses restricted access boundaries with Operating Engineers (OE)

1011 CSM notifies AW Area Day Manager (ADM) of TFC-OPS-OPER-C-67 response

1011 OEs in route to demarcate access restriction

1012 CSM requests Affected Workers fill out Odor-Vapor Response Cards (OVRC) at CSO and provides route of travel

1013 CSM notifies Department of Energy (DOE) Facility Representative (Fac. Rep.) of stronger than normal odors and TFC-OPS-OPER-C-67 response

1015 CSM begins notification to Hanford Patrol of road restriction

1015 POE IH-1 notifies POE Shift Industrial Hygiene Technician (IHT) Supervisor 1 of TFC-OPS-OPER-C-67 response

1015 POE Shift IHT Supervisor-1 arrives at CSO

1017 Affected Workers arrive at CSO, POE IH-1 provides OVRCs and directs POE Shift IHT Supervisor-1 to assist workers with OVRCs

1017 CSM completes notification of road restriction to Hanford Patrol and Hanford Fire

1019 POE IH-1 attempts to check Data Fusion Advisory System (DFAS), powered SmartSite™. DFAS is offline.

1020 CSM discusses restricted area with field work supervisor (FWS) in A Farm change trailer

1020 POE IH-2 arrives at CSO

1022 POE Shift IHT Supervisor-2 arrives at CSO

1022 POE Shift IHT Supervisor-1 confirms no painting was occurring at A285

1023 POE IH-1 contacts Hanford Meteorological Station for weather information for Station #6 at 0945 on 02/14/2024:

- Temperature: 36°F
- Relative Humidity: 60%
- Wind Speed: 7 mph
- Wind Direction: from North
- Barometric Pressure: 29.34 inches of mercury and steady

All meteorological information remained the same for 1000

Field Response Timeline continued on next page.

Washington River Protection Solutions
INDUSTRIAL HYGIENE EVENT INVESTIGATION REPORT (IHIR) (Continued)

Event Summary and Timeline:

Field Response Timeline (continued):

1026 Emergency Operations Center (EOC) contacted CSM to determine if any assistance was required from Hanford Patrol or Hanford Fire

1028 OEs notify CSM the road access restrictions are in place

1029 CSM asks Affected Workers if they experienced symptoms

1030 CSM determines 2 Affected works experienced symptoms and all 3 require precautionary medical surveillance at Inomedic Health Applications (IHA)

1031 CSM contacts Affected Workers' manager to notify of required medical and request Transportation

1033 POE Shift IHT Supervisor-1 notifies POE Level 3 Safety & Health (S&H) Manager, Level 2 IH Manager, Level 1 Environmental, Safety, Health, & Quality (ESH&Q) Manager, and ESH&Q Deputy of TFC-OPS-OPER-C-67 response

1037 POE IH-2 attempts to check DFAS, it remained offline

1037 POE IHs check Vapor Monitoring Detection System (VMDS) exhaust ammonia readings on 02/14/2024 @ 0950:

- POR518 (241-A): 1.285 ppm
- POR519 (241-A): 0.338 ppm
- 241-AN: -2.09 ppm
- 241-AW: 0 ppm
- POR126 (241-AX): 0 ppm
- POR127 (241-AX): 2.505 ppm
- 702AZ (241-AY/AZ): 7.823 ppm
- 241-AP: N/A

1039 POE IHs review odor descriptors on OVRCs and determine required response instrumentation based on proximity to tank farms and descriptors from OVRC and initial phone calls of "chemical", "paint", and "sulfur". Shift IHT Supervisor-1 notifies responding IHTs to prepare direct reading instrumentation (DRI) instrumentation with the following sensors: ammonia, volatile organic compounds (VOC) 10.6 eV photoionization detector (PID), and VOC 11.7 eV PID

1040 POE IHT Supervisor-1 requests Effluent Treatment Facility (ETF) IHT prepare DRI instrumentation with hydrogen sulfide sensor

1040 CSM notifies workers at Boiler Annex "doghouse" of access restrictions and instructs them to secure HVAC

1042 CSM and POE IH-2 discuss respiratory protection, determine none required

1044 POE IH-3 arrives at CSO

1047 CSM and POE IH-2 discuss process for escorting workers out of 217AW change tent

1048 CSM receives notification that 2 IHTs experienced strong odor outside 217AW change tent, near the restricted area, and were both experiencing a "numb tongue". This occurred after the initial TFC-OPS-OPER-C-67 response began

1052 CSM discusses Affected Workers (IHTs) with FWS and informs that the responding IH team will escort workers from tent and to contact CSM if conditions change

1054 CSM and POE IH-2 discuss escort route from multiple buildings

1055 POE Shift IHT Supervisor-1 notifies POE IHs and CSM of DRI with VOC 10.6 eV PID was present in 217AW change tent at time of odors and had readings of 0.06 parts per million (ppm) and discuss that is a normal background reading for a tent structure. Also notifies of 2 additional Affected Workers with symptoms

1057 POE Level 3 S&H Manager arrives at CSO

1058 Shift IHTs arrive with several of the response DRI

1059 POE IH-2 notifies POE Shift IHT Supervisor-1 to request preparation of nitrous oxide analyzer for potential grab air samples

1100 POE IH-2 attempts to check DFAS, it remained offline

1102 CSM contacts Level 1 Maintenance Manager and Level 1 ESH&Q Manager

1103 POE Shift IHT Supervisor-1 contacts Retrieval Manager and confirms bleach was used to clean laundry trailer north of the Boiler Annex, WRPS-RMA-188, on 02/13/2024

1104 CSM contacts work crew from 241AW and determine Simple Green was in use

1106 CSM discusses transportation needs of crew in 217AW change tent with FWS

1108 CSM and POE IH-2 sign TFC-OPS-OPER-C-67 Attachment A Sheet 1 of 2, Response Plan

Field Response Timeline continued on next page.

Washington River Protection Solutions
INDUSTRIAL HYGIENE EVENT INVESTIGATION REPORT (IHIR) (Continued)

Event Summary and Timeline:

Field Response Timeline (continued):

1109 POE IH-2 briefs response team

- 2 IHs, 3 IHTs, 1 IHT Supervisor
- Monitor per IHSP-POE-MULTI-TFCOPSOPERC67:
 - o DRI equipped with the following sensors:
 - Hydrogen Sulfide
 - Ammonia
 - VOC 10.6 eV PID
 - VOC 11.7 eV PID
 - o Collect grab air sample if source identified
- Respiratory Protection Equipment not required, Voluntary Use

1111 HMIS CSO contacts WRPS CSM to notify of sitewide alert

1110 Responding IHTs and Supervisor are in route to IHT Lab

1113 Responding IHs depart CSO to join Responding IHTs

1113 CSM requests American Electric bus to transport crew that cannot access vehicles due to restricted area

1115 CSM discusses restricted access barriers in place with OEs, caution tape and OE control of road. Stanchions may be added

1116 CSM receives notification of pesticide use at Sub Burial Pit

1118 CSM notifies Production Operations Level 1 Manager of TFC-OPS-OPER-C-67 response

1120-1125 Response Team approaches AW271 instrument building and escorts out 1 worker then approaches 217AW change tent and escorts out 24 workers

1122 CSM contacts IT regarding DFAS website status

1125 POE Shift IHT Supervisor updates CSM on worker escort status

1125 CSM discusses route for bus

1128 Response Team approaches Boiler Annex, reports nondescript odor but readings less than detectable

1130 CSM notifies worker that bus is in route

1132 OE notifies CSM of Event Investigation Number (EIR) request

1133 CSM cancels bus transport as work crew no longer requires transport

1133 POE IHs receive IHIR number

1138 Response Team monitors laundry trailer, WRPS-RMA-188, notes "fresh" odor

1139 POE Shift IHT Supervisor requests nitrous oxide analyzer preparation

1147 CSM notifies DOE Fac. Rep. of EIR

1144 Response Team indicates fleeting odor near AX151

1146 Lead Hanford Atomic Metal Trades Council (HAMTC) Safety Representative contacts CSM to determine if Tank Side Cesium Removal (TSCR) work is affected by TFC-OPS-OPER-C-67 response

1149 Response Team collects bag at 4th St and Buffalo Ave

1155 Responding IHs arrive at CSO, report no readings above detection limits and fleeting "fresh" "clean" odor

1156 POE Shift IHT Supervisor-1 is notified the nitrous oxide analyzer is out of calibration. POE IH-2 determines it will not be used

1157 POE Shift IHT Supervisor-1 instructs responding IHTs to store grab air sample in lab refrigerator

1157 CSM contacts workers in Boiler Annex and determines no chemicals were in use

1200 POE Shift IHT Supervisor-1 notifies POE IHs that most instruments passed Post-Use Function Test. Hydrogen sulfide sensor check still pending

1201 CSM updates Performance Assurance (PA)

1204 CSM contacts Maintenance Manager to determine contact for portable restroom maintenance

1206 Responding POE Shift IHT Supervisor arrives at CSO

1207 CSM attempts to contact portable restroom Point-of-Contact

1214 POE IH-1 requests POE Shift IHT Supervisor-1 obtain OVRCs from remaining Affected Workers

1218 POE Shift IHT Supervisor-2 notifies CSM and POE IHs final DRI instrument passed Post-Use Function Test

1219 CSM and POE IH-2 sign TFC-OPS-OPER-C-67 Attachment A Sheet 2 of 2, Response Plan

1220 CSM notifies OE at Boiler Annex that they can now move locations

1220 CSM contacts PA

1222 POE IHs depart CSO

Field Response Timeline continued on next page.

Washington River Protection Solutions
INDUSTRIAL HYGIENE EVENT INVESTIGATION REPORT (IHIR) (Continued)

Event Summary and Timeline:

Field Response Timeline (continued):

1223 SOEN: "Completed response per TFC-OPS-OPER-C-67 for odors from Canton and 4th to just west of 4th and Buffalo. All IHT readings were at or below background. Access to the affected area has been restored. CSM"

1353-1453 VOC thermal desorption unit (TDU) sample is collected from grab air sample and sent for analysis with a "RUSH" turnaround time request

1444 CSM notifies POE IH-1 of additional symptom listed on OVRC, clarifying that all 3 initial Affected Workers reported symptoms

1537 POE-IH-2 receives remaining 2 OVRCs

Field Response Timeline Acronyms:

ADM	Area Day Manager	mph	miles per hour
CSM	Central Shift Manager	NCO	Nuclear Chemical Operator
CSO	Central Shift Office	OE	Operating Engineer
DFAS	Data Fusion Advisory System	OVRC	dor-Vapor Response Cards
DOE	Department of Energy	PA	Performance Assurance
DRI	direct reading instrument	PID	photoionization detector
EIR	Event Investigation Number	PO	Production Operations
ESH&Q	Environmental, Safety, Health, & Quality	POE	Production Operations-East
eV	electron-volts	ppm	parts per million
FWS	Field Work Supervisor	RPE	Respiratory Protection Equipment
HAMTC	Hanford Atomic Metal Trades Council	S&H	Safety & Health
HVAC	heating, ventilation, air conditioning	SOEN	Shift Office Event Notification
IH	Industrial Hygienist	SWIHD	Site Wide Industrial Hygiene Database
IHA	Inomedic Health Applications	TSCR	Tank Side Cesium Removal
IHIR	Industrial Hygiene Event Investigation Report System	TDU	Thermal Desorption Unit
IHT	Industrial Hygiene Technician	VMDS	Vapor Monitoring Detection
		VOC	Volatile Organic Compound

Sampling/Monitoring Results:

Direct Reading Instrument Monitoring Results:

- Monitoring was performed into the Affected Area from the East and then to AW271 Instrument Building, AW217 Projects Tent, Boiler Annex "Doghouse", laundry storage trailer (WRPS-RMA-188), and AX151 Diverter Station.
- Peak readings during response at or below background:
 - o Ammonia: less than 1 ppm
 - o Volatile Organic Compounds (10.6 eV lamp): less than 0.010 ppm
 - o Volatile Organic Compounds (11.7 eV lamp): less than 0.010 ppm
 - o Hydrogen Sulfide: less than 0.1 ppm

Sampling Results continued on next page.

Washington River Protection Solutions
INDUSTRIAL HYGIENE EVENT INVESTIGATION REPORT (IHIR) (Continued)

Sampling/Monitoring Results:

Grab Air Sample Results:

One grab air sample was collected with a SKC SamplePro® FlexFilm Sample Bags (cat. no. 236-003) during the response. One VOC sample was collected utilizing a CarboTrap 300 (Carbotrap C, Carbotrap B, and Carbosieve SIII) Thermal Desorption Unit (TDU) from the grab air sample. The VOC sample and a blank were analyzed per EPA T0-17-Modified. A manual blank correction was performed on the detectable sample results. The blank corrected values were used to manually calculate the air concentration. The results were consistent with background levels of Volatile Organic Compounds and consistent with the DRI monitoring results. Refer to the Site Wide Industrial Hygiene Database (SWIHD) Air Survey for more details.

Valid Detectable VOC Results *A	OEL (TWA)	Grab Air Sample 24-01097-1-01*B
Acetonitrile	20 ppm	0.003 ppm
Ethanol	1000 ppm	0.006 ppm
Acetone	250 ppm	0.004 ppm
Ethyl acetate	400 ppm	0.001 ppm

*A Calibrated agents only.

*B Grab Air Sample Location was at the intersection of 4th St and Buffalo Ave, where the odor was most consistently noted during response actions.

SWIHD References:

Event Response Site Wide Industrial Hygiene Database (SWIHD) Direct Reading Instrumentation (DRI) Survey:

- # 24-01089 "TFC-OPS-OPER-C-67 at 4th and Buffalo"

Event Response SWIHD Air Sample Survey:

- # 24-01097 "Bag Sample for TFC-OPS-OPER-C-67 @4th & Buffalo"

Simple Green work SWIHD DRI Survey:

- # 24-01095 "AW-VPA install cover blocks, Jumpers, fixtures"

Enhanced Monitoring SWIHD DRI Survey:

- # 24-01081 "Enhanced Monitoring of A-Complex Perimeter"

Upwind combustion monitoring SWIHD DRI Surveys:

- # 24-01080 "A-Farm Controlled Environment Staging Area (AM)"
- # 24-01082 "A-Farm Staging Area Diesel Monitoring (AM)"

Additional Information:

Concurrent Co-located Work

Several work activities near or at the Affected Area had Direct Reading Instrument monitoring concurrent with the event.

12/14/2024 0931 Enhanced monitoring walkdown reading at 4th St and Buffalo Ave occurred.

DRI Monitoring Results:

- Peak readings at or below background:
 - Ammonia: less than 1 ppm
 - Volatile Organic Compounds (VOC) (10.6 eV lamp): less than 0.010 ppm
- Comments indicate "no abnormal odors were observed"

Additional Information continued on next page.

12/14/2024 0847-1035 Work south of the Affected area "AW-VPA install cover blocks, Jumpers, fixtures" occurred. Pit covers were open and Simple Green and water were in use.

Washington River Protection Solutions
INDUSTRIAL HYGIENE EVENT INVESTIGATION REPORT (IHIR) (Continued)

Additional Information:

DRI Monitoring Results:

- Peak readings at or below background:
 - o Ammonia: less than 1 ppm
 - o VOC (10.6 eV lamp): less than 0.010 ppm
 - Survey comments indicate a background VOC reading of 0.080 ppm within change tent. During the response the reading was reported to the shift office at 0.060 ppm. The difference would not have changed response actions and both would be considered typical background levels for a tent.
 - o Flammable Gas: less than 1 %
 - o Carbon Monoxide: less than 1 ppm
 - o Oxygen: between 20.9 % and 21.7 %

12/14/2024 0740-1004 Work northeast of the Affected area "A-Farm Staging Area Diesel Monitoring (AM)" occurred. Diesel heaters were in use.

DRI Monitoring Results:

- Peak readings:
 - o Ammonia: less than 1 ppm
 - o VOC (10.6 eV lamp): 0.050 ppm
 - o Carbon Monoxide: less than 1 ppm
 - o Nitric Oxide: less than 1 ppm
 - o Nitrogen Dioxide: 0.1 ppm
 - o Sulfur Dioxide: less than 0.1 ppm

Respiratory Protection

Respiratory Protection Equipment was not prescribed for the Initiating Event. Accordingly, at the time of the Initiating Event, the Affected Personnel were not wearing Respiratory Protection Equipment. Respiratory Protection Equipment was not required, nor worn, for Response Actions.

Tank Waste Chemical Vapors

While the odor description is inconsistent with Tank Waste Chemical Vapors, due to the proximity to the Tank Farms, monitoring for Tank Waste Chemical Vapors was performed:

Ammonia is used as a sentinel Tank Waste Chemical Vapor for chemicals of potential concern (COPC). Each Hanford production process had different feedstock chemicals and generated different waste streams. Hanford production processes were also separated temporally, with different processes being performed at different times in the history of Hanford production (1943 - 1986). Some chemicals are common to all processes/waste streams (e.g., nitric acid), while others are specific to particular processes/waste streams. Some in-tank waste treatment processes (e.g., neutralization and de-nitrification) used the same chemical feed stocks (e.g., sodium hydroxide solution) in most, if not all Tank Farms. The chemistry and radiochemistry of these compounds result in waste stream similarities across all tank farms. Because nitric acid was common to nearly all processes that generated tank waste, and the most common result of those processes was reduction of nitrate ion to ammonia during the dissolution (oxidation) of irradiated fuel, ammonia is the most common COPC and is found in all tanks. It is logical to choose ammonia for the sentinel as it is a byproduct of all production processes and found in all tanks.

Therefore, when monitoring for Tank Waste Chemical Vapors/COPCs, DRI equipped with an ammonia sensor is utilized at a minimum. Additional COPC monitoring was conducted concurrently with ammonia during the event response. The COPC with DRI monitoring capabilities readily available at the Tank Farms includes VOCs. As individual agents are not identified when monitoring for VOCs, an Action Limit was developed as an indicator of Tank Farm emissions (mixture of organic vapors) that could impact workers' health and conservatively set at 2 ppm*. When monitoring for Tank Waste VOC vapors, DRI equipped with a 10.6 eV photoionization detector (PID) is utilized to detect multiple VOC COPCs simultaneously.

*NOTE: The 2 ppm Action Limit is not applicable to chemical use.

Additional Information continued on next page.

Washington River Protection Solutions
INDUSTRIAL HYGIENE EVENT INVESTIGATION REPORT (IHIR) (Continued)

Additional Information:

Review of the Data Fusion Advisory System (DFAS) application, powered by SmartSite™, Weather Details dashboard for the approximate time of the Event:

02/14/2024 @ 0950 (weather data at approximate time of Initiating Event):

- Wind Speed: 9.0 mph
- Wind Direction: 28° (out of North North East)
- Mixing Height: 1100 feet above grade
- Stability Class: D (neutral conditions)



Figure 1. 200-East Area (with 241-AW, 241-AP, 241-AN, 241-AY/AZ, 241-AX, 241-A Farm projected plume models) at 0950 02/14/2024 from DFAS application, powered by SmartSite™.

NOTE: 241-AN, 241-A, 241-AW Farm Exhausters are not connected to the DFAS; however, an approximate exhauster plume was added for each based on other modeled plumes.

Additional Information continued on next page.

Washington River Protection Solutions
INDUSTRIAL HYGIENE EVENT INVESTIGATION REPORT (IHIR) (Continued)

Additional Information:



Figure 2. 200-East Area (with 241-AW, 241-AN, 241-AY/AZ, 241-AX, 241-A Farm projected plume models) at 0950 02/14/2024 from DFAS application, powered by SmartSite™.

NOTE: 241-AN, 241-A, 241-AW Farm Exhausters are not connected to the DFAS; however, an approximate exhauster plume was added for each based on other modeled plumes.

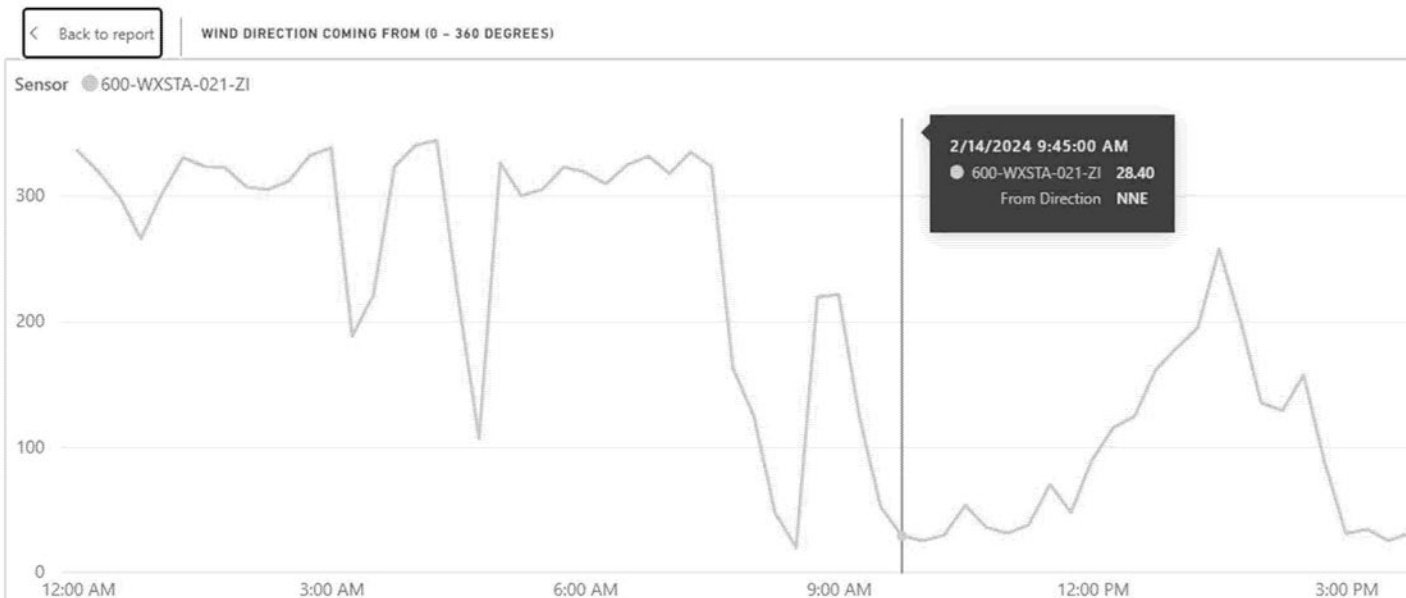


Figure 3. DFAS application, powered by SmartSite™ Weather Data (wind direction) from 0945 02/14/2024.

Additional Information continued on next page.

Washington River Protection Solutions
INDUSTRIAL HYGIENE EVENT INVESTIGATION REPORT (IHIR) (Continued)

Additional Information:

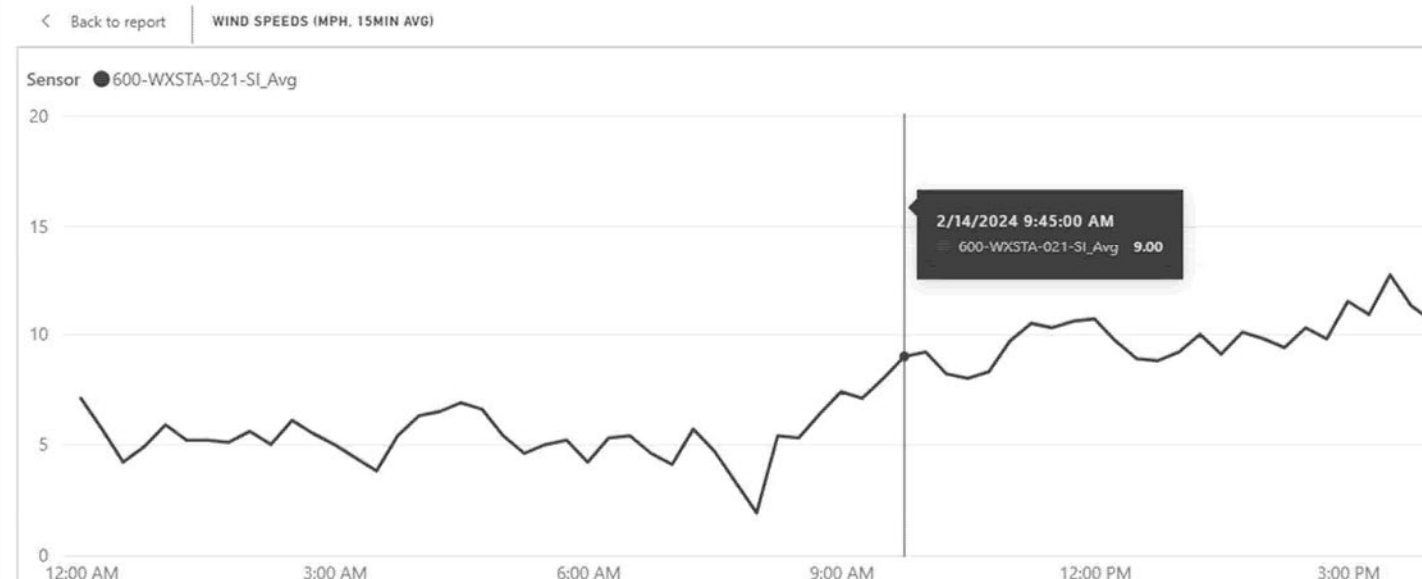


Figure 4. DFAS application, powered by SmartSite™ Weather Data (wind speed) from 0945 02/14/2024.

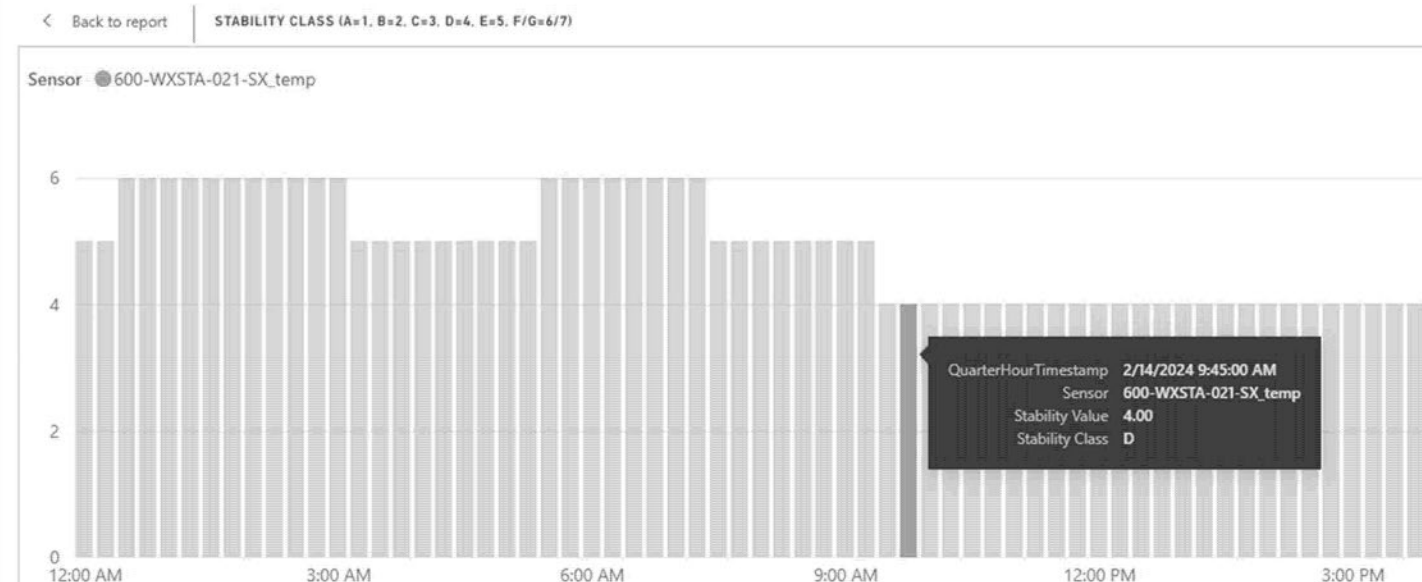


Figure 5. DFAS application, powered by SmartSite™ Weather Data (stability class) from 0945 02/14/2024.

Additional Information continued on next page.

Washington River Protection Solutions
INDUSTRIAL HYGIENE EVENT INVESTIGATION REPORT (IHIR) (Continued)

Additional Information:

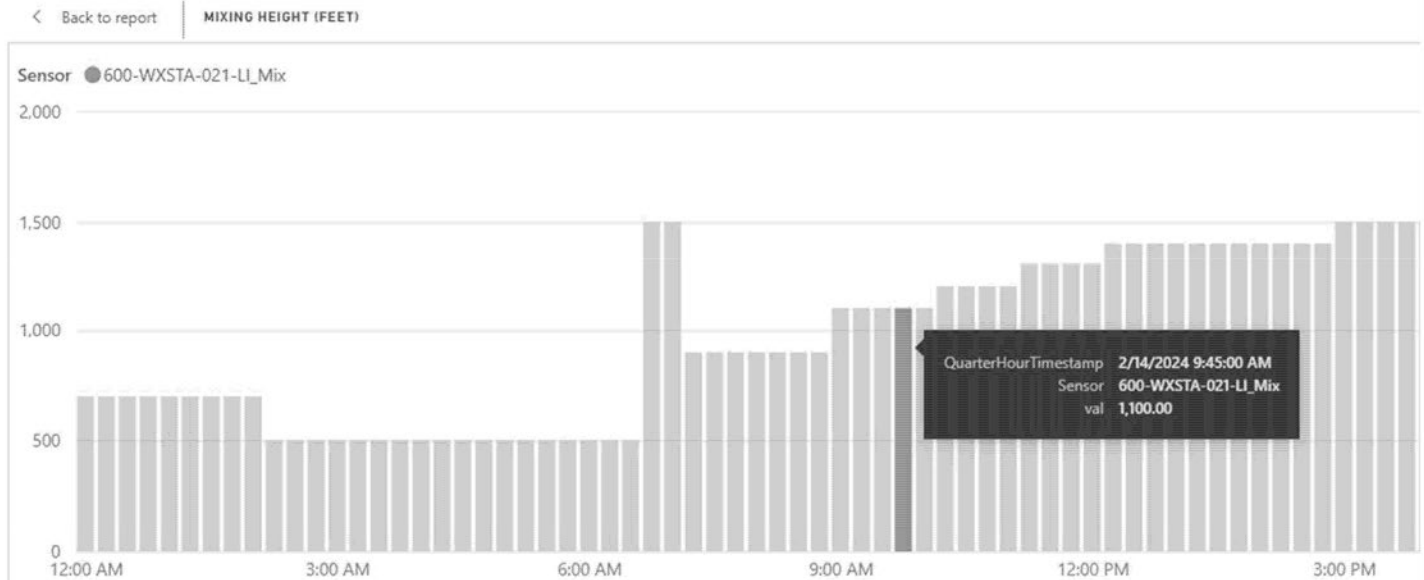


Figure 6. DFAS application, powered by SmartSite™ Weather Data (mixing height) from 0945 02/14/2024.

Review of the DFAS application, powered by SmartSite™, Weather Details dashboard for conditions during response actions:

02/14/2024 @ 1113 (current weather data for Response actions):

- Wind Speed: 9.7 mph
- Wind Direction: 31° (out of North East)
- Mixing Height: 1200 feet above grade
- Stability Class: D (neutral conditions)

Meteorological information from the Hanford Weather Station for Station #6 on 02/14/2024 @ 0945 and 1000:

- Temperature: 36°F
- Relative Humidity: 60%
- Wind Speed: 7 mph
- Wind Direction: from North
- Barometric Pressure: 29.34 inches of mercury and steady

Vapor Monitoring Detection System (VMDS) exhaust ammonia readings on 02/14/2024 @ 0950:

- POR518 (241-A): 1.285 ppm
- POR519 (241-A): 0.338 ppm
- 241-AN: -2.09 ppm
- 241-AW: 0 ppm
- POR126 (241-AX): 0 ppm
- POR127 (241-AX): 2.505 ppm
- 702AZ (241-AY/AZ): 7.823 ppm
- 241-AP: N/A

Additional Information continued on next page.

Washington River Protection Solutions
INDUSTRIAL HYGIENE EVENT INVESTIGATION REPORT (IHIR) (Continued)

Additional Information:

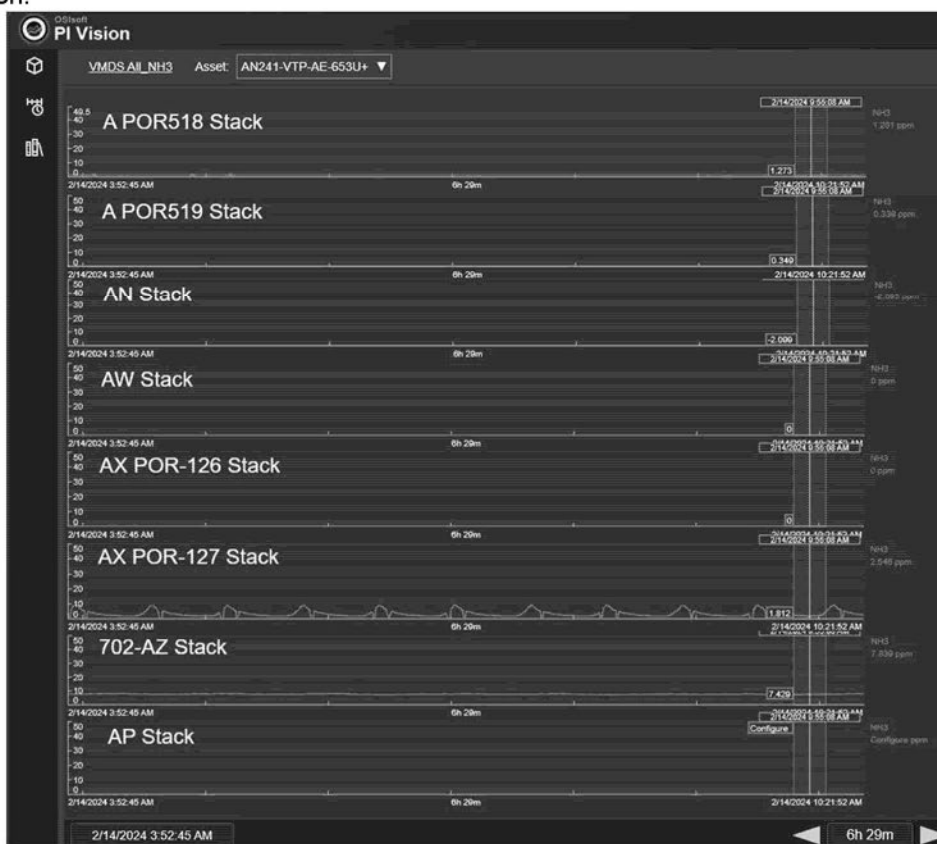


Figure 7. OSisoft Pi Vision VMDS Ammonia Concentrations for 0955 02/14/2024.

Memo WRPS-1904672.1, TANK FARM EXHAUST STACK CONCENTRATION ALARM/ ACTION LEVELS FOR AMMONIA establishes stack alarm/action set points for Tank Farm Exhausters. The alarm/action set points are based on a linear extrapolation of the Quantitative Risk Assessment (QRA) model prediction; conservatively established at the ammonia stack concentration that could result in various ammonia concentrations at an unspecified ground receptor:

- High Alarm → ammonia concentration of 2.5 ppm at an unspecified ground receptor
- High High Alarm → ammonia concentration of 5 ppm at an unspecified ground receptor

Memo WRPS-1904672.1, TANK FARM EXHAUST STACK CONCENTRATION ALARM/ ACTION LEVELS FOR AMMONIA:

Tank Farm	Exhauster	High Alarm	High High Alarm
241-A	POR518/POR519	160 ppm	320 ppm
241-AN	Primary		
241-AP	Primary		
241-AW	Primary	460 ppm	920 ppm
241-AX	POR126/POR127		
241-AY/AZ	702AZ		

Additional Information continued on next page.

Washington River Protection Solutions
INDUSTRIAL HYGIENE EVENT INVESTIGATION REPORT (IHIR) (Continued)

Additional Information:

Vapor Monitoring Detection System (VMDS) 02/07/2024 @ 1000 to 02/14/2024 @ 1000:

Tank Farm	Exhauster	Minimum*A	Maximum*A
241-A	POR518/POR519	0 ppm	7.853 ppm *B
241-AN	Primary	-2.113 ppm	-2.027 ppm
241-AW	Primary	0 ppm	0 ppm
241-AX	POR127	0 ppm	31.676 ppm
241-AY/AZ	702AZ	7.251 ppm	13.498 ppm

*A VMDS Alternate Real Time Monitoring performed 02/08/2024 to 02/14/2024 for 241-AN, 241-AP, and 241-AW. VMDS Alternate Real Time Monitoring performed 02/08/2024 to 02/12/2024 for 241-A. VMDS Alternate Real Time Monitoring performed 02/08/2024 to 02/11/2024 for 241-AX.

*B Maximum reading excludes maintenance activities. On 02/13/2024 at 0900 the 241-A VMDS underwent calibration. Calibration activities confirmed by the Projects Team Instrument Technician Field Work Supervisor.

The 241-AP Primary Exhauster is not currently connected to the VMDS. Readings are acquired in accordance with TF-OPS-IHT-037 when Stack Monitoring for ammonia via the VMDS is unavailable. Stack readings are required once per calendar day in accordance with ARP-T-041-00002.

VMDS Alternate Monitoring 02/08/2024 to 02/14/2024:

Tank Farm	Exhauster	Minimum	Maximum
241-A	POR 518/519	0 ppm	1 ppm
241-AN	Primary	10 ppm	25 ppm
241-AP	Primary	3 ppm	8 ppm
241-AW	Primary	1 ppm	2 ppm
241-AX	POR 126/127	1 ppm	3 ppm

The event response DRI results were less than detectable in the Affected Area for ammonia and VOCs. These results along with the review of the atmospheric conditions (DFAS application, powered by SmartSite™, and those provided by On-Duty Forecaster) around the reported time of the event indicate the cause of the odor is unlikely to be from Tank Farm emissions.

Hydrogen Sulfide

Based on the odor descriptor "sulfur", monitoring for hydrogen sulfide vapors was performed:

- The American Industrial Hygiene Association (AIHA) Odor Threshold for Chemicals with Established Health Standards, 2nd Edition, lists hydrogen sulfide with the odor character "rotten eggs".
- Refer to TOC-IH-58956 for more detail on the monitoring strategy for response to odors.

The Hanford Site Tank Operations Contractor, Washington River Protections Solutions, LLC (WRPS), Chemical Vapor Solutions Team (CVST) chartered a Fugitive Emissions (FE) sub-team. The primary focus of the FE workscope was to identify odor sources around the Tank Farms work areas, characterizing the type and concentration of the odor constituents. The FE sub-team's investigations included characterizing how septic/sewer odors change odor profile across a gradient when diluted by ambient atmosphere with distance from a point source. The major components of sewer gases can include: hydrogen sulfide, carbon dioxide, methane, and ammonia. The FE sub-team's investigations found that close to the septic system (within approximately 20') the odor was described as sewer. Further away from septic system (within approximately 100') the odor was described as skunk. Even further away from septic system (within approximately 200') the odor was described as body odor. It should be noted that odors are a perception and can vary between individuals.

Additional Information continued on next page.

Washington River Protection Solutions
INDUSTRIAL HYGIENE EVENT INVESTIGATION REPORT (IHIR) (Continued)

Additional Information:

The Affected Area has a long history of similar odors or odors that have been found to be associated with sources other than Tank Farm vapor source emissions, such as septic tank gaseous emissions which are known to change odor profile across a gradient when diluted by ambient atmosphere with distance from a point source. The initiating event was a stronger than normal odor which one worker described as "sulfur". These odors are indicative of nearby septic related equipment. The closest septic equipment located upwind of the Affected Area were 6 portable restrooms, "blue rooms". They are located immediately north of the Boiler Annex and directly adjacent to the laundry trailer, WRPS-RMA-188. They are approximately 200 feet northeast of the 4th St and Buffalo Ave intersection.

Hydrogen sulfide gas has an offensive distinct rotten egg odor that is detectable at very low concentrations. The lower range of odor values for hydrogen sulfide as 40 ppt (or 0.04 ppb or 0.00004 ppm). Ammonia gas has an offensive pungent, irritating odor that is detectable at very low concentrations. The lower range of odor values for ammonia as 43 ppb (or 0.043 ppm) (AIHA, 2013). While odors may be readily perceived, concentrations are still well below levels of worker exposure concern. Hydrogen sulfide, ammonia, and VOC gas production rate is a function of bacteria/organics concentrations, temperature, and dissolved oxygen.

The resolution of DRI equipped with hydrogen sulfide (0.1 ppm) and ammonia (1 ppm) sensors are comparatively inadequate as a detection tool at the concentrations perceived by the human olfactory sense. While the resolution of the DRI equipped with these sensors are insufficient to detect concentrations at the lower range of odor threshold values, they are sufficient to detect hydrogen sulfide and ammonia at concentrations that approach their established occupational exposure limits (OELs).

Limit Type	Concentrations		
	Hydrogen Sulfide	Ammonia	VOCs
Odor Response Action Limit	0.5 ppm	12 ppm	2 ppm
ACGIH 8-hour TWA-TLV	1 ppm	25 ppm	--
ACGIH 15-minute STEL-TLV	5 ppm	35 ppm	--
OSHA 8-hour TWA-PEL	--	50 ppm	--
OSHA Ceiling-PEL	20 ppm	--	--
OSHA 10-minute Peak-PEL*	50 ppm	--	--
NIOSH IDLH	100 ppm	300 ppm	--

*Allowed for 10-minutes if there is no other exposure to hydrogen sulfide during the shift

The event response DRI results were less than detectable in the Affected Area for hydrogen sulfide, ammonia, and VOCs. A portable restroom maintenance truck was observed driving south on Canton Ave shortly before the event. It is possible that recent portable restroom maintenance including pumping and standard cleaning chemicals were used upwind of the Affected Area around the time of the event. Due to the proximity and wind direction, the portable restrooms were a potential odor source.



Figure 8. Portable restrooms upwind of Affected Area

Additional Information continued on next page.

Washington River Protection Solutions
INDUSTRIAL HYGIENE EVENT INVESTIGATION REPORT (IHIR) (Continued)

Additional Information:

Other Chemical Odors

Based on the odor descriptor "strong chemical", monitoring for VOCs with 10.6 eV and 11.7 eV PID was performed:

- The supporting hygienists interpreted "strong chemical" to have the potential to be a solvent odor, and verbal discussion indicated the potential for paint use in the area. (Paint was later determined to not be in use.)
- "Solvent": The AIHA Odor Threshold for Chemicals with Established Health Standards, 2nd Edition, lists several chemicals with the odor character "solvent". All of them volatile organic compounds detectable with DRI equipped with a 10.6 eV and/or 11.7 eV PID.
- As there was not a readily apparent source, both the 10.6 eV and 11.7 eV PID were utilized, providing a broader range of detection for volatile organic compounds. The action limit for the direct reading instrument equipped with the 10.6 eV PID was 2 ppm due to the proximity to the 241-AW Tank Farm boundary. Without a readily apparent source, a chemical specific action limit could not be developed for the direct reading instrument equipped with the 11.7 eV PID. Accordingly, this instrument was for indication purposes only to help identify a potential source.
- Refer to TOC-IH-58956 for more detail on the monitoring strategy for response to odors.

Herbicide Use

At the time of the event DFAS shows winds blowing at 9 mph from north northeast to south southwest. Though it was noted that herbicide application had occurred at the Sub Basin, the basin was approximately 1 mile directly north of the Affected Area and due to significant distance is an unlikely source of the odor.



Figure 9: Location of herbicide use in relation to Affected Area

Additional Information continued on next page.

Washington River Protection Solutions
INDUSTRIAL HYGIENE EVENT INVESTIGATION REPORT (IHIR) (Continued)

Additional Information:

Bleach Use

Bleach had been used to disinfect a laundry trailer, WRPS-RMA-188, 02/13/2024 approximately 225 feet directly north northeast of the Affected Area. It had been left open to ventilate. Due to the proximity and wind direction it was a potential odor source. The response team noted it had a "fresh bleach" odor.



Figure 10. Laundry Trailer WRPS-RMA-188. Sign indicates bleach disinfection in progress

Diesel Combustion

Several diesel heaters and generators were in the area and diesel odors were noted at multiple locations by the response team. One heater was located upwind and operating, approximately 275 feet north of the Affected Area at the 241-A controlled environment staging area "warm up tent". The staging area was manned with DRI monitoring for VOCs, ammonia, carbon monoxide, nitric oxide, nitrogen oxide, and sulfur dioxide at the time of the event. Nitrogen dioxide had a reading of 0.1 ppm and VOCs had a reading of 0.050 ppm. All other agents were less than detectable. Reference SWIHD surveys 24-01080 and 24-01082. Survey comments indicate "no unusual conditions observed". Due to wind direction and location this was a potential odor source. However, diesel combustion type odors do not correspond with the reported odor and the response team did not observe unusual odors at the location, so it is unlikely that it is the source.

Additional Information continued on next page.

Washington River Protection Solutions
INDUSTRIAL HYGIENE EVENT INVESTIGATION REPORT (IHIR) (Continued)

Additional Information:

241-AX-151

The 241-AX-151 Diverter Station, located 160 feet north northwest of Affected Area, was utilized for the Plutonium-Uranium Extraction Facility (PUREX) to send waste to the 244-AR Vault or 241-AY/AZ Tank Farms. 241-AX-151 was isolated in 1985, with the lines flushed and blanked, and weather protective foam applied. As of 2006, the catch tank contained approximately two-thousand-eight-hundred-thirty-eight (2,838) gallons of 241-AX Farm-like supernatant waste.

When outside air pressure changes, there is a small pressure imbalance between the headspace of a passively ventilated tank and the outside air. This imbalance pushes air into the tank or draws it out (barometric breathing). 241-AX-151 may have unsealed emission points that could result in odors through barometric breathing. At the approximate time of the event, the barometric pressure was steady. Due to wind direction and steady barometric pressure it is an unlikely odor source. Furthermore, the response team noted a "chemical, floral, pleasant" fleeting odor near 241-AX-151. The odor description is inconsistent with Tank Waste Chemical Vapors.

• 241-AX-151 Reference Documents:

- o RPP-RPT-31102, Catch Tank 241-AX-151-CT Liquid Level Assessment Report
- o 200-IS-1 Scoping Summary: 241-AX-151
- o HNF-2503, Authorization Basis Status Report (Miscellaneous TWRS Facilities, Tanks and Components)
- o BHI-00179, PUREX Plant Aggregate Area Management Study Technical Baseline Report
- o Waste Information Data System General Summary Report 241-AX-151
- o PNL-MA-588, Resource Book - Decommissioning of Contaminated Facilities at Hanford (Waste Management Facilities)
- o H-2-71635, Piping, Enlarged Plan 241-A & 202-A Areas



Figures 11 and 12. 241-AX-151

Simple Green Use

Simple Green and water were in use at 241-AW Valve Pit A, located approximately 300 feet southeast of the Affected Area. According to the manufacturer, Simple Green has an added "sassafras" odor. DRI monitoring for VOCs and ammonia was conducted at the pit around the time of the event. Readings were less than detectable. Reference SWIHD survey # 24-01095. Due to the location and wind direction it is an unlikely odor source.

References

- American Conference of Governmental Industrial Hygienists (2016). TLVs® and BEIs® Based on the Documentation of the Threshold Limit Values for Chemicals Substances and Physical Agents & Biological Exposure Indices. Cincinnati, OH: Signature Publications.
- American Industrial Hygiene Association (2013). Odor Thresholds for Chemicals with Established Health Standards, 2nd Edition.
- Hanford. Safety Data Sheets - Material Safety Data Sheets (SDS-MSDS) System. Retrieved from http://msnet.ms.rl.gov/msds/msds_search.aspx
- Silva, D.P. (2002). The chemical logic behind... Fermentation and Respiration. Retrieved from <https://aggie-horticulture.tamu.edu/earthkind/landscape/dont-bag-it/chapter-1-the-decomposition-process/>
- Texas A&M (2009). Earth-Kind Landscaping: Chapter 1, The Decomposition Process. Retrieved from <https://web.archive.org/web/20080917123419/http://www2.ufp.pt/~pedros/bq/respi.htm>

Additional Information continued on next page.

Washington River Protection Solutions
INDUSTRIAL HYGIENE EVENT INVESTIGATION REPORT (IHIR) (Continued)

Additional Information:

Additional Information Acronyms

ACGIH	American Conference of Governmental Industrial Hygienists	OSHA	Occupational Safety & Health Administration
AIHA	American Industrial Hygiene Association	PEL	Permissible Exposure Limit
COPC	Chemical of Potential Concern	PID	photoionization detector
CVST	Chemical Vapor Solutions Team	ppb	parts per billion
DFAS	Data Fusion Advisory System	ppm	parts per million
DRI	Direct Reading Instrument	ppt	parts per trillion
eV	electron-volts	QRA	Quantitative Risk Assessment
FE	Fugitive Emissions	SOEN	Shift Office Event Notification
mph	miles per hour	STEL	short-term exposure limit
NIOSH	National Institute for Occupational Safety and Health	TLV	Threshold Limit Value
OEL	occupational exposure limit	TWA	time-weighted average
		VMDS	Vapor Monitoring Detection System
		VOC	Volatile Organic Compound

Recommendations/Conclusions:

Recommendations:

N/A

Conclusions:

Direct Reading Instrumentation monitoring performed during response actions did not indicate further action was necessary to protect worker safety and health. As a result the area was released from restricted access and work was allowed to continue. The review of the atmospheric conditions around the reported time of the event indicate the cause of the symptoms is unlikely to be from Tank Farm emissions. The atmospheric mixing height was 1100 feet above grade, the atmospheric stability class was neutral conditions and the VMDS/VMDS Alternate Monitoring Ammonia concentrations were well below the high alarm set points. Therefore, the cause of the symptoms is unlikely to be from actively ventilated tanks. Additionally, as the barometric pressure trend was steady at the time of the event, passively ventilated tanks would not be pushing air out of the tank. Therefore, the cause of the symptoms is unlikely to be from passively ventilated tanks. Several other known nearby upwind potential odor sources exist such as portable restrooms, diesel combustion, and bleach use. However, monitoring performed to support response actions did not readily identify a source, as readings indicated that further response action was not necessary.

Others:

- All 5 Affected Workers reported symptoms and were sent for a precautionary medical surveillance. They were released to work without restrictions.

Associated Documents:

iCAS Number: WRPS-AR-2024-0963

EIR Number: EIR-2024-013

Industrial Hygienist:

Print First and Last Name

Digitally signed by _____
Date: 2024.02.22 14:39:38 -08'00'
Signature / Date

Industrial Hygiene Level 3 Manager

Print First and Last Name

Digitally signed by _____
Date: 2024.02.22 14:42:37 -08'00'
Signature / Date

Industrial Hygiene Level 2 Manager:

Print First and Last Name

Digitally signed by _____
Date: 2024.02.25 14:05:28 -08'00'
Signature / Date

ODOR/VAPOR RESPONSE CARD - 242 A

1. Complete below information and map (Page 1).

- Date and time of event: 2/15/24 0950
- Check Applicable:
 - ☒ Odor
 - ☐ Ammonia Alarm (6 ppm)
 - ☐ Ammonia Alarm (12 ppm)
 - ☐ Alarm (other - describe): _____
- ~~What was the work~~ performing: checking salt buckets for snow removal
- Other Work Underway? Describe: ASIA
- Location of event (mark area on map and wind direction): between the Evaporator & the train tracks
- Name(s) of others in or near the affected area: _____
- Was Industrial Hygiene present, who? No
- Describe the odor:

☐ Sweet	☐ Sour	☐ Smoky	☐ Septic/Sewer	☒ Musty	☐ Rotten
☐ Metallic	☐ Onion	☐ Earthy	☐ Ammonia	☐ Citrus	☒ Solvent
☒ Other (describe): <u>Chemical smell</u>					
- Is source known/likely? Describe: No
- Your symptoms? ☒ None

☐ Headache	☐ Dizziness	☐ Nausea	☐ Cough	☐ Fatigue
☐ Weakness	☒ Sore Throat	☐ Difficulty Breathing	☐ Eye Irritation	☐ Rash
☐ Itch	☐ Tingling	☐ Numbness	☐ Taste	
☐ Other (describe): _____				

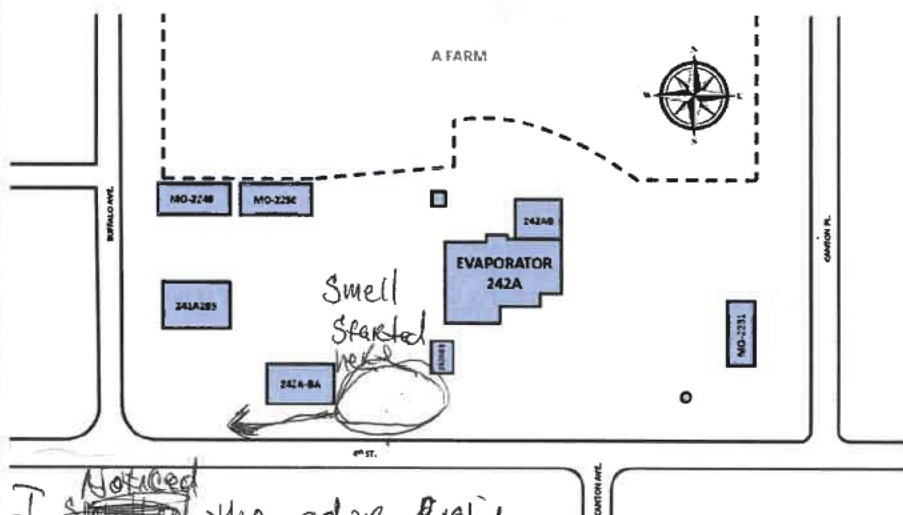
2. Provide this completed card (Page 1 & 2) to Supervisor, Industrial Hygiene, your Union Safety Representative or the CSM. If received by Supervisor/IH/U-SR, Supervisor/IH/U-SR will ensure card is provided to the CSM.

ODOR/VAPOR RESPONSE CARD - 242 A

Instructions:

1. Notify Immediate Supervisor.
2. Contact Central Shift Manager (CSM),
at [REDACTED]
3. Complete both pages of this form and
include as many details as possible,
including:
 - a. Approximate location, see map
at right;
 - b. Wind direction, speed and
description, such as stable or
gusty wind;
 - c. Environmental conditions, such
as hot, cold, windy, rainy;
 - d. Other work or contractors in the
area;
 - e. Anything else you think is
relevant.
4. Provide the completed card to your
Supervisor*, Industrial Hygiene*, Union
Safety Representative* or the CSM.

* If received by Supervisor, IH, or Union Safety Representative, the Supervisor/IH/ Union-SR will ensure card is provided to the CSM.



4th ST.
I ~~stayed~~^{Noticed} the odor right before the train tracks

ODOR/VAPOR RESPONSE CARD - 242 A

1. Complete below information and map (Page 1).

- Date and time of event: 2-14-24 0950 am
- Check Applicable:
 - ☒ Odor
 - ☐ Ammonia Alarm (6 ppm)
 - ☐ Ammonia Alarm (12 ppm)
 - ☐ Alarm (other - describe):
- Your name and the work you were performing: [REDACTED] driving.
- Other Work Underway? Describe: N/A
- Location of event (mark area on map and wind direction): Truck
- Name(s) of others in or near the affected area: [REDACTED]
- Was Industrial Hygiene present, who? [REDACTED]
- Describe the odor:

☐ Sweet	☐ Sour	☐ Smoky	☐ Septic/Sewer	☒ Musty	☐ Rotten
☐ Metallic	☐ Onion	☐ Earthy	☐ Ammonia	☐ Citrus	☒ Solvent
☐ Other (describe):					
- Is source known/likely? Describe: Chemical Smell
- Your symptoms? ☐ None

☐ Headache	☐ Dizziness	☐ Nausea	☐ Cough	☐ Fatigue
☐ Weakness	☐ Sore Throat	☐ Difficulty Breathing	☐ Eye Irritation	☐ Rash
☐ Itch	☐ Tingling	☐ Numbness	☐ Taste	
☒ Other (describe):				

2. Provide this completed card (Page 1 & 2) to Supervisor, Industrial Hygiene, your Union Safety Representative or the CSM. If received by Supervisor/IH/U-SR, Supervisor/IH/U-SR will ensure card is provided to the CSM.

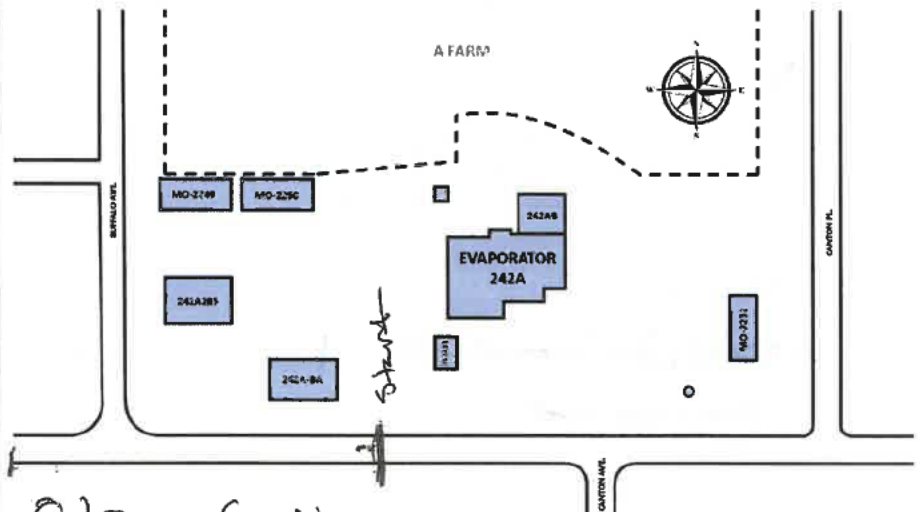
felt it in my chest took my breath away for a second

ODOR/VAPOR RESPONSE CARD - 242 A

Instructions:

1. Notify Immediate Supervisor.
2. Contact Central Shift Manager (CSM), at [REDACTED]
3. Complete both pages of this form and include as many details as possible, including:
 - a. Approximate location, see map at right;
 - b. Wind direction, speed and description, such as stable or gusty wind;
 - c. Environmental conditions, such as hot, cold, windy, rainy;
 - d. Other work or contractors in the area;
 - e. Anything else you think is relevant.
4. Provide the completed card to your Supervisor*, Industrial Hygiene*, Union Safety Representative* or the CSM.

* If received by Supervisor, IH, or Union Safety Representative, the Supervisor/IH/ Union-SR will ensure card it is provided to the CSM.



Odor Continue up to the train tracks

ODOR/VAPOR RESPONSE CARD - 242 A

1. Complete below information and map (Page 1).

- Date and time of event: 2/14/24
- Check Applicable:
 - ☒ Odor ☐ Ammonia Alarm (6 ppm) ☐ Ammonia Alarm (12 ppm) ☐ Alarm (other - describe): _____
- Your name and the work you were performing:

[REDACTED] driving through the area on the way to a job
- Other Work Underway? Describe:

AW Farm lots of work being done at AW Farm at the time
- Location of event (mark area on map and wind direction):

In front of boiler annex, towards Panex
- Name(s) of others in or near the affected area:

[REDACTED]
- Was Industrial Hygiene present, who?

NO
- Describe the odor:

☐ Sweet	☐ Sour	☐ Smoky	☐ Septic/Sewer	☒ Musty	☐ Rotten
☐ Metallic	☐ Onion	☐ Earthy	☐ Ammonia	☐ Citrus	☒ Solvent

☒ Other (describe): slight smell of sulfur
- Is source known/likely? Describe:

unknown, work being done at AW Farm
- Your symptoms? ☐ None

☐ Headache	☐ Dizziness	☐ Nausea	☐ Cough	☐ Fatigue
☐ Weakness	☐ Sore Throat	☐ Difficulty Breathing	☐ Eye Irritation	☐ Rash
☐ Itch	☐ Tingling	☐ Numbness	☐ Taste	

☒ Other (describe): Slightly light-headed

2. Provide this completed card (Page 1 & 2) to Supervisor, Industrial Hygiene, your Union Safety Representative or the CSM. If received by Supervisor/IH/U-SR, Supervisor/IH/U-SR will ensure card is provided to the CSM.

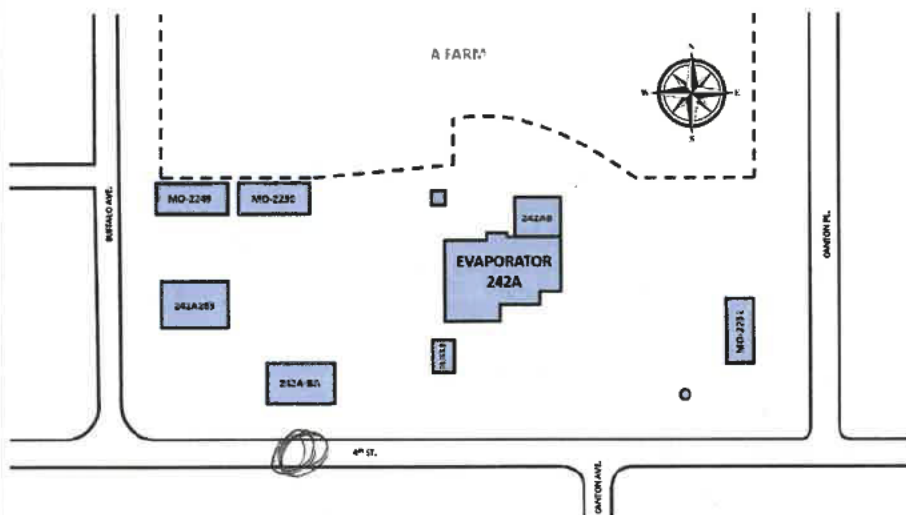
⊙ = Start point

ODOR/VAPOR RESPONSE CARD - 242 A

Instructions:

1. Notify Immediate Supervisor.
2. Contact Central Shift Manager (CSM), at [REDACTED]
3. Complete both pages of this form and include as many details as possible, including:
 - a. Approximate location, see map at right;
 - b. Wind direction, speed and description, such as stable or gusty wind;
 - c. Environmental conditions, such as hot, cold, windy, rainy;
 - d. Other work or contractors in the area;
 - e. Anything else you think is relevant.
4. Provide the completed card to your Supervisor*, Industrial Hygiene*, Union Safety Representative* or the CSM.

* If received by Supervisor, IH, or Union Safety Representative, the Supervisor/IH/ Union-SR will ensure card it is provided to the CSM.



A: Odor starting ⊙ at the boiler annex and continuing up to the train tracks near Purac

B: Was driving on 4th street at the time, unsure of wind direction.

C: Cool, overcast day

D: ~~se~~ multiple (8+) cars at AW Farm, manager mention some painting being done to the north of that area

E: Musty odor, hard to describe. Smelt like a combination of Sulfur + chemical.

ODOR/VAPOR RESPONSE CARD - 241 AW FARM

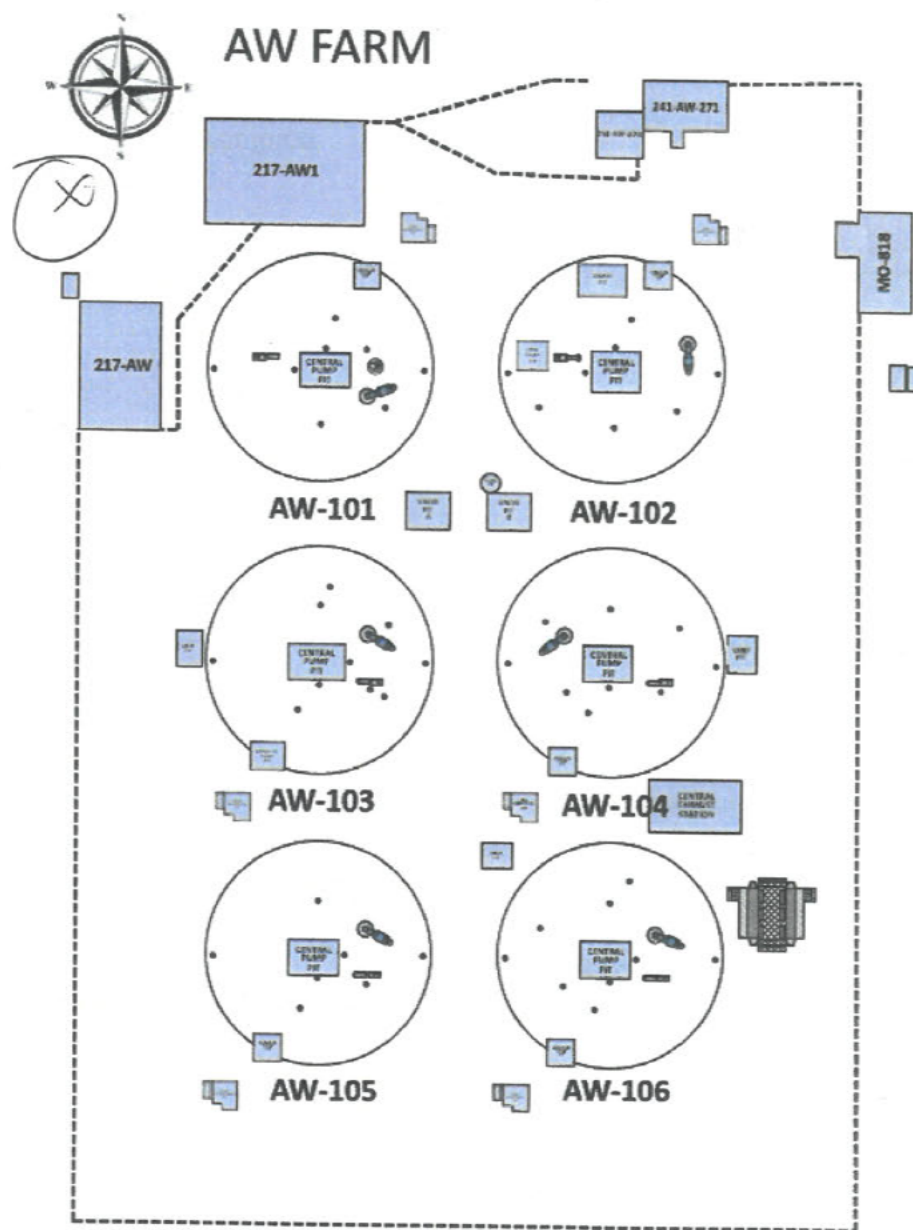
Instructions:

1. Notify Immediate Supervisor. *Yes*
2. Contact Central Shift Manager (CSM),
at [REDACTED] *Yes*
3. Complete both pages of this form and
include as many details as possible,
including:

- a. Approximate location, see map
at right; *West side of change trailer*
- b. Wind direction, speed and
description, such as stable or
gusty wind; *unsure of direction
breezy*
- c. Environmental conditions, such
as hot, cold, windy, rainy; *breezy*
- d. Other work or contractors in the
area; *Yes*
- e. Anything else you think is
relevant. —

4. Provide the completed card to your
Supervisor*, Industrial Hygiene*, Union
Safety Representative* or the CSM.

* If received by Supervisor, IH, or Union
Safety Representative, the Supervisor/IH/
Union-SR will ensure card it is provided to
the CSM.



ODOR/VAPOR RESPONSE CARD - 241 AW FARM

1. Complete below information and map (Page 1).

- Date and time of event: 2/14/24
- Check Applicable:
 - ☒ Odor
 - ☐ Ammonia Alarm (6 ppm)
 - ☐ Ammonia Alarm (12 ppm)
 - ☒ Alarm (other - describe): CBZ
- Your name and the work you were performing:
[REDACTED] IHT, noise monitoring
- Other Work Underway? Describe:
AW VP cleaning
- Location of event (mark area on map and wind direction):
West of AW change trailer
- Name(s) of others in or near the affected area:
[REDACTED]
- Was Industrial Hygiene present, who?
[REDACTED]
- Describe the odor:
 - ☐ Sweet
 - ☐ Sour
 - ☒ Smoky
 - ☐ Septic/Sewer
 - ☐ Musty
 - ☐ Rotten
 - ☐ Metallic
 - ☐ Onion
 - ☐ Earthy
 - ☐ Ammonia
 - ☐ Citrus
 - ☐ Solvent
 - ☒ Other (describe): WARM PLASTIC
- Is source known/likely? Describe:
unknown
- Your symptoms? ☐ None
 - ☒ Headache
 - ☐ Weakness
 - ☐ Itch
 - ☐ Other (describe):
 - ☐ Dizziness
 - ☒ Sore Throat
 - ☒ Tingling tongue
 - ☒ Nausea
 - ☐ Difficulty Breathing
 - ☒ Numbness tongue
 - ☐ Cough
 - ☐ Eye Irritation
 - ☐ Taste
 - ☐ Fatigue
 - ☐ Rash

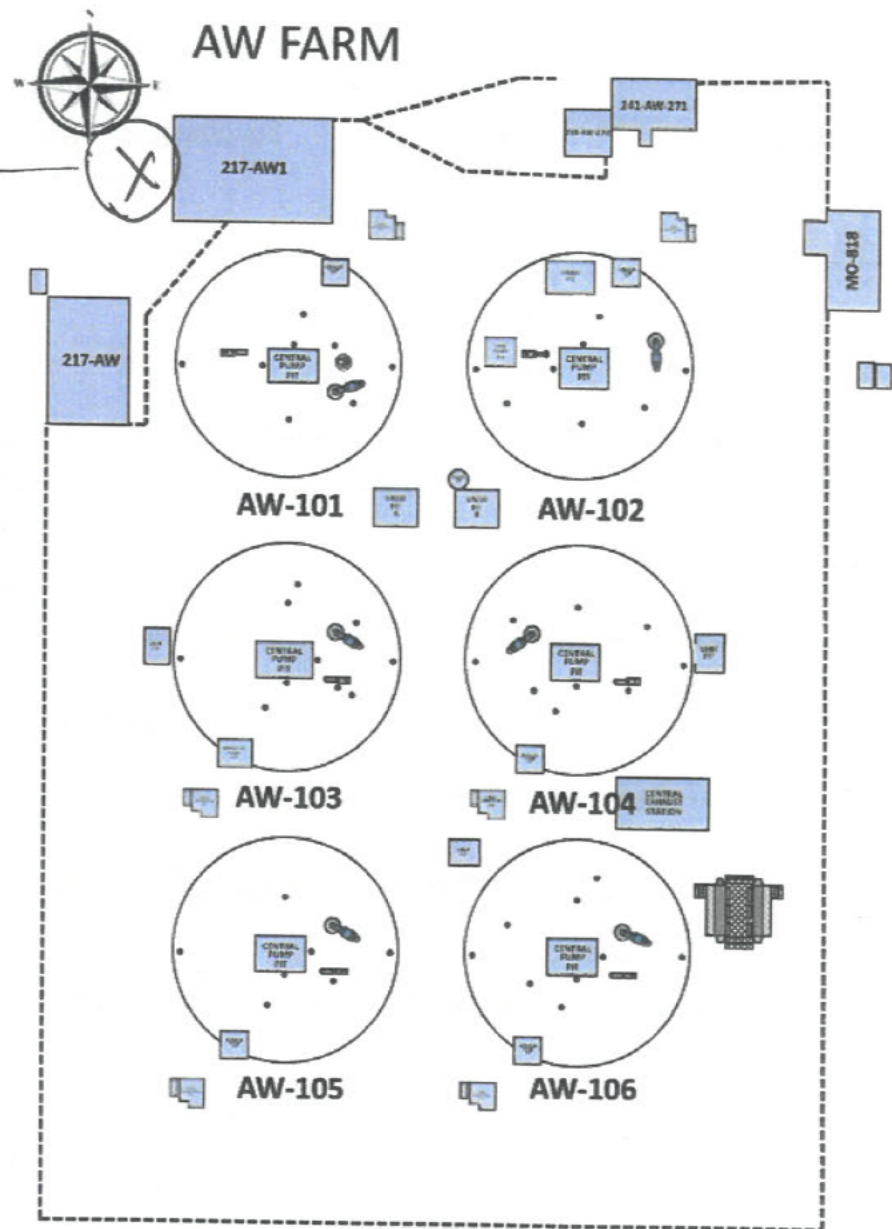
2. Provide this completed card (Page 1 & 2) to Supervisor, Industrial Hygiene, your Union Safety Representative or the CSM.
If received by Supervisor/IH/U-SR, Supervisor/IH/U-SR will ensure card is provided to the CSM.

ODOR/VAPOR RESPONSE CARD - 241 AW FARM

Instructions:

1. Notify Immediate Supervisor.
2. Contact Central Shift Manager (CSM), at [REDACTED]
3. Complete both pages of this form and include as many details as possible, including:
 - a. Approximate location, see map at right; *berm, change trailer entrance*
 - b. Wind direction, speed and description, such as stable or gusty wind; *unknown*
 - c. Environmental conditions, such as hot, cold, windy, rainy; *cold*
 - d. Other work or contractors in the area; *WRPS - AW Farm*
 - e. Anything else you think is relevant. *none*
4. Provide the completed card to your Supervisor*, Industrial Hygiene*, Union Safety Representative* or the CSM.

* If received by Supervisor, IH, or Union Safety Representative, the Supervisor/IH/ Union-SR will ensure card it is provided to the CSM.



ODOR/VAPOR RESPONSE CARD - 241 AW FARM

1. Complete below information and map (Page 1).

- Date and time of event: 02/14/2024
- Check Applicable:
 - ☒ Odor
 - ☐ Ammonia Alarm (6 ppm)
 - ☐ Ammonia Alarm (12 ppm)
 - ☐ Alarm (other - describe): _____
- Your name and the work you were performing:
[REDACTED], IHT performing Noise monitoring AW farm
- Other Work Underway? Describe:
AW A Valve P.H. (we were supporting)
- Location of event (mark area on map and wind direction):
West AW farm Change trailer entrance
- Name(s) of others in or near the affected area:
[REDACTED]
- Was Industrial Hygiene present, who?
yes, no instruments on hand.
- Describe the odor:
 - ☐ Sweet
 - ☐ Sour
 - ☒ Smoky
 - ☐ Septic/Sewer
 - ☐ Musty
 - ☐ Rotten
 - ☐ Metallic
 - ☐ Onion
 - ☐ Earthy
 - ☐ Ammonia
 - ☐ Citrus
 - ☐ Solvent
 - ☒ Other (describe): burnt plastic
- Is source known/likely? Describe:
unknown
- Your symptoms? ☐ None
 - ☒ Headache
 - ☒ Dizziness
 - ☒ Nausea
 - ☐ Cough
 - ☐ Fatigue
 - ☒ Weakness
 - ☒ Sore Throat
 - ☐ Difficulty Breathing
 - ☐ Eye Irritation
 - ☐ Rash
 - ☐ Itch
 - ☐ Tingling
 - ☐ Numbness
 - ☒ Taste
 - ☒ Other (describe): numb tongue

2. Provide this completed card (Page 1 & 2) to Supervisor, Industrial Hygiene, your Union Safety Representative or the CSM.
If received by Supervisor/IH/U-SR, Supervisor/IH/U-SR will ensure card is provided to the CSM.