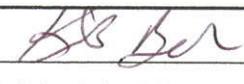


Approved by:		
	General Manager	Radiation Safety Officer

STANDARD OPERATING PROCEDURE

15.OPS.09

OPERATION OF GEIGER MUELLER PANCAKE PROBE

1.0 OBJECTIVE

To provide instruction for the operation of Geiger Mueller (GM) pancake-type probes for the measurement of surface radioactivity levels for receiving, free release, routine, and health and safety surveys.

2.0 SCOPE

This standard operating procedure (SOP) applies to the operation and use of survey meters with GM pancake probes only, such as the Ludlum Model 44-9. These instruments may be used to identify and quantify surface radioactivity levels. 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.

4.0 RESPONSIBILITIES

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

5.0 SURVEY DATA COLLECTION

5.1 Instrument Description

The Ludlum Model 44-9 GM pancake probe is a small area (15 square centimeters [cm²]) probe with a inert gas filled tube. The GM pancake probe may detect alpha, beta, and gamma radiation, but is most efficient in detecting beta and low-energy gamma radiation. Radiation incident upon the tube produces a response in the meter, which may display the results in counts per minute (cpm), microroentgens per hour (μR/hr), or other units. *The preferred units for this instrument are cpm.*

The GM pancake probe may be used with a number of different meters (e.g., Ludlum Model 3, Ludlum Model 12), provided that the meter has been specifically calibrated to do so. Meters are may not be interchanged with probes; a calibration must be performed prior to use of a meter with a second probe. The front panel controls on the meter generally include a rotary switch for selecting the 5 decade 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, high voltage display and battery test.

5.2 Instrument Setup and Initial Quality Control

Upon receipt of the instrument through purchase or rental, 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; confirm high voltage (HV) setting on instrument with calibration
- Perform ten (10) initial background quality control (QC) measurements
 - Use location away from radioactive sources
 - Set response to “S” for slow and use
 - Using the lowest meter 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 for a GM pancake probe is between 40 and 80 cpm.
- 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.

5.2.1 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
- Check the HV against the calibrated HV
- 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.

5.2.2 Collection of Survey Measurements

Survey measurements with the GM pancake probe may be collected as part of equipment or routine surveys for surface contamination. The probe should be placed in contact with or as close as possible to the surface being surveyed, keeping in mind that direct contact may present a cross-contamination concern. To perform scanning measurements, the probe should be moved slowly across the surface at a consistent distance. The technician should use the instrument's audio response to initially identify potential contamination. If the count rate is heard to increase, the probe should be returned to the affected area and held over for a longer time period to determine if the readings are consistent. The range of observed count rates should be noted and recorded on the appropriate survey form, along with the instrument's make and model, serial numbers, and calibration due date.

5.2.3 Evaluation of Results

In most circumstances, measurements collected with a GM pancake probe will be qualitatively evaluated with background. As a result, the technician must have a thorough understanding of the background associated with the instrument and the audio response. When evaluating GM pancake probe data qualitatively, a measurement greater than 1.5 or 2 times background is typically indicative of contamination. The specific criteria will be determined by the CHDT RSO or designee.

In the event that a quantitative evaluation of survey data is required, the following calculation is required to convert the instrument response in units of cpm to the standard units of surface radioactivity of decays per minute per 100 cm².

$$Net\ Activity\left(\frac{dpm}{100cm^2}\right) = \frac{Measurement - Background\ (cpm)}{Efficiency\left(\frac{cpm}{dpm}\right) \times \left(\frac{Probe\ Area\ cm^2}{100\ cm^2}\right)}$$

For a standard GM pancake probe, the general efficiency may be estimated to be 15% (0.15 cpm/dpm) and the probe area is 15 cm².

6.0 STANDARDS AND CRITERIA

Specific surface contamination 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.

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

ANSI/HPS 1999. Surface and Volume Radioactivity Standards for Clearance.

Ludlum Measurements, Inc., Instruction Manual Model 44-9 Geiger Mueller Pancake Probe, Current Version.

Ludlum Measurements, Inc., Instruction Manual Model 3 Survey Meter, Current Version.

Ludlum Measurements, Inc., Instruction Manual Model 12 Rate Meter, Current Version.