

STANDARD OPERATING PROCEDURE

15.OPS.07

OPERATION OF EXPOSURE / DOSE RATE METERS

1.0 OBJECTIVE

To provide instruction for the operation of exposure rate or dose rate survey meters for the measurement of gamma radiation levels for receiving, free release, routine, and health and safety surveys.

2.0 SCOPE

This standard operating procedure (SOPs) applies to the operation of survey meters which may be used to determine ambient gamma radiation levels and to predict worker exposure in facility areas and from packages or vehicles. Examples of such instruments used at CHDT include Ludlum Models 3, 19, 19A, 193-6, etc. These instruments may only be used in low radiation environments. Radiation environments which exceed the capabilities of these instruments are not anticipated.

3.0 POLICY

Instruments will be used in accordance with manufacturer's recommendations, SOPs, and site-specific requirements by trained personnel. The use of an instrument outside of its intended capabilities requires approval by the CHDT Radiation Safety Officer (RSO) or designee. Radiation detection instruments shall not be used in lieu of dosimetry for determining employee occupational dose.

4.0 RESPONSIBILITIES

Responsibilities of the CHDT RSO, management, and staff are defined in the CHDT Radiation Protection Plan (SOP 15.RPP.01).

5.0 SURVEY DATA COLLECTION

5.1 Use of Exposure Rate Meters

5.1.1 Instrument Descriptions

All of the exposure rate instruments in use at CHDT are "MicroR" instruments that measure gamma radiation in units of microRoentgens per hour ($\mu\text{R/hr}$). The front panel controls typically include a rotary switch for selecting the range and instrument shut off, an audio on/off switch, a fast/slow response switch, and push buttons for activating the meter lamp, count reset, and battery test. The meter scale and scale settings may vary depending on the specific instrument.

5.1.2 Typical Instrument Setup and Initial Quality Control

Upon receipt of the instrument through purchase, rental, or receipt from annual calibrations, the following steps should be taken to initially setup the instrument and verify that it is in good working order.

- Verify that the instrument calibration is current; confirm that serial number on instrument matches that on the calibration certificate.
- Perform ten (10) initial background quality control (QC) measurements
 - Use location away from radioactive sources
 - Set response to “S” for slow meter response
 - Using the appropriate scale, depress the reset button (“RES”) and allow the needle to come to a rest (approximately 20 to 30 seconds). Record the measurement to the nearest tick mark, and repeat for 10 measurements.
 - Calculate the average plus and minus 20%. Subsequent background QC measurements must fall within this range. Typical background is between 5 and 20 μ R/hr.
- Perform ten (10) initial source QC measurements
 - Use cesium-137 source in a repeatable geometry (i.e., orientation of the source relative to the meter).
 - Use same location as background measurements
 - Using an appropriate scale, depress the reset button (“RES”) and allow the needle to come to a rest (approximately 20 to 30 seconds). Record the measurement to the nearest tick mark, and repeat for 10 measurements.
 - Calculate the average plus and minus 20%. Subsequent source QC measurements must fall within this range.

5.1.3 Daily Instrument Quality Control

Each day that the instrument is used, the following QC checks and measurements must be performed and recorded.

- Check the battery by depressing the “BAT” button, or turn the selector switch to “BAT”.
- Perform background QC measurement
 - Use same location as with initial QC measurements
 - Measurement must be within plus or minus 20% of the initial average
- Perform source QC measurement
 - Use same location and source geometry as with initial QC measurements
 - Measurement must be within plus or minus 20% of the initial average

If either measurement does not fall within the required tolerances, turn the unit off, turn it back on, and repeat the measurement(s). If the unit fails a second consecutive time, remove the unit from service and notify the CHDT RSO or designee.

5.1.4 Collection of Survey Measurements

Survey measurements may be collected as part of equipment or routine surveys. If the ambient radiation level of an area is being measured, the measurement should be collected at waist-level, or at a height of approximately 1 meter. If a package, container, or vehicle is being measured, the instrument should be placed in contact with the surface, provided that doing so does not present a cross-contamination concern.

When collecting a measurement of an unknown radiation field, use the “fast” response on the instrument and start with the highest scale setting, working downward until the lowest setting the measurement falls within is reached. At that point, switch the response to “slow” and read and record the measurement to the nearest tick mark.

5.1.5 Evaluation of Results

The use of survey data in units of $\mu\text{R/hr}$ is acceptable for use in predicting worker exposures under most circumstances. However, the use of exposure rate meters may not be substituted for required dosimetry.

Measurements of naturally-occurring radioactive materials or of materials shielded by containers may result in an overly conservative estimate of the true radiation levels. The CHDT RSO or designee should be consulted if this appears to be an issue.

6.0 STANDARDS AND CRITERIA

Specific exposure or dose rate limits may be established for the type of survey being performed. The CHDT RSO or designee should be consulted to determine the appropriate limits for any new activity. If the ambient radiation level exceeds 2000 microR/hr (2mR) the CHDT RSO or designee should be notified and work in the area should cease until further direction is received.

An annual instrument calibration must be performed by the instrument manufacturer or other qualified vendor. Copies of the instrument calibration certificates must be maintained for a period of five years. Current calibration certificates should be maintained with the instrument daily QC measurement logs.

7.0 REFERENCES

Ludlum Measurements, Inc., Instruction Manuals, various models