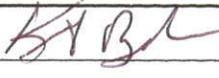


Approved by:		
	General Manager	Radiation Safety Officer

STANDARD OPERATING PROCEDURE
15.OPS.12
PERSONNEL CONTAMINATION SURVEYS

1.0 OBJECTIVE

To define general and specific methods and procedures for personnel contamination surveys at the Clean Harbors Deer Trail (CHDT) landfill or other job sites.

2.0 SCOPE

This standard operating procedure (SOP) applies to the release of personnel following decontamination activities, from radioactive materials handling areas, and after an emergency response event.

3.0 POLICY

Personnel surveys are required when personnel contamination is suspected to prevent further contamination of personnel, equipment, and/or facilities. In addition, personnel surveys are required to verify and document that worker exposures are maintained as low as reasonably achievable (ALARA).

4.0 RESPONSIBILITIES

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

5.0 GENERAL SURVEY METHODS

Direct surveys of personnel ("frisks") may be conducted using a Ludlum Model 44-9 Geiger Mueller (GM) "pancake"-type probe with Ludlum Model 3 survey meter (or equivalent) for beta-gamma measurements; or a Ludlum 43-93 alpha-beta scintillation detector with Ludlum 2360 survey meter (or equivalent) for alpha-beta measurements. Other instruments that measure ambient, rather than surface, radioactivity, such as a Ludlum Model 19 (or equivalent) for ambient exposure rate measurements, or a Ludlum Model 193-6 Survey Wand (or equivalent) for large area gamma scanning measurements, are not appropriate for conducting personnel contamination surveys. Personnel 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 what background is 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 General Personnel Surveys

Where possible, CHDT personnel should conduct the survey measurements themselves. Activities that may require a second or support technician will be identified in advance. The general scanning or frisk procedure for the GM Pancake probe (Ludlum 44-9) is as follows:

- Prior to initiating the activity, verify that the instrument is turned on, the audio response is audible, and the probe is face up so that the hands may be scanned without touching the instrument.

- After completion of the activity, start the frisk by scanning the fronts and backs of hands without touching the instrument. After the hands have been determined to be free of contamination, the instrument may be picked up to conduct the remainder of the frisk.
- Hold the probe 1 cm from the body surface being surveyed and move the probe slowly over the surface, approximately 2 inches per second.
- If the count rate increases, pause for 5 to 10 seconds over the area to provide for adequate time for instrument response.
- If consistent count rates consistently in excess 1.5 times background are detected, decontamination according to the procedure in Section 5.4 shall be followed prior to re-surveying.
- The remaining survey order will be from head to foot, *prior to the removal of personal protective equipment (PPE)*, as follows:
 - Head – pause at the mouth and nose for five seconds; conduct thorough scan of respirator cartridges and faceshield, if present
 - Neck
 - Arms
 - Chest and abdomen
 - Back, hips, and seat of pants
 - Legs – pause at the knees and cuffs for five seconds
 - Tops of shoes or shoe coverings
 - Bottom of shoes or shoe coverings
 - Personal items – hats, gloves, notebooks, equipment, etc.
- If measurements on PPE are at background levels, the PPE may be removed under the constraints of the hazardous materials handling requirements (i.e., without regard to radioactivity)
- If measurements that exceed background by a factor of 1.5X are found on personnel, contact the CHDT RSO. Decontamination of personnel will be performed according to SOP 15.OPS.19, *Decontamination of Personnel*. If necessary, determination of removable contamination shall be made using a two inch diameter filter paper to wipe a surface (i.e., clothes, shoes, or other items). The filter paper shall be applied to the surface with moderate pressure, and shall wipe about 100 square centimeters (cm²) (about four inches by four inches) of surface area. The filter paper shall then be held in close proximity of the count rate meter probe to determine the presence of elevated levels of removable radioactive contamination. Verification of positive contamination, if encountered, shall be accomplished by sending smear samples to the CHDT laboratory for analysis using the Ludlum 3030 Alpha Beta Sample

counter. Decontamination 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 the affected personnel may be electronically inserted into the survey form to facilitate documentation.

5.3 Additional Personnel Surveys

In some cases, additional measurement sensitivity may be required. An integrated scanning count may be collected using the 43-93 alpha/beta probe and 2360 scaler/data logger. The collected measurement is essentially a timed scan, where the scaler count is initiated and the detector is slowly moved at a consistent distance over a selected portion of the body (e.g., the feet). The total number of counts over a set time, such as one or two minutes, may be used for compliance with surface activity limits. The total counting time, which is greater than what is done with a typical scan, allows for a lower calculated minimum detectable concentration (MDC). MDC calculations for the 43-93 are described in SOP 15.OPS.08, *Operation of Alpha-Beta Scintillation Detector*.

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 Indistinguishable from Background

The majority of personnel contamination surveys will be performed with the criterion of no contamination present, or no radioactivity above background. Therefore, the technician must have a clear understanding of the appropriate background levels for the instrument being used and for the location of the survey.

6.2 Data Conversion

For comparison with the measurement criteria listed in Section 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.

6.3 Surface Contamination Limits

Fixed and removable activity that may be present on PPE 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.

6.4 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

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