Introduction

This document provides the requirements, terms, and conditions under which the Nevada Test Site (NTS) will accept low-level radioactive and mixed waste for disposal; and transuranic and transuranic mixed waste for interim storage at the NTS.

Review each section of this document. This document is not intended to include all of the requirements; rather, it is meant as a guide toward meeting the regulations. All references in this document should be observed to avoid omission of requirements on which acceptance or rejection of waste will be based.

The Department of Energy/Nevada Operations Office (DOE/NV) and support contractors are available to assist you in understanding or interpreting this document.

For assistance, please call:

DOE/NV WMD: phone 702-295-3181 fax 702-295-1153

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Approval Signatures

To the best of our knowledge, this document is correct and the process and criteria stated within meet the U.S. Department of Energy and appropriate federal regulation requirements.

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Date:  8/11/99

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Contents

1.0 Radioactive Waste Management at the Nevada Test Site ........................................ 1-1
   1.1 Purpose and Scope ................................................................................. 1-1
   1.2 Policy ................................................................................................. 1-1
      1.2.1 DOE/NV Policy ........................................................................ 1-1
      1.2.2 Process ...................................................................................... 1-1
      1.2.3 Waste Type ............................................................................... 1-1
      1.2.4 Regulators and Stakeholders .................................................... 1-2
   1.3 Requirements ..................................................................................... 1-2
   1.4 Responsibilities ................................................................................. 1-2

2.0 Approval Process ......................................................................................... 2-1
   2.1 Generator Document Requirements ..................................................... 2-1
      2.1.1 Waste Profiles .......................................................................... 2-1
      2.1.2 Waste Certification Program Plan .............................................. 2-1
      2.1.3 Certification Personnel List ....................................................... 2-1
      2.1.4 Document and Personnel Changes ............................................ 2-2
   2.2 RWAP Review .................................................................................. 2-2
      2.2.1 Facility Evaluations ................................................................. 2-2
         2.2.1.1 Triennial Audit ................................................................. 2-2
         2.2.1.2 Annual Assessment ......................................................... 2-2
         2.2.1.3 Surveillance ................................................................. 2-3
      2.2.2 Waste Profiles .......................................................................... 2-3
      2.2.3 Document and Personnel Changes ............................................ 2-3
      2.2.4 Split Sampling .......................................................................... 2-3
   2.3 Approval ............................................................................................ 2-4
   2.4 Suspending Approval ........................................................................ 2-4
   2.5 Terminating an Approved Waste Stream ............................................. 2-4
   2.6 Site Visit ........................................................................................... 2-5
   2.7 DOE/NV Policy ................................................................................ 2-5
   2.8 Options for Low-Volume Generators ................................................ 2-5

3.0 Waste Criteria ........................................................................................... 3-1
   3.1 General Waste Form Criteria ............................................................... 3-1
      3.1.1 Transuranics ............................................................................ 3-1
      3.1.2 Radionuclide Content or Concentrations .................................. 3-1
      3.1.3 Greater-than-Class C Waste ...................................................... 3-1
      3.1.4 Hazardous Waste ................................................................... 3-1
      3.1.5 Free Liquids ............................................................................ 3-2
      3.1.6 Particulates ............................................................................. 3-2
      3.1.7 Gases ....................................................................................... 3-2
Contents

3.1.8 Stabilization ........................................... 3-2
3.1.9 Etiologic Agents .................................... 3-3
3.1.10 Chelating Agents .................................. 3-3
3.1.11 Polychlorinated Biphenyls (PCBs) .................. 3-3
3.1.12 Explosives ......................................... 3-3
3.1.13 Pyrophorics ....................................... 3-3
3.1.14 Sealed Sources .................................... 3-3
3.1.15 Low-Level Waste Containing Asbestos ............. 3-4
3.1.16 Radioactive Animal Carcasses ...................... 3-5

3.2 Waste Package Criteria .................................. 3-5
3.2.1 Nuclear Criticality Safety ............................ 3-5
3.2.2 Closure ............................................. 3-6
3.2.3 Strength ........................................... 3-6
3.2.4 Handling .......................................... 3-6
3.2.5 Size ............................................... 3-7
3.2.6 Weight ............................................. 3-7
3.2.7 Loading (Void Space) ............................... 3-7
3.2.8 Package Protection .................................. 3-7
3.2.9 Marking and Labeling ................................ 3-7
3.2.10 Bar Coding ........................................ 3-7

3.3 Mixed Waste ............................................. 3-8
3.3.1 Mixed Waste Generated Within the State of Nevada
   3.3.1.1 Free Liquids .................................. 3-8
   3.3.1.2 Treatment ..................................... 3-8
   3.3.1.3 Incompatible Wastes ......................... 3-8
   3.3.1.4 Marking and Labeling ....................... 3-8
   3.3.1.5 Containers .................................. 3-8
3.3.2 Mixed Waste Generated Outside the State of Nevada 3-8

3.4 WAC Deviations .......................................... 3-9
3.5 Shipping Arrangements .................................. 3-9
3.6 Shipping Documentation ................................ 3-11

4.0 Waste Characterization .................................. 4-1
4.1 Process Knowledge ...................................... 4-1
4.2 Sampling and Analysis .................................. 4-2
4.2.1 Data Validation ................................... 4-2

5.0 Quality Assurance Requirements for Waste Certification Program 5-1
5.1 Organization ............................................ 5-1
Contents

5.2 QA Program .................................................... 5-1
5.3 Design Control ................................................ 5-2
5.4 Procurement Document Control ................................ 5-3
5.5 Instructions, Procedures, Drawings ........................ 5-3
5.6 Document Control ................................................ 5-3
5.7 Control of Purchased Items and Services .................. 5-4
5.8 Identification and Control of Items .......................... 5-4
5.9 Control of Processes ............................................ 5-5
5.10 Inspection ...................................................... 5-5
5.11 Test Control ..................................................... 5-6
5.12 Control of Measuring and Test Equipment ................. 5-6
5.13 Handling, Storage, and Shipping ............................ 5-7
5.14 Inspection, Test, and Operational Status ................... 5-7
5.15 Control of Nonconforming Items ............................ 5-7
5.16 Corrective Actions .............................................. 5-8
5.17 Quality Assurance Records .................................... 5-8
5.18 Audits/Surveillance ............................................. 5-9

6.0 Waste Transportation and Receipt Information .............. 6-1
6.1 Waste Transportation ........................................... 6-1
6.2 Waste Receipt and Records .................................... 6-1
6.3 Funding and Forecasting ....................................... 6-2
6.4 Disposition of Noncompliant Conditions ..................... 6-2
6.5 Waste Refusal ..................................................... 6-2

Appendix B Nevada Test Site Waste Profile, Revision 2, 01/99 .......... B-1
Appendix C Marking and Labeling .................................. C-1
Appendix D Package Storage and Disposal Request ................ D-1
Appendix E Radiological Waste Characterization and Reporting Requirements .... E-1
Appendix F Glossary .................................................. F-1

References .............................................................. Reference-1

Figure C-1 Bar Code Label Example .................................. C-1
Figure C-2 Package Certification Label ............................. C-2
Table E-1 Radionuclide Action Levels for Waste Characterization and Reporting .... E-4
Table E-2 Exempt Radionuclides .................................... E-5
Figure E-1 Radiological Characterization Flow Diagram ............ E-6
## Acronyms

<table>
<thead>
<tr>
<th>Acronym</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>ALARA</td>
<td>As Low As Reasonably Achievable</td>
</tr>
<tr>
<td>ALLW</td>
<td>Asbestiform Low-Level Waste</td>
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<tr>
<td>AMEM</td>
<td>Assistant Manager for Environmental Management</td>
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<tr>
<td>ANSI</td>
<td>American National Standards Institute</td>
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<tr>
<td>ASME</td>
<td>American Society of Mechanical Engineers</td>
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<td>ASTM</td>
<td>American Society for Testing and Materials</td>
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<td>BN</td>
<td>Bechtel Nevada</td>
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<tr>
<td>CAR</td>
<td>Corrective Action Request</td>
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<tr>
<td>CFR</td>
<td>Code of Federal Regulations</td>
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<td>DOE</td>
<td>U.S. Department of Energy</td>
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<td>DOE/NV</td>
<td>U.S. Department of Energy/Nevada Operations Office</td>
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<tr>
<td>DOT</td>
<td>U.S. Department of Transportation</td>
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<tr>
<td>DQO</td>
<td>Data Quality Objectives</td>
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<tr>
<td>EPA</td>
<td>U.S. Environmental Protection Agency</td>
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<tr>
<td>ETA</td>
<td>Estimated Time of Arrival</td>
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<tr>
<td>HRI</td>
<td>Human Readable Interpretation</td>
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<tr>
<td>LDR</td>
<td>Land Disposal Restrictions</td>
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<tr>
<td>LLW</td>
<td>Low-Level Waste</td>
</tr>
<tr>
<td>MC&amp;A</td>
<td>Materials Control and Accountability</td>
</tr>
<tr>
<td>MW</td>
<td>Mixed Waste</td>
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<tr>
<td>NDEP</td>
<td>Nevada Division of Environmental Protection</td>
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<tr>
<td>NQA-1</td>
<td>Quality Assurance Program Requirements for Nuclear Facilities</td>
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<td>NRC</td>
<td>Nuclear Regulatory Commission</td>
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<td>NTS</td>
<td>Nevada Test Site</td>
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<td>NTSWAC</td>
<td>Nevada Test Site Waste Acceptance Criteria</td>
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<tr>
<td>PCB</td>
<td>Polychlorinated Biphenyls</td>
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<td>PCL</td>
<td>Package Certification Label</td>
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<tr>
<td>PK</td>
<td>Process Knowledge</td>
</tr>
<tr>
<td>PSDR</td>
<td>Package Storage and Disposal Request</td>
</tr>
<tr>
<td>Acronym</td>
<td>Definition</td>
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<tr>
<td>QA</td>
<td>Quality Assurance</td>
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<tr>
<td>QC</td>
<td>Quality Control</td>
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<tr>
<td>RACM</td>
<td>Regulated Asbestos-Containing Material</td>
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<td>RCRA</td>
<td>Resource Conservation and Recovery Act</td>
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<td>RTR</td>
<td>Real-Time Radiography</td>
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<tr>
<td>RWAP</td>
<td>Radioactive Waste Acceptance Program</td>
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<td>RWMS</td>
<td>Radioactive Waste Management Site</td>
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<tr>
<td>SAP</td>
<td>Sampling and Analysis Plan</td>
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<tr>
<td>SOW</td>
<td>Scope of Work; Statement of Work</td>
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<tr>
<td>TCLP</td>
<td>Toxicity Characteristic Leaching Procedure</td>
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<tr>
<td>TRU</td>
<td>Transuranic</td>
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<tr>
<td>WAC</td>
<td>Waste Acceptance Criteria</td>
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<tr>
<td>WCO</td>
<td>Waste Certification Official</td>
</tr>
<tr>
<td>WCPP</td>
<td>Waste Certification Program Plan</td>
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<td>WMD</td>
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<tr>
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1.0

Radioactive Waste Management at the Nevada Test Site
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Radioactive Waste Management at the Nevada Test Site

Purpose and Scope

This document establishes the U. S. Department of Energy, Nevada Operations Office (DOE/NV) waste acceptance criteria (WAC). The WAC includes requirements for the generator waste certification program, characterization, traceability, waste form, packaging, and transfer. The criteria apply to radioactive waste received at the Nevada Test Site (NTS) Area 3 and Area 5 Radioactive Waste Management Sites (RWMSs) for storage or disposal.

Policy

1.2.1 DOE/NV Policy

The DOE/NV policy is to:

- ensure safe and compliant storage and disposal of radioactive waste;
- protect the environment and personnel from chemical and radiological hazards in accordance with Title 40 Code of Federal Regulations (CFR), the Resource Conservation and Recovery Act (RCRA); 10 CFR 835, “Occupational Radiation Protection;” DOE Order 5820.2A, “Radioactive Waste Management;” state of Nevada and applicable Department of Transportation (DOT) regulations;
- ensure that present and future radiation exposures are kept as low as reasonably achievable (ALARA) and do not exceed the radiation protection standards established in 10 CFR 835, “Occupational Radiation Protection;”
- ensure Quality Assurance (QA) programs are established and implemented to fulfill the requirements of DOE Order 5820.2A, “Radioactive Waste Management”; and 10 CFR 830.120, “Quality Assurance,” and
- be consistent with applicable federal, state, and local regulations.

1.2.2 Process

Waste will be accepted from generators approved by DOE/NV. The approval process is described in Section 2.0.

1.2.3 Waste Type

Low-Level Waste (LLW) and mixed waste (MW) will be accepted for disposal at the NTS. However, to verify current acceptance status of waste types, please contact DOE/NV Waste Management Division (WMD).
1.2.4 Regulators and Stakeholders

DOE/NV will facilitate appropriate regulatory oversight by state agencies and support the involvement of the stakeholders. Where appropriate, to the extent possible, and in accordance with applicable DOE/NV authority, DOE/NV will provide regulatory agencies and stakeholders access to information related to NTSWAC activities, including waste characterization data, from all generators. Upon request by such parties, arrangements may be made to observe NTSWAC-related facility evaluations and participate in other activities such as NTSWAC revisions.

1.3 Requirements

Requirements are identified by “shall” or “must.” The source of the requirement is identified by a superscript number which correspond to the reference list. Statements not identified in this manner are provided as guidance. Section 2 requirements do not have corresponding references because the approval process is DOE/NV policy.

1.4 Responsibilities

The following offices and personnel have responsibilities for management and acceptance of radioactive waste at the NTS. The offices identified are within the DOE/NV, unless otherwise stated.

1.4.1 Manager
Responsibilities and authorities as assigned in DOE Order 5820.2A.

1.4.2 Assistant Manager for Environmental Management (AMEM)
Responsible for the DOE/NV Radioactive Waste Management Program according to DOE Order 5820.2A. Provides approval to waste generators to dispose of or store radioactive waste at the NTS and grants any deviations from the requirements of this document. Responsible for suspension of any generator. May delegate his/her responsibilities except for approval and suspension.

1.4.3 Director, Waste Management Division
Responsible for management of radioactive waste at the NTS. Responsible for radioactive waste management operation of the Areas 3 and 5 RWMSs in compliance with applicable DOE Orders and federal and state regulations.

1.4.4 Radioactive Waste Acceptance Program (RWAP) Personnel
Responsible for development, implementation, and maintenance of the RWAP and the NTSWAC. Responsible for providing guidance to generators shipping radioactive waste to the NTS.

1.4.5 Director, Safeguards and Security Division
Responsible for acceptance of documentation for classified/unclassified accountable or special nuclear material waste. Coordinates acceptance of classified waste shipments at the NTS.
2.0

Approval Process
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Approval Process

The approval process is a series of steps the generator and DOE/NV follow resulting in the generator receiving an approval to ship waste to the NTS. A flow chart of the approval process can be found in Appendix A.

All official interactions referenced in this section between the generator and DOE/NV take place through the generator’s appropriate oversight office.

Generator Document Requirements

Prior to document development, the generator shall contact DOE/NV WMD to verify that the waste form can be accepted at the NTS. The generator is responsible for the development, implementation, and maintenance of NTSWAC compliant documents. The documents listed below shall be developed and/or completed.

2.1.1 Waste Profiles

A Waste Profile (WP) must be submitted for each waste stream in the format found in Appendix B. The WP summarizes the characterization and WAC compliance of the waste stream (see Sections 3.0 and 4.0 for requirements). A list of referenced procedures, citing the number and title of the procedures shall be included as an attachment to the WP.

The WP number is the waste stream identification number. This unique two-part, 13-character alphanumeric code identifies the generator and the generator’s waste code. The first part of the number is a four-character alphanumeric code used by RWMS personnel to identify the generator (see Appendix C). The second part is a nine-character, generator-assigned alphanumeric code for each waste stream (e.g., BCLA-HWM000001. BCLA is the designation for Lawrence Livermore National Laboratory and HWM000001 is the Laboratory’s assigned waste stream code).

2.1.2 Waste Certification Program Plan

The Waste Certification Program Plan (WCPP) shall be documented in accordance with Section 5.0. A controlled copy of the WCPP shall be sent to DOE/NV.

2.1.3 Certification Personnel List

A list of the Waste Certification Official(s) and Package Certifier(s) shall be developed. The list contains the telephone and telefax number for the WCO(s). It is used by RWMS personnel to ensure signatures on certified packages and shipments are from authorized personnel. Any packages or shipments certified by personnel not on this list will not be accepted by the RWMS.

2.1.4 Document and Personnel Changes

Generators shall notify DOE/NV in writing of changes to the above documents and any key personnel changes.
2.2 RWAP Review

DOE/NV's process of approval for a generator's certification program and waste streams includes document reviews and evaluations of implementation at the generator facility. Corrective Action Requests (CARs) will be issued to generator sites when conditions adverse to quality are identified by DOE/NV. CARs require the generator to document a root cause, corrective action, and action to preclude recurrence. Failure to respond to CARs could lead to delays in approval or suspension in accordance with Section 2.4.

2.2.1 Facility Evaluations

Facility evaluations (audits, surveillances, and annual assessments) are conducted according to periodic review requirements.

2.2.1.1 Triennial Audit

An audit of the generator is conducted on a triennial basis. New generators are audited prior to program approval. New generators shall submit the documents described in Section 2.1 to DOE/NV prior to the audit. Approved generators (triennial audit) shall submit a list of those documents that have changed since their last Annual Assessment.

The audit will verify by examination and evaluation of objective evidence that the documents contain the necessary elements and have been adequately implemented. The audit scope will include an on-site evaluation of the characterization, quality assurance, and traceability waste certification program elements.

2.2.1.2 Annual Assessment

An annual assessment of generator performance is conducted every year after the generator's initial pre-approval or triennial audit. Generators receive an "Annual Assessment Generator Survey" from DOE/NV and send the completed survey back with any requested information. Requested information may include nonconformance reports, internal audit reports, etc. The scope of the annual assessment includes program changes, operational concerns, and internal assessments. Based upon the results of the annual assessment, a surveillance of the generator's facility may be conducted.

2.2.1.3 Surveillance

A surveillance may be performed to verify the effectiveness of corrective actions, review a new waste stream or program element, resolve discrepancies, ensure compliance with specific requirements of the NTSWAC, or at the discretion of DOE/NV.
2.2.2 Waste Profiles

Waste profiles are reviewed by the DOE/NV Waste Acceptance Review Panel (WARP). The WARP may require additional information from the generator, recommend the waste stream for approval, or recommend a surveillance of the waste stream. Once a generator has completed the pre-approval audit and received approval to ship from DOE/NV, waste profiles for new waste streams or modifications to approved waste streams may be submitted to DOE/NV at any time.

2.2.3 Document And Personnel Changes

Depending on the significance of the change, the approval to ship may be temporarily suspended until the change(s) is reviewed and accepted.

2.2.4 Split Sampling

The purpose of the split sampling program is to independently assess or confirm the results of waste analysis. DOE/NV may choose waste streams based on the annual volume, the potential for finding hazardous components, or the scope and complexity of the sampling process being performed. For mixed waste, DOE/NV may require split sampling prior to the waste stream being approved.

Samples will be collected by the generator's sampling team under the observation of an RWAP representative. DOE/NV may split a representative waste sample with the generator for independent analysis. Samples will be sent to the generator laboratory and to an independent laboratory chosen by DOE/NV. The samples will be analyzed by the same analytical methods. Results of the analyses from both laboratories will be compared by RWAP after data validation. Differences between the two sets of data may require further investigation.
2.3 Approval

RWAP personnel recommend to DOE/NV AMEM that approval be granted after the generator has demonstrated satisfactory implementation of the NTWAC. Current copies of the following documents must be maintained by the organizations identified below while the generator’s approval to ship waste is in effect:

- Waste profiles by DOE/NV RWAP, RWMS, and generating facilities
- Controlled copy of the WCPP by DOE/NV RWAP and generating facilities
- Certification List by DOE/NV RWAP, RWMS and generating facilities

The DOE/NV AMEM will provide written notice of approval, identifying facility evaluation number(s) and acceptable waste stream(s) by identification number, title, profile revision and date. Any conditions affecting the waste stream approval will be identified. Approval letters will be issued after successful completion of facility evaluation(s) and/or waste profile WARP review(s). Each approval letter will detail current approved waste streams and WCPPs.

2.4 Suspending Approval

DOE/NV may suspend approval if the generator’s waste or documents do not meet the NTWAC requirements. Individual waste streams or the generator’s entire program may be suspended. Reasons for suspension may include but are not limited to:

- Improper manifesting (e.g., incorrect activity reported)
- Repetitive programmatic deficiencies.
- Incorrect waste characterization.
- Waste container integrity deficiencies.
- Nuclear safety limits violations.
- Facility evaluation results.

Suspension may be issued verbally by DOE/NV representatives and followed by official written notification.

2.5 Terminating an Approved Waste Stream

Generators will notify DOE/NV in writing if they no longer need an approved waste stream (project is complete, one-time-only waste stream has been shipped, etc.).
Site Visit

Generators may request a site visit by RWAP personnel to provide guidance in the development and implementation of documentation. Identification of areas requiring assistance should be communicated to RWAP to ensure the appropriate personnel participate in the site visit. The site visit is documented but does not require a response from the generator. The site visit documentation may be used by DOE/NV in the preparation of facility evaluations.

DOE/NV Policy

Due to changes in regulatory requirements, NTS policies, and changes instituted as a result of lessons learned, any aspect of the waste certification process may be subject to a full review to ensure its continued compliance and effectiveness. This review may entail imposing additional requirements or reversing previous decisions. Unannounced facility evaluations may be performed at the discretion of DOE/NV.

Options for Low-Volume Generators

Generators may elect to become low-volume generators (LVG) if the total volume of waste to be shipped to the NTS per fiscal year does not exceed 200 m³ (7,063 ft³). The LVG status exempts the generator from the triennial audit described in Section 2.2.1.1.

LVGs must complete and submit: waste profile(s), a list of certification personnel, and a master list of applicable procedures. DOE/NV may perform a limited-scope facility evaluation based on the uniqueness of the waste type, discrepancies identified by the NTS RWMS, or the generator’s internal assessment results.

LVGs must meet the requirements described in Section 5.0 commensurate with their program for certifying the waste (e.g., apply required standards to the waste generation and characterization process without developing a full waste certification program).

If a LVG determines that it would not be cost effective to establish a program that meets the requirements of the NTSCWAC, DOE/NV encourages the LVG to team with a DOE/NV approved generator to dispose of their waste. All arrangements between a LVG site and an approved generator should receive concurrence from DOE/Headquarters, the approved site’s DOE oversight office, and DOE/NV.
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3.0

Waste Criteria
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Waste Criteria

Waste accepted at the NTS must be radioactive and shall meet the waste form criteria outlined below. Generators must ensure waste is handled, stored, and shipped in accordance with applicable DOE, DOT, EPA, State and Local regulations and requirements. Waste streams deviating from these requirements will be evaluated in accordance with Section 3.4, WAC Deviations.

General Waste Form Criteria

These waste form criteria are based on current DOE LLW management policies and practices.

3.1.1 Transuranics

The concentration of alpha-emitting transuranic nuclides with half-lives greater than 20 years must not exceed 100 nCi/g. The net weight of the waste (excluding the weight of the container and shielding) must be used to calculate the specific activity of the waste in each container. The following isotopes shall be considered when making the TRU waste determination: \(^{237}\)Np, \(^{239}\)Np, \(^{239}\)Pu, \(^{240}\)Pu, \(^{241}\)Pu, \(^{244}\)Pu, \(^{241}\)Am, \(^{242}\)Am, \(^{243}\)Am, \(^{244}\)Cm, \(^{245}\)Cm, \(^{246}\)Cm, \(^{247}\)Cm, \(^{248}\)Cm, \(^{249}\)Cm, \(^{249}\)Cm, \(^{251}\)Bk, \(^{249}\)Cf, and \(^{251}\)Cf. Also see Appendix E for radionuclide reporting requirements.

3.1.2 Radionuclide Content or Concentration

Radionuclide concentration must be reported in accordance with Appendix E, "Radionuclide Characterization and Reporting Requirements." Radionuclide limits for disposal are listed in Table E-1, "Radionuclide Action Levels for Waste Characterization and Reporting." Waste having radionuclide concentrations above these limits may be acceptable for disposal upon further review by DOE/NV.

3.1.3 Greater-than-Class C Waste

Commercial waste designated as Greater-than-Class C (GTCC), as defined in 10CFR 61.55 and DOE waste that, if commercially generated, would meet the GTCC definition, may be evaluated for disposal on a case-by-case basis depending on site-specific waste classification limits. This review may involve considering non-routine disposal options (i.e., controlling depth of disposal, considering other waste forms and package integrity, limiting the other types of wastes disposed nearby) or the development of a specific radiological performance assessment.

3.1.4 Hazardous Waste

LLW offered for disposal must not exhibit characteristics of, or be listed as, hazardous waste as identified in Title 40 CFR, state of Nevada regulations, or state-of-generation hazardous waste regulations. State of Nevada regulations require that waste regulated as hazardous in the state of generation must be regulated as hazardous when brought into the state of Nevada.
3.1.4.1 The use of lead shielding in containers of LLW is an acceptable practice provided the shielding is necessary for radiation protection and not radioactively contaminated when introduced. 

3.1.5 Free Liquids

Liquid waste and waste containing free liquids must be converted into a form that contains as little freestanding and noncorrosive liquid as is reasonably achievable. Liquid waste and waste containing free liquids should be processed to a solid form or packaged in sufficient sorbent for twice the volume of the liquid. The free liquid must not exceed 1 percent of the volume of the waste when the waste is in a disposal container; or 0.5 percent of the volume of the waste processed to a solidified form. Provisions for additional sorbent should be made when significant temperature and atmospheric differences exist between the generating site and the disposal site.

Waste must be evaluated to determine its potential to release liquid during handling, storage, and transportation. High moisture content waste is defined as waste that has the potential to release moisture from its final waste form in excess of the NTSWAC requirement. Generators must document the decisions made when characterizing and determining sorbents for high moisture content waste (See the Nevada Test Site Generator Work Group “Position Paper for High Moisture Content Waste” revision 0, dated 11/3/98 for use as guidance).

3.1.6 Particulates

Fine particulate wastes shall be immobilized so that the waste package contains no more than 1 weight percent of less-than-10-micrometer-diameter particles, or 15 weight percent of less-than-200-micrometer-diameter particles. Waste that is known to be in a fine particulate form or in a form that could mechanically or chemically be transformed to a particulate during handling and interim storage must be immobilized.

Secure packaging may be used in place of immobilization. Examples of acceptable packaging are overpacking (i.e., 55-gallon drum inside 85-gallon drum) and steel boxes. Drums and wooden boxes with sealed 6-mil (minimum) liners will also satisfy this requirement. Disposal containers with contents individually wrapped and sealed in plastic are also acceptable.

3.1.7 Gases

LLW gases must be packaged at a pressure that does not exceed 1.5 atmospheres at 20°C. Compressed gases as defined by Title 49 CFR shall not be accepted. Examples of compliance methods include puncturing aerosol cans and removing the valve mechanism from expended gas cylinders.

3.1.8 Stabilization

Where practical, waste must be treated to reduce volume and provide a more stable waste form. Wastes must not react with the packaging during storage, shipping, handling, and disposal.

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3.1.8.1 Structural stability can be accomplished by crushing, shredding, or placing a smaller piece inside an opening of a larger piece, such as nesting pipes.

3.1.8.2 Chemical stability and compatibility must be demonstrated to ensure no reactions occur and significant quantities of harmful gases, vapors, or liquids are not generated. Specifically when different waste forms are combined in a single waste container.

3.1.9 Etiologic Agents

LLW containing pathogens, infectious wastes, or other etiologic agents as defined in Title 49 CFR shall not be accepted.

3.1.10 Chelating Agents

LLW packages containing chelating or complexing agents in amounts greater than 1 percent of the waste shall not be accepted unless stabilized or solidified.

3.1.11 Polychlorinated Biphenyls (PCBs)

PCB-contaminated LLW shall not be accepted for disposal unless the PCB concentration meets municipal solid waste disposal levels of 50 ppm. Refer to Title 40 CFR, state of Nevada, and state-of-generation regulations for PCB disposal requirements.

3.1.12 Explosives

Waste must not be readily capable of detonation or of explosive decomposition or reaction at normal pressures and temperatures, or of explosive reaction with water.

3.1.13 Pyrophorics

Waste must not be pyrophoric. Pyrophoric materials contained in the waste shall be treated, prepared, and packaged to be nonflammable. Pyrophoric materials that are blended in a hardened concrete matrix are considered to be treated to be nonflammable.

3.1.14 Sealed Sources

Sources containing transuranic nuclides must be individually evaluated against the transuranic criteria (section 3.1.1), considering only the mass of the source and any component integral to the source.

Sealed sources that have an activity of less than 3.7 MBq (100μCi) can be a component of waste streams such as contaminated trash. The total volume of the waste can be used for waste classification and for determination of the radionuclide concentration. Characterization of non-transuranic sources on an individual source basis is not required provided the characterization method used is adequate to ensure compliance with the radionuclide reporting criteria.

Sealed sources that have an activity of 3.7 MBq (100μCi) or greater shall be segregated from other waste and profiled as a separate waste stream. These sealed sources shall be characterized on an individual basis using the volume or mass of the source to determine the activity.
the radionuclide concentration. Sealed sources may be co-packaged with other waste streams provided Section 3.0, Waste Acceptance Criteria are met. See Appendix E for more information on the encapsulation of sealed sources.

3.1.15 Low-Level Waste Containing Asbestos

Asbestiform Low-Level Waste (ALLW) is defined as any LLW containing friable asbestos material, Category I nonfriable asbestos containing material (ACM) that has become friable, Category I nonfriable ACM that will be or has been subjected to sanding, grinding, cutting, or abrading, or Category II nonfriable ACM that has a high probability of becoming or has become crumbled, pulverized, or reduced to powder. ALLW must be packaged, marked, and labeled in accordance with the requirements of Title 40 CFR, state of Nevada, state of generation, and the NTS Management Plan for the Disposal of Low-Level Waste with Regulated Asbestos Waste, dated August 1996 or subsequent revisions. Packages containing ALLW must meet the applicable shipping requirements for the radioactive contents of the package. ALLW must be wetted with a water and surfactant mixture and packaged in a plastic bag which is not less than 6 mils in thickness, a combination of plastic bags which equal at least 6 mils in thickness, or a container which is lined with plastic.

If free liquid is present, sorbent must be added to ensure compliance with the free-liquids criteria. Sharp edges and corners in the package must be padded or protected to prevent damage to the plastic bag during handling, shipping, and disposal.

Each container used to dispose of ALLW must bear a label that contains one of the following statements:

(1) CAUTION CONTAINS ASBESTOS FIBERS AVOID OPENING OR BREAKING CONTAINER BREATHING ASBESTOS IS HAZARDOUS TO YOUR HEALTH

(2) CAUTION CONTAINS ASBESTOS FIBERS AVOID CREATING DUST MAY CAUSE SERIOUS BODILY HARM

(3) DANGER CONTAINS ASBESTOS FIBERS AVOID CREATING DUST CANCER AND LUNG DISEASE HAZARD

ALLW must be segregated into a separate waste stream. Due to state notification requirements and disposal cell capacity, ALLW must be packaged separately from other waste streams. Call DOE/NV WMD at (702) 295-3181 for assistance and a copy of the current NTS Management Plan for the Disposal of Low-Level Waste with Regulated Asbestos Waste which includes specific requirements for pre-shipment notifications.
3.1.16 Radioactive Animal Carcasses

Animal carcasses containing, or contained in, radioactive materials shall be packaged with the biological material layered with lime and placed in a metal container meeting applicable requirements. If the resultant waste matrix is capable of gas generation, the container shall be vented with a carbon composite High-Efficiency Particulate Air (HEPA)-rated filtration device. DOE/NV may require analysis of the waste decomposition gases. Animal carcasses preserved with formaldehyde shall not be accepted for disposal.

Waste Package Criteria

Waste packages must meet applicable DOE Orders, 10CFR, 40 CFR, and 49 CFR requirements such as: design, nuclear safety, radiation levels, external contamination, activity limits, nuclear heating, and multiple hazards. Waste packages must be capable of withstanding the stresses associated with the loading, handling, stacking, and shipping of the package. DOE/NV has adopted the following waste package criteria to assure that the NTS RWMSs are operated safely and efficiently.

3.2.1 Nuclear Criticality Safety

3.2.1.1 The quantity of fissionable (fissile) material in a waste package shall be limited so that an infinite array of such packages will remain subcritical. This quantity shall be determined on the basis of a specific Criticality Safety Evaluation (CSE). A CSE shall be performed for the following wastes:

3.2.1.1.1 Waste packages containing greater than 15 g of uranium with a 235U enrichment equal to or greater than 0.90% by weight (Wt%). Any level of enriched uranium present in the waste must be identified and reported on the waste profile in Section E.

3.2.1.1.2 Waste shipments with natural or depleted uranium exceeding 36,000 Kg.

3.2.1.1.3 Waste packages containing fissionable nuclides, other than enriched uranium nuclides, will be assessed on a case-by-case basis. Fissionable nuclides are listed in DOE Order 420.1, "Facility Safety," Table 4.3-1.

3.2.1.2 The CSE shall be performed in accordance with DOE Order 420.1, "Facility Safety" and applicable ANSI/ANS standards. DOE Standard STD-3007-93, Change Notice 1, "Guidelines for Preparing CSEs at Department of Energy Non-Reactor Nuclear Facilities," September 1998, is recommended as guidance for developing CSEs.
3.2.1.3 The CSE shall consider the actual materials in the waste and the accident condition where the waste would be flooded with water. An array of 7 packages by 7 packages by 7 packages may be assumed to approximate an infinite array.

The infinite array of waste packages must remain subcritical given the following conditions for water leaking into the waste container:

3.2.1.3.1 maximum reactivity of the fissionable material present is attained,

3.2.1.3.2 the most reactive credible configuration consistent with the chemical and physical form of the material (e.g., lumped source, cylindrical, sphere, dispersed, etc.),

3.2.1.3.3 moderation by water to the most reactive credible extent, and

3.2.1.3.4 full reflection of the waste by water.

3.2.2 Closure

The package closure must be sturdy enough that it will not be breached under normal handling conditions.

3.2.3 Strength

The disposal package (packaging and contents) must be capable of supporting a uniformly distributed load of 16,477 kg/m² (3,375 lbs/ft²). This is required to support other waste packages and earth cover without crushing during stacking and covering operations. Actual physical testing or design engineering calculations can be used to demonstrate this requirement. This section does not apply to bulk waste, waste packaged in steel drums, or SEALAND® containers.

3.2.4 Handling

Waste packages must be provided with cleats, offsets, rings, handles, permanently attached or removable skids, other auxiliary lifting devices to allow handling by means of forklifts, cranes, or similar handling equipment. Removable skids are preferred to assist in meeting NTS PA objectives for reducing disposal cell subsidence. Lifting rings and other auxiliary lifting devices on the package are permissible, provided they are recessed, offset, or hinged in a manner that does not inhibit stacking the packages. The lifting devices must be designed to a 5:1 safety factor based on the ultimate strength of the material. All rigging devices that are not permanently attached to the waste package must have a current load test based on 125 percent of the safe working load.

Handling procedures and ALARA documentation must be referenced on the WP for wastes requiring remote handling. The disposal site may request this documentation. Packages exceeding 200 mR/hr dose rate on contact are usually considered for remote handling.
3.2.5 Size

1.2 × 1.2 × 2.1-m (4 × 4 × 7-ft) or 1.2 × 0.6 × 2.1-m (4 × 2 × 7-ft) boxes (width × height × length, plus or minus 1/2 inch) or 208-liter (55-gallon) drums should be used. These sizes allow optimum stacking efficiency in disposal cells. Alternate packages (i.e., supersacks, burrito wraps) will be considered; however, RWMS operations personnel need to be consulted to ensure equipment compatibility.

Bulk waste generally exists in a form not suited to the conventional packaging requirements. Bulk LLW must meet the requirements of Title 49 CFR. Large items of bulk waste, such as machinery, may be considered for disposal unpackaged. For the transfer of unpackaged bulk material having external contamination, the contamination must be fixed, covered, or contained sufficiently for safe transfer.

Bulk waste shipping containers may be returned to the generator after decontamination. Decontamination and return of bulk waste shipping containers will incur additional operational costs for the generator.

3.2.6 Weight

In addition to the weight limits for specific packaging designs, packages shall not exceed 4,082 kg (9,000 pounds) per box and 544 kg (1,200 pounds) per drum. This weight limit does not apply to bulk waste.

3.2.7 Loading (Void Space)

Waste packages must be loaded to ensure that the interior volume is as efficiently and compactly loaded as practical to minimize void space. More than one waste stream may be packaged in a disposal container (see Appendix C and D). High-density loading will allow efficient RWMS space utilization and provide a more stable waste form that will reduce subsidence and enhance the long-term performance of the disposal site.

3.2.8 Package Protection

The following precautions ensure the integrity of the waste characterization and the certification processes.

Methods must be employed to ensure that the integrity of the in-process waste package is not compromised (i.e., prohibited items are not introduced into the waste package).

Once the waste package certification activities have been completed and the packages have been sealed, the packages must be stored in a secure, protected area to prevent deterioration and unauthorized intrusion. Tamper indicating devices, clips, or banding can be used to indicate that the package has not been opened.

3.2.9 Marking and Labeling

Each waste package must be marked and labeled according to Appendix C.

3.2.10 Bar Coding

The shipment and package numbers must be bar coded according to the standards in Appendix C.
3.3 Mixed Waste

MW offered for disposal must meet the applicable requirements of the NTSWAC, Title 40 CFR, state of Nevada, state of generation, package criteria and disposal site permit requirements for identification, treatment, and disposal.1.2.3.4.5.6

3.3.1 Mixed Waste Generated Within the State of Nevada

3.3.1.1 Free Liquids

MW must contain no free liquids.3.11 Any sorbents used in the waste must be non-biodegradable.3.17

3.3.1.2 Treatment

MW accepted for disposal at the Mixed Waste Management Unit must meet applicable Title 40 CFR, “Land Disposal Restrictions.”3.14

3.3.1.3 Incompatible Wastes

Incompatible MW must be packaged in accordance with Title 40 CFR, “Special Requirements for Incompatible Wastes.”1.12

3.3.1.4 Marking and Labeling

MW packages of 416 liters (110 gallons) or less must be marked in accordance with Title 40 CFR.3.19 Marking and labeling of the waste packages must be for the hazardous and radioactive waste.3.37.38.39.44 Limited quantity MW must be classified according to the requirements for hazardous components as defined by Title 49 CFR.4.50.49

3.3.1.5 Containers

The requirements of Title 40 CFR, “Use and Management of Containers,” must be met.3.10

3.3.2 Mixed Waste Generated Outside the State of Nevada

(Reserved for future use) Call DOE/NV Waste Management Division for information at (702) 295-3181.
WAC Deviations

Deviations from the NTSWAC that do not compromise the performance objectives for the disposal site or violate permit requirements may be accepted. The following information must be included with the WP: the NTSWAC requirement that cannot be met; the justification for not meeting the requirement; the duration of the deviation, if applicable; and the action plan to correct the deviation, if applicable.

Example:

Requirement: NTSWAC, Revision 0, Section 3.1.E, Gases, requires that expended gas cylinders have the valve mechanism removed.

Justification: The pressure container and manifold valves cannot be removed, but each waste item will be documented by procedure and signed verification that the container/manifold internal pressure has been emptied to less than 1.5 atmospheres at 20°C. This method allows for direct venting, depressurization of the container/vessel without the potential of radioactive tritium gas exposure, and is in keeping with mandated DOE ALARA principles and practices. Even when a tritium vessel is depressurized, there is a certain amount of residual tritium that remains in the vessel. If the valve stem is removed, the cylinder will continue to emit tritium to the atmosphere and possibly result in exposure to personnel. The generator seeks to avoid unnecessary or accidental venting of tritium to the atmosphere by allowing the valve stem to remain on the vessel. The waste packaging procedure provides details about the handling of these waste items. The WCO procedure details the internal pressure verification.

Duration: The duration of the deviation is the lifetime of the waste stream.

Corrective Action: There is no action required.

Shipping Arrangements

After a generator secures written approval from the DOE/NV AMEM to send waste to an NTS RWMS, the generator should contact Bechtel Nevada (BN) to arrange for transfer of the waste and accompanying records. BN will coordinate unclassified waste shipment transfers at NTS. Classified waste shipments will be coordinated by DOE/NV Safeguards and Security Division.

3.5.1 To expedite waste receipt and handling at NTS, waste generators shall, at a minimum comply with the following:

3.5.1.1 Prior to departure of a waste shipment to the NTS, the generator shall attach security seals to the shipping trailer's door latches or to each package if not enclosed in a trailer.
3.5.1.2 Before a waste shipment arrives at the NTS, the generator shall enter the following pre-notification information on the DOE/NV VAX traffic database. If the generator is unable to enter information on the DOE/NV VAX, pre-notification should be made by phone to BN. For classified/unclassified accountable or special nuclear material shipments, generators should also contact DOE/NV Safeguards and Security Division (phone: 702-295-0082). For all shipments, the following information must be provided:

- Time of departure from shipping point and estimated time of arrival (ETA) at NTS;
- Carrier, trailer, and security seal numbers;
- Description of load (number and type of pieces [e.g., boxes, drums, SEALAND®], volume and weight);
- Waste type (LLW, MW, TRU, or Transuranic Mixed Waste); and
- Any additional information (e.g., special handling requirements).

3.5.2 Consign unclassified waste shipments to:
Bechtel Nevada
For U.S. Department of Energy
Waste Management
Nevada Test Site-Zone 2
Mercury, NV 89023

Consign classified/unclassified accountable or special nuclear material waste shipments to:
U.S. Department of Energy
Attn: Security Specialist
DOE/NV Safeguards and Security Division
For Bechtel Nevada
Waste Management
Nevada Test Site-Zone 2
Mercury, NV 89023

Because unclassified and classified shipments are consigned differently, they should be shipped separately; i.e., on different trailers and have different shipment numbers and separate shipping papers. Under small volume conditions, combined shipments can be arranged. Contact BN and DOE/NV Safeguards and Security Division for guidance.

3.5.3 If the shipment's ETA should change, the generator shall enter the changes on the DOE/NV VAX traffic database at the earliest opportunity and provide the new ETA. Generators unable to update information on the DOE/NV VAX account shall notify BN by phone. For classified shipments, generators should contact DOE/NV Safeguards and Security Division.
3.5.4 The hours for receiving waste at the RWMS are from 0700 to 1530, Monday through Thursday, except holidays. If a shipment arrives after 1530, trailers (except classified loads) may be left at the parking area outside gate 100 of the NTS after conferring with the NTS Duty Officer. Shipments may be subject to off-loading delays at any time due to NTS operational schedules.

### Shipping Documentation

The following records are required:

3.6.1 When accountable quantities of nuclear materials are involved, a “Nuclear Material Transaction Report” (DOE/Nuclear Regulatory Commission [NRC] Form 741) shall be completed for transfers of nuclear material between facilities having differing Reporting Identification Symbols and received by the DOE/NV Safeguards and Security Division and RWMS prior to shipment arrival. For additional information, call Safeguards and Security at (702) 295-0082 and RWMS at (702) 295-6811. The shipment may be refused if a Form 741 is not on file.

3.6.2 For materials regulated by DOT, completed shipping papers with shippers certification, as required by Title 49 CFR, must accompany each shipment.

A “Uniform Hazardous Waste Manifest” or equivalent state-of-generation manifest, accompanied by the appropriate documentation, shall be used when shipping MW. For onsite shipments of MW an onsite Waste Manifest may be used.

3.6.3 The original completed and signed PSDR or the original of an equivalent, shall accompany each shipment. An electronic version of the PSDR shall be transferred to BN prior to shipment arrival (internet address: wmdata). If the PSDR is considered “classified,” DOE/NV Safeguards and Security Division ([702] 295-0082) must receive the PSDR prior to arrival of waste. Classified shipments will not be accepted if a PSDR is not on file.

3.6.4 An appropriate Waste Certification Statement shall be signed by the WCO (see below).
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4.0

Waste Characterization
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Waste Characterization

Generators must characterize waste destined for disposal at NTS. When similar requirements are listed in separate regulations, the most stringent shall be met. Waste is considered MW until the generator, through chemical analysis, process knowledge (PK), or a combination of both, demonstrates the LLW or TRU waste contains no hazardous waste as identified in 40 CFR, state-of-generation, and state of Nevada hazardous waste regulations (Nevada Administrative Code [NAC] 444) and that the waste meets the WAC. For waste characterized as MW, generators must demonstrate that the MW meets the applicable 40 CFR Land Disposal Restrictions (LDR) and WAC. 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. Characterization methods should undergo a peer review by personnel with appropriate expertise.

Waste shall be characterized prior to waste profile submittal. Generators must prepare and submit a Waste Profile (WP) for each waste stream (see Appendix B) which provides DOE/NV with a summary of waste characterization information. Generators shall provide waste characterization documentation that supports the WP (see Appendix E for radiological requirements) to DOE/NV for review during facility evaluations or upon DOE/NV request. Waste characterization documentation shall be traceable to the WP and disposal packages. Isotopic distributions and corresponding activity concentrations shall be traceable to the package. Traceability to a parcel level shall be required if characterization is being conducted at that level (e.g., individual sealed sources, bags, or components characterized on an individual basis but packaged together).

Waste characterization may be conducted using process knowledge (PK), sampling and analysis, or a combination of both. The following sections provide specific information and requirements for these characterization methods.

Process Knowledge

Process Knowledge (PK) is a characterization technique that relies on the generator’s knowledge of the physical, chemical, and radiological properties of the materials associated with the waste generation process(es), the fate of those materials during and subsequent to the process, and associated administrative controls.

PK sources include historic records, historic analytical data, system descriptions, plans and drawings, manufacturing specifications, mass balance documentation, literature searches, living memory, and procedures.

When PK consists of historic analytical data, generators must document the data limitations. Historical data should be routinely verified through controlled analytical methods such as verification sampling and analysis; however, if the data can successfully undergo a full validation, this verification may not be necessary.
When PK relies on living memory, the individual’s knowledge must be documented and signed by both the interviewer and the interviewee. For telephone interviews, a statement outlining relevant information must be signed by the interviewer (and interviewee if possible).

PK can be used for waste characterization in lieu of sampling and analysis if the generator’s PK is of sufficient detail to qualify as acceptable. Acceptable PK is PK that is based on detailed information on the waste obtained from existing waste analysis data, studies on similar waste generating process(es), or detailed information relative to the properties of the waste that are known due to site-specific and/or process-specific factors.

Generators should conduct a documented evaluation of compiled PK against criteria. The generator should identify the following items in the evaluation: uncertainties, consistencies, limitations, and usefulness.

### 4.2 Sampling and Analysis

Generators shall obtain legally and scientifically defensible data that can be used to identify the physical, chemical, and radiological properties of the waste. When waste streams are characterized by sampling and analysis, the process shall be controlled and documented. Propagation of error throughout the sampling and analytical process shall be evaluated and considered when ascertaining usability of data for characterization of waste.

Sampling and Analysis Data Quality Objectives (DQOs) should meet Environmental Protection Agency (EPA) guidelines (see the seven-step process in EPA QA/G-4, “Guidance for the Data Quality Objectives Process,” September 1994). A supplementary document is available from RWAP upon request which contains sample laboratory audit plates and EPA-type forms.

Generators shall demonstrate that controls are in place to trace each sample number to a specific package number. All sampling and analysis efforts, including verification and confirmatory sampling, should include screening analyses such as gamma spectroscopy, gross beta, and gross alpha.

DOE/NV may evaluate sampling and analysis documentation to ensure that 1) samples will be representative of the waste inventory, 2) appropriate analytical procedures are used, and 3) sufficient quality controls have been established to allow measurement and documentation of data quality.

#### 4.2.1 Data Validation

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 DQO process and depend upon the type(s) of data involved and the purpose for which the data are collected. Data should be validated by technically qualified personnel who are independent of those performing the analyses.
A portion of all data, historical or current, should be validated prior to use of the data for characterization purposes. Validation reports should cite the guidelines or procedures used to validate the data.

The complete validation report should be available to DOE/NV, if requested. Validation reports should include:

4.2.1.1 Review and evaluation of the adequacy of the analytical methods used (taking into consideration expected contaminants, nuclide inventory, expected activity, decay mode, radiation energy, and any other relevant parameters).

4.2.1.2 An evaluation as to whether the requirements of the Scope/Statement of Work (SOW) have been met (i.e., required detection limits, 90 percent confidence, acceptable error, standards for precision and accuracy).

4.2.1.3 A data confidence statement and a determination of useability including an evaluation as to whether the DQOs have been met. DQOs and the other criteria are generally presented in the SOW, applicable procedures, and/or the SAP.
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5.0

Quality Assurance Requirements for Waste Certification Program
Generators shall develop, implement, and maintain a Waste Certification Program Plan (WCPP) to fulfill the requirements of DOE Order 5820.2A, "Radioactive Waste Management;" and 10 CFR Part 830.120, "Quality Assurance." American National Standards Institute/American Society of Mechanical Engineers (ANSI/ASME) NQA-1, "Quality Assurance Program Requirements for Nuclear Facilities," was selected to identify the NTSWAC quality assurance elements. A generator waste certification program may be based on a site-wide quality assurance program. However, a cross-walk of the implementing procedures to the NTSWAC criteria must be provided and the WCO functions delineated in the criteria below addressed.

Organization

An organizational chart specific to the waste management organization shall be developed. It should depict the general management structure, functional responsibilities, levels of authority, and lines of communication as it affects waste management and certification organizations activities. A description of the responsibilities and activities of each organizational unit depicted should be provided. The chart should reflect organizations that generate, characterize, package, ship, and inspect; conduct audits and surveillances; and perform support functions (i.e., procurement, document control, RCRA oversight, and training). The chart shall indicate the independence of the WCO through direct access to a management level demonstrating sufficient authority and organizational freedom.

Each generator shall designate a WCO and an alternate(s) as applicable, who will be responsible for verifying implementation of the WCPP. The WCO shall ensure that waste packages, data, and waste shipments comply with the requirements of the NTSWAC. The alternate WCO shall report to the primary WCO for certification activities.

Each generator may designate Package Certifiers responsible for signing the Package Certification Label (PCL). Package Certifiers shall report to the WCO for certification activities.

The WCO(s) and Package Certifier(s) shall be independent of those who have direct responsibility for performing waste generation activities.

QA Program

The generator shall establish and maintain a WCPP describing the quality affecting activities important to the waste certification process. The WCPP may reference higher-tier documents (e.g., sitewide QA program). The WCPP shall identify the activities and items to which it applies and provide control over activities to an extent consistent with their importance. The WCPP should contain or reference procedures used to certify the waste.

The WCPP shall provide for the planning and accomplishment of waste certification activities under suitably controlled conditions. Controlled conditions include the use of appropriate equipment, suitable environmental conditions for accomplishing the activity, and assurance that
prerequisites for the given activity have been satisfied. The WCPP shall provide for any special controls, processes, test equipment, tools, and skills to attain waste certification and for verification of quality.

The WCPP shall provide for indoctrination and training, as necessary, of personnel performing activities affecting waste certification to ensure that suitable proficiency is achieved and maintained.

Management of those organizations implementing the WCPP, or portions thereof, should regularly assess the adequacy of that part of the WCPP for which they are responsible and ensure its effective implementation.

5.3 Design Control

Items, facilities, or processes to be designed and constructed to satisfy or confirm that wastes meet certification requirements, shall be defined, controlled and verified. Waste treatment processes require specific controls to verify design parameters related to volume, proper mixture, hydration, sizing of equipment for proper throughput, and product specification. Design of process or laboratory facilities may require consideration of safety standards for nuclear facilities, or a permit for MW treatment and storage.

Applicable design inputs shall be specified and translated into design documents. Design inputs, such as design bases, performance requirements, regulatory requirements, codes, and standards, shall be identified and documented, and their selection reviewed and approved by a responsible design organization.

Design interfaces shall be identified and controlled. The responsible design organization shall prescribe and document the design activities to the level necessary to permit the design process to be implemented and verified. Design analyses shall be performed in a planned, controlled, and documented manner.

Design adequacy shall be verified by any competent person(s) other than those who designed the item. This verification may be performed by the originator’s supervisor, provided the supervisor does not specify a singular design approach or rule out certain design considerations and did not establish the design inputs used in the design. However, design adequacy verification may be performed by the originator’s supervisor provided the supervisor is the only individual in the organization competent to perform the verification. The extent of design verification required is a function of the importance to safety, the complexity of the design, the degree of standardization, the state of the art, and the similarity with previously proven designs.

Generators shall document their review of the product or process design when the design is performed by others (e.g., containers designed by a vendor).

Design changes shall be governed by control measures commensurate with those applied to the original design.
Procurement Document Control

Items and services critical to the waste certification program shall be procured under a controlled and documented system. Technical requirements shall be specified in the procurement documents. The procurement documents shall specify and/or reference (as applicable) drawings, specifications, codes, standards, regulations, procedures, or instructions that describe the items or services to be furnished. The procurement documents should include a statement that provides access to the Supplier's facilities and records for inspection or audit by the purchaser. The procurement documents shall specify any tests, inspections, and acceptance requirements of the purchaser. The procurement documents shall require that the Supplier have a documented quality assurance program consistent with the applicable requirements of the item or service to be procured.

The procurement documents shall identify the documentation required to be submitted for information, review and approval (i.e., certificates of conformance/compliance, radiological assay results, analytical results, inspection or test results, and supplier nonconformance disposition "use as is" or "repair").

Procurement documents shall be reviewed to ensure they contain appropriate technical and quality requirements. These reviews shall be recorded on the procurement documents or on documents traceable to the procurement documents. The procurement document review should be conducted by personnel who have access to pertinent information and who have understanding of the requirements and intent of the procurement documents. Procurement document changes shall require the same degree of review and approval as the original.

Instructions, Procedures, Drawings

Activities affecting the quality of the waste certification program shall be prescribed by and performed in accordance with instructions, procedures, or drawings. These documents shall include or reference appropriate quantitative or qualitative acceptance criteria for determining that prescribed activities have been satisfactorily accomplished.

Document Control

A document control system shall be established to control waste certification documents (e.g., the WP(s), WCPP, and procedures). The document control system shall include the following as a minimum:

5.6.1 Identification of documents (including forms) important to waste certification activities to be controlled and their specified distribution.

5.6.2 Assignment of responsibility for preparing, reviewing, approving, and issuing documents.

5.6.3 Review of documents for adequacy, completeness, and correctness prior to approval and issuance.
5.6.4 A method to control document changes/revisions which includes the same review and approvals as the original documents.

5.6.5 Identification of the organizations responsible for the control and distribution of documents to ensure current versions are available in the workplace.

### 5.7 Control of Purchased Items and Services

The procurement of items and services important to the waste certification program shall be controlled to ensure conformance with specified requirements (e.g., Type A containers, analytical or assay services, and calibration services). The selection of Suppliers shall be based on evaluation of their capability to provide items or services in accordance with the requirements of the procurement documents. These evaluations shall provide evidence of quality furnished by the Supplier. Based upon the complexity of the item or service, this may be accomplished through receipt inspections, source inspections, audits or surveillances as appropriate. As a minimum, Supplier audits or surveys shall be conducted on a triennial basis; however, annual reviews of supplier performance shall be conducted to ensure conformance to specified requirements is maintained. When third party (e.g., Supplier Quality Information Group) audits are used, the generator shall perform a documented review of the audit and the lead auditor’s qualifications. This review should be conducted by a certified lead auditor.

The extent of verification activities, including planning, should be a function of the relative importance, complexity, and quantity of the item or services procured and the Supplier’s quality performance. Verification activities shall be accomplished by qualified personnel assigned to check, inspect, or audit the activities of Suppliers.

### 5.8 Identification and Control of Items

Controls shall be established to ensure the traceability of waste from the point of generation through shipment is maintained. Waste characterization documentation shall be traceable to the exact package in which the waste was placed.

Controls shall be established to ensure that only correct and accepted items (e.g., waste containers and liners, cement, solidifiers) are used in the waste certification process.

Identification shall be maintained on items or documents traceable to the items. Identification markings shall be applied using materials and methods which provide a clear and legible identification and do not detrimentally affect the function or acceptability of the item.

Physical identification should be used to the maximum extent possible. Where physical identification on the item is either impractical or insufficient, physical separation, procedural control, or other appropriate means should be employed to maintain traceability.
Control of Processes

Work shall be planned, authorized, and accomplished under controlled conditions using technical standards, instructions, procedures, or other appropriate means of a detail commensurate with the complexity and risk of the work.\(^8_{67,96}\)

Qualification of personnel, procedures, and equipment shall comply with specified requirements.\(^8_{96}\)

Processes important to waste certification activities (e.g., characterization, RTR, radiological surveys, and waste treatment) shall have controls or verification steps identified as part of operating procedures.\(^8_{96}\)

Inspection

Inspections required to verify conformance of an item or activity to specified requirements shall be planned and executed.\(^8_{10}\) Responsibilities for performing inspections, characteristics to be inspected, inspection methods to be employed, acceptance criteria, and documentation requirements shall be specified.\(^8_{10}\)

Inspection activities shall be documented and controlled by instructions, procedures, drawings, specifications, procurement documents, checklists, travelers, or other appropriate means.\(^8_{10a}\)

Inspections shall be conducted by qualified personnel having no responsibility for performing or supervising the work being inspected.\(^8_{10}\)

Where a sample is used to verify acceptability of a group of items, the sampling procedure shall be based on recognized standard practices.\(^8_{10b}\)

Receipt inspections shall be conducted to verify conformance to procurement documents and design criteria (e.g., dimensions, configuration, materials, welding, required documentation).\(^8_{10c}\)

In-process inspections shall be conducted to ensure that specified process control requirements and/or WAC are achieved and maintained throughout the waste certification process.\(^8_{10d}\)

Final inspections shall be conducted to verify the quality and conformance of items or waste to specified requirements.\(^8_{10d}\) Final inspections shall include a review of the records, results, and resolution of nonconformances identified by prior inspections.\(^8_{10d}\)

Any modifications, repairs, replacements, or repackaging of waste performed subsequent to final inspection shall require reinspection to verify acceptability.\(^8_{10e}\)

Records of inspection shall identify the item inspected, date of inspection, inspector, type of inspection, and inspection results, and reference to information on action taken in connection with nonconformances.\(^8_{10f}\)

May 1999

Quality Assurance Requirements for Waste Certification Program
5.11 Test Control

Tests required to verify conformance of an item or computer system (hardware and software) to specified requirements and to demonstrate satisfactory performance for service shall be planned and executed. Characteristics to be tested and test methods to be employed shall be specified. Test results shall be reviewed and their conformance with acceptance criteria evaluated and documented.

Unless otherwise designated, test requirements and acceptance criteria shall be provided or approved by the organization responsible for the design of the item to be tested (e.g., waste process; computer system). Test requirements and acceptance criteria shall be based upon specified requirements contained in applicable design or other pertinent technical documents.

Computer systems shall undergo data testing to verify the ability to obtain valid results. Data testing shall be initiated upon installation and after significant modification of a computer system.

Test procedures shall include or reference test objectives and provisions for ensuring that pre-requisites for the given test have been met. In lieu of specially prepared written test procedures, appropriate sections of related documents, such as ASTM methods, Supplier manuals, equipment maintenance instructions, or approved drawings or travelers with acceptance criteria can be used. If used, such documents shall include instructions to ensure the validity of the results.

Test results shall be documented and evaluated by a responsible authority to ensure that test requirements have been satisfied. Test records shall, as a minimum, be documented to identify the item tested, equipment used for the test, date of the test, test parameters, action taken in connection with any deviations noted, and the names of the individuals who conducted the test and evaluated the test results.

5.12 Control of Measuring and Test Equipment

Tools, gages, instruments, calibration standards, and other measuring and test equipment shall be controlled, calibrated, adjusted, and maintained at prescribed intervals or, prior to use, against certified equipment having known valid relationships to nationally recognized standards (e.g., National Institute of Standards and Technology). If no nationally recognized standards exist, the bases for calibration shall be documented.

The selection of measuring and test equipment shall be controlled to ensure that such items are of the proper type, range, accuracy, and tolerance to accomplish the function of determining conformance to specified requirements.

The methods and intervals of calibration for each item shall be defined based on the type of equipment stability characteristics, required accuracy, intended use, and other conditions affecting measurement control.

Measurement and test equipment shall be calibrated, utilized, and maintained in an environment controlled to the extent necessary to ensure continued accuracy. Temperature, humidity, vibration, cleanliness, and other controlled factors should be considered.
When measuring and test equipment is found to be out of tolerance or calibration, an evaluation shall be made and documented of the validity of previous inspection or test results and of the acceptability of items previously inspected or tested. Out-of-calibration devices shall be tagged or segregated and not used until they have been recalibrated.

Records shall be maintained and equipment suitably marked to indicate calibration status. Records of calibration should provide a description or identification of the item, calibration interval, date calibrated, calibration procedure, identification of the calibration standards, identification of the individual performing the calibration, calibration results, and any corrective actions taken. Equipment marking shall include, as a minimum, the date of calibration, the calibration due date, and any limitations.

Users of measuring and test equipment should conduct and document operational readiness checks of equipment under their purview.

**Handling, Storage, and Shipping**

Handling, storage, packaging, shipping, and preservation of items shall be controlled to prevent deterioration or damage for the life-cycle of the item until disposal.

**Inspection, Test, and Operational Status**

The status of inspection and test activities shall be identified and placed on the items, and/or in the waste certification documents traceable to the items to ensure those items that have not passed inspections and tests are not inadvertently shipped. Status shall be maintained through indicators, such as segregation, tags, checklists, calibration indicators, PCL labels, markings, inspection travelers, stamps, inspection records, or other suitable means. The authority for applying and removing status indicators shall be specified.

**Control of Nonconforming Items**

Controls for nonconforming items shall provide for identification, documentation, evaluation, segregation when practical, disposition and notification to the affected organizations including the WCO. Provisions should be established to ensure that anyone associated with waste operations and certification activities can identify nonconformances. Nonconformances shall be conspicuously labeled, tagged, color coded, or otherwise marked to ensure their removal from the waste certification process and to prevent their inadvertent use. The responsibility and authority for the evaluation and disposition of nonconforming items shall be defined. When nonconforming conditions are identified that effect the quality of previously shipped waste, DOE/NV must be notified. Nonconforming characteristics shall be reviewed and the recommended disposition approved in accordance with documented procedures. The disposition “use-as-is” or “repair” shall include technical justification.
5.16 Corrective Actions

A process **shall** be established for the identification and timely correction of conditions adverse to quality. The identification, root cause, corrective action, action to preclude recurrence, and an estimated completion date **shall** be documented. Appropriate levels of management **shall** be involved in the corrective action processes (identification, root cause, corrective action, action to prevent recurrence). Conditions adverse to quality **shall** be tracked until successful resolution can be demonstrated.

5.17 Quality Assurance Records

A Quality Assurance Record is a completed document that furnishes evidence of the quality of items, and/or activities affecting quality.

Records demonstrating compliance with waste certification criteria **shall** be specified, prepared, maintained, legible, identifiable, and retrievable. Requirements and responsibilities for record transmittal, distribution, retention, handling, corrections, control, maintenance, and disposition **shall** be established. The records system **shall** be defined, implemented, and enforced in accordance with written procedures, instructions, or other documentation.

The generator **shall** maintain records for time periods equivalent to on-site records retention requirements, but not less than five years (or for time periods designated by other regulatory authority[s]). Records **shall** be considered valid only if stamped, initialed, or signed and dated by authorized personnel. Records should be indexed using a system which includes, as a minimum, record retention times and the location of the record within the record system. Mistakes or changes in records should have a single line drawn through the changed data and be initialed and dated. Correction fluids or tapes should not be used.

Records related to waste certification **shall** be stored in a single location properly secured and protected from damage, or maintained in dual storage that provides for replacement of lost or damaged records. The generator **shall** control access to the record files.

Records important to waste certification may include, but are not limited to, training; calibration; inspection; audit records; nonconformance reports with completed corrective actions; test records; laboratory reports; waste profile; shipping documents; and waste certification statements.
Audits/Surveillances

Quality assurance audits **shall** be scheduled in a manner to provide coverage and coordination with ongoing quality assurance/certification activity. Audits **shall** be scheduled at a frequency commensurate with the status and importance of the activity. Planned and scheduled audits should be conducted on an annual basis to ensure compliance with the requirements of the NTSWAC and the waste certification program.

Audit team members **shall** be independent of the audited activities. The audit team leader **shall** be certified in accordance with a program meeting the requirements of NQA-1, Supplement 2S-3.

According to Basic Requirement 5.4, generators may contract an outside agency to conduct their audits. When the services of an outside agency are utilized, the generator is responsible for ensuring compliance with Basic Requirement 5.18.

The auditing organization **shall** develop an audit plan for each audit. This plan **shall** identify the audit scope, requirements, audit personnel, activities to be audited, organizations to be audited, applicable documents, schedule, and written procedures or checklists.

Audits **shall** be documented, reported to, and reviewed by responsible management, including the WCO.

Surveillances should be scheduled and performed on waste activities. Unscheduled surveillances should also be conducted to augment the scheduled surveillances when scheduled dates are not met due to a lack of activity, to verify effectiveness of corrective actions resulting from a nonconformance, CAR, and/or audit/surveillance findings.

Personnel performing a surveillance should be qualified and be an individual other than those who performed or directly supervised the work.

The following criteria should be reviewed when conducting surveillances: qualification of personnel performing the activity, verification of procedural compliance, calibration of instruments used, and the proper completion of records generated as a result of the activity being performed.
<table>
<thead>
<tr>
<th>NTSWAC</th>
<th>DOE Order 5700.6C</th>
<th>10 CFR Part 830.120</th>
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<tr>
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</table>
6.0

Waste Transportation and Receipt Information
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Waste Transportation and Receipt Information

This section provides general guidelines that generators should follow to expedite waste transportation and receipt. This section is "FOR INFORMATION ONLY" and will not be evaluated during facility evaluations.

It is requested the DOE/NV AMEM be notified when 1) the motor carrier(s) is being evaluated; 2) the motor carrier route selection is being reviewed; 3) a motor carrier discrepancy, noncompliance, or inadequate performance has been identified; or 4) there is a transportation incident or emergency situation. This notification will keep DOE/NV personnel informed of generator transportation plans, activities, and issues. DOE/NV personnel will be able to use the information provided to inform stakeholders of transportation activities of radioactive low-level waste destined for the NTS. DOE/NV personnel may request to participate in the review of transportation-related information.

Waste Transportation

Classified and unclassified waste shipments consigned to BN or to DOE/NV Safeguards and Security Division will be made in accordance with applicable DOE, DOT, EPA, state, and local hazardous waste regulations and requirements.

Generators are responsible for the evaluation of the motor carriers used for transporting radioactive waste. Motor carrier documentation (i.e., past carrier performance, prior evaluations, accident history, vehicle maintenance, etc.) should be reviewed to ensure the carrier is in compliance with 49 CFR, state, and local transportation requirements.

If carrier performance has been determined to violate federal, state or local transportation safety regulations, a demonstration of corrective action may be required. Failure to initiate corrective action may result in waste refusal at the NTS.

Generators should review route selection with the carriers. Routes selected are required to minimize radiological risk. Information on accident rates, time in transit, population density, construction activities, and time of day should be considered when determining radiological risk. DOE/NV may provide driver advisories to inform generators of local driving conditions (i.e., road construction, detours, safety issues). The generators will be responsible for notifying carriers of changes to the routes.

Waste Receipt and Records

BN will be responsible for inspecting radioactive waste shipments upon arrival and maintaining shipment records for DOE/NV.
Funding and Forecasting

For information regarding funding and forecasting requirements, contact DOE/NV WMD at (702) 295-3181.

Disposition of Noncompliant Conditions

NTS RWMS personnel are responsible for identifying and documenting non-compliance issues (i.e., physical or documentation errors) discovered when conducting low level waste receipt and disposal activities. Radioactive waste shipments received at the NTS that are not in compliance with requirements may be returned to the generator facility or require resolution from the generator.

DOE/NV shall be notified of waste shipment noncompliance issues. Appropriate action will be initiated based upon the level of the non-compliance and the established program requirements. Generators may be charged for costs incurred for noncompliant waste shipments.

Waste Refusal

BN personnel will be responsible for notifying the appropriate DOE/NV personnel regarding any refused radioactive waste shipments. Reasons for waste shipment refusal include but are not limited to:

6.5.1 Failure to have sufficient funding transferred to BN to cover the cost of handling disposal, or storage.

6.5.2 Failure to have DOE/NRC Form 741 on file at the NTS prior to the shipments' arrival.

6.5.3 Failure to have a signed certification statement accompanying the shipment.
Appendix A

Waste Generator Approval Process Flow Diagram
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The following diagram identifies key process steps. Operations and logistics may influence the order in which these activities are conducted. A Site Visit (Section 2.6) may be requested by the generator at any time during the process.

**Legend**

- DOE/NV - Department of Energy, Nevada Operations
- CAP - Corrective Action Plan
- CAR - Corrective Action Request
- RWAP - Radioactive Waste Management Plan
- NTSEC - Nevada Test Site Waste Acceptance Criteria
- WCPP - Waste Certification Program Plan
- WARP - Waste Acceptance Review Panel
- WP - Waste Profile
Section 2.2.2 Waste Profile

Generator Submits New WP to DOE/NV

Is WP Complete?

Yes

WARP Reviews WP

No

Generator Provides Additional Information

Recommend Conducting Surveillance of New WP

Request Additional Information From Generator

Recommend Approval of WP

Section 2.2.3 Document and Personnel Changes

Generator Submits a Program Change to DOE/NV

Suspend Approval

Acknowledge Change

No Response Necessary

RWAP Reviews Change

Generator Submits Additional Information

Recommend Conducting Surveillance of Program Change

Recommend Approval of Change

Contact Generator for Additional Information

Legend

(see) - Corresponding section of NTSWAC
DOE/NV - Department of Energy, Nevada Operations
CAP - Corrective Action Plan
CAR - Corrective Action Request
RWAP - Radioactive Waste Management Plan
NTSWAC - Nevada Test Site Waste Acceptance Criteria
WCPP - Waste Certification Program Plan
WARP - Waste Acceptance Review Panel
WP - Waste Profile

May 1999

Waste Generator Approval Process Flow Diagram
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Appendix B

Nevada Test Site Waste Profile
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# Nevada Test Site Waste Profile, Revision 2, 01/99

## A. Generator Information
1. WCO Phone Fax
2. Technical Contact Phone Fax
3. DOE Contact Phone Fax
4. Facility Name Address Phone Fax
5. EPA Identification Number

## B. General Waste Stream Information
1. Waste Stream Identification Number
   - Profile Revision Number
   - Profile Revision Date
2. Title of Waste Stream
3. Waste Category
   - Low-Level
   - Mixed Low-Level (Generated within Nevada only)
4. Generating Process Description
   - Process Description Continuation Page Attached?
   - Flow Diagram Attached?
5. Estimated Rate of Generation
   - One Time Only
   - Ongoing
6. Reasons for Submittal (specify one)
   - New Waste Stream
   - Modification to Waste Stream
   - Date Change Effective
7. Does this waste stream require a WAC deviation?
   - Attach information.

## C. Physical Properties
1. Waste Form Description
   - Solid
   - Solidified
   - Encapsulated
   - Sludge
   - Powder/
     - Dust
   - Sealed
   - Absorbed
   - Other
   - Liquid

---

May 1999

Nevada Test Site Waste Profile
2. List Waste Stream Components

____________________
____________________
____________________
____________________
____________________

Estimated Percent by:
☐ Volume       ☐ Weight

☐ Yes       ☐ No Component Continuation Page Attached?

3. The final waste form must comply with the following criteria as defined in the WAC. List documentation that demonstrates WAC compliance for each.

Free Liquids
Particulates
Gases
Etiologic Agents
Chelating Agents
Polychlorinated Biphenyls
Explosives
Pyrophorics
Regulated Asbestos-Containing Material
Radioactive Animal Carcasses
DOE Waste Equivalent to Greater-Than-Class C
Other

D. RCRA Characterization

1. RCRA characterization by:
   Check all that apply.
   ☐ Process Knowledge
   ☐ Sampling and analysis for complete characterization
   ☐ Confirmatory Sampling and Analysis

   List documents that control RCRA determinations.

2. If sampling and analysis was used, attach Table 1 or an equivalent sample result summary that includes analytical results, upper confidence limits, and explanations of anomalies for all analytes analyzed.

3. ☐ Yes ☐ No Was the waste listed or characterically hazardous as generated?

   EPA Code(s):______________________________

May 1999
4. Does the final waste form exhibit any characteristic of hazardous waste as defined in 40 CFR 261?
   - Yes
   - No
   - Ignitability
   - Yes
   - No
   - Corrosivity
   - Yes
   - No
   - Reactivity
   - Yes
   - No
   - Toxicity

5. Yes
   - No
   Is the final waste form listed as defined in 40 CFR 261?
   - EPA Code(s):

6. Yes
   - No
   Is the waste hazardous per state-of-generation regulations?
   - If yes, identify hazardous components and state regulations.

7. Yes
   - No
   Has the waste been treated?
   - Attach information which verifies WAC compliance.

8. Yes
   - No
   Is the final waste form mixed waste?
   - If yes, attach information which verifies LDR compliance.

E. Radiological Properties

1. Radiological characterization by: (Check all that apply)
   - Yes
   - No
   - Process Knowledge
   - Yes
   - No
   - Sampling and Analysis
   - Yes
   - No
   - Materials Control and Accountability
   - Yes
   - No
   - Direct Measurement
   - Yes
   - No
   - Gross Radiation Measurement
   - Yes
   - No
   - Scaling Factors
   - Yes
   - No
   - Other

2. Reference documents that describe the radiological characterization process.

3. Reference documents that describe the method of determining package activity.

4. List reportable radionuclides as defined in the WAC.

<table>
<thead>
<tr>
<th>Radionuclide</th>
<th>Activity Range (Bq/m³)</th>
<th>Activity Representative of Final Waste Form (Bq/m³)</th>
</tr>
</thead>
<tbody>
<tr>
<td>--------------</td>
<td>------------------------</td>
<td>--------------------------------------------------</td>
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<td>--------------------------------------------------</td>
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<tr>
<td>--------------</td>
<td>------------------------</td>
<td>--------------------------------------------------</td>
</tr>
</tbody>
</table>

   - Yes
   - No
   Reportable Radionuclide Continuation Page Attached? 000070
5. □ Yes □ No  Attach list of chemical form of radionuclide, if known.  Page attached?

6. □ Yes □ No  Does the waste contain transuranic waste creating nuclides as defined in the WAC?  If yes, list below.

<table>
<thead>
<tr>
<th>Transuranic Nuclide</th>
<th>Activity Range (nCi/g)</th>
<th>Activity Representative of Final Waste Form (nCi/g)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

□ Yes □ No  Transuranic Nuclide Continuation Page Attached?

7. List documents that control TRU determinations.

    ________________________________________________________

    ________________________________________________________

8. □ Yes □ No  Is enriched uranium present?  If yes, provide enrichment of U-235 by weight percent ________%.  Provide maximum mass of U-235 per package ________ g/package.  Reference controlling documents.

    ________________________________________________________

F. Packaging Description

1. □ Yes □ No  Does the waste meet each of the package criteria as defined in the WAC?  List the documentation that demonstrates WAC compliance.

    ________________________________________________________

    ________________________________________________________

2. Container type(s) ________________________________

   DOT Specification(s)/Description(s) ________________________________

   □ Yes  □ No  □ N/A  Does box meet 3,375 lb/ft² strength test?

3. Standard container external dimensions ________________________________

   Packaged bulk external dimensions ________________________________

   Bulk Shipment dimensions __________________________________________

4. Weight Range ________ kg to ________ kg

5. □ Yes □ No  Waste stream includes unclassified material?
6. □ Yes □ No  Waste stream includes classified material? --8062

7. Estimated radiation dose rate of disposal package:
   Surface _______ to _______ mSv/h
   One meter _______ to _______ mSv/h.

8. Reference special handling procedures and ALARA documentation, if appropriate.

   _______________________________________________________
   _______________________________________________________
   _______________________________________________________

G. Signature

To the best of my knowledge, the information in this document and attachments is true and accurate. Willful and deliberate omissions have not been made. All known and suspected hazardous materials have been disclosed.

__________________________  __________________________  _________________
Technical Contact Printed Name  Signature                 Date

__________________________  __________________________  _________________
WCO's Printed Name            Signature                   Date
<table>
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<tr>
<th></th>
<th>Statistical Mean (mg/L)</th>
<th>Upper Confidence Interval</th>
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<td></td>
<td>o-Cresol</td>
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<td>Methyl ethyl ketone</td>
<td></td>
<td></td>
<td>Heptachlor (and Hydroxide)</td>
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<tr>
<td>Pyridine</td>
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<td></td>
<td>Lindane</td>
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<tr>
<td>Tetrachloroethylene</td>
<td></td>
<td></td>
<td>Methoxychlor</td>
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<td></td>
</tr>
<tr>
<td>Trichloroethylene</td>
<td></td>
<td></td>
<td>Toxaphene</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vinyl chloride</td>
<td></td>
<td></td>
<td>2,4,5-TP (Silvex)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Attach a list of all procedures cited with their numbers and titles. Citations within the Waste Profile should provide only the procedure number.

A.1 Name, phone number, and fax number of the Waste Certification Official that certifies the waste.
A.2 Name, phone number, and fax number of the technical contact. The technical contact should be an individual who understands the characteristics of the waste profiled.
A.3 Name, phone number, and fax number of the DOE Field Office/Area Office/Operations Office representative for the facility.
A.4 Facility name and complete address. If the waste is being shipped from a location other than the stated facility include the address from which the waste is to be shipped.
A.5 EPA identification number if shipping Mixed Waste.

B.1 Waste stream number: unique two-part, 13-character alphanumeric code. First four characters are alphanumeric code for the facility found in Appendix C, page C-4. The second part is a generator determined nine-character alphanumeric code for the waste stream (e.g., LITN000000001, where LITN is the facility code for IT Corporation and 000000001 is the IT assigned waste stream code). Include the Profile revision number and date.
B.2 Title of waste stream (e.g., laboratory trash, soil, sump sludge)
B.3 Check the appropriate box for the waste category.
B.4 Description of the process and/or information used as the basis for characterization. Shall include at a minimum: Waste characterization determination (RCRA-regulated; not regulated, transuranic); description of waste to include physical state, chemical and radiological composition and a description of any treatment; origin or waste; method of characterization; process knowledge summary; and sampling and analysis summary.

Check "Yes" if additional pages are attached.
Check "Yes" if a process diagram is attached.
B.5 Total amount of waste expected to be shipped under this waste profile. If the waste generation is ongoing indicate rate of production during the fiscal year. DO NOT enter >, <, , or a range (i.e., 30-50).
B.6 Reason for profile submittal and effective date of changes, if any.
B.7 Check "Yes" if the waste stream requires a WAC deviation (see section 3.4).

C.1 Check the appropriate box(es) for the description of the waste. If "Other", include waste form description.
C.2 List waste stream components. Indicate the estimated percent of material in the waste stream (i.e., 50% PPE, 25% paper). The percentages must total 100%. DO NOT enter >, <, , or a range (i.e., 30-50).
C.3 If the waste form was treated to meet the NTSTWAC cite the procedure or process used to treat the waste. If a procedure was used to ensure compliance cite the procedure number. "N/A" is acceptable.

D.1 Check the appropriate box(es) for how the RCRA determination was made. Cite process or procedure used for RCRA hazardous/nonhazardous determination.
D.2 Attach sample result summary to waste profile.
<table>
<thead>
<tr>
<th>Section</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>D.3</td>
<td>Check the appropriate box. If yes, identify the EPA codes for which the waste was originally hazardous. See D.6 and D.7</td>
</tr>
<tr>
<td>D.4</td>
<td>Check the appropriate box. If yes, see D.6</td>
</tr>
<tr>
<td>D.5</td>
<td>Check the appropriate box. If yes, see D.6</td>
</tr>
<tr>
<td>D.6</td>
<td>Check the appropriate box. List state of generation regulations.</td>
</tr>
<tr>
<td>D.7</td>
<td>Check the appropriate box if the waste has been treated. If Yes, attach documentation that supports the treatment standard and final waste form conformance with the WAC.</td>
</tr>
<tr>
<td>D.8</td>
<td>Check the appropriate box if the waste is MW. If Yes, attach documentation that verifies LDR compliance.</td>
</tr>
<tr>
<td>E.1</td>
<td>Check the appropriate box(es) for how the radiological characteristics of the waste were determined. (See Appendix E - Scaling factors are ratios used to estimate the activity of a radionuclide from the known activity of another radionuclide.)</td>
</tr>
<tr>
<td>E.2</td>
<td>List documentation that describes how the radiological characterization was controlled.</td>
</tr>
<tr>
<td>E.3</td>
<td>List documentation that describes how package activity determination was determined.</td>
</tr>
<tr>
<td>E.4</td>
<td>List radionuclides as required by Appendix E, Sections E.1 and E.2. Radionuclides that are not considered reportable may also be listed. DO NOT enter &gt;, &lt;, , or a range (i.e., 30-50).</td>
</tr>
<tr>
<td>E.5</td>
<td>Indicate whether a list detailing the chemical form of the radionuclides is attached.</td>
</tr>
<tr>
<td>E.6</td>
<td>Check “Yes” box if the waste contains nuclides listed in Appendix E, Section E.1.A.2. List the radionuclides as required by Appendix E, Sections E.1 and E.2. List the lower limit, upper limit, and the representative (best estimate) activity concentration in units of nCi/g. DO NOT enter &gt;, &lt;, , or a range (i.e., 30-50).</td>
</tr>
<tr>
<td>E.7</td>
<td>List documentation that controls TRU determinations.</td>
</tr>
<tr>
<td>E.8</td>
<td>Check “Yes” box if waste contains enriched uranium. If yes, provide the weight percent of enrichment and maximum mass of U-235 per package in grams. List documentation that demonstrates compliance with the nuclear criticality safety criteria (section 3.2.1) and that controls the maximum mass of U-235 per package. DO NOT enter g/pkg as &gt;, &lt;, , or a range (i.e., 30-50).</td>
</tr>
<tr>
<td>F.1</td>
<td>Check Yes box if waste meets package criteria. List documentation that controls the package compliance.</td>
</tr>
<tr>
<td>F.2</td>
<td>Specify type of containers and DOT specifications. If boxes are used, check the appropriate box for the strength requirement.</td>
</tr>
<tr>
<td>F.3</td>
<td>State the external dimensions of the shipping containers.</td>
</tr>
<tr>
<td>F.4</td>
<td>State the weight range for the containers</td>
</tr>
<tr>
<td>F.5</td>
<td>Check Yes if the waste includes unclassified material</td>
</tr>
<tr>
<td>F.6</td>
<td>Check Yes if the waste includes classified material. NOTE, F.5 and F.6 can both be Yes.</td>
</tr>
<tr>
<td>F.7</td>
<td>State the estimated radiation dose rate at the package surface and at 1 meter.</td>
</tr>
<tr>
<td>F.8</td>
<td>List any special handling procedures or ALARA documentation necessary for the waste.</td>
</tr>
</tbody>
</table>

G. The Technical Representative and WCO must sign to certify that the information given on the profile is true and correct.
Appendix C

Marking and Labeling
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Barcodes used on packages must meet the following standards:\textsuperscript{7a}

A. Code 39.
B. Low- to medium-density; low-density preferred.
C. 1.0”-high bar code.
D. Human readable interpretation (HRI) 0.50” high printed, below the bar code.
E. Spacing between bar code and HRI will be 0.10”.
F. Minimum left and right margin (quiet zones) will be at least 0.25”.
G. Bar codes and HRI will be stacked with a minimum separation of 0.50” and in the following order: shipment number, container number.
H. A total of two bar code labels must be placed on each package near the top and on opposite sides.\textsuperscript{7a} Drums must have a total of two bar code labels, one on top of the drum lid and one on the side near the top.\textsuperscript{7a}

Note: Example not actual size.
I. A sample bar code must be submitted to BN prior to the first shipment to ensure that the RWMS equipment can be used to read the bar code. BN will provide bar codes for low-volume generators (less than ten shipments per year) that do not have the equipment to print bar codes. Contact BN at least one month in advance to arrange for the bar codes.

C.3 Marking and Labeling

Packages must have the following markings and labels.

A. Marking and labeling as required in Title 49 CFR, for additional Asbestos Labeling, see Section 3.1.15.

B. "Package Certification Label" (PCL) (see Figure C-2), signed by the WCO or package certifier. If the waste is unpackaged bulk, a signed PCL must accompany the shipment papers. Low volume generators can obtain these labels from BN.

C. Shipment number in the following sequence: Two alpha character generator-site-designator codes assigned by DOE/NV/WMD (see Section C-4); one alpha character for type of waste (L for LLW, M for MW, T for TRU, or X for Transuranic Mixed Waste); two numerical characters for current fiscal year; three numerical characters for shipment sequence. This number must be on the bar code. Example: MDL97001 indicates a shipment from the Mound Facility of LLW in fiscal year 1997 and the first shipment.

---

Figure C-2

Package Certification Label

NV-211 August 1997

PACKAGE CERTIFICATION LABEL

This label certifies this container and its contents meet the requirements of DOT (49 CFR), EPA (40 CFR), and NTSWAC for transportation and disposal.

DATE: _____________________________

CERTIFIED BY (print): _____________________________

CERTIFIED BY (signature): _____________________________

Waste Certification Official □
Alternate Waste Certification Official □
Package Certifier □

RWMS DESIGNATION (i.e., ONLO, ARIR): _____________________________

C-2

Marking and Labeling

060079 May 1999
D. Package number **must** be six characters (alpha, numeric, or combination) with no duplication within the shipment.\textsuperscript{7}\textsuperscript{8} This number **must** be on the bar code.\textsuperscript{7}\textsuperscript{8}

E. Package weight in units of kilograms and pounds **must** be included on the side of each waste package.\textsuperscript{7}\textsuperscript{8} This requirement can be met through the use of a label, additions to bar code labels, or by writing the weight on the side of the waste package.

### Generator Waste Stream and Shipment Codes

<table>
<thead>
<tr>
<th>GENERATOR</th>
<th>RWMS DESIGNATION*</th>
<th>SITE DESIGNATOR**</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aberdeen Proving Ground</td>
<td>USAA</td>
<td>AP</td>
</tr>
<tr>
<td>AlliedSignal</td>
<td>ABXX</td>
<td>AS</td>
</tr>
<tr>
<td>Babcock &amp; Wilcox</td>
<td>IBWV</td>
<td>GW</td>
</tr>
<tr>
<td>Bechtel - NTS</td>
<td>LRY5</td>
<td>DP</td>
</tr>
<tr>
<td>DNA - NTS</td>
<td>LDN1</td>
<td>DT</td>
</tr>
<tr>
<td>Fernald</td>
<td>ONLO</td>
<td>WM</td>
</tr>
<tr>
<td>GA Technologies</td>
<td>BGAT</td>
<td>BG</td>
</tr>
<tr>
<td>Grand Junction</td>
<td>JMTC</td>
<td>GJ</td>
</tr>
<tr>
<td>IT Corp.</td>
<td>LITN</td>
<td>IT</td>
</tr>
<tr>
<td>Johnston Atoll</td>
<td>DDJA</td>
<td>JA</td>
</tr>
<tr>
<td>LLNL - California</td>
<td>BCLA</td>
<td>LL</td>
</tr>
<tr>
<td>Lovelace Foundation (ITRI)</td>
<td>ALVI</td>
<td>LV</td>
</tr>
<tr>
<td>Mound</td>
<td>AMDM</td>
<td>MD</td>
</tr>
<tr>
<td>Oak Ridge</td>
<td>MMES</td>
<td>MM</td>
</tr>
<tr>
<td>Pantex</td>
<td>AMHP</td>
<td>PX</td>
</tr>
<tr>
<td>Pinellas</td>
<td>AGEP</td>
<td>PN</td>
</tr>
<tr>
<td>RMI Extrusion Plant</td>
<td>ORMI</td>
<td>RM</td>
</tr>
<tr>
<td>Rocketdyne</td>
<td>BNRC</td>
<td>BN</td>
</tr>
<tr>
<td>Rocky Flats</td>
<td>ARIR</td>
<td>RF</td>
</tr>
<tr>
<td>Sandia - Albuquerque</td>
<td>ASLA</td>
<td>SA</td>
</tr>
<tr>
<td>Sandia - Livermore</td>
<td>ASLL</td>
<td>SL</td>
</tr>
<tr>
<td>U.S. Army Industrial Operations</td>
<td>ISOC</td>
<td>RI</td>
</tr>
</tbody>
</table>

**Note:** Contact RWMS Contractor if generator site is not listed.

*RWMS Designation is the first four characters of the Waste Stream ID number.

**Site Designator is the first two characters of a shipment number.
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Appendix D

Package Storage and Disposal Request
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Every Package Storage & Disposal Request (PSDR) generated on a package level should fall within the boundaries on the WP for that waste stream. See Section 3.1.2 for reportable nuclides.

<table>
<thead>
<tr>
<th>Package No.</th>
<th>Contact (mSv/h)</th>
<th>Completed Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Container Code</td>
<td>One Meter (mSv/h)</td>
<td>Operation Type</td>
</tr>
<tr>
<td>External Volume (m³)</td>
<td>Gross Weight (kg)</td>
<td>Total Activity (bq)</td>
</tr>
<tr>
<td>Waste Volume (m³)</td>
<td>Net Weight (kg)</td>
<td>Activity Date</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Waste Stream</th>
<th>Form Code</th>
<th>Form Description</th>
<th>Treatment Code</th>
<th>Treatment Description</th>
<th>Rev. No.</th>
<th>Rev. Date</th>
<th>Nuclide</th>
<th>Qty (Bq)</th>
</tr>
</thead>
<tbody>
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</tbody>
</table>
If you have any questions on completing this document, contact Waste Management Department at (702) 295-6811. Data entered on the form must be legible. Hand-printing or typing of letters and numbers is preferred to handwriting. When using a decimal, it must be clearly defined. DO NOT USE COMMAS!

SHIPMENT NUMBER: Consists of 8 alphanumeric characters. Enter the shipment number in the following sequence: 2-digit generator code assigned by WMD, L (low-level), M (mixed), T (TRU), or X (TRU Mixed), last two digits of the current fiscal year (Oct. 1 - Sept. 30), and the consecutive number of shipments from the generating facility. EXAMPLE: DPL90001 represents Decon Pad, low-level waste, fiscal year 1990, and the first shipment sent to WMD for fiscal year 1990. The shipment number must be 8 characters in the above sequence.

MANIFEST NUMBER: Required only on mixed waste shipments, a 5-digit number.

PACKAGE NUMBER: 6 unique characters for each container in the shipment.

WASTE FORM CODES: Enter the appropriate code and description.

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
<th>Length</th>
<th>Width</th>
<th>Height</th>
<th>Cubic Feet</th>
<th>Cubic Meters</th>
</tr>
</thead>
<tbody>
<tr>
<td>100</td>
<td>Miscellaneous</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>101</td>
<td>30-gallon drum</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>4.99-6.99</td>
<td>0.113-0.170</td>
</tr>
<tr>
<td>102</td>
<td>55-gallon drum</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>7.99-9.99</td>
<td>0.226-0.283</td>
</tr>
<tr>
<td>124</td>
<td>85-gallon drum</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>12.99-14.99</td>
<td>0.368-0.424</td>
</tr>
<tr>
<td>125</td>
<td>110-gallon drum</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>18.99-20.99</td>
<td>0.537-0.594</td>
</tr>
<tr>
<td>200*</td>
<td>Half box</td>
<td>78&quot;-90&quot;</td>
<td>42&quot;-56&quot;</td>
<td>18&quot;-30&quot;</td>
<td>34.125-87.5</td>
<td>0.9663-2.4777</td>
</tr>
<tr>
<td>201*</td>
<td>Wooden half box</td>
<td>78&quot;-90&quot;</td>
<td>42&quot;-56&quot;</td>
<td>18&quot;-30&quot;</td>
<td>34.125-87.5</td>
<td>0.9663-2.4777</td>
</tr>
<tr>
<td>210*</td>
<td>Full box</td>
<td>78&quot;-90&quot;</td>
<td>42&quot;-56&quot;</td>
<td>42&quot;-56&quot;</td>
<td>79.625-163.33</td>
<td>2.2547-4.6250</td>
</tr>
<tr>
<td>211*</td>
<td>Wooden full box</td>
<td>78&quot;-90&quot;</td>
<td>42&quot;-56&quot;</td>
<td>42&quot;-56&quot;</td>
<td>79.625-163.33</td>
<td>2.2547-4.6250</td>
</tr>
<tr>
<td>220*</td>
<td>Cargo container</td>
<td>234&quot;-246&quot;</td>
<td>90&quot;-102&quot;</td>
<td>90&quot;-102&quot;</td>
<td>1096.875-1481.125</td>
<td>31.060-41.940</td>
</tr>
<tr>
<td>230</td>
<td>Supersack</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>240</td>
<td>Burrito Wrap</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
</tr>
</tbody>
</table>

* External volumes reported for containers using these codes must be based on the containers' external dimensions. Volume should be within range specified.
WASTE TREATMENT CODES: Enter the appropriate code and description.

**Sorption**

- 60 - SpeediDri
- 61 - Celetom
- 62 - Floor Dry/Superfine
- 63 - HiDri
- 64 - Safe T Sorb
- 65 - Safe N Dry
- 66 - Florco
- 67 - Forco X
- 68 - Solid A Sorb
- 69 - Chemsil 30

**Solidification**

- 70 - Chemsil 50
- 71 - Chemsil 3030
- 72 - Dicapperl HP200
- 73 - Dicapperl HP500
- 74 - Zonolite Gd4
- 75 - Petroset
- 76 - Petroset
- 77 - Aquaset II
- 78 - Aquaset II
- 79 - Other (Describe)

**OPERATION TYPE:** B for burial or R for retrievable storage.

**EXTERNAL VOLUME:** Total volume displaced by the container in cubic meters. Refer to CONTAINER CODE. Written in scientific notation X.XXXE+00.

**GROSS WEIGHT:** Total weight of container including waste and solidification or absorbent media in kilograms. Written in scientific notation X.XXXE+00.

**TOTAL ACTIVITY:** Total becquerels must equal the sum of becquerels for each nuclide reported. Written in scientific notation X.XXXE+00.

**WASTE VOLUME:** Actual volume of waste material in package (cubic meters).

**NET WEIGHT:** Total weight of waste and solidification or absorbent media, excluding container, in kilograms. Written in scientific notation X.XXXE+00.

**ACTIVITY DATE:** The date, in the formal DD/MMM/YYYY (e.g., 01/JAN/1992) that the activity of the package was determined.

**CONTACT:** Maximum radiation reading at the surface of the package in mSv/H: Written in scientific notation X.XXXE+00.

**1 METER:** Maximum radiation reading at 1 meter in mSv/h: Written in scientific notation X.XXXE+00.

**COMMENTS:** Comments such as enriched Uranium, special handling required, etc. in this field.

**WASTE STREAM/PROFILE:** Waste Stream Identification or profile number. 13 alphanumeric characters. First 4 characters will be the RWMS designation. next 9 alphanumeric characters will be assigned by the generator. EXAMPLE: LRY5000000001 represents waste from the NTS.

**REVISION:** Approved Waste Profile Revision number: profile revision must be a two digit number.

**REVISION DATE:** Approved Waste Profile Date: in the formal DD/MMM/YYYY. If no profile has been approved for the waste stream the date of the last DOE/NV approval letter for the waste stream must be used.

**NUCLIDE:** Valid nuclide description. Attach additional sheet to report more nuclides than space allows - dash is required in format.

**QUANTITY:** The quantity of the nuclide present in the container in becquerels. The sum of each nuclide reported must not exceed the total activity reported for the total package. Written in scientific notation X.XXXE+00.
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Appendix E

Radiological Waste Characterization and Reporting Requirements
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Radiological Waste Characterization and Reporting Requirements

Radiological Reporting

Reportable radionuclides shall be reported on the WP and Package Storage and Disposal Request (PSDR). The WP is applied at a waste stream level. The PSDR is applied at a waste package level. Any radionuclides reported on the PSDR must also be identified on the WP. (See Appendices B and D for examples of WP and PSDR.)

A. Reportable Radionuclides

Radionuclides known or reasonably expected to be present in a waste stream meeting the following criteria shall be reported.

1. The activity concentration in the final waste form exceeds one percent of the Action Level (Table E-1). These radionuclides require rigorous waste characterization.

2. The radionuclide is an alpha emitting transuranic radionuclide with a half-life greater than 5 years, Pu-241, or Cm-242. The waste mass must be determined as described in Section E.5. Transuranic waste creating radionuclides with concentrations that exceed 1 nCi/g require rigorous waste characterization methods.

3. The activity concentration in the final waste form exceeds one percent of the total activity concentration. The total activity concentration shall include the activity of all radionuclides except for those that are exempt from the reporting requirements as specified below. For these radionuclides and for those present at a level less than the detection limit of industry accepted characterization methods, Process Knowledge (PK) should be sufficient for characterization.

B. Exempt Radionuclides

Radionuclides meeting any of the following criteria are exempt from the reporting requirements:

1. Any radionuclide, as listed in Table E-2, that will reach a state of transient or secular equilibrium with a parent radionuclide within the operational period of the disposal site.

2. Any radionuclide occurring at activity concentrations not exceeding background ranges for the region in which it was generated and material of interest.
E.2 Waste Profile Instructions

The reported activity concentrations (profile sections E.4 and E.6) must be representative of the final waste form after treatment or stabilization. Zero will not be accepted as the lower limit value. The lower limit must be set as the expected lower limit concentration or as the lower limit of detection (LLD) of the characterization method. If the lower limit is set by the LLD, list the lower limit value in parenthesis. Waste packages exceeding the upper limit will not be accepted for disposal without prior approval of a revised waste profile. The waste concentration may be less than the lower limit without prior approval.

E.3 Radiological Characterization Methods

Waste characterization methods are described below and are not intended to be all-inclusive. These methods can be used individually or in combination. The DOE/NV will use a graded approach in its acceptance of waste characterization methods. Generators are encouraged to develop innovative waste characterization plans designed for the specific conditions at their facilities.

The acceptability of a generator's waste characterization plan will be based on a determination that the level of effort is appropriate, given the potential of the waste stream to exceed the waste concentration action levels (Table E-1) and the physical limitations of the waste stream. Physical limitations may include waste matrices that cannot be representatively sampled with reasonable radiation exposure. Generators are expected to identify, based on knowledge of their processes and facility, those radionuclides with a reasonable probability of exceeding 1 percent of the waste concentration action level. Waste streams or waste packages reasonably expected to exceed 1 percent of the waste concentration action levels (Table E-1) will require the greatest level of characterization and verification.

A. Materials Controls and Accountability (MC&A)

MC&A records are data developed from a mass balance of material entering and exiting a process. MC&A data can be used to estimate the activity concentration of waste streams. This method is expected to be most useful for generators possessing limited numbers of nuclides, such as special nuclear materials, in known activity concentrations.

B. Gross Radiation Measurements

Scaling factors can be developed that relate gross radiation measurements to the activity concentration of a waste stream. Generators using gross radiation measurements shall ensure that measurements correlate with activity concentration on a consistent basis. Radionuclide distributions in the waste stream shall be initially determined and periodically verified through direct measurements or sampling and analysis. Generators shall document all methods used to develop scaling factors which relate gross radiation measurements to the activity concentration. When developing scaling factors, generators must consider the waste package and detector geometry; shielding and attenuation effects; and the energy spectra and decay schemes of radionuclides in the waste.
F. In all cases when a discrete source of radioactive solid waste is encapsulated, written procedures should be established to ensure that the radiation source(s) is reasonably centered within the encapsulating medium.

Encapsulated waste must be recognizable after the institutional control period of the disposal site so that inadvertent intrusion would be unlikely. This is accomplished by the waste maintaining its structural integrity under the expected disposal conditions. The NRC Technical Position on Waste Form provides guidance in using cementitious materials to solidify and stabilize LLW.

<table>
<thead>
<tr>
<th>NUCLIDE</th>
<th>ACTION LEVEL (Bq m⁻³)</th>
<th>NUCLIDE</th>
<th>ACTION LEVEL (Bq m⁻³)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unlisted nuclide with a $t_{1/2} \leq 5$ yr</td>
<td>No Limit</td>
<td>$^{227}$Ac</td>
<td>$1.0 \times 10^{12}$</td>
</tr>
<tr>
<td>$^3$H</td>
<td>$5.6 \times 10^{15}$</td>
<td>$^{229}$Th</td>
<td>$4.1 \times 10^9$</td>
</tr>
<tr>
<td>$^{14}$C</td>
<td>$2.3 \times 10^8$</td>
<td>$^{230}$Th</td>
<td>$3.1 \times 10^9$</td>
</tr>
<tr>
<td>$^{36}$Cl</td>
<td>$1.1 \times 10^{10}$</td>
<td>$^{232}$Th</td>
<td>$8.1 \times 10^4$</td>
</tr>
<tr>
<td>$^{59}$Ni</td>
<td>$8.1 \times 10^{12}$</td>
<td>$^{231}$Pa</td>
<td>$1.4 \times 10^9$</td>
</tr>
<tr>
<td>$^{63}$Ni (activated metal)</td>
<td>$2.5 \times 10^{14}$</td>
<td>$^{232}$U</td>
<td>$9.3 \times 10^9$</td>
</tr>
<tr>
<td>$^{65}$Ni</td>
<td>$2.5 \times 10^{13}$</td>
<td>$^{233}$U</td>
<td>$3.1 \times 10^{10}$</td>
</tr>
<tr>
<td>$^{60}$Co</td>
<td>No Limit</td>
<td>$^{234}$U</td>
<td>$3.7 \times 10^{10}$</td>
</tr>
<tr>
<td>$^{90}$Sr</td>
<td>$1.5 \times 10^{12}$</td>
<td>$^{235}$U</td>
<td>$1.2 \times 10^{10}$</td>
</tr>
<tr>
<td>$^{93}$Zr</td>
<td>$1.4 \times 10^{13}$</td>
<td>$^{238}$U</td>
<td>$1.2 \times 10^{11}$</td>
</tr>
<tr>
<td>$^{99}$Tc</td>
<td>$1.1 \times 10^{11}$</td>
<td>$^{238}$U</td>
<td>$5.9 \times 10^{10}$</td>
</tr>
<tr>
<td>$^{100}$Pd</td>
<td>$1.3 \times 10^{14}$</td>
<td>$^{237}$Np</td>
<td>$7.0 \times 10^6$</td>
</tr>
<tr>
<td>$^{126}$Sn</td>
<td>$5.9 \times 10^{8}$</td>
<td>$^{238}$Pu</td>
<td>$2.3 \times 10^{11}$</td>
</tr>
<tr>
<td>$^{129}$I</td>
<td>$2.9 \times 10^{9}$</td>
<td>$^{239}$Pu</td>
<td>$1.2 \times 10^{11}$</td>
</tr>
<tr>
<td>$^{133}$Ba</td>
<td>No Limit</td>
<td>$^{239}$Pu</td>
<td>$2.3 \times 10^{10}$</td>
</tr>
<tr>
<td>$^{137}$Cs</td>
<td>$2.8 \times 10^{12}$</td>
<td>$^{240}$Pu</td>
<td>$2.3 \times 10^{10}$</td>
</tr>
<tr>
<td>$^{137}$Cs</td>
<td>$3.4 \times 10^{11}$</td>
<td>$^{241}$Pu</td>
<td>$5.2 \times 10^{11}$</td>
</tr>
<tr>
<td>$^{151}$Sm</td>
<td>$1.2 \times 10^{15}$</td>
<td>$^{242}$Pu</td>
<td>$2.4 \times 10^{10}$</td>
</tr>
<tr>
<td>$^{152}$Eu</td>
<td>$4.8 \times 10^{13}$</td>
<td>$^{244}$Am</td>
<td>$1.8 \times 10^{10}$</td>
</tr>
<tr>
<td>$^{154}$Eu</td>
<td>$1.2 \times 10^{16}$</td>
<td>$^{243}$Am</td>
<td>$7.0 \times 10^9$</td>
</tr>
<tr>
<td>$^{210}$Pb</td>
<td>$1.3 \times 10^{13}$</td>
<td>$^{242}$Cm</td>
<td>$2.4 \times 10^{13}$</td>
</tr>
<tr>
<td>$^{207}$Bi</td>
<td>$1.1 \times 10^{11}$</td>
<td>$^{244}$Cm</td>
<td>$8.1 \times 10^{12}$</td>
</tr>
<tr>
<td>$^{226}$Ra</td>
<td>$1.3 \times 10^{9}$</td>
<td>$^{248}$Cm</td>
<td>$6.3 \times 10^9$</td>
</tr>
<tr>
<td>$^{228}$Ra</td>
<td>No Limit</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
C. Direct Measurement of Specific Radionuclides

Direct measurement of radionuclides may include nondestructive analysis of waste packages. In using this method, individual radionuclides are measured.

D. Sampling and Analysis

Radiological characterization using sampling and analysis, including swipes taken for characterization, shall be controlled.

E. Process Knowledge

Process knowledge will often be sufficient for characterization of radionuclides not having action levels or occurring at concentrations less than 1 percent of the action level. This method involves determining the radionuclide content of the waste through knowledge and control of the source of the waste.

E. Other

Other methods of radiological characterization may be acceptable.

Encapsulaton of Sealed Sources and Other Waste

The encapsulation of sealed sources can mitigate dispersion of waste and limit the impacts from direct and potential exposure pathways. The bounding conditions for the encapsulation of sealed sources are as follows:

A. A minimum solidified volume or mass that precludes significant movement of the waste without the assistance of mechanical equipment.

B. A maximum solidified volume or mass for encapsulation of a single discrete source will be 0.2 m³ or 500 Kg (55-gallon drum).

C. A maximum amount of gamma-emitting radioactivity or radioactive material generally acceptable for encapsulation is that which, if credit is taken for a 500 year decay period, would result in a dose rate of less than 0.2 Sv/hr (0.02 mrem/hr) on the surface of the encapsulating media. The maximum Cs-137/Ba-137m encapsulation in a single disposal container is 1.1 TBq (30 Ci).

D. A maximum amount of any non-transuranic radionuclide that can be encapsulated in a single disposal container intended for shallow land disposal is that which, when averaged over the waste and the encapsulating media, does not exceed the maximum concentration limits for Class C waste, as defined in Table 1 and 2 of 10 CFR 61.55.

E. Sealed sources containing transuranic radionuclides shall be evaluated against the NTSWAC TRU waste criteria individually, considering only the mass of the source itself (no packaging, extrinsic shielding or other waste-diluting materials). Encapsulation and concentration averaging over the waste and encapsulating media cannot be used to meet the NTSWAC TRU criteria.
The progeny radionuclides listed are exempt from reporting requirements when a parent radionuclide is present.

\[
\begin{align*}
\text{\textsuperscript{90}Y, \text{\textsuperscript{93}Nb, \text{\textsuperscript{126m}Sb, \text{\textsuperscript{126}Sb, \text{\textsuperscript{137m}Ba}}} & \quad = -8062 \\
\text{\textsuperscript{233}Pa, \text{\textsuperscript{235}Ra, \text{\textsuperscript{235}Ac, \text{\textsuperscript{217}Fr, \text{217}At, \text{\textsuperscript{213}Bi, \text{\textsuperscript{213}Po, \text{\textsuperscript{209}Tl, \text{\textsuperscript{209}Pb}}} & \\
\text{\textsuperscript{239}Np, \text{\textsuperscript{239}Th, \text{\textsuperscript{232}Th, \text{\textsuperscript{232}Ra, \text{\textsuperscript{223}Ra, \text{\textsuperscript{219}Po, \text{\textsuperscript{219}Pb, \text{\textsuperscript{211}Bi, \text{\textsuperscript{211}Po, \text{\textsuperscript{207}Tl}}} & \\
\text{\textsuperscript{234}Th, \text{\textsuperscript{234m}Pa, \text{\textsuperscript{234}Pa, \text{\textsuperscript{222}Rn, \text{\textsuperscript{221}Po, \text{\textsuperscript{221}Pb, \text{\textsuperscript{218}Bi, \text{\textsuperscript{218}Po, \text{\textsuperscript{210}Bi, \text{\textsuperscript{210}Po}}} & \\
\text{\textsuperscript{240}U, \text{\textsuperscript{240}Np, \text{\textsuperscript{238}Ra, \text{\textsuperscript{238}Ac, \text{\textsuperscript{228}Th, \text{\textsuperscript{226}Ra, \text{\textsuperscript{226}Rn, \text{\textsuperscript{226}Po, \text{\textsuperscript{222}Pb, \text{\textsuperscript{222}Bi, \text{\textsuperscript{222}Po, \text{\textsuperscript{208}Tl}}} & \\
\end{align*}
\]}

**Determination of Waste Volume**

Waste activity concentration **shall** be determined based on the volume of the final waste form as offered for disposal. Measurement or analysis of samples may be performed prior to final processing if the measured activity concentration can be related to the final activity concentration. The volume of the waste can usually be taken as the internal volume of the container if the radionuclides are reasonably homogeneously distributed throughout the waste and the waste fills at least 90 percent of the waste container. When these conditions are not met, for example when the package contains significant void space or contains irregularly shaped equipment or components, the volume **shall** be taken as the volume occupied by the waste in the container. The activity concentration of transuranic creating radionuclides in units of nCi/g **shall** be based on the mass of the contents of a single waste container, excluding the mass of the container and any shielding present.

**Examples of Waste Characterization Documentation**

A. Process knowledge documentation:

- Historical analytical data, literature searches, living memory, historic records, MC&A records, mass balance documentation, production specifications, certificates of traceability, plans and drawings, signed statements of living memory, system descriptions, work and operating procedures which generated waste, and Material Safety Data Sheets.

B. Evaluation of PK and historical data.

C. Independent review of program documents (may be in the form of a sign-off page within the approved document).

D. Reviewed and approved procedures:

- Direct measurement and/or survey processes, surface area estimations (when surface area of waste material is utilized in radiological characterization calculations), ratio/scaling factor information (approach to ratio/scaling factor development, application of ratios/scaling factors, justification for use of ratios/scaling factors, supporting calculations, operating procedures for assay equipment).

E. Evaluated Data, Validated Data, Sampling and Analysis Plan, Scope Of Work, and Laboratory Acquisition Document.
Radiological Characterization Flow Diagram Overview

Figure E-1, the radiological characterization flow diagram, illustrates the approach that should be used in order to obtain adequate radiological characterization. The approach allows for the utilization of generally accepted radiological characterization methodologies and documentation. Radiological characterization documentation is outlined by markers (□) on the radiological characterization flow diagram.

Start → Develop Programmatic Documents Based on Predetermined Approach to Radiological Characterization

- Procedures, Evaluation Criteria, SOW, S&A Plan, Lab Acquisition, Valid Criteria, Data Quality Objectives (DQQ), etc.

→ Independent Methodology Review (Technical Review) of Programmatic Documents with Concurrence

- Reviewed and Approved Programmatic Documents

→ PK Development

- Historical Data Collection, Literature Search, Interviews, etc.

→ PK Review and Evaluation

→ Description of Approach to Radiological Characterization

1

Independent Methodology Review (Technical Evaluation) of PK Package Including Evaluation and "Description of Approach to Radiological Characterization"

Evaluated PK Package

PK Sufficient for Characterizing Waste?

No → End

Yes → Waste Adequately Characterized

Documents to be referenced in waste profile

000095

Radiological Waste Characterization and Reporting Requirements May 1999
Historical Analytical Data Being Used for Characterization?

Yes

Sampling & Analysis to be Used, Including Scaling Factors & Contamination Surveys?

No

Direct Measure/Gross Radiation Measurements

Conducted Under Approved Procedures

Evaluation

Against Reviewed and Approved Criteria

Evaluated Data

Method and Data Summary

Waste Adequately Characterized

Sampling Including Verification Sampling

Performed in Accordance with an Approved S&A Plan and/or Approved Procedures

Analysis: Conducted Under Approved Procedures in On-site Lab or Conducted Under an Approved SOW by a Formally Requisitioned Lab

Data Validation

Against Reviewed and Approved Criteria

Validated Data

Scaling Factors to Be Used

Yes

End

Waste Adequately Characterized

No

Method and Data Summary

End

Waste Adequately Characterized

NOTE: Historical analytical data used for characterization should be verified through controlled analytical methods.

Documents to be referenced in waste profile
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Appendix F

Glossary
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Glossary

Certified Waste: Waste that has been confirmed to comply with disposal site WAC under an approved certification program.

Chelating Agents: Amine polycarboxylic acids (e.g., EDTA, DPTA), hydroxy-carboxylic acids, and polycarboxylic acids (e.g., citric acid, carbolic acid, and gluconic acid).

Corrective Action: Measures taken to rectify conditions adverse to quality and, where necessary, to preclude repetition.

Disposal: The emplacement of LLW or MW in a manner which is considered permanent in that routine recovery is not provided for.

Facility Evaluation: A documented review to evaluate a generator’s program to be in compliance with the waste acceptance criteria. Facility evaluations are conducted by RWAP personnel in the form of an audit, surveillance, annual assessment, or a combination of these.

Free Liquid: Liquids which readily separate from the solid portion of the waste including liquid that has been released during handling, storage, or transportation.

Generator: An individual, facility, corporation, government agency, or other institution that offers waste material for certification, treatment, storage, or disposal.

Hazardous Waste Component: Waste identified or listed in Title 40 CFR 261, or that otherwise meets the RCRA definition of hazardous, or waste identified by applicable state-of-generation hazardous waste regulations.

Incompatible Waste: Waste type that might react adversely with its containment materials or commingled waste as defined in Title 40 CFR 260.10.

Item: An all-inclusive term used in place of any of the following: assembly, component, equipment, material, part, structure, or system. The term “item” may also include technical data, documents, computer codes, or samples.

Land Disposal Restricted Waste: Waste that is prohibited from land disposal in accordance with Title 40 CFR 268.

Low-Level Waste: Radioactive waste not classified as high-level waste, spent nuclear fuel, TRU waste, uranium mill tailings, MW or 11e(2) by-product material as defined in DOE Order 5820.2A. Test specimens of fissionable material irradiated for research and development only, and not for the production of power or plutonium, may be classified as LLW, provided the concentrations of TRU is less that 100 nCi/g.

Mixed Waste: Waste containing both radioactive and hazardous components as defined by the Atomic Energy Act and the RCRA. MW must meet the LDRs as listed in Title 40 CFR 268.

May 1999

Glossary
Nonconformance: A deficiency in characteristic, documentation, or procedure that renders the quality of an item or activity unacceptable or indeterminate.

Package: The packaging together with its contents; a container (usually a drum or box) of waste in final form for disposal, one or more of which may constitute a shipment.

Packaging: The assembly of components necessary to ensure compliance with DOT, EPA, and DOE/NV requirements. It may consist of one or more receptacles, absorbent materials, radiation shielding, spacing structures, thermal insulation, and devices for cooling or absorbing mechanical shocks. The conveyance, tie-down system, and auxiliary equipment may sometimes be designated as part of the packaging.

Parcel: An individual component, item, or bag of waste, two or more of which may make up a package.

Pyrophoric Material: A material which under normal conditions is liable to cause fires through friction, retain heat from processing, or which can be ignited readily and, when ignited, burns so vigorously and persistently as to create serious transportation, handling, or disposal hazards.

Qualification: The characteristics or abilities gained through education, training, or experience, as measured against established requirements, such as standards or tests, that qualify an individual to perform a required function.

Qualified: Having complied with the specific requirements or precedent conditions.

Quality Assurance: All those planned and systematic actions necessary to provide adequate confidence that a structure, system, or component will perform satisfactorily in service.

Radioactive Waste: Solid, liquid, or gaseous material that contains radioactive nuclides regulated under the Atomic Energy Act of 1954, as amended.

Radioactive Waste Management Site: Designated locations where radioactive waste handling, storage, or disposal operations are conducted.

Real-Time Radiography (RTR): X-ray unit used to examine waste packages.

Removable Contamination: Removable radioactive material on the package surface or shipping vehicle.

Stabilization and Solidification: A technique that limits the solubility and mobility of waste constituents. Solidification immobilizes a waste through physical means and stabilization immobilizes the waste by bonding or chemically reacting with the stabilizing material.

Supplier: Any individual or organization who furnishes items or services in accordance with a procurement document. An all-inclusive term used in place of any of the following: vendor, seller, contractor, subcontractor, fabricator, consultant, and their subtier levels.

Tamper-Indicating Devices: Devices that may be used on containers and that, because of their uniqueness in design or structure, reveal violations of containment integrity.
Transuranic Mixed Waste: Waste containing both TRU and hazardous components.

Transuranic Waste: Radioactive waste containing alpha-emitting radionuclides having an atomic number greater than 92, and half-lives greater than 20 years, in concentrations greater than 100 nCi/g.

Treatment: Any method, technique, or process designed to change the physical or chemical character of waste to render it less hazardous; safer to transport, store, or dispose; or reduce in volume. Five basic treatments are (a) volume reduction, (b) immobilization of radioactive/hazardous components, (c) change of composition, (d) removal of radioactive or hazardous components from the waste, and (e) solidification of liquids.

Uniform Hazardous Waste Manifest: The shipping document EPA Form 8700-22 originated and signed by the generator in accordance with the instructions included in the Appendix to Title 40 CFR 262.

Verification Sampling: A DOE/NV program which confirms the accuracy and precision of a generator's analytical data by obtaining split samples of the waste from the generator, and having them analyzed.

Waste Characterization: Determination of the physical, chemical, or radiological properties of waste.

Waste Stream: A waste or group of wastes from a process or a facility with similar physical, chemical, and radiological properties.
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# References

## Title 10 - Energy
1.1 10 CFR 61.56(a)(2)
1.2 10 CFR 61.56(a)(5)
1.3 10 CFR 61.56(a)(8)

## Title 29 - Labor
2.1 29 CFR 1910.66(f)(4)(v)
2.2 29 CFR 1910.66(f)(4)(ix)
2.3 29 CFR 1910.178(0)(2)

## Title 40 - Protection of Environment
3.1 40 CFR 61.140 - .157
3.2 40 CFR 260.11(a)
3.3 40 CFR 261
3.4 40 CFR 261.1(a)
3.5 40 CFR 261.33(a)
3.6 40 CFR 262.20(a)
3.7 40 CFR 262.31
3.8 40 CFR 262.32
3.9 40 CFR 262.32(b)
3.10 40 CFR 264.170 - .179
3.11 40 CFR 264.314(d)
3.12 40 CFR 265.177
3.13 40 CFR 265.314(f)
3.14 40 CFR 268
3.15 40 CFR 268.7(a)(1),(2), and (3)
3.16 40 CFR 761.60 - .79

## Title 49 - Transportation
4.1 49 CFR 172.200 - .205
4.2 49 CFR 172 Subparts D (172.300 - .338) and E (172.400 - .450)
4.3 49 CFR 172.310
4.4 49 CFR 172.403
4.5 49 CFR 173.410
4.6 49 CFR 173.2a(c)(5)
4.7 49 CFR 173.24
4.8 49 CFR 173.115(b)(3)
4.9 49 CFR 173.423
4.10 49 CFR 173.427(b)(3)
4.11 49 CFR 173.427

## Nevada Administrative Code (NAC)
5.1 NAC 444.490 - .948
5.2 NAC 444.965 - .976
5.3 NAC 444.971(1)
5.4 NAC 444.971(2)
5.5 NAC 444.8565(2)(c)
5.6 NAC 444.8632

DOE Orders

DOE Order 420.1, “Facility Safety”
6.1 420.1 4.3.2
6.2 420.1 4.3.3

DOE Order 5633.3B, “Control and Accountability of Nuclear Materials”
6.3 5633.3B II.5.a(2)
6.4 5633.3B II.7.b(2)(c)(1)

DOE Order 5820.2A, “Radioactive Waste Management”
6.5 5820.2A 5
6.6 5820.2A Attachment 2, 39
6.7 5820.2A III.3.a(2)
6.8 5820.2A II.3.a(3)
6.9 5820.2A III.3.d(1)
6.10 5820.2A III.3.d(2)
6.11 5820.2A III.3.d(2)(b)
6.12 5820.2A III.3.d(2)(d)
6.13 5820.2A III.3.e(2)
6.14 5820.2A III.3.e(3)
6.15 5820.2A III.3.e(5)(a)
6.16 5820.2A III.3.e(5)(e)
6.17 5820.2A III.3.e(5)(f)
6.18 5820.2A III.3.e(5)(g)
6.19 5820.2A III.3.f(2)
6.20 5820.2A III.3.g(3)
6.21 5820.2A III.3.i(5)(a)
6.22 5820.2A III.3.i(5)(b)
6.23 5820.2A III.3.i(5)(c)
6.24 5820.2A III.3.i(5)(d)
6.25 5820.2A III.3.i(5)(e)
6.26 5820.2A III.3.i(5)(f)
6.27 5820.2A III.3.m(1)

Federal Manuals and Policy

7.1 DOE Hoisting & Rigging Manual, 8.3.1.a
7.2 Memo for the Record from Wendy A. Griffin, 7-10-95, “Acceptance of the Lawrence Livermore National Laboratory, Livermore, California, Position Paper on Depleted Uranium Tailings.” (Pyrophoric Position Paper)
7.3 “Position Paper on the Proper Characterization and Disposal of Sealed Radioactive Sources.” Revision 2, October 1997

000105
7.7 “Test Methods for Evaluating Solid Waste, Physical/Chemical Methods,” EPA Publication SW-846, Chapter 1, Section 1.0
7.8 Low-Level Waste Licensing Branch, Technical Position on Radioactive Waste Classification, May 1983, Revision 0, Section C.1.c
7.10 USEPA “Waste Analysis at Facilities that Generate, Treat, Store, and Dispose of Hazardous Wastes” PB94-463603, OSWER 9938.4-03, April 1994, Section 1.5.2
7.12 “Position Paper for High Moisture Content Waste” revision 0, dated 11/3/98
7.13 “Position on the Use of Lead Shielding for the Disposal of Low Level Radioactive Waste at the Nevada Test Site”

American National Standards Institute (ANSI)
8.1 NQA-1, Basic and Supplementary Requirements #1
8.1a 1S-1.2.1(b)
8.2 NQA-1, Basic and Supplementary Requirements #2
8.2a 2S-3.1
8.3 NQA-1, Basic and Supplementary Requirements #3
8.3a 3S-1.2
8.3b 3S-1.3
8.3c 3S-1.3.1
8.3d 3S-1.3.1.a
8.3e 3S-1.4
8.3f 3S-1.5
8.3g 3S-1.6
8.4 NQA-1, Basic and Supplementary Requirements #4
8.4a 4S-1.2.2
8.4b 4S-1.2.3
8.4c 4S-1.2.5
8.4d 4S-1.3
8.4e 4S-1.4
8.5 NQA-1, Basic Requirements #5
8.6 NQA-1, Basic and Supplementary Requirements #6
8.6a 6S-1.2
8.6b 6S-1.3.1
8.7 NQA-1, Basic and Supplementary Requirements #7
8.7a 7S-1.3.1
8.7b 7S-1.5
8.7c 7S-1.5.1
8.7d 7S-1.8.2.3
8.8 NQA-1, Basic and Supplementary Requirements #8
8.8a 8S-1.2.3
8.8b 8S-1.3.1
8.9 NQA-1, Basic and Supplementary Requirements #9
8.9a 9S-1.2
8.9b 9S-1.3
8.9c 9S-1.3.1.1
8.9d 9S-1.3.2
8.10 NQA-1, Basic and Supplementary Requirements #10
8.10a 10S-1.2
8.10b 10S-1.5.2
8.10c 10S-1.6.1
8.10d 10S-1.7.1
8.10e 10S-1.7.4
8.10f 10S-1.9
8.11 NQA-1, Basic and Supplementary Requirements #11
8.11a 11S-1.2
8.11b 11S-1.3
8.11c 11S-1.4
8.11d 11S-1.5
8.11e 11S-2.2.1
8.11f 11S-2.2.2
8.12 NQA-1, Basic and Supplementary Requirements #12
8.12a 12S-1.2
8.12b 12S-1.3.1
8.12c 12S-1.3.2
8.12d 12S-1.4
8.12e 12S-1.5
8.13 NQA-1, Basic and Supplementary Requirements #13
8.14 NQA-1, Basic Requirements #14
8.15 NQA-1, Basic and Supplementary Requirements #15
8.15a 15S-1.2(a)
8.15b 15S-1.4.1
8.15c 15S-1.4.2
8.15d 15S-1.4.4
8.16 NQA-1, Basic Requirements #16
8.17 NQA-1, Basic and Supplementary Requirements #17
8.17a 17S-1.2.1
8.17b 17S-1.2.3
8.17c 17S-1.2.8
8.17d 17S-1.4.2(a)
8.17e 17S-1.4.3
8.17f 17S-1.4.4.2
8.17g 17S-1.4.4.4
8.17h 17S-1.5(c)
8.18 NQA-1, Basic and Supplementary Requirements #18
8.18a 18S-1.2
8.18b 18S-1.3.1
8.18c 18S-1.3.2
8.18d 18S-1.3.3
8.18e 18S-1.4

9.1 NRC Low-Level Waste Manifest Implementation Guidance