

Approved by:		
	General Manager	Radiation Safety Officer

STANDARD OPERATING PROCEDURE

15.WAC.03

RADIATION SURVEY OF MATERIALS WITH RADIUM SCALE

1.0 OBJECTIVE

To define the specific methods and procedures for generators and Clean Harbors Deer Trail (CHDT) personnel to use in conducting radiation surveys for the characterization of pipe, equipment, and general debris containing radium-contaminated scale.

2.0 SCOPE

This standard operating procedure (SOP) addresses the performance and documentation of radiation surveys by waste generators and CHDT personnel to determine the ambient radiation levels that ensure the receipt of pipe and equipment (such as valves) contaminated with radium scale in compliance with the CHDT waste acceptance criteria. This SOP is not intended for use by the generator in preparing a load of materials to comply with Department of Transportation regulations on the shipment of radioactive materials.

3.0 POLICY

Radiation surveys for the shipment of pipe and equipment contaminated with radium scale shall be conducted to ensure that average contamination levels do not exceed the CHDT waste acceptance criteria. Generators following this procedure are required to complete the standard CHDT waste profile and NORM questionnaire provided in 15.WAC.01, *Waste Acceptance Criteria*, to certify that no man-made or other unacceptable radionuclides are present.

4.0 RESPONSIBILITIES

It is the responsibility of the waste generator to conduct surveys consistent with those required by the CHDT Radiation Safety Officer (RSO) and CHDT management, as defined in the Radiation Protection Plan (SOP 15.RPP.01). The surveys may be performed by the generator, Clean Harbors on behalf of the generator, or an independent party, such as a licensed waste broker.

5.0 GENERAL PROCEDURE

Radiation surveys for shipment of pipe and equipment contaminated with radium scale shall be conducted using a Ludlum Model 19 MicroR Meter. It is assumed that generator surveys will be performed on non-containerized materials.

5.1 Exposure Rate Meter Check List

Prior to using the Ludlum Model 19 MicroR Meter, the instrument shall be checked using the following procedure. Further direction on the use of the Model 19 may be found in SOP 15.OPS.07, *Operation of Exposure/Dose Rate Meters*.

- Check Batteries

- Turn the meter on and check the battery using the battery test button.
- The meter reading should be within the “BAT TEST” range on the meter display.
- Replace batteries if needed before use (two standard D cell batteries are required).
- Check Background
 - Turn the meter on and set the black range selector switch to the 0-25 range.
 - Set the Fast-Slow toggle switch to “f.”
 - Background or ambient exposure rates are typically in the range of 5 to 15 microroentgens per hour ($\mu\text{R/hr}$)
 - Do not use the meter if there appears to be no background response, as it may not be functioning properly.

5.2 Generator Survey of Radiation Levels – Multiple Pipe Configuration

Surveys of the radiation levels associated with multiple pipe shipment configurations of contaminated pipe and equipment shall be made using a Ludlum Model 19 MicroR Meter. Other survey instruments may be used only with the approval of the CHDT RSO.

Background instrument readings shall be made and recorded on the CHDT survey form shown in Attachment 1 or its equivalent. If possible, a description of the background location should be made.

Surveys of the contaminated materials shall be performed by holding the meter in contact with individual pipes or pieces of equipment, and recording the maximum dose rate readings at a minimum of nine locations upon each truck load or pile on the example CHDT survey form (Attachment 1) or its equivalent. Measurements should be collected at three general areas on the shipment. Standard locations are from two to three feet from each end of the shipment (to avoid potentially inconsistent readings at the pipe ends), and at the middle of the shipment. Alternative measurement locations can be selected if there are wide variations (a factor of two) from location to location for the shipment. Three measurements shall be made at each location: one reading each at about two feet in from the left and right edge of the stack, and one at the center of the stack.

To be consistent with the modeling basis, piles of pipe or equipment should not exceed a maximum height of 8 inches, maximum width of 14 inches, and maximum length of 30 feet for small diameter pipe; and a maximum height of 1.5 feet, maximum width of 3.5 feet, and maximum length of 30 feet for large diameter pipe. Measurements of multiple pipes and equipment should be collected prior to containerization of the material.

The approximate reading locations and gross exposure rates in units of $\mu\text{R/hr}$ must be documented on the example survey form or its equivalent. Enter both the gross and net (background corrected) exposure rates. Determine the average exposure rate for the nine net exposure rate measurements.

For pipe, determine if it is small diameter (less than four inches), or large diameter (greater than four inches). The limits for acceptance at CHDT are shown in Table 1. For small diameter pipe,

the average contact exposure rate is limited to 170 $\mu\text{R/hr}$ or less. For large diameter pipe (or equipment) the average contact exposure rate is limited to 230 $\mu\text{R/hr}$ or less. For random mixtures of small and large diameter pipes and equipment, or general oil field debris, the small diameter contact exposure rate of 170 $\mu\text{R/hour}$ shall apply.

5.3 Generator Survey of Radiation Levels – Single Pipe Configuration

When feasible, and when inconclusive multiple pipe configuration measurements are obtained, single pipe measurements may be performed using the Ludlum Model 19 MicroR Meter. Background instrument readings shall be made and recorded on the CHDT survey form shown in Attachment 1 or its equivalent. If possible, a description of the background location should be made.

Surveys shall be performed by holding the meter in near contact with individual pipes or pieces of equipment, and slowly scanning the length of the pipe (or piece of equipment), at a rate not to exceed two inches per second. The maximum net (background corrected) dose rate readings of the oil field pipe or equipment, in units of $\mu\text{R/hr}$, shall be recorded on the example survey form or its equivalent, shown in Attachment 1.

For individual pieces of pipe, determine if it is small diameter (less than four inches), or large diameter (greater than four inches). The limits for acceptance at CHDT are shown in Table 1. For small diameter pipe, the maximum contact exposure rate is limited to 120 $\mu\text{R/hour}$. For large diameter pipe (or equipment) the maximum contact exposure rate is limited to 150 $\mu\text{R/hour}$.

5.4 Receipt Survey of Materials Contaminated with Radium Scale

Upon arrival at CHDT, shipments of pipe and equipment contaminated with radium scale will be subject to exposure rate measurements using the facility gate monitor, per SOP 15.OPS.05, *Operation of Gate Monitor Detectors*. If waste materials are received on a flatbed truck, or are containerized in packaging with minimal gamma attenuation properties (e.g., soft side supersack), CHDT personnel will conduct an exposure rate survey according the requirements of Sections 5.2 and 5.3 of this SOP to verify the data provided by the generator. If pipe or debris has been containerized, measurements will be collected on the outside of the shipping container and compared with the range of values listed in Table 2 to account for the shielding properties of the container and the buildup of scattered radiation. Dose response or shielding modeling may be performed as necessary to provide additional backup for measured exposure rates. A duplicate survey form will be completed and maintained with the paperwork associated with the profile. In addition, contamination surveys will be performed on the received waste materials as necessary to determine material handling requirements.

6.0 STANDARDS AND CRITERIA

Based on the evaluation documented in Kennedy et al, 2009, the values listed in Table 1 are the limits for acceptance for disposal at CHDT.

Table 1. Exposure Rate Limits for Non-Containerized Radium-Scale Waste

	Diameter of 4 inches or less (µR/hr)	Diameter greater than 4 inches (µR/hr)	Miscellaneous Debris (µR/hr)
Multiple Pipe Configuration	Average of 9 measurements less than 170	Average of 9 measurements less than 230	Average of 9 measurements less than 170
Individual Pipe Configuration	Maximum of 9 measurements less than 120	Maximum of 9 measurements less than 150	Maximum of 9 measurements less than 150

A minimum of nine measurements must be documented, with the average (for multiple pipe configuration) or maximum (for single pipes or pieces of debris) result being compared with the limits in Table 1.

Upon receipt of containerized radium-scale wastes at the CHDT facility, survey measurements will be compared with the range of limits listed in Table 2.

Table 2. Container Exposure Rate Limits

	Non-Containerized Limit (µR/hr) ⁽¹⁾	Aluminum Container (µR/hr) ⁽²⁾	Aluminum Container w/ Buildup (µR/hr) ⁽²⁾	Steel Container (µR/hr) ⁽²⁾	Steel Container w/ Buildup (µR/hr) ⁽²⁾
Multiple < 4 inches	170 ⁽³⁾	160	230	140	200
Multiple > 4 inches	230 ⁽³⁾	210	320	190	280
Multiple Debris	170 ⁽³⁾	160	230	140	200
Single < 4 inches	120 ⁽⁴⁾	110	160	100	140
Single > 4 inches	150 ⁽⁴⁾	140	210	130	180
Single Debris	120 ⁽⁴⁾	110	160	100	140

1. µR/hr = microroentgens per hour.
2. Values are rounded to the nearest multiple of ten.
3. The generator limit for multiple pipes/pieces of debris is the average of nine measurements.
4. The generator limit for single pipes/pieces of debris is the maximum of nine measurements.

The limits shown in Table 2 will be used by CHDT personnel to verify that shipments of radium scale wastes meet the CHDT waste acceptance criteria. CHDT confirmation measurements will be collected with a Ludlum Model 19 exposure rate meter. Any measurements exceeding the ranges listed in Table 2 may require the shipment to be unloaded from the shipping container for further surveys, or container-specific shielding calculations; any unresolved discrepancies between generator and CHDT data will result in rejection of the load.

7.0 REFERENCES

Clean Harbors Environmental Services, 2010. *Technical Basis for Receipt Surveys for Radium-Scale Materials*. February.

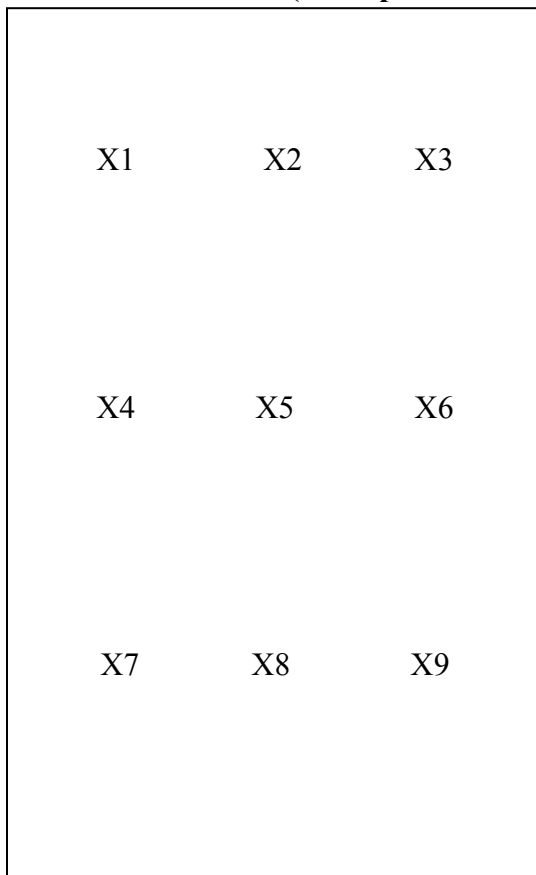
Instruction Manual Model 19 Micro R Meter, Ludlum Measurements, Inc, Current Version.

Kennedy, W.E., Jr., R.C. Winslow, and T.A. Ikenberry. 2009. *Technical Basis for the Acceptance of Oil Production Piping and Equipment Containing Radioactive Pipe Scale at the Deer Trail Landfill*. DMA-TR-042, Prepared for the Clean Harbors Deer Trail Landfill by Dade Moeller & Associates, Richland, Washington.

ATTACHMENT 1 – EXAMPLE RADIUM SCALE SURVEY FORM, MULTIPLE PIPES

Date	Time	Location
Description of waste generation process:		
Survey conducted by (name and contact information):		
Instrument/Probe Model	Ludlum Model 19 Micro R Exposure Rate Meter	Instrument Comments
Serial No.		
Background Reading	μR/hr	Background Description:

**Record the gross exposure rates and locations on the figure below:
 (Example Truck Bed - Measurement Locations X)**



Description of pipe and pipe configuration (including pipe diameter) :

Measurement	Gross Measurement (μR/hr)	Background-Corrected Measurement (μR/hr)
X1		
X2		
X3		
X4		
X5		
X6		
X7		
X8		
X9		
Maximum		
Average		
Applicable Exposure Rate Limit		

<i>Clean Harbors Use Only:</i>	Approved by: _____
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