

SECTION 7.5

GAMMA RADIATION (EXPOSURE RATE) MEASUREMENT

1.0 Purpose

To describe the method for measuring external gamma radiation levels in buildings and over ground surfaces.

2.0 Responsibilities

- The site coordinator is responsible for assuring that this procedure is implemented.
- Survey team personnel are responsible for following this procedure.

3.0 Procedure

3.1 Pressurized Ion Chamber (PIC) (0 - 500 μ R)

3.1.1 Equipment

- ✓ Pressurized Ion Chamber: Model RSS-112, Reuter Stokes Co.
- ✓ Tripod.
- ✓ Record forms.
- ✓ Check source.

3.1.2 Operational Check-Out

- 3.1.2.1 Assemble instrument, turn on, check batteries, and allow to stabilize approximately 5 minutes. Check background level and response to the gamma check source. Follow procedures described in Section 5.

3.1.3 Measurement Procedure for the RSS-112 PIC

- 3.1.3.1 Adjust the tripod to place the center of the detector chamber approximately 1 m above the surface.
- 3.1.3.2 With unit in the **CURRENT DATA/DOSE INTEGRATOR** mode and the power switch in the read position (see Section 5.8), press the reset integrator key in order to re-zero the dose integrator display (located in the lower right of the data screen). Allow the unit to acquire a new average exposure rate over a 1 to 2 minute period.

Record this value on the appropriate form (Figure B-3, B-15, or the equivalent).

3.1.3.3 An action level will be determined based on the exposure rate guidelines that have been established for the site. For a particular site the action level may be established as any activity exceeding background. A field measurement at or above this value indicates that further investigation at this location is necessary.

3.2 Bicron Microrem Meter (0 to 200 mrem/h)

3.2.1 Equipment

- ✓ Bicron Micro-rem meter.
- ✓ Record Forms.
- ✓ Check Source.

3.2.2 Operational Checkout

3.2.2.1 Turn unit on. Check battery and high voltage.

3.2.2.2 Check the background dose rate and the detector response to the gamma check source dose rate. If the check source response is outside the established limits, the unit is to be removed from service until the problem can be identified and corrected. Record the values on the daily instrument PIC Field Check-out Form. (See Section 5).

NOTE: If the site background is not consistent with the predetermined response range, then a new response range shall be established at the specific site and noted on the Instrument Operational Check-Out Form.

3.2.3 Measurements

3.2.3.1 Hold the meter at 1 meter above the surface.

NOTE: Ensure that the check source has been removed from inside the detector prior to making measurements.

3.2.3.2 Obtain 10 instantaneous readings and record on the appropriate form (Figure B-3, B-15, B-22, or equivalent. Average these values to determine the dose rate at this location.

NOTE: Although the meter displays the data in $\mu\text{rem/h}$, the $\mu\text{rem/h}$ to $\mu\text{R/h}$ conversion is essentially unity.

3.2.3.3 An action level will be determined based on the exposure rate guidelines that have been established for the site. For a particular site the action level may be established as any activity exceeding background. A field measurement at or above this value indicates that further investigation at this location is necessary.

3.3 Sodium Iodide Scintillator (0 to 500 Kcpm: approximate exposure rate range 0-1000 $\mu\text{R/h}$)

3.3.1 Equipment

- ✓ Portable ratemeter: Model PRM-6, Eberline Instrument Corporation; or equivalent.
- ✓ Sodium iodide detector: Model 489-55, Victoreen Instrument Co; Model SPA-3, Eberline Instrument Corporation; or equivalent.
- ✓ Cable: As appropriate (see Section 5).
- ✓ Record forms.
- ✓ Check source.

3.3.2 Operational Check-Out

3.3.2.1 Assemble unit, check battery, and adjust high voltage, as necessary. Set the PRM-6 for 'SLOW' response.

3.3.2.2 Check the background count rate and the detector response to the gamma check source. If the check source response is outside the established limits, the unit is to be removed from service until the problem can be identified and corrected. Record the values on the daily Instrument Field Check Form (see Section 5).

NOTE: If the site background is not consistent with the predetermined response range, then a new response range shall be established at the specific site and noted on the Instrument Operational Check-Out Form.

3.3.3 Measurements

3.3.3.1 Place the detector at the position where the measurement is desired.

- 3.3.3.2 Observe the count rate displayed on the meter; switch the range selector until the meter response is over 10 percent of full scale.
 - 3.3.3.3 Estimate the average count rate and record it on the appropriate record form (Figures B-9, B-10, B-13, B-15, or equivalent).
 - 3.3.3.4 Convert the count rate (cpm) to exposure rate ($\mu\text{R/h}$) using factors determined by cross calibration with the Pressurized Ionization Chamber (see Section 5.0).
 - 3.3.3.5 An action level will be determined based on the exposure rate guidelines that have been established for the site. For a particular site the action level may be established as any activity exceeding background. A field measurement at or above this value indicates that further investigation at this location is necessary.
- 3.4 Compensated GM Detector (0 to 999,999) cpm: approximate exposure rate range (500 $\mu\text{R/h}$ to 50 mR/h)

3.4.1 Equipment

- ✓ Portable Scaler: Model PRS-1 (Rascal), Eberline Instrument Corporation; Model 2221, Ludlum Instrument Corporation; or equivalent.
- ✓ Compensated GM detector: Model HP-270, Eberline Instrument Corporation; or equivalent.
- ✓ Cable: As appropriate (see Section 5).
- ✓ Record forms.
- ✓ Check source.

3.4.2 Operational Check-Out

Assemble detector unit (detector shield closed), check battery, and adjust high voltage and threshold, if necessary.

- 3.4.3 Check the background count rate and the detector response to the gamma check source. If the check source response is outside the established limits, the unit is to be removed from service until the problem can be identified and corrected. Record the values on the daily Instrument Operational Check-Out Form (see Section 5).

NOTE: If the site background is not consistent with the predetermined response range, then a new response range shall be established at the specific site and noted on the Instrument Operational Check-Out Form.

3.4.4 Measurements

- 3.4.4.1 Place the GM detector at the position where the measurement is desired.
- 3.4.4.2 Set the meter timer switch to 1 minute, press the count reset button, and accumulate count events until the meter display indicates the count cycle is complete.
- 3.4.4.3 Record the count rate measurement on the appropriate record form (Figures B-9, B-10, B-13, B-14, B-15, or equivalent).
- 3.4.4.4 Calculate the exposure rate by applying the calibration factor determined by comparison with the Pressurized Ionization Chamber or by exposure to a source of known radiation intensity (Section 5.8).

3.5 Ionization Survey Meter (0 to 20 R/h)

3.5.1 Equipment

- ✓ Ionization Survey Meter: Model 36100, Keithly Instruments, Inc.; or equivalent.
- ✓ Record forms.

3.5.2 Operational Check-Out

Check battery and adjust zero balance control. If malfunctions are noted, remove instrument from service until problems are identified and corrected.

3.5.3 Measurements

- 3.5.3.1 Place the detector at the position where the measurement is desired.
- 3.5.3.2 Observe the rate displayed on the meter; switch the range selector until the meter response is over 10 percent of full scale. Record measurements on appropriate record form (Figures B-9, B-10, B-13, B-14, B-15, or equivalent).