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WM-SVS: Waste Management Services
Administrative Procedure

Radioactive Characterization of Waste

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1.0 INTRODUCTION

The purpose of this document is to provide requirements for radioactive characterization of waste. This procedure is managed and owned by the Associate Directorate Environment, Safety and Health and provides instructions on the applicability and implementation of the requirement.

1.1 Purpose

This document summarizes the requirements in United States Department of Energy (DOE) [Manual 435.1-1](#), Radioactive Waste Management Manual and [DOE O 458.1](#), Radiation Protection of the Public and the Environment, Section 4.k.

1.2 Scope

The Waste Management Division (WM) provides radioactive waste planning, characterization, reporting, and disposal services in support of LANL's radiological and environmental protection missions. Generators must characterize waste through sampling and analysis, acceptable knowledge (AK), or a combination of both, to demonstrate the waste meets TSDF requirements. For waste characterized as MLLW, generators shall demonstrate that the MLLW meets the applicable Title 40 CFR. Generators shall characterize waste with sufficient accuracy to permit proper segregation, treatment, storage, and disposal. The characterization methods and procedures employed by the generator shall ensure that the physical, chemical, and radiological characteristics of the waste are recorded and known during all stages of the waste management process.

Mixed waste contains both radioactive and hazardous components as defined by the Atomic Energy Act of 1954 (as amended) and [Title 40 Code of Federal Regulations \(CFR\) §261](#). Users of this Function Series Document (FSD) must also follow the guidance in [ADESH-AP-TOOL-111](#), "Waste Characterization," to ensure their waste characterization process complies with the hazardous waste characterization requirements in Title 40 CFR §262.11, "Hazardous Waste Determination" and the Los Alamos National Laboratory (LANL) Hazardous Waste Facility Permit. This document will also assist in making transportation determinations as required by the Department of Transportation [Title 49 CFR §173](#).

Users seeking authorized release limits based on requirements in Section 4.k of DOE Order 458.1 should follow the requirements provided under "Release and Clearance of Property," below.

1.3 Applicability

This document applies to any LANL employee, contractor, or sub-contractor who has been identified as a waste generator.

Note: Treatment and Storage Facility (TSF) workers become "Waste Generators" when activities at the TSF (e.g., repackaging, sorting, and segregation) lead to the generation of regulated waste or trigger re-characterization of the waste stream.

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2.0 PRECAUTIONS AND LIMITATIONS

This document cannot establish new requirements; it may only summarize the requirements in federal/state statutes/regulations/permits, DOE Orders, and authorized Laboratory policies.

3.0 RADIOLOGICAL CHARACTERIZATION METHODS

There are several methods for radiological characterization of waste. The waste characterization methods described below are not intended to be all-inclusive. In addition, these methods can be used individually or in combination.

Note: SAFE-4 (Material Control and Accountability), uses NON-DESTRUCTIVE ASSAY (NDA) instruments for accountability, confirmation, and verification measurements. SAFE-4 requirements may be in addition to waste characterization methods described in this procedure.

3.1 Using Direct Analytical Data to Characterize the Waste

Direct sampling and analytical analysis is the preferred method of radiological characterization, which is generated from samples taken directly from the waste being characterized. Waste Generators can meet general and specific waste analysis requirements using several methods or combinations of methods. Wherever feasible, the preferred method to meet the waste analysis requirements is to conduct sampling and laboratory analysis because it is more accurate and defensible than other options.

When sampling and analysis is used as a method of characterization, data validation shall be conducted on a portion of chemical and radiological data prior to use of the data for characterization. Data validation is a comprehensive analysis and review of analytical data conducted against a set of predetermined criteria and leading to the assignment of relative usability (i.e., completely usable, estimated value, unusable) for each analytical result. The validation criteria should be developed using the Data Quality Objective (DQO) process and are dependent upon the type(s) of data involved and the purpose for which the data are collected. Data shall be validated by technically qualified personnel who are independent of those performing the analyses.

There are job aids to assist in determining the concentration of isotopes in the waste located on the [WM website](#).

3.2 Using Non-Destructive Assay to Characterize Radioactive Constituents

Non-Destructive Assay (NDA) can deliver measurements of radioactive and nuclear materials for characterization purposes. Some of which include, radioactive waste container characterization, assessments of material hold-up in process equipment, confirmation and verification measurements of special nuclear materials for safeguards processes, and quantification of fissile materials for criticality safety purposes.

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Note: Due to the minimum detectable activities of the assay equipment, only TRU and LLW determinations can be made using NDA. NDA cannot be used for the Release and Clearance of Property.

3.3 Using Acceptable Knowledge to Characterize Radioactive Constituents

Waste generators can meet general and specific radioactive waste analysis requirements using several methods or combinations of methods. Wherever feasible, the preferred method to meet the radioactive waste analysis requirements is to conduct sampling and laboratory analysis because it is more accurate and defensible than other options. However, waste generators can meet the intent of radioactive waste analysis requirements by applying acceptable knowledge. Acceptable knowledge can be used to meet all or part of the radioactive waste analysis requirements. Acceptable knowledge can be broadly defined to include:

"Process knowledge," whereby detailed information on the wastes is obtained from existing published or documented waste analysis data or studies conducted on wastes generated by processes similar to that which generated the waste. Therefore, with many wastes the application of acceptable knowledge is appropriate because the physical/chemical makeup of the waste is generally well known and consistent.

While seemingly attractive because of the potential savings associated with using existing information (such as published data), waste generators must ensure that this information is current (prevalent) and accurate. If waste generators use acceptable knowledge in addition to or in place of sampling and analysis, regulators, administrators, auditors, etc. look for documentation that clearly demonstrates that the information relied upon is sufficient to identify the waste accurately and completely.

The following sources of acceptable knowledge may be used to segregate and characterize the radiological constituents of a waste stream. These methods may use source information, gross radiation measurements including scaling factors, calculations, and/or may include Surface Contaminated Object (SCO) calculations. All characterization methods must be documented and legally defensible for internal or external third party reviews. AK can be used for waste characterization in lieu of sampling and analysis if the waste generator's AK is of sufficient detail to qualify as acceptable. Other sources of AK may include but are not limited to:

- Plans and drawings;
- Areas and/or buildings where each waste stream is generated;
- Material inputs, including MSDSs;
- Manufacturing specifications;
- Mass balance documentation;
- Literature searches;
- Living memory (documented interviews);
- Laboratory notes and batch records;

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- Process logs and batch records; and
- Procedures.

Source information. If the radionuclides used in a controlled area are well known and documented (e.g. materials control and accountability), and if operational controls limit the transfer of material containing other radionuclides into the area, the waste stream generated in this area may be segregated and characterized using source information. Values must be verified and documented periodically, at a minimum annually, or when a change in process or area controls has occurred.

Gross radiation measurements. Gross radiation measurements (e.g., gross alpha [fixed and/or removable], Beta and Gamma surveys) may be used if there is a demonstrable correlation between the gross radiation and the radionuclide content and/or activity of the waste stream. Scaling factors can be developed that relate gross radiation measurements to the activity concentration and/or activity of a waste stream. Waste Generators using gross radiation measurements shall ensure that measurements correlate with activity concentration on a consistent basis. Radionuclide distributions in the waste stream must be initially determined and periodically verified through direct measurements or sampling and analysis. Generators must document the methods used to develop scaling factors that relate gross radiation measurements to the activity concentration. When developing scaling factors, generators shall consider the waste package and detector geometry, shielding and attenuation effects, self-absorption, and the energy spectra and decay schemes of radionuclides in the waste.

Calculations. When applicable, calculations may be used to identify radionuclides and estimate activities, provided that the computational methods and software used have been verified, validated, and documented. Ensure that the computational methods used to segregate and characterize wastes are described in the waste characterization documentation. It is very important for waste generators to accurately complete WCATS panels, Process Information, Waste Description, and to add all necessary information in the Documentation panel.

Surface Contaminated Objects (SCOs). [EP-TD-2204](#), *Requirements Document for Radiological Characterization of Surface Contaminated Objects at LANL*, defines the requirements for radiological characterization of SCOs. The methods described in EP-TD-2204 are used to determine:

- Compliance with U.S. Department of Transportation (DOT) regulations for categorization of SCOs;
- Total radioactivity for all radionuclides within a shipping container packed with SCOs;
- Radioactivity concentration (activity per gram of waste) in the shipping container to demonstrate conformance to portions of disposal site waste acceptance criteria (WAC) for near-surface land disposal.

An SCO is a solid object which itself is not radioactive, but which has fixed and/or removable radioactive contamination distributed on any of its surfaces. In keeping with DOE Order M 435.1-1, the methods presented in EP-TD-2204 incorporate a graded approach to waste characterization. More rigorous, detailed analysis is performed when waste approaches a DOT or WAC limitation.

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3.4 Release and Clearance of Property

Release or clearance of property, soil, rubble, and debris from demolition and remediation activities may contain very low levels of radioactivity that are above background but below the radiological release limits. Release of these wastes must be conducted in accordance with the requirements in [P412, Environmental Radiation Protection](#) and [DOE Order 458](#), Section 4.k.

The order sets forth the criteria for establishing the authorized limits for the release of property and defines residual radioactive material as material having a level of radioactivity that is low enough for release without restrictions.

If waste generators, project managers, construction managers, or other waste management personnel plan to utilize the release or clearance criteria established by P412 and DOE O 458 contact the WM-SVS Group Leader. The Group Leader will appoint the Rad Waste Authority to evaluate the potential for release or clearance of property, soil, rubble, and debris. If this path is viable, WM-SVS will assist in the process to ensure the requirements identified in P412 and DOE O 458 are satisfied.

3.5 Re-characterization of Waste Stream

Waste Generators must update waste characterization based on the following:

- there is a change to the waste-generating processes or operations;
- analytical results indicate a discrepancy in the waste stream description;
- new characterization information becomes available;
- a waste container is opened and secondary material is added to the container;
- waste is repackaged and secondary material is added during this process;
- there is a change in the ownership of a WSP;
- loss of process controls that are in place to ensure generated waste remains within the bounds of the WSP;
- inconsistencies in the AK documentation are identified;
- the Waste Generator is notified that waste received at an off-site facility does not match a pre-approved waste analysis certification or accompanying shipping documentation;
- waste is repackaged and no longer matches the characterization in its WSP;
- annual notification of AK waste streams indicates the waste does not match the waste specified by the waste generator;
- waste received at an off-site facility does not match a pre-approved waste analysis certification or accompanying shipping documentation; or
- an inspection reveals that the waste does not match the identity of the waste specified by the Waste Generator or a manifest on a shipping paper.

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4.0 DEFINITIONS AND ACRONYMS

See LANL *Definition of Terms*.

See LANL *Acronym Master List*.

5.0 RECORDS

Records generated by this document will be submitted for records management in accordance with P1020-1 Laboratory Records Management and if applicable, with the ADESH-AP-006 Records Management Plan.

- Generators must keep characterization documentation such as analytical data, acceptable knowledge, spreadsheets, and/or calculations. This documentation must be uploaded into WCATs.

6.0 REFERENCES

DOE O 435.1, Radioactive Waste Management

DOE M 435.1-1, Radioactive Waste Management Manual

DOE O 458.1, Radiation Protection of the Public and the Environment

EP-DOP-2203, R4, *Operation and Calibration of Spectroscopy Systems*

EP-AP-2203, RO, *Analysis of Gamma Spectroscopy Data Acquired with HPGe Systems*

The LANL Hazardous Waste Facility Permit issued by the New Mexico Environment Department, December 2010 and updated versions.

7.0 ATTACHMENTS OR APPENDICES

N/A