

WRPS-1603146

Enclosure

INITIAL EVENT INVESTIGATION REPORT  
EIR-2016-020

AOP-015 ENTRY AT AP-107 CORE SAMPLE PLATFORM

Consisting of 21 pages  
Including cover sheet

**EVENT INVESTIGATION REPORT**

**Title AOP-015 Entry at AP-107 Core Sample Platform**  
**Event Investigation Report Number EIR-2016-020**

~~Event Investigator Under Instruction~~

Date

7/6/16

~~Event Investigator~~

Date

7/6/2016

PIH Responsible Manager

Date

6/30/16

PER No. WRPS-PER-2016-0928

## **Event Title AOP-015 Entry at AP-107 Core Sample Platform**

### **Investigation Summary**

#### **Event Description**

At approximately 1047 on May 2, 2016 while performing maintenance on the core sampler platform a direct reading instrument alarmed with the high reading exceeding the upper limit of the instrument at 99 ppm ammonia. Personnel immediately moved away from the core sample platform within the established contamination area (CA). The Industrial Hygiene Technician (IHT) monitoring the work activity verified the reading on the instrument and instructed personnel to exit the CA. The field work supervisor (FWS) began making notifications to the Central Shift Office (CSO), and Management. The CSO entered into AOP-015 and the farm was evacuated. Four employees experienced symptoms and were taken to HPMC for evaluation (three initially and one the subsequent day).

#### **Background:**

The Core Sample Platform was fabricated in 2014, and has since been deployed to SY-102 and most recently SY-103. During the SY-102 sample, the platform was used to sample 2 risers with approximately 20 samples per riser. SY-103 was sampled at one riser, with approximately 20 samples. During these evolutions, two Event Investigations took place at SY farm due to AOP-015 entries. EIR-2014-029 investigated odors experienced while setting up the core sampling platform, and EIR-2014-030 investigated odors experienced outside of SY farm during construction activities at the pump laydown yard. Neither investigations were conclusive as to the source of the odor with both concluding that the primary stack was the most likely source. When sampling concluded at SY farm, the platform components were flushed with water prior to being mobilized to AP-107. During transport of the platform from SY to AP farm the platform towers (shielded receiver and drill unit) were lowered from their vertical position and then stored/transported horizontally until set up at AP-107 where they were returned to their vertical position resulting in the likely movement of residual contaminated flush water internal to the towers. At the time of this event, the platform was staged at AP-107 for maintenance, but was not physically connected to the tank.

A maintenance crew composed of four Instrument Technicians, two IHTs, two Health Physics Technicians (HPTs), five Nuclear Chemical Operators (NCO), one FWS, and a technical support staff member were performing WO# 172267 "Grapple and Sample Hoist Load Cell Loop Test and Calibration on AP-107." This scope included performing procedure 1-GENI-900, "Grapple and Sample Hoist Load Cell Loop Test and Calibration." The digital readout for the load cell required replacement and subsequent calibration which was a first time evolution since the platform has been deployed in the field (internally contaminated). See attachment 1, Core Sample System Drawing for system configuration.

#### **Event Details:**

The pre-job was held at 0645 and workers arrived at the jobsite (AP-107) around 0830. The scope of the work was to calibrate the load cell and its digital readout module using different increments of weight. Based on the work planning hazard evaluation workers were not prescribed respiratory protection, but continuous monitoring was being performed by IHTs (1) and (2) for volatile organic compounds (VOCs), ammonia, oxygen, and flammability levels.

A CA was set up around the core sample platform, approx. 5ft by 10ft area. See Attachment 2, Field Configuration. Preparation for calibration included removal of the Camlock cap on the bottom of shielded receiver utilizing containment and a catch bag. The ball valve was opened and allowed to drain residual flush water out of the tower into the catch bag at approximately 0940am, (see Attachment 3, Preparing Shielded Receiver). Once the flush water was drained, the ball valve was closed, the bag horse tailed and removed for disposal. Next, contamination sleeving (e.g. polyurethane) was secured around the remote latch unit (RLU) and was pulled through and attached to the shielded receiver/ball valve using white tape, creating a seal. The sleeving included a High Efficiency Particulate Air (HEPA)/breather filter installed using white tape to seal the HEPA filter. The HEPA filter was in place to ensure the sleeving could breathe during the work evolution preventing the buildup of air in the sleeve. The installed HEPA filter was at a height of approximately 4 feet above ground level. After the sleeving was installed, the ball valve was opened and the RLU/shielded receiver was lowered down to allow the grapple connection to the d-ring. The instrument technicians installed approximately 100 pound increments of weight to the d-ring and began the load test. See Attachment 4, Set Up of RLU for Weight Calibration.

There were five individuals located within the CA, including two NCOs, two Instrument Technicians, and one HPT. Due to the small area of the CA and ALARA considerations, the IHTs were located outside the CA. IHT (1) was monitoring inside the CA and had a wand approximately 4-12” from the sleeving filter on the west side of the workers, IHT (2) was located about 5’ southeast of the shielded receiver (SR). Both IHTs were performing continuous monitoring throughout the work evolution. See Attachment 5, Field Personnel Positions.

At approximately 10:47 am at the start of the 4<sup>th</sup> load test, IHT(1) received a high alarm for Ammonia and peak/max reading of 99 parts per million (ppm). IHT(2) did not have any readings above the detectable limit. Almost simultaneously when the alarm sounded, workers in the immediate work area experienced symptoms and backed away from the platform. The alarm was sustained for approximately 110 seconds. IHT(1) directed field crew to immediately exit the CA. Three employees in the CA smelled ammonia-like odor or experienced symptoms, and were transported to HPMC for evaluation. The FWS made notifications to the Central Shift Office (CSO), and Management. The associated Odor Response Cards have been included as Attachment 6.

The IHTs were using a MultiRae Pro detector, with ammonia alarm setpoints at the Action Limit (12ppm) and the Occupation Exposure Limit (25ppm). The MultiRae Pro has an upper ammonia measurement limit of 99ppm. During interviews, IHT (1) reported receiving two short instantaneous alarms prior to the sustained alarm (refer to event timeline). As a result of this information, the detector data log was downloaded to provide further details. The data log history validated two short duration ammonia alarms were received prior to the upper scale exceedence which both cleared immediately (non-latching alarms). The data log recorded the ammonia alarm levels at 34ppm, and at 26 ppm respectively. These alarms were received after the installation of the sleeving and prior to start of the load cell calibration. The subsequent sustained ammonia initially alarmed at 28 ppm then quickly escalated to the maximum reading of 100 ppm lasting approximately 1.8 minutes (110 seconds). The duration the ammonia levels at or over the 100ppm upper limit was approximately 20 seconds.

It is noted that when “non-latching” alarms are received on the MultiRae Pro, it is standard protocol to allow work to continue when brief, transient alarm signals occur and no other concerns are present. The response by IHT (1) when hearing the instantaneous earlier alarms was in accordance with standard IH practices. See further discussion in recommendations/proposed corrective actions.

When the sustained ammonia alarm had cleared, IHT (1) placed a call to the Industrial Hygienist to report status and receive concurrence to allow the work crew to re-enter the CA to place the equipment in a safe configuration as the ammonia levels had returned to less than detectable levels and it was safe to re-enter. There was concern that the sharp edges of the grapple hook could puncture the sleeving due to wind, breaching the sleeving and allowing contamination to spread.

Within 10 minutes from the sustained alarm, no ammonia was detected and additional AOP-015 IH sweeps of AP Farm in and around AP-107 confirmed less than detectable. Weather conditions were 72°F, 4 mph winds out of the Northwest, 31% humidity, with a barometric pressure at 29.28in/Hg as documented in the associated IH report.

One of the employees experiencing symptoms was wearing a personal sample pump. The personal sample was analyzed at the laboratory with results indicating less than the analytical detection limitations for all analyzed constituents. It is expected that these results would not show exposure from this brief event. At the onset of the odor, the employees moved away from the suspected source. At the time of the alarm, NCO (1) was located closest to the HEPA filter at approximately 24" away.

During the fact finding meeting, at least one employee reported hearing a 'Hooter' alarm, a tank high pressure alarm, during the calibration of the Core Sample Platform. The event investigation team has reviewed AP tank pressure readings during the time of this activity and although AP team was switching exhausters that morning prior to the maintenance crew entering the farm, there is no indication of a tank pressurization alarm during the timeframe in question. Since the AP pressurization alarm was locked in due to AP-02A pump installation, it is suspected that the audible alarm heard was the short duration ammonia alarms which immediately cleared.

The crew reentered the field on Tuesday, May 3<sup>rd</sup> to place the core sample platform in a stable configuration. This involved, disconnecting the weights, pulling RLU into the receiver, removing the sleeving, and closing the ball valve. All work was completed on a minimum full face APR with dual cartridge, danger tape was placed around the platform in a 30' radius. There were no detectable ammonia readings during this evolution.

### **Exposure Assessment:**

Personal monitoring (via the sample pump) was collected for 93 minutes. Analytical results were below detection limits of 10 micrograms. The employee exposure was brief, i.e., momentary (1-2 seconds).

Based on the nature and location of the measurements taken, the nature of the applicable exposure limits and the brevity of the event, there is no indication that employees were exposed above any of the short-term, or full-shift exposure limits, both regulatory and non-regulatory including PEL (8 hr.), TLV-TWA (8 hr.), TLV-STEL (15 min.), IDLH (30 min.), ERPG (1 hr.), and AEGL (10 min. to 8 hr.). The actual concentration the instrument and employee experienced during the event cannot be definitively ascertained beyond that the instrument was over-range (above 99 ppm) for approximately 20 seconds and above the Action Level (12 ppm) for approximately 110 seconds. The instrument wand, while proximate to the employees, was not in any individual's personal breathing zone at the time, and the typical variability of air movement at a particular point in time does not permit confirmation of a personal exposure concentration at the time of the event.

## Event Timeline

05/02/2016

- 0830 Arrived at Jobsite, began working to WO# 172267.
- 0851 IHT (2) began general area sweeps with results below detectable limits (this continued with consistent results throughout the remainder of the timeline)
- 0940 Started accessing the SR to remove Camlock cap and drain liquid (approx. 2 tablespoons)
- 0944 Opened ball valve on SR (approx. 1 cup of liquid)
- 0945 Placed waste (Camlock cap, liquid and absorbent) into double bag from SR and closed ball valve
- 0949 Sleeving applied to the SR
- 0950 First instantaneous alarm (34 ppm)
- 0952 Second instantaneous alarm (26 ppm)
- 1014 Re-opening of the ball valve in the SR (approx. 1 oz. of liquid) as seen through sleeving
- 1019 Began calibration with series of weights, 100 lbs applied
- 1023 2<sup>nd</sup> weight applied 200 lbs
- 1027 3<sup>rd</sup> weight applied 300 lbs
- 1040 Starting 4<sup>th</sup> weight  
High Ammonia Alarm - IHT(1) instrument alarmed peaking at high detection limit of 99ppm, IHT(2) approx. 5 to 6 feet from source was performing general sweeps had less than detectable ammonia outside of the CA.
- 1047 IHT (1) call to Industrial Hygienist  
Alarm reset and work crew re-entered CA to place equipment in safe configuration
- 1056 Notified Shift Office, and Management
- 1101 Entered AOP-015 for AP Farm
- 1105 SOEN message issued, notified ORP On-Call FR
- 1115 General area IH sweeps, below detectable limits prior exiting farm
- 1123 APO-015 response IHTs dispatched to AP Farm
- 1124 Instrument Tech (1) and (2), and NCO (1) are taken to HPMC for evaluation
- 1155 Initiated Event Investigation
- 1157 Response IHTs arrive at AP Farm/AP-107 to collect samples and perform readings
- 1206 Response IHTs exit AP Farm
- 1210 Response IHTs report no readings above background on DRI.
- 1448 Instrument Technicians (1) and (2), and NCO (1) released from HPMC to return to work.
- 1803 AP Farm exited AOP-015
- 05/03 Farm entry to place core sample platform in safe configuration.  
NCO (2) reports to HPMC for symptoms, was cleared and returned to work.
- 05/04 Fact Finding Meeting held at 2704HV

Instrument Tech (1) reports back to HPMC for continuing symptoms, was cleared and returned to work.

05/05 Instrument Tech (1) taken to Kadlec for symptoms

It is noted that the time stamp from the data log downloaded from IHT (1)'s instrument had a discrepancy from the times reported during the fact finding meeting, interviews, and logs. It was verified that the instrument's internal time setting was incorrect.

### **Compensatory Measures**

1. Tank Farm entry on the following day, Tuesday, to place area in safe configuration.
2. Made a procedure change to 1-GENI-900, to remove the breather filter from the sleeving, and making a modification to add a Nuc filter to a purge line off of the hoist boxes.
3. Added a respiratory protection boundary around work area until IH demonstrates the breather filter from the hoist boxes are working as intended
4. Updated Respiratory Protection Form to require Chemical Cartridge use.

### **Preliminary Extent of Condition Review**

As this was a first time evolution using the sleeving with a HEPA filter installed on the core sampling platform post field deployment (contaminated system), it is not a repeat issue and is unique to this equipment configuration. However, it may be prudent to evaluate other work activities involving breaching of previously tank waste contacted systems/components for consideration of upgraded respiratory protection due to potential entrapment/release of waste tank vapors.

Although a search in the PER database, for AOP-015 had 2 events in AP farm in the past 12 months, this event is unique as the source is identifiable and considerably above levels experienced with general farm odors.

### **Discussion of Potential Causes**

The most likely source is from the flush liquid being trapped in the sleeving where the HEPA filter was installed, and during the work evolution the ammonia vapors were trapped and exhausted. Some workers commented that AP farm and work around AP-107 have unique odors consistently. These odors are described as ammonia like, musty or onion. Other workers supporting WO# 172267 around AP-107 on May 2<sup>nd</sup> said they noticed the ammonia odor, however did not fill out Odor Response Cards, but it is also noted that not all workers smelled odors. Upon thorough review of the IH data, workers statements, and the onset of symptoms, it is determined that the liquid in the sleeving was the most likely source, and the venting of air/vapors through the breather filter was the most likely transport.

### **Discussion of Barriers That Could Have Impacted the Cause**

1. This was the first time the procedure/section was used on the contaminated platform.
2. IH alarm response, regarding the 2 previous alarms that reset before actions could be taken may have been a leading indication.
3. Hazard analysis process did not identify residual/trapped chemical vapors in the sleeving being released through the HEPA filter as potential hazard (analysis recognized the HEPA filter as a radiological barrier only).

### **Recommendations/Proposed Corrective Actions to Be Evaluated by Causal Analysis**

1. Revise core sample platform technical work documents and PPE requirements to address the potential hazard for tank vapor entrapment and release.
2. Evaluate if the hazard analysis process requires revision to address the potential hazard for tank vapor entrapment and release when breaching tank waste contacted systems/components.
3. Develop and run drill scenarios for IHTs involving high alarm response actions, including short duration excursions above action limits.
4. IH should evaluate the “non-latching” alarm response protocol to determine if it is conservative in nature, particularly with regarding the 2 initial ammonia alarms that reset immediately in this event.
5. Address protocol/expectation with regard to re-entry into work areas following IH alarms to place equipment in safe configuration

### **Attachments (as they apply):**

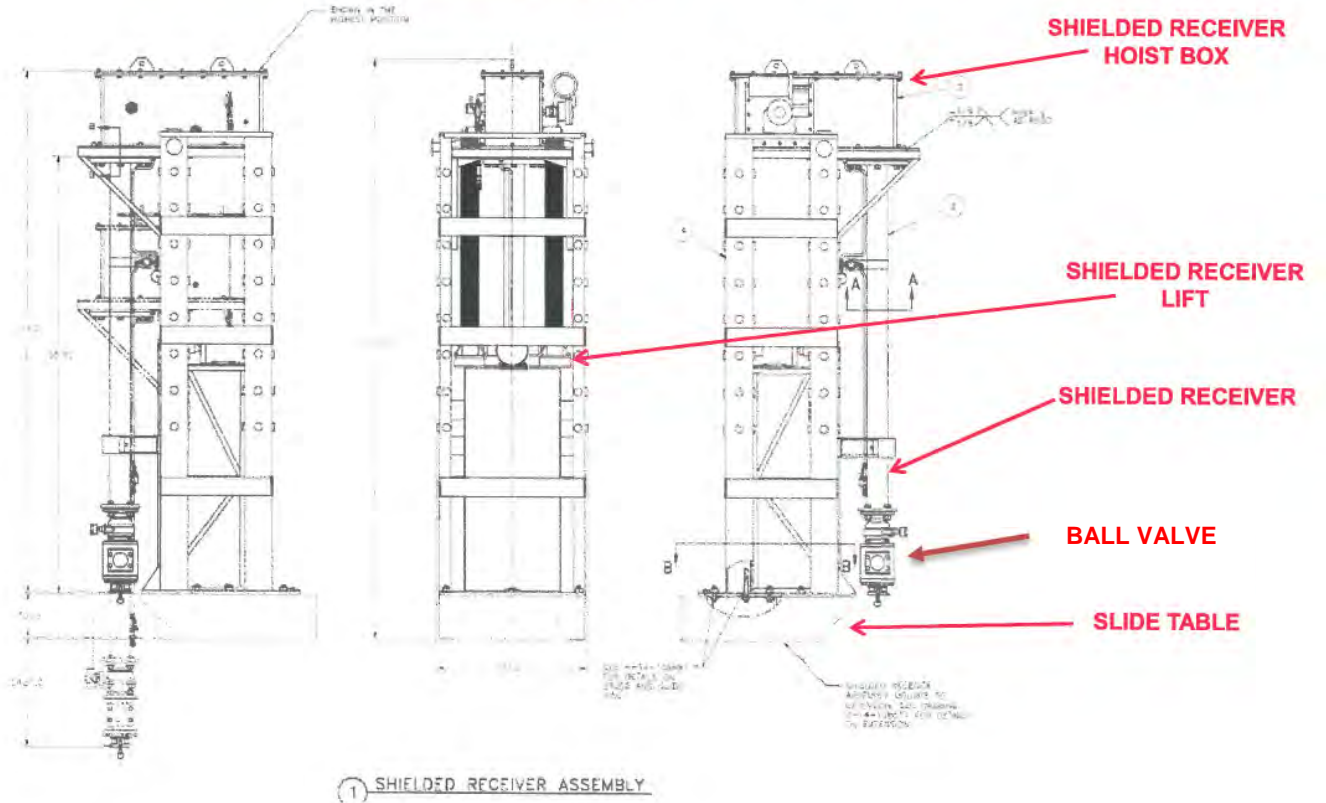
1. Core Sampling System Drawing
2. Field Configuration
3. Preparing Shielded Receiver
4. Set Up of RLU for Weight Calibration
5. Field Personnel Positions
6. Odor Response Cards
7. Fact Finding Rosters



Attachment 1: Core Sampling System Drawing

**Core Sampling System Project – Project Overview**

**SHIELDED RECEIVER**



**Attachment 2: Field Configuration**





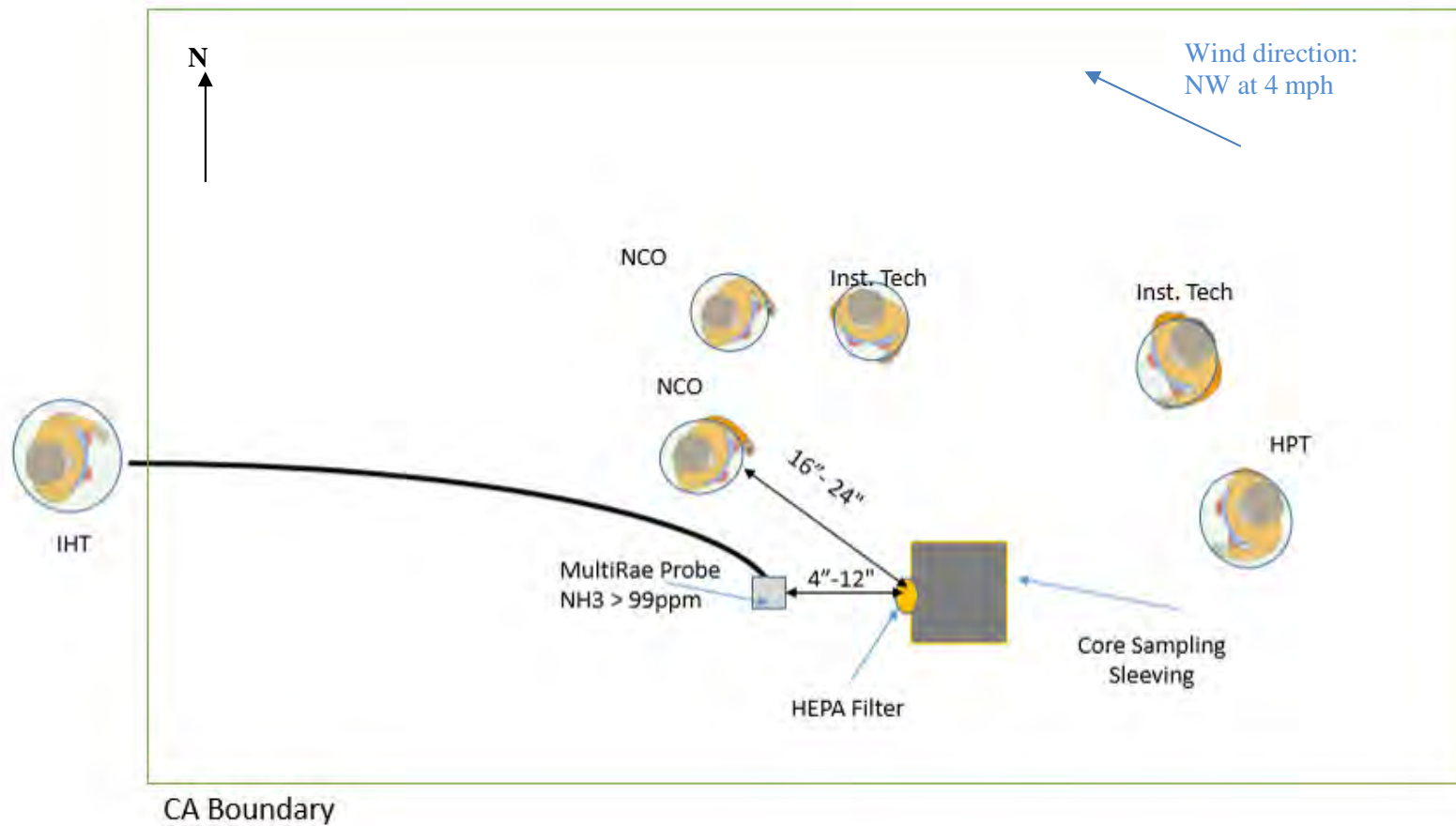
**Attachment 3: Preparing Shielded Receiver**



**Attachment 4: Set up of RLU for weight calibration**



**Attachment 5: Field Personnel Positions**



## Attachment 6: Odor Response Cards

**ODOR RESPONSE CARD - 241-AP FARM**

**Odors Detected with *NO* Immediate symptoms**

1. Notify Immediate Supervisor.
2. Contact Central Shift Manager. [REDACTED]  
Provide the bulleted information below.
3. Complete map, return to Central Shift Office as soon as practicable.

**Odors Detected *WITH* Symptoms**

4. Notify Immediate Supervisor.
5. Contact CSM. [REDACTED]  
complete below bulleted information and map.
  - Your name and the work you were performing
  - Your symptoms (if any)
  - Date and time odor was noticed
  - Location of odors (mark area on map and the wind direction)
  - Describe the odor
  - Name(s) of others in or near the affected area
  - Was an IHT present?
  - Possible source
6. Provide information on the back of card.
7. Send this card immediately to the Central Shift Office.

**ODOR RESPONSE CARD - 241-AP FARM**

1. **Contact CSM, Complete below bulleted information and map.**
  - Date and time odor was noticed 5/2/16 10:50
  - Your name and the work you were performing Estimate truck weight
  - Location of odors (mark area on map and wind direction) AP-100
  - Name(s) of others in or near the affected area CAFE Tending area
  - Was an IHT present? Yes
  - Describe the odor  Sweet  Sour  Musty  Earthy  Metallic  Smoky  Rotten  Onion  Cleaning Solution  Ammonia  Other: \_\_\_\_\_
  - Possible Source CCS - Ammonia
  - Your symptoms (if any)  Headache  Dizziness/Light-Headed  Nausea  Cough  Fatigue/Drowsiness/Weakness  Sore/Burning Throat  Difficulty Breathing  Watery/Irritated Eyes/Trouble with Vision  Tingling/Numbness/Paralysis  Rash/itching  Other: \_\_\_\_\_
2. **Send this card to the Central Shift Office.**



## Attachment 6 (Cont.): Odor Response Cards

**ODOR RESPONSE CARD - 241-AP FARM**

**Odors Detected with *NO* Immediate symptoms**

1. Notify Immediate Supervisor.
2. Contact Central Shift Manager, [REDACTED]. Provide the bulleted information above.
3. Complete map, return to Central Shift Office as soon as practicable.

**Odors Detected *WITH* Symptoms**

4. Notify Immediate Supervisor.
5. Contact CSM [REDACTED] complete below bulleted information and map.
  - Your name and the work you were performing
  - Your symptoms (if any)
  - Date and time odor was noticed
  - Location of odors (mark area on map and the wind direction)
  - Describe the odor
  - Name of others in or near the affected area
  - Was an IHT present?
  - Possible source
6. Provide information on the back of card.
7. Send this card immediately to the Central Shift Office.

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**ODOR RESPONSE CARD - 241-AP FARM**

1. Contact CSM, Complete below bulleted information and map.
  - Date and time odor was noticed 5-2-16 10:50 am
  - Your name and the work you were performing \_\_\_\_\_
  - Location of odors (mark area on map and wind direction) \_\_\_\_\_
  - Name(s) of others in or near the affected area \_\_\_\_\_
  - Was an IHT present? Yes
  - Describe the odor  Sweet  Sour  Musty  Earthy  Metallic  Smoky  Rotten  Onion  
 Cleaning Solution  Ammonia  Other: \_\_\_\_\_
  - Possible Source \_\_\_\_\_
  - Your symptoms (if any)  Headache  Dizziness/Light-Headed  Nausea  Cough  
 Fatigue/Drowsiness/Weakness  Sore/Burning Throat  Difficulty Breathing  
 Watery/Irritated Eyes/Trouble with Vision  Tingling/Numbness/Paralysis  Rash/Itching  
 Other: Burning inside nose
2. Send this card to the Central Shift Office.

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## Attachment 6 (Cont.): Odor Response Cards

### ODOR RESPONSE CARD - 241-AP FARM

**Odors Detected with *NO* Immediate symptoms**

- Notify Immediate Supervisor.
- Contact Central Shift Manager, [REDACTED]. Provide the bulleted information below.
- Complete map, return to Central Shift Office as soon as practicable.

**Odors Detected *WITH* Symptoms**

- Notify Immediate Supervisor.
- Contact CSM [REDACTED] and complete below bulleted information and map.
  - Your name and the work you were performing
  - Your symptoms (if any)
  - Date and time odor was noticed
  - Location of odors (mark area on map and the wind direction)
  - Describe the odor
  - Name of other in or near the affected area
  - Was an IHT present?
  - Possible source
- Provide information on the back of card.
- Send this card immediately to the Central Shift Office.

### ODOR RESPONSE CARD - 241-AP FARM

- Contact CSM, Complete below bulleted information and map.**
  - Date and time odor was noticed 5-2-2016 10:50 AM
  - Your name and the work you were performing CO2 sampling / BLM load cell calibration
  - Location of odors (mark area on map and wind direction) \_\_\_\_\_
  - Name(s) of others in or near the affected area \_\_\_\_\_
  - Was an IHT present? YES
  - Describe the odor  Sweet  Sour  Musty  Earthy  Metallic  Smoky  Rotten  Onion  
 Cleaning Solution  Ammonia  Other: \_\_\_\_\_
  - Possible Source \_\_\_\_\_
  - Your symptoms (if any)  Headache  Dizziness/Light-Headed  Nausea  Cough  
 Fatigue/Drowsiness/Weakness  Sore/Burning Throat  Difficulty Breathing  
 Watery/Irritated Eyes/Trouble with Vision  Tingling/Numbness/Paralysis  Rash/Itching  
 Other: \_\_\_\_\_
- Send this card to the Central Shift Office.**





**Attachment 7 (Cont.): Fact Finding Roster**

Date: 5/4/16		EVENT INVESTIGATION ATTENDANCE FORM		
Event Title: Investigation of ADP-15 Entry at AP-107				
Event Number: FIR-2016-020				
Print Name	Signature	HID	Job Position	Organization
			PLS	WTS
			PCT	WRPS
			HPT	WRPS
			Inst	WRPS
			NCO	WRPS
			NCO	WTS
			INST	WRPS
			Inst	WRPS
			Ration	WRPS
			IA Programs	WRPS
			Admin	"
			Mgr. ESH	WRPS
			Naval SA	WRPS
			maint	WRPS
			Ops for Specimen	WRPS
			SEH	WRPS
			SEH	WRPS
			NCO	WTS
			IHT	WRPS
			IHT FLM	WRPS

**Attachment 7 (Cont.): Fact Finding Roster**

Date: <u>5/4/16</u>		<b>EVENT INVESTIGATION ATTENDANCE FORM</b>		
Event Title: <u>Investigation of ACP-15 Entry at AP-107</u>				
Event Number: <u>ER-2016-020</u>				
Print Name	Signature	HID	Job Position	Organization
			NCO	WRAS
			SA REP	DNFSB
			nco	ITA
			OE	US
			FWS	WIS
			FR	DoE/OEP
			Inst	PROJ
			HAMTC	Safety
			HAMTC	Safety
			MGR	S&H
			IH/ES	TFP
			MGR	P.O.
			MGR	Maintenance
			mGR	TFP
			Gen ASI	R&C
			MGR	TFP
			Inst	Prog
			FWS	Proc/RET

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