Changes “Other Than Inconsequential” Require These Additional Reviews:

Radiological Controls:
Central Radcon Organization

USQ # Routine Maintenance

<table>
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<th>Rev-Mod</th>
<th>Release Date</th>
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<tr>
<td>D-7</td>
<td>05/07/2018</td>
<td>Maintenance Request</td>
<td>Add to Step 5.2.26, &quot;otherwise set to 1&quot;.</td>
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<tr>
<td>D-6</td>
<td>03/08/2018</td>
<td>Maintenance Request</td>
<td>Changes made to add Cal_Tech and a note for clarification.</td>
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<tr>
<td>D-5</td>
<td>03/14/2017</td>
<td>The change is in support of field performance clarification.</td>
<td>Added &quot;first and last&quot; to the signature line in step 4.3.1, added a special instruction above step 5.1.4, modified step 5.1.5, clarified the note above step 5.1.8.3, clarified step 5.1.9, deleted step 5.1.10, added clarification to new step 5.1.10, clarified step 5.1.11, clarified the second note above step 5.2.1, added clarification to step 5.2.26, deleted step 5.2.29, modified step 5.2.29.8, added steps 5.2.29.9, 5.2.29.10, 5.2.29.11, modified step 5.2.29.19, deleted steps 5.2.35 through 5.2.42, added step 5.4.5, updated the records section.</td>
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<tr>
<td>D-4</td>
<td>08/29/2016</td>
<td>Engineering Request</td>
<td>Changed Title, Changed Step 5.1.3, Changed Title before Step 5.2.1 and 5.2.3, Moved Warning above Step 5.2.5 and changed title and added Note. Changed Step 5.2.7, Changed Title before Step 5.2.9 and Changed Step 5.2.10.</td>
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<tr>
<td>D-3</td>
<td>02/23/2016</td>
<td>Project &amp; Maintenance Request</td>
<td>modified title, scope, added reference to POR126 &amp; POR127 to 5.1.9 &amp; 5.4.6</td>
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1.0 PURPOSE AND SCOPE

1.1 Purpose

This procedure provides instructions for calibrating, troubleshooting, and replacing Eberline AMS-4 Beta CAMs as installed in AP, AN, AW, POR126, POR127 and POR107 C-Farm Primary Ventilation Exhausters.

1.2 Scope

1.2.1 This procedure applies to calibration, troubleshooting, and replacement of the following AMS-4 CAMs:

- AN241-VTP-RT-554 - AN A-Train CAM
- AN241-VTP-RT-654 - AN B-Train CAM
- AW241-VTP-RT-554 - AW A-Train CAM
- AW241-VTP-RT-654 - AW B-Train CAM
- POR107-VTP-RT-554 - POR107 CAM
- POR126-VTP-RT-554 - POR126 CAM
- POR127-VTP-RT-554 - POR127 CAM
- AP241-VTP-RT-554, APATrain CAM
- AP241-VTP-RT-654, APBTrain CAM.

2.0 INFORMATION

2.1 Terms and Definitions

- NIST National Institute of Standards and Technology

3.0 PRECAUTIONS AND LIMITATIONS

3.1 Personnel Safety

**WARNING** - Failure to use extreme caution when working with high voltage detector cable may result in personal injury.

3.1.1 Filter and filter holder should be considered potentially radiologically contaminated.

3.1.2 Compliance with DOE–0359, Hanford Site Electrical Safety Program is required when working with this procedure.

3.1.3 If a lock and tag is required during the performance of this procedure, comply with the DOE-0336, Hanford Site Lockout/Tagout Procedure.
3.2 Radiation and Contamination Control

3.2.1 Work in radiological areas will be performed using a Radiological Work Permit following review by Radiological Control per TFC-ESHQ-RP_RWP-C-03, ALARA Work Planning.

3.2.2 The opening of any system or component within a Radiological Area requires the presence of a Health Physics Technician to verify contamination control.

3.3 Environmental

3.3.1 Work on potentially contaminated ventilation system/components shall be in accordance with TFC-ESHQ-ENV-STD-06, Attachment A - ALARACT Demonstrations, ALARACT 16.1, “Tank Farm ALARACT Demonstration For Work On Potentially Contaminated Ventilation System Components”.

3.4 Limits

Tank farm ventilation systems and exhaust monitoring systems are regulated under Washington State Administrative Code (WAC) chapters 173-400, 173-401, and 246-247 and applicable Notices of Construction (NOC) issued to ensure compliance with these regulations. To ensure reporting requirements are met, 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 Environmental per the On-Call List in compliance with TFC-ESHQ-ENV-FS-C-01.


HNF-SD-WM-TSR-006, Tank Farm Technical Safety Basis

- LCO 3.1 DST Primary Tank Ventilation Systems
- LCO 3.4 DST Induced Gas Release Event Flammable Gas Control
4.0 PREREQUISITES

4.1 Special Tools, Equipment and Supplies

NOTE - The amount of material taken into contaminated areas is limited to minimize radioactive waste and future decontamination.

The following supplies may be needed to perform this procedure:

- AMS-4 password, from supervisor/lead
- Request engineering enable/provide Cal_Tech user login
- USB storage device
- CAM Bypass key
- Digital voltmeter (DVM)
- High voltage probe
- NIST traceable $^{90}\text{SrY}$ source, 47mm (1-7/8") overall source size, Current assay with 1-7/8" filter retention ring
- O-Rings as specified by engineering on Bill Of Material (B.O.M.).

NOTE - Current source activity may be verified through the following calculation:

$$A_F = A_0 e^{-\lambda t}$$

where: $\lambda$ = 0.693/half-life

$A_F$ = Current activity

$A_0$ = Initial activity

$t$ = time since initial activity (t and half-life must be in the same units)

- Beta Source: $^{90}\text{SrY}$, 10,000 - 90,000 dpm (Obtained from, and returned to, Health Physics.)
- Filter paper, 3-micron, Gelman Versapor-3000.
4.1 Special Tools, Equipment and Supplies (Cont.)

NOTE - A Bill of Material must be added to the work package for any components listed below requiring replacement.

The following items may be needed for replacement during use of this procedure:

- **Key Pad** 20 Key Matrix Eberline part number SWMI43
- **P.C. Board** Beta/Alpha Detector board Eberline part number SP28E
- **P.C. Board** Front Panel Board Eberline part number YP11526000
- **P.C. Board** Background Detector Board Eberline part number SP28F
- **Detector** Pancake Mica Window Alpha, Beta, Gamma Detector LND733
- **Cable Set** In-Line Head Cable Set Eberline part number YP11562098
- **Porous Support** 1.15” diameter Filter Paper Support Eberline part number ZP11479101
- Special High Voltage Cable Assembly for SP28E/F boards on Eberline AMS-4 CAMs
- AMS-4 CAM door switch Eberline PN SWM122
- Door switch cable.

4.2 Performance Documents

The following documents may be needed for performance of this procedure:

- AMS-4 Beta Particulate Monitor Technical Manual
- Bill of Material (B.O.M.) (for replacement of components).

4.3 Field Preparation

4.3.1 **IF** performing maintenance on DST ventilation, Shift Manager/OE, **VERIFY** that there are no ongoing transfers and no waste disturbing activities that require this system to be OPERABLE. **(LCO 3.4)**

________________________/________________________/__________
Signature Print (First and Last) Date
Shift Manager /OE

4.3.2 **IF** performing maintenance on DST ventilation, **PERFORM** calibration on standby exhaust train only **AND**

**NOTIFY** Shift Manager to initiate time monitoring per LCO 3.1.B. **(LCO 3.1)**
5.0 PROCEDURE

NOTE - Each train HMI is directly connected to a single CAM located on the same train as the HMI. Any CAM interfacing through Win AMS must be performed from the HMI on the same train as the CAM.

5.1 Preparation and Setup

5.1.1 UNLOCK AND PUSH CAM bypass button.

5.1.1.1 REMOVE CAM bypass key if used.

5.1.2 LOGIN with Cal_Tech user credentials at exhauster HMI.

NOTE - CAM Serial Number and Flow Rate Setpoint are displayed on HMI.

5.1.3 RECORD CAM Serial Numbers, on Data Sheet.

5.1.3.1 IF necessary, CHANGE serial number on HMI to match serial number on CAM.

Special Instruction:

The rest of the maintenance (except GAMMA Subtract Factor Test) may be performed either at the exhauster or in the instrument shop.

5.1.4 IF performing periodic O-ring change out, PERFORM Steps 5.1.4.1 through 5.1.4.4.

5.1.4.1 REMOVE detector assembly O-rings and gaskets.

5.1.4.2 CLEAN detector assembly.

5.1.4.3 LUBRICATE AND INSTALL new O-rings and chamber gaskets in detector assembly grooves.

NOTE - Alignment pins must be in position in flow chamber.

5.1.4.4 RE-ASSEMBLE detector assembly AND REPLACE sample window “O” ring with new “O” ring.

5.1.5 START Win AMS-4 program from HMI or computer.

NOTE - It may be necessary to toggle (Alt + Tab) to WINAMS screen.

5.1.6 SELECT Edit from main menu AND ENTER Password.
NOTE - Each train HMI is directly connected to a single CAM located on the same train as the HMI. Any CAM interfacing through Win AMS must be performed from the HMI on the same train as the CAM.

Preparation and Setup (Cont.)

NOTE - Blue icon next to American flag confirms correct password was entered.
- “Com Fail” indicates a communications failure.

5.1.7 CHECK “DAC” is displayed under 0-100% bar graph on screen (communication established).

5.1.8 IF communication cannot be established, PERFORM the following:

5.1.8.1 SELECT EDIT from PC menu AND SELECT System.

5.1.8.2 SET the following computer parameters:
- Communications Port- Located on Data Sheet
- Communications Baud- The same as on Data Sheet
- Selected Address (1-12)- The same number as the CAM’s “Instrument Address”
- Active Continuous Air Monitors- Box is marked by selecting number, relative to “Instrument Address.”

NOTE - ULAN Mode within Menu of CAM can be changed under Instrument Parameters.

5.1.8.3 IF ULAN Mode of CAM is ON, CHANGE CAMs “ULAN Mode” to OFF.

5.1.8.4 IF communication still cannot be established, STOP work AND NOTIFY FWS.

5.1.9 ENSURE Sample Flow Setpoint for both the CAM (short cut key # 2) and HMI (navigate to exhauster AMS-4 screen) are as follows:
- 2.0 SCFM (for AP, AN, AW)
- 1.0 SCFM (for POR107, POR126, and POR127).
NOTE - Each train HMI is directly connected to a single CAM located on the same train as the HMI. Any CAM interfacing through Win AMS must be performed from the HMI on the same train as the CAM.

Preparation and Setup (Cont.)

5.1.10 RECORD As-Found parameters on Data Sheet:
   - Instrument Parameters
   - Fail Parameters
   - Alarm Parameters
   - Detector Parameters.

5.1.11 ENSURE parameters match Desired Values on Data Sheet AND RECORD As-Left parameters on Data Sheet.
5.2 Calibration

NOTE - During performance of this section troubleshooting may be performed per Section 5.3 at any time. After troubleshooting and repair, re-perform calibration procedure starting at the beginning of this section. Document failure mode, repair performed, and parts replaced on calibration Data Sheet.

- When entering 900 V the displayed value will be 898 due to steps in the processor.

Set High Voltage Parameter for Beta Detector

5.2.1 SELECT Detector Parameters, AMS-4 B/G HIGH VOLTAGE.

5.2.2 ENSURE High Voltage is set to 900 V (898 V).

Set High Voltage Parameter for Background Detector

5.2.3 SELECT Detector Parameter, AMS-4 HIGH VOLTAGE.

5.2.4 ENSURE High Voltage is set to 900 V (898 V).

WARNING

Failure to use extreme caution when working with high voltage detector cable may result in personal injury.

Beta High Voltage Adjustment

NOTE: - Utilize Fluke and High Voltage Probe for making measurements and when performing voltage adjustments

5.2.5 DISCONNECT high voltage cable at detector head box.

5.2.6 MEASURE Beta high voltage with high voltage probe AND

RECORD measured beta high voltage on Data Sheet.

5.2.7 IF beta high voltage is not within ±20V of 900V, ADJUST voltage (R10) on E board in high voltage assembly to 900V ±10 V (as close to 900 V as possible).

5.2.8 RECORD As-Left Beta High Voltage on Data Sheet.
5.2 Calibration (Cont.)

Background High Voltage Adjustment (Cont.)

5.2.9 MEASURE background high voltage AND

RECORD measured background high voltage on Data Sheet.

5.2.10 IF background high voltage is not within ±20V of 900 V, ADJUST voltage (R10) on F board to 900 V ±10 V (as close to 900 V as possible).

5.2.11 RECORD As-Left background high voltage on Data Sheet.

Determine Efficiency of Beta Detector at HMI

5.2.12 SELECT “Calibrate” from main menu.

5.2.13 SELECT “Step 2-Determine Efficiency.”

5.2.14 EDIT source information AND

ENTER source label information as necessary:

- Cal. Source Activity (dpm)
- Isotope
- Serial Number.

5.2.15 RECORD As-Left source activity variable (dpm) on Data Sheet.

5.2.16 ENTER 300 sec in Count Time Remaining window.

5.2.17 SELECT Background mode.

5.2.18 SELECT “Start” AND

WAIT until complete.

5.2.19 SELECT “Efficiency” mode.

5.2.20 SELECT “Start” AND

INSERT Beta source.
5.2 Calibration (Cont.)

5.2.21 CLOSE door AND
SELECT “OK” (starts count).

5.2.22 WAIT until source count is complete.

5.2.23 RECORD As-Left Beta Efficiency on Data Sheet.

5.2.24 SELECT “YES” to change efficiency to new value.

5.2.25 REMOVE source.

NOTE - In low background environment CAM may take 2 to 4 hours to collect GAMMA FACTOR count.

5.2.26 IF craft determines performance of GAMMA Subtract Factor Test is needed ENSURE it is performed at the installed location, otherwise set to 1.

5.2.26.1 TOGGLE to MENU screen (AMS-4 display).

5.2.26.2 ENTER password AND PRESS <ENTER>.

5.2.26.3 TOGGLE to CALIBRATE screen AND PRESS <ENTER>.

5.2.26.4 TOGGLE with arrow key to GAMMA FACTOR count screen AND PRESS <ENTER>.

NOTE - Count should continue until 400 counts have been collected.

5.2.26.5 WHEN count is complete, PRESS <ENTER>.

NOTE - Expected values for Gamma Subtract Factor Test are 0.7 to 1.3.

5.2.27 IF CAM fails Gamma Subtract Factor Test, PERFORM applicable steps in Section 5.3.

5.2.28 IF craft determines GAMMA Subtract Factor retest is necessary, REPEAT Steps 5.2.26.1 through 5.2.26.5.
5.2 Calibration (Cont.)

5.2.29 **RECORD** PASS/FAIL for the following input/output tests on Data Sheet:

5.2.29.1 **SELECT** Test Input/Outputs from AMS-4 Test Menu.

5.2.29.2 **SELECT** Keypad.

5.2.29.3 **PERFORM** Keypad test.

5.2.29.4 IF Keypad Test fails, **REPLACE** Keypad per Section 5.3 AND **REPEAT** Steps 5.2.29.1 through 5.2.29.3.

5.2.29.5 **SELECT** Menu on keypad.

5.2.29.6 **SELECT** Outputs.

5.2.29.7 **PERFORM** Malfunction Light test.

5.2.29.8 **SELECT** Ready Light.

5.2.29.9 **SELECT** remote inputs.

5.2.29.10 **PERFORM** remote alarm acknowledge switch test.

5.2.29.11 **PERFORM** filter door switch test.

5.2.29.12 **SELECT** Alarm Relay test.

5.2.29.13 **CONNECT** DVM (24 VDC) to Alarm Relay Normal Closed contacts terminals C and NC.

5.2.29.14 **WHEN** alarm relay is ON, **CHECK** Alarm Relay contact is OPEN.
5.2  Calibration (Cont.)

5.2.29.15  **PRESS** EDIT key.

5.2.29.16  **WHEN** alarm relay is OFF, **CHECK** Alarm Relay contact is CLOSED.

5.2.29.17  **DISCONNECT** DVM.

5.2.29.18  **SELECT** Fail Relay test.

5.2.29.19  **CONNECT** DVM to Fail Relay Normal Closed contacts, terminals C and NO.

5.2.29.20  **WHEN** Fail Relay is OFF, **CHECK** Fail Relay contact is OPEN.

5.2.29.21  **SELECT** Edit.

5.2.29.22  **WHEN** Fail Relay is ON, **CHECK** Fail Relay contact is CLOSED.

5.2.29.23  **DISCONNECT** DVM from Fail Relay.

5.2.30  **SELECT** LED BAR Graph test.

5.2.31  **USE** EDIT to set Bar Graph to 95% of maximum value.

5.2.32  **RECORD** As-Found value indicated by Bar Graph on Data Sheet.

5.2.33  **IF** As-Found value is less than 90% or greater than 95%:

5.2.33.1  **REMOVE** cover from AMS-4.

5.2.33.2  **ADJUST** R12 potentiometer until "LED BAR" reads 95%.

5.2.33.3  **REINSTALL** cover.

5.2.34  **RECORD** As-Left “LED BAR” on Data Sheet.

5.2.35  **GO TO** Section 5.4.
5.3 Troubleshooting and Acquire Parts

NOTE - Section 5.3 may be performed prior to or in parallel with other sections of this procedure, provided procedure is performed after repair is complete. Failure mode, repairs, and parts replaced are documented on calibration Data Sheet.

- If troubleshooting and/or replacement parts are not necessary this section may be skipped.

- This section may be performed at any time and steps may be performed in any order or in parallel by procedure or FWS.

5.3.1 TROUBLESHOOT per Eberline AMS-4 Beta Particulate Monitor Technical Manual.

NOTE - Replacement parts are listed in Section 4.1.

5.3.2 IF parts replacement is required, ENSURE B.O.M. has been generated, and approved per TFC-BSM-CP_CPR-C-18.

NOTE - Replacement parts are available from material coordinators and are staged in East and West Tank Farm storage areas.

5.3.3 RECORD all repairs and parts replacement on calibration data sheet.

5.3.4 RETURN to applicable point in procedure.
5.4 Restoration

5.4.1 DISCONNECT AND REMOVE test equipment.

5.4.2 EXIT AMS-4 WINAMS software.

5.4.3 RECORD M&TE and Source information on Data Sheet.

5.4.4 PLACE a 365-day calibration sticker on CAM.

5.4.5 IF calibration was performed in the Instrument Shop REINSTALL CAM at the exhauster.

5.4.6 IF exhauster is in operation, ENSURE alarms are reset or cleared after READY light is illuminated and flow has stabilized.

5.4.7 IF clearing CAM Bypass for POR107, POR126 or POR127 SELECT Clear CAM Alarms Bypass from HMI screen AND

   GO TO Step 5.4.9.

5.4.8 IF clearing CAM Bypass for AP A-Train, AP B-Train, AW A-Train, AWB-Train, ANA-Train, or AN-B Train, PERFORM the following:

   5.4.8.1 OPEN CAM Bypass Faceplate from HMI screen.

   5.4.8.2 SELECT Alarm/Event tab.

   5.4.8.3 SELECT Reset button.

5.4.9 FWS NOTIFY Responsible Shift Manager of the calibration status and that the Functional Test must be completed before exhauster may be returned to operation.

   5.4.9.1 IF calibration passed successfully, STOP time monitoring per LCO 3.1.b. (LCO 3.1)
5.5 Review

NOTE - Acceptance Criteria has been met when steps in this procedure have been satisfactorily performed and As-Left values meet the specifications and tolerance(s) per the Data Sheet.

5.5.1 FWS must REVIEW AND ENSURE completed Data Sheets meet acceptance criteria and comments sections are filled out appropriately.

5.5.2 ENSURE any work requests needed as a result of this procedure are identified and generated.

5.6 Records

This procedure is performed within a work package, as such, the procedure in its entirety will be maintained as a record per the Work Control process.

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