Changes “Other Than Inconsequential” Require These Additional Reviews:

222-S Laboratory

USQ # N/A-4

<table>
<thead>
<tr>
<th>Rev-Mod</th>
<th>Release Date</th>
<th>Justification</th>
<th>Summary of Changes</th>
</tr>
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<tr>
<td>E-4</td>
<td>10/23/2018</td>
<td>Vent and Balance Request</td>
<td>Added “GHS-SDS and/or MSDS for ATI PAO-4 (GHS-SDS and/or MSDS #065495)” to Section 4.2. Updated Aerosol Generator Operating Pressure Ranges for Aerosol Generators table in Section 5.5. Added “PASS = P &lt; 0.05%  FAIL = P ≥ 0.05%” to Data Sheet 1. Updated Signature line.</td>
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<tr>
<td>E-3</td>
<td>03/29/2017</td>
<td>Periodic Review</td>
<td>Removed vague phrases for field work clarification.</td>
</tr>
<tr>
<td>E-2</td>
<td>02/14/2017</td>
<td>Vent and Balance Request</td>
<td>Changed Vent and Balance FWS to Vent and Balance Reviewer and deleted step 3.2.3 per radon request.</td>
</tr>
<tr>
<td>E-1</td>
<td>09/16/2015</td>
<td>Maintenance Request</td>
<td>Changed use type to Reference</td>
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<tr>
<td>E-0</td>
<td>05/13/2014</td>
<td>Periodic Review</td>
<td>Changed bulleted items with action verbs to step numbers. Used verbs from our verb list. Added criteria to conditional steps (eliminate vague phrases).</td>
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1.0 PURPOSE AND SCOPE

1.1 Purpose

This procedure provides instructions for a safe, uniform method for determining leaks in vacuum cleaners containing High Efficiency Particulate Air (HEPA) filters.

1.2 Scope

This procedure involves testing of HEPA filter systems on the Hanford Site. A DOE approved challenge aerosol is used in accordance with ASME N511-2007. The test in this procedure determines aerosol penetration as a result of leakage through or around filters due to faulty installation, defects in filter mounting frame and housing, or defects and/or damage to individual vacuum cleaner.

2.0 INFORMATION

2.1 General Information

2.1.1 All measuring and testing equipment used to perform this procedure must be within its current calibration cycle as shown on calibration label.

2.1.2 If performance of any steps in this procedure is not required for procedure completion, indicate steps not performed by entering "N/A" in appropriate Data Sheet signoff space and explain in Comments/Remarks section of Data Sheet.

2.1.3 Data sheets required for this procedure may be duplicated for systems requiring multiple copies.

2.1.4 This procedure may be supplemented with system-specific information in the form of drawings, sketches, work instructions, or custom data sheets. If specific information is not available, document the testing process in the work package.
3.0 PRECAUTIONS AND LIMITATIONS

3.1 Personnel Safety

3.1.1 Facility safety rules shall be reviewed and complied with when performing this procedure.

3.1.2 To avoid injury, use caution when working around rotating machinery.

3.1.3 Obtain and review GHS-SDS and/or MSDS for ATI PAO-4 Aerosol agent, GHS-SDS and/or MSDS #065495.

3.2 Radiation and Contamination Control

3.2.1 Radiological Work Permits shall be reviewed and complied with when performing this procedure.

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

3.2.3 The opening of any system or component within a Radiological Area requires the presence of an HPT to verify contamination control.

3.2.4 Special care should be taken to ensure contamination control when inserting and withdrawing any vent and balance equipment.

3.2.5 Externals of caps, plugs, instrumentation, and Vent & Balance test equipment shall be surveyed by an HPT for contamination before and after insertion/removal from the ventilation system and again after reinstallation.

3.3 Environmental Compliance

If any waste is generated during performance of this procedure, consult Facility/Plant/Area Hazardous Waste Coordinator for specific instructions to ensure compliance with environmental standards, as applicable, for disposal.
4.0 PREREQUISITES

4.1 Special Tools, Equipment, and Supplies

The following supplies may be needed to perform this procedure:
- Aerosol generator capable of producing an acceptable aerosol. Aerosol generators can be air/nitrogen generated or thermal generated provided adequate aerosol is generated to conduct a valid test
- A linear - readout forward - light scattering photometer or "percent penetration meter"
- High Efficiency Particulate Air Filter System Data/Test Record Sheets
- Airflow measuring device(s) (manometer, micro-manometer, pitot tube, hot wire anemometer, etc.)
- Aerosol (Department of Energy approved)
- Respiratory protection
- Plastic bags
- Tape
- Funnel.

4.2 Performance Documents

The following document may be needed to perform this procedure:
- ACGIH, Industrial Ventilation, Section 9, "Testing of Ventilation Systems"
  - PG 5-13
  - PG 5-21.
- GHS-SDS and/or MSDS for ATI PAO-4 (GHS-SDS and/or MSDS #065495)

4.3 Field Preparation

NOTE - Steps 4.3.1 through 4.3.3 can be performed in any logical order.

4.3.1 ENSURE Operations personnel have configured vacuum cleaner (cleaned, emptied, re-bagged) to allow performance of this procedure.

4.3.2 OBTAIN release from Operations management prior to beginning performance of this procedure.

4.3.3 Facility Supervisor/FWS shall conduct pre-job safety planning, including all involved personnel.
5.0  PROCEDURE

5.1  Prepare Test Equipment

NOTE - Photometers and/or aerosol generators may not be exchanged until completion of a test trial.

- Calibration data for additional or replacement instrumentation required to complete testing should be recorded in the comment section of Data Sheet 1.
- Steps 5.1.1 and 5.1.2 may be performed in any order.

5.1.1  RECORD equipment calibration data and aerosol type in Step 1 of Data Sheet 1.

5.1.2  ENERGIZE photometer AND COMPLETE minimum 15-minute warm-up.

5.2  Inspect (Visually) Filter System

5.2.1  COMPLETE visual inspection of vacuum cleaner for damage to hoses, cords, vacuum body, and signs of leaks.

5.2.2  RECORD any observed problems in the Comments section of Data Sheet 1.
5.3 Prepare Vacuum for Testing

NOTE - Figure 1 shows typical testing configurations for the various HEPA vacuums.

5.3.1 IF the poly bag method is used for testing, PERFORM the following:

5.3.1.1 TAPE AND SEAL plastic bag to exhaust portion of vacuum cleaner.

5.3.1.2 CUT a slit in top corner of bag to allow system to exhaust.

5.3.2 IF the vacuum is internally contaminated, ENSURE vacuum inlet is closed or taped before continuing.

5.3.3 TURN vacuum cleaner ON.

5.3.4 ENSURE vacuum inlet is open.

5.3.5 HOOK UP section of hose to vacuum intake.

5.3.6 IF the poly bag method is used for testing, ENSURE plastic bag is sealed to the vacuum housing and becomes fully inflated.
5.4 Determine System Air Flow

5.4.1 MEASURE velocity pressure (VP) AND

RECORD all VP (in. wg) measurements in Step 2 of Data Sheet 1.

5.4.2 CALCULATE velocity (in feet per minute [fpm]) at each traverse point interval from corresponding VP measurement using the following equation AND

RECORD results in Step 2 of Data Sheet 1.

\[ \text{velocity (fpm)} = 4005 \times \sqrt{\text{vp}} \]

5.4.3 ADD entries of velocity column AND

RECORD total in Step 3 of Data Sheet 1.

5.4.4 DIVIDE velocity total by number of entries AND

RECORD result in Step 4 of Data Sheet 1.

5.4.5 RECORD duct size in square feet in Step 5 of Data Sheet 1.

5.4.6 CALCULATE total air flow rate (in cubic feet per minute [cfm]) using the following equation.

Total air flow rate (cfm) = (Average velocity ) x (Area sq ft)

5.4.7 RECORD results in Step 6 Data Sheet 1.
5.5 Establish Base Percent (BP)

5.5.1 **INSERT** Base Percent (BP) probe upstream of vacuum cleaner filter to be tested.

5.5.2 **INJECT** an appropriate concentration of challenge aerosol upstream of vacuum cleaner filter to be tested and upstream of BP probe.

**NOTE** - The following table provides operating pressure ranges for the listed aerosol generators.

<table>
<thead>
<tr>
<th>AEROSOL GENERATOR</th>
<th>OPERATING PRESSURE</th>
</tr>
</thead>
<tbody>
<tr>
<td>TDA-4B,TDA-6C,TDA-6D</td>
<td>18 to 22 psi</td>
</tr>
<tr>
<td>TDA-5B,TDA-5C</td>
<td>45 to 55 psi</td>
</tr>
<tr>
<td>TDA-6A</td>
<td>N/A</td>
</tr>
</tbody>
</table>

5.5.3 **RECORD** aerosol generator pressure in Step 8 of Data Sheet 1.

5.5.4 **RECORD** range switch setting (scale) and meter readings for (BP) in Step 9 of Data Sheet 1.

5.5.5 **TURN** aerosol generator OFF.

5.6 Determine Total Penetration for Vacuum Cleaner

5.6.1 **INJECT** aerosol at same pressure established in Step 5.5.3 upstream of vacuum cleaner filter to be tested.

5.6.2 **MEASURE** total penetration (P1) through vacuum cleaner filter **AND** **RECORD** scale and meter readings in Step 10 of Data Sheet 1.

5.6.3 **TURN** aerosol generator OFF.

5.6.4 **REMOVE** section of hose from vacuum intake.

5.6.5 **IF** the vacuum is internally contaminated, **ENSURE** vacuum inlet is closed or taped before continuing.

5.6.6 **TURN** vacuum cleaner OFF.
5.7 Calculations

5.7.1 **CALCULATE** aerosol penetration using the following equation **AND** **RECORD** in Step 11 of Data Sheet 1.

\[
\text{Calculated Penetration (\%)} = 100 \times \frac{(P1)}{(BP)}
\]

**NOTE** - Filter **PASSES** if aerosol penetration is less than 0.05%. Filter **FAILS** if aerosol penetration is equal to or greater than 0.05%.

5.7.2 **MARK** results (PASS or FAIL) in Step 11 of Data Sheet 1.

5.7.3 **IF** any calculated penetration is equal to or greater than 0.05%, **IMMEDIATELY NOTIFY** Facility FWS or Facility Manager **AND** **OBTAIN** Facility FWS or Facility Manager Signature in Step 12 of Data Sheet 1 acknowledging failure.

5.8 Restoration

5.8.1 **PERFORM** a radiological survey of all equipment prior to removal from work area.

5.8.2 **INSTALL** any caps/plugs removed from test ports.

**NOTE** - Sticker for last inspection should be left on filter housing so that results of this inspection and last inspection are available in field.

5.8.3 **INSTALL** test sticker (BL-6000-780) indicating test date and results.

5.8.4 **FILL OUT AND INSTALL** HEPA Vacuum Tamper Seal (BL-6000-785) so that access to the HEPA Filter will be denied without breaking the seal.
5.9 **Review**

5.9.1 **DOCUMENT** any deficiencies or component failures observed during the performance of this procedure.

5.9.2 **RECORD** comments on Data Sheet 1 AND **NOTIFY** Facility FWS or Facility Manager.

5.9.3 **ENSURE** Data Sheet 1 entries are complete.

5.9.4 Vent and Balance FWS, **REVIEW** procedure Data Sheets for completeness, legibility AND **CHECK** all calculations.

5.10 **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.
Figure 1 - Typical Test Configurations for HEPA Filter Vacuum Cleaners
## In-Place Testing of HEPA Filter Systems (Vacuum Cleaner)

### Data Sheet 1

<table>
<thead>
<tr>
<th>Step 1</th>
<th>Aerosol Generator</th>
<th>Additional Instrument Calibration Data</th>
</tr>
</thead>
<tbody>
<tr>
<td>Date of Test:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Work Order #:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Instrument #:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Inst. Cal Due Date:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Funct. Test Due Date:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Inst. Code #:</td>
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<td></td>
</tr>
<tr>
<td>Vacuum #:</td>
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<tr>
<td>Facility:</td>
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<td>Inst. Cal Due Date:</td>
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<tr>
<td>Data Taken By:</td>
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<tr>
<td><strong>Step 1</strong></td>
<td><strong>Aerosol Generator</strong></td>
<td><strong>Additional Instrument Calibration Data</strong></td>
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<td></td>
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<tr>
<td>Equipment Number:</td>
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<td></td>
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<tr>
<td>Funct. Test Due Date:</td>
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<tr>
<td>Aerosol Type:</td>
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</tbody>
</table>

### Step 2

<table>
<thead>
<tr>
<th>Velocity Pressure (VP) (in. wg)</th>
<th>Velocity (fpm)</th>
<th>Step 3</th>
<th>Total Velocity (fpm):</th>
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<tbody>
<tr>
<td>1</td>
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<td>Step 4</td>
<td>Average Velocity (fpm):</td>
</tr>
<tr>
<td>2</td>
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<td>Step 5</td>
<td>Duct Size:</td>
</tr>
<tr>
<td>3</td>
<td></td>
<td>Step 6</td>
<td>Total Air Flow (cfm):</td>
</tr>
<tr>
<td>4</td>
<td></td>
<td>Step 8</td>
<td>Generator psi:</td>
</tr>
<tr>
<td>5</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td></td>
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<td></td>
</tr>
<tr>
<td>SCALE X READING =</td>
<td>INPUT</td>
<td>Calculated Penetration</td>
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</tr>
<tr>
<td>------------------</td>
<td>-------</td>
<td>-----------------------</td>
<td></td>
</tr>
<tr>
<td>Step 9</td>
<td><em><strong><strong><strong>X</strong></strong></strong></em>_ = ________ (BP)</td>
<td>CP1 = 100 X (P1) (BP)</td>
<td></td>
</tr>
<tr>
<td>Step 10</td>
<td><em><strong><strong><strong>X</strong></strong></strong></em>_ = ________ (P1)</td>
<td>CP1 = 100 X (_________ /___________)</td>
<td></td>
</tr>
</tbody>
</table>

Step 11

CP1 = ___________

PASS = P < 0.05%  FAIL = P ≥ 0.05%

PASS / FAIL

Step 12

Notify Facility Manager of Failure.

Signature / Print (First & Last) / Date

Facility Rep.

Comments:

___________________________________________________________________________________________________
___________________________________________________________________________________________________
___________________________________________________________________________________________________
___________________________________________________________________________________________________
___________________________________________________________________________________________________
___________________________________________________________________________________________________

Signature / Print (First and Last) / Date

Vent and Balance Lead

Signature / Print (First and Last) / Date

Vent and Balance Reviewer