**GM Portable Survey Instrument Operation and Source Checks**

**Tank Farm Plant Operating Procedure**

**RADCON**

**USQ # N/A-4**

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1.0 PURPOSE AND SCOPE

1.1 Purpose

This procedure provides specific information regarding the Geiger-Muller (GM) Portable Survey Instruments.

1.2 Scope

This procedure provides instruction for operation and performing operational, source and response checks of the Eberline E140 series and Ludlum Model 3 series with standard GM probes.

2.0 INFORMATION

2.1 General Information

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

3.0 PRECAUTIONS AND LIMITATIONS

3.1 Equipment Safety

CAUTION - Avoid touching probe to potentially contaminated surface to prevent contaminating probe.

CAUTION - Avoid touching probe to small sharp objects (e.g., pencil points, grass, tumbleweeds) to avoid damaging probe window.
4.0 PREREQUISITES

4.1 Special Tools, Equipment and Supplies

The following supplies may be needed to perform this procedure:
- GM check source assembly
- Two D-cell alkaline batteries.

4.2 Performance Documents

The following documents may be needed to perform this procedure:
- BT-6002-880, Instrument Service Tag
- A-6002-895, Daily Instrument Source Check Log
- BL-6006-213, Daily Source Check Label
5.0 PROCEDURE

5.1 Operational Check

NOTE - Steps within this section may be performed in any logical order.

5.1.1 CONFIRM calibration of instrument meter body and probe are current.

5.1.2 CONFIRM source check of instrument (meter/probe combination) is current (unless performing during initial source check).

NOTE - An inspection of the instrument is required before each intermittent use of the GM Portable Survey Instrument.

5.1.3 INSPECT instrument for the following physical defects:
   • Broken meter glass
   • Loose knobs
   • Punctured probe window
   • Defective cables
   • Any other observable defects that would affect operation.

5.1.3.1 IF any defects are found, other than a defective cable, TAG defective component (meter or probe) with a completed Instrument Service Tag (BT-6002-880) AND PERFORM the following:
   a. SEGREGATE the instrument component to prevent inadvertent use.
   b. NOTIFY RadCon management.

5.1.3.2 IF the cable is found to be defective, PERFORM one of the following:
   • Replace the cable (preferred)
     OR
   • Tag defective component (meter or probe) with a completed Instrument Service Tag (BT-6002-880).

   a. IF tagging the defective component with a completed Instrument Service Tag was performed, SEGREGATE the instrument component to prevent inadvertent use AND NOTIFY RadCon management.
5.1 Operational Check (Cont.)

5.1.3.3 IF cable was replaced, PRIOR to use, PERFORM daily source check per Section 5.2.

5.1.4 TURN selector switch to “BATT” position AND

CONFIRM meter reading is above (BATT Test/BATT OK) position on meter face.

5.1.4.1 IF meter reading indicates left end of (BATT Test/BATT OK) band, ENSURE batteries are replaced.

5.1.4.2 ENSURE background is \( \leq 150 \text{ CPM} \).

5.1.4.3 PRIOR to use, PERFORM a daily source check per Section 5.2.

5.1.5 RESPONSE CHECK instrument as follows:

5.1.5.1 TURN instrument range selector switch to lowest scale.

5.1.5.2 TURN speaker ON.

5.1.5.3 HOLD instrument vertically.

5.1.5.4 HOLD probe over check source marking.

5.1.5.5 CONFIRM instrument meter increases.

5.1.5.6 CONFIRM an audible response.

5.1.5.7 IF initial source check has already been performed, GO TO Step 5.2.14.

5.1.6 IF an instrument component(s) fails, PERFORM the following:

5.1.6.1 TAG failed component(s) (meter body or probe) with a completed Instrument Service Tag (BT-6002-880).

a. REPLACE GM probe with a new one.

b. REPEAT Step 5.1.5.

c. IF Step 5.1.5 is completed successfully, then the probe was at fault.

d. IF Step 5.1.5 is not completed successfully, then the GM meter body was at fault.
GM Portable Survey Instrument Operation and Source Checks

5.1 Operational Check (Cont.)

5.1.6.2 SEGREGATE the instrument component(s) to prevent inadvertent use.

5.1.6.3 NOTIFY RadCon management.

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

5.1.7.1 PERFORM all required operational checks in Section 5.1 AND CONFIRM instrument passes checks.

5.1.7.2 OBTAIN First Line Manager Approval to remove Instrument Service Tag.

5.1.7.3 REMOVE Instrument Service Tag AND RETURN instrument to service.
5.2 Source Check

NOTE - A GM check source assembly is utilized to source check the GM portable survey instrument.
- All ranges of the instrument should be source checked.
- Background is limited to \( \leq 150 \) cpm for source checks.

Initial Source Check

NOTE - An initial source check is performed when instrument is first received from the Calibration Laboratory.

5.2.1 CONNECT GM probe to any calibrated count rate meter body.

5.2.2 RECORD barcode number of probe (the number of the count rate meter will be added when the probe is put into use) on the Daily Instrument Source Check Log (A-6002-895).

5.2.3 IF installed, REMOVE cardboard cover from detector.

5.2.4 TURN-ON the rate meter AND ALLOW meter to warm up for a minimum of 10 seconds.

5.2.5 PERFORM operational checks of Section 5.1.

5.2.6 NOTE background reading is \( \leq 150 \) CPM.

5.2.7 PLACE detector over check source assembly.
5.2 Source Check (Cont.)

5.2.8 **AFTER** the response is noted, **PUSH** the RESET button.

5.2.8.1 **IF** the reading does not drop to zero rapidly and then climb back to the original source reading when the RESET button is released, **PERFORM** the following:

a. **FILL-OUT** the Instrument Service Tag.

b. **RETURN** the instrument to the Radiological Calibration Laboratory.

5.2.9 **MOVE** source and instrument to appropriate positions for each range of the instrument:

- For Eberline instruments, use range multiplier marking on source.
- For Ludlum Model 3, use one range multiplier marking ABOVE the instrument range multiplier (e.g., X0.1 on instrument, use X1 on source)

**AND**

**ALLOW** instrument’s reading to stabilize.

5.2.10 **DOCUMENT** instrument's net response on each range on the Daily Instrument Source Check Log (A-6002-895).

5.2.11 **EVALUATE** instruments initial net source response as follows:

5.2.11.1 **IF** beta response is within +/- 20% of the mean or typical instrument response for that source (3-5 instruments), **OR**

**IF** Beta response is within +/- 20% of source activity as determined for the source by a source calibration provider, **PERFORM** the following:

a. **ATTACH** a Daily Source Check label (BL-6006-213) to the instrument.

b. **COMPLETE** the label.

c. **GO TO** Step 5.2.14.
5.2  Source Check (Cont.)

5.2.12  IF instruments initial net source response for each range falls within the source mean, **PERFORM** the following:

5.2.12.1  **MULTIPLY** each of instrument's net responses by 0.8 and 1.2 to determine acceptable range for that instrument.

5.2.12.2  **RECORD** acceptable range on Daily Instrument Source Check Log (A-6002-895).

5.2.12.3  **COMPLETE** the remainder of the Daily Instrument Source Check Log (A-6002-895).

5.2.13  IF instruments initial net source response for each range does not fall within the source mean, **PERFORM** the following:

5.2.13.1  IF beta response is not within +/- 20% of the mean or typical instrument response for that source,

**OR**

IF beta response is not within +/- 20% of source activity as determined for the source by a source calibration provider, **PERFORM** the following:

a.  IF reading is high out-of-range, **CONTACT** the Instrument FPOC for evaluation for continued use.

b.  IF the reading is low out-of-range or Instrument FPOC determines not acceptable for continued use, **THEN**:

1.  **TAG** the instrument with a completed instrument service tag (BT-6002-880) identifying the problem(s).

2.  **SEGREGATE** the instrument to prevent inadvertent use.

3.  **NOTIFY** RadCon management.
5.2 Source Check (Cont.)

Daily Source Check

5.2.14 IF shield is installed, REMOVE the cardboard cover from the detector AND PLACE the detector over the check source assembly.

5.2.15 PERFORM operational checks of Section 5.1.

5.2.16 MOVE source and instrument to the appropriate position for each range of the instrument.

5.2.16.1 ALLOW instrument’s reading to stabilize AND OBSERVE reading.

- For Eberline instruments, use range multiplier marking on source.
- For Ludlum Model 3, use one range multiplier marking ABOVE the instrument range multiplier (e.g., X0.1 on instrument, use X1 on source)

5.2.17 IF instrument response is within the acceptable ranges, COMPLETE the Daily Instrument Source Check Log (A-6002-895).

5.2.18 IF instrument response is acceptable, COMPLETE the Daily Source Check label, (BL-6006-213).

5.2.19 IF response is not acceptable, or an instrument component(s) fails, PERFORM the following:

5.2.19.1 TAG failed component (meter body or probe) with a completed Instrument Service Tag (BT-6002-880).

a. REPLACE GM probe with a new one.

b. REPEAT daily source check.

c. IF daily source check is completed successfully, THEN the probe was at fault.

d. IF daily source check is not completed successfully, THEN the GM meter body was at fault.
5.2 Source Check (Cont.)

5.2.19.2 SEGREGATE the instrument component to prevent inadvertent use.

5.2.19.3 NOTIFY RadCon management.

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

5.2.20.1 PERFORM all required operational checks in Section 5.1 AND CONFIRM instrument passes checks.

5.2.20.2 OBTAIN First Line Manager Approval to remove Instrument Service Tag.

5.2.20.3 REMOVE Instrument Service Tag AND RETURN instrument to service.
5.3 Operating Instructions

NOTE – Survey protocols for unconditional release of material and equipment are performed in accordance with TF-RC-043, Perform Release Surveys for Material and Equipment, or TFC-ESHQ-RP_MON-C-28, Release Survey Plans.

5.3.1 IF damage to the GM Portable Survey Instrument is suspected during survey (e.g., instrument is dropped), **PERFORM** either of the following steps:

NOTE - An established field value may be a previous reading or a well-known, constant, non-zero field.

5.3.1.1 **IF** an established field is available, **CONFIRM** response is within ±20% of established value.

5.3.1.2 **IF** an established field is not available, **PERFORM** Daily Source Check per Section 5.2.

5.3.2 **TURN** selector switch to lowest scale position **AND**

**ALLOW** 10 second warm up.

5.3.3 **TURN** instrument’s speaker **ON**.

5.3.4 **SET** response to slow setting **AND**

**ESTIMATE** background.

5.3.5 **ALLOW** the instrument response to stabilize (reach final value).

NOTE - The response time (time to reach 90% of final reading) for the Eberline E-140 is adjustable from 2 to 10 seconds.

- The response time for the Ludlum Model 3 can be adjusted with a toggle switch between two discrete settings (F or S).

5.3.6 **ADJUST** RESPONSE control to appropriate level based on expected contamination values.
5.3 Operating Instructions (Cont.)

5.3.7 PERFORM response check intermittently throughout use.

CAUTION
Avoid touching probe to potentially contaminated surface to prevent contaminating probe.

CAUTION
Avoid touching probe to small sharp objects (e.g., pencil points, grass, tumbleweeds) to avoid damaging probe window.

5.3.8 SURVEY material, personnel, or samples as follows:

5.3.8.1 HOLD probe \( \leq \frac{1}{4} \) inch from surface.

5.3.8.2 PERFORM a survey per the appropriate methodology to meet required Minimum Detectable Activity (MDA) for the type of survey being performed.

5.3.9 IF scaler function is available and scaler count is desired, DEPRESS AND RELEASE scaler button to set scaler function on Ludlum Model 3.

5.3.10 IF performing a scanning survey to verify absence of contamination and audible count rate is elevated above background, INVESTIGATE by pausing over suspected area for 5 seconds AND SCAN approximately 13 cm (5 in.) of the previous path at a reduced rate.
5.4 Correction Factors

5.4.1 **MULTIPLY** meter reading with scale correction (minus background) for an unknown beta source by 10 to convert an instrument response (cpm) to beta activity (dpm)

**NOTE** - Efficiencies for a few radionuclide’s (i.e., $^{90}$Sr/Y, $^{137}$Cs, $^{99}$Tc) are printed on calibration label of each detector.

5.4.2 **IF** radionuclide is known,

**OR**

**IF** directed by an activity specific procedure, **DIVIDE** meter reading, with scale correction (minus background), by appropriate efficiency (as indicated on probe) for a more accurate measurement.

5.4.3 **IF** required to determine measurements in units of dpm/100 cm$^2$,

**PERFORM** either of the following steps:

5.4.3.1 **ADD** six adjacent dpm/probe readings to convert measurements to dpm/100 cm$^2$ for area.

5.4.3.2 **IF** measurements are constant over the area, **MULTIPLY** dpm/probe area by 6 to obtain dpm/100 cm$^2$. 
5.5 Records

5.5.1 PERFORM the following for records identified within this procedure.

5.5.1.1 On the Records Submittal Checklist, RECORD the number of pages that were completed

OR

PLACE a check mark (✓) in the N/A column.

5.5.1.2 ATTACH the completed records to the Records Submittal Checklist AND SIGN Records Submittal Checklist indicating the package is complete.

5.5.1.3 SUBMIT the completed records to an approved RadCon Record Storage Area for retention.

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.

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_________________________ / ________________________ / ______________________
Signature              Print (First & Last)                Date
First Line Manager (or designee)