Ammonia Vapor Monitoring for Tank Farm Exhaust Stacks

Tank Farm Environmental Procedure

CHANGE HISTORY (≤ LAST 5 REV-MODS)

<table>
<thead>
<tr>
<th>Rev-Mod</th>
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<tr>
<td>A-2</td>
<td>06/19/2018</td>
<td>This change is for full face APR implementation.</td>
<td>Added new Step 3.1.1 &quot;A portion of this work scope meets Tank Vapor Risk Classification RC-3 per TFC-ESHQ-S_IH-C-48. The RC-3 work will occur in a permanently posted VCZ; therefore, changing farm respiratory protection postings per TFC-OPS-OPER-C-08 is not required.&quot;</td>
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<tr>
<td>A-1</td>
<td>02/12/2018</td>
<td>Update Procedure to Current Field Conditions</td>
<td>Update procedure to current field conditions. Removal of inapplicable steps. Added note to allow for use of 2 MultiRAE Pro analyzers.</td>
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<tr>
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<td>11/07/2017</td>
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1.0 PURPOSE AND SCOPE

1.1 Purpose

This procedure provides instructions for measuring the concentration of ammonia compounds emitted from Tank Farm ventilation exhaust stacks to meet Environmental permit conditions. Most ammonia readings are expected to be below 90 ppm, the principle measurement method will be to use an electrochemical cell, specific for ammonia. Higher ammonia concentrations will poison the chemical sensor, Drager tubes (specific for ammonia), will be used for higher ammonia concentrations.

1.2 Scope

1.2.1 This procedure applies to ventilation exhaust stacks located in East and West Tank Farms that are permitted by the Washington Department of Ecology (WDOE). Measurements taken by MultiRAE PRO or equivalent are used to verify that ammonia concentrations do not exceed WDOE Notice of Construction (NOC) Approval Condition Emission Limits.

1.2.2 This procedure includes site-specific appendices. Changes or revisions to the instructions may affect the appendices and must be approved by Environmental.

1.2.3 This procedure is worked in accordance with an approved work package.
2.0 INFORMATION

2.1 Terms and Definitions

- **Calibration Drift** - Difference in the measurement system response to a mid-level calibration gas before and after a stated period of operation during which no unscheduled maintenance, repair, or adjustment took place.

- **Calibration Error** - Difference between the measurement system's indicated gas concentration and the known concentration of a calibration gas.

- **Calibration Gas, High-Level** - Ammonia Calibration gas with a concentration equivalent to 80% to 90% of applicable span value.


- **Response Time** - Time interval between a step change in pollutant concentration at the measurement system inlet to the time at which 95 percent of the corresponding final value is indicated on the measurement system display.

- **Span Value** - Upper limit of a gas concentration measurement range specified for affected source categories. Span value is usually 1.5 to 2.5 times the NOC Approval Condition Emission Limit.

- **Zero Drift** - Difference in the measurement system response to a zero level calibration gas before or after a stated period of operation during which no unscheduled maintenance, repair, or adjustment took place.

- **Fresh Air Calibration** - Sensor calibration used to determine a zero value for a target chemical. This calibration must be performed in clean air with 20.9% oxygen, or alternatively, by utilizing a cylinder of clean zero air.
2.2 General Information

This procedure specifies use of MultiRAE Pro (or equivalent ammonia monitor) for concentrations of Ammonia 0-90ppm and for Drager Tube readings of ammonia at concentrations greater than 90ppm. This method is applicable for measuring total ammonia.

2.2.1 A maximum number of two (2) MultiRAE PRO analyzers may be used during the performance of this procedure.

OPERATIONAL AND ENGINEERING LIMITS

- Calibration Gases shall be traceable to a national standard. A calibration gas shelf life, within which the concentration does not change by more than ± 2% from the certified value, shall be supplied by the manufacturer.
- The MultiRAE PRO should be operated within the parameters described in TF-OPS-IHT-024.
- The ammonia measurement system shall be capable of recording at least one measurement per minute with a calibration error of less than ± 10% or 2ppm of calibration gas value, whichever is greater. A satisfactory calibration error test shall be performed within 2 hours before starting ammonia measurements.
- Four separate samples shall be taken. Each sample shall consist of three readings collected across the traverse of the stack diameter. Immediately after the sample period, the Ammonia Monitor must pass a second calibration error test to verify that excessive calibration drift has not occurred. If the Ammonia Monitor does not pass by the end of shift, then data is not valid. Environmental will determine whether repairs should be made or equipment replaced before repeating the sample measurements.
3.0 PRECAUTIONS AND LIMITATIONS

3.1 Personnel Safety

3.1.1 A portion of this work scope meets Tank Vapor Risk Classification RC-3 per TFC-ESHQ-S_IH-C-48. The RC-3 work will occur in a permanently posted VCZ; therefore, changing farm respiratory protection postings per TFC-OPS-OPER-C-08 is not required.

3.1.1.1 Minimum required respiratory protection for work within a permanently posted VCZ is identified on the Management Directed Respiratory Protection Form.

3.1.2 If the exhauster shuts down during the performance of this procedure, the applicable alarm response procedure shall be followed. The Tank Farm shall be evacuated and the Shift Manager shall be notified immediately that the exhauster has shut down.

3.1.3 Contact IH for current and appropriate TVIS (Tank Vapor Information Sheet) and RC (Risk Classification) sampling plan.

3.2 Radiation and Contamination Control

3.2.1 Without proper use of a drape and the wiping of equipment upon removal from the ventilation system could cause personnel and/or environmental contamination.

3.2.2 When this procedure is worked in radiological areas, an approved radiological work permit (RWP) is required. If radiological conditions or work performed falls outside the scope of the RWP, all work activities must be discontinued until a new or revised RWP has been issued in accordance with TFC-ESHQ-RP_RWP-C-03.

3.2.3 The following controls shall be implemented when working on potentially contaminated tank farm ventilation systems:

- Directed airflow is maintained at the inspection point.
- Insertion probes shall be wiped as they are removed from the port.
- Yellow plastic bags shall be positioned close to the work to receive radioactive waste.
- HPT Job Coverage is required for initial system breaching.
- The work area will have CA posting or a well-defined boundary controlled as a CA by the job coverage HPT.
3.3 Environmental Compliance

3.3.1 All planned and unplanned outages of or problems with tank farm ventilation and exhaust monitoring systems, including portable exhausters, and filters must be immediately reported to the appropriate shift office and Environmental per the On-Call List in compliance with TFC-ESHQ-ENV-FS-C-01.

3.3.2 Work on potentially contaminated tank farm ventilation systems shall be performed in accordance with TFC-ESHQ-ENV-STD-06 as follows:

- Equipment with removable contamination and/or work with removable contamination will be contained per the latest revision of the Containment Selection guide, Attachment A, in TFC-ESHQ-RP_RWP-C-02
- Pre- and post-job surveys (smears) shall be taken.
4.0 PREREQUISITES

4.1 Special Tools, Equipment and Supplies

The following equipment and supplies may be needed to perform this procedure:

NOTE - Calibration gases must be within the manufacturer's specified shelf life.

- Ammonia Analyzer (MultiRAE PRO or equivalent)
- Zeroing tube/Charcoal filter or zero air
- Ammonia (NH3) function test gas
- Sample line with stainless steel or Teflon line. Sample Teflon lined, Tygon tubing (maximum length not to exceed 3 feet)
- Sample port connecting fittings, as required (See Appendices)
- Drager Pump and 18 Ammonia Drager Tubes
- Sample probe consisting of an approximately 12 inch long stainless steel or rigid Teflon tube that is connected to the instruments probe.
- Insert inline 2 micron filter
- Time piece or stop watch
- Calculator
- Other tools, equipment and supplies as identified by Shift Manager/ OE/ FWS/ FLM/ User
- SKC Pump Model # XR500.

4.2 Performance Documents

The following documents/procedures may be needed to perform this procedure:

- 2-MISC-160, Static Bonding for Portable Equipment in Tank Farms, as required
- TO-100-052, Perform Waste Generation, Segregation, Accumulation and Clean-up
- TF-OPS-IHT-006, Preparation and Field Use of the Drager Pump Colorimetric Indicator Tubes.
- TF-OPS-IHT-024, Preparation and Field Use of MultiRAE PRO Volatile Organic Compound and Multi-Gas Monitor
- Site-specific appendix, as required.
4.3 Field Preparation

4.3.1 IF static bonding is required for flammable gas control, **PERFORM** Maintenance Procedure 2-MISC-160 in conjunction with this procedure.

4.3.2 **ENSURE** Additional site-specific prerequisites per applicable Appendices have been performed.

**NOTE** - Traverse point intervals on Appendix Data Sheet are measured relative to stack internal diameter (i.d.). Test ports are identified on Figure 1.

4.3.3 **OBTAIN** pre-marked sample probes.
5.0 PROCEDURE

NOTE - A maximum number of two (2) MultiRAE PRO analyzers may be used during the performance of this procedure.

5.1 Prepare Monitoring Equipment

5.1.1 IF use of Drager Tubes are required to collect monitor readings, PERFORM Section 5.4.

5.1.2 RECORD equipment calibration data on Appendix Data Sheet 1.

5.1.3 IF additional or replacement equipment is used, RECORD calibration data AND EXPLAIN on Comments Section Appendix Data Sheet 1.

5.1.4 ENTER the following on Appendix Data Sheet 1:

- Signature
- Printed name (First & Last)
- Date
- Time.

5.1.5 ENTER calibration gas concentrations in "Actual Value" column on Appendix Data Sheet 2.
5.2 Perform Pre-Use Function Test

5.2.1 WARM UP MultiRAE PRO a minimum of 30 minutes prior to starting calibration.

5.2.2 PRESS the [Y+] button from the “Ready…Start Sampling?” screen.

5.2.3 CHECK the readings are as follows, before function testing begins:
   - <300 ppb VOC
   - 0 ppm NH₃.

PERFORM Fresh Air Calibration

5.2.4 CONFIRM readings are within the “Acceptable Range for Calibration Gas” listed on Appendix Data Sheet 2.

5.2.5 IF concentrations are within acceptable range, RECORD readings on Appendix Data Sheet 2.

5.2.6 RECORD Ammonia (NH₃) Reading level on Appendix Data Sheet 2.

5.2.7 INDICATE PASS or FAIL for Fresh Air Calibration on Appendix Data Sheet 2.

5.2.8 ATTACH high-level gas cylinder tubing to inlet of MultiRAE PRO.

5.2.8.1 START Stop Watch AND WAIT for the sensors to respond fully to the known gas concentration before recording the reading.

5.2.8.2 CONFIRM readings are within the “Acceptable Range for Calibration Gas” listed on Appendix Data Sheet 2.

5.2.8.3 IF concentrations are within acceptable range, RECORD readings on Appendix Data Sheet 2.

5.2.8.4 INDICATE PASS or FAIL for High-Level Calibration on Appendix Data Sheet 2.

5.2.8.5 RECORD response time on Appendix Data Sheet 2.
5.2 - Perform Pre-Use Function Test (Cont.)

5.2.9  **IF** readings are not within “Acceptable Range” limits, **REPEAT** Steps 5.2.4 through 5.2.8 a maximum of 2 times before proceeding to Step 5.2.9.2.

   5.2.9.1 **COMPARE** readings to acceptable range limits **AND**
   
   **CIRCLE** PASS or FAIL on Appendix Data Sheet 2.

   5.2.9.2 **IF** not within the acceptable range for each sensor, **TROUBLESHOOT** per TF-OPS-IHT-024. **PERFORM** zero, span test and function check as previously described.

   5.2.9.3 **IF** not within the acceptable range, **RETURN** meter to equipment custodian with a completed green tag “IH INSTRUMENT SERVICE TAG” (BT-6004-019) indicating “Function Check Failure.”

**NOTE** - No adjustments to measurement equipment are allowed after successfully completing the calibration error test. Completing the calibration error test means that measurement equipment is ready for use.

5.2.10 **ENTER** the following on Appendix Data Sheet 2:

- Signature
- Printed name (First & Last)
- Date
- Time.
5.3 Monitor Exhaust Stack Ammonia Levels

NOTE - Steps 5.3.1 through 5.3.4 may be performed in any logical order.

5.3.1 PERFORM pre-job radiological survey of work area.

5.3.2 CONTACT Hanford Weather Forecaster by telephone (373-2716).

5.3.2.1 REQUEST absolute barometric pressure for closest weather station AND RECORD pressure and time of pressure reading on Appendix Data Sheet 3, Sheet 1.

NOTE - Stack Flow Rate may be obtained from stack flow instrumentation, or from Vent and Balance measurement, per applicable appendix.

5.3.3 OBTAIN stack flow and stack temperature from Operations by telephone (373-2618) AND RECORD on Appendix Data Sheet 3.

5.3.4 REMOVE all caps, plugs, or instrumentation on first Test Port as indicated in Appendix.
5.3 - Monitor Exhaust Stack Ammonia Levels (Cont.)

5.3.5 RECORD Start Time for sample period on Appendix Data Sheet 3.

5.3.6 MONITOR exhaust gas ammonia levels at each traverse point in order at first Test Port shown in Appendix Data Sheet 3 AND

RECORD Reading #1 values on Appendix Data Sheet 3.

5.3.7 IF reading is greater than or equal to 90ppm, THEN proceed to Section 5.4.

5.3.8 REMOVE AND WIPE equipment on removal from stack AND

ALLOW instrument to return to levels at or near background before reinsertion.

5.3.9 MONITOR exhaust gas ammonia levels at each traverse point in order at first Test Port shown in Appendix Data Sheet 3 AND

RECORD Reading #2 values on Appendix Data Sheet 3.

5.3.10 REMOVE AND WIPE equipment on removal from stack AND

ALLOW instrument to return to levels at or near background before reinsertion.

5.3.11 INSTALL all caps, plugs, or instrumentation on first Test Port.

5.3.12 REMOVE all caps, plugs, or instrumentation on second Test Port as indicated in Appendix.

5.3.13 MONITOR exhaust gas ammonia levels at each traverse point in order at second Test Port shown in Appendix Data Sheet 3 AND

RECORD Reading #3 values on of Appendix Data Sheet 3.

5.3.14 REMOVE AND WIPE equipment on removal from stack AND

ALLOW instrument to return to levels at or near background before reinsertion.
5.3 - Monitor Exhaust Stack Ammonia Levels (Cont.)

5.3.15  **MONITOR** exhaust gas ammonia levels at each traverse point in order at second Test Port shown in Appendix Data Sheet 3 **AND**

**RECORD** Reading #4 values on Appendix Data Sheet 3.

5.3.16  **REMOVE AND WIPE** equipment on removal from stack **AND**

**ALLOW** instrument to return to levels at or near background before reinsertion.

5.3.17  **RECORD** Stop Time for sample period on Appendix Data Sheet 3.

5.3.18  **REMOVE AND WIPE** equipment on removal from stack.

5.3.19  **INSTALL** all caps, plugs, or instrumentation on second Test Port.

5.3.20  **IF** any traverse reading exceeds the emission limit shown in Appendix Data Sheet 3, **NOTIFY** Environmental.

5.3.20.1  **IF** Ammonia Readings are equal to or greater than 90 ppm **THEN** perform Section 5.4.

5.3.21  **PERFORM** radiological survey of equipment upon removal from ventilation system.

5.3.22  **RESTORE** all caps, valves, plugs or instrumentation to original configuration.

5.3.23  **PERFORM** radiological survey of all equipment before removal from work area.

**Perform Post-Use Function Check**

5.3.24  **PERFORM** Fresh Air Calibration.

5.3.25  **CONFIRM** readings are within the tolerance values listed on Appendix Data Sheet 3.

5.3.26  **IF** concentrations are within tolerance, **RECORD** readings on Appendix Data Sheet 3.

5.3.27  **RECORD** Ammonia (NH₃) Reading level on Appendix Data Sheet 3.

5.3.28  **INDICATE** PASS or FAIL for Fresh Air Calibration on Appendix Data Sheet 3.
5.3 - Monitor Exhaust Stack Ammonia Levels (Cont.)

5.3.29  ATTACH high-level gas cylinder tubing to inlet of MultiRAE PRO

5.3.29.1  WAIT for the sensors to respond fully to the known gas concentration before recording the reading.

5.3.29.2  CONFIRM readings are within the tolerance values listed on Appendix Data Sheet 3.

5.3.29.3  IF concentrations are within tolerance, RECORD readings on Step 1 of Appendix Data Sheet 3.

5.3.29.4  INDICATE PASS or FAIL for High-Level Calibration on Appendix Data Sheet 3.

5.3.29.5  RECORD response time on Appendix Data Sheet 3.

5.3.30  IF Post-Use Function Check failed, NOTIFY Environmental for decision as to whether or not test needs to be repeated.

5.3.31  ENTER signature, printed (first and last) name, date, and time on Appendix Data Sheet 3.

5.3.32  ENTER the following on Appendix Data Sheet 3:

- Signature
- Printed name (First & Last)
- Date
- Time.
5.3 - Monitor Exhaust Stack Ammonia Levels (Cont.)

5.3.33 FWS **ENSURE** all caps, valves, plugs and instrumentation have been restored to original configuration **AND**

**CIRCLE** YES or NO on Appendix Data Sheet 6.

5.3.34 FWS **ENTER** the following on Appendix Data Sheet 6:
- Signature
- Printed name (First & Last)
- Date
- Time.

5.3.35 **FORWARD** to Environmental for calculations.
5.4 Drager Tube and Drager Pump Use

5.4.1 IF Average Ammonia Reading is equal to or greater than 90 ppm THEN perform Section 5.4.

Drager Pump Leak Check

5.4.2 CONFIRM the maintenance calibration date is current for the Drager pump.

5.4.3 IF the calibration is past due, RETURN the instrument to the equipment custodian with a completed green tag, i.e., “IH Instrument Service Tag” (BT-6004-019) indicating it is “Out of Service” AND OBTAIN another Drager pump.

5.4.4 INSERT an unopened colorimetric tube into the inlet of the Drager pump.

5.4.5 SQUEEZE the pump completely AND RELEASE.

5.4.6 ALLOW the pump to try to draw air off the sealed inlet for fifteen minutes.

5.4.7 CONFIRM that the end-of-stroke indicator (i.e., white dot) does not appear.

5.4.8 IF the end-of-stroke indicator does appear before fifteen minutes, RETRY, OR

RETURN the instrument to the equipment custodian with a completed green tag, i.e., “IH Instrument Service Tag” (BT-6004-019) indicating it is “Out of Service,” AND OBTAIN another Drager pump.

5.4.9 IF the pump passes this leak check, REMOVE the colorimetric tube from the Drager pump inlet.

5.4.10 PRESS the reset button on top of the pump next to the stroke counter to reset it to zero.
5.4 - Drager Tube and Drager Pump Use (Cont.)

Drager Pump Use

5.4.11 SELECT the appropriate colorimetric tube for Ammonia and its expected concentration.

5.4.12 CONFIRM that the shelf life of the colorimetric tube has not expired.

5.4.13 READ the instructions contained in the box of colorimetric tubes to determine the following:
- Operating temperature and relative humidity range
- Proper number of pump strokes
- Expected color change
- Concentration range
- Possible interferences
- Other specific information, e.g. disposal information.

5.4.14 USE the Drager tube opener AND

OPEN a colorimetric tube.

5.4.14.1 INSERT the colorimetric tube into the center opening of the Drager tube opener AND

TURN it to score the tip.

5.4.14.2 PUSH tube into the second opening with light pressure until the end pops off.

5.4.14.3 REPEAT Steps 5.4.14.1 and 5.4.14.2 to open the opposite end of the tube.

5.4.15 INSERT the colorimetric tube into the pump inlet AND

ENSURE the arrow on the tube is pointing TOWARDS the pump.
5.4 - Drager Tube and Drager Pump Use (Cont.)

Obtain Samples

5.4.16 INSERT tube to specified traverse point as indicated on Appendix Data Sheet 4, AND PURGE sample line for a minimum of 10 seconds.

5.4.17 HOLD the pump between the thumb and index finger so that the end-of-stroke indicator and stroke counter are easily visible.

5.4.18 PLACE the inlet of the colorimetric tube in the location of the atmosphere to be measured.

5.4.19 SQUEEZE the pump fully away from the breathing zone until it stops and release until the bellows are fully expanded.

5.4.20 WAIT for the end-of-stroke indicator to appear.

5.4.21 SQUEEZE the pump again fully, repeating Steps 5.4.19 and 5.4.20 for the required number of pump strokes.

5.4.22 EVALUATE the color result in accordance with the instructions for the colorimetric tube.

5.4.23 RECORD the sample reading on Appendix Data Sheet 4.

5.4.24 REMOVE the used tube from the Drager pump socket AND DISCARD the used tube into the tube box.

5.4.25 RETURN the used tubes and tube box to the Industrial Hygiene Lab for proper disposal.

5.4.26 OBTAIN remaining samples in accordance with Steps 5.4.14 through 5.4.24 AND RECORD monitor readings on Appendix Data Sheet 4.

5.4.27 SQUEEZE the pump several times away from the breathing zone when the monitoring is completed to clear the residual gases and vapors out of the pump bellows.

5.4.28 IF any traverse reading exceeds the emission limit shown in Appendix Data Sheet 4, NOTIFY Environmental.
5.4 - Drager Tube and Drager Pump Use (Cont.)

5.4.29  FWS **ENSURE** all caps, valves, plugs and instrumentation have been restored to original configuration **AND**

**CIRCLE** YES or NO on Appendix Data Sheet 6.

5.4.30  FWS **ENTER** the following on Appendix Data Sheet 6:

- Signature
- Printed name (First & Last)
- Date
- Time.

5.4.31  **FORWARD** to Environmental for calculations.
5.5 Perform Stack Emission Calculations

5.5.1 **ADD** monitor readings from Appendix Data Sheet 3 **AND**

**RECORD** Total ammonia readings on Appendix Data Sheet 5.

5.5.2 **CALCULATE** the sum of all traverse readings collected from Appendix Data Sheets 3 or 4.

**AND RECORD** on Appendix Data Sheet 5.

5.5.3 **DETERMINE** the total number of Traverse Readings (N) from Appendix Data Sheets 3 or 4

**AND RECORD** on Appendix Data Sheet 5.

5.5.4 **CALCULATE** Average Ammonia Reading (μ) by dividing sum of all traverse readings by number of traverse readings collected

**AND RECORD** on Appendix Data Sheet 5.
5.5 - Perform Stack Emission Calculations (Cont.)

5.5.5 **CALCULATE** Emission Rate

**AND RECORD** on Appendix Data Sheet 5.

5.5.6 **ENTER** the following on Appendix Data Sheet 5:
- Signature
- Printed name (First & Last)
- Date
- Time.

5.5.7 Environmental **ENTER** the following on Appendix Data Sheet 6:
- Signature
- Printed name (First & Last)
- Date
- Time.

5.5.8 **SEND** work package to Area OE for Operations Acceptance.
5.6 Records

The performance of this procedure generates no records. However, PM Data Sheets associated with the procedure, are records and are maintained in the work package as record material.

The record custodian identified in the Company Level Record Inventory and Disposition Schedule (RIDS) is responsible for record retention in accordance with TFC-BSM-IRM_DC-C-02.