

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: 08/20/2024

3. Investigation Title: C-67 Response between 242-A and 2506E2

4. Investigation Report Number: EIR-2024-063

5. Responsible Manager: [REDACTED]

6. Event Investigator: [REDACTED]

7. Area / Building / Location: 200E / Outdoor area between 242-A Evaporator and 2506E2

8. Date and Approximate Time of Event: Date: 08/13/2024 Time (military): 1310

9. Associated Action Request (AR) Number: WRPS-AR-2024-2506

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

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

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

Two workers reported stronger than normal odors when traversing northward between 242-A and 2506E2. Traversing between work locations is considered a Level 4 activity, therefore, procedures and/or work order numbers are not applicable.

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

One Maintenance Field Work Supervisor and one Instrument Specialist.

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

On 08/13/2024, at approximately 1310 hours, two workers reported stronger than normal "ammonia-like" odors when traversing northward between 242-A and 2506E2. 45 minutes later, one of the workers updated their description of the odor to "strong, foul, rotten and sour."

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

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

The Data Fusion and Advisory System (DFAS) application, powered by SmartSite™, was utilized for outdoor weather details at the time odors were reported. The DFAS dashboard indicated the following weather conditions at 1310 hours on 08/13/2024:

- Wind Speed: 7.7 mph
- Wind Direction: 87° (from East)
- Mixing Height: 1500 feet above grade
- Stability Class: C (slightly unstable conditions)

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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. Access was restricted between 2506E2 and 242-A for approximately 50 minutes. No additional impacts to scheduled 08/13/2024 work evolutions occurred.

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

- Central Shift Manager (CSM) initiated TFC-OPS-OPER-C-67, *Response to Stronger than Normal Odors*, response actions for reported stronger than normal odors.
- CSM issued a Shift Office Event Notification (SOEN) that access restriction was in place between 2506E2 and 242-A Evaporator.
- CSM made required TFC-OPS-OPER-C-67 notifications.
- Production Operations Shift Industrial Hygiene Technician (IHT) initiated TFC-OPS-OPER-C-67 response actions and monitoring per Industrial Hygiene Sample Plan (IHSP) POE-MULTI-TFCOPSOPER67.
- Event Investigation EIR-2024-063, "C-67 Response between 242A and 2506E2," 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-00101, "TFC-OPS-OPER-C-67 Response South of 242-A," investigation and Direct Reading Instrument (DRI) monitoring could not readily identify a source of the reported odor.

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.

The following considerations support the IHIR-00101 conclusions:

- 1) 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 (Refer to Attachment 1). 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 (1500 feet above grade) and atmospheric stability class (slightly unstable conditions).

While the reported odor location appeared to be within the PEZ of the AP exhauster emission plume, the approximate distance between the odor location and the AP exhauster is approximately 700 feet. Thus, determining the cause of the observed odors was unlikely to be resultant of the AP exhauster emissions (Refer to Attachment 1).

- 2) The reported odor descriptions are consistent with Tank Waste Chemical Vapors, therefore monitoring for Tank Waste Chemical Vapors was conducted during the TFC-OPS-OPER-C-67 response.

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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 photoionization detectors provides further indication for Tank Waste Chemical Vapors/COPCs.

Investigative TFC-OPS-OPER-C-67 DRI area monitoring was performed in the general areas around the perimeter of 2506E2, 4th Street at Canton Avenue, South and East sides of 242-A, perimeter of 243-G82, vent assemblies and perimeter of 2607-E12. 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.

- 3) 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 11.792 ppm at the 241-AW exhauster, 0.539 at 241-AP exhauster, 0 ppm at the POR-126 exhauster, 0 ppm at the POR-127. The AN exhauster and 702-AZ exhauster VMDS was out-of-service, therefore, alternate readings were acquired once per calendar day in accordance with TF-OPS-IHT-037, *IHT Ammonia Monitoring on Exhausters*. The highest ammonia concentrations observed between 08/06/2024 and 08/13/2024 was 67 ppm at the 702-AZ Exhauster and 21 ppm at the 241-AN exhauster. Conservatively utilizing the higher ammonia concentration observed in the 702-AZ exhauster, a predicted ground receptor ammonia concentration of 0.36 ppm (or 1.46% of the established Occupational Exposure Limit for ammonia) would be expected if 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 0 ppm at the POR-518 exhauster and 24.592 ppm at the POR-519 exhauster. Thus, a predicted ground receptor ammonia concentration of 0.38 ppm (or 1.54% 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.

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21. Positive Aspects Identified:

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

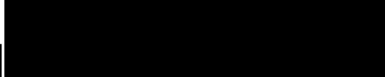
22. Key Take Aways / Learning Opportunities:

None.

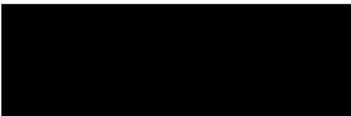
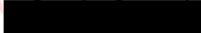
23. Event Investigation:

- ☐ 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: 2024.08.20 16:53:56 -07'00'

Signature / Date

CAS Manager Approval:



Name (First, Middle Initial, Last)


Digitally signed by 
Date: 2024.08.20 17:01:36 -07'00'

Signature / Date

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



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INDUSTRIAL HYGIENE EVENT INVESTIGATION REPORT (IHIR)

Event Title: TFC-OPS-OPER-C-67 Response South of 242-A.			IHIR Number: IHIR-00101
			IHEI Number: N/A
Date: 08/13/2024	Time: 1310	Location: In between 242-A and 2506E2.	

Event Summary and Timeline:

Event Summary:

At approximately 1310 on August 13th, 2024, 2 workers reported stronger than normal “ammonia-like, sour, rotten, and foul” odors as they traversed Northward in between 22506E2 and 242-A. No symptoms were reported. The affected employees declined precautionary medical evaluation.

Field Response Timeline:

- 1324 Central Shift Manager (CSM) contacts DFLAW Industrial Hygienist (IH) to request support for TFC-OPS-OPER-C-67 response actions.
- 1325 DFLAW IH contacts Production Operations (PO) Shift Industrial Hygiene Technician (IHT) Supervisor to request support for TFC-OPS-OPER-C-67 response actions.
- 1327 DFLAW IH and PO/DFLAW Safety and Health (S&H) Manager arrive at the Central Shift Office (CSO) and receive briefing from CSM:
- “Stronger than normal” “ammonia-like” odors in between 242-A and 2506E2.
 - No symptoms reported, precautionary medical evaluation declined.
 - Odor/Vapor Response Cards (O/VRCs) requested.
- 1328 PO IH arrives at CSO.
- 1329 DFLAW IH informs CSM of Data Fusion and Advisory System (DFAS) current weather conditions:
- Stability Class – C (slightly unstable conditions)
 - Wind speed – 7.7 mph
 - Wind direction – from 87° (East)
 - Mixing Height – 1500 ft above grade
- 1330 PO IHT and PO Shift IHT Supervisor arrive at CSO to support response actions.
- 1330 DFLAW IH informs CSM of Vapor Monitoring Detection System (VMDS) Ammonia (NH₃) readings @ 1310 08/13/2024:
- POR-518 – 0 parts per million (ppm)
 - POR-519 – 24.592 ppm
 - AN VTP – N/A
 - AW VTP – 11.792 ppm
 - POR-126 – 0 ppm
 - POR-127 – 0 ppm
 - 702-AZ VTP – N/A
 - AP VTP – 0.539 ppm
- 1333 Weather station contacted for additional weather data at time of initiating event, IHIR number requested.
- 1334 DFLAW IH consults TOC-IH-58956 to determine DRI selections for field response actions.
- 1334 SOEN: “Responding per TFC-OPS-OPER-C-67 for stronger than normal odors reported between the Bundy Hut (2506E2) to 242-A Evaporator. Access restriction is in place between 2506E2 and 242-A Evaporator.”
- 1338 PO Shift IHT Supervisor briefs senior Environmental Safety Health and Quality (ESH&Q) Management.
- 1339 IHIR-00101 assigned.
- 1343 Access restriction is implemented.
- 1352 DFLAW IH Briefs PO IHT on field response actions:
- Conduct survey of affected area with Direct Reading Instrumentation (DRI) in accordance with IHSP-POE-MULTI-TFCOPSOPERC67:
 - o NH₃, Action Level (AL) – 12 ppm
 - o Volatile Organic Compounds (VOCs) 10.6 electron volts (eV) Photoionization Detector (PID), AL – 2 ppm
 - RPE voluntary-use.
 - Monitor from 2506E2 to 242-A and surrounding area.
- 1354 DFLAW IH and PO IHT (Field Response Team) are dispatched to affected area.
- 1355 242-A Supervisor updates odor description to “strong, foul, rotten, sour”
- 1358 Field response team arrives at affected area.
- 1400 No odors observed near 2506E2:
- NH₃ – Less than Detectable (< 1.0 ppm)
 - VOCs – Less than Detectable (<0.010 ppm)
- 1402 No odors observed near 242-A:
- NH₃ – Less than Detectable (< 1.0 ppm)
 - VOCs – Less than Detectable (<0.010 ppm)

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INDUSTRIAL HYGIENE EVENT INVESTIGATION REPORT (IHIR) (Continued)

Event Summary and Timeline:

NOTE: Event Summary and Timeline continued on next page:

Event Summary and Timeline Continued:

1403 No odors observed near 243-G82:

- NH₃ – Less than Detectable (< 1.0 ppm)
- VOCs – Less than Detectable (<0.010 ppm)

1405 No odors observed near 2607-E12:

- NH₃ – Less than Detectable (< 1.0 ppm)
- VOCs – Less than Detectable (<0.010 ppm)

1407 DFLAW IH returns to CSO, PO IHT reports to 272AW IH Laboratory to perform DRI post-use-function-test.

1411 PO IHT reports that DRI passed post-use-function-test.

1414 O/VRCs arrive at CSO.

1419 SOEN: "Response to C-67 Odor Event between 242A and 2506E2 have been completed. Survey results are less than background. Normal access is restored to the area. CSM"

Field Response Timeline Acronyms:

CSM	Central Shift Manager
CSO	Central Shift Office
DFAS	Data Fusion & Advisory System
DFLAW	Direct Feed Low Activity Waste
DRI	direct reading instrument
ESH&Q	Environmental, Safety, Health, & Quality
eV	electron-volts
IH	Industrial Hygienist
IHIR	Industrial Hygiene Investigation Report
IHT	Industrial Hygiene Technician
mph	miles per hour
NH ₃	Ammonia
OVRC	Odor/Vapor Response Card
PID	photoionization detector
POE	Production Operations-East
ppm	parts per million
S&H	Safety & Health
SOEN	Shift Office Event Notification
VMDS	Vapor Monitoring Detection System
VOCs	Volatile Organic Compounds

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INDUSTRIAL HYGIENE EVENT INVESTIGATION REPORT (IHIR) (Continued)

Event Summary and Timeline:

Sampling/Monitoring Results:

Direct Reading Instrument Monitoring Results:

- Response Team approached affected area from the South, surveyed around the perimeter of 2506E2, proceeded across 4th Street at Canton Avenue, surveyed around the South and East sides of 242-A, surveyed around the perimeter of 243-G82, and surveyed the vent assemblies and perimeter of 2607-E12.

- DRI readings acquired during field response:

Location	NH ₃	VOCs
2506E2	< 1 ppm	< 0.010 ppm
242-A	< 1 ppm	< 0.010 ppm
243-G82	< 1 ppm	< 0.010 ppm
2607-E12	< 1 ppm	< 0.010 ppm

Sampling/Monitoring Results Acronyms:

NH ₃	Ammonia
ppm	Parts Per Million
VOCs	Volatile Organic Compounds

SWIHD References:

Event Response Site Wide Industrial Hygiene Database DRI Survey:

- # 24-06451 "TFC-OPS-OPER-C-67 field response near 242-A"

Additional Information:

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

The odor description initially provided is consistent with Tank Waste Chemical Vapors, and 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 PID is utilized to detect multiple VOC COPCs simultaneously.

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

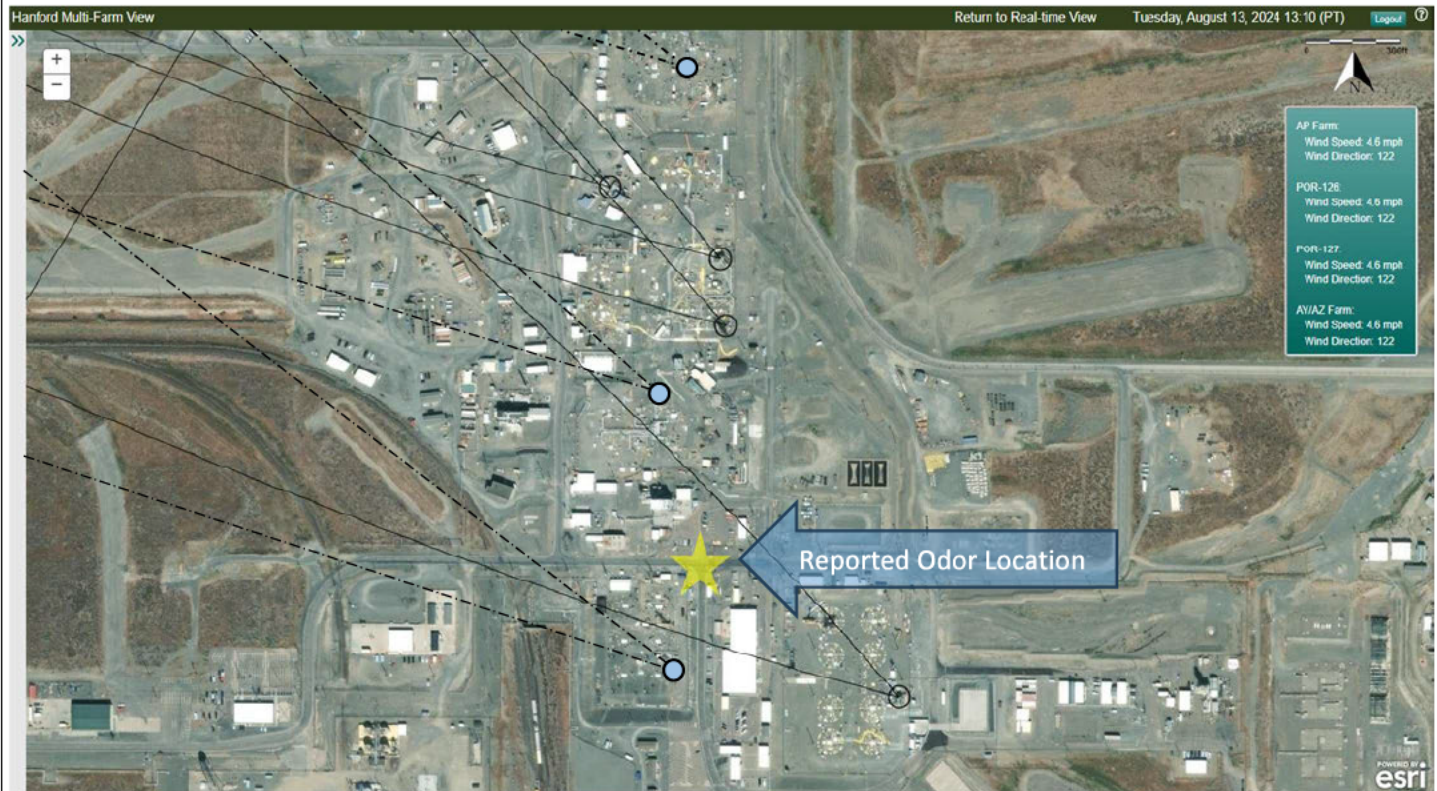
Note: Additional Information continued on next page.

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INDUSTRIAL HYGIENE EVENT INVESTIGATION REPORT (IHIR) (Continued)

Additional Information:

Additional Information continued:

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



NOTE: 241-AN Farm, 241-AW Farm, and POR-518/519 Exhausters are not connected to the DFAS; however, approximate exhauster plumes are added based on other modeled plumes.

08/13/2024 @ 1310 (approximate time of initiating event):

- Wind Speed: 4.6 mph (15-minute average)
- Wind Direction: 122° (out of East-Southeast)
- Mixing Height: 1400 feet above grade
- Stability Class: D (Neutral conditions)

Weather Conditions as provided by Hanford Meteorological Station for Weather Station 6 at approximate time of initiating event (08/13/2024 @1310):

- Wind Speed: 6 mph
- Wind Direction: East
- Barometric Pressure 29.179 inHg and falling
- Relative Humidity 27%
- Mixing Height: 1500 meters above grade
- Stability Class: A (Extremely Unstable conditions)

Review of the DFAS application, powered by SmartSite™, dashboard for current conditions during response actions, per TFC-OPS-OPER-C-67 4.2.8:

08/13/2024 @ 1400 (current weather data for Response actions):

- Wind Speed: 5.3 mph (15-minute average)
- Wind Direction: 129° (out of East-Southeast)
- Mixing Height: 1500 feet above grade
- Stability Class: C (Slightly Unstable conditions)

NOTE: Additional Information continued on next page.

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INDUSTRIAL HYGIENE EVENT INVESTIGATION REPORT (IHIR) (Continued)

Additional Information:

Additional Information continued:

Vapor Monitoring Detection System (VMDS) exhauster ammonia readings on 08/13/2024 @ 1310:

- POR518 (241-A): 0 ppm
- POR519 (241-A): 24.592 ppm
- 241-AN: N/A
- 241-AW: 11.792 ppm
- POR126 (241-AX): 0.000 ppm
- POR127 (241-AX): 0.000 ppm
- 702AZ (241-AY/AZ): N/A
- 241-AP: 0.539 ppm

Memo WRPS-1904672.1, TANK FARM EXHAUST ~ CK 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 ~ CK 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		
241-SY	Primary	310 ppm	620 ppm

Vapor Monitoring Detection System (VMDS) 08/06/2024 @ 1310 to 08/13/2024 @ 1310:

Tank Farm	Exhauster	Minimum ^{*A}	Maximum ^{*A}
241-A	POR518/POR519	N/A	1576.172 ppm
241-AN	Primary	N/A	N/A
241-AW	Primary	N/A	28.778 ppm
241-AX	POR126/POR127	N/A	39.214 ppm
241-AY/AZ	702AZ	N/A	N/A
241-AP	Primary	N/A	0.627 ppm

^{*A} VMDS Alternate Real Time Monitoring performed 08/06/2024 to 08/13/2024 for 241-A (POR518/POR519), 241-AN, 241-AP, 241-AW, 241-AX (POR126/127), 241-AY/AZ (702AZ), and 241-SY.

The 241-SY Primary Exhauster is not currently connected to the VMDS software. When stack monitoring via the VMDS is unavailable, and ventilation is operating, IH will conduct alternate monitoring for ammonia. Report TOC-IH-RPT-50042, Ammonia Monitoring- Rate of Change of Tank Vapor Source Concentration and Monitoring Frequency, recommends measuring the exhaust ventilation systems once every 4 days. Conservatively, stack readings are required once per calendar day, in accordance with ARP-T-041-00002 and are acquired in accordance with TF-OPS-IHT-037.

Vapor Monitoring Detection System (VMDS) Alternate Monitoring 07/16/2024 to 07/23/2024:

Tank Farm	Exhauster	Minimum	Maximum
241-A	POR518/POR519	1	1
241-AN	Primary	17	21
241-AP	Primary	6	13
241-AW	Primary	5	6
241-AX	POR126/POR127	0	0
241-AY/AZ	702AZ	15	67
241-SY	Primary	23	27

NOTE: Additional Information continued on next page.

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INDUSTRIAL HYGIENE EVENT INVESTIGATION REPORT (IHIR) (Continued)

Additional Information:

Additional Information continued:

Odor descriptors provided by Affected Workers are consistent with some constituents of tank vapors Tank Vapors. However, review of the DFAS application, powered by SmartSite™, Weather Details dashboard and VMDS exhaust ammonia readings for the approximate time of the Event, indicate the cause of the odor is unlikely to be from Tank Farm Exhauster emissions.

American Industrial Hygiene Association Odor Thresholds for Chemicals 4th Edition provides chemical odor descriptors and associated odor detection and recognition concentration values. Below are the possible chemicals associated with the odor descriptors provided by the affected personnel, and the Occupational Exposure Limits (OELs) assigned to each chemical (as applicable). In most cases the odor detection concentration and/or odor recognition concentration is below applicable OELs. Chemicals with established OELs which are less than or similar to published odor thresholds are highlighted.

“Ammonia-like”:

Chemical	Lowest Detection Concentration	Lowest Recognition Concentration	Applicable OEL
Ammonia	0.057 ppm	0.57 ppm	25 ppm TWA (ACGIH TLV)
n-Butylamine	0.08 ppm	0.24 ppm	5 ppm STEL (ACGIH TLV)
sec-Butylamine	0.17 ppm	N/A	N/A
tert-Butylamine	0.17 ppm	N/A	N/A
Cyclohexylamine	2.42 ppm	N/A	10 ppm TWA (ACGIH TLV)
Diethanolamine	N/A	0.279 ppm	1 mg/m ³ TWA (ACGIH TLV)
Diethylamine	0.0033 to 0.033 ppm	0.06 ppm	5 ppm TWA (ACGIH TLV)
Diethylaminoethanol	0.01 ppm	0.04 ppm	10 ppm TWA (NIOSH REL)
Diisopropylamine	0.14 ppm	0.39 ppm	5 ppm TWA (ACGIH TLV)
n,n-Dimethylacetamide	3.199 ppm	48 ppm	10 ppm TWA (ACGIH TLV)
Dimethylamine	0.00076 ppm	0.012 ppm	5 ppm TWA (ACGIH TLV)
1,1-Dimethylhydrazine	6.1 to 14 ppm	N/A	0.01 ppm TWA (ACGIH TLV)
Ethanolamine	2.6 ppm	24 ppm	3 ppm TWA (ACGIH TLV)
Ethyl Acrylate	0.0000066 ppm	0.00037 ppm	5 ppm TWA (ACGIH TLV)
Ethylamine	0.045 ppm	0.81 ppm	5 ppm TWA (ACGIH TLV)
Ethylenediamine	N/A	N/A	10 ppm TWA (ACGIH TLV)
Ethyleneimine	0.71 ppm	N/A	0.05 ppm TWA (ACGIH TLV)
n-Ethylmorpholine	0.085 ppm	0.25 ppm	5 ppm TWA (ACGIH TLV)
Hydrazine	3 ppm	N/A	0.01 ppm TWA (ACGIH TLV)
Isopropylamine	0.025 ppm	0.7 ppm	5 ppm TWA (ACGIH TLV)
1-Methoxy-2-Propanol	0.0029 ppm	N/A	50 ppm TWA (ACGIH TLV)
Methylamine	0.00095 ppm	0.0095 ppm	5 ppm TWA (ACGIH TLV)
Methyl Hydrazine	1.01 to 3.03 ppm	N/A	0.01 ppm TWA (ACGIH TLV)
Morpholine	0.01 ppm	0.07 ppm	20 ppm TWA (ACGIH TLV)
Triethanolamine	> 10 ppm	N/A	5 mg/m ³ TWA (ACGIH TLV)
Triethylamine	0.0053 ppm	0.27 ppm	0.5 ppm TWA (ACGIH TLV)
Trimethylamine	0.00011 ppm	0.00021 ppm	5 ppm TWA (ACGIH TLV)
n-Dipropylamine	0.02 ppm	N/A	5 ppm TLV (ACGIH TLV)
Propylene Diamine	0.014 ppm	0.048 ppm	0.1 mg/m ³ TWA (NIOSH REL)
Formamide	82 ppm	N/A	10 ppm TWA (ACGIH TLV)
Cycloheptylamine	67 ppm	N/A	10 ppm TWA (NIOSH REL)
Pyrrolidine	20 ppm	N/A	N/A
Amyl Amine	15.8 ppm	N/A	N/A
n-Propyl Amine	0.061 ppm	N/A	N/A

NOTE: Additional Information continued on next page.

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INDUSTRIAL HYGIENE EVENT INVESTIGATION REPORT (IHIR) (Continued)

Additional Information:

Additional Information continued:

“Sour”:

Chemical	Lowest Detection Concentration	Lowest Recognition Concentration	Applicable OEL
Acetic Acid	0.0004 ppm	0.02 ppm	10 ppm TWA (ACGIH TLV)
Acetic Anhydride	< 0.14 ppm	0.36 ppm	1 ppm TWA (ACGIH TLV)
n-Butylamine	0.08 ppm	0.24 ppm	5 ppm Ceiling (ACGIH TLV)
Methyl Alcohol	3.05 ppm	7.63 ppm	200 ppm TWA (ACGIH TLV)
Propionic Acid	0.00099 ppm	0.0083 ppm	10 ppm TWA (ACGIH TLV)
Pyridine	0.007 ppm	0.021 ppm	1 ppm TWA (ACGIH TLV)
Toluene	0.008 ppm	0.93 to 0.96 ppm	20 ppm TWA (ACGIH TLV)
Vinyl Acetate	0.12 ppm	< 0.40 ppm	4 ppm Ceiling (NIOSH REL)
Isohexanoic Acid	0.0004 ppm	N/A	N/A

“Rotten” (ambiguous, includes listed odor character for “Rotten-Cabbage”, “Rotten-Eggs”, “Rotten-Fish”):

Chemical	Lowest Detection Concentration	Lowest Recognition Concentration	Applicable OEL
Ethyl Mercaptan	0.000017 ppm	0.00029 ppm	0.5 ppm TWA (ACGIH TLV)
Methyl Mercaptan	0.0000002 ppm	0.000071 ppm	0.5 ppm TWA (ACGIH TLV)
Hydrogen Sulfide	0.00007 ppm	0.00046 to 0.00093 ppm	1 ppm TWA (ACGIH TLV)
Diethanolamine	N/A	0.279 ppm	1 mg/m ³ TWA (ACGIH TLV)
Dimethylamine	0.00076 ppm	0.012 ppm	5 ppm TWA (ACGIH TLV)

Foul: None listed, subjective.

The specific chemical or chemicals resulting in the odor(s) detected by the affected individuals could not be readily determined. Odor descriptors provided were ambiguous (no specific chemical recognized) due to individual lack of knowledge of specific chemical odor descriptors, resulting olfactory response due to mixture of multiple chemical constituents, or inadequate concentration for recognition. Odor descriptors are often subjective and dependent on individual experience, individual odor attenuation, and can differ among individuals at certain concentrations. As the odor descriptors changed from “ammonia-like” upon initial report to “sour”, “rotten”, and “foul” during recollection of the event during population of the O/VRCs approximately 30 minutes later it is a possible indication that a transient concentration gradient was encountered. During the odor event the affected personnel were traveling Northward, and the ground-level atmospheric layer was traveling Westward. The concentration of the odorous chemicals could have been higher during the initial detection event as the personnel entered the transient odor plume and then diluted as the event transpired, or concentration increased as the until the affected personnel exited the odor “plume”. It is known that episodic recollection is most strongly associated with the conclusion of discrete temporal event rather than the time during or beginning. Based on comparison of the relative odor detection values associated with each provided odor descriptor and the time that the odors were recollected it is most likely that the concentration gradient as plotted for the duration of the event changed from higher concentration to lower. This suggests the affected employees encountered an odor plume originating from a discrete, relatively short duration “puff” release. The most likely source of this release, based on wind direction, barometric pressure trend, and provided odor descriptors is the 2607-E12 Septic Lift station. However, there is inadequate observational evidence to support this hypothesis.

Monitoring Selections Based on Information Provided by Affected Workers:

The affected employees initially reported that the odor was “ammonia-like”. DRI monitoring selections were based on the initial odor descriptors. Based on the odor descriptors provided to the Field Response Team by the CSM DRI monitoring for Ammonia and VOCs was selected in accordance with TOC-IH-58956 “Monitoring Strategy for Response to Odors”:

Tank Waste Chemical Vapors:

- Ammonia is used as an indicator for other Tank Farm chemicals of potential concern (COPC). The Hanford Tank Farms COPC list is chemically and toxicologically diverse. Determining the concentration of some COPCs with sampling/laboratory analysis is difficult and real-time monitoring for those COPCs is currently impossible. Ammonia's concentration can be easily determined by sampling/laboratory analysis, and real-time monitoring is possible; therefore, it is a good candidate to use as an indicator of changing conditions within the Tank Farms.

NOTE: Additional Information continued on next page.

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

Additional Information:

Additional Information continued:

The Pacific Northwest National Laboratory (PNNL) was contracted to conduct a leading indicator (LI) study using a statistical approach to analyze tank vapor data and determine whether sufficient association existed in COPC concentration data to recommend some easily measured, higher concentration COPCs as LIs for less concentrated, less easily measured COPCs. This study was conducted in two phases. Phase 1 was the Leading Indicators Process Development report. This was followed up by the FY18 Leading Indicator Phase 2 Report, drafted in April 2018. This report concluded that ammonia, nitrous oxide, and mercury were potential LIs for multiple COPCs. From an individual indicator basis, ammonia had the most COPCs with a LI relationship (36-43 COPCs) at 90/90 tolerance limits depending on the concentration of interest. When focusing on the 24 COPCs on the TVIS lists [in2018], ammonia had a LI relationship with 16-19 COPCs, a lagging indicator relationship with 2-5 COPCs, and only 3 COPCs with insufficient data at the 90/90 tolerance limits. The use of multiple Lis increases the overall range of COPCs that can be indicated.

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 (e.g., tributyl phosphate, dibutyl butylphosphonate). Some in-tank waste treatment processes (e.g., neutralization and de-nitrification) used the same chemical feed stocks (e.g., sodium hydroxide solution, sucrose) 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 as an indicator because it a byproduct of all production processes and found in all tanks. This is especially true for A-Complex actively ventilated Tank Farms (241-AN, 241-AP, 241-AW) as mixing of all waste streams occurs in these farms. Therefore, when monitoring for tank waste chemical vapors, DRI equipped with an ammonia sensor should be utilized at a minimum.

See TOC-IH-58956 “Monitoring Strategy for Response to Odors” for more information related to odor monitoring strategy.

Additional Information Acronyms:

DFAS	Data Fusion & Advisory System
DRI	direct reading instrument
eV	electron-volts
OVRC	Odor/Vapor Response Card
PEL	Permissible Exposure Limit
PID	photoionization detector
ppm	parts per million
TLV	Threshold Limit Value
TWA	Time Weighted Average
VMDS	Vapor Monitoring Detection System
VOC	Volatile Organic Compounds

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.
- Honeywell (2018). Technical Note TN-106: A Guideline for PID Instrument Response. Retrieved from https://prod-edam.honeywell.com/content/dam/honeywell-edam/sps/his/en-us/products/gas-and-flame-detection/documents/Technical-Note-106_A-Guideline-for-Pid-Instrument-Response.pdf
- Occupational Safety & Health Administration (n.d.). Permissible Exposure Limits- Annotated Tables, OSHA Annotated Table Z-1. Retrieved from <https://www.osha.gov/annotated-pels/table-z-1>
- TOC-IH-58956. Monitoring Strategy for Response to Odors: Common Odor Sources in the 200 East, 200 West, & 600 Areas.

Recommendations/Conclusions:

Recommendations:

N/A

Conclusions:

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

Recommendations/Conclusions:

As Direct Reading Instrumentation monitoring at and around identified odor location and possible sources did not indicate further action was necessary to protect worker safety and health, the area was released from restricted access and work was allowed to continue.

Odor descriptors provided by Affected Workers as initially reported are consistent with Tank Vapors. Based on a review of the DFAS application, powered by SmartSite™, Weather Details dashboard and VMDS exhaust ammonia readings for the approximate time of the Event, the cause of the odor is unlikely to be from Tank Farm Exhauster emissions. The atmospheric stability at the time of the event was Neutral conditions and the mixing height was 1400 feet above grade. The weather information provided by the Hanford Meteorological Station at Weather Station 6 also reported mixing height above that provided by Quantitative Risk Assessment for 241-AP Farm Primary Exhauster (the only Tank Farm emission upwind from the event location at the time of the event) which could result in exhauster-plume to ground interaction. Hanford Meteorological Station 6 reported a mixing height of 1500 meters above grade, but with Extremely Stable conditions.

During performance of field response actions odors matching all provided descriptors were not present, and an odor source was not identified.

Others:

N/A

Associated Documents:

iCAS Number: N/A

EIR Number: EIR 2024-063

Industrial Hygienist:

Print First and Last Name

Digitally signed by _____
Date: 2024.08.14 13:54:45 -07'00'

Signature / Date

Industrial Hygiene Level 3 Manager

Print First and Last Name

Digitally signed by _____
Date: 2024.08.14 13:52:04 -07'00'

Signature / Date

Industrial Hygiene Level 2 Manager:

Print First and Last Name

Digitally signed by _____
Date: 2024.08.14 14:35:37 -07'00'

Signature / Date

ODOR/VAPOR RESPONSE CARD

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.

8/13/24 @ 1305 while walking outside on the east side of 242A evaporator before entering into the building I could smell a strong odor no symptoms were felt.

ODOR/VAPOR RESPONSE CARD

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

- Date and time of event: 08/13/24 @ 1305
- Check Applicable:
 - ☒ Odor
 - ☐ Ammonia Alarm (6 ppm)
 - ☐ Ammonia Alarm (12 ppm)
 - ☐ Alarm (other - describe):
- Your name and the work you were performing:
[REDACTED] walking to Evaporator
- Other Work Underway? Describe:
Not aware of any other work.
- Location of event (mark area on map and wind direction):
242 A west wind Direction
- 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):
- Is source known/likely? Describe:
[REDACTED] 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

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.

WHILE WAKING OUT OF 272 AW NORTH ENTRANCE
AT 13:00, I SMELL A STRONG FOUL ODOR BETWEEN
THE BUNDY HUT AND 272 AW BLDG.

- NOTIFIED SUPERVISOR.

ODOR/VAPOR RESPONSE CARD

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

- Date and time of event: 8/13/24 1300
- Check Applicable:
 - ☒ Odor
 - ☐ Ammonia Alarm (6 ppm)
 - ☐ Ammonia Alarm (12 ppm)
 - ☐ Alarm (other - describe):
- Your name and the work you were performing:
[REDACTED] / WALKING TO EVAPORATOR.
- Other Work Underway? Describe:
NOT AWARE OF ANY OTHER WORK.
- Location of event (mark area on map and wind direction):
242 AW / BUNDY HUT
- 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):
- 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.