

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:** Effluent Treatment Facility (ETF) **2. Report Date:** 11/11/2024

**3. Investigation Title:** C-67 Response at ETF

**4. Investigation Report Number:** EIR-2025-012

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

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

**7. Area / Building / Location:** 200 East Area/ETF/2025E/Room 134 (Compressor Room)

**8. Date and Approximate Time of Event:** **Date:** 11/05/2024 **Time (military):** 0920 hours

**9. Associated Action Request (AR) Number:** WRPS-AR-2025-0305

**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)

Monthly fire extinguisher inspections [level 4 activity].

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

WRPS Nuclear Chemical Operators (NCO) - 2

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

On 11/05/2024, at approximately 0920 hours, two NCOs were performing monthly fire extinguisher inspections when they reported smelling stronger than normal odors they described as "strong acid smell like battery being overcharged, acidic, sulfur, and rotten eggs" at the Effluent Treatment Facility (ETF), building 2025E, room 134 (Compressor Room). The NCOs reported the stronger than normal odors to the ETF Shift Operations Manager (SOM). The workers reported experiencing no symptoms and declined a precautionary medical evaluation.

At approximately 0930 hours, the ETF SOM was directed to place fans and prop open access doors to dissipate the odors. The Field Work Supervisor (FWS) opened the door to room 134 and turned on the floor fan located inside the room.

At 0937 hours, the ETF SOM notified the Central Shift Manager (CSM) of the stronger than normal odors. Access was restricted in-place to room 134 (Compressor Room).

At 0941 hours, the CSM contacted Direct Feed Low Activity Waste (DFLAW) Industrial Hygiene (IH) to request for TFC-OPS-OPER-C-67, Response to Stronger than Normal Odors, field response actions.

At 0955 hours, the CSM notified the Department of Energy (DOE) Facility Representative to provide event notification.

At 1107 hours, the IH field response was initiated, and direct reading instrument (DRI) monitoring was performed per survey plan IHSP-POE-MULTI-TFCOPSOPER67. The DRI readings took place in and around building 2025E, room 134. All readings were less than detectable. All DRI instruments passed the post-use function tests.

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At 1214 hours, TFC-OPS-OPER-C-67 response actions were completed. Normal Access was restored to room 134 at building 2025E.

**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 NCOs were wearing Level D Personal Protective Equipment (PPE) and in a work location that is not posted as a radiological controlled area. The personnel were not in an area requiring the use of respiratory protection or personal ammonia monitor (e.g., Ventispro or ToxiRAE).

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

No impacts to facility safety status and operational capabilities occurred.

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

- The workers were offered precautionary medical evaluation.
- Access doors were propped open and fans were put in place to dissipate the odors.
- The CSM initiated TFC-OPS-OPER-C-67, *Response to Stronger than Normal Odors*, response actions.
- Access was restricted to room 134 at building 2025E.
- The CSM made required TFC-OPS-OPER-C-67 notifications.
- IHTs took readings in and around building 2025E, room 134 per survey plan IHSP-POE-MULTI-TFCOOPSOPERC67.
- Event Investigation EIR-2025-012, *C-67 Response at ETF*, was initiated.

**18. Compensatory Actions Taken:**

None.

**19. Remedial Actions Taken:**

None.

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

- Per Industrial Hygiene Event Investigation Report, IHIR-00108, specific chemical constituents currently stored in room 134 at building 2025E could not be identified at the time of response plan development, therefore, volatile organic compounds (VOC) monitoring utilizing both 10.6 eV photoionization detector (PID) and 11.7 eV PID was selected for indication purposes only. As "acid" was specified as an odor descriptor by affected personnel, all available monitoring equipment utilizing electrochemical sensors for molecules with high electronegativity were selected (Nitric Oxide, Nitrogen Dioxide, Sulfur Dioxide, Carbon Monoxide). Figure 1 below identifies the DRI readings acquired during the initial field response. All readings were less than detectable.

Figure 1:

Location	NH <sub>3</sub>	VOCs (10.6 eV PID)	VOCs (11.7 eV PID)	H <sub>2</sub> S	NO	NO <sub>2</sub>	CO	SO <sub>2</sub>
2025E Room 134 General Area	< 1 ppm	<0.010 ppm	<0.010 ppm	<0.1 ppm	<0.5 ppm	<0.1 ppm	< 1 ppm	<0.1 ppm
2025E Room 134 General Area	< 1 ppm	<0.010 ppm	<0.010 ppm	<0.1 ppm	<0.5 ppm	<0.1 ppm	< 1 ppm	<0.1 ppm
2025E Room 134 General Area	< 1 ppm	<0.010 ppm	<0.010 ppm	<0.1 ppm	<0.5 ppm	<0.1 ppm	< 1 ppm	<0.1 ppm
Growth Inhibitor tank opening	< 1 ppm	<0.010 ppm	<0.010 ppm	<0.1 ppm	<0.5 ppm	1.5 ppm	< 1 ppm	<0.1 ppm

*Figure 1: Direct Reading Instrument Monitoring Results*

The affected personnel provided odor descriptors of "rotten eggs and sulfur" on the Odor/Vapor Response Cards (OVRs) and reported smelling stronger than normal odors "strong acid smell like battery being overcharged." Battery acid can also be

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identified as sulfuric acid. Sulfuric acid has a distinct and unpleasant odor that is commonly described as sharp, pungent, and reminiscent of rotten eggs. The smell is a result of the chemical composition of sulfuric acid and the release of sulfur compounds. Hydrogen sulfide H<sub>2</sub>S gas can be produced from batteries. It is formed when sulfuric acid in the battery breaks down during overcharging or overheating. Hydrogen sulfide and sulfur dioxide were monitored per IHSP-POE-MULTI-TFCOPSOPERC67. The readings for these chemicals were less than detectable. Readings did not indicate that further action was necessary to protect worker safety and health. Hydrogen sulfide can be smelled by most individuals at low concentrations in air, ranging from 0.0005 to 0.3 parts per million (ppm) parts of air. Most individuals can smell sulfur dioxide at levels of 0.3 to 1 ppm.

The resolution of DRI equipped with a hydrogen sulfide (H<sub>2</sub>S) sensor (0.1 ppm) is comparatively inadequate as a detection tool at the concentrations perceived by the human olfactory sense. While the resolution of the DRI equipped with an H<sub>2</sub>S sensor is insufficient to detect H<sub>2</sub>S at the lower range of odor threshold values, it is sufficient to detect H<sub>2</sub>S at concentrations that approach the established occupational exposure limits (OELs).

- o Action Limit: 0.5 ppm
  - o ACGIH 8-hour time-weighted-average (TWA) Threshold Limit Value (TLV): 1 ppm
  - o ACGIH 15-minute short-term-exposure-limit (STEL) TLV: 5 ppm
- The source of the odor was not identified due to facility personnel taking actions to dilute the odor source(s) prior to field response actions. A review of possible chemicals based on odor descriptors shows that most plausible chemical odor thresholds are well below applicable TWA OELs.
  - As the event was of short duration, and personnel exited the area soon after odors were reported, it's unlikely applicable OELs were exceeded. General area readings did not indicate that further action was necessary to protect worker safety and health access to the area was restored.

**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.

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**Responsible Manager Approval:**

\_\_\_\_\_  
Name (First, Middle Initial, Last)

\_\_\_\_\_  
Signature / Date

**CAS Manager Approval:**

\_\_\_\_\_  
Name (First, Middle Initial, Last)

\_\_\_\_\_  
Signature / Date

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**INDUSTRIAL HYGIENE EVENT INVESTIGATION REPORT (IHIR)**

<b>Event Title:</b> TFC-OPS-OPER-C-67 Response at 2025E Room 134.		<b>IHIR Number:</b> IHIR-00108
		<b>IHEI Number:</b> N/A
<b>Date:</b> 11/05/2024	<b>Time:</b> 0920	<b>Location:</b> 2025E Room 134

**Event Summary and Timeline:**

**Event Summary:**

At approximately 0920 on November 5th 2024 two workers who were performing fire extinguisher inspections encountered a stronger than normal “over charged battery, acid” smell in Room 134 of 2025E. No symptoms were reported, and all workers declined precautionary medical evaluation.

**Field Response Timeline:**

- 0941 Central Shift Manager (CSM) contacts Direct Feed Low Activity Waste (DFLAW) Industrial Hygienist (IH) 1 to request for TFC-OPS-OPER-C-67 field response actions.
- 0943 DFLAW IH 1 and Production Operations (PO) Shift Industrial Hygiene Technician (IHT) Supervisor arrive at Central Shift Office (CSO) and is briefed on event:
  - No odor descriptor provided.
  - 2025E Room 134.
  - No symptoms were reported.
  - Odor/Vapor Response Cards are currently being populated.
- 0945 Effluent Treatment Facility (ETF) Shift Operations Manager (SOM) contacts CSM to report odor descriptor: “Over charged battery, acid”.
- 0946 Shift Operations Event Notification (SOEN): “Responding to stronger than normal odors per C-67 at 2025E Rm 134. Access is restricted in Rm134. CSM”
- 0946 DFLAW IH 1 checks Data Fusion and Advisory System (DFAS) for weather events at approximate time of event (0930):
  - Stability Class – D (Neutral conditions)
  - Wind Speed – 19.0 miles per hour (MPH)
  - Wind Direction - 312° (out of Northwest)
  - Mixing Height – 1000 feet above grade
- 0947 DFLAW IH 1 informs CSM of Vapor Monitoring Detection System (VMDS) Ammonia (NH<sub>3</sub>) readings @ 0930 11/05/2024:
  - POR-518 – 27.683 parts per million (ppm)
  - POR-519 – 0.000 ppm
  - AN VTP – N/A
  - AW VTP – 10.678 ppm
  - POR-126 – 0.000 ppm
  - POR-127 – 0.000 ppm
  - 702-AZ VTP – 19.308 ppm
  - AP VTP – N/A
- 0950 Production Operations (PO) IH arrives at CSO to support field response actions.
- 0952 ETF IHT informs PO Shift IHT Supervisor that 2025E Room 134 is the facility air compressor room.
- 0953 PO Shift IHTs arrive at CSO to support field response actions.
- 0954 DFLAW IH 1 requests Direct Reading Instrumentation be acquired and prepared to support field response actions.
- 0955 CSM contacts Department of Energy (DOE) Facility Representative to provide event notification.
- 0958 PO Shift IHTs depart CSO to acquire and prepare DRI instrumentation.

NOTE: Field Response Timeline continued on next page.

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**INDUSTRIAL HYGIENE EVENT INVESTIGATION REPORT (IHIR) (Continued)**

**Event Summary and Timeline:**

Field Response Timeline continued:

0959 CSM contacts ETF SOM for additional information:

- Workers were performing inspection of fire extinguishers.
- No RPE was being worn in affected area at time of event.
- Odor descriptors provided: “rotten eggs”.
- SOM has directed placement of fans and propped open access door to dissipate odor.

0959 DFLAW IH 1 contacts DFLAW IH 2 for information related to event initiation:

- Room 134 door was opened, and fans were placed at approximately 0930.
- Access restriction was in-place at 0937.
- O/VRCs are currently being populated.

1001 DFLAW IH Manager arrives at CSO to provide support for field response actions.

1004 CSM contacts Issues Management (IM) to determine IM Point of Contact (POC).

1005 CSM contacts IM POC to assign Event Investigation Report (EIR) number.

1006 PO Shift IHT Supervisor provides event notification and briefing to IH Level 2 Manager and Environmental Safety Health & Quality (ESH&Q) Level 1 Manager and ESH&Q Level 1 Deputy Manager.

1007 CSM provides IM POC event notification and briefing.

1010 CSM provides updated briefing to DOE Facility Representative.

1016 IM POC contacts CSM for additional information.

1018 O/VRCs arrive at CSO and are reviewed by CSM and DFLAW IH 1.

1019 TFC-OPS-OPER-C-67 Attachment A “response Plan” Page 1 approved by CSM and DFLAW IH 1.

1050 PO Shift IHTs arrive at CSO with requested DRI to support field response actions.

1051 DFLAW IH 1 provides response action briefing to PO Shift IHTs:

- Perform monitoring as per IHSP-POE-MULTI-TFCOPSOPER67:
  - NH<sub>3</sub> – Action Limit (AL) 12 ppm
  - Volatile Organic Compounds (VOCs) (10.6 eV PID) – AL 2 ppm
  - VOCs (11.7 eV PID) - AL N/A, for indication purposes only.
  - Sulfur Dioxide (SO<sub>2</sub>) – AL 0.1 ppm
  - Nitric Oxide (NO) – AL 12.5 ppm
  - Nitrogen Dioxide (NO<sub>2</sub>) – AL 0.1 ppm
  - Hydrogen Sulfide (H<sub>2</sub>S) – Action Limit 0.5 ppm
  - Carbon Monoxide (CO) – Action level 12 ppm
- Respiratory Protection Equipment (RPE) – voluntary use.
- Survey all accessible areas of the 2025E room 134.

1053 Field Response Team (PO Shift IHTs and DFLAW IH 1) depart CSO to perform field response actions.

1101 Field Response Team arrives at 2025E.

1102 Field Response Team is joined by DFLAW IH 2 to support field response actions.

1105 Field Response Team checks in with ETF SOM.

1107 Field Response Team arrives at 2025E Room 134.

- All Area DRI readings less than detectable.

1120 Field Response Team departs 2025E Room 134.

1122 Field Response Team notifies ETF SOM that field response actions are complete.

1126 Field Response Team departs 2025E.

1133 DFLAW IH 1 arrives at CSO.

1208 PO Shift IHT notifies DFLAW IH 1 that all DRI passed post-use-function-test.

1210 DFLAW IH 1 and CSM approve TFC-OPS-OPER-C-67 Attachment A “Response Plan” Page 2.

1214 SOEN: “Response actions for C-67 event at ETF have been completed with all readings below background. Normal Access is restored to Rm 134 at 2025E. CSM”

NOTE: Field Response Timeline continued on next page.

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**INDUSTRIAL HYGIENE EVENT INVESTIGATION REPORT (IHIR) (Continued)**

**Event Summary and Timeline:**

Field Response Timeline continued:

**Field Response Timeline Acronyms:**

CO	Carbon Monoxide
CSM	Central Shift Manager
CSO	Central Shift Office
DFAS	Data Fusion & Advisory System
DFLAW	Direct Feed Low Activity Waste
DOE	Department of Energy
DRI	direct reading instrument
ESH&Q	Environmental, Safety, Health, & Quality
ETF	Effluent Treatment Facility
eV	electron-volts
H <sub>2</sub> S	Hydrogen Sulfide
IH	Industrial Hygienist
IHT	Industrial Hygiene Technician
mph	miles per hour
NH <sub>3</sub>	Ammonia
NO	Nitric Oxide
NO <sub>2</sub>	Nitrogen Dioxide
O/VRC	Odor/Vapor Response Card
PID	photoionization detector
POC	Point of Contact
PO	Production Operations
ppm	parts per million
SOM	Shift Operations Manager
SOEN	Shift Office Event Notification
SO <sub>2</sub>	Sulfur Dioxide
VMDS	Vapor Monitoring Detection System
VOC	Volatile Organic Compound
VTP	Ventilation Train Primary

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**INDUSTRIAL HYGIENE EVENT INVESTIGATION REPORT (IHIR) (Continued)**

**Sampling/Monitoring Results:**

**Direct Reading Instrument Monitoring Results:**

- Due to placement of large air moving equipment within room 134 and opening of facility access point before initiation of field response actions odors matching the provided odor descriptors were no longer present in the affected area.
- DRI readings acquired during initial field response:

Location	NH <sub>3</sub>	VOCs (10.6 eV PID)	VOCs (11.7 eV PID)	H <sub>2</sub> S	NO	NO <sub>2</sub>	CO	SO <sub>2</sub>
2025E Room 134 General Area	< 1 ppm	<0.010 ppm	<0.010 ppm	<0.1 ppm	<0.5 ppm	<0.1 ppm	< 1 ppm	<0.1 ppm
2025E Room 134 General Area	< 1 ppm	<0.010 ppm	<0.010 ppm	<0.1 ppm	<0.5 ppm	<0.1 ppm	< 1 ppm	<0.1 ppm
2025E Room 134 General Area	< 1 ppm	<0.010 ppm	<0.010 ppm	<0.1 ppm	<0.5 ppm	<0.1 ppm	< 1 ppm	<0.1 ppm
Growth Inhibitor tank opening	< 1 ppm	<0.010 ppm	<0.010 ppm	<0.1 ppm	<0.5 ppm	1.5 ppm	< 1 ppm	<0.1 ppm

**Sampling Results:**

N/A

**Sampling/Monitoring Results Acronyms:**

CO	Carbon Monoxide
DRI	Direct Reading Instrumentation
eV	Electron Volts
H <sub>2</sub> S	Hydrogen Sulfide
NH <sub>3</sub>	Ammonia
NO	Nitric Oxide
NO <sub>2</sub>	Nitrogen Dioxide
PID	Photo Ionization Detector
ppm	Parts Per Million
SO <sub>2</sub>	Sulfur Dioxide
VOCs	Volatile Organic Compounds

**SWIHD References:**

**Event Response Site Wide Industrial Hygiene Database DRI Surveys:**

- DRI # 24-07305 "TFC-OPS-OPER-C-67 at ETF 2025E Rm 134"

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**INDUSTRIAL HYGIENE EVENT INVESTIGATION REPORT (IHIR) (Continued)**

**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. Voluntary-use of Respiratory Protection Equipment was offered to event response participants, but was declined.

While the odor description is inconsistent with Tank Waste Chemical Vapors, due to the proximity to the Tank Farms and workforce cultural expectations, 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:**

**DFAS Multi-Farm View Exhauster Plume Model: 11/05/2024 @ 0920 (approximate time of initiating event):**



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

**DFAS Weather Conditions: 11/05/2024 @ 0920 (approximate time of initiating event):**

- Wind Speed: 17.1 mph (15-minute average)
- Wind Direction: 312° (out of Northwest)
- Mixing Height: 100 feet above grade
- Stability Class: D (neutral conditions)

NOTE: Additional Information continued on next page.

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**Additional Information:**

Additional Information continued:

The atmospheric stability is the tendency of the atmosphere to increase or decrease the vertical displacement of air through mode of force such as the wind. This function is closely related to the ability of the atmosphere to disperse pollutants. Atmospheric stability cannot be measured directly. Rather, it is generally estimated based on the wind velocity and the solar radiation (Casal, 2008). The stability is also impacted by the slope of the temperature relative to altitude (environmental lapse rate) (CushmanRoisin, 2012). The National Oceanic and Atmospheric Administration (NOAA) Pasquill stability classes are denoted by 7 letters ranging from A (extremely unstable conditions) to G (extremely stable conditions). An unstable atmosphere is characterized by significant vertical displacement of air, a negative vertical temperature gradient (the temperature decreases with height), along with frequent fluctuations in wind direction and strong solar radiation. A stable atmosphere has low turbulence, positive vertical temperature (temperature increases with height), little fluctuation in the wind direction, and limited solar radiation (Casal, 2008). Exhauster plumes may move horizontally (stability classes A, B, C, and D) or vertical (stability classes E, F, and G). Horizontal plumes found during unstable and neutral states are further characterized by their pattern: fanning, fumigation, coning, looping, and lofting. At Hanford Tank Farms exhauster plumes may interact with ground level during stability class A conditions if the Mixing Height constricts plume dispersion at sufficiently low levels (typically less than 100 ft. above grade). The concentration of plume-borne contaminants at the ground level receptor is dependent on the concentration of the emission and the factor of dilution occurring through dispersion as the plume emission moves away from the emission point.

**Vapor Monitoring Detection System (VMDS):**

Active ventilation systems exhaust a mixture of all connected tanks with output through a “stack”. The emission of exhaust ventilation systems is monitored either continuously by the VMDS or periodically by alternate monitoring.

VMDS exhauster ammonia readings on 11/05/2024 @ 0920 (approximate time of initiating event):

- POR518 (241-A): 34.598 ppm
- POR519 (241-A): 0.000 ppm
- 241-AN: N/A
- 241-AW: 10.331 ppm
- POR126 (241-AX): 0.000 ppm
- POR127 (241-AX): 0.000 ppm
- 702AZ (241-AY/AZ): 20.697 ppm
- 241-AP: 26.290 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

NOTE: Additional Information continued on next page.

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**Additional Information:**

Additional Information continued:

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) summary: 10/29/2024 @ 0920 to 11/05/2024 @ 0920:

Tank Farm	Exhauster	Minimum* <sup>A</sup>	Maximum* <sup>A</sup>
241-A	POR518/POR519	0.000 ppm	151.046 ppm
241-AN	Primary	N/A	N/A
241-AP	Primary	0.000 ppm	48.164 ppm
241-AW	Primary	7.908 ppm	18.836 ppm
241-AX	POR126/POR127	0.000 ppm	23.056 ppm
241-AY/AZ	702AZ	N/A	29.216 ppm

\*<sup>A</sup> VMDS Alternate Real Time Monitoring performed 10/29/2024 to 11/05/2024 for 241-A (POR518/POR519), 241-AN, 241-AP, 241-AY/AZ, 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 10/29/2024 to 11/05/2024:

Tank Farm	Exhauster	Minimum	Maximum
241-A	POR518/POR519	4 ppm	78 ppm
241-AN	Primary	12 ppm	27 ppm
241-AP	Primary	11 ppm	11 ppm
241-AW	Primary	N/A	N/A
241-AX	POR126/POR127	N/A	N/A
241-AY/AZ	702AZ	21 ppm	46 ppm
241-SY	Primary	2 ppm	24 ppm

NOTE: Additional Information continued on next page.

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**Additional Information:**

Additional Information continued:

Odor descriptors provided by Affected Workers are inconsistent with Tank Vapors. Additionally, 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; as concentrations at emission points was insufficient to allow for the possibility of notable concentrations at the ground receptor, weather conditions did not allow for ground-plume interaction, and the event location was located a significant distance from ant Tank Farm chemical vapor emission points.

**Monitoring Selections Based on Information Provided by Affected Workers:**

Based on the odor descriptors provided affected workers DRI monitoring for Ammonia, VOCs (10.6 eV PID and 11.7 eV PID), Hydrogen Sulfide, Carbon Monoxide, Sulfur Dioxide, Nitric Oxide, and Nitrogen Dioxide was requested:

**ETF specific monitoring strategy:**

Minimal odors associated with stagnant water is an anticipated occurrence at the Effluent Treatment Facility (ETF). Low levels of Hydrogen Sulfide (H<sub>2</sub>S) gas, Ammonia (NH<sub>3</sub>), and various Volatile Organic Compounds (VOCs) may be produced by the stagnant water at the ETF when within a confined area for an extended period.

Low levels of Hydrogen Sulfide (H<sub>2</sub>S) gas is produced at the ETF when sulfate containing water, low airflow, and sulfur seeking bacteria stagnate within a confined area for an extended period. Hydrogen Sulfide gas has an offensive distinct rotten egg odor that is detectable at very low concentrations. The American Industrial Hygiene Association (AIHA) Odor Threshold for Chemicals with Established Health Standards, 2nd Edition, lists the lower range of odor values for H<sub>2</sub>S as 40 ppt (or 0.04 ppb or 0.00004 ppm). While odors may be readily perceived, concentrations are still well below levels of worker exposure concern. H<sub>2</sub>S gas production rate is a function of sulfate/bacteria/organics concentrations, temperature, and dissolved oxygen. Relatively moderate levels of sulfate ions are both introduced (via sulfuric acid) and inherent in the wastewater treated at the ETF. High source concentrations are not expected as the ETF wastewater streams do not contain the high sulfate/bacteria/organics found with sanitary waste (i.e. sewage). The limiting factor at the ETF is primarily the relatively low bacterial levels, followed by moderate to low levels of sulfate.

The resolution of direct reading instrument (DRI) equipped with a H<sub>2</sub>S sensor (0.1 ppm) is comparatively inadequate as a detection tool at the concentrations perceived by the human olfactory sense. While the resolution of the direct reading instrument (DRI) equipped with a H<sub>2</sub>S sensor is insufficient to detect H<sub>2</sub>S at the lower range of odor threshold values, it is sufficient to detect H<sub>2</sub>S at concentrations that approach the established occupational exposure limits (OELs).

- Action Limit: 0.5 ppm
- ACGIH 8-hour time-weighted-average (TWA) Threshold Limit Value (TLV): 1 ppm
- ACGIH 15-minute short-term-exposure-limit (STEL) TLV: 5 ppm

Low levels of NH<sub>3</sub> gas are produced at the ETF primarily as the result of natural decay of organic material through biological decomposition. The biological decomposition process produces a great number of odors from decomposition of organic material into simpler intermediate chemical compounds which can be re-introduced into the environment in the form of solids (particulates), liquids (volatile organic compounds such as alcohols, organic acids), and gases (H<sub>2</sub>S, sulfur dioxide [SO<sub>2</sub>], ammonia, methane[CH<sub>4</sub>]) (Silva, 2002; Texas A&M, 2009). NH<sub>3</sub> gas has an offensive pungent, irritating odor that is detectable at very low concentrations. The American Industrial Hygiene Association (AIHA) Odor Threshold for Chemicals with Established Health Standards, 2nd Edition, lists the lower range of odor values for H<sub>2</sub>S as 43 ppb (or 0.043 ppm). While odors may be readily perceived, concentrations are still well below levels of worker exposure concern.

The resolution of direct reading instrument (DRI) equipped with a NH<sub>3</sub> sensor (1 ppm) is comparatively inadequate as a detection tool at the concentrations perceived by the human olfactory sense. While the resolution of the direct reading instrument (DRI) equipped with an NH<sub>3</sub> sensor is insufficient to detect NH<sub>3</sub> at the lower range of odor threshold values, it is sufficient to detect NH<sub>3</sub> at concentrations that approach the established occupational exposure limits (OELs).

NOTE: Additional Information continued on next page.

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

**Additional Information:**

Additional Information continued:

- Action Limit: 12 ppm
- ACGIH 8-hour time-weighted-average (TWA) Threshold Limit Value (TLV): 25 ppm
- ACGIH 15-minute short-term-exposure-limit (STEL) TLV: 35 ppm

Low levels of volatile organic compounds (VOC) are produced at the ETF primarily as the result of natural decay of organic material through biological decomposition. The biological decomposition process produces a great number of odors from decomposition of organic material into simpler intermediate chemical compounds which can be re-introduced into the environment in the form of solids (particulates), liquids (volatile organic compounds such as alcohols, organic acids), and gases (H<sub>2</sub>S, SO<sub>2</sub>, NH<sub>3</sub>, CH<sub>4</sub>) (Silva, 2002; Texas A&M, 2009). DRI monitoring for VOCs at ETF is utilized for indication purposes only.

**Chemical Use Vapors:**

If chemical use is the suspected source of odors, a review of the applicable MSDS/GHS-SDS will be conducted to determine the appropriate DRI and applicable manufacturer's correction factor (CF). The development of a compound specific AL will be performed on a case-by-case and documented on the Response Plan.

As specific chemical constituents currently stored in 2025E Room 134 could not be identified at the time of response plan development, VOC monitoring utilizing both 10.6 eV PID and 11.7 eV PID was selected for indication purposes only.

**Additional Monitoring Selections:**

As "acid" was specified as an odor descriptor by affected workers all available monitoring equipment utilizing electrochemical sensors for molecules with high electronegativity were selected (Nitric Oxide, Nitrogen Dioxide, Sulfur Dioxide, Carbon Monoxide).

**Monitoring Strategy References:**

Refer to [TOC-IH-58956](#) for more detail on the monitoring strategy for response to odors.

Refer to [SIHEA-PO-ETF-01](#) Attachment F for more detail on the monitoring strategy utilized for routine work at ETF.

NOTE: Additional Information continued on next page.

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

**Additional Information:**

Additional Information continued:

**Chemicals associated with Odor Descriptors provided by O/VRCs and Associated Odor Thresholds:**

The American Industrial Hygiene Association “Odor Thresholds for Chemicals with Established Health Standards” (2<sup>nd</sup> Edition) and the American Industrial Hygiene Association “Odor Thresholds for Chemicals” (4<sup>th</sup> Edition) provides a reference list of chemicals associated with typical odor descriptors. Below is the reference list of chemicals associated with odor descriptors provided by O/VRCs and their applicable OELs. Chemicals where the odor detection concentration is similar to or greater than the associated OEL are notated in **gray**.

Odor Descriptor	Chemical	Lowest Detection Concentration	Lowest Recognition Concentration	Applicable OEL
Rotten Eggs	Hydrogen Sulfide	0.00007 ppm	0.00046 to 0.00093 ppm	1 ppm TWA (ACGIH TLV)

Odor Descriptor	Chemical	Lowest Detection Concentration	Lowest Recognition Concentration	Applicable OEL
Sulfur	Amyl Mercaptan	0.00012868 ppm	N/A	0.5 ppm Ceiling (NIOSH REL)
	Butyl Mercaptan	0.0000027 ppm	0.00073 ppm	0.5 ppm TWA (ACGIH TLV)
	Carbon Disulfide	0.022 ppm	0.21 ppm	1 ppm TWA (ACGIH TLV)
	Dimethyl Disulfide	0.00029 ppm	0.00286 ppm	0.5 ppm TWA (ACGIH TLV)
	Dimethyl Sulfide	0.000110 ppm	0.006 ppm	10 ppm TWA (ACGIH TLV)
	Ethyl Mercaptan	0.000017 ppm	0.00029 ppm	0.5 ppm TWA (ACGIH TLV)
	Hexyl Mercaptan (1-Hexanethiol)	0.0000041 ppm	N/A	0.5 ppm Ceiling (NIOSH REL)
	Hydrogen Sulfide	0.00007 ppm	0.00046 to 0.00093 ppm	1 ppm TWA (ACGIH TLV)
	Mercaptoethanol	0.075 ppm	N/A	N/A
	Methyl Mercaptan	0.0000002 ppm	0.000071 ppm	0.5 ppm TWA (ACGIH TLV)
	Methyl Methacrylate	0.049 ppm	0.21 ppm	50 ppm TWA (ACGIH TLV)
	Octyl Mercaptan	0.0000167 ppm	N/A	N/A
	Sulfur Dioxide	0.11 ppm	0.46 ppm	0.25 ppm STEL (ACGIH TLV)
	Diethyl Trisulfide	0.001 ppm	N/A	N/A
	Benzothiazole	0.00003 ppm	N/A	N/A
	Ethyl Methyl Disulfide	0.01 ppm	N/A	N/A
Diethyl Sulfide	0.001 ppm	N/A	N/A	

Odor Descriptor	Chemical	Lowest Detection Concentration	Lowest Recognition Concentration	Applicable OEL
Acid; Acidic	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)
	Cyanogen Chloride	0.994 ppm	N/A	0.3 ppm Ceiling (ACGIH TLV)
	Phenol	0.0055 ppm	0.034 ppm	5 ppm TWA (ACGIH TLV)
	Propionic Acid	0.00099 ppm	0.0083 ppm	10 ppm TWA (ACGIH TLV)

**Odor Threshold References:**

- American Industrial Hygiene Association (2013). Odor Thresholds for Chemicals with Established Health Standards, 2<sup>nd</sup> Edition.
- American Industrial Hygiene Association (2024). Odor Thresholds for Chemicals, 4<sup>th</sup> Edition.

NOTE: Additional Information continued on next page.

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

**Additional Information:**

Additional Information continued:

**Additional Information Acronyms:**

ACGIH	American Conference of Governmental Industrial Hygienists
AIHA	American Industrial Hygiene Association
AL	Action Limit
COPC	chemicals of potential concern
DFAS	Data Fusion & Advisory System
DRI	direct reading instrument
ETF	Effluent Treatment Plant
eV	electron-volts
H <sub>2</sub> S	Hydrogen Sulfide
NH <sub>3</sub>	Ammonia
NOAA	National Oceanic and Atmospheric Administration
OEL	Occupational Exposure Limit
OSHA	Occupational Safety & Health Administration
O/VRC	Odor/Vapor Response Card
PEL	Permissible Exposure Limit
PID	photoionization detector
ppb	parts per Billion
ppm	parts per million
ppt	Parts per trillion
QRA	Quantitative Risk Assessment
REL	Recommended Exposure Limit
RPE	Respiratory Protection Equipment
SO <sub>2</sub>	Sulfur Dioxide
STEL	Short Term Exposure Limit
TLV	Threshold Limit Value
TWA	Time Weighted Average
VMDS	Vapor Monitoring Detection System
VOC	Volatile Organic Compounds

NOTE: Additional Information continued on next page.

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

**Additional Information:**

Additional Information continued:

**Additional Information 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.
- American Industrial Hygiene Association (2024). Odor Thresholds for Chemicals, 4<sup>th</sup> Edition.
- American Industrial Hygiene Association (2013). Odor Thresholds for Chemicals with Established Health Standards, 2<sup>nd</sup> Edition.
- Memo WRPS-1904672.1, TANK FARM EXHAUST ~ CK CONCENTRATION ALARM/ ACTION LEVELS FOR AMMONIA
- National Institute of Standards and Technology. NIST Chemistry WebBook, SRD#69. Retrieved from: <https://webbook.nist.gov/chemistry/>
- NIOSH Pocket Guide to Chemical Hazards. Dept. of Health and Human Services, Public Health Service, Centers for Disease Control and Prevention, National Institute for Occupational Safety and Health.
- 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>
- [SIHEA-PO-ETF-01](#) "Routine Work Activities at ETF" Attachment F
- [TOC-IH-58956](#). Monitoring Strategy for Response to Odors: Common Odor Sources in the 200 East, 200 West, & 600 Areas.



## ODOR/VAPOR RESPONSE CARD

In 154 Compressor Room

### Instructions:

1. Notify Immediate Supervisor.
2. Contact Central Shift Manager (CSM), at (509) 373-2689.
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/VAPOR RESPONSE CARD

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

- Date and time of event: 11/5/24 09:00am
- Check Applicable:
  - Odor
  - Ammonia Alarm (6 ppm)
  - Ammonia Alarm (12 ppm)
  - Alarm (other - describe):

Your name and the work you were performing:  
Fire extinguisher inspection

Other Work Underway? Describe:  
None

Location of event (mark area on map and wind direction):  
Rm 134 Compressor Room

Name(s) of others in or near the affected area:  
[Redacted]

Was Industrial Hygiene present, who?  
NO

- Describe the odor:
- Sweet
  - Sour
  - Smoky
  - Musty
  - Rotten
  - Metallic
  - Onion
  - Earthy
  - Citrus
  - Solvent
  - Other (describe): Acidic/Sulfur
  - Septic/Sewer
  - Ammonia

Is source known/likely? Describe:  
NO

- Your symptoms?  None none currently
- 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/USR, Supervisor/IH/USR will ensure card is provided to the CSM.

## ODOR/VAPOR RESPONSE CARD

### Instructions:

1. Notify Immediate Supervisor.
2. Contact Central Shift Manager (CSM), at (509) 373-2689.
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.

MAP???

Room 134 Door 7 Fire Extinguisher  
Immediately to the Right.

# ODOR/VAPOR RESPONSE CARD

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

- Date and time of event: 11/15/24 09:30
- Check Applicable:
  - Odor
  - Ammonia Alarm (6 ppm)
  - Ammonia Alarm (12 ppm)
  - Alarm (other - describe):

• Your name and the work you were performing:

Fuse Extrusion Inspector

• Other Work Underway? Describe:

None

• Location of event (mark area on map and wind direction):

Room 134 Door 7 Compressor Room

• 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):

• Is source known/likely? Describe: Acidic, Sulfur, Rotten Egg

No

• Your symptoms?  None Currently

- 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.