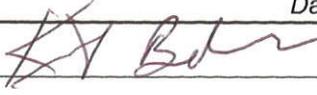


Approved by:		
	General Manager	Radiation Safety Officer

STANDARD OPERATING PROCEDURE

15.OPS.13

EQUIPMENT AND VEHICLE RELEASE SURVEYS

1.0 OBJECTIVE

To define general and specific methods and procedures for conducting radiation surveys for release of equipment from restricted areas at the Clean Harbors Deer Trail (CHDT) landfill or other job sites, or following decontamination.

2.0 SCOPE

This standard operating procedure (SOP) applies to the release of equipment or vehicles following their use in restricted areas at the CHDT facility, or following decontamination.

3.0 POLICY

Radiological contamination surveys will be performed on all equipment leaving restricted areas to verify surface contamination levels meet unrestricted release limits. In addition, contamination surveys will be performed following the decontamination of equipment to document the effectiveness of decontamination prior to unrestricted release.

4.0 RESPONSIBILITIES

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

5.0 GENERAL SURVEY METHODS

Direct surveys of equipment may be conducted using a Ludlum Model 44-9 Geiger Mueller (GM) "pancake"-type probe with Ludlum Model 3 survey meter (or equivalent) for surface beta-gamma measurements; a Ludlum 43-93 alpha-beta scintillation detector with Ludlum 2360 survey meter (or equivalent) for surface alpha-beta measurements; a Ludlum Model 19 (or equivalent) for ambient exposure rate measurements; a Ludlum Model 193-6 Survey Wand (or equivalent) for large area gamma scanning measurements; or any other radiation measuring instrument appropriate for the task. Equipment surveys will be supported by smear sample analyses for removable radioactivity using the Ludlum 3030 alpha-beta sample counter (or equivalent).

5.1 Pre-Survey Instrument Check List

Prior to use of any field instrument, the operation of the probe and survey meter used shall be checked using the following general procedure. Specific direction is provided in the SOP for each individual instrument.

- Check Batteries

- Turn the switch to “BAT” or flip the “BAT” switch to “ON.”
- The needle on the meter face should move to a position within or beyond the indicated area on the meter scale.
- Replace batteries if needed before use.
- Check Count Rate Meter Speaker
 - Turn the audio switch, if present, to ON.
 - Set the Fast-Slow toggle switch to the F position (for fast response).
 - Set the count rate meter scale to X1.
 - The rate meter should “chirp” or “click.”
 - If the speaker does not function, the survey meter can be used, but the surveyor will need to check the meter reading or display frequently.
- Background Check
 - Conduct background check during daily quality control (QC) measurements.
 - On most instruments, the background count rate is observed when the survey meter scale is set to the lowest scale setting – X0.1 or X1.
 - Prior to conducting surveys, verify background at that location.
 - Most surveys rely upon the technician to identify contamination above background. Therefore, *the survey technician must have a strong understanding of background levels for the instrument being used.*
 - Do not use the meter if it does not register a background reading.
- Source Check
 - Conduct source check during daily QC measurements.
 - Use the same source in the same geometry for all QC measurements.
 - The technician should be familiar with the detector response to a source.
 - Do not use the instrument if the QC falls out of requirements.

5.2 Equipment and Vehicle Release Surveys

Release surveys will be performed to free-release equipment and vehicles exiting restricted areas of the site. Where possible, surveys will be conducted in dedicated areas. Equipment and vehicle surveys shall be recorded in ink on appropriate survey forms, which shall document the following:

- Time and date of the survey
- Technician(s) performing the survey
- Instrument(s) used, with serial number, calibration due date

- Measurement locations, with pictures or drawings as necessary
- Background and efficiency information for the instruments, as appropriate
- Raw measurements, including measurement type and count time (if necessary)

Where necessary, surveys may be documented in a field logbook in the absence of a survey form. Pictures or drawings of equipment, vehicles, or frequently surveyed items may be electronically inserted into the survey form to facilitate documentation.

For free release surveys vehicles and equipment, a minimum of five locations will be measured for fixed and/or removable contamination. The CHDT RSO or designee will determine additional survey requirements as necessary. Measurements for fixed contamination will be collected prior to the collection of smear samples. Specific measurement locations are to be determined at the discretion of the survey technician; however, measurements should be biased toward the most likely areas of contamination to provide conservative survey results. These areas may include the tires or treads; undercarriage of the vehicle; within the cab of the vehicle; within equipment buckets; or on other surfaces potentially contacted by contaminated material.

5.3 Measurements for Fixed Contamination

Measurements for fixed contamination can be directly collected by scaler or scanning measurements with field instruments. Scaler measurements are collected by leaving the probe stationary over a given location, and initiating a scaler count with the meter (typically one minute in length). To allow for consistent measurement geometry, it may be necessary to rest the probe on the surface being measured. However, please note that this action *may result in contamination of the probe* and appropriate precautions should be taken to prevent cross contamination (e.g., the use of removable spacers on the probe, routine wipe and decontamination of probe surfaces, etc).

Scanning measurements are collected by slowly moving the probe over a given surface. The instrument's audio response and meter reading are monitored to identify any anomalies. Typically scanning measurements are performed to increase survey coverage over an area. The probe is held approximately 1 centimeter from the surface being surveyed and is moved at a rate of approximately 2 inches per second. If the count rate audibly increases, or if the alarm sounds, pause for 5 to 10 seconds over the area to provide for adequate time for instrument response. Scanning measurements may be recorded as a range of measurements for a given surface or area, and are generally evaluated to identify any outliers above background.

5.4 Measurements for Removable Contamination

Measurements for removable contamination are measured indirectly by the collection of smear or wipe samples. Smears are collected with a 47-millimeter smear filter. Using evenly applied pressure, the smear should be collected with an S-shape over approximately 100 square centimeters. The smear may then be removed from the paper folder, adhered to an aluminum planchet and counted in the alpha-beta sample counter.

If directed by the CHDT RSO or designee, large-area smears may be collected on a larger surface area using masselin or other absorbent cloth. The large area smear may then be checked

using a field instrument for any radioactivity above background. A large area smear should be considered to be a qualitative measurement only.

6.0 STANDARDS AND CRITERIA

6.1 Data Conversion

For comparison with the measurement criteria listed in Sections 6.2 and 6.3, surface measurements in counts per minute (cpm) must be converted to units of decays per minute per 100 square centimeters (dpm/100cm²). Procedures for data conversion are provided in SOPs 15.OPS.08, *Operation of Alpha-Beta Scintillation Detector*, and 15.OPS.09, *Operation of GM Pancake Probe*. The Ludlum 3030 used at CHDT provides measurements in units of dpm.

6.2 Surface Contamination Levels

Fixed radioactivity measured by direct measurements and removable activity measured by smear samples will be evaluated against the values listed in Table 1, from ANSI/HPS N13.12-1999 (ANSI/HPS 1999). In the absence of radionuclide data to establish the appropriate screening group, the most conservative screening levels will be used.

Table 1 – Surface Contamination Limits for Free Release Surveys

Radionuclide Group	Surface Screening Levels (Bq/cm ²)	Surface Screening Levels (dpm/100cm ²) ^(a)	Removable Contamination Limits (dpm/100cm ²)
Group 1 Radium and Thorium: ²¹⁰ Po, ²¹⁰ Pb, ²²⁶ Ra, ²²⁸ Ra, ²²⁸ Th, ²³⁰ Th, ²³² Th, and associated decay chains ^(b)	0.1	600	60 alpha
Group 2 Uranium: ²³⁴ U, ²³⁵ U, ²³⁸ U, natural uranium ^(c) , and associated decay chains	1	6,000	600 alpha
Group 3 General Beta-Gamma Emitters: ²⁴ Na, ³⁶ Cl, ⁵⁹ Fe, ¹⁰⁹ Cd, ¹³¹ I, ¹²⁹ I, ¹⁴⁴ Ce, ¹⁹⁸ Au, ²⁴¹ Pu, and others	10	60,000	600 beta
Group 4 Other Beta-Gamma Emitters: ³ H, ¹⁴ C, ³² P, ³⁵ S, ⁴⁵ Ca, ⁵¹ Cr, ⁵⁵ Fe, ⁶³ Ni, ⁸⁹ Sr, ⁹⁹ Tc, ¹¹¹ In, ¹²⁵ I, ¹⁴⁷ Pm, and others	100	600,000	600 beta

(a) Rounded to one significant figure.

(b) For decay chains, the screening levels represent the total activity (i.e. the activity of the parent plus the activity of all progeny) present.

(c) Where the Natural Uranium activity equals 48.9% from ²³⁸U, plus 48.9% from ²³⁴U, plus 2.25% from ²³⁵U.

6.3 Transportation – Non-Fixed Contamination

Contamination control limits for non-fixed (i.e., removable) surface contamination are established by the Department of Transportation (DOT) in 49 CFR 173.443. Additional requirements for empty packaging are established in 49 CFR 173.428. These limits are summarized in Table 2.

Table 2 – DOT Non-Fixed Surface Contamination Limits

Radionuclide Group	Maximum Permissible Limit (Bq/cm ²)	Maximum Permissible Limit (dpm/cm ²) ^(a)	Maximum Permissible Limit (dpm/100 cm ²) ^(a)	Maximum Permissible Limit for Empty Packaging (dpm/100 cm ²) ^(a)
1. Beta and gamma emitters and low-toxicity alpha emitters	4	220	2,200	220,000
2. All other alpha-emitting radionuclides	0.4	22	220	22,000

(a) Averaged over 300 cm².

In addition, there are exposure rate limits associated with different types of shipments. Task-specific direction will be provided by the CHDT RSO or designee regarding these limits.

6.4 Quality Control

In addition to the daily QC measurements required by each individual instrument SOP, survey forms must be reviewed and approved by the CHDT RSO or designee. The frequency of review and approval will be dictated by the frequency of the surveys.

7.0 REFERENCES

49 CFR 173. *Shippers – General Requirements for Shipments and Packagings*. Current Version.
 ANSI/HPS 1999. *Surface and Volume Radioactivity Standards for Clearance*.