Perform Operational and Source Check of Eberline Model EC-4 Area Radiation Monitor

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Change History (≤ last 5 Rev-Mods)

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<tr>
<td>C-0</td>
<td>08/30/2013</td>
<td>All changes are as a result of the periodic review process.</td>
<td>Globally deleted/modified vague phrases.</td>
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<tr>
<td>B-4</td>
<td>07/15/2013</td>
<td>RadCon request</td>
<td>Globally deleted PNL/PNNL as a referenced document.</td>
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<td>B-3</td>
<td>06/14/2012</td>
<td>Operations request to update the job hazards as a result of JHA review.</td>
<td>Removed electrical warnings, references and steps pertaining to donning electrical PPE. New steps 5.2.2 and 5.2.21 to don ear plugs</td>
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1.0 PURPOSE AND SCOPE

1.1 Purpose

This procedure provides specific information regarding the Eberline Model EC-4 Area Radiation Monitor when used for occupational radiation monitoring per 10CFR835 (i.e., not applicable for process monitoring).

1.2 Scope

This procedure involves operation and performing operational and source checks of the Eberline Model EC-4 Area Radiation Monitor.

2.0 INFORMATION

2.1 General Information

2.1.1 Specific information regarding theory of operation, calibration, maintenance and instrument specifications and limitations, including environmental and interfering radiation can be found in MA-562, Radiation Protection Instrument Manual (or equivalent).

2.2 Terms and Definitions

ASP - Alarm Setpoint

ARM - Area Radiation Monitor
3.0 PRECAUTIONS AND LIMITATIONS

3.1 Personnel Safety

**WARNING** - Failure to wear hearing protection may result in hearing loss. Noise levels may exceed 100 dB.

3.1.1 The temperature range for the EC-4 has been extended beyond the range listed in MA-562. The acceptable temperature range is 14 °F to 122 °F.

3.2 Radiation and Contamination Control

**Internal Check Sources**

3.2.1 Some EC-4 units contain internal $^{90}$Sr check sources ranging from 0.15 μCi to 5 μCi. Though below levels that require labeling, these items should be labeled with radioactive material stickers and controlled as radioactive material in accordance with HNF-5183, Article 411.2.

3.2.2 There are two types of internal sources that may be found in an EC-4.

- A solenoid-activated check source is used to source response check the detector. Detectors that contain these sources will have a model number ending with the suffix “CC”.

- A “keep-alive” source is used in low-background areas to prevent false failure alarms. The detector model number does not end with “CC” for these sources.
4.0 PREREQUISITES

4.1 Special Tools, Equipment, and Supplies

The following supplies may be needed to perform this procedure:

NOTE - Higher activity sources may be required in areas where the background radiation prevents the use of the 10 mR/hr V-block. It is recommended the V-block check source be at least twice the background dose rate. The RCT should determine the best source to be used per application.

- Greater than 10 mR/hr (nominal) V-block check source for instruments not equipped with an internal source check
- Hearing protection

4.2 Performance Documents

The following documents may be needed to perform this procedure:

- A-6004-432, Area Radiation Monitor Source Check
- BT-6002-880, Instrument Service Tag.
5.0 **PROCEDURE**

5.1 **Operational Check**

**NOTE** - The facility should take steps to ensure the calibration expiration date is not exceeded in cases where the instruments calibration will expire before the next operational check occurs.

5.1.1 **CONFIRM** calibration of instrument is current.

5.1.2 **IF** calibration has expired or will expire prior to next scheduled check, **PERFORM** the following:

5.1.2.1 **REMOVE** instrument from service.

5.1.2.2 **TAG** instrument with a complete Instrument Service Tag (BT-6002-880).

5.1.2.3 **RETURN** instrument to calibration facility for service.

5.1.3 **CONFIRM** instrument source check is current.

5.1.4 **INSPECT** instrument for the following physical defects:

- Defective cables
- Broken meter glass
- Loose knobs
- Any other observable defects that may affect operation.

5.1.5 **IF** physical defects of instrument are found, **PERFORM** the following:

5.1.5.1 **REMOVE** instrument from service.

5.1.5.2 **TAG** instrument with complete Instrument Service Tag (BT-6002-880).

5.1.5.3 **RETURN** instrument to calibration facility for service.
5.1 Operational Check (Cont.)

5.1.6 **IF** it is determined that the Instrument Service Tag was installed in error, **PERFORM** the following:

5.1.6.1 **CONFIRM** the instrument passes all required operational checks.

5.1.6.2 **OBTAIN** concurrence from the First Line Manager to place instrument back into service.

5.1.6.3 **REMOVE** the Instrument Service Tag.

5.1.6.4 **PLACE** the instrument back in service.

5.1.7 **WITH** power on, **CONFIRM** “Normal” light is lit.

NOTE - An unlit “Normal” light may indicate a failed detector.

5.1.7.1 **IF** “Normal” light is not lit, **CONTACT** facility technical staff for resolution.

5.1.8 **CONFIRM** the alert (if used) and high alarm set-points are set in accordance with project-specific documents, technical work document, or Radiological Work Permit (RWP).
5.2 Source Check

NOTE - Upon receipt from the Calibration Service Provider and prior to placing an EC-4 into service, an initial response reading has to be obtained.

- Periodically (at least quarterly) between calibrations, each in service EC-4 has to be response checked to confirm the reading is within operating parameters of the initial response reading. This is only a one point check and the response reading should not include background (the background is to be subtracted from the total reading to obtain the response reading).

5.2.1 IF a good response reading cannot be obtained because of high background, MOVE the EC-4 to a low-background area prior to obtaining the response reading.

Initial Source Check

NOTE - The initial source check is performed when the instrument is first received from the calibration facility.

WARNING

Failure to wear hearing protection may result in hearing loss. Noise levels may exceed 100 dB.

5.2.2 DON ear plugs.

5.2.3 INFORM personnel in area that source check of instrument is to be performed.

5.2.4 RECORD the Alarm Setpoint (ASP) in the ASP column on Area Radiation Monitor (ARM) Source Check form (A-6004-432).

5.2.5 ADJUST High Alarm Set Potentiometer to a setting within range of check source for detector (V-block or Internal type).
5.2 Source Check (Cont.)

NOTE - Background is current exposure rate reading on instrument without internal check source engaged or the V-block present.

5.2.6 RECORD background on ARM Source Check form.

5.2.7 IF instrument is equipped with an Internal Check Source ($\geq 10$ mr/hr), PERFORM Steps 5.2.8 through 5.2.10

OR

IF instrument requires use of External (V-Block) Check Source, GO TO Step 5.2.11.

**Instruments With Internal Check Sources**

5.2.8 DEPRESS “NORMAL” button.

5.2.9 RECORD response reading on ARM Source Check form.

5.2.10 GO TO Step 5.2.15.

**Instruments Requiring Use of External (V-Block) Check Sources**

5.2.11 PLACE suitable V block source on detector.

NOTE - Marking on the face should be close to the center.

- The V-block should be placed in the same position every time to maintain reproducible geometry.

5.2.12 IF possible, CENTER V-block over rectangular box or black box.

5.2.13 IF detector does not have manufacturer's labeling, USE a mark or jig to assure reproducible geometry.

5.2.14 RECORD response reading on ARM Source Check form.

5.2.15 CONFIRM alarm sounded AND

ACKNOWLEDGE alarm.
5.2 Source Check (Cont.)

5.2.16 **IF** this is the initial source check, **PERFORM** the following:

5.2.16.1 **CALCULATE** the net “initial reading” by subtracting the background reading from the response reading.

5.2.16.2 **RECORD** the calculated value **AND**

**RECORD** in the Initial Reading block on the ARM Source Check form.

5.2.16.3 **CALCULATE** the ± 20% of initial reading acceptance values **AND**

**RECORD** those values in the Initial Reading block on the ARM Source Check form.

5.2.16.4 **RECORD** this is the initial reading in the comments section **AND**

**CIRCLE** P for Pass in the ARM Reading Pass/Fail column on the ARM Source Check form.

5.2.16.5 **CIRCLE** Trip Pass/Fail column on ARM Source Check form as appropriate.

5.2.17 **IF** alarm check fails, **PERFORM** the following:

5.2.17.1 **REMOVE** instrument from service.

5.2.17.2 **TAG** instrument with complete Instrument Service Tag (BT-6002-880).

5.2.17.3 **RETURN** instrument to calibration facility for service.
5.2 Source Check (Cont.)

5.2.18  IF it is determined that the Instrument Service Tag was installed in error, PERFORM the following:

5.2.18.1 CONFIRM the instrument passes all required operational checks.

5.2.18.2 OBTAIN concurrence from the First Line Manager to place instrument back into service.

5.2.18.3 REMOVE the Instrument Service Tag.

5.2.18.4 PLACE the instrument back in service.

5.2.19  RETURN alarm set-points to appropriate values in accordance with project-specific documents, technical work document, or Radiological Work Permit (RWP).

5.2.20  IF all checks have been completed satisfactory, CIRCLE Operable Yes/No column on ARM Source Check form as appropriate.
5.2 Source Check (Cont.)

Periodic Source Check

NOTE - Periodic source checks are performed prior to intermittent use (each time the EC-4 is moved or turned ON) and quarterly thereafter (for continuous use) as a minimum frequency.

WARNING
Failure to wear hearing protection may result in hearing loss. Noise levels may exceed 100 dB.

5.2.21 DON ear plugs.

5.2.22 INFORM personnel in area that source check of instrument is to be performed.

5.2.23 RECORD ASP in ASP column on ARM Source Check form.

5.2.24 ADJUST High Alarm Set Potentiometer to a setting within range of check source for detector (V-block or Internal type).

NOTE - Background is current exposure rate reading on instrument without internal check source engaged or the V-block present.

5.2.25 RECORD background on ARM Source Check form.

5.2.26 IF instrument is equipped with an Internal Check Source (≥ 10 mr/hr), PERFORM Steps 5.2.27 through 5.2.31

OR

IF instrument requires use of External (V-Block) Check Source, GO TO Step 5.2.32.
Perform Operational and Source Check of Eberline Model EC-4 Area Radiation Monitor

5.2 Source Check (Cont.)

Instruments with Internal Check Sources

5.2.27 DEPRESS “NORMAL” button.

5.2.28 RECORD response reading on ARM Source form AND CONFIRM the net response reading is within the ±20% range listed in the Initial Reading column of the ARM Source Check form for the instrument under test.

5.2.28.1 CIRCLE ARM Reading Pass/Fail column on ARM Source Check form.

5.2.29 IF instrument fails response reading, PERFORM the following:

5.2.29.1 REMOVE instrument from service.

5.2.29.2 TAG instrument with completed Instrument Service Tag (BT-6002-880).

5.2.29.3 RETURN instrument to calibration facility for service.

5.2.30 IF it is determined that the Instrument Service Tag was installed in error, PERFORM the following:

5.2.30.1 CONFIRM the instrument passes all required operational checks.

5.2.30.2 OBTAIN concurrence from the First Line Manager to place instrument back into service.

5.2.30.3 REMOVE the Instrument Service Tag.

5.2.30.4 PLACE the instrument back in service.

5.2.31 GO TO Step 5.2.38.

Instruments Requiring Use of External (V-Block) Check Sources

5.2.32 PLACE suitable V-block source on detector.

NOTE - Marking on the face should be close to the center.

- The V-block should be placed in the same position every time to maintain reproducible geometry.
5.2 Source Check (Cont.)

5.2.33 IF possible, CENTER V-block over rectangular box or black box.

5.2.34 IF detector does not have manufacturer's labeling, USE a mark or jig to assure reproducible geometry.

5.2.35 ALLOW reading to stabilize AND

PERFORM the following:

5.2.35.1 RECORD reading on ARM Source Check form.

5.2.35.2 CONFIRM reading is within ± 20 % of initial check.

5.2.35.3 CIRCLE Pass/Fail column on ARM Source Check form as appropriate.

5.2.36 IF instrument fails response reading, PERFORM the following:

5.2.36.1 REMOVE instrument from service.

5.2.36.2 TAG instrument with completed Instrument Service Tag (BT-6002-880).

5.2.36.3 RETURN instrument to calibration facility for service.

5.2.37 IF it is determined that the Instrument Service Tag was installed in error, PERFORM the following:

5.2.37.1 CONFIRM the instrument passes all required operational checks.

5.2.37.2 OBTAIN concurrence from the First Line Manager to place instrument back into service.

5.2.37.3 REMOVE the Instrument Service Tag.

5.2.37.4 PLACE the instrument back in service.

5.2.38 CONFIRM alarm sounded AND

ACKNOWLEDGE alarm.

5.2.38.1 CIRCLE the Trip Pass/Fail column on ARM Source Check form.
5.2 Source Check (Cont.)

5.2.39 IF alarm check fails, **PERFORM** the following:

5.2.39.1 **REMOVE** instrument from service.

5.2.39.2 **TAG** instrument with complete Instrument Service Tag (BT-6002-880).

5.2.39.3 **RETURN** instrument to calibration facility for service.

5.2.40 IF it is determined that the Instrument Service Tag was installed in error, **PERFORM** the following:

5.2.40.1 **CONFIRM** the instrument passes all required operational checks.

5.2.40.2 **OBTAIN** concurrence from the First Line Manager to place instrument back into service.

5.2.40.3 **REMOVE** the Instrument Service Tag.

5.2.40.4 **PLACE** the instrument back in service.

5.2.41 **RETURN** alarm set-points to appropriate values in accordance with project specific documents, technical work document, or Radiological Work Permit (RWP).

5.2.42 IF all checks have been completed satisfactory, **CIRCLE** Operable Yes/No column on ARM Source Check form.
5.3 Operating Instructions

5.3.1 PRIOR to using the EC-4 CONFIRM Sections 5.1 and 5.2 have been performed.

5.3.2 SELECT a suitable location for the instrument.

NOTE - The detector may be located remotely from the instrument location if necessary and so equipped.

5.3.3 LOCATE instrument where it will not become a hazard to personnel working in the area.

5.3.4 PLUG the instrument into a nominal 120 VAC power receptacle.

5.3.5 CONFIRM the “NORMAL” light is illuminated.

Selecting an Alarm Set-point

NOTE - Unless otherwise determined by RWP or ALARA Management Work Sheet, the alarm set-point should be based on a high/low concept.

5.3.6 SET alarm set-point based on the following:
- Low enough to allow for personnel response to alarms
- High enough to allow for normal background fluctuations
- Indicate only abnormal increases in dose rate
- Avoid false alarms.
5.3 Operating Instructions (Cont.)

5.3.7 SET alarm set-point two to four times background dose rate in the area monitored by the detector.

5.3.8 FOLLOW radiological posting criteria when establishing set-points.

5.3.9 IF any question remains as to the suitability of an alarm set-point, CONSULT with the cognizant RC First Line Manager.

NOTE - Periodic source checks are performed prior to intermittent use (each time the EC-4 is moved or turned on) and quarterly thereafter (for continuous use) as a minimum frequency.

5.3.10 PERFORM source check per Section 5.2.

5.4 Records

NOTE - The following records are generated during the performance of this procedure:

- A-6004-432, Area Radiation Monitor Source Check.

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.

Records that are generated during the performance of this procedure should be submitted to an approved RadCon record storage area.