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: Production Operations **2. Report Date:** 12/13/2023

3. Investigation Title: TFC-OPS-OPER-C-67 Response at MO-2522

4. Investigation Report Number: EIR-2023-092

5. Responsible Manager: [redacted]

6. Event Investigator: [redacted]

7. Area / Building / Location: 200E/MO-2522

8. Date and Approximate Time of Event: Date: 12/11/2023 **Time *(military)*:** 0730 Hours

9. Associated Action Request (AR) Number: WRPS-AR-2024-0516

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)*

Two Nuclear Chemical Operators (NCOs) were performing laundry restock at MO-2522.

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

– 2 Nuclear Chemical Operators (NCOs).

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

On 12/11/2023, at approximately 0730 hours, two NCOs reported "septic/sewer" like odors while performing laundry restocking duties inside MO-2522. The two NCOs did not report experiencing symptoms and were offered, yet declined, precautionary medical evaluation.

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

Inside MO-2522 [Wet Grout Loop Men's Change Room (Shower Trailer)].

The NCOs were wearing standard street clothes (which is considered Level D PPE) and were in a work location that is not posted as a radiologically controlled area. Workers were performing work activities that do not require 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 0730 hours on 12/11/2023:

- Wind Speed: 8 mph
- Wind Direction: 301° (out of Northwest)
- Mixing Height: 140 feet above grade
- Stability Class: E (slightly stable conditions)
- Barometric Pressure: 29.54 inches Hg and rising.

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

Access was restricted to MO-2522. No operational impacts, impacts to facility safety status, or facility reliability occurred.

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

- The Central Shift Manager (CSM) initiated TFC-OPS-OPER-C-67, "Response to Stronger than Normal Odors," response actions and restricted access to MO-2522.
- The CSM made required TFC-OPS-OPER-C-67 notifications.
- Event Investigation EIR-2023-092, "TFC-OPS-OPER-C-67 Odor Response at MO-2522," 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-00086, "TFC-OPS-OPER-C-67 Response at MO-2522," investigation and direct reading instrument (DRI) monitoring could not readily identify the odor source, although, the reported odors were determined to likely be a combination of sewer p-traps, used gym clothing and equipment, and/or infrequent use of change/shower trailer over the weekend. Odor descriptors provided by affected workers are not consistent with Tank Vapor sources. 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.

The following considerations support the IHIR-00086 conclusion:

(1) A previous similar odor was reported in this location on Monday, July 24, 2023, and was determined to likely be resultant of dried out p-traps in the shower drains. Industrial Hygiene (IH) personnel performing TFC-OPS-OPER-C-67 response actions for this event occurrence noted the MO-2522 odor was not as strong as a previous response where p-traps had dried out, and the odor was described as being more like sweaty/used socks or equipment, mildew, or sewage. There appeared to be water in all the p-traps in the drains, however, used gym clothing and equipment was observed within the shower trailer/locker rooms. Under normal use, MO-2522 is ventilated regularly from an exhaust fan that operates when overhead lighting is turned on. Due to the fact the odor was experienced on a Monday, and it's presumable that trailer had not been utilized during the weekend, odors could have accumulated from the varying odoriferous sources within the shower trailer/locker room areas. Once the MO-2522 door was opened and the light and ventilation turned on, odors were purged and quickly dissipated from the change room.

(2) DRI monitoring for hydrogen sulfide was conducted during the TFC-OPS-OPER-C-67 response based on the "septic/sewer" odor descriptor provided by the Affected Workers. Investigative TFC-OPS-OPER-C-67 DRI monitoring indicated hydrogen sulfide concentrations of <0.1 ppm.

The resolution of DRI equipped with a hydrogen sulfide sensor (0.1 ppm) is comparatively inadequate as a detection tool at the concentrations perceived by the human olfactory senses. 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 odor threshold value being 0.00004 ppm. While the resolution of the DRI is insufficient to detect concentration 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).

(3) While the reported odor descriptions are inconsistent with Tank Waste Chemical Vapors, due to the proximity of MO-2522 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 Volatile Organic Compounds (VOCs) utilizing a DRI equipped 10.6 eV photoionization detector provides further indication for Tank Waste Chemical Vapors/COPCs.

Investigative TFC-OPS-OPER-C-67 DRI monitoring in the general areas inside and outside of MO-2522 indicated less than detectable concentrations for ammonia (< 1 ppm) and 0.04 ppm VOCs, which are below anticipated background levels. Providing further indication the cause of the reported odors was unlikely to be resultant of Tank Farm exhauster emissions.

(4) Low levels of hydrogen sulfide gas (consistent with Affected Workers' odor description), ammonia, and various VOCs are a function of bacteria/organics concentrations, temperature, and dissolved oxygen and may be produced by stagnant water and/or from a dried-out P-trap in drainage piping.

While transient odors may be readily perceived, concentrations are still well below levels of worker exposure concern. Investigative TFC-OPS-OPER-C-67 DRI monitoring conducted within the general areas of MO-2522 and source readings from the shower drains indicated less than detectable concentrations for ammonia (< 1 ppm) and hydrogen sulfide (<0.1 ppm) and peak VOC readings of 0.050 ppm.

(5) The Affected Area has a long history of similar 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 "sewer/septic" odor, which could be indicative of nearby septic related equipment. The closest sewer system located upwind of the Affected Area, and connected to the Affected Area's drains, is the 2607-E10 Septic Tank system (~100' upwind).

(6) Evaluation of the weather details determined the cause of the odor source was unlikely to be resultant of Tank Farms exhauster emissions based on the wind direction, wind speed, mixing height, and stability class.

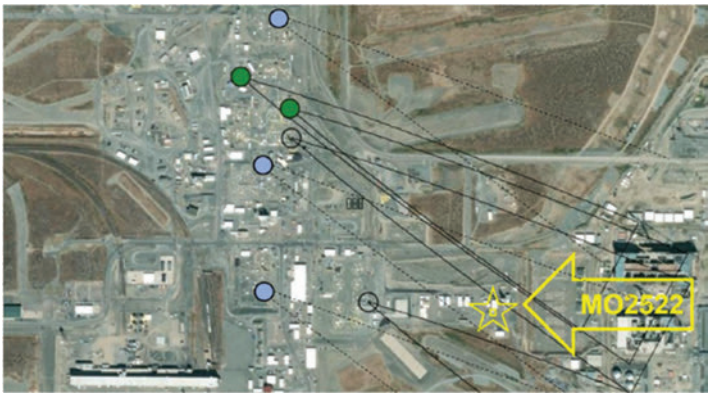


Figure 1- DFAS Exhauster Potential Exposure Zone Model

(7) 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, 0 ppm at the POR-126 exhauster, 2.186 ppm at the POR-127, and 28.018 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, IHT Ammonia Monitoring on Exhausters, when ammonia stack monitoring via VMDS is unavailable. The highest ammonia concentrations observed between 12/04/2023 and 12/10/2023 was 5 ppm at the AP Exhauster. Conservatively utilizing the higher ammonia concentration observed in the 702-AZ exhauster, a predicted ground receptor ammonia concentration of 0.159 ppm (or 0.64% of the established Occupational Exposure Limit for ammonia) would be expected if AP, AY/AZ, AX tank, or AW farm exhauster emissions were present.

The exhauster high level alarm conservatively established for A farm is 160 ppm. According to the VMDS, the ammonia concentration observed at the time of event occurrence was 3.231 ppm at the POR-518 exhauster and 0.805 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 0.050 ppm (or 0.20% 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.

(8) While MO-2522 is located within the area of the Grout Treatment Facility (GTF), the cause of the odors is unlikely to be resultant from the GTF. The GTF Waste Information Data System (WIDS) General Summary Report indicates the GTF ditch was backfilled and stabilized. In addition, the leachate that was stored at GTF and the excess water from the vaults and flush solutions was transferred back to the Double Shell Tank (DST) System. The dry materials (from the Dry Materials Receiving and Handling Facility) were trucked to the Transportable Grout Equipment, where the dry blend was mixed with liquid additives and aqueous waste to form a cementitious slurry. The slurry was pumped to a below grade vault located in the GTF Landfill, where it hardened.

21. Positive Aspects Identified:

None.

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.

[X] This event does not require continuation of the Event Investigation process.

Responsible Manager Approval:

[redacted]
Name (First, Middle Initial, Last)

[redacted]
Date: 2023.12.14 15:00:15 -08'00'
Signature / Date

CAS Manager Approval:

[redacted]
Name (First, Middle Initial, Last)

[redacted]
Date: 2023.12.14 15:10:51 -08'00'
Signature / Date

Washington River Protection Solutions

INDUSTRIAL HYGIENE EVENT INVESTIGATION REPORT

Event Title:	PER Number:
TFC-OPS-OPER-C-67 Response MO2522	N/A
	IHIR Number: IHIR-00086

Date:	Time:	Location:
12/11/2023	0730	MO2522 [Wet Grout Loop Men's Change Room (Shower Trailer)]

Event Summary and Timeline:

Event Summary:

At approximately 0730 on 12/11/2023 two Nuclear Chemical Operators (NCOs) encountered a stronger than normal "septic/sewer" odor inside of MO2522 while restocking laundry. No symptoms were reported. Workers were offered precautionary medical evaluation and both declined.

Field Response Timeline:

0739 Central Shift Manager (CSM) notifies Production Operations-East (POE) Shift Industrial Hygiene Technician (IHT) Supervisor of stronger than normal odors and TFC-OPS-OPER-C-67 response
0740 IHT Shift Supervisor informs POE Shift IHTs of TFC-OPS-OPER-C-67 response and to start preparing DRI instrumentation
0742 Shift IHTs request IHT Shift Supervisor indicate required sensors
0742 POE Shift IHT Supervisor notifies POE Industrial Hygienist (IH) 1 and POE IH-2 of TFC-OPS-OPER-C-67 response
0746 POE IH-1 and POE Level 3 Safety & Health (S&H) Manager arrive at Central Shift Office (CSO)
0746 NCO and Operating Engineer (OE) in route to demarcate trailer
0746 IHT Shift Supervisor informs POE Shift IHTs to prepare DRI instrumentation with the following sensors based on recent similar response: Hydrogen sulfide, ammonia, volatile organic compounds(VOC) 10.6 eV photoionization detector (PID)
0748 POE IH-2 arrives at CSO
0748 CSM updates POE IHs on stronger than normal odors:
- Odor Descriptor: "septic/sewer"
- MO2522 (shower trailer in Wet Grout Loop)
- Two Affected Workers
- Both NCOs performing laundry activities

0749 POE Shift IHT Supervisor confirms sensor selection with POE IHs and then confirms with Shift IHTs
0749 CSM notifies Department of Energy (DOE) Facility Representative (Fac. Rep.) of stronger than normal odors and TFC-OPS-OPER-C-67 response
0752 CSM makes radio announcement of MO2522 access restriction and TFC-OPS-OPER-C-67 response. CSM informs POE IHs that the Shift Office Event Notification (SOEN)system is down
0753 POE IH-2 contacts Hanford Meteorological Station for weather information for Station #6 at 0730 on 12/11/2023:
- Temperature: 38°F
- Relative Humidity: 85%
- Wind Speed: 8 mph
- Wind Direction: from North West
- Barometric Pressure: 29.54 inches of mercury and rising

0753 CSM checks Data Fusion Advisory System (DFAS), powered SmartSite™, for current weather details:
- Wind Direction: 301° (out of North West)
- Mixing Height: 140 feet above grade

0755 POE IH-3 (POE IH In-Training) arrives at CSO
0757 CSM contacts Performance Assurance (PA) to obtain PA Point-of-Contact
- PA assigns PA Technical Specialist

0803 NCO and OE arrive at CSO and confirm signs were posted at MO2522
0806 CSM notifies DOE Fac. Rep. of EIR initiation
0808 POE Shift IHT-1 arrives at CSO with DRI instrumentation with ammonia and VOC 10.6 eV PID sensors

Field Response Timeline continued on next page.

Event Summary and Timeline:

Field Response Timeline (continued):

0814 POE Level 3 S&H Manager attempts to contact Level 1 Environmental, Safety, Health, & Quality (ESH&Q) Manager and Level 2 IH Manager on TFC-OPS-OPER-C-67 response:
- Two Affected Workers without symptoms
- Offered and declined precautionary medical surveillance
- "septic/sewer"
- MO2522 Shower Trailer down at Wet Grout Loop
- Affected Workers performing laundry activities

0823 POE Shift IHT-2 arrives at CSO with DRI instrumentation with hydrogen sulfide sensor
0829 Due to multiple computer connection issues POE IH-1 and CSM verbally agree to TFC-OPS-OPER-C-67 Attachment A Sheet 1 of 2, Response Plan
0830 POE IHs provide POE Shift IHTs and POE IH-3 briefing for response:
- Monitor per IHSP-POE-MULTI-TFCOPSOPERC67:
  - DRI equipped with the following sensors:
    - Hydrogen Sulfide
    - Ammonia
    - VOC 10.6 eV PID
  - Survey around the floor drains/p-traps
  - General area inside MO2522
- Respiratory Protection Equipment not required, Voluntary Use

0831 Responding POE IH (POE IH-3) and POE Shift IHTs depart CSO for Response Actions.
0833 POE Level 3 S&H Manager requests IH Records to obtain an IH Event Investigation Report (IHIR) number
0836 CSM and POE IH-1 sign TFC-OPS-OPER-C-67 Attachment A Sheet 1 of 2, Response Plan
0837 Responding POE IH and POE Shift IHTs arrive at MO2522.
0838 POE IH-3 updates POE POE IH-2:
- Entered south unit
- Less than detectable source reading at shower 1 and running shower to flush water down drains

0839 POE IH-3 updates POE IH-2:
- VOC area readings ~0.030-0.050 parts per million (ppm)

0840 POE IH-3 updates POE IH-2:
- Less than detectable source reading at shower 2

0841 POE IH-3 updates POE IH-2:
- Less than detectable source reading at shower 3
- Less than detectable area readings for hydrogen sulfide and ammonia

0845 POE IH-3 updates POE IH-2:
- Entered north unit
- Less than detectable source reading at floor drain

0846 POE IH-3 updates POE IH-2:
- POE IH-3 in route to CSO
- POE Shift IHTs in route to perform Post-Use Function Test

0851 Responding POE IH (POE IH-3) returns to CSO
0855 POE Level 3 S&H Manager attempts to update Level 1 ESH&Q Manager and Level 2 IH Manager on TFC-OPS-OPER-C-67 response:
- Post-Use Function Test

0858 POE Shift IHT-1 informs POE IHs that ammonia and VOC DRI passed the post-use function test
0859 POE IHs confirm area and source reading values and locations with POE Shift IHT-1
- Maximum Area Readings Inside and Outside MO2522
  - Hydrogen Sulfide- Less than detectable (< 0.1 ppm)
  - Ammonia- Less than detectable (< 1 ppm)
  - VOCs- 0.050 ppm
- Maximum Drain Source Readings
  - Hydrogen Sulfide- Less than detectable (< 0.1 ppm)
  - Ammonia- 1 ppm
  - VOCs- 0.050 ppm
- Heating, ventilation, air conditioning (HVAC) running on both sides of MO2522

Field Response Timeline continued on next page.

Field Response Timeline (continued):

0905 POE IH-2 confirms with CSM that Affected Employees were offered medical and declined
0911 POE Shift IHT-2 informs POE Shift IHT Supervisor that hydrogen sulfide DRI passed Post-Use Function Test
0920 CSM and POE IH-1 sign TFC-OPS-OPER-C-67 Attachment A Sheet 2 of 2, Response Plan
0920 POE IHs depart CSO
1056 SOEN: "Responded per TFC-OPS-OPER-C-67 for reported odors at MO-2522. IHT results were at or below background levels, access restored to MO-2522. CSM"

Field Response Timeline Acronyms:

CSM	Central Shift Manager	NCO	Nuclear Chemical Operator
CSO	Central Shift Office	PA	Performance Assurance
DFAS	Data Fusion Advisory System	PID	photoionization detector
DOE	Department of Energy	PO	Production Operations
DRI	direct reading instrument	POE	Production Operations-East
EIR	Event Investigation Number	ppm	parts per million
ESH&Q	Environmental, Safety, Health, & Quality	RPE	Respiratory Protection Equipment
eV	electron-volts	S&H	Safety & Health
HVAC	heating, ventilation, air conditioning	SOEN	Shift Office Event Notification
IH	Industrial Hygienist	SWIHD	Site Wide Industrial Hygiene Database
IHIR	Industrial Hygiene Event Investigation Report	VMDS	Vapor Monitoring Detection System
IHT	Industrial Hygiene Technician	VOC	Volatile Organic Compound
mph	miles per hour		

Sampling/Monitoring Results:

Direct Reading Instrument Monitoring Results:

- Monitoring performed in and around Affected Area
  - Comments by Responding POE IH- "MO2522 is split into separate North and South shower units. North contains 1 shower and a small 'locker room' area, no toilets or sinks. South contains 3 showers and a small 'locker room' area, no toilets or sinks". "After initial monitoring, ran all showers in the south unit but there was no noticeable difference in odor. Odor was not as strong as a previous response with dried p-traps and it was not the sewer type odor previously experienced, but more like sweaty gym socks or used gym equipment. It did not smell like fresh air, but also not overly strong. The north side had a weaker odor."
  - Comments by Responding IHT- "IHT's monitored MO-2522 (Men's Shower Room) in response to odors that were reported earlier in the morning. IHTs entered into the southside men's change room first. There were a total of 3 showers and 1 floor drain in this room. upon entering the change room there was a obvious bad smell. Some felt the smell was a mildew type of smell others claimed it was a sewage smell. IHT's monitored each drain for readings. There appeared to be water in all of the P-traps in the drains. There were also several lockers that contained gym clothing. The IHTs then entered the northside change room which contained 1 shower drain and 1 floor drain. the shower drain did get a reading of 1 ppm NH3, which is well below the action limit for ammonia. VOC reading fluctuated between 30-50 ppb. This was not an increase from the surrounding area. The discoverer of the odors report extremely foul odor. Under normal use, MO-2522 is ventilated regularly. Due to the fact that it was a Monday and presumable that trailer was not used during the weekend, it allowed for the odors to accumulate. Once the door was opened and the light and ventilation turned on, it allowed for the odors to be purged from the change room. "

- Peak readings during response at or below background.

Location	Ammonia	VOCs	Hydrogen Sulfide
MO2522 South Side General Area	< 1 ppm	0.030 ppm	< 0.1 ppm
MO2522 South Side Shower Drains	< 1 ppm	0.040 ppm	< 0.1 ppm
MO2522 North Side General Area	< 1 ppm	0.040 ppm	< 0.1 ppm
MO2522 North Side Shower Drains	1 ppm	0.050 ppm	< 0.1 ppm

Refer to IHIR-00086 Attachment A for SmartSite™ Summary, Response Map, and Response Pictures.

SWIHD References:

Event Response Site Wide Industrial Hygiene Database Direct Reading Instrumentation (DRI) Survey:
• # 23-08130 "C-67 response to MO-2522 "

Additional Information:

12/12/2023 0550 POE IHT Supervisor performed a follow-up walkdown of MO2522. Evidence indicated that the trailer had been cleaned. The current odor "smelled like it had been cleaned".

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.

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 PID is utilized to detect multiple VOC COPCs simultaneously. NOTE: The 2 ppm Action Limit is not applicable to chemical use.

Review of the DFAS application, powered by SmartSite™, Weather Details dashboard for the approximate time of the Event:

12/11/2023 @ 0730 (weather data at approximate time of Initiating Event):
• Wind Speed: 7.5 mph
• Wind Direction: 298.50° (out of West North West)
• Mixing Height: 140 feet above grade
• Stability Class: E (slightly stable conditions)

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

12/11/2023 @ 0753(current weather data for Response actions):
• Wind Speed: not recorded in timeline
• Wind Direction: 301° (out of North West)
• Mixing Height: 140 feet above grade
• Stability Class: not recorded in timeline

Additional Information continued on next page.

Additional Information:

Additional Information (continued):

Meteorological information from the Hanford Weather Station for Station #6 on 12/11/2023 @ 0730:
- Temperature: 38°F
- Relative Humidity: 85%
- Wind Speed: 8 mph
- Wind Direction: from North West
- Barometric Pressure: 29.54 inches of mercury and increasing

Vapor Monitoring Detection System (VMDS) exhauster ammonia readings on 12/11/2023 @ 0730:
- POR518 (241-A): 3.231 ppm
- POR519 (241-A): 0.805 ppm
- 241-AN: -1.943 ppm
- 241-AW: 0 ppm
- POR126 (241-AX): 0 ppm
- POR127 (241-AX): 2.186 ppm
- 702AZ (241-AY/AZ): 28.018 ppm
- 241-AP: N/A

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		

Vapor Monitoring Detection System (VMDS) 12/04/2023 @ 1504 to 12/11/2023 @ 1504:

Tank Farm	Exhauster	Minimum*A	Maximum*A
241-A	POR518/POR519	0 ppm	4.173 ppm
241-AN	Primary	-1.977 ppm	49.605 ppm
241-AW	Primary	0 ppm	16.734 ppm
241-AX	POR127	0 ppm	33.292 ppm
241-AY/AZ	702AZ	0 ppm	33.406 ppm

*A VMDS Alternate Real Time Monitoring performed 12/04/2023 to 12/10/2023 for 241-AP, 241-AX, and 241-A.

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.

Additional Information continued on next page.

Additional Information (continued):

Vapor Monitoring Detection System (VMDS) Alternate Monitoring 012/04/2023 to 12/10/2023:

Tank Farm	Exhauster	Minimum	Maximum
241-AP	Primary	1 ppm	5 ppm
241-AX	POR 127	0 ppm	1 ppm
241-A	POR 519	1 ppm	1 ppm

Based on the odor descriptor "septic/sewer", 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.

MO2522 NI Narrative, Original Inspection Date 04/2013-

The MO2522 unit was constructed in 2008, installed in 2010, and is 360 gross square feet in size. The unit was previously installed at 200W and has recently [prior to 04/2013] been relocated at the grout facility at the east end of the 200E. The unit has electric, water, sewer, and the HVAC is provided by a Bard wall mounted heat pump on the south end. Building access is provided by two personnel doors on the west side with one door on the east side of the unit. The structure provides shower and locker space for site contractor personnel.

Reference
MO2522 NI Narrative. Retrieved from [redacted]idms/livelink.exe?func=ll&objId=200302917&objAction=Open&nexturl=%2Fidms%2Flivelink%2Eexe%3Ffunc%3Dsrch%2ESearchCache%26cacheId%3D1918826341&logStopConditionID=12955727_1231004005_5_open

Grout Treatment Facility (GTF) Waste Information Data System (WIDS) General Summary Report-

The GTF included the Transportable Grout Equipment from the 241-AP-102 tank. The feed line is WIDS sitecode 200-E-308-PL. The fenced area, previously known as the Grout Treatment Facility has been transitioned to the construction contractor that will build the new Waste Treatment Facility (vitrification plant). The head end of the 216-A-29 ditch was located within this fenced area. The ditch was backfilled and stabilized.

The technology and process operation of the GTF was demonstrated from August 1988 through July 1989 with the treatment of 3,785,400 liters (1,000,000 gallons) of radioactive, non-dangerous waste. Processing of this waste generated leachate that was a corrosive mixed waste. The leachate was stored at GTF and later transferred back to the Double Shell Tank (DST) System.

The GTF was put on long term standby and the project was later canceled. The feed transfer system was disconnected from the 241-AP-102 Tank. The High Efficiency Particulate Air (HEPA) filters were removed from the Liquid Collection Tank/Mixer Module (Transportable Grout Equipment) ventilation system. This reduced the level of contamination in the facility. A failed mixer pump in Tank 241-AP-102 was removed in 1995. The Grout Treatment Facility was to be used as an emergency option in the event that tank space is not available to resolve tank safety issues. During operations, the waste was stored in Tank 241-AP-104 and pumped to the Grout Feed Tank 241-AP-102 . The dry materials (from the Dry Materials Receiving and Handling Facility) were trucked to the Transportable Grout Equipment. The Transportable Grout Equipment mixed the dry blend with liquid additives and aqueous waste to form a cementitious slurry. The slurry was pumped to a below grade vault located in the Grout Treatment Facility Landfill, where it hardened. Excess water from the vaults and flush solutions from the Transportable Grout Equipment were pumped to feed Tank 241-AP-102 or other tanks in the tank farms.

Additional Information continued on next page.

Additional Information (continued):

GTF WIDS General Summary Report (continued)-

Reference
WIDS. Grout Treatment Facility- General Summary Report. Retrieved from [redacted]/idms/livelink.exe/fetch/2000/18814/1081672/227793668/300922911/300982835/156482318/-/01_WIDS_Summary_Sheet.pdf?nodeid=156482325&vernum=-2

Additional information about odor conditions around Tank Farm facilities-

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 be vary between individuals.

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 "sewer/septic" odor. These odors are indicative of nearby septic related equipment. The closest sewer system located upwind of the Affected Area, and connected to the Affected Area's drains, is the 2607-E10 Septic Tank system (~100' upwind).

2607-E10 Septic System-

Water to MO2522 was tied in to the existing line currently feeding the restrooms in MO-041. Sewer was tied in down stream from MO-041 to the existing system flowing to drain field 2607-E10.

The 2607-E10 Septic Tank system consists of two tanks and two drain fields. It receives sanitary wastewater and sewage. The drain fields associated with this system has a design capacity of 1,298 gallons (4,900 liters) per day and an estimated rate of 665 gallons (2,500 liters) per day. This unit lies north of the 216-A-37-1 Crib and east of the 241-AP Tank Farm, in the area known as the Grout Treatment Facility. The 2607-E10 Septic Tank is associated with a drain field, the Grout Trailer, MO-392, MO-041, MO-282, MO-283, MO-284, MO-997 and MO-243-G4.

As of 10/06/2021, the 2607-E10 Septic Tank system was an active, permitted system that was scheduled to be abandoned in the year 2023. Document 51506-39-SUB-096-001 states MSA removed pumps, piping, valves, pipe stands, electrical wires, grouted plug openings, removed structure to 2 ft. below grade and filled with Controlled Density Fill (CDF) in 2020. One existing tank was left in place for emergency storage.

References
WIDS. 2607-E10; 2607-E10 Septic System- General Summary Report. Retrieved from [redacted]/idms/livelink.exe/fetch/2000/18814/1081672/227793668/300922911/300982835/158692742/-/01_WIDS_Summary_Sheet.pdf?nodeid=158692749&vernum=-2
WRPS-NVC-12-007. Relocate Shower Facility to Wet Grout Area. Retrieved from [redacted]/idms/livelink.exe/fetch/2000/18814/1081672/60849/154706650/154709122/165711107/-/WRPS-NVC-12-007_Relocate_Shower_Facility_MO-2522_to_Wet_Grout_Area_Grout_Drive_-_DOE_CX-00059.pdf?nodeid=167252060&vernum=-2

Additional Information continued on next page.

Additional Information (continued):

Stagnant Water/Dried-Out P-Trap Odors-

Transient odors are associated with stagnant water. Additionally, transient odors are an anticipated occurrence when a p-trap in drainage piping dries out. Low levels of hydrogen sulfide gas (consistent with Affected Workers' odor description), ammonia, and various VOCs may be produced by the stagnant water and/or from a dried-out p-trap. While odors may be readily perceived, concentrations are still well below levels of worker exposure concern.

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).

		Concentrations	
Limit Type	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-mintues if there is no other exposure to hydrogen sulfide during the shift

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.

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

The event response DRI results were less than detectable in the Affected Area for hydrogen sulfide and was at or below background levels 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) outside of Affected Area around the reported time of the event indicate the cause of the odor is unlikely to be from Tank Farm emissions. The Atmospheric Stability Class at 0730 was slightly stable. The Atmospheric Mixing Height was steady at 140 feet above grade.

At the approximate time of the event, the Barometric Pressure was increasing when the 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). As the outside air pressure was increasing at the time of the event, passively ventilated tanks, such as septic tanks, pulls air into the tank ("breathing-in"). The p-traps were found to contain water and the responding team did not experience strong sewer odors. Therefore, the cause of the odors is unlikely to be from septic tank gaseous emissions, via

Additional Information continued on next page.

Additional Information (continued):

barometric breathing and/or dried-out p-traps, from the shower drains located inside the MO2522 Shower Trailer at that time. It is possible that the automatic HVAC after initial entry may have dissipated odors that had accumulated over the weekend.

Refer to IHIR-00086 Attachment A for SmartSite™ Summary, Response Map, and Response Pictures.

Additional Information Acronyms:

ACGIH	American Conference of Governmental Industrial Hygienist		
ADM	Area Dayshift Manager	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
DST	Double Shell Tank	QRA	Quantitative Risk Assessment
eV	electron-volts	SOEN	Shift Office Event Notification
FE	Fugitive Emissions	STEL	short-term exposure limit
GTF	Grout Treatment Facility	TLV	Threshold Limit Value
HEPA	High Efficiency Particulate Air	TWA	time-weighted average
HVAC	heating, ventilation, air conditioning	VMDS	Vapor Monitoring Detection System
mph	miles per hour	VOC	Volatile Organic Compound
OEL	occupational exposure limit	WIDS	Waste Information Data System

Recommendations/Conclusions:

Recommendations:
No special recommendations. Continue routine sanitation activities.

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. Odors are consistent with an infrequently used change/shower trailer. Although known nearby sources exist, monitoring performed to support response actions did not readily identify a source. Based on observations during Response Actions, multiple potential offensive odor sources were present in the trailer such as used towels, shoes, clothing, and shower drains.

Other:

- Event Investigation Report (EIR) #2023-092.
- Action Request (AR) # WRPS-AR-2024-0516.

Industrial Hygienist:

[redacted] *Print First and Last Name*

[redacted] *Signature / Date*

Industrial Hygiene Level 2 Manager:

[redacted] *Print First and Last Name*

[redacted] *Signature / Date*

ODOR/VAPOR RESPONSE CARD

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

- Date and time of event: 12-11-2023 7:30AM
- Check Applicable:
  ☑ Odor ☐ Ammonia Alarm *(6 ppm)* ☐ Ammonia Alarm *(12 ppm)* ☐ Alarm *(other - describe)*: _____
- Your name and the work you were performing:
  [redacted] doing laundry
- Other Work Underway? Describe:
- Location of event *(mark area on map and wind direction)*:
  M02522 East Grout Loop
- Name(s) of others in or near the affected area:
- Was Industrial Hygiene present, who?
- Describe the odor:
  ☐ Sweet ☐ Sour ☐ Smoky ☑ Septic/Sewer ☐ Musty ☐ Rotten
  ☐ Metallic ☐ Onion ☐ Earthy ☐ Ammonia ☐ Citrus ☐ Solvent
  ☐ Other *(describe)*:
- Is source known/likely? Describe:
- Your symptoms? ☑ None
  JJ 12-11-23
  ☐ 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.

[redacted]

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.

East Grout Loop

M02522

Smelled bad odor

[redacted]

ODOR/VAPOR RESPONSE CARD

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

- Date and time of event: 12/11/2023
- Check Applicable:
  - ☒ Odor ☐ Ammonia Alarm *(6 ppm)* ☐ Ammonia Alarm *(12 ppm)* ☐ Alarm *(other - describe)*: _____
- Your name and the work you were performing: [redacted] laundry
- Other Work Underway? Describe: _____
- Location of event *(mark area on map and wind direction)*: no 2522
- Name(s) of others in or near the affected area: none
- Was Industrial Hygiene present, who? none
- Describe the odor:
  - ☐ Sweet ☐ Sour ☐ Smoky ☒ Septic/Sewer ☐ Musty ☐ Rotten
  - ☐ Metallic ☐ Onion ☐ Earthy ☐ Ammonia ☐ Citrus ☐ Solvent
  - ☐ Other *(describe)*:
- Is source known/likely? Describe: _____
- 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.

[redacted]

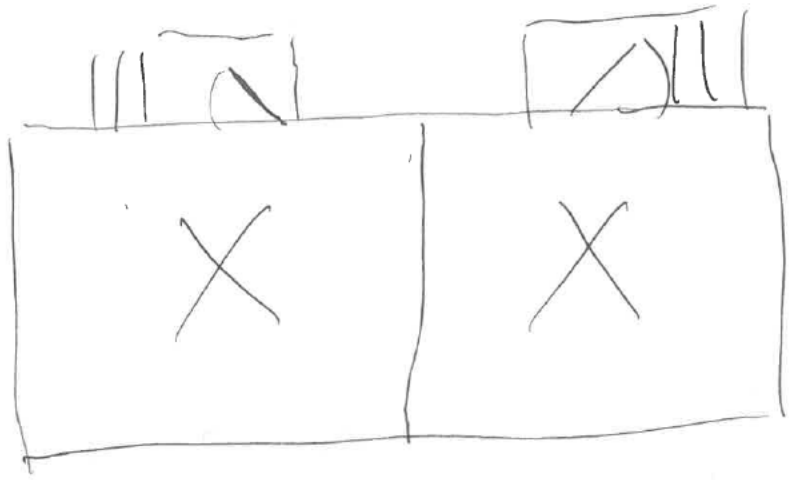
ODOR/VAPOR RESPONSE CARD

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.

Odor inside Both sides MO2522



[redacted]

Figure 1. 200-East Area (with 241-AW, 241-AP, 241-AN, 241-AY/AZ, 241-AX, 241-A Farm projected plume models) at 0730 12/11/2023 from Data Fusion and Advisory System (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 2. Wet Grout Loop Area Overview

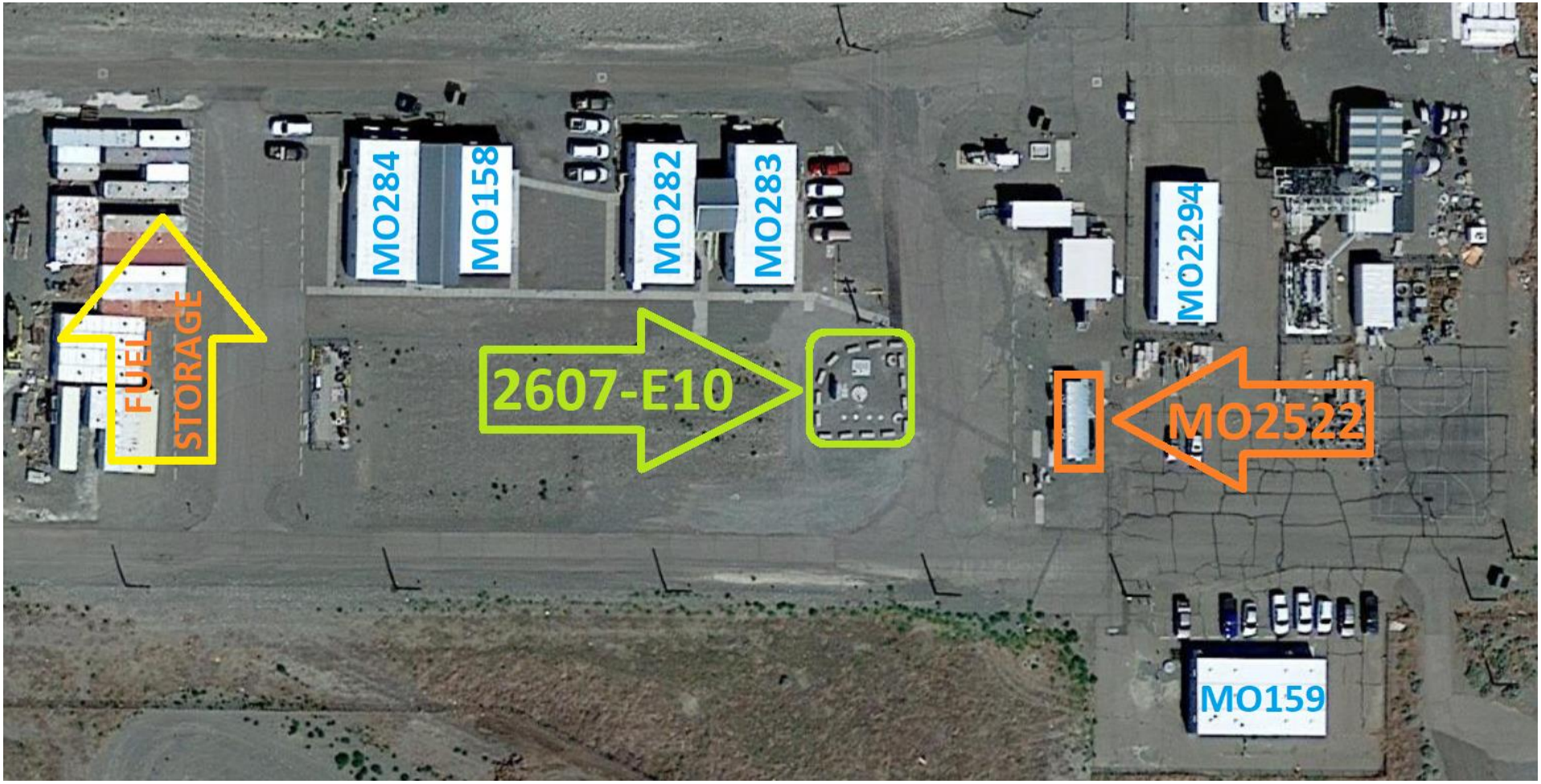


Figure 3. Wet Grout Loop Area and 2607-E10 Septic System

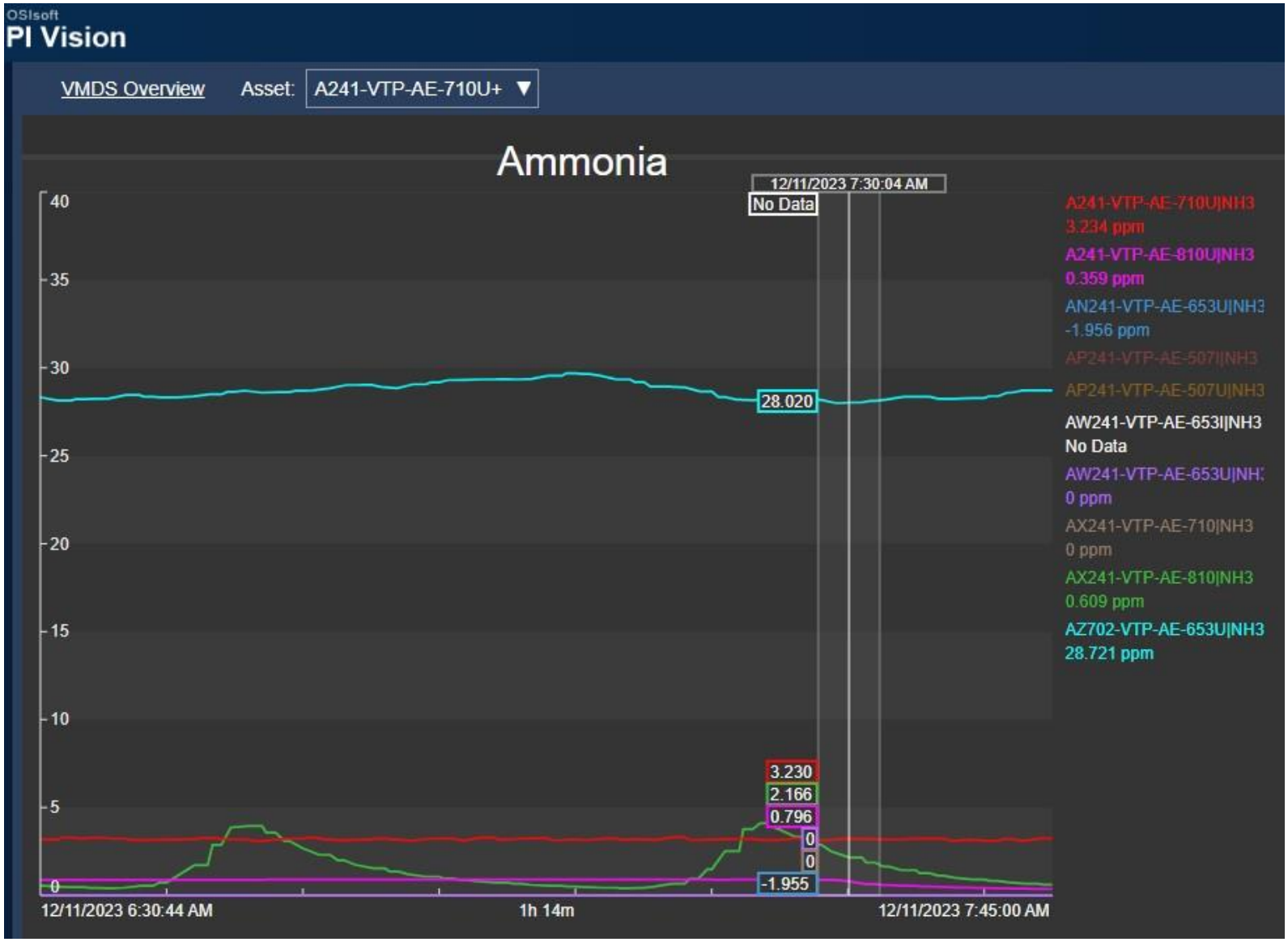


Figure 4. OSIsoft Pi Vision VMDS Ammonia Concentrations for 0730 12/11/2023

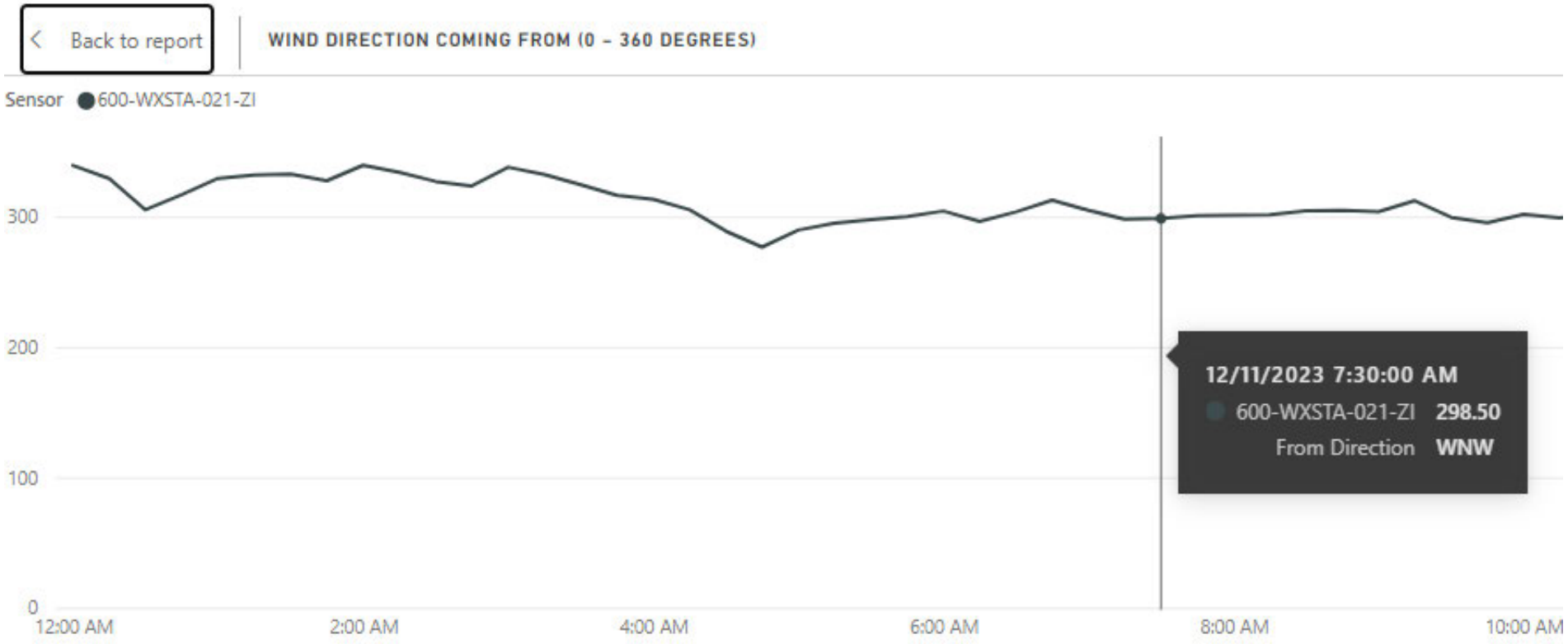


Figure 5. DFAS application, powered by SmartSite™ Weather Data (Wind Direction) from 0730 12/11/2023

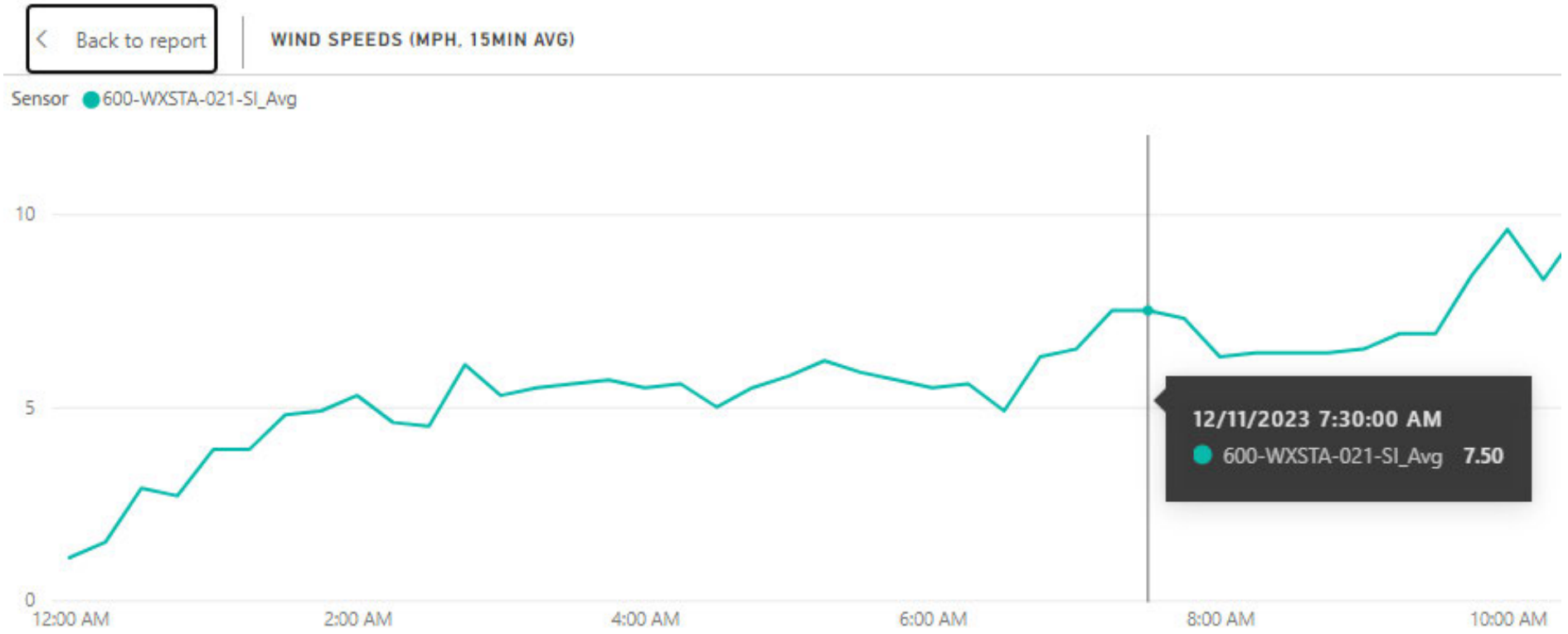


Figure 6. DFAS application, powered powered by SmartSite™ Weather Data (Wind Speed) from 0730 12/11/2023

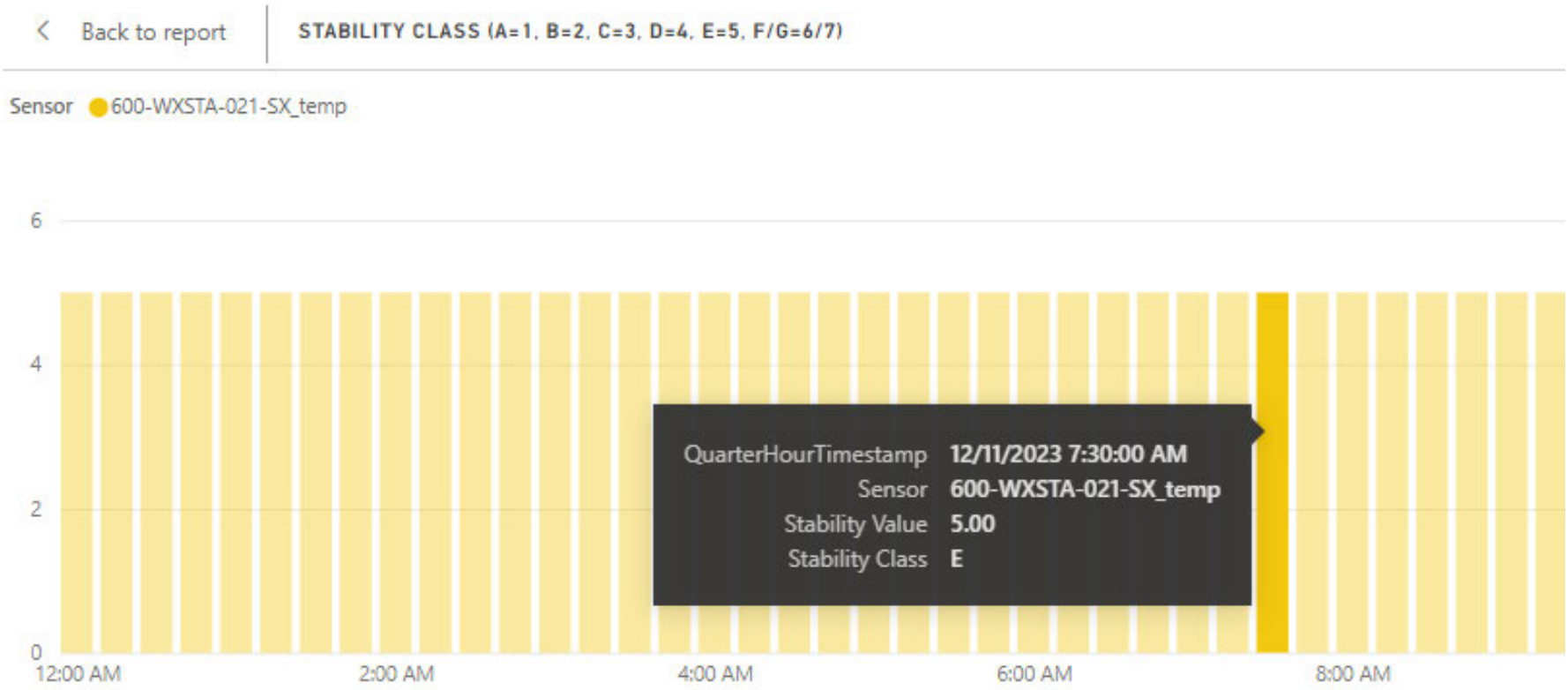


Figure 7. DFAS application, powered by SmartSite™ Weather Data (Stability Class) from 0730 12/11/2023

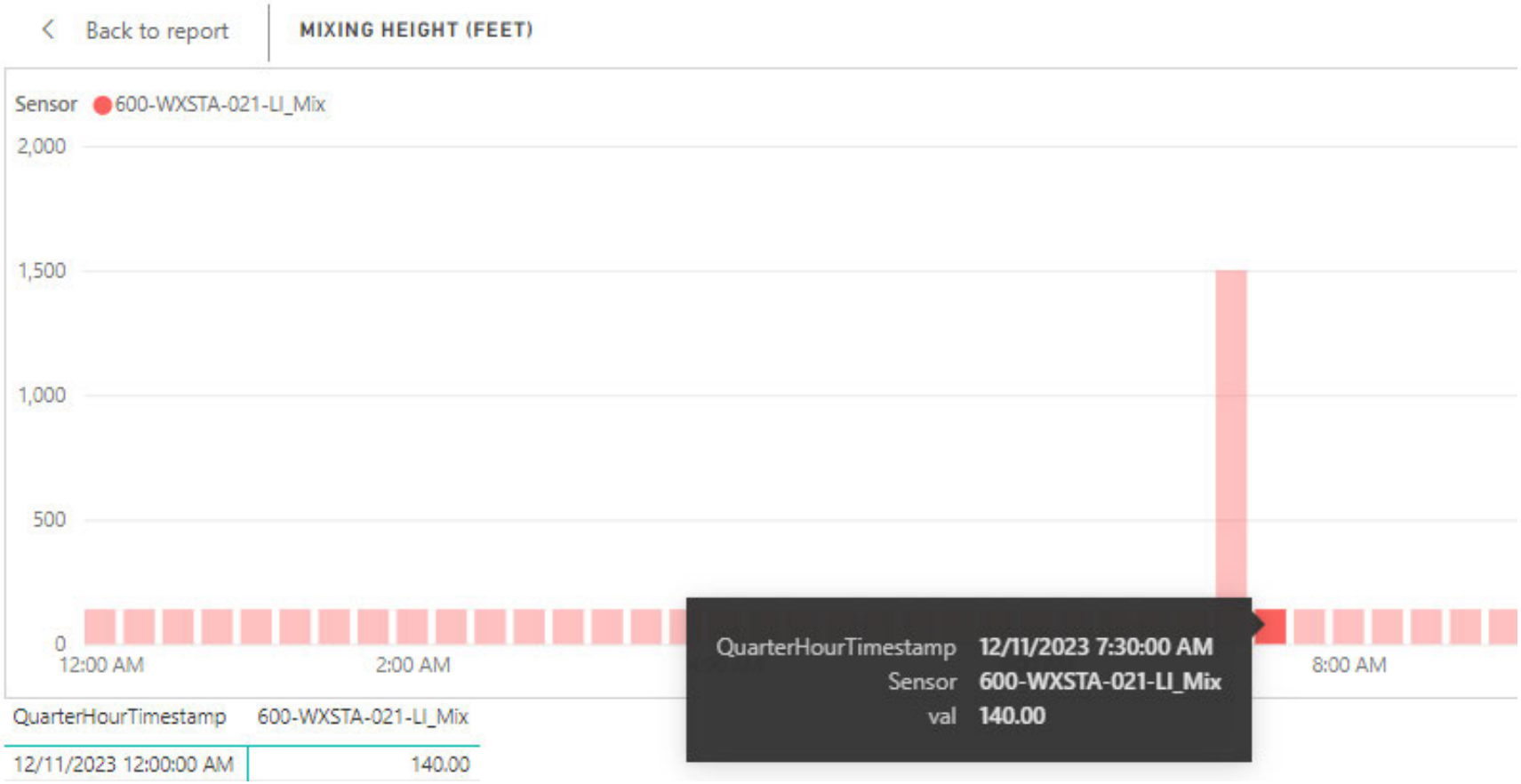


Figure 8. DFAS application, powered by SmartSite™ Weather Data (Mixing Height) from 0730 12/11/2023

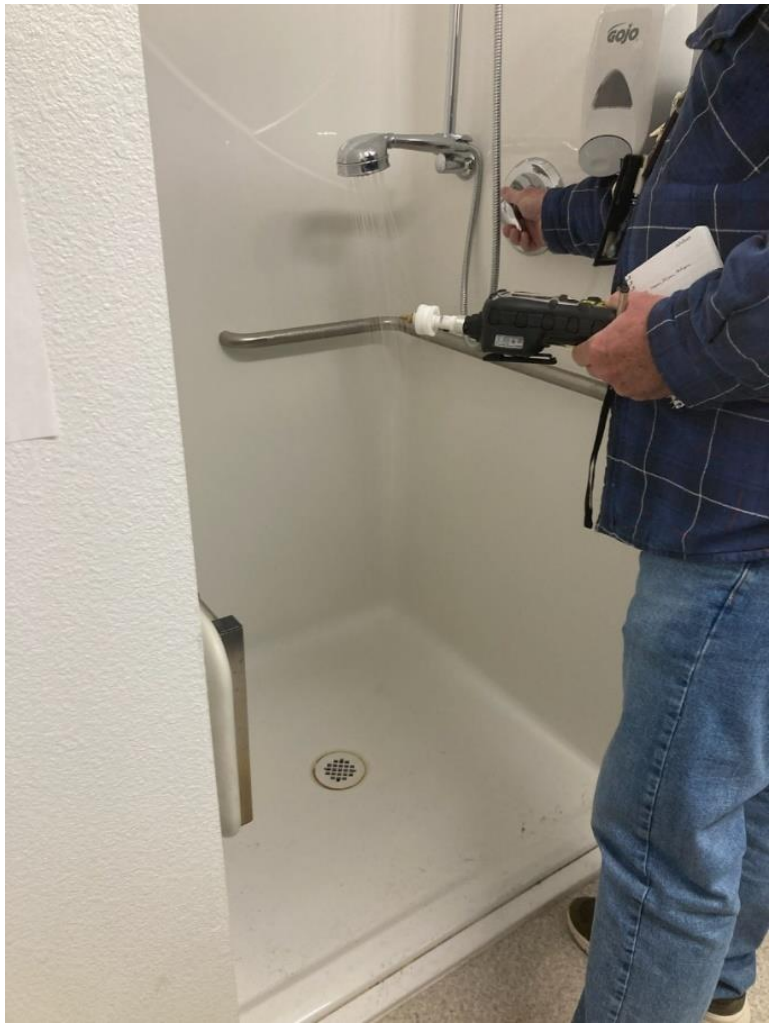


Figure 9. MO2522 South Shower Stall 1

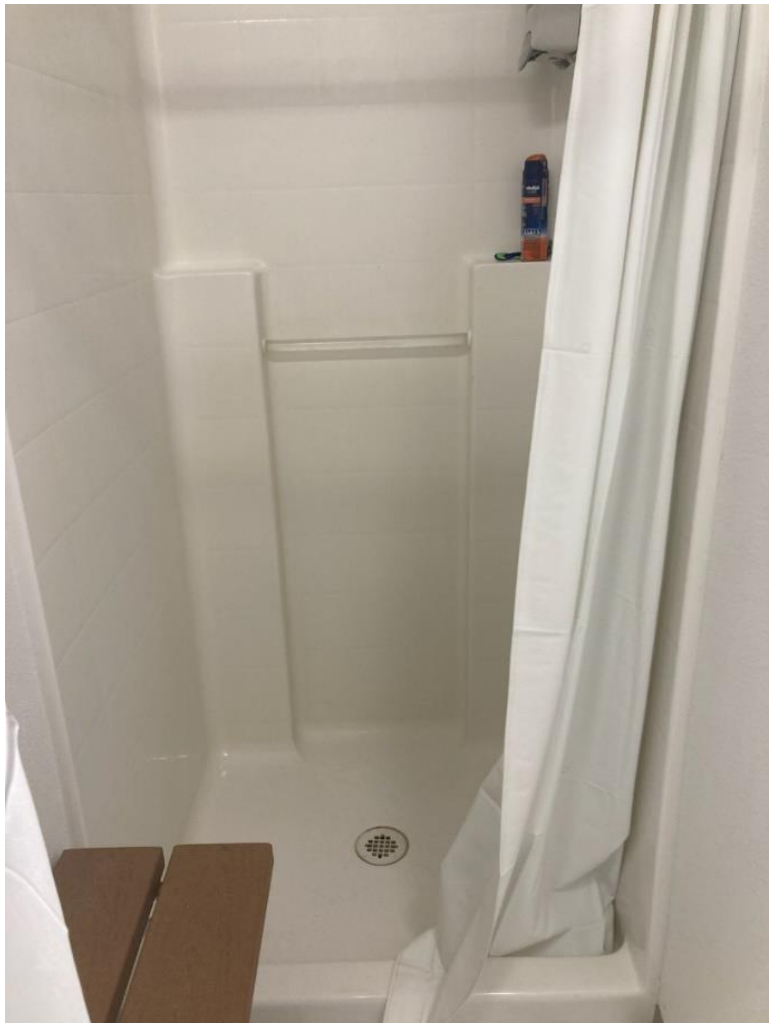


Figure 10. MO2522 South Shower Stall 2

Figure 11. MO2522 South Shower Stall 3

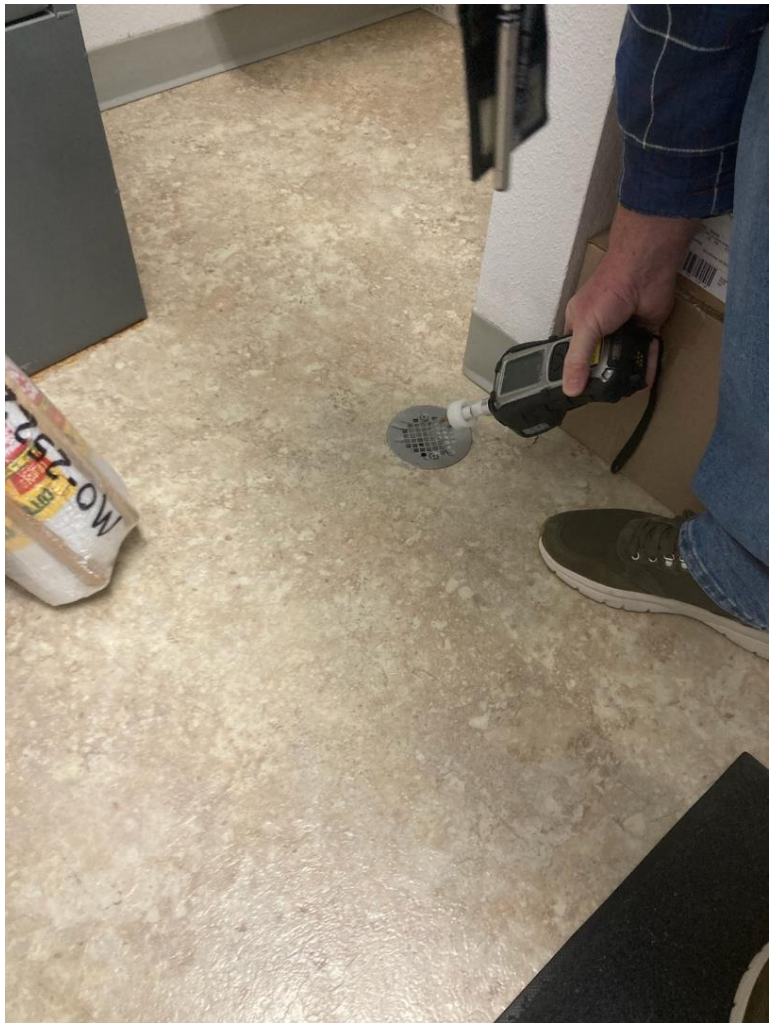


Figure 12. MO2522 North Floor Drain

Figure 13. MO2522 North unit shower
after cleaning, morning 12/12/2023

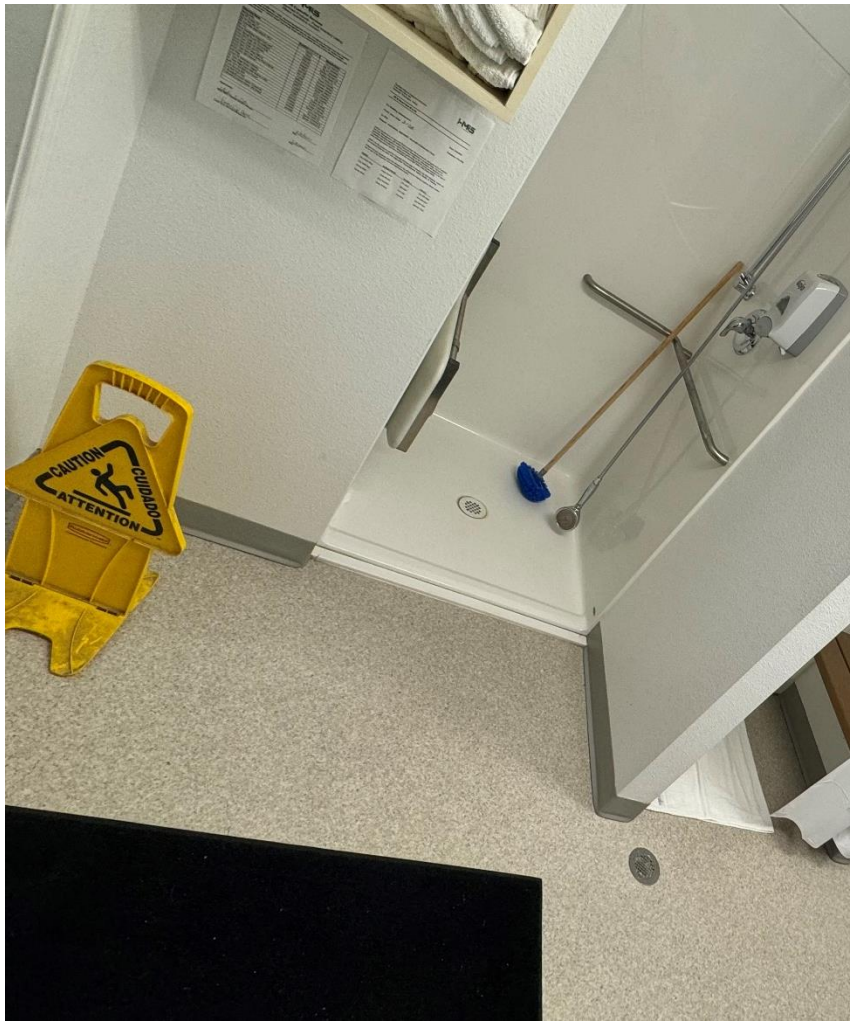


Figure 14. MO2522 South unit
after cleaning, morning 12/12/2023