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SILO PROJECT INDEPENDENT REVIEW TEAM DOCUMENTATION - NEVADA TEST SITE DEFENSE WASTE ACCEPTANCE CRITERIA, CERTIFICATION, AND TRANSFER REQUIREMENTS - JUNE 1992

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REPORT

NVO-325 (Rev.1)

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Nevada Test Site Defense Waste Acceptance Criteria, Certification, and Transfer Requirements

June 1992

Prepared Jointly by:

U.S. Department of Energy
Nevada Field Office

and

Reynolds Electrical & Engineering Co., Inc.
Waste Management Department

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INTRODUCTION

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

It is urged that potential qualified shippers of defense-related radioactive waste to NTS review every segment of this document carefully. Particular attention must be paid to the important details of the application process including characterization and certification programs, analytical laboratory requirements, and financial responsibilities.

All references in this document must be observed to avoid omission of critical requirements on which acceptance or rejection of an application will be based.

Although every attempt has been made to address all aspects of the application process, the Department of Energy/Nevada Field Office (DOE/NV) and Reynolds Electrical & Engineering Co., Inc./Waste Management Division (REECo/WMD) remain available to assist you in understanding or interpreting various segments of this document as they are intended.

For assistance, please call:

DOE/NV, Commercial/FTS: 702-295-3181

REECo/WMD, Commercial/FTS: 702-295-6406

ABSTRACT

The **Nevada Test Site Defense Waste Acceptance Criteria, Certification, and Transfer Requirements** establishes procedures, requirements, and criteria for safe transfer and disposal of low-level and mixed waste and storage of transuranic and transuranic mixed waste at the NTS. Included are the following: overview of the NTS Defense Waste Management Program, guidance for the application to dispose or store waste, the NTS waste acceptance criteria including the waste characterization certification requirements, and requirements for waste receipt.

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List of Acronyms

ALARA	As Low As Reasonably Achievable
ANSI	American National Standards Institute
ASME	American Society of Mechanical Engineers
ASTE	American Society of Testing Engineers
ASTM	American Society for Testing of Materials
CFR	Code of Federal Regulations
CLP	Contract Laboratory Program
DOE	U.S. Department of Energy
DOE/HQ	U.S. Department of Energy/Headquarters
DOE/NV	U.S. Department of Energy/Nevada Field Office
DoD	U.S. Department of Defense
DOT	U.S. Department of Transportation
EPA	U.S. Environmental Protection Agency
EPD	Environmental Protection Division
ERWM	Environmental Restoration & Waste Management
ES&H	Environmental Safety & Health
ETA	Estimated Time of Arrival
FTS	Federal Telephone System
HRI	Human Readable Interpretation
LDR	Land Disposal Restrictions
LLW	Low-Level Waste

MKS	Meter-Kilogram-Second
MW	Mixed Waste
MWMU	Mixed Waste Management Unit
NE	Office of Nuclear Energy
NEPA	National Environmental Policy Act
NRC	Nuclear Regulatory Commission
NTS	Nevada Test Site
NVO-325	Nevada Test Site Defense Waste Acceptance Criteria, Certification, and Transfer Requirements
NVO-325LRD	NVO-325 Laboratory Reference Document
PAQD	Performance Assessment & Quality Division
PCB	Polychlorinated Biphenyls
PPBD	Programs, Plans and Budgets Department
QA	Quality Assurance
QC	Quality Control
RAMATROL	Radioactive Materials Control
RCRA	Resource Conservation and Recovery Act
REECo	Reynolds Electrical & Engineering Co., Inc.
RTR	Real-Time Radiography
RWMS	Radioactive Waste Management Site
SOP	Standard Operating Procedure
SW-846	EPA Document SW-846, "Test Methods for Evaluating Solid Waste, Physical/ Chemical Methods"
TCLP	Toxicity Characteristic Leaching Procedure
TID	Tamper Indicating Device
TRU	Transuranic
TRUMW	Transuranic Mixed Waste

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TSCA	Toxic Substances Control Act
WAC	Waste Acceptance Criteria
WCO	Waste Certification Official
WIPP	Waste Isolation Pilot Plant
WMD	Waste Management Department (REECo)
WMIS	Waste Management Information System
WOB	Waste Operations Branch (DOE/NV)
WOS	Waste Operations Section (REECo/WMD)

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1.0 Defense Waste Management at the Nevada Test Site

1.1 Purpose and Scope

This document establishes the U. S. Department of Energy, Nevada Field Office (DOE/NV) waste acceptance criteria and requirements for waste certification and transfer. These criteria and requirements apply to all defense radioactive waste received at the Nevada Test Site (NTS) Area 3 and Area 5 Radioactive Waste Management Sites (RWMS) for storage or disposal. The generator approval process also is outlined.

1.2 Policy

The policy of DOE/NV is to approve generators and to receive, store, and dispose of radioactive wastes generated by DOE defense programs in a manner consistent with DOE Order 5820.2A, "Radioactive Waste Management," and applicable federal, state, and local regulations and requirements. In addition, classified waste generated by the Department of Defense (DoD) will be accepted. This policy is designed to 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 DOE Order 5480.11, "Radiation Protection for Occupational Workers," and NV 54XG.1A, "DOE/NV Radiological Safety Manual." This policy also is designed to protect the environment from any chemical hazards in the waste in accordance with the Resource Conservation and Recovery Act (RCRA) and to meet applicable Department of Transportation (DOT) regulations.

It is the policy of DOE to develop, implement, and maintain Quality Assurance (Q A) programs to fulfill the requirements of the DOE Orders 5820.2A, "Radioactive Waste Management" and 5700.6C, "Quality Assurance" and to

be consistent with applicable federal, state, and local regulations and requirements.

It is the policy of DOE that waste will be accepted only from generators designated by DOE Headquarters (DOE/HQ) and approved by DOE/NV. All generators will be reviewed for compliance with the requirements of this document, and additional requirements as may be established by DOE/NV, before receiving approval to ship waste to the NTS.

It is the policy of DOE that only low-level waste (LLW) and mixed waste (MW) will be accepted for disposal at the NTS and that transuranic waste (TRU) and transuranic mixed waste (TRUMW) will be accepted for storage at the NTS.

The policy of DOE/NV is to consider LLW containing hazardous components which are regulated as hazardous in the state-of-generation to be regulated as MW at the NTS. DOE/NV retains the final decision on applying state-of-generation regulations to out-of-state generators. These regulations may include, but may not be limited to, waste analysis, treatment, and disposal requirements.

1.3 Implementation Plan

The waste acceptance criteria, characterization, and certification requirements detailed in this document are effective immediately. All waste generators, both on and off site, shall submit to DOE/NV and REECo/WMD a schedule for complying with the requirements within 90 days of issuance of this document. This schedule will detail a time frame for application revision and programmatic changes. In no case will this time frame exceed six months from the official issue date of this document. Between revisions, DOE/NV will advise all generators, in writing, of any additional requirements for waste acceptance at the NTS waste management sites.

1.4 Responsibilities

Responsibility for the proper management of defense radioactive waste at the NTS is as follows:

A. **DOE/HQ (EM-30):** Responsible for the oversight of DOE waste generated by operations and activities under the cognizance of

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Defense Programs and Environmental Restoration & Waste Management (ERWM) in accordance with DOE Order 5820.2A, "Radioactive Waste Management." Management of these wastes includes determinations as to site of disposition.

B. **Manager, DOE/NV:** Has those responsibilities and authorities as assigned in DOE Order 5820.2A. The Manager provides approval to waste generators to dispose of defense waste at the NTS and grants any exemptions to the requirements of this document.

C. **Director, DOE/NV, Performance Assessment & Quality Division (PAQD):** Has those responsibilities and authorities as assigned in DOE Order 5700.6C and the DOE/NV "Quality Assurance Manual," NV 57XB.1-11.

D. **Director, DOE/NV, Environmental Restoration & Waste Management Division (ERWM):** Responsible for the DOE/NV Defense Waste Management Program according to the requirements of DOE Order 5820.2A.

E. **Director, DOE/NV, Environmental Protection Division (EPD):** Responsible for DOE/NV environmental oversight of Area 5, Mixed Waste Management Unit (MWMU) and act as official point of contact between DOE/NV and the state of Nevada.

F. **Chief, DOE/NV Safeguards and NTS Security Branch:** Responsible for acceptance and review of all classified documentation and review for classified/unclassified accountable or special nuclear material waste.

G. **Chief, DOE/NV, Waste Operations Branch (WOB):** Responsible for Program Management of the NVO-325 Waste Certification Program.

H. **Reynolds Electrical and Engineering Co., Inc. (REECo):** Responsible for the safe management of defense radioactive waste at the NTS. REECo is the NTS management and operations contractor.

I. **REECo Waste Management Department (REECo/WMD):** Responsible for conducting NTS defense radioactive waste management activities, which include maintenance and operations of the Area 3 RWMS and the Area 5 RWMS.

J. **REECo Health Protection Department/Radioactive Materials Control (RAMATROL):** Responsible for verifying DOT shipping documents and placarding upon shipment arrival at NTS, according to the applicable requirements of Title 49 CFR 172, Subpart F and C.

K. **REECo Traffic:** Responsible for verifying trailer, seal, and container numbers (when accessible) upon arrival at NTS.

L. **Generators of Low-level, Mixed, Transuranic, and Transuranic Mixed Waste:** Responsible for conducting waste management programs in accordance with all applicable requirements as referenced in this document.

M. **Generator DOE Field or Area Offices:** Responsible for reviewing and signing the Waste Generator Applications for the waste generator sites under their purview.

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2.0 Application Approval Process

The application 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. These steps are outlined in this section.

Note: All interactions referenced in this section between the generator and DOE/NV must take place through the generator's appropriate DOE office.

DOE/NV will coordinate all activities relating to the generator application approval process.

2.1 Preapplication Approval

2.1.1 Application to Headquarters

Before new off-site generators may be considered for shipping waste to the NTS, they must contact DOE/HQ to obtain an official written designation of the waste as defense waste. The NTS and current DOE/HQ-approved generators wishing to add waste streams to their application are exempt from this requirement.

2.1.2 DOE/NV Approval to Apply

Once official designation is obtained from DOE/HQ, off-site generators must then contact the DOE/NV Manager for an approval to submit an application to ship waste to the NTS. DOE/NV will consider application submittal requests from DOE/HQ, DOE Field Offices, and DOE Area Offices generating defense waste. In addition, requests from other government agencies generating classified waste will be considered. If approval is granted, a copy of the current

Nevada Test Site Defense Waste Acceptance Criteria, Certification, and Transfer Requirements (NVO-325) will be sent to the generator. Generator waste must meet all the requirements of this document. In addition, any NVO-325 reference document(s) are available upon request (see Section 4.3).

2.2 Generator Application Format

The generator application format (Figure 1, page 9) consists of six main parts: generator information, waste characterization program, waste stream information, waste certification program, exemption requests, and procedures and supporting documentation. The application must be submitted as a controlled document and must follow the format outlined. Failure to follow these directions will lead to delays in processing the application.

Note: Call DOE/NV/WOB prior to application submission to determine the number of controlled and uncontrolled application copies to be sent. Address transmittal to the Director DOE/NV Environmental Restoration and Waste Management (ERWM) Division.

2.3 Generator Approval Process

Generator applications will be processed in the order received. A controlled application must be maintained at DOE/NV for the entire period of time a generator's approval to ship waste is to remain in effect.

The generator's application will be arranged and reviewed according to the format in Figure 1, page 9, and the requirements specified in this document. DOE/NV will provide application comments to the generator. Depending upon the adequacy of the application information, DOE/NV will request a response to the application comments or schedule an audit. In cases of insufficient information, the generator response will entail a revision and resubmission of the application prior to scheduling an audit. If an application is adequate, an audit will be scheduled and the application review comments will be discussed during that audit. Waste stream approval will be granted after the generator has

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demonstrated completion of any audit findings and the application has been revised.

At the time the audit arrangements are made, any supporting procedures or documentation essential to waste certification shall be current.

An audit of the generator's waste characterization and certification program will be conducted. This audit will verify, by examination and evaluation of objective evidence, that the documented program has been adequately implemented. This audit will include an on-site traceability review of each waste stream from the point of generation to the point the container is placed on the truck for shipment. An audit report will be issued within 30 calendar days. Should there be significant findings, corrective action will be required. The generator has 30 calendar days to provide an audit response to DOE/NV. The DOE/NV team will review any corrective action responses and approve or reject them. A surveillance of the generator will be performed to verify corrective action. When corrective action is complete, the DOE/NV Manager will provide written notice of approval of the entire application by waste stream identification number, including exemptions.

Note: Where only some of the waste streams are acceptable for shipment to NTS, an amended application, including only those approved waste streams, must be resubmitted for approval to the DOE/NV Manager.

Unannounced audits and surveillances may be performed at the discretion of DOE/NV. Additional waste sampling, analysis, and characterization may be requested to ensure generator compliance with the waste certification program at any time. In addition, DOE/NV may also split a representative waste sample with the generator for verification by independent analysis. Figure 2, page 10, depicts the waste generator application, audit, and approval process.

2.4 Application Changes

Controlled document revisions should be submitted to DOE/NV whenever operating changes alter conditions or waste types stated in the original waste generator application. Examples of changes requiring application revision are:

- Changes of the Waste Certification Official (WCO).
- Changes in DOE contact personnel.
- Changes in sampling plan.
- Changes in analytical laboratory.
- Changes required by outside regulator requirements.
- Changes or additions of waste streams.

2.5 Waste Stream Additions and Changes

Whenever a change occurs to the generating or treatment processes of a waste stream, the generator must notify DOE/NV. The change will be reviewed by DOE/NV and a recommendation will be made for the creation of a new waste stream, if required. Depending upon the significance of the change, the approval to ship that waste stream may be suspended until characterization and certification information is submitted as a revision to the application. This revised application will be reviewed according to the process described in Section 2.3. DOE/NV will perform a surveillance on that portion of the waste characterization and certification program affected by the change. Upon completion of any corrective action, approval to ship this waste stream will be granted.

2.6 Annual Program Review and Approval

An annual DOE/NV audit will be conducted approximately one year from the date of approval or reapproval. The application must be current at that time and reflect waste streams requested for disposal for the coming year. This application will be subject to the review process in Section 2.3.

Findings identified during the audit will not usually cause withdrawal of approval, providing DOE/NV-approved corrective action is implemented within 60 calendar days. Should the 60-calendar-day time frame for corrective action be exceeded, approval to ship will be withdrawn for those affected waste streams until the corrective action is completed.

DOE/NV reserves the right to suspend approval at any time if programmatic quality falls below acceptable standards.

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Figure 1 Generator Application Format

I. Generator Information (Section 3.0*)

A. Signature Page
B. Facility Name and Location
C. EPA Identification Number (for MW generators)
D. DOE Field/Area Office and Contacts
E. Contractor Name and Contacts
F. Waste Certification Official and Alternate(s)
G. Justification for Shipment to NTS
H. Waste Minimization Plan Statement
I. Funding Method

II. WASTE CHARACTERIZATION PROGRAM (Section 4.0*)

A. Process Knowledge Plan
B. Sampling Plan
C. Waste Analysis Requirements
D. Standardized Data Reporting Forms

III. WASTE STREAM INFORMATION (Section 5.0*)

A. Waste Stream Identification Number
B. Waste Type (i.e., LLW, MW, TRU, TRUMW)
C. Waste Description
D. Waste Certification Flow Diagram
E. Waste Acceptance Criteria (WAC) Statements
F. Waste Stream Characterization Data Sheet
G. Three-Year Waste Shipment Forecast
H. Packaging and Shipping Information
I. Waste Security Information

IV. WASTE CERTIFICATION PROGRAM PLAN (Section 6.0*)

V. EXEMPTION REQUESTS (Section 7.0*)

A. Area of Noncompliance and Reason for Request
B. Requested Duration
C. Plan for Corrective Action

VI. PROCEDURES AND SUPPORTING DOCUMENTATION (Section 8.0*)

To be provided as a separate, uncontrolled reference

* Reference sections of this document

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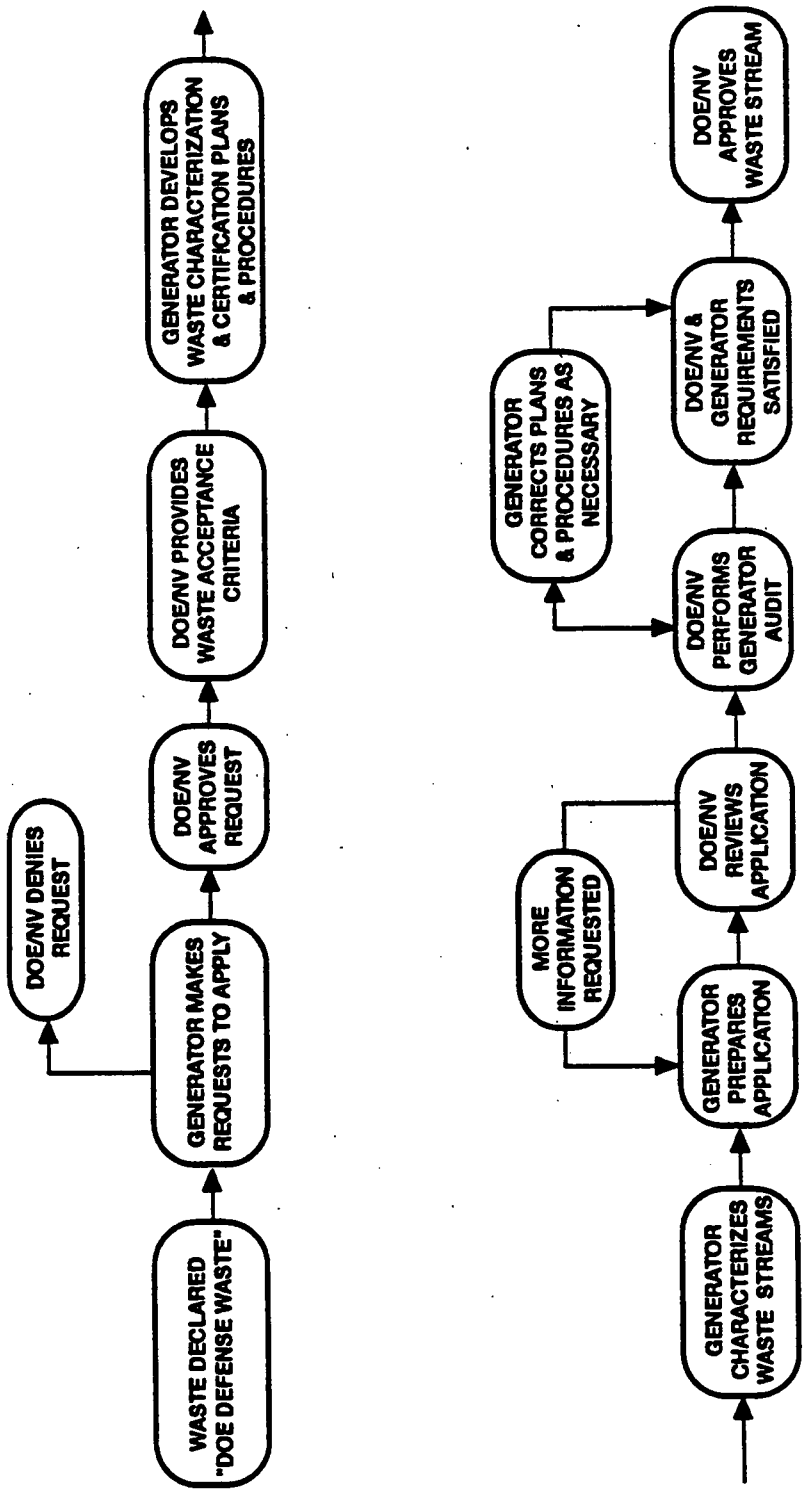
Figure 2 Waste Generator Approval Process



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3.0 Generator Information

The purpose of Sections 3.0 through 8.0 is to provide the generator with further guidance to the requirements shown in the application format, Figure 1, page 9. By following the guidance in this document, generators should be able to develop an application which can be easily evaluated by the DOE/NV technical reviewers.

3.1 Signature Page

The signature page verifies that key personnel have reviewed and approved as correct the information found in the generator application (see Figure 3, page 13). According to the unique operations found at the generator facility, this page shall include the appropriate personnel in the following departments or functional roles:

- DOE/HQ, DOE Field Office, or DOE Area Office;
- Generator Facility Manager;
- Waste Certification Official;
- Environmental Compliance Office;
- Waste Operations;
- Quality Assurance;
- Analytical Laboratory;
- Traffic Manager.

3.2 Facility Information

- Facility Name and Location
- EPA Identification Number (for MW Generators)
- DOE Field/Area Office and Contacts
  1. Name and Title
  2. Address
  3. Telephone Number
  4. Fax Number
- Contractor Name and Contacts
  1. Name and Title
  2. Address
  3. Telephone Number
  4. Fax Number
- Waste Certification Official(s) and Alternate(s)
  1. Name and Title
  2. Address
  3. Telephone Number
  4. Fax Number
- Package Certification Official(s)
  1. Name and Title
  2. Address
  3. Telephone Number
  4. Fax Number

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Figure 3 Example of Application Signature Page

GENERATOR APPLICATION TITLE

DATE

REVISION

PREPARED BY:

PREPARED FOR: (If Applicable)

Signatures below attest that the information within this application is correct and that the waste streams to be shipped shall meet the NTS waste acceptance criteria.

_____ _____

_____ _____

_____ _____

_____

DOE Signature

3.3 Justification

Justification to ship waste should be based on DOE Order 5820.2A "Radioactive Waste Management" requirements (Chapter III.2.c).

3.4 Waste Minimization Plan

Reference the title of the facility's Waste Minimization Plan as required by DOE Orders 5820.2A and 5400.1.

3.5 Funding

3.5.1 Generator Purchase Orders

All generators must establish purchase orders with REECo prior to shipping waste. To establish purchase orders for disposal, all generators shall:

- Contact REECo/WMD

  Commercial/FTS: 702-295-6406
- Prepare purchase orders to be sent to REECo addressed:

  REECo

  Attn: Manager

  Programs, Plans & Budgets Department (PPBD)

  Work Order Section

  P.O. Box 98521

  Las Vegas, NV 89193-8521
- Department of Defense Waste Generators shall submit Military Interagency Purchase Request to:

  U.S. DOE

  Attn: Budget Analyst

  Nevada Field Office

  Resource Management Division

  P.O. Box 98518

  Las Vegas, NV 89193-8518

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The purchase order shall be based upon four fiscal quarters estimated waste volume.

If the actual volume of waste to be disposed exceeds the forecasted amount and corresponding purchase order, an adjustment (increase) to the original purchase order must be established and conveyed to the REECo/PPBD Work Order Section by sending an alteration to the original purchase order before costs exceed payments.

3.5.2 Generator Payment Methods

DOE/NV designates which of the following payment methods that generators will use. DOE/NV reserves the right to modify the payment method for any generator.

3.5.2.1 Prepayment Method

Fernald Environmental Management Project, Lawrence Livermore National Laboratory, Mound, and Rocky Flats Plant will prepay their estimated waste disposal charges by at least one fiscal quarter. These disposal charges are based upon the estimated volumes listed on their Three-Year Waste Shipment Forecast multiplied by the corresponding disposal charge per cubic foot. Upon receipt of the purchase order, REECo will bill the generator the projected amount for the first succeeding fiscal quarter. One month before the beginning of each succeeding fiscal quarter, REECo will bill for one quarter of the generator's purchase order and associated forecasted volumes.

Due to projected operating costs, if actual waste volumes disposed do not reach the prepaid forecasted volumes, refunds will not be issued. Generators may adjust any quarterly forecast 45 days prior to the beginning of that fiscal quarter by contacting REECo/WMD. Informal information on purchase order balances may also be obtained by contacting REECo/WMD.

3.5.2.2 Monthly Billing Method

All other generators not specified in Section 3.5.2.1, will be billed on a monthly basis as the waste is received.

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3.5.3 Miscellaneous Charges

Generators shall be backcharged for costs incurred at the REECo/WMD RWMS for any of the following conditions:

- Package protection - cost for repairs of damage caused by waste generator or carrier negligence.
- Decontamination costs - any necessary decontamination resulting from above-stated damage.
- Corrections of other deficiencies - such as overpacking; containers that exceed radiation levels or external contamination levels, etc.
- Remote handling of high-specific-activity waste.
- Decontamination of bulk waste containers to the NTS specific release criteria (see NV 54XG.1A, "DOE/NV Radiological Safety Manual") prior to returning these containers to the generator.
- Special handling for containers exceeding weight limitations.
- Special handling for air cargo waste.
- Retrieval of waste packages which have been disposed.

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4.0 Waste Characterization

The focus of the characterization activities will be to demonstrate documented compliance with Title 40, Code of Federal Regulations (CFR) 261 through 268 and to provide information required for the DOE Order 5820.2A performance assessment of the waste disposal site.

All waste will be considered MW until the generator, through chemical analysis or process knowledge, can document that the LLW or TRU waste contains no hazardous wastes as identified in 40 CFR 261 or the state-of-generation hazardous waste regulations.

The generator's waste characterization program must include the identification of methods and the establishment of procedures to accurately determine the physical, chemical, and radiological properties of LLW in order to ensure that the waste conforms to the NTS waste acceptance criteria (WAC). The characterization methodology must allow such determinations to be accomplished with sufficient accuracy in all stages of the waste certification process to permit proper segregation, treatment, storage, and disposal of waste.

All waste characterization activities described below must be integrated into the Waste Certification Program as described in Section 6.

4.1 Waste Characterization By Process Knowledge

Process knowledge is describing the identity of the waste stream by means other than those relying solely on sampling and analysis methods. The focus of using process knowledge characterization is 1) balancing the requirements for providing definitive chemical and physical characterization of the waste stream with the need to protect personnel from radiation exposure; and 2) to address those circumstances where sampling and analysis is not feasible or necessary.

4.1.1 Conditions for Waste Characterization by Process Knowledge

Under the following circumstances, characterization techniques that rely primarily on knowledge of raw materials, processes, materials balance, and administrative controls can be employed. Such techniques may be utilized when one or more of the following conditions are present:

A. Waste stream is difficult to sample because of physical form. This primarily applies to solid matrix waste such as metal, glass, or wood, rather than as a residue that could be removed for testing or in a decontamination process.

B. Sampling and analysis of waste stream would result in unacceptable risks of radiation exposure (i.e., violate the ALARA precept of the DOE).

C. Waste is too heterogenous in composition (e.g., compactible trash containing clothing, booties, plastic, and paper, experiment-driven, and decontamination and decommissioning waste).

Note: Rigid administrative controls and documentation will be required to support the absence of hazardous components for LLW, and compliance with the Land Disposal Restrictions for MW.

4.1.2 Requirements For Characterization

Procedures that outline the process producing the waste must have documented reviews by persons of appropriate expertise; e.g., environmental compliance [Resource Conservation and Recovery Act (RCRA) and Toxic Substance Control Act (TSCA)], waste operations, waste quality assurance, and by persons responsible for assuring that the WAC have been met. If procedures that outline the process are not available, supporting documentation such as spill reporting, and chemical inventory of the place where the waste was discovered, chemical inventory of the makeup of the waste (e.g., fluids from discarded equipment) may be utilized.

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Documented inspection of the supporting documentation by qualified RCRA, health physics, industrial hygiene, or other appropriate expert personnel must take place.

Procedures must specify that sufficient Quality Assurance/Quality Control (QA/QC) controls are in place to assure that no contamination of the waste stream by outside sources occurs. If segregation of the waste stream is required, it must be controlled.

For the purpose of an audit, it is recommended that process knowledge documentation be placed in one file per project or activity. If some sampling and analysis is required, refer to Sections 4.2 and 4.3 for reporting requirements. Reviews for environmental compliance and this WAC must be included in the file on each project/activity. In all cases, the documentation establishing the identity of the waste stream must be traceable to the package serial number and the waste stream identification number.

4.1.3 Documentation To Be Provided In Application

Include the documentation that specifically supports the choice for process knowledge as the method of characterization. This may be in the form of supporting analytical data, or process procedures describing the ingredients used. See Section 8 for a further description of procedures and supporting documentation to be provided with the application. Contact DOE/NV if further clarification is needed.

4.2 Waste Characterization By Sampling And Analysis

When waste streams are to be characterized by sampling and analysis, each generator must prepare a written plan. This plan must describe waste sampling and analysis procedures that will result in the determination of its chemical and radiological components and identify hazardous components if present.

Sampling and analysis plans must be submitted to DOE/NV prior to sampling of the waste stream. It is understood that this plan may be submitted prior to the application itself. In cases where a generator prepares more than one sampling and analysis plan, DOE/NV will decide, on a case-by-case basis, how

many of these plans must be submitted for approval. All MW sampling and analysis plans must be submitted.

DOE/NV technical reviewers will review and evaluate sampling and analysis plans to ensure that 1) samples will be representative of the waste inventory, 2) appropriate analytical procedures are used, and 3) quality control procedures are implemented to document the quality of analytical results.

4.2.1 Sampling and Analysis Plan Guidance

The purpose of Sections 4.2.1 through 4.2.7 are to provide guidance on how to prepare a sampling and analysis plan. Approval of the plan is dependent upon the generator's demonstration that the sampling and analysis effort provides sound, defensible waste characterization data.

Much of the information in this section focuses on the sampling and analysis of LLW according to RCRA. This means that LLW generators who plan to ship waste to NTS must document any sampling and analysis performed and the absence of RCRA-regulated constituents. Generators who plan to ship mixed waste to NTS must document that the hazardous waste concentrations do not exceed applicable Land Disposal Restrictions (LDR) treatment standards. In addition, some general information on evaluation of specific NVO-325 acceptance criteria is provided.

4.2.1.1 Project Description

The project description shall provide a general overview of the project, including a schedule of major milestones. The generator's sampling and analysis plan shall begin with a description of the project. At a minimum, the information in Sections 4.2.1.1.1 to 4.2.1.1.6 must be included in this description.

4.2.1.1.1 Description of the Site

A brief description of the site, facility, or area where the sampling will occur is necessary. Be sure to use identifiers such as the names of buildings or process areas to describe the source of the waste and its present location. Also include

areas of in situ sampling; e.g., ponds and hillsides, as well as maps or diagrams that are clearly marked to show waste generation locations. If waste containers (i.e., packages or drums) will be sampled, state the total number of containers in the waste inventory and the number sampled at each location. If in situ sampling is to be used, give an approximate number of containers that will be filled for disposal.

4.2.1.1.2 Identification of Types of Waste to be Evaluated

Identify the type of waste that will be evaluated; e.g., contaminated soil, sludge, process waste, laboratory waste, etc. Describe the physical properties (liquid, solid, gas) and chemical properties (include organic, inorganic, and radionuclide components) of the waste. Describe the processes that generate the waste. Process knowledge, available analytical data, or both may be used to provide a general description of the waste properties. All information shall be documented from reliable sources, and the sources should be referenced.

4.2.1.1.3 Objective of the Sampling and Analysis Plan

Once the need for sampling and analysis has been identified; sampling, analytical, and data objectives must be established. The objectives will dictate the design of the sampling and analysis plan.

The primary objective of a sampling and analysis plan is to determine if a waste complies with NVO-325 low-level, mixed, transuranic, and transuranic mixed waste acceptance criteria. This objective must be stated.

Secondary objectives shall also be stated for each waste stream. A review of process knowledge and other preliminary data should generate logical questions about the waste and help identify the secondary objectives. At a minimum, address the following questions:

1) What regulatory requirements are applicable? RCRA thresholds for the Toxicity Characteristic? LDR treatment levels (for mixed waste)? PCB levels?

2) Should waste inventory be stratified (subcategorized in populations of similar waste)? Which waste parameters should be analyzed to characterize the waste? Why?

3) When should the waste be sampled? When it is generated; before or after stabilization, before or after packaging, etc.?

4) What analysis will be performed on previously generated waste if historical data are insufficient or unavailable to guide the analysis process?

As mentioned above, all generators must meet the same primary objective: obtaining defensible data that can be used to identify the physical and chemical properties of the waste to comply with the NVO-325 waste acceptance criteria. Secondary sampling, analytical, and data objectives will vary according to the wastes generated at each facility.

4.2.1.1.4 Use of Process Knowledge and Existing Analytical Data

Include a discussion on how process knowledge and existing analytical data is used to determine what information is needed to meet the objectives of the plan.

Process knowledge is a valuable source of information for characterizing waste streams if it is documented and comes from reliable sources. It is important, however, that each generator understand its limitations. For example, a statement such as "based on process knowledge we know that the waste does not contain metals" is not acceptable. The process must be described to show why metals are not present and supporting documentation provided, such as process diagrams and procedures. This information must be provided in the sampling and analysis plan and will be reviewed during the facility audit.

Existing analytical data and process knowledge can be combined to determine what is known about the waste and what additional information is necessary to fully characterize the waste. However, it is important to validate existing data and to understand its limitations. For example, pre-1989 analytical data may not include analyses of toxicity characteristic organics such as benzene (see 40 CFR 261.24). If these constituents are present in the waste at concentrations that exceed regulatory levels, the waste is hazardous waste (or mixed waste), and must be managed according to the RCRA hazardous waste regulations. Such wastes will not be accepted for disposal at the NTS's LLW disposal site. In the case of mixed waste, it is necessary to show that the waste concentration does not exceed applicable LDR regulatory thresholds. Wastes

that exceed these thresholds will not be accepted at the NTS mixed waste management unit.

4.2.1.1.5 Use of Results

Explain how the results of the sampling and analysis will meet the primary and secondary objectives. For example, discuss how the results will influence waste management decision-making. Flow diagrams describing this process should be included.

4.2.1.1.6 Sampling and Analysis Schedule

State projected start and end dates and include a list of major milestones in the sampling and analysis plan.

4.2.2 Sampling and Analysis Organization and Responsibilities

Include the names and positions of key technical and quality assurance personnel who will be involved in implementing each part of the sampling plan. Use a flowchart to show the process and the group (or person) responsible for performing each step.

4.2.3 Data Quality Objectives

The Data Quality Objectives must be defined in the waste generator's sampling and analysis plan according to the guidelines given in Sections 4.2.3.1 through 4.2.3.7. The Data Quality Objective Process, the Graded Approach, and the Observational Approach are cost-effective planning processes that increase the likelihood that data are of sufficient quality to meet the requirements for making management decisions. These processes are all similar in that they require substantial planning and up-front consideration of issues. This section does not attempt to describe these planning processes, but, only attempts to address RCRA-specific objectives and quality indicators that should be addressed to ensure conformance with NVO-325 waste characterization requirements. The sampling and analysis plan also must comply with the

applicable elements of the Waste Certification Program Plan specified in Appendix C.

4.2.3.1 90 Percent Confidence Limit

RCRA regulations specify an acceptable level of certainty of 90 percent, equivalent to an uncertainty level of 10 percent, which DOE/NV has adopted as their confidence level requirement. When characterizing waste, samples are used to make certain inferences about a population as a whole. There is always some measure of uncertainty about whether samples are truly representative of an entire population. The listed planning processes in Section 4.2.3 must take into consideration the required confidence interval when developing an analysis strategy (e.g., the acceptable levels for false positives or negatives).

Section 4.2.4.2 of this guidance describes how the statistical analysis described in Environmental Protection Agency (EPA) document SW-846, Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, can be used to develop a sampling strategy to achieve a 90 percent confidence level that the waste is not RCRA-regulated. Generators are not required to use SW-846 statistical procedures; however, each generator must explain how the proposed sampling method will meet the data quality objectives.

SW-846 describes how statistics can be used to achieve at least a 90 percent confidence level (based on a one-sided Student "t" Test) that the waste is not RCRA regulated, or that mixed waste will meet RCRA LDR regulatory thresholds. A 90 percent confidence limit is the lowest confidence limit that DOE/NV will accept. If the data do not allow a confidence level of 90 percent or more, then the waste is considered hazardous, unless further sampling increases the level of confidence. In addition, any waste represented by an individual sample that surpasses the RCRA threshold for a specific analyte will not be accepted for disposal at NTS, unless further sampling and analysis prove that the waste is nonhazardous due to an error in the original determination sequence. In summary, DOE/NV by requiring further evaluation of wastes represented by an individual sample that surpasses a RCRA threshold limit, is attempting to prevent unintentional acceptance of waste that does not meet the waste acceptance criteria.

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4.2.3.2 Representativeness

Describe why the strategy chosen for sampling will result in samples that are unbiased and representative throughout the entire waste inventory. (SW-846 defines representative samples "as exhibiting average properties of the whole waste.") The primary objective of representativeness is to ensure sampling accuracy and sampling precision. Sampling accuracy refers to the closeness of the resulting data to the true value; sampling precision refers to the closeness of a set of repeated sample values. The sampling strategy, therefore, must ensure that sampling will be sufficiently accurate and precise so that results are reliable estimates of the chemical characteristics of the waste.

4.2.3.3 Sampling Accuracy

Develop plans to achieve the greatest possible degree of accuracy. Accomplish this by using random sampling techniques described in Section 4.2.4.1. Random sampling is designed to minimize bias in the selection of sample locations by giving each location (e.g., within and among containers in the waste inventory) an equal chance of being sampled. Likewise, laboratory preparation and analytical methods should be chosen to minimize bias.

4.2.3.4 Sampling Precision

It must be demonstrated in the plan how sample precision will be met. Sampling precision can be improved by increasing the number of samples, increasing the actual volume of the samples, or by dividing a population into appropriate strata prior to sampling. The choice of laboratory methods should also reflect the need to meet the required level of precision. Section 4.2 describes methods for increasing sample precision.

4.2.3.5 Method Detection Limit

Analytical instruments used for testing samples must have sufficient sensitivity to detect analytes within that matrix at regulatory or other specified levels. The RCRA LDR treatment levels may be particularly difficult to detect because they are generally in the very low ppm range. For example, an analyte may be

detected in water when present at 0.05 ppm, but may not be detectable at the same concentration in a semisolid matrix such as sludge.

Data quality objectives may dictate the analytical method utilized. If the method detection limit cannot detect analytes at regulatory or other required levels for the waste matrix, the analytical results are not valid. Chapter One-16 of SW-846 provides information on determining the method detection limit for a specific waste matrix.

4.2.3.6 Completeness

An evaluation of completeness must be included in this plan. Completeness is a data quality indicator that is defined as the amount of collected and valid data compared to the planned amount. That is, the amount of validated data available for submission to the decision maker is compared to the amount defined in the sampling and analytical plan. Completeness is usually presented in percentages.

4.2.3.7 Comparability

Comparability is a quality indicator that is defined as the degree to which data sets can be considered similar and comparable. When necessary, comparability must be addressed in the plan. Comparability often becomes an issue when data sets are generated from samples collected at different times or places; when they are analyzed by different labs, by different methods, or by similar methods with different method detection limits; whenever samples are collected, handled, or analyzed differently; or whenever data are manipulated differently.

4.2.4 Site Selection and Sampling Procedures

Describe in this section, sampling strategies and procedures that will be used to increase the probability that samples will be representative throughout the waste inventory. Also describe the rationale used to determine the suitability of one sample site over another.

4.2.4.1 Sampling Approach

Describe in detail the sampling approach to be used for the sampling strategy. The selection of an appropriate sampling site and strategy is largely dependent on the uniformity (or variability) of the waste matrix. For example, if the waste is homogeneous (i.e., the chemical and physical properties of the waste are uniform and do not change over time), one or two grab samples may be representative of the waste stream. However, most waste streams from DOE operations are heterogenous and require a sampling strategy accounting for variability in the waste.

The random sampling procedures described in this section minimize sampling bias and increase the probability that samples will be representative of the waste inventory. Random sampling is used to designate sampling locations.

Random sampling procedures are difficult to implement when the waste consists of heterogenous components such as bricks, wood, glass, and other debris. There is no universally accepted method for sampling extremely heterogenous waste; however, this section provides information to assist generators in developing random sampling strategies for heterogeneous waste.

For more information on sampling approaches, consult Statistical Methods for Environmental Pollution Monitoring, by Richard O. Gilbert, 1987; and Methods for Evaluating the Attainment of Cleanup Standards, Vol. I, Soils and Solid Media, EPA/230-02-89-042, Feb. 1989, NTIS #PB89-23-4959.

4.2.4.1.1 Simple Random Sampling

In random sampling, each container or unit (elements of a grid) has an equal chance of being sampled. A simple random sampling strategy is appropriate when process knowledge or existing data suggest that the chemical properties of the waste are not significantly different over time and space and there is no obvious stratification of the waste.

There are several ways random sampling can be used to identify which containers or units should be sampled. The first method involves assigning sequential numbers to each container and using a random number table or a

computer program to identify the units to be sampled. The second method involves using an imaginary grid to divide the waste inventory. Consecutive numbers are assigned to each of the units in the grid. The numbers of the units to be sampled are selected from the random number table.

Generators must demonstrate that procedures are in place to track each random number selected to a specific package identification number. Standard operating procedures (SOPs) for sample selection or a summary table with the required information can be included in the plan. Section 4.2.4.2 provides information on determining the appropriate number of containers or units to sample.

4.2.4.1.2 Stratified Random Sampling

Stratified random sampling is appropriate when process knowledge or existing data suggest that the waste can be divided into different categories (or strata) which are similar in composition. Stratified random sampling requires random sampling of each strata, which results in a more precise estimate of the mean concentration of a selected constituent. The mean concentration of a constituent is used in statistical calculations, as described in SW-846, to determine if a waste is hazardous.

Stratified random sampling is most effective in reducing uncertainty when enough is known about the waste to minimize variability within each strata. Existing analytical data and process knowledge can be used to stratify the waste so that similar materials are grouped together. The following are examples of criteria that can be used to select strata:

1) Physical characteristics.
2) Chemical properties.
3) Date of generation.
4) Process or place of generation.
5) Treatability of the waste (i.e., waste that will be treated by the same process).
6) Analytical method (e.g., waste that will be analyzed for the same analytes).

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If there is insufficient information to justify one particular stratification technique, the waste can be divided into equal-sized strata arbitrarily to ensure that random samples are appropriately dispersed among the entire population. This is advantageous when the sample population is large (e.g., thousands of drums).

Containers in each strata should be identified and sampled using the method described for simple random sampling.

4.2.4.1.3 Systematic Random Sampling

In systematic random sampling, the first unit to be sampled is chosen using the random selection method. All other units to be sampled are selected in fixed intervals. For example, if the total population consists of 50 homogenous waste packages, a starting point is selected and the remaining drums are selected at a designated interval, such as every other drum, or every third drum, and so on. The procedures for simple random sampling should be followed for selecting sampling locations.

This method may be easier to implement than other random sampling methods. However, it may be helpful to consult a statistician because systematic random sampling may be subject to error if there is a potential for cyclical variability of the waste stream.

4.2.4.2 Number Of Samples

Explain the approach used to determine the number of samples that will be collected during the sampling effort. Generators must explain how the approach will ensure that the sampling effort will meet the project data quality objectives (see Section 4.2.3).

This section presents some approaches that are frequently used to determine the appropriate number of samples that should be collected to obtain a representative sample of the waste. It attempts to describe complex statistical concepts in a manner that is understandable to a person who is not familiar with statistics. Detailed information on the mathematical calculations needed to conduct these analyses is provided in Chapter Nine of SW-846. DOE/NV

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strongly suggests that generators who use statistics consult with a statistician for assistance in developing a sampling approach.

Statistical methods require information about the mean concentration of the analyte(s) to be measured in the waste, the standard deviation, and the applicable regulatory level for the analyte. Existing data can be used to obtain this information or to perform some preliminary analyses to obtain it.

The mean represents the average concentration of the analyte in the waste. For example, if four samples are analyzed for an analyte and the concentrations in the samples are 2.0, 3.0, 4.0, and 7.0 ppm, the mean is 4.0 ppm. The greater the number of samples analyzed, the more precisely the mean will represent the group of samples.

The standard error (or standard deviation of the mean) provides information about the variability of the mean [refer to Equation (5) in Chapter Nine of SW-846]. The standard error and the desired level of confidence are used to calculate the interval in which the mean will lie [refer to Equation (6) in Chapter Nine of SW-846]. This interval is used to determine if a waste is hazardous or nonhazardous.

For example, consider the case when the mean concentration of analyte x, for a set of 10 waste samples is 3.5 ppm, the standard error is + 1.2, and the student "t" value is 1.383. Under this scenario, there is an 80 percent confidence level (when a normal distribution and no bias are assumed), that the true mean is between 1.84 and 5.16 ppm. [It is important to note that an 80 percent confidence limit for a two-sided statistical test is equivalent to a 90 percent confident limit for a single-sided statistical test.] However, in order to determine if the mean waste concentration exceeds the RCRA threshold for the analyte, it is only the upper end of the interval (known as the upper confidence interval) that would be compared to the RCRA threshold. If the regulatory threshold for a hypothetical analyte was 10 ppm, the upper confidence interval of 5.16 would be well below the regulatory threshold and the waste would be deemed nonhazardous with respect to this analyte. If the upper confidence level was equal to or greater than the regulatory threshold, the waste would be deemed hazardous.

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In some cases, the upper confidence level is close to the regulatory threshold. More samples would be required to decrease the uncertainty. Equation (8) in SW-846 should be used to determine the number of additional samples needed. If the upper confidence level is four standard deviations less than the regulatory level, additional sampling is not needed.

4.2.4.2.1 Use Of SW-846 Equation (8)

Equation (8) should be used to calculate the appropriate number of samples needed to achieve the desired confidence limit. Proper use of Equation (8) requires preliminary estimates of the mean and standard deviation and knowledge of the regulatory threshold for the analytes being investigated.

If data are available for the waste stream, Equation (8) can be used to determine whether additional samples are needed. If no data are available, conduct preliminary sampling and analysis using a limited number of samples to estimate the mean and variance, then use Equation (8) to calculate the appropriate number of samples that will be needed to characterize the waste.

4.2.4.2.2 Other Methods

There are other options for determining the number of samples that should be collected. These methods have been used by DOE and EPA for numerous types of containerized waste. Each generator should evaluate these methods and determine which method is best for their specific waste type and sampling plan objectives which have been previously identified.

One available option is to sample 10 percent of the waste. This approach often results in the collection of large numbers of samples and, therefore, may not be cost-effective. Equation (8) may be used for verification purposes.

Another option is to separate the waste into strata and collect a number of samples in each strata equal to or greater than the cube root. The cube root approach must be used in conjunction with Equation (8) of SW-846 to ensure that enough samples will be collected to make a decision within the 90 percent confidence limit.

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4.2.4.3 Sample Volume

The sampling and analysis plan must specify the sample volume required for each analytical method that will be performed. The sample size must be large enough for all analyses, including spikes and duplicates. For example, the Toxicity Characteristic Leaching Procedure (TCLP) requires 100 grams of sample for the nonvolatile analysis, an additional 25 grams for the volatile analysis, and additional samples for the TCLP matrix evaluation. Enough sample must be collected for the method and for quality control analyses.

4.2.4.4 Compositing

If applicable, describe the rationale and methods for compositing samples. Compositing of samples involves combining samples or aliquots of samples of the same waste. For example, four vertical core samples are obtained from one drum; these component samples (or aliquots of each component sample) may be combined to represent the contents of the drum. To ensure that the composite is representative of the waste, an equal amount of each sample must be combined and then the composite must be homogenized.

Compositing should be performed in the laboratory, not in the field. The major reasons are that 1) laboratories have better equipment to composite and homogenize waste, 2) remaining portions of composite samples can be recomposited if problems occur during analysis, and 3) component samples can be analyzed separately to verify results achieved during composite sampling.

> **Note:** Samples that will be analyzed for volatile organics should not be composited.

4.2.4.5 Selection Of Sampling Equipment

The sampling and analysis plan must include a list of equipment that will be used in the sampling effort. The list should include health and safety equipment, sampling equipment (i.e., containers and devices), field test equipment, forms and office supplies (such as labels, shipping and chain-of-custody forms, pens, and tape), and other items that will be used in the field.

Each generator should choose sampling equipment appropriate for the physical form of the waste and the properties of the analytes being investigated.

Some of the factors to consider when choosing appropriate sample containers are:

1) potential adsorption of the analyte of interest on the container,
2) leaching of contaminants from the container into the sample,
3) loss of volatile analytes,
4) break and leak-resistance, and
5) size (must be large enough to hold the required sample volume).

The mouth of the container must be wide enough to facilitate transfer of the waste from the sampling device into the container.

Glass and plastic sample containers are commercially available. Glass containers (with teflon-lined lids) are required for samples that will be analyzed for organic components. They also can be used for sampling most inert wastes. Acidic or alkaline samples, however, should be placed in plastic containers. SW-846 specifies the appropriate type of container for each analyte that will be measured.

To choose an appropriate sampling device, consider the following factors:

1) Hazards associated with using the equipment,
2) Sample volume required,
3) Potential for cross-contamination among samples,
4) Ease of use and cleaning, and
5) Physical form of the waste.

For liquid waste samples, the following types of samplers can be used: 1) Coliwasa, 2) Dipper, and 3) Weighted Bottle.

The following devices are used to sample solid waste and soil-like materials: 1) Thief; 2) Trier; 3) Scoops and Shovels; 4) Auger; 5) Veihmeyer Soil Sampler; and 6) Drills, Sledge Hammers, or other Coring Tools. For further information on the above-listed sampling equipment, refer to SW-846.

4.2.4.6 Sample Handling

The sampling and analysis plan must include procedures for handling samples from the time they are collected in the field until they arrive at the laboratory for testing. The plan shall address sample preservation, holding time requirements, shipping of samples, chain-of-custody, and other applicable handling methods. SOPs shall be included as an attachment or in the appendices to the plan.

The following information will assist generators in determining which procedures for sample handling must be included in their sampling and analysis plan.

4.2.4.6.1 Sample Preservation

Samples must be stored or preserved so significant changes in the chemical and physical properties will not occur. Waste samples that will be analyzed for organic, inorganic, or metal analytes must be kept cool at 4° C.

Consult SW-846 for specific information regarding the preservation of waste samples.

4.2.4.6.2 Holding Times

The sampling and analysis plan must identify appropriate holding times for analytes that will be measured. Holding times are particularly important to minimize volatilization or loss of analytes that will be evaluated. If holding times are exceeded, the analytical data can only be used to prove that a waste is hazardous and cannot be used to prove that a waste is nonhazardous.

4.2.4.6.3 Shipping

Deliver to the analytical laboratory as soon as possible after collection. Sample analysis request forms (see Section 4.2.5.4) and chain-of-custody records and forms (see Section 4.2.5.3) must accompany the samples.

Generators must ensure that materials that are listed in the DOT Hazardous Materials Table are shipped according to the specified DOT requirements in

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49 CFR 172.101. Other samples may be shipped according to the requirements in SW-846. These requirements are summarized below:

1) Solid samples plus containers should not exceed 1 lb.
2) Overpack volatile organic samples into larger containers.
3) Place samples in plastic bags (4-mil thick) and place each bag inside a metal can.
4) Mark can as required in SW-846 and place in cooler.
5) Label shipping papers and outside container as required in SW-846.

4.2.4.7 Field Quality Control

Quality control procedures in the field are used to document the accuracy and precision of sampling methods. Quality control samples must accompany each set of samples. These generally include a trip blank, a field blank, and a field duplicate. Blanks are used to detect and measure the introduction of outside contaminants into samples. Duplicates are necessary to estimate the level of imprecision associated with sampling and analytical procedures. Additional types of quality control samples may be needed to achieve project-specific data quality objectives.

SOPs for addressing the following quality control requirements shall be included in the sampling and analysis plan.

4.2.4.7.1 Trip Blanks

A trip blank must be transported unopened from the laboratory to the sampling site and is then returned to the laboratory with each set of samples. For example, if a set of samples is transported from the sampling site in a cooler, a trip blank is placed in the cooler. The trip blank is included to document any contamination that may be attributable to shipping and handling of the sample containers. The blank is generally an analyte-free media such as distilled water.

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4.2.4.7.2 Field Blanks

The purpose of a field blank is to detect any contamination from sampling equipment, cross contamination from previously collected samples, or contamination from conditions during sampling. Field blanks are often metal and/or organic-free water aliquots that contact sampling equipment and should be collected at specified frequencies according to the probability of contamination.

4.2.4.7.3 Field Duplicates

The field duplicate is used to document the precision of sampling and analytical procedures. This precision will be influenced by variance in waste composition, variance of the sampling technique, and the variance in the analytical technique. For each waste stream sampled, make one field duplicate for each set of samples. For example, if several drums are sampled, at least one drum should be sampled in duplicate. The sample and its field duplicate are two samples taken from the same source and analyzed separately.

4.2.5 Documentation and Sample Custody

Provide sample custody and documentation procedures. Data cannot be considered defensible without documented sample custody procedures. Chain-of-custody ensures that the sample is traceable from the time it is collected through laboratory analysis. It is used to track the movement of samples and ensure scientific credibility and legal defensibility of the data obtained. DOE/NV will not approve generator sampling and analysis plans if sample custody SOPs are not included.

The following sections will assist generators in preparing sample custody operating procedures.

4.2.5.1 Labels and Seals

A gummed paper label or tag must be affixed to the sample container before or during the sampling effort. The label should include, at a minimum, the following information: sample number, name of collector, date and time of

collection, place of collection, and package identification number where applicable or place from the grid.

Seal the sample container at the time of collection, before the sample leaves the custody of sampling personnel. The seal must be affixed in such a way that it must be broken to open the container. The seal should include at least the following information: sample number (which must be identical with the number on the sample label), name of collector, date and time of collection, and place of collection.

4.2.5.2 Logbooks

A logbook must be kept to record all information pertinent to the collection of samples in the field. The information should be comprehensive enough so that the sampling activity could be reconstructed without relying on the memory of the collectors. The logbook entry must be written in ink, dated, and signed by the person responsible for the sampling procedure. Entries must be kept in chronological order, preferably in a bound book with consecutively numbered pages. Corrections and additions must be dated and initialed. No information should be entirely obliterated or rendered unreadable.

The information in each logbook entry must include, but does not need to be limited to, the following: location and description of place of sampling, purpose of sampling, name and address of field contact, producer of waste and address (if different location), type of process producing waste (if known), type of waste, suspected waste composition (including concentrations), sampling methodology, number and volume of samples taken, sample identification number, sample destination and how transported (e.g., name of laboratory, UPS, Federal Express), field measurements (e.g., pH, flammability, explosivity), and field observations and any other information concerning the sampling site (e.g., maps, photographs).

4.2.5.3 Chain-of-Custody Records

A chain-of-custody record must accompany the sample as a verification of each stage of the sampling operation from the time of collection to the final disposition. A sample is considered under custody if it is in your possession, or

it is in your view after being in your possession; or you have locked it up, or you have put it in a designated secure area, accessible only to authorized personnel. The chain-of-custody record must contain at least the following information: sample number, date, time and place of collection, type of waste, signature of collector, and signatures of all persons involved in the chain of possession and inclusive dates of their possession.

4.2.5.4 Analysis Request Sheets

A sample analysis request sheet must accompany the sample when it is delivered to the laboratory for analysis. The field portion of the form must be completed by the sample collector, and must include the information relevant to the sample as noted in the logbook. The laboratory portion of the form must be filled out by the laboratory personnel. It must include at least the following information: name of person receiving the sample, date and time of sample receipt, laboratory sample number, sample allocation, and analyses to be performed on the sample.

The sample, accompanied by its chain-of-custody record and analysis request sheet, must be delivered to the person in the laboratory who is authorized to receive samples. The delivery should take place as soon as practicable, usually within one to two days following the sample collection.

4.2.6 Analysis of Waste Samples

Each generator must identify the laboratory that will analyze the samples. All analytical results included in the sampling and analysis plan must be documented in an analytical report. See NVO-325, Laboratory Reference Document (NVO-325LRD) for standardized data reporting forms.

4.2.6.1 Waste Analysis Parameters and Methods

The project objectives identified early in the sampling and analysis plan will indicate which parameters need to be monitored. Generators must include a discussion of each parameter that will be measured and provide a rationale for selecting the parameter.

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Sections 4.2.6.1.1 through 4.2.6.1.3 provides information for selecting appropriate analytical methods for evaluating waste samples.

4.2.6.1.1 Radioactive Components

Describe the methods used to evaluate the radionuclides in the waste samples to ensure compliance with the requirements in NVO-325. Some of the tests that are used for isotopic analyses are gamma spectroscopy, alpha spectroscopy, fluorimetry, liquid scintillation, alpha counting, beta counting, and thermal ionization mass spectroscopy.

4.2.6.1.2 RCRA Hazardous Constituents

The sampling and analysis plan must have a list of analyses that will be conducted to fully characterize the waste and ensure that RCRA constituents are not present (or that mixed waste meets the LDR levels). The method detection limit for each test method must be included.

The TCLP is an analytical method which is used to evaluate whether a waste exceeds specified RCRA levels for toxicity. Waste exceeding these levels is hazardous waste (or mixed waste) and must be managed according to the RCRA or state-of-generation hazardous waste regulations. Other methods are used to evaluate whether waste exhibits a hazardous characteristic of ignitability, corrosivity, or reactivity. The TCLP is also used to determine if mixed waste meets the applicable LDR threshold limits.

Waste can also be hazardous if it meets the listing descriptions in 40 CFR 261.31, 32, or 33. The listings include specific waste from industrial processes; generic process wastes such as solvents, and the unused portion of commercial chemical products. Evaluating whether a waste is listed does not always require testing. In most cases, process knowledge will provide sufficient information to determine if the waste is a listed industrial process waste.

The spent solvent listings (i.e., F001-F005) are unique because only certain uses are covered in the listing. The presence of one or more of the listed solvents in the waste sample does not necessarily mean that the waste is hazardous (i.e., an F001-F005 solvent). Solvents and certain solvent mixtures that were used for degreasing, cleaning, or other solvent uses meet the listing

description; other solvent uses do not. If solvents were used as described above, and they are present in the waste, the waste is hazardous and testing is required to determine compliance with the Land Disposal Restrictions (LDR).

The unused portion of listed commercial chemical products (and contaminated waste) is also RCRA hazardous waste. If one or more of these chemicals is known to be or is detected in waste samples, use process knowledge to determine whether the waste comprises or contains unused commercial chemical products.

The following methods are described in Appendix I of 40 CFR 261 and SW-846 and are used to evaluate RCRA status:

Methods Used

Parameter	Test Methods
Ignitability	EPA Method 1010 or 1020
Reactivity	Described in 40 CFR 261.23, Para #7.3.3.2 and 7.3.4.3
Corrosivity	EPA Method 9040
Toxicity Characteristic	EPA Method 1311 - Toxicity Characteristic Leaching Procedure, see 40 CFR 261.24 (TC)
LDR solvents	TCLP (F001-F005)
LDR halogenated organic compounds	EPA Method 9020
Cyanides	EPA Method 9010 or 9012
Sulfides	EPA Method 9030

Screening Methods

It generally is not cost-effective to use the TCLP to detect the presence of RCRA constituents. Begin by using the methods listed below to detect and measure the total concentration of organic and inorganic constituents in the waste sample.

Parameter		Test Method
Organics	1)	Gas Chromatographic Methods: EPA Methods 8010, 8015, 8020, 8030, 8040, 8060, 8080, 8090, 8120, 8140, 8150
	2)	Gas Chromatographic/Mass Spectroscopy: EPA Methods 8240, 8250, 8270, 8280
	3)	High Performance Liquid Chromatographic Methods - EPA Method 8310
Inorganics/Metals	1)	Atomic Absorption Spectroscopy (AAS methods listed in 40 CFR 261, Appendix III, Table 3
	2)	Inductively Coupled Plasma-Atomic Emission Spectroscopy (ICPES).

Once this information is obtained, the TCLP can be used to evaluate analytes that exceeded regulatory levels. Analytes with total concentrations below regulatory levels do not require further analysis.

4.2.6.1.3 Other NVO-325 Waste Acceptance Requirements

Identify the analytical methods that will be used to ensure that free liquids are not present in the waste, and that Polychlorinated Biphenyls (PCBs) do not exceed the applicable limits identified in NVO-325.

Methods Used

The following test methods should be used:

Parameter	Test Method
Free Liquids	EPA Method 9095, Paint Filter Liquids Test
PCBs	EPA Method 8080

4.2.7 Analytical Quality Control

Quality control procedures must be described in the sampling and analysis plan. Also include a copy of quality control SOPs.

Quality control procedures are used to document the accuracy and precision of sampling and specific analytical methods. The accuracy of these methods indicates the quality of the data derived from the analysis. A quality control program will also identify areas that need improved monitoring or changes in the operating methods to make the analytical system more reliable.

Implementation of a quality control program for the analysis of waste samples generally involves analysis of blank, spiked, and duplicate samples. The quality control samples must be analyzed with every analytical batch or with at least 1 of every 20 samples, whichever results in the greater number of quality control samples. Examples of quality control samples used to evaluate the accuracy and precision of the analytical system are described in Sections 4.2.7.1 through 4.2.7.6. Additional project-specific quality control samples may be included in each analytical batch as needed to achieve project-specific data quality objectives.

4.2.7.1 Method Blank/Reagent Blank

Use a method or reagent blank to detect possible contamination resulting from the preparation or processing of the sample. This blank is carried through the complete sample preparation procedure and is usually an organic or aqueous solution that is free of the analyte but contains all the reagents in the same volume as used in the processing of the samples.

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4.2.7.2 Matrix Spikes

Use a matrix-spiked sample which measures, to a certain degree, the accuracy of an analytical method used in a given matrix. A sample is spiked with a known concentration of the target analyte prior to sample analysis.

4.2.7.3 Matrix-Spike Duplicates

Use matrix-spike duplicates to determine the precision of organic samples. Matrix-spike duplicates are split samples spiked with identical concentrations of target analytes.

4.2.7.4 Matrix Duplicates

Use matrix duplicates to determine the precision of inorganic samples. Matrix duplicates are split samples used to document the precision of a method in a given sample matrix.

4.2.7.5 Surrogate Spikes

The purpose of a surrogate spike is to monitor the efficiency of the preparation and analysis of samples. A surrogate is an organic compound that is chemically similar to a contaminant of interest but is not normally found in the waste. Use surrogates spiked into blanks and samples prior to the analysis, and report percent recoveries calculated for each surrogate.

4.2.7.6 Laboratory Control Sample

A laboratory control sample is a standardized sample prepared independently from the test samples. Use a known matrix with compounds representative of the target analytes to check laboratory technique, methodology, and standards.

4.3 Analytical Requirements

Data submitted to the NTS in support of waste characterization must be sufficiently detailed and accompanied by adequate quality assurance to permit

validation of the data. This section provides guidance for laboratory selection and outlines the minimum requirements for quality assurance and delivery of data to the NTS. The reference document, NVO-325LRD, mentioned in the following sections includes 1) Standardized Data Reporting Forms for organics, inorganics, and radioanalysis; 2) Performance Evaluation Sample Sources and Round-Robin Evaluation Programs; and 3) Laboratory Audit Checklists and Audit Plates.

4.3.1 Defining Analytical Requirements

The first step in selecting a laboratory is to clearly define the analytical needs of the waste generator and what is expected of the laboratory. Begin by preparing a written document listing the types of analyses required and what analytical methods are to be used. Explicitly state what quality assurance the laboratory must meet. For chemical analysis, the applicable SW-846 method QA requirements must be met. Describe the exact format for the reporting of data and the accompanying quality assurance by using the forms in the NVO-325LRD. Special requirements which are not normally part of the method protocols should be noted (e.g., turnaround time for data, special holding time, or preservation requirements).

4.3.2 Qualifying The Laboratory

Once the analytical needs have been defined, the second step is to find laboratories which can perform the analytical work at acceptable standards. It is strongly recommended that both a primary and secondary laboratory be selected so that if problems develop with the primary laboratory, an alternate laboratory is available.

Begin by soliciting information from the laboratory. There are a number of ways to gauge the ability of a laboratory. The laboratory may be a holder of state and federal certifications for the type of analyses required. The laboratory should be a participant in radiochemical and organic/inorganic round-robin performance evaluation programs. Several nationally recognized programs which can be used are listed in the NVO-325LRD. Performance in these programs is a good guide to laboratory quality. Ask the laboratory about their participation in these

programs and have them provide results of their performance over several years. Length of participation by individual laboratories may vary. While the laboratory should provide evidence of past achievement on performance evaluations, it is best to verify the information with the evaluation source when possible [e.g., for EPA/Environmental Monitoring Laboratory (EML) and CLP, contact EPA/Environmental Monitoring Systems Laboratory - Las Vegas (EMSL-LV) at 702-798-2113]. Avoid using a laboratory that does not participate in these programs or which has a poor performance record, particularly if inadequate in the analytical areas needed for a contract laboratory. Obtain copies of the laboratory Quality Assurance Manual, a facility and equipment list, and resumes and training records for those personnel assigned to do the analytical work. The waste generator must review these items to demonstrate that the laboratory is capable of performing the analyses requested and handling the number of samples expected.

Award of a contract (or selection of an on-site laboratory) should be made contingent on successful completion of an audit (on-site evaluation) of the laboratory facility by the waste generator. Prepare a written audit plan before visiting the laboratory. Example audit plates for radiochemical, organic, and inorganic laboratory facilities are shown in the NVO-325LRD. The audit should include a review of laboratory facilities and personnel, (SOPs), QA program implementation, and a laboratory operations review.

4.3.3 Laboratory Performance Monitoring

Once a laboratory is under contract, the performance of the laboratory must be monitored over the life of the contract to ensure that the analytical laboratory continues to be capable of providing acceptable data. The waste generator must perform timely reviews of laboratory performance on round-robin performance evaluations, create control charts based upon the laboratory's adherence to the quality assurance requirements of each method, and review laboratory performance on blind and duplicate samples. The generator must audit the laboratory annually.

4.3.4 Standardized Data Reporting Forms

The reason for specifying Standardized Data Reporting Forms is to force the laboratory to submit sufficient quality assurance information to allow DOE/NV to perform data validation. Since the reporting format for the Contract Laboratory Program (CLP) is compatible with the requirements of the SW-846 methods for the analysis of the RCRA organic and inorganic constituents, modified CLP forms are to be used. These forms have been modified such that entries that are specific to the CLP and, which have no counterpart in SW-846, have been deleted. The reporting format for radiochemical results has been derived from the forms used for the DOE Environmental Monitoring Program, predecessor to the current Environmental Restoration Program. Example copies of the forms are shown in the NVO-325LRD. The laboratory may also submit computer-generated CLP forms using manufacturer's instrument software. The generators are strongly urged to obtain the organic and inorganic data on floppy disks and in EPA format so that automated data validation can be performed on the data by DOE/NV.

Note: Use of floppy disks will expedite application review.

4.3.5 Documentation to be Provided in Application

A. Requirements document described in Section 4.3.1.

B. Waste Characterization Data Sheet (see Figure 4, pages 48 & 49 and refer to Appendix B for instructions) with Standardized Data Reporting Forms (see NVO-325, Laboratory Reference Document).

4.3.6 Documentation to be Provided for Audit Review

A. Copies of state and federal certificates (if available).

B. Results from participation in round-robin or other performance evaluation programs.

C. Audit plate, results of audit, and resolution of findings.

D. Laboratory facility and equipment list.

E. Results from submission of blind samples provided to the laboratory from the waste generator.

F. Laboratory personnel resumes and training records.

G. Identification of laboratory personnel by job classification.

H. Identification of laboratory personnel responsible for checking the data package for completeness and accuracy.

I. Laboratory QA manual or project specific QA manual.

J. Copy of laboratory contract exclusive of cost information.

K. Laboratory QA Control Charts.

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Figure 4 Page 1 of Waste Stream Characterization Data Sheet

Waste Stream Characterization Data Sheet

1. Waste Stream No.: _ _ _ _ - _ _ _ _ _ _ _ _ _ _

2. Waste Description:

   a. Physical Characteristics: _____

   _____

   _____

   b. Special Handling/Disposal Requirements: _____

   _____

   _____

3. Basis for Characterization:

   a. Process Knowledge: ____ b. Analytical Knowledge: ____

   c. Both: ____

   If B or C, provide Standardized Data Reporting Forms as necessary.

4. Radioactive Characteristics:

   a. Is Waste > NRC Class-C (see Title 10 CFR 61.55) ?: _____

   b. WMIS Nuclide Category (circle): 1 2 3 4 5 NA 7 8

   (Choose the highest predominate nuclide. The number 6 is not an option.)

   c. Radioactive Constituents:

   Specific Activity Range of Waste Stream

	Nuclide	Chemical Forms	Low	Mean	High	Units (Ci/kg)
(1)						
(2)						
(3)						
(4)						

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Figure 4 Page 2 of Waste Stream Characterization Data Sheet

Waste Stream Characterization Data Sheet

5. Hazardous Components (for MW):

   a. Basis for Identifying as MW (circle): (1) Ignitable (2) Reactive (3) Corrosive (4) TCLP (5) Listed Waste

   b. List the applicable EPA waste code, the chemical name, the treatment performed (if applicable) and the Regulatory/Treatment Standard. Attach Standardized Data Forms.

EPA Hazardous Waste No.	Chemical Name	Treatment Performed	Regulatory Threshold/Treatment Standard
(1)			
(2)			
(3)			
(4)			

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5.0 Waste Stream Information

The generator shall provide the following information for each waste stream as explained in the sections below. Where multiple waste streams are addressed, the information shall be organized by waste stream in separate subsections.

5.1 Waste Stream Identification Number

List a unique 13-character alphanumeric code which identifies generator and generator's waste stream code. The intent of this number is to clearly identify the waste generator and to separate waste streams (see Appendix B).

Note: The waste stream identification number must be unique to the identity of the waste stream. Changes in identity will require a new waste stream identification number.

5.2 Waste Type

Identify the waste type as LLW, MW, TRU or TRUMW.

5.3 Waste Description

Briefly describe the waste generation process, treatment, and final form.

5.4 Waste Certification Flow Diagram

Waste certification flow diagrams are discussed in Appendix C, Item 1, "Organization." The following is a list of items that, at a minimum, the generator shall provide in a detailed waste flow diagram for each waste stream. Indicate each step the waste follows from point-of-generation to disposal

(e.g., identification, characterization, packaging, labeling and marking, and shipping, etc):

- Indicate hold points illustrated in Figure 5, page 52.
- Indicate points where the quality activities of inspection and surveillances are performed.
- Indicate points where the waste certification official and/or package certifier perform certification activities.
- Indicate where nonconformances are addressed.
- Indicate each functional group responsible for the waste stream activities. Clarify operational, oversight, and waste certification groups.

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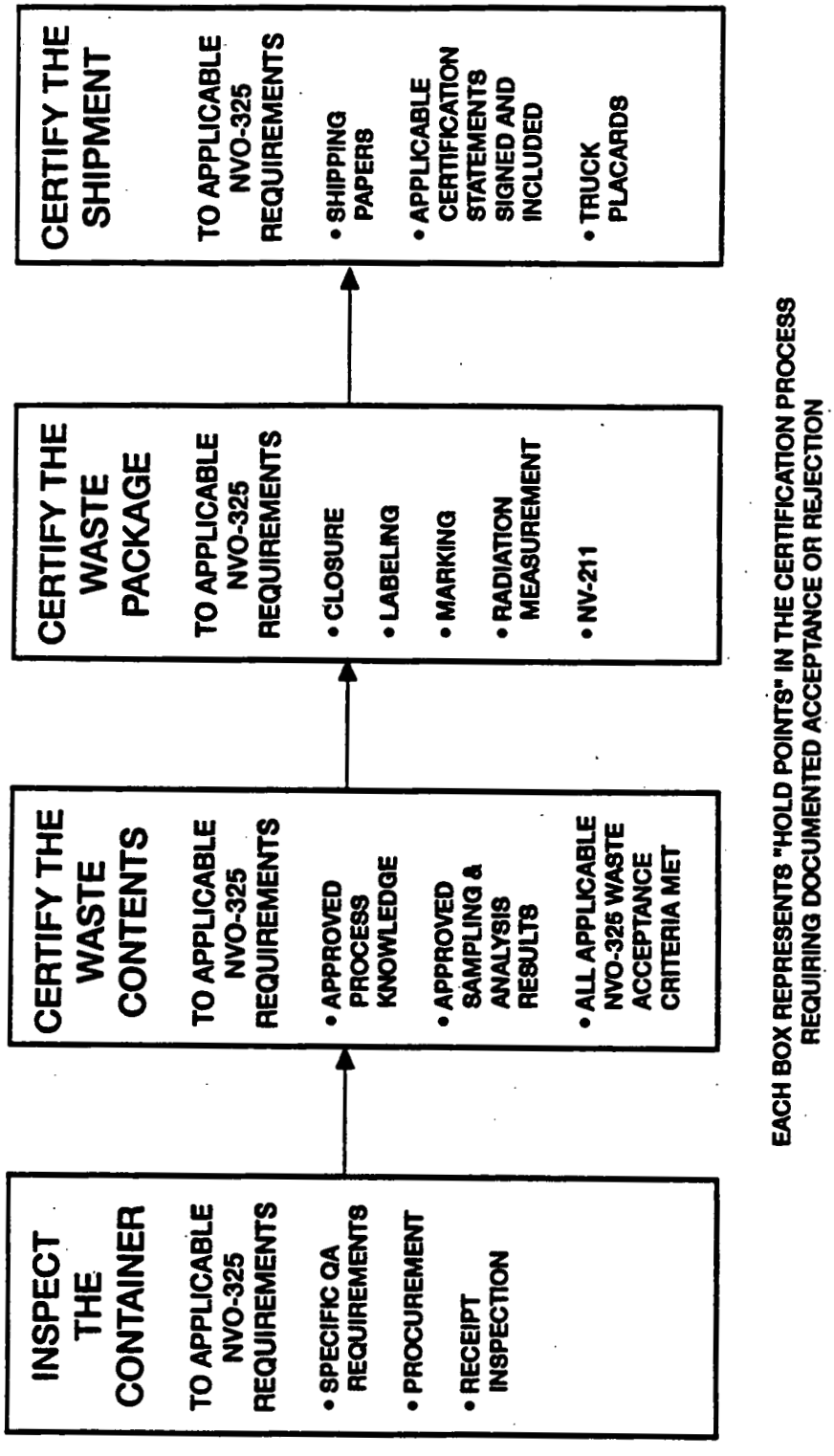
Figure 5 Waste Certification Hold Point Diagram



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5.5 Waste Acceptance Criteria Statements

Address each of the following waste acceptance criteria (WAC). Provide a brief statement of the NVO-325 criteria objective. State the regulatory or other reference(s) as provided in the WAC and provide a brief discussion of how each waste stream will comply with the individual criteria. In addition, where compliance is procedurally controlled, reference the applicable procedure(s). For example:

1) **Closure:** The package closure shall be sturdy enough that it will not be breached under normal handling conditions and will not serve as a weak point for package failure (per NVO-325, 5.5.1.3.A).

   Compliance Method: Waste containers shall be closed with metal clips and banding, per procedure XXXX, to prevent breaching under normal handling conditions.

2) **Free Liquids:** LLW disposed at the NTS waste management sites shall contain as little free liquids as is reasonably achievable, but in no case shall the liquid equal or exceed 0.5 percent by volume of the external waste container (per NVO-325, 5.5.1.1.C).

   Compliance Method: This criteria is evaluated by process knowledge, waste segregation, visual verification, and evaluation of the waste stream (e.g., contaminated soil) utilizing the Paint Filter Test, per procedure XXXX, XXXX, and XXXX. Absorbent will be added, per procedure XXXX, as a precautionary measure to absorb any moisture that may form due to condensation attributed to the variations in temperature and humidity from state-of-generation to NTS. Packages will also be reviewed by Real-Time Radiography (RTR) prior to package certification. Any packages suspected of having greater that 0.5 percent free liquids will be segregated and marked to prevent inadvertent shipment to NTS.

5.5.1 Low-level Waste Acceptance Criteria

Defense waste accepted at NTS must be radioactive and meet the waste form criteria outlined below. These requirements are minimum requirements for all

types of wastes and are intended to facilitate handling and provide health and safety protection of personnel at the disposal site.

5.5.1.1 General Waste Form Criteria

These waste form criteria are based on current DOE LLW management policies and practices per DOE Order 5820.2A guidelines. Any waste streams not meeting these basic requirements must be evaluated on a case-by-case basis and must not compromise the performance objectives for the disposal site or violate any permit requirements.

A. **Transuranics:** LLW must have a transuranic nuclide concentration less than 100 nCi/g. The mass of the waste container, including shielding, shall not be used in calculating the specific activity of the waste.

B. **Hazardous Waste Components:** LLW offered for disposal at NTS waste management sites shall not exhibit any characteristics of, or be listed as, hazardous waste as identified in Title 40 CFR 261, "Identification and Listing of Hazardous Waste" or state-of-generation hazardous waste regulations.

C. **Free Liquids:** Free liquids mean liquids which readily separate from the solid portion of a waste under ambient temperature and pressure conditions.

   LLW disposed at the NTS waste management sites shall contain as little free liquids as is reasonably achievable, but in no case shall the liquid equal or exceed 0.5 percent by volume of the external waste container and shall meet the following criteria:

   - Bottles, cans, or other similar well-drained containers may contain residual liquids.
   - Where practicable, residual liquids in well-drained containers shall be mixed with absorbent or solidified so that free liquids are no longer observed.

- If absorbent materials are added to a waste for control of free liquids, the generator must calculate the volume of liquid in the waste and use a quantity of sorbent material sufficient to absorb a minimum of twice the calculated volume of the liquid. Please note when significant differences of temperature exist between the generating site and the disposing site, provisions for additional absorbent materials must be made for affected waste forms.
- To demonstrate compliance with the free liquids requirement, the generator may be required to use Method 9095 (Paint Filter Test) as described in "Test Methods For Evaluating Solid Wastes, Physical/Chemical Methods." (EPA Publication No. SW-846) The Paint Filter Test may not be applicable to certain waste forms; e.g., concrete. If the generator determines that the waste form is not conducive to the Paint Filter Test, documentation must be provided to substantiate the claim.

D. 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 particulate form or in a form that could mechanically or chemically be transformed to a particulate during handling and interim storage shall be immobilized.

When immobilization is impractical, other acceptable waste packaging shall be used, such as the following:

- Overpacking (i.e., 55-gallon drum inside 83- or 85-gallon drum);
- steel box with no liner;
- wooden box with a minimum of 6-mil sealed plastic liner;
- steel drum with a minimum of 6-mil sealed plastic liner.

E. Gases: LLW gases shall be stabilized or absorbed so that pressure in the waste package does not exceed 1.5 atmospheres at 20° C.

Compressed gases as defined by Title 49, CFR 173.300, including unpunctured aerosol cans, will not be accepted for storage or disposal. Aerosol cans will have puncture disfigurements recognizable by (RTR). Expended gas cylinders must have the valve mechanism removed.

F. **Stabilization:** Where practical, waste shall be treated to reduce volume, promote waste minimization, and provide a more structurally and chemically stable waste form.

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

Chemical stability must be documented to show that significant quantities of harmful gases, vapors, or liquids are not generated. Wastes shall not react with the packaging during storage, shipping, and handling time.

Where stabilization is required for the waste to meet this waste acceptance criteria, it must be shown that the stabilization process is adequately controlled. Control is shown through the use of procedures, sampling, test plans, etc., and the results of such controls shall be made available for examination and approval.

G. **Etiologic Agents:** LLW containing pathogens, infectious wastes, or other etiologic agents as defined in Title 49, CFR 173.386 will not be accepted for disposal at NTS.

H. **Chelating Agents:** LLW containing chelating or complexing agents at concentrations greater than 1 percent by weight of the waste form will not be accepted.

I. **Polychlorinated Biphenyls (PCBs):** PCB-contaminated LLW will not be accepted for disposal at NTS unless the PCB concentration meets municipal solid waste disposal levels of 50 ppm or less. See Title 40, CFR 761.60 for PCB disposal requirements.

J. **Explosives and Pyrophorics:** LLW containing explosive and/or pyrophoric material in a form that may spontaneously explode or combust, if the container is breached, will not be accepted.

5.5.1.2 General Regulatory Waste Package Criteria

The NTS waste package criteria include regulatory criteria to meet applicable DOE, EPA, and DOT requirements and criteria established to meet site-specific requirements at NTS waste management sites. Defense waste shipped to NTS waste management sites for disposal or storage must be packaged in accordance with all DOE and DOT regulations. These include the requirements of DOE Order 1540.1, "Materials Transportation and Traffic Management"; Titles 49, CFR 173.448, "General Transportation Requirements"; 49 CFR 173.474, "Quality Control for Construction of Packaging," and 49 CFR 173.475, "Quality Control Requirements Prior to Each Shipment of Radioactive Materials."

A. **Design:** Type A packaging shall be designed to meet Title 49 CFR 173.411, "General Design Requirements," and Title 49 CFR 173.412, "Additional Design Requirements for Type A Packages." Type A packages must have been evaluated under the DOE Type A package Certification Program (see MLM-3245, "DOT 7A Type A Certification Document" or succeeding DOE publication). Type B packaging must meet the applicable requirements of Title 10 CFR 71. Strong, tight packaging used for shipping limited quantities and low specific activity LLW excepted by Titles 49 CFR 173.421 and 173.425, respectively, must be constructed so that it will not leak during normal transportation and handling conditions.

B. **Nuclear Safety:** The quantity of fissile radioactive materials 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 nuclear safety analysis, considering credible accident situations, and taking into account the actual materials in the waste. See Title 49 CFR 173.451, "Fissile Materials - General Requirements."

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C. **Nuclear Heating:** The quantity of radioactive materials shall be limited for each waste matrix and package type so that the effects of nuclear decay heat will not adversely affect the physical or chemical stability of the contents or package integrity. See Title 49 CFR 173.442, "Thermal Limitations," for temperature limits of accessible external package surfaces.

D. **Radiation Levels:** The external radiation levels for packages shall not exceed 200 millirem per hour on contact during handling, shipment, and disposal unless specifically excepted by DOT regulations. See Title 49 CFR 173.441, "Radiation Level Limitations." Type B containers that will be unloaded by remote procedures will be addressed on a case-by-case basis.

E. **External Contamination:** Packages shall be within DOT contamination limits upon receipt at NTS. See Title 49 CFR 173.443, "Contamination Control." On-site generators refer to current NTS external contamination limits.

F. **Activity Limits:** The activity limits listed in Title 49 CFR 173.431, "Activity Limits for Type A and Type B Packages," shall be met. Where applicable, the activity limits of Titles 49 CFR 173.421, "Limited Quantities of Radioactive Materials," and 49 CFR 173.425, "Transport Requirements for Low-Specific Activity Radioactive Materials," shall be met for strong, tight packages. See Section 5.5.5.2 for additional requirements for activity limits outside of this range.

G. **Multiple Hazards:** Waste containing multiple hazards shall be packaged according to the level of hazard as defined in Title 49 CFR 173.2, "Classification of Material Having More than One Hazard."

5.5.1.3 NTS Specific Package Criteria

The use of properly designed packaging reduces the chance of radiological or occupational safety occurrences during transportation, handling, and disposal operations. In addition, preplanning the size and load of each package is

essential to reducing the number of waste shipments to the NTS and the space required for disposal. DOE/NV has adopted the following criteria to assure that the NTS RWMSs are operated safely and efficiently. The criteria shall be incorporated in the design of all waste packaging, including strong, tight containers.

A. **Closure:** The package closure shall be sturdy enough that it will not be breached under normal handling conditions and will not serve as a weak point for package failure.

B. **Strength:** Except for bulk waste, waste packaged in steel drums or SEALAND® containers, the waste package (packaging and contents) shall be capable of supporting a uniformly distributed load of 19,528 kg/m2 (4,000 lbs/ft2). This is required to support other waste packages and earth cover without crushing during stacking and covering operations.

C. **Handling:** All waste packages shall be provided with permanently attached skids, cleats, offsets, rings, handles, or other auxiliary lifting devices to allow handling by means of forklifts, cranes, or similar handling equipment. 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.

D. **Size:** 1.2- x 1.2- x 2.1-m (4- x 4- x 7-ft) or 1.2- x 0.6- x 2.1-m (4- x 2- x 7-ft) (width, height, length) boxes or 208-liter (55-gallon) drums are required to be used. Bulk waste container approval is discussed in Section 5.5.4. While these sizes allow optimum stacking efficiency in disposal cells, other dimensions are acceptable with approval from DOE/NV on a case-by-case basis.

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E. **Weight:** In addition to the weight limits set for specific packaging designs, NTS imposes limits of 4,082 kg (9,000 pounds) per box and 544 kg (1,200 pounds) per 208-liter (55-gallon) drum. Packages exceeding 4,082 kg (9,000 pounds) require crane or large forklift removal and must be approved by REECo/WMD prior to shipment. Shipments of this type must be in a removable-top or removable-side trailer.

F. **Loading:** Waste packages shall be loaded to ensure that the interior volume is as efficiently and compactly loaded as practical. 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.

G. **Nonstandard Type A Packaging:** Use of DOT Type A packages not previously evaluated under the DOE Type A Package Certification Program (see MLM- 3245, etc.) will not be permitted.

H. **Package Protection:** The generator shall take the following precautions to protect the waste package after closure.

1. The preshipment storage environment shall be controlled to avoid adverse influence from weather or other factors on the containment capability of the waste packaging during handling, storage, and transport. The generator preparing waste for preshipment storage shall take all reasonable precautions to preclude the accumulation of moisture on or in packages prior to their arrival at the NTS.
2. A form of Tamper Indicating Device (TID) shall be applied to each waste container, once certification actions have been completed.
3. Each waste package shall be prepared for shipment so as to minimize damage during transit. Minor damage incurred during transit, not attributable to poor packaging, will be repaired at the RWMS without charge to the waste generator. Costs for repairs of damage caused by waste generator or carrier negligence as well as any necessary decontamination to meet DOE Order 5480.11 will be charged to the waste generator.

I. **Marking and Labeling:** Each waste package shall have the following information:

1. Marking and labeling as required in Title 49 CFR 172, subparts D and E.
2. Signed NV-211 "Packaging Certification" label (revision date January 27, 1989) (see Figure 8, page 76). If the waste is unpackaged bulk, a signed NV-211 label must accompany the shipment papers. These labels can be obtained from REECo/ WMD.
3. Shipment number in the following sequence: Two alpha character generator-site-designator codes assigned by WMD (see Appendix D); one alpha character for type of waste L for LLW, M for MW, T for TRU, or X for TRUMW; two numerical characters for current fiscal year; three numerical characters for shipment sequence. Example: MDL90001 would mean a shipment from EG&G Mound of LLW in fiscal year 1990 and the first shipment.
4. Package number shall be six characters (alpha, numeric, or combination) with no duplication within that shipment.
5. Approved 13-digit waste stream identification number (see Section 5.1).
6. Package weight in units of pounds and kilograms.

Note: Except for the required DOT labels and NV-211, these items must be clearly and legibly placed on the container using alphanumeric characters of at least one-half inch in height. The information that is included on the barcode label (see next section) does not need to be duplicated.

J. **Barcoding:** The shipment, package, and waste stream identification numbers shall be barcoded according to the following standards:

1. Code 39.
2. Medium to high density, high density preferred.

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3. 1.0" high barcode.
4. Human readable interpretation (HRI) 0.50" high printed below the barcode.
5. Spacing between barcode and HRI will be 0.10".
6. Minimum left and right margin (quiet zones) will be at least 0.25".
7. All barcodes and HRI will be stacked with a minimum separation of 0.50" and in the following order: shipment number, container number, and waste stream identification number. (See Figures 6A and 6B.)

Note: Waste Stream ID number will not have the dash barcoded. EXAMPLE: LRY5-000000001 would be barcoded as LRY5000000001.

8. A total of two barcode labels shall be placed on each box or nonstandard package near the top and on opposite sides. Drums will have a total of two barcode labels, one on top of the drum lid and one on the side near the top.
9. A sample barcode must be submitted to WMD prior to the first shipment to ensure that WMD equipment can be used to read the barcode. WMD will provide barcodes if you are a low-volume generator (less than 10 shipments per year) and do not have the equipment to print barcodes. Contact WMD at least one month in advance to arrange for the barcodes.

K. On-Site Transfer: On-site transfer must be in accordance with NV 54XG.1A, NV Radiological Safety Manual, and applicable DOT requirements. For the transfer of unpackaged bulk material having external contamination, that contamination shall be fixed, covered, or contained sufficiently for safe transfer.

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Figure 6A Barcode Label

A5L92ØØ1

ØØØØØ1

LRY1ØØØØØØØØØ1

MINIMUM REQUIREMENTS FOR HIGH DENSITY BARCODE LABEL

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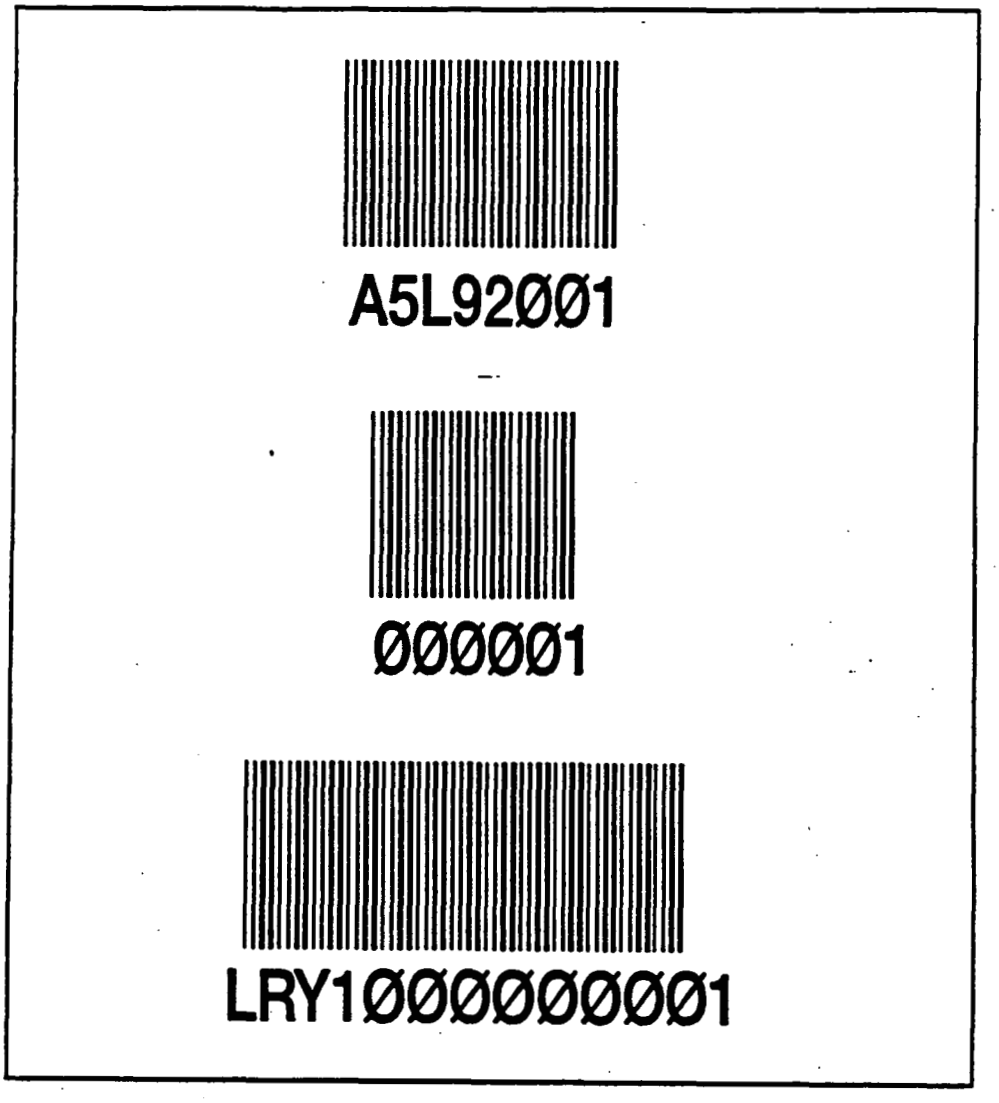
Figure 6B Barcode Label



MINIMUM REQUIREMENTS FOR MEDIUM DENSITY BARCODE LABEL

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5.5.2 Additional Criteria for Mixed Waste

In addition to meeting all of the LLW WAC, MW offered for disposal at the Area 5 RWMS Mixed Waste Management Unit (MWMU) must meet the criteria described below.

Note: MW will not be accepted for bulk disposal in the Area 3 RWMS. MW containing asbestos will be handled on a case-by-case basis. State-of-generation requirements for identifying, treatment, and disposal will also apply.

A. Free Liquids: MW disposed at the NTS shall contain no free liquids.

- Residual liquids in well-drained containers shall be mixed with absorbent or solidified so that free liquids are no longer observed.
- If absorbent materials are added to a waste for control of free liquids, the generator must calculate the volume of liquid in the waste and use a quantity of sorbent material sufficient to absorb a minimum of twice the calculated volume of the liquid. Please note when significant differences of temperature exist between the generating site and the disposing site, provisions for additional absorbent materials must be made for affected waste forms.
- To demonstrate the absence of free liquids, the generator may be required to use Method 9095 (Paint Filter Test) as described in "Test Methods For Evaluating Solid Wastes, Physical/Chemical Methods." (EPA Publication No. SW-846) The Paint Filter Test may not be applicable to certain waste forms; e.g., concrete. If the generator determines that the waste form is not conducive to the Paint Filter Test, documentation must be provided to substantiate the claim.

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B. **Treatment:** All MW accepted for disposal at the MWMU must comply with land disposal restrictions for the hazardous component(s) as specified under Title 40 CFR 268, "Land Disposal Restrictions" unless treated as specified under Title 40 CFR 268, Subpart D, "Treatment Standards."

C. **Reactive Wastes:** All reactive wastes must be treated in accordance with Title 40 CFR 268, Subpart D, "Treatment Standards."

D. **Potentially Incompatible Wastes:** Wastes must be identified by the most appropriate compatibility group listed in Title 40 CFR 264, Appendix V, "Examples of Potentially Incompatible Waste," to ensure that incompatible wastes are not shipped or disposed together. Incompatible MW shall be packaged in accordance with Title 40 CFR 264.177, "Special Requirements for Incompatible Wastes."

E. **Marking and Labeling:** MW packages of 110 gallons or less must be marked in accordance with Title 40 CFR 262.32(b). Intrasite shipments shall be marked and labeled in accordance with the above requirements as well as NV 54XG.1A, "DOE/NV Radiological Safety Manual." Marking and labeling of the waste packages shall be for the hazardous component in addition to the radioactive component. Limited quantity MW must be classified according to the requirements for hazardous components as defined by Title 49 CFR 173.2.

F. **Package Protection:** The requirements of Title 40 CFR 264, Subpart I, "Use and Management of Containers," shall be met for MW packages.

5.5.3 Additional Criteria for Transuranic/Transuranic Mixed Waste

Requests for storage of all TRU waste will be considered on a case-by-case basis.

TRU waste must meet all the LLW WAC including DOE/HQ designation, application to DOE/NV, and participation in the waste generator approval process. TRU waste is only accepted at the NTS for interim storage prior to shipment to the Waste Isolation Pilot Plant (WIPP). In addition, the generator

will be required to provide documentation with their application that the waste is certified to the WIPP WAC.

5.5.4 Additional Criteria for Bulk Waste

Bulk waste is disposed of in Area 3. It generally exists in a form not suited to the conventional packaging requirements of Area 5. In addition to meeting the LLW WAC, bulk LLW must meet the requirements of Title 49 CFR 173.425(c). NTS-generated bulk waste must be transported in accordance with NV 54XG.1A, "DOE/NV Radiological Safety Manual," and applicable DOT requirements.

Bulk waste containers must be approved by DOE/NV. Bulk waste containers may be returned to the generator after decontamination to meet NV 54XG.1A, "DOE/NV Radiological Safety Manual," off-site release limits. Decontamination and return of bulk waste containers will incur additional operational costs for the generator.

Note: MW will not be accepted for bulk disposal.

5.5.5 Additional Criteria for Case-by-Case Waste

In addition to meeting LLW WAC, the following case-by-case waste types offered for disposal at the NTS must meet the criteria described below.

5.5.5.1 Weight

Packages exceeding 4,082 kg (9,000 pounds) require crane or large forklift removal and must be approved prior to shipment. Shipments of this type must be in a removable-top trailer or removable-side trailer and will incur additional operational costs for the generator.

5.5.5.2 Activity Limits

Activity limits outside the range of Section 5.5.1.2.F shall meet the requirements of Title 10 CFR 61 (see Section 5.5.5.4). Material requiring remote handling will incur additional operational costs for the generator.

5.5.5.3 Radioactively Contaminated Asbestos

All regulated asbestos that is friable or otherwise capable of giving off friable asbestos dust must be wetted with a water and surfactant mix and stored in two plastic bags whose combined thickness equals at least 6 mil. The plastic bags must be overpacked in a leak-resistant wood or metal container that meets applicable shipping requirements for the radioactive content of the package involved. Sharp edges and corners within the package shall be padded or otherwise protected to prevent damage to the plastic inner wrap during handling, shipping, and disposal. Because the asbestos must be wetted during abatement activities, an absorbent must be added to ensure compliance with the free liquid requirement for LLW, see Section 5.5.1.1.C.

For further reference on regulated asbestos, see 40 CFR 61.140-61.157 and state-of-generation regulations. All LLW containing regulated asbestos shall be packaged, marked, and labeled in accordance with the requirements of 40 CFR 61.150.

> **Note:** Any regulated asbestos waste must be segregated into a separate waste stream.

SEALAND® containers are accepted on a case-by-case basis.

5.5.5.4 DOE Comparable Greater-Than-Class-C as Defined in 10 CFR 61.55

Disposal systems for such waste must be justified by a site-specific performance assessment through the National Environment Policy Act (NEPA) process and with the concurrence of EM-32 for all EM-1 disposal facilities and of NE-20 for those disposal facilities under the cognizance of NE-1.

Disposition of waste designated as greater-than-class-C, as defined in Title 10 CFR 61.55, will be handled as special case waste. Greater-than-class-C waste will be considered for disposal on a case-by-case basis depending on existing site-specific waste classification limits or limits that may be developed based on performance assessments.

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5.5.5.5 Classified Waste Streams

Classified waste will be handled in such a manner to ensure that security requirements are complied with. All security information requirements in this WAC are applicable and must be included in the application.

Classified waste shipments shall be made in accordance with those requirements of Section 9.0 applicable to classified waste.

5.5.5.6 Radioactive Animal Carcasses

Animal carcasses containing, or contained in, radioactive materials shall be packaged with the following requirements: the biological material shall be layered with lime and placed in a metal container meeting applicable requirements of DOT and this document. If the resultant waste matrix is capable of gas generation, the container shall be vented with a carbon composite High -Efficiency Particulate Air-Rated (HEPA) filtration device. DOE/NV may require analysis of the waste decomposition gases.

Note: Animal carcasses preserved with formaldehyde are not suitable for disposal at the NTS.

5.5.5.7 Other Waste Forms

Other waste forms that do not meet NTS requirements will be evaluated on a case-by-case basis.

5.6 Waste Stream Characterization Data Sheet

Include a copy of the Waste Stream Characterization Data Sheet reported in Section 4.3.5.B.

Note: Do not attach the Standardized Data Reporting Forms in this section.

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5.7 Waste Forecasting

The generator shall provide to DOE/NV and REECo/WMD the following information for each waste stream on a separate "Three-Year Waste Shipment Forecast" form (Figure 7, page 72):

1. **Generator:**

   Enter the generator facility name.

2. **Prepared by:**

   Enter the name of the person preparing the form.

3. **Date:**

   Enter the date the form is being completed.

4. **Forecast Period:**

   Enter the forecast periods.

   Note: Forecasts shall be prepared for a three-fiscal-year period with the first fiscal year divided into four three-month increments; that is, October through December, January through March, April through June, and July through September.

5. **Waste Stream Number:**

   Enter the waste stream number. For generators with multiple waste streams, individual waste streams must be addressed.

6. **Waste Type:**

   Enter the waste type (i.e., LLW, MW, TRU, & TRUMW).

7. **Container Type:**

   Enter a brief description of the waste container (i.e., metal box).

8. **Container Size:**

   Enter the size the waste container used (i.e., 4'x4'x7').

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9. **Container:**

   Enter the number of containers for that specific forecast (i.e., 20).

10. **No. of Shipments:**

    Enter the estimated number of shipments required to ship the number of containers listed for that forecast (i.e., 2).

11. **Total Volume:**

    Enter the total volume for the shipment forecasted (i.e., 2,040 cubic meters).

Note: Reporting units for forecasted volumes must be in cubic meters.

12. **Remarks:**

    Enter any additional information deemed necessary. Example: Biological waste emitting ammonia or waste that requires special handling due to weight, etc.

Note: Forecasts shall be updated every six months and are due by August 15 and February 15. Failure to provide these forecasts promptly may delay acceptance of waste shipments.

5.8 Packaging and Shipping Information

Include the DOT proper shipping name, hazard class, and hazard identification number.

5.9 Waste Security Information

Provide information regarding any special security requirements.

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Figure 7 Example of Three-Year Waste Shipment Forecast

THREE-YEAR WASTE SHIPMENT FORECAST

GENERATOR #1 PREPARED BY #2 DATE #3

FORECAST PERIOD	WASTE STREAM NUMBER	WASTE TYPE	CONTAINER			NO. OF SHIPMENTS	TOTAL VOLUME
			TYPE	SIZE	#		
FY 19 #4	#5	#6	#7	#8	#9	#10	#11
10/01 - 12/31							
1/01 - 3/31							
4/01 - 6/30							
7/1 - 9/30							
FY 19							
FY 19							

REMARKS

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6.0 Waste Certification

6.1 Waste Certification Program and Plan

Waste generators are required to develop a waste certification program as required by DOE Order 5820.2A to ensure that DOE, EPA, DOT, and NTS waste acceptance criteria are met. This program must be documented in the Waste Certification Program Plan. The Waste Certification Program Plan defines the generator's QA program as it applies to waste certification and characterization.

The purpose of the waste certification program is to ensure safe, efficient, and effective management of waste received at the NTS by providing an auditable system for verifying that the generators are properly identifying, characterizing, segregating, packaging, certifying, and shipping their wastes.

The standard for the waste certification program shall be American National Standards Institute/American Society of Mechanical Engineers (ANSI/ASME) NQA-1 Quality Assurance Program and its supplements. The relevant elements of NQA-1 and the requirements specified in Appendix C of this document, "Quality Assurance Requirements For Waste Certification Program," shall be addressed.

Generators may contact DOE/NV/WOB for case-by-case guidance regarding applicable Certification Program and Plan requirements under the following conditions:

- waste is characterized exclusively by process knowledge; and
- minimal volumes of waste will be shipped to the NTS per calendar year.

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The Waste Certification Program Plan shall also reference the procedures to be applied by the generator to certify that the waste and waste packages meet the certification requirements.

6.2 Waste Certification Officials, Statements, and Labels

Each generator shall designate a chief Waste Certification Official (WCO) and may have one alternate who will be responsible for assuring that all waste packages, data, and waste shipments comply with the requirements of this document. The alternate WCO shall be responsible to the chief WCO for certification activities. The WCOs shall be independent of those who have direct responsibility for performing waste generation activities, and shall report directly to the facility manager. This independence shall be shown in the organizational chart and described in the organizational section of the generator's Waste Certification Program Plan.

Generators having 24-hour operations or producing large volumes of waste can request to have additional alternate WCOs. Requests for additional alternate WCOs must include a detailed justification and be included in the generator's application to ship waste.

The generator shall provide DOE/NV and REECo/WMD immediate written notification of any changes in the names of the WCO, alternate(s), and all qualified package certifiers. See section 2.4.

The Waste Certification Official shall:

- Sign the generator's application signature page certifying that the information is correct and that the waste stream(s) will meet the NVO-325 upon implementation of the certification program.
- Ensure the performance of the internal audits, inspections, and surveillances.
- Ensure timely identification of deficiencies and effective corrective action.
- Be responsible for ensuring that each Package Certifier (see Section 6.3) is properly trained and qualified to the requirements of this document.

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- Sign and affix the NV-211 sticker (Figure 8, page 76) to each waste package. The NV-211 is available from REECo/WMD.

Note: The NV-211 may be signed by either the Package Certifier or the WCO. This sticker provides highly visible confirmation that the waste is certified as meeting all requirements of the WAC.

- For LLW: Sign the LLW certification statement described in Figure 9, page 77. This statement must be included in the shipping papers and indicates that the shipment meets NVO-325.
- For MW and TRUMW: Sign the generator's certification statement on the "Uniform Hazardous Waste Manifest" (EPA Forms 8700-22 and 8700-22A) or other equivalent manifests (see Section 9.1.B.2). In addition, sign the certification statement in 40 CFR 268.7(a)(2)(ii), see Figure 9, page 77.

6.3 Package Certifiers

Each generator may designate Package Certifiers responsible for signing the NV-211 sticker (see Figure 8, page 76). Package Certifiers must be trained according to the requirements of this document and the generator's Waste Certification Program Plan. The Package Certifier(s) shall be independent of those who have direct responsibility for performing waste generation activities, and be responsible to the WCO or alternates for certification activities. This independence shall be shown in the organizational chart and described in the organizational section of the generator's Waste Certification Program Plan.

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Figure 8 Example of NV-211

NV-211
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PACKAGING CERTIFICATION

U.S.
DOE

This certifies that this container and its contents are in acceptable condition for transportation and waste disposal according to DOT (49 CFR), EPA (40 CFR), and DOE/NV (NVO-325) requirements.

DATE: _____

CERTIFIED BY: _____

TITLE: _____

ORGANIZATION: _____

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Figure 9 Certification Statements

Low-Level Waste Certification:

"I certify that containers:

(Your container I.D. numbers should go here)

do not contain hazardous waste as defined in Title 40 CFR 261 or _____ (state-of-generation) hazardous waste regulations:

(1) according to the results of tests performed in accordance with the requirements as specified in Subpart C of Title 40 CFR 261; and/or

(2) according to the supporting documentation provided to me about the materials and processes that produced this waste.

To the best of my knowledge, I believe the information I have submitted is true, accurate, and complete."

_____

Generator Waste Certification Official

Mixed Waste Certification for Land Disposal Restrictions:

I certify under penalty of law that I personally have examined and am familiar with the waste through analysis and testing or through knowledge of the waste to support this certification that the waste complies with the treatment standards specified in 40 CFR Part 268, Subpart D and all applicable prohibitions set forth in 40 CFR 268.32, RCRA Section 3004(d) or _____ (state-of generation) hazardous waste regulations.

I believe that the information I submitted is true, accurate, and complete. I am aware that there are significant penalties for submitting a false certification, including the possibility of a fine and imprisonment.

_____

Generator Waste Certification Official

7.0 Exemption Requests

An exemption request is required for any envisioned noncompliance to NVO-325 requirements. The exemption request, which must accompany the application to ship waste, shall include:

- the type of exemption requested and the present circumstances that prevent compliance with the criterion for which an exemption is being sought;
- the projected duration of the exemption or reason why the waste cannot be brought into compliance; and
- a plan and schedule for corrective action to bring the waste into compliance with all criteria.

Exemptions identified after an application has been submitted may be requested separately as an application revision. Exemptions will be granted for the duration of corrective action only and not as permanent variances to NVO-325.

It should be noted that exemptions will only be considered for those circumstances of the most critical or unusual nature and shall be submitted from the generator's DOE Field or Area Office Manager.

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8.0 Procedures and Supporting Documentation

The following sections describe documentation that must be referenced in the application, and in specific instances provided with the application.

8.1 Procedures and Documentation Referenced in the Application

Procedures that detail the identification, characterization, segregation, packaging, and certification of waste shall be referenced in the application.

These include the following:

- Procedures that describe the peripheral activities supporting the generator's Waste Certification Program (i.e., calibration, procurement, document control, etc.), refer to Appendix C.
- Procedures that detail how applicable *General Regulatory Waste Package Criteria* (Section 5.5.1.2) are being met.
- Procedures that detail how applicable *NTS Specific Package Criteria* (Section 5.5.1.3) are being met.
- Procedures for container approval (see Figure 5, page 52).
- Facility Waste Minimization Plan (see Section 3.4).
- Laboratory Documentation (for review during an audit, see Section 4.3.6).

8.2 Procedures And Documentation Submitted Along With the Application

The facility procedures and supporting documentation referenced in the generator application that are to be provided to DOE/NV, shall be submitted as

a separate, uncontrolled supporting reference to the application. Typical examples of procedures and supporting documentation to be submitted to DOE/NV are:

- Waste Traceability (provide forms referenced in procedures but not included)
- Characterization of Waste Contents
  1) Process knowledge procedures (detailing ingredients used in processes, see Section 4.1.3).
  2) Sampling and analysis procedures (see Section 4.2).
  3) Laboratory documentation (see Section 4.3.5).
  4) Procedures that detail how the generator will ensure that the waste stream complies with the WAC for *General Waste Form* (see Section 5.5.1.1).
- Certification of Waste Contents
  1) Inspection procedures used to verify that process knowledge documentation and/or analytical data is adequate and traceable to the waste package.
  2) Inspection procedures used to verify all WAC have been met.
- Certification of Waste Packages - procedures that the WCO or Package Certifiers use to ensure that the waste packages meet all WAC.
- Certification of Waste Shipments - procedures the WCO uses to ensure that the waste shipment meet all WAC.

Note: Supporting procedures provided as a separate reference to the application are exempt from the requirements of Section 2.4, *Application Changes*. However, prior to audit, DOE/NV may request current copies of some or all procedures referenced in the application. This request may include procedures that were not originally provided to DOE/NV.

9.0 Waste Transfer

All waste shipments, classified and unclassified, consigned to an NTS waste management site, or to DOE/NV Safeguards and NTS Security Branch, shall be made in accordance with applicable DOE, DOT, EPA, state, and local hazardous waste regulations and requirements contained herein. Also, all MW shipments shall be in accordance with Title 40 CFR 263, "Standards Applicable to Transporting of Hazardous Waste."

9.1 Shipping Arrangements

After a generator secures written approval from the DOE/NV Manager to send waste to an NTS RWMS, the generator shall contact REECo/WMD to arrange for transfer of the waste and all accompanying records. REECo/WMD, Traffic, and Health Protection Departments will coordinate unclassified waste shipment transfers at NTS. Classified waste shipments will be coordinated by DOE/NV Safeguards and NTS Security Branch.

A. To expedite waste receipt and handling at NTS, waste generators shall comply with the following procedures:

1. Prior to departure, security seals shall be affixed to the trailer or on packages not enclosed in trailers. Refer to 49 CFR 101-1, "Seal Accountability and Procedures."
2. Before an unclassified waste shipment arrives at the NTS, the generator shall contact the REECo Traffic Section by phone (Commercial/FTS: 702-295-6931 or 6307), or if the generator has an account on the WMD VAX, data will be entered on the computer. For classified and special nuclear material shipments, contact DOE/NV Safeguards and NTS Security Branch

(Commercial/FTS: 702-295-0082). For either classified or unclassified shipments, the generator shall provide the following information:

a. time of departure from shipping point and estimated time of arrival (ETA) at NTS;

b. carrier, trailer, and security seal numbers;

c. description of load (number and type of pieces [e.g., boxes, drums, SEALANDS®], volume and weight);

d. Waste type (LLW, MW, TRU, or TRUMW); and

e. Any additional information deemed necessary (e.g., special handling requirements).

3. Consign unclassified waste shipments to:

Reynolds Electrical & Engineering Co., Inc.
For U.S. Department of Energy
Waste Management Department Manager
Nevada Test Site-Zone 2
Mercury, NV 89023

Consign all classified and all accountable or special nuclear material waste shipments to:

U.S. Department of Energy
Attn: Physical Security Specialist
DOE/NV Safeguards and NTS Security Branch
For Reynolds Electrical & Engineering Co., Inc.
Waste Management Department Manager
Nevada Test Site-Zone 2
Mercury, NV 89023

Note: Because unclassified and classified shipments are consigned differently, they must be shipped separately; i.e., on different

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trucks. Under small volume conditions, combined shipments can be arranged. Contact REECo/WMD and DOE/NV Safeguards and NTS Security Branch for guidance.

4. If the shipment's ETA should change for any reason, the generator shall contact REECo Traffic Section, (for classified shipments contact DOE/NV Safeguards and NTS Security Branch) at the earliest opportunity and provide the new ETA with pertinent information regarding the reason for the change.

5. The hours for receiving are 0800 to 1430, Monday through Friday, except holidays. If a shipment arrives too late to off-load, the REECo Duty Officer will instruct the driver to park the load at the front gate until it can be inspected by REECo RAMATROL and Traffic personnel and be approved to proceed to an NTS RWMS. The trailer(s) may be left at the holding area outside the front gate while driver(s) attend to personal needs.

B. The waste generator should also contact REECo/WMD (Commercial/ FTS: 702-295-6406) for determination of records requirements and to coordinate funding transfers. At a minimum, the following records are required:

1. When accountable source and special nuclear materials sources are involved, a "Nuclear Material Transaction Report" (DOE/NRC Form 741) shall be completed and received by the DOE/NV Safeguards and NTS Security Branch prior to shipment arrival. In addition, for unclassified accountable waste, the Form 741 must also be faxed to DOE/NV/WOB (Commercial/FTS: 702-295-1810) and REECo/WMD/WOS (Commercial/FTS: 702-295-6852). The shipment will be refused if a Form 741 is not on file.

2. Properly completed shipping papers as required by Title 49 CFR 172.200, "Shipping Papers," and Title CFR 172.204, "Shipper's Certification," must accompany each shipment. Intrasite shipments must also meet any additional requirements of NV 54XG.1A, "DOE/NV Radiological Safety Manual."

For off-site MW generators, a "Uniform Hazardous Waste Manifest" (EPA Forms 8700-22 and 8700-22A) or equivalent state-of-generation manifest shall be used. On-site MW generators may use a "Uniform Hazardous Waste Manifest" or "NTS On-site Waste Transport Manifest" (RE-2232A). If the MW is regulated under Title 40 CFR 268, the manifest shall also be accompanied by the appropriate documentation required by Title 40 CFR 268.7(a).

3. The original completed "Radioactive Waste Management - Storage and Disposal" Form RE-0166 (See Appendix E), or the original of an equivalent form, shall accompany each classified and unclassified shipment. The RE-0166 is available from REECo/WMD. If the RE- 0166 is considered to be "classified," DOE/NV Safeguards and NTS Security Branch must receive the RE-0166 prior to arrival of waste at the NTS. The classified shipment will not be accepted if an RE-0166 is not on file.

   The information required on the RE-0166 includes identities, quantities, and concentrations of radionuclides and hazardous chemicals in waste material by package. Each package in a shipment must be identified by a shipment number (see Appendix D), six character package identification number, and waste stream identification number (see Section 5.1).

   The information can be submitted on RE-0166 or on computer printouts.

   For high-volume generators (over ten shipments per year), a subset of this printed information shall be electronically transferred to REECo/WMD. REECo/WMD will provide a copy of "Low-Level Waste Information System Data Transmission Guide" for instructions on electronic data transfers. More information on electronic data transfers can be obtained by contacting REECo/WMD data management personnel (Commercial/FTS: 702-295-7365).

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C. On-site transfer of LLW to the Area 3 or Area 5 RWMS shall be coordinated through REECo/WMD by calling 295-6811 prior to shipment.

9.2 Waste Receipt

Upon arrival at NTS, shipments may be subject to off-loading delays at any time due to NTS operational schedules.

A. At Mercury, the NTS base camp, each waste shipment from off site will be inspected by REECo RAMATROL and Traffic personnel. Placarding and shipping papers will be inspected to ensure compliance with Title 49 CFR 172 Subpart F and Subpart C.

B. Upon receipt of waste at the NTS RWMS, REECo/WMD personnel:

1. Receive the shipping papers, waste generator's records, and other pertinent data. Verify that all required information is supplied and is correct. Verify that the shipment is properly placarded. In addition, on-site generators must also comply with the requirements of NV 54XG.1A, "DOE/NV Radiological Safety Manual" and applicable DOT requirements.
2. Inspect the shipping vehicle and individual packages for integrity, external radiation levels, and radioactive contamination. Inspect MW shipments for hazardous waste contamination.
3. Verify that waste packages, including marking and labeling, meet all applicable requirements of NVO-325.
4. Assign waste to appropriate area of the RWMS for storage or disposal.
5. Record all actions taken regarding receipt and disposition of received waste. Report any noncompliance to DOE/NV.

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6. Enter waste data or, if records are sent electronically, verify the information entered into the NTS defense waste database and file shipment folder.
7. Return a copy of the "Uniform Hazardous Waste Manifest" or equivalent manifest to the generator and the state of Nevada.

9.3 Waste Records

Waste records include those required for shipping as well as those needed for the NTS defense waste database maintained by REECo/WMD. All hard copy shipping records submitted must be legible (preferably typed) to assure that they can be read by REECo personnel. Assurance of the accuracy of the waste data is necessary to guarantee the integrity and quality of the NTS defense waste database.

For LLW, the following records shall be included with each shipment:

A. DOT required shipping papers, including "Shipper's Certification."

B. RE-0166 form or equivalent information.

C. LLW generator certification statement declaring that all packages in the shipment are certified as containing no hazardous components regulated by RCRA or the state-of-generation hazardous waste regulation (see Figure 9, page 77).

For MW, the following records shall be included with each shipment:

A. EPA required documentation for shipments of restricted MW (see Title 40 CFR 268.7(a)).

B. RE-0166 form or equivalent information.

C. MW generator certification statement declaring that all packages in the shipment are certified to meet the Land Disposal Restriction requirements of 40 CFR 268 (see Figure 9, page 77).

D. An EPA "Uniform Hazardous Waste Manifest," or equivalent manifest.

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9.4 Disposition Of Noncompliant Conditions

Radioactive solid waste packages/shipments received at the NTS, with conditions that are determined as not in compliance with requirements in this document, will require resolution. The resolution will be handled through the use of one or more of the following alternatives depending upon the condition:

- NTS RWMS may hold the waste packages and request the waste generator to provide written instructions to correct the condition before the waste package is accepted.
- NTS RWMS may correct the condition and charge the waste generator for any costs incurred.
- NTS RWMS may require that the waste packages be returned to the generator's facilities for correction.
- Each occurrence of a noncompliant package/shipment, as identified in this section, requires the preparation of a Noncompliance Report. Repeated instances of noncompliant conditions could result in an increased frequency of surveillances and may result in a suspension of authorization to ship waste. Instances of noncompliance will be recorded and tracked to identify trends and severity for application of corrective action.

9.5 Waste Refusal

Waste shipments will not be accepted at the NTS if any of the following conditions exist:

- Failure to have sufficient funding transferred to REECo to cover the cost of handling, disposal, or storage.
- Failure to have DOE/NRC Form 741 on file at the NTS prior to the shipments arrival.
- Review of Form 741 reveals unacceptable nuclide concentrations.
- Failure to have a signed certification statement accompanying the shipment certifying that the LLW contains no hazardous constituents.
- Failure to have a signed certification statement declaring that the MW meets the Land Disposal Restriction requirements.

Appendix

A Glossary

ALARA: As Low As Reasonably Achievable

Ambient: Any temperature or pressure experienced by the container during loading, shipping, and/or disposal operations.

Audit: An audit will verify by examination and evaluation of objective evidence that the documented program has been adequately implemented. This will include an on-site traceability review of each waste stream from the point of generation to the point the container is placed on the truck for shipment.

Bulk Waste Management Unit: That portion of the Area 3 Radioactive Waste Management Site (RWMS) used for disposal of bulk low-level waste (LLW).

Certification: The process of determining, verifying, and attesting in writing that Waste Acceptance Criteria (WAC) have been complied with.

Certified: Identification, in writing, that personnel or items have complied with a specific set of criteria, including a signature of a responsible party. Class-C Waste: Any waste that meets the description of 10 CFR 61.55.

Chelating Agents: Chelating agents mobilize fixed heavy metals for migration in the environment.

Chemically Stable Form: A chemical compound that is solid and will not spontaneously decompose when in contact with air or moisture.

Contact-Handled: Waste packaged such that the dose rate at the package surface is not greater than 200 millirem per hour.

Contamination: Removable radioactive contamination on the package surface or shipping vehicle that exceeds the contamination levels listed in Title 49 Code of Federal Regulations (CFR) 173.443, "Contamination Control." See Title 49 CFR 173.443 for swiping techniques.

Corrective Action: Measures taken to rectify conditions adverse to quality identified in an audit usually accompanied by a root cause analysis and action to prevent recurrence.

Decontamination: The removal of radioactive or hazardous materials contamination from facilities, equipment, or soils by washing, heating, chemical or electrochemical action, mechanical cleaning, or other techniques.

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

Free Liquid: Free liquids means liquids which readily separate from the solid portion of a waste under ambient temperature and pressure conditions (see ambient).

Generator: An organization which produces LLW, MW, TRU, or TRUMW as a by-product or which certifies the waste.

Hazardous Waste Component: Waste identified or listed in Title 40 CFR 261, or that otherwise meets the Resource Conservation and Recovery Act (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 another waste as defined in Title 40 CFR 260.10.

Item: An all-inclusive term commonly used in place of any of the following: structure, system, component, material, and equipment. 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 40 CFR 268 (EPA 1989c).

Leak-Resistant: Leak-resistant in reference to a container means that solids or liquids cannot escape or spill out. The term "leak-resistant" also means dust-tight.

Low-Level Waste: All 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 nanocuries per gram.

LLW Management Unit: Portion of the Area 5 RWMS used for the disposal of packaged LLW.

Mixed Waste: Waste containing both radioactive and hazardous components as defined by the Atomic Energy Act and the RCRA, respectively. MW must meet the Land Disposal Restrictions (LDR) as listed in 40 CFR 268.

MW Management Unit: Portion of the Area 5 RWMS used for disposal of MW.

Package: The packaging together with its contents.

Packaging: The assembly of components necessary to ensure compliance with U.S. Department of Transportation (DOT), EPA, and U.S. Department of Energy Nevada Operations Office (DOE/NV) requirements (see Title 49 CFR 173.403(u)). It does not include radioactive or hazardous components of the waste.

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.

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

Radioactive Waste: Solid, liquid, or gaseous material that contains radioactive nuclides regulated under the Atomic Energy Act of 1954, as amended, and of negligible economic value considering costs of recovery.

Radioactive Waste Management Site: Designated NTS location where radioactive waste handling, storage, or disposal operations are conducted under REECo Waste Management Department control. The only approved NTS RWMSs are the Area 5 RWMS for storage of packaged TRU waste and disposal of LLW and MW and the Area 3 RWMS for bulk LLW disposal.

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

Solid Waste: Waste material that is an essentially dry, solid form. The waste stream may include well-drained containers or liquids which have been entrapped or otherwise solidified so that they will retain their solid form without the presence of free liquids during handling, transportation, storage, or disposal. Viscous waste material is determined to be a solid by testing in accordance with American Society for Testing Materials Standard D 4359, "Standard Test Method for Determining Whether a Material is a Liquid or a Solid."

Surveillance: The act of monitoring or observing to verify whether an item or activity conforms to specified requirements.

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. Tamper-indicating devices include seals, mechanisms, containers, and enclosures.

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 of, 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 40 CFR 262.

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

Waste Management: The planning, coordination, and direction of those functions relating to generation, handling, treatment, storage, transportation,

and disposal of waste, as well as associated surveillance and maintenance activities.

Waste Minimization: As required by DOE Orders 5400.1, 5820.2A and 40 CFR 262, the reduction to the extent feasible, of radioactive or mixed waste that is generated or subsequently treated, stored, or disposed. It includes any source reduction or recycling activity undertaken by a generator that results in either (1) the reduction of total volume or quantity of waste; or (2) the reduction of toxicity of the waste, or both, so long as such reduction is consistent with the goal of minimizing present and future threats to human health and the environment.

Waste Stream: The categorization of waste defined by the ability or method of characterization and certification. Examples are (1) by matrix; e.g., compactable trash, metal, wood, sludge, filter cakes, glass; and (2) by process; e.g., controlled experiments, decommissioning activities as described in DOE Order 5820.2A, Section V.

Appendix

B Instructions for the Waste Stream Characterization Data Sheet

1) **Waste Stream Identification Number:** List a unique two-part, 13-character alphanumeric code which identifies generator and generator's waste stream code. The intent of this number is to clearly identify the waste generator and to separate waste streams.

   Generator: Four-character alphanumeric code used by the U.S. Department of Energy (DOE) Waste Management Information System (WMIS). See Appendix D.

   Waste Stream: Nine-character, generator-assigned alphanumeric code for a specific waste stream. This is an arbitrary number assigned by the generator to assist the disposal area in tracking of each waste stream.

   Example: For a Rocky Flats waste stream, the waste stream number would be written as:

   ARIR-000000001

   where ARIR is the WMIS designation for Rocky Flats and 000000001 is the Rocky Flats-assigned waste stream code.

2) **Waste Description:**

   a. **Physical Characteristics:** Provide a description of the physical form of the waste that describes the origin and use of the material (e.g., contaminated soil, laboratory trash, decommissioning debris, HEPA filters etc.) and the bulk composition (e.g., paper, plastic, concrete, steel, etc.). If the material has been sorbed, solidified, or stabilized, identify the material used (e.g., superfine, bitumen, concrete).

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b. **Special Handling/Disposal Requirements:** Report the estimated mean and range of the surface radiation levels of the packages (mrem/hr) and any special handling or disposal concerns including 1) release of gases from radioactive decay or biological decomposition 2) off WAC size and/or weight 3) ALARA and 4) bulk waste.

3) **Basis for Characterization:** Select the appropriate basis for characterization: Process Knowledge, Analytical Knowledge, or both. If Analytical Knowledge is used, provide Standardized Data Reporting Forms.

4) **Radioactive Characteristics:**

a. Indicate whether waste would be classified as being greater than Class-C as defined in Title 10 Code of Federal Regulations (CFR) 61.55, "Waste Classification."

b. **Nuclide Category:** Identify WMIS nuclide category number as follows: 1-TRU, 2-Uranium/Thorium, 3-Fission Product, 4-Induced Activity, 5-Tritium, 6-NA (this category is not a valid selection), 7-Alpha, 8-Other.

Note: Choose the highest predominate nuclide.

c. **Radioactive Constituents:** List the major radionuclide with its respective mean and range (high and low) of the activity concentration of that major radionuclide in the waste. Major radionuclides are those nuclides that occur at mean concentrations greater than 0.01 times the Table 1 values in 10 CFR 61.55 or 0.01 times the lowest concentration in Table 2 of 10 CFR 61.55 or any unlisted radionuclide present at concentrations greater than 7 microcuries/cm^3 or that compromises greater than 1 percent of the total activity concentration of the waste stream. Activity concentrations shall be reported in scientific notation (i.e., X.XXXE±00) using the appropriate number of significant figures. The units shall be Curies/kilogram (Ci/kg). In addition, describe the most

prevalent chemical forms of the radionuclides present if known (e.g., tritium oxide, uranyl trioxide, metal oxides). Attach Standardized Data Reporting forms if available.

5) **Hazardous Components (for MW):**

a. **Basis for Identifying as MW:** Identify decision-making process using criteria listed in Title 40 CFR 261, "Identification and Listing of Hazardous Waste." Attach analytical data sheets.

b. List all components which are part of the waste and which are considered hazardous under Title 40 CFR 261 or state-of-generation hazardous waste regulations. The components will be identified by their EPA waste code numbers. Above descriptions for activity declarations are applicable to concentration declarations.

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Appendix

C Quality Assurance Requirements for Waste Certification Program

Policy

It is the policy of DOE to develop, implement, and maintain a Quality Assurance (QA) Program to fulfill the requirements of Orders 5820.2A, "Radioactive Waste Management," and applicable elements of 5700.6C, "Quality Assurance," and to be consistent with applicable federal, state, and local regulations and requirements. ANSI/ASME NQA-1 "Quality Assurance Program Requirements for Nuclear Facilities" has been selected as the standard of choice for DOE/NV Waste Certification Program. All Certification Program Plans shall use this standard.

Introduction

The waste generator shall define a management system to be used to assure the quality of the desired results for waste certification activities. It is the responsibility of the generator's waste management staff to define the desired results, establish sufficient quality control hold points, and to ensure satisfactory progress of waste certification activity by program self-assessments, surveillance, and audits. The quality control hold points shall be monitored by the generator's waste management staff to assure that program quality has been satisfactorily accomplished.

Other standards shall be identified for inspection, sampling, and testing requirements for all waste certification projects and activities as necessary; e.g., ANSI N323, American National Standard, Radiation Protection Instrumentation, Test and Calibration, and MIL I. DOE Order 5820.2A identifies ANSI/ASME NQA-1 and the applicable supplements as the required standards for radioactive waste management operation applications.

This document provides specific interpretation of certain NQA-1 requirements for application to LLW certification programs. Where specific interpretations are

provided, they should be followed. Where no specific interpretation is provided, use specific NQA-1 requirements.

Basic Requirements

1) **Organization**

A simplified organizational chart shall be included, depicting the general management structure of the waste management organization. The organizational chart shall reflect organizations that generate, characterize, package, ship, inspect, conduct surveillances and audits, perform support functions such as procurement, calibration, document control, laboratory services including data validation, RCRA oversight, training, and any other applicable functions that comprise the waste management program. The chart shall also show the independence of the WCO and Package Certifier and indicate by a dotted line direct access to the facility manager.

Descriptive paragraphs shall be provided for each of the organizational units identified in the waste management organizational chart that discuss briefly the waste management activities each unit performs.

2) **QA Program**

It is expected that each generator site will have a higher tier site-wide QA program plan in place that generally governs waste management activities. The waste generator shall write a certification program plan that references the higher tier program where appropriate, but must deal specifically with activities unique to the waste management program; e.g., audits must be performed according to NVO-325, Rev. 1, on an annual basis, inspections must be described exactly as they are conducted in the waste management program, etc.

3) **Design Control**

Certain facilities or processes to be designed and constructed to satisfy waste certification criteria, or confirm that certain wastes meet waste certification requirements, must have specific design controls imposed. For example, waste solidification treatment facilities involve a process which requires 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. Design of facilities related to MW certification must reflect the standards for treatment appearing in Title 40 CFR 268. Design of facilities for MW analysis must consider requirements for sampling analysis and data control required by EPA SW-846.

The design of waste certification related equipment or processes shall be reviewed by persons other than the primary designers. Reviewers are to be technically competent to perform a meaningful review and must have organizational independence from cost and schedule considerations. Written comments on design issues from the reviewers shall be provided to task managers, studied and resolved. The entire design and design review task shall be subject to independent review by a QA organization. Design changes, including field changes, shall be governed by control measures commensurate with those applied to the original design.

4) **Procurement Document Control**

Certain items and services critical to the certification program shall be procured under a controlled and documented system. Approved documents shall be used to prepare purchase requisitions and purchase orders. Provisions to review purchase requests for both cost and quality shall be included in the purchasing documents. The procurement documents shall include provisions for materials inspection, vendor/fabrication inspections, receipt inspections and specify documentation; e.g., material certifications, certificates of conformance, inspection reports, etc. Examples of items or services to be procured according to controlled procurement document procedures are Type A containers, analytical services for identifying and quantifying hazardous waste constituents of MW, and specific assay systems for radionuclides. To the extent necessary, suppliers shall be required to have a QA program consistent with applicable requirements in NQA-1.

5) Instructions, Procedures, Drawings

Activities affecting the quality of the waste certification program which require procedures, instructions, or drawings shall be reviewed and approved, kept current, retained, and controlled. These documents shall include or reference appropriate quantitative or qualitative acceptance criteria for determining that prescribed activities have been satisfactorily accomplished. These procedures shall be listed in the procedures and supporting documentation section of the generator's application (see Section 8 of NVO-325).

6) Document Control

The waste generator shall have in place a system which controls authorization, preparation, review and approval, distribution, recall, and update of documents important to certification. The generator's application and other applicable waste certification documents shall be controlled.

Procedures shall identify those organizations or persons responsible for the control of documents. Controlled waste certification documents shall be kept current.

7) Control of Purchased Items and Services

Purchase of materials, items, or systems important to certification activities shall be controlled by carefully prepared requisitions and purchase orders. Compliance with the written specifications must be verified upon receipt. Vendor audits shall be performed to observe manufacture or assembly of the purchased products. Examples of items or services important to the certification process are containers (DOT Type A), analytical or assay services, and process equipment for production of acceptable waste forms.

When purchasing departments perform vendor inspections, a specialist familiar with EPA sampling, chain-of-custody, analytical, and quality control requirements shall review, verify, and document these specific tasks. Persons or organizations performing these tasks shall be identified in the plan.

8) Identification and Control of Materials, Parts, and Components

Controls shall be established to assure that only correct and accepted items are used or installed. Materials important to the certification processes shall be carefully identified. Examples are waste packages with conforming waste materials, radiation detection instruments used for certification-related surveys, calibration sources for radiation detection instruments, acceptable waste containers and liners, and cement or accepted solidifiers.

Traceability of documentation of the waste management process is critical to understanding the generator's system for a defensible waste certification program. This traceability must show documented connections between each step of the waste handling process beginning with generation. For example, waste characterization documentation that has been verified must be traceable to the exact package in which the waste was placed. The generators must describe the specific steps of documentation, beginning at the point of generation (or before if applicable), through packaging, and shipping. Include documentation of operational and oversight quality activities such as inspection, surveillance, and waste certification activities.

Samples and data packages shall be properly identified and carefully controlled to ensure traceability. Materials, parts, samples, and components found to be out of specification, or not operable, shall be identified as nonconforming items.

9) Control of Processes

Processes, or series of activities important to waste certification, must have controls or verification steps identified as part of operating procedures. Processes and critical inspection points must be clearly identified and described in the waste certification program plan.

Critical requirements related to sample collection, packaging, analysis, verification, and data handling must be described in detail sufficient to qualify as acceptable waste characterization/waste analysis plans for off-site disposal. Similar activities related to radiological assays shall be controlled and carefully described. The entire waste certification

process, which provides evidence of compliance with NVO-325, is a controlled process. A controlled process shall include records, statements, labels, reports, and data being used by the Certification Official to sign a certification statement.

10) Inspection

Inspections must be conducted on waste management activities. Inspections may be conducted by operational persons other than those who performed or directly supervised the work being inspected. However, inspections must be conducted by the quality assurance and certification organization to verify compliance.

Where a sample is used to verify the acceptability of a group of items, the sampling procedure shall be based on recognized standard practices; e.g., Military Inspection Standard MIL I-452088. As a minimum, inspections shall be performed at the following hold points described in Figure 5, page 52:

- Inspection of waste containers received from the fabricator.
- Verification and certification of contents placed in the container (this type of inspection shall be repeated if waste has been repackaged; i.e., after compaction).
- Inspection and certification of the final package prior to shipment.
- Inspection and certification of the shipment and shipment documentation.

Inspections shall be scheduled, performed, and results documented. Inspection for acceptance shall be performed by persons other than those who performed or directly supervised the work being inspected.

11) Test Controls

Tests required to verify conformance of an item or computer program 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

documented and their conformance with acceptance criteria shall be evaluated. Examples where test controls may need application would be a waste treatment process and analytical laboratory control samples leading to the waste meeting NVO-325 certification requirements.

Test plans or protocols shall be prepared by those who will perform tests and reviewed by objective but technically competent individuals who are independent of the activity being reviewed. Independent individuals, who inspect or audit the certification program, shall review the process by which tests are planned, controlled, and technically reviewed.

Verification tests of computer program(s) and software utilized in the generator's waste certification program shall demonstrate the capability of the computer program(s) and software to produce valid results. Verification tests shall be performed after installation of, or changes in computer systems are made.

12) Control of Measuring and Test Equipment

Test equipment and measuring devices shall bear, by label, evidence that they are currently calibrated or certified for current use. Out of calibration devices shall be tagged and/or segregated and not used. If instruments are calibrated on site, environmental controls and measurements which determine temperature, humidity, and dust concentrations shall apply. Standards shall be traceable to National Institute of Science and Technology. If off-site calibration laboratories are used, requirements in Item 7, "Control of Purchased Items and Services," shall be applied.

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

The method and interval 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. When measuring and test equipment is found to be out of calibration, 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.

Users of test and measurement equipment shall provide evidence of operational readiness for equipment under their purview. Periodic reviews of the program shall be conducted by an independent entity.

13) Handling Storage And Shipping

Wastes shall be handled, stored, and shipped in a manner which shall not alter the certification status. Handling and storage considerations shall include provisions for security and fire protection. MW shall comply with EPA requirements for storage (Title 40 CFR 264 Subpart I). Handling and storage of radioactive waste shall comply with ALARA precepts. Waste shipments are to comply with DOT (Title 49 CFR Parts 171-177), EPA (Title 40 CFR Parts 262 and 263), and NVO-325 requirements with respect to packaging, labeling, and manifests.

14) Inspection, Test, and Operational Status

The status of inspection and test activities must be identified and placed on the items and/or in the waste certification documents traceable to the items to assure those items that have not passed inspections and tests are not inadvertently shipped. Status shall be maintained through indicators, such as physical location and accept or reject tags for waste containers, checklists, calibration indicators, NV-211 labels, markings, inspection travelers, stamps, inspection records, or other suitable means. The authority for application and removal of tags, markings, labels, and stamps shall be specified.

15) Control of Nonconforming Items

Nonconformances shall be identified by anyone associated with waste operations and certification activities. Nonconforming items can be out-of-specification empty waste containers, nonconforming wastes, nonconforming test and measurement devices, or any out-of-specification or noncompliance item which could adversely affect waste certification. Such nonconformances must result in removal of the nonconforming item from operating status or operational acceptance. Nonconforming objects, equipment, items, containers, or waste shall be

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clearly identified by label, tag, segregation, or other mechanism to ensure removal from the certification process. Written documentation of nonconforming items and their resolutions is required.

16) Corrective Actions

The generator shall have in place a method for the identification and correction of systematic nonconformances. The identification process for nonconformances can include 1) inspections 2) surveillances 3) audits or 4) trending analysis. The corrective action shall be performed to correct nonconformances resulting from but not limited to:

- **a.** failure of current processes to provide certified waste forms;
- **b.** certification of waste based on assay system data or analytical processes found to be out of calibration or inoperable;
- **c.** failure to properly perform activities critical to certification because of lack of or inadequate procedures;
- **d.** continuous improper packaging;
- **e.** repeated submission of inadequate or erroneous manifests or data packages;
- **f.** lack of waste certification statement on data packages, which relate to specific containers; or
- **g.** inadequate waste analysis and/or failure to analyze a representative sample.

Nonconforming items and activities must be documented and tracked until successful resolution can be demonstrated.

17) QA Records

Records demonstrating compliance with waste certification criteria shall be maintained for time periods equivalent to on-site records retention requirements, but not less than three years (or for time periods designated by other regulatory authority(s)). Certification documents shall be considered valid records only if signed and dated by authorized personnel. Mistakes or changes in records shall have a single line drawn

through the changed data and be initialed and dated. The use of correction fluids or tapes are prohibited. QA records important to certification include, but are not limited to, training records, letters/ memos providing notification of planned technical or quality audits, inspections, audit report checklists, responses, and nonconformance findings with completed corrective actions. In addition, applicable tests, lab reports, shipping documents, and waste certification are also considered QA records. QA 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.

18) Audits/Surveillances

Planned and scheduled audits and surveillances shall be performed on an annual basis to verify compliance with all aspects of the waste management program to determine its effectiveness. These shall be performed in accordance with written procedures or checklists by personnel who do not have direct responsibility for performing the activities being audited. Results shall be documented and reported to and reviewed by responsible management, including the WCO. Follow-up action shall be taken where indicated.

19) Training

All persons associated with the NVO-325 waste management and certification program at generator sites shall be trained in the requirements of their waste certification program plan and NVO-325. All persons who generate, package, certify, prepare data, perform related radiation surveys, or perform the associated quality functions, must have received training in the requirements and implementing procedures for those parts of the certification program in which they are involved. EPA and state regulations related to hazardous waste activities must also be included in the training program to ensure that waste analysis and characterization, process knowledge, sampling, and control of data are performed as required.

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Personnel training courses in waste certification shall be prepared according to instructions provided and/or accepted by those responsible for the certification program. Personnel retraining shall be conducted on a specified frequency.

Records of training course content, exams, and test results shall be maintained. A master list of trained individuals shall be maintained and available for review by audit personnel. The organization responsible for the training program shall maintain training materials and records as required by Item 17 "QA Records."

Appendix

D Generator Waste Stream and Shipment Codes

GENERATOR	WMIS DESIGNATION*	SITE DESIGNATOR**
Aberdeen Proving Ground	USAA	AP
Allied Signal	ABXK	AS
CETO - NTS	LCE1	CE
DNA - Pacific Ops	LDN2	PA
DNA - Tunnel Complex	LDN1	DT
EG&G - Atlas/Las Vegas	LEGL	EA
EG&G Mound	AMDM	MD
EG&G Rocky Flats	ARIR	RF
EG&G Santa Barbara	LEGS	ES
EPA - Las Vegas	LEPC	EP
FOD/DoD - NTS Area 12	LFDD	FD
Fernald-Westinghouse	ONLO	WM
GA Technologies	BGAT	BG
LANL-NTS	LCAB	LA
LLNL-California	BCLA	LL
LLNL-NTS	LCAA	LN
Lovelace Foundation (ITRI)	ALVI	LV
Pantex	AMHP	PX
Pinellas	****	PN
REECo - Area 3 U3AHAT	LRY2	A3

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GENERATOR	WMIS DESIGNATION*	SITE DESIGNATOR**
REECo - Area 5 RWMS	LRY1	A5
REECo - ATDDP	LRY7	AT
REECo - Decon Pad	LRY5	DP
REECo - Mercury Lab	LRY8	ML
REECo - NAEG Soils Lab	LRY6	RS
RMI Extrusion Plant	ORMI	RM
Rocketdyne - Canoga Park	BNRC	BN
Sandia - Albuquerque	ASLA	SA
Sandia - Livermore	ASLL	SL

Note: Contact WMD if generator site is not listed.

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

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

**** WMIS Designation not yet assigned

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Appendix

E Form RE-0166 "Package Storage & Disposal"

Reynolds Electrical & Engineering Co., Inc.
Package Storage & Disposal

Shipment Number _____ Prepared by _____

Date _____ Manifest No. _____ Work Order No. _____

Package No. _____ W/S ID _____ Package Completed ___/___/___

Operation Type _____ Total Curies in Package _____ Assay Date ___/___/___

Container Code _____ External Vol. _____m³ Internal Vol. _____m³

NC _____ Waste Code _____ Gross Weight _____k Net Weight _____k

Nuclide	Quantity	Nuclide	Quantity	Nuclide	Quantity	Radiation in mr/h at Contact	1 Meter

Comments _____

Package No. _____ W/S ID _____ Package Completed ___/___/___

Operation Type _____ Total Curies in Package _____ Assay Date ___/___/___

Container Code _____ External Vol. _____m³ Internal Vol. _____m³

NC _____ Waste Code _____ Gross Weight _____k Net Weight _____k

Nuclide	Quantity	Nuclide	Quantity	Nuclide	Quantity	Radiation in mr/h at Contact	1 Meter

Comments _____

Package No. _____ W/S ID _____ Package Completed ___/___/___

Operation Type _____ Total Curies in Package _____ Assay Date ___/___/___

Container Code _____ External Vol. _____m³ Internal Vol. _____m³

NC _____ Waste Code _____ Gross Weight _____k Net Weight _____k

Nuclide	Quantity	Nuclide	Quantity	Nuclide	Quantity	Radiation in mr/h at Contact	1 Meter

Comments _____

RE-0166 (3/92)

Form RE-0166 "Package Storage & Disposal"

If you have any questions on completing this form contact Waste Management Department at NTS 5-6811, FTS 575-6811, or commercial (702) 295-6811. Data entered on the form must be legible. Handprinting 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 alpha-numeric 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 No.: Only required on mixed waste shipments. A 5 digit number.

PACKAGE No.: 6 characters for each container that is unique for that shipment.

W/S ID: Waste Stream Identification. 13 alpha-numeric characters. First 4 characters will be the generator code used by DOE Waste Management Information System (WMIS). Next 9 alpha-numeric characters will be generator assigned for an approved waste stream. EXAMPLE: LRY5000000001 represents waste from the NTS Area 5 Waste Management Department.

PACKAGE COMPLETED: The date, in the formal DD/MMM/YY (e.g., 01/JAN/92), that the last waste material was placed in the package.

OPERATION TYPE: B for burial, G for generated, or R for retrievable storage.

TOTAL CURIES IN PACKAGE: Written in scientific notation X.XXXE±00. Total curies must equal the sum of curies for each nuclide reported.

ASSAY DATE: The date, in the formal DD/MMM/YY (e.g., 01/JAN/92), that the curie activity of the package was determined.

CONTAINER CODE: 3 digit number that identifies the type of container. NOTE: If your container is not listed, contact WMD or refer to NVO-325.

Code	Description	Cubic Meters	Code	Description	Cubic Meters
100	type not listed	fill in volume	104	2'x4'x7' box w/o skids	1.586E+00
101	30 gallon drum	1.982E-01	105	2'x4'x7' box with skids	1.841E+00
102	55 gallon drum	2.265E-01	107	4'x4'x7' box w/o skids	3.172E+00
103	83 gallon drum	3.964E-01	108	4'x4'x7' box with skids	3.426E+00

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

INTERNAL VOL.: Written in scientific notation X.XXXE±00. Total volume of waste and any solidification or absorbent media inside container in cubic meters.

NC: 1 digit for the nuclide category: 1-TRU 2-Uranium/Thorium 3-Fission Product 4-Induced Activity 5-Tritium 6-Not Used 7-Alpha 8-Other

WASTE CODE: BW Biological Waste CE Contaminated Equipment DD Decontamination Debris DS Dry Solid SS Solidified Sludge NC Not Classified

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

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

NUCLIDE: Valid nuclide description. Attach additional sheet to report more nuclides than what space allows.

QUANTITY: Written in scientific notation X.XXXE±00. The quantify of the nuclide present in the container in curies. The sum of each nuclide reported must NOT exceed the total curie amount reported for the total package.

RADIATION IN MR/H: Radiation reading at the surface of the package and at 1 meter.

COMMENTS: Any additional information about the container contents.

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Nevada Test Site Waste Acceptance Criteria and Waste Management Program Requirements

Marcus B. Brown, John H. Bell & Mark J. Krauss

Abstract

This article describes the specific Waste Acceptance Criteria (WAC) that must be met, in order to dispose of DOE low-level radioactive waste at the Nevada Test Site (NTS). The article also describes the development and requirements of a "Radioactive Waste Management" program meeting the NTS WAC. The intent of this article is to provide the reader with a fundamental understanding of the programmatic requirements for DOE facilities wishing to dispose of LLW at the Nevada Test Site.

Key Words

certification
characterization
hold points
process knowledge
sampling and analysis
waste acceptance criteria
waste stream

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Introduction

The safe and long-term disposal of radioactive waste is an issue that exists throughout the United States. Public concern over the potential hazards associated with handling radioactive waste has increased as a result of nuclear reactor accidents and the well-publicized environmental difficulties experienced at several government-owned contractor-operated (GOCO) nuclear facilities.

The United States Department of Energy (DOE) owns several facilities that are directly involved with the nation's nuclear defense program. These facilities are involved in nuclear-related processes ranging from production of nuclear materials to decontamination and decommissioning activities that result in the generation of radioactive waste. Three federally owned disposal sites accept radioactive waste generated by DOE facilities: the Savannah River facility in South Carolina, the Hanford facility in Washington, and the Nevada Test Site (NTS) in Nevada.

To enhance management of radioactive waste generated within DOE facilities, the Department has developed a comprehensive procedure detailing management requirements for handling radioactive waste.[1] This DOE order calls for the development of radioactive waste management programs that, in addition to meeting all other applicable DOE orders, must also comply with all applicable federal (Environmental Protection Agency and Department of Transportation), state, and local regulations pertaining to the environment and

the health and safety of the public. These programs are also required to use extensive quality assurance program (QAP) practices based on accepted guidance;[2] these are also described in a DOE Order.[3] Radioactive waste management program requirements and waste acceptance criteria (the requirements, terms, and conditions under which a disposal facility accepts waste) based on these guidelines were developed for DOE waste generators who dispose of their waste at one of the three federal disposal facilities.

One of the three facilities accepting radioactive waste is the Radioactive Waste Management Site (RWMS) located on the NTS and operated by Reynolds Electrical & Engineering Company, Inc. (REECo). REECo also provides technical expertise in developing and promulgating the waste acceptance criteria (WAC) established by the DOE Nevada Field Office (DOE/NV) in NVO-325, "Nevada Test Site Defense Waste Acceptance Criteria, Certification, and Transfer Requirements."[4]

This article will examine the WAC, certification, and transfer requirements of DOE/NV for managing, preparing, and shipping radioactive waste offered for disposal at the NTS. The development of a radioactive waste management program as used in this article is based on the approach that has been implemented by the Reynolds Electrical & Engineering Company, Inc. Work on the comprehensive radioactive waste management program began in December of 1991 and is continuing today. The article also describes the programmatic requirements of the waste generators. Although requirements at other facilities will differ to some extent, this article will serve to describe the elements of a successful program that can be implemented, with necessary modifications, by generators and disposal facilities governed by either the DOE or the Nuclear Regulatory Commission.

History

For several decades, DOE facilities were immune from external regulations governing waste for reasons of national security. The Atomic Energy Act (AEA) of 1954 identified and regulated source, special nuclear, and byproduct material used in the nation's nuclear defense program; however, radioactive waste generated from processes used in the production of fissionable material for nuclear weapons was considered byproduct material and exempted from regulation by outside federal or local agencies. Since the 1940's, the various facilities involved in nuclear defense projects (such as the NTS) developed internal radioactive waste management programs following broad guidance offered by the various governmental agencies in charge of the defense programs (Atomic Energy Commission, Energy Research and Development Administration, and the DOE).

In 1984, Congress passed the Hazardous and Solid Waste (HSWA) Amendment to the Resource Conservation and Recovery Act (RCRA) of 1976. This amendment included provisions banning land disposal of hazardous materials that may be included in byproduct material. The DOE, however, claimed exemption under the Atomic Energy Act (AEA). In 1987, a final determination was made regarding byproduct material. It was established that byproduct material as defined in the AEA containing hazardous waste under RCRA "... will be subject to regulation under both RCRA and the AEA." In an effort to comply with the federal regulations regarding radioactive waste disposal, DOE was obligated to provide regulatory guidance incorporating the requirements of RCRA to DOE facilities managing and disposing of radioactive waste. This guidance[1] has resulted in the development of WAC with which waste generators must comply. In October of 1992, Congress passed the Federal Facilities Compliance Act, which essentially waives the right of sovereign immunity. Without sovereign immunity, the DOE is now subject to fines and penalties for failure to properly implement waste disposal programs mandated

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by statute. The Act has caused concern in the DOE community; however, it does allow a three year grace period prior to compliance.

Waste Types

Disposal facilities identify four radioactive waste types:[4] low-level radioactive waste (LLW), mixed waste (MW), transuranic waste (TRU), and transuranic mixed waste (TRUMW). Low-level radioactive waste is defined as all radioactive waste not classified as high-level waste, spent nuclear fuel, TRU waste, uranium mill tailings, MW, or byproduct materials as defined by the DOE.[1] Test specimens of fissionable material irradiated for research and development only, and not for the production of power or plutonium, may also be classified as LLW, provided the concentration of transuranic nuclides is less than 100 nanocuries per gram. It is interesting to note that the definitions for radioactive waste are not really definitions, but are more of an explanation of what the various radioactive wastes are not. In the same vein, "Low Level" has absolutely no correlation with the curie content or exposure rate associated with the waste. It is not uncommon for low level waste to contain significant amounts of radioactivity and high exposure rates that require shielding.

Mixed waste is defined as waste containing both radioactive and hazardous components as defined by the Atomic Energy Act and the RCRA, respectively. MW must meet the Land Disposal Restrictions (LDR) as listed in the Code of Federal Regulations.[5]

Transuranic waste is defined as radioactive waste containing alpha-emitting radionuclides having an atomic number greater than 92, with half-lives greater than 20 years, in concentrations greater than 100 nCi/g.

Transuranic mixed waste is defined as waste containing both TRU and hazardous components.

The radioactive waste disposal facility located at the NTS accepts only low-level radioactive waste for disposal. LLW typically consists of waste generated as a result of work conducted in radiologically controlled areas and may include contaminated clothing, laboratory waste, contaminated soils, obsolete equipment, and demolition rubble. To comply with the WAC,[4] certain constituents are prohibited from being included in the waste. These prohibited items are: hazardous waste (as defined by the Environmental Protection Agency), particulates or fine particulate waste with a diameter of less than 200 micrometers, compressed gasses, etiological waste (e.g., animal carcasses from disease research), free liquids, chelating agents, explosives, and polychlorinated biphenyls (PCBs). By segregating or excluding these constituents from the radioactive waste, the WAC can be met.

Radioactive waste generators wishing to dispose of LLW at the NTS must implement a radioactive waste management program that establishes goals to develop a process to prevent the inclusion of these prohibited materials into their waste and initiate a verification method that allows certification of the material as meeting the WAC. This management program must meet DOE field office surveillance requirements.

DOE Waste Generator Application Process

The first step for disposal at the facility is to petition to apply for "DOE approved generator" status. The DOE headquarters office (DOE/HQ) in Washington, D.C. will inform the generator in writing that the waste generated at the facility is designated as defense waste that must be managed by the DOE. Once this has been established, DOE/HQ will designate which DOE disposal facility the generator is to use. Upon notification, the waste generator must then receive approval from the manager of the field office responsible for the disposal facility, to apply formally for waste disposal. At this time, the generator will be supplied with a current edition of the WAC and certification

and transfer requirements. It is then incumbent upon the generator to develop and implement a waste management program that satisfies the applicable WAC.

Once the waste generator has established a waste management program that satisfies the WAC, a formal application to ship waste to the facility is prepared. The application must contain information concerning the following topics: generator information, waste identification, waste characterization, waste origin information showing compliance with the WAC, waste certification program, exemption requests, and waste transfer. The application should also include procedures and supporting documentation used by the generator in managing the waste.

Representatives from the DOE field office will then review and comment on the application, provide guidance that may improve the program, and identify any deficiencies that might exist. The LLW generator is then given the opportunity to correct the deficiencies and respond to the comments. Once the comments and deficiencies have been resolved to the satisfaction of the field office, an audit of the waste management program is scheduled. Approval to dispose of any wastes is granted after successful completion of the audit, including resolution of any program deficiencies identified.

DOE Audit Process

An audit is "A planned and documented activity, performed to determine by investigation, examination, or evaluation of objective evidence, the adequacy of and compliance with established procedures, instructions, drawings, or other applicable documents, and the effectiveness of implementation."[2] Consequently, the audit conducted by the DOE field office is comprehensive and encompasses the entire radioactive waste management program of the generator. The purpose of the audit is to verify that the waste management program, as described in the application, is adequately implemented. During the DOE audit process the waste generator must demonstrate traceable "cradle to grave" management and a verifiable certification program for all radioactive wastes for which approval to dispose is sought.

The audit consists of an operational review of specific radioactive waste management processes such as characterization (the process of identifying the physical, chemical, and radiological characteristics of the waste), waste packaging, and waste certification. This review includes an observation of waste management procedures and interviews with individuals involved in various phases of the management process.

The audit also consists of a thorough evaluation of objective evidence for traceability of processes, waste certification, and operational procedures related to the waste generation process at the site of the LLW generation. Objective evidence consists of:

- Forms, analytical results, procedures, training, and supporting documentation used to characterize waste;
- Forms, procedures, and training used in managing the waste;
- Forms, procedures, and training used in the certification process of the waste;
- Forms, procedures, and training used in any activities that are involved directly or indirectly with the waste management function (for example, an audit of instrument calibration procedures).

Upon completion of the audit, a report is issued within 30 calendar days. The report will contain significant findings that require corrective action, to which the waste generator has 30 days to respond. The field office reviews the responses and determines if they are acceptable. Once accepted, a surveillance will be scheduled by the DOE to verify that the corrective action has been incorporated.

after which the waste generator will be granted approval to ship LLW for disposal.

To ensure waste generators are in continued compliance, DOE conducts annual recertification audits that follow the entire system as described above. Additionally, any waste identified after initial acceptance by DOE must be approved and included in a revised application prior to the material's being shipped for disposal.

Generator Program Requirements

Prior to submitting an application to dispose of waste:

- The waste management program of the generator must be implemented and fully operational;
- The waste generator must document that the waste has been characterized in accordance with the requirements in the Code of Federal Regulations[6] to ensure that the LLW does not contain hazardous constituents;
- The waste management program must meet the requirements established by the Department of Energy[1,3] and all applicable state and local (site of generation) regulations.

Additionally, the waste generator must comply with a number of regulations that are directly related to the protection of personnel working with radioactive material, including:

- DOE Radiological Control Manual,[7]
- DOE Order 5480.11,[8]
- DOT regulations.[9]

Generator Program Development

To ensure that all of these requirements are incorporated into the waste management program, a technical support team should be assembled that consists of subject matter experts in the fields of Health Physics, Environmental Compliance, Facility Operations, Quality Assurance, Analytical Laboratory Support, Technical Writing, Hazardous Material Transportation, and Procurement. Responsibilities of the group include identifying the particular wastes to be incorporated into the waste management program and designing a waste certification program to verify the waste management program's compliance with the WAC. The program should be designed so that the entire waste generation process is controlled, from point of generation until disposal.

Waste Stream Identification

The first step in the waste generation process is the identification of radioactive waste. Waste that is a result of an operational "process" is termed a "waste stream." Identification of the waste stream is an important part of the waste disposal process and is often a difficult task to complete. There is no defined process for identifying or classifying radioactive waste, and waste generators may designate waste at their discretion; however, waste streams designated for disposal must first be concurred with by the DOE through the application review process. Typically, a waste stream should be established based on specific characteristics of the waste, such as radionuclide content, physical makeup of the waste (e.g., metal, wood, ceramic, or combinations), or the ability of the generator to characterize waste. The key is to be able to demonstrate, through characterization and documentation, that the waste has been determined to be LLW. Careful consideration should be given to this aspect of waste identification; difficulty in characterization and documentation will lead to delays in the waste stream approval. For this reason, waste stream identification should be based upon materials that have similar characteristics and origins, or based on methods of characterization.

For example, a waste stream might consist of debris generated at a radiological control point, or cement rubble from decontamination

and decommissioning (D&D) activities. Another waste stream might consist of materials found in a facility designated for D&D, such as tools, compactible trash, building materials, etc. It is important to make the waste stream as broad or as narrow in scope as the generator's ability to characterize it. The designation of waste streams will effect how characterization of the waste is conducted. This is explained in detail later in this article.

Flow Chart (Figure 1)

One of the most important tools that the waste generator will use in planning and developing a waste management program is a waste management flow chart. The flow chart should identify the sub-organizations involved in each step of the waste generation process. It should also include the decision blocks used in the characterization and classification of the waste, identification of required procedures, and identification of "hold points."[4] These "hold points," described later in this article, are certification requirements[4] for LLW and waste packaging. Formulation of a flow chart, such as the one shown in Figure 1, will perform four important functions:

1. A road map in the waste management program by clearly defining required procedures, locating hold points, and identifying responsible organizations;

2. An assessment tool for the waste generator's determination of those portions of the program that are in place and those that require development prior to submittal to DOE;

3. A checklist for ensuring that the entire program is in place and that all applicable requirements are met;[4]

4. A graphic representation to aid the waste generator and the DOE representatives in understanding the waste generator's process.

The flow chart is fairly easy to develop once the waste generator has established which waste streams will be submitted for DOE/NV approval. The Department of Energy provides specific criteria[4] that must be met, required documents which must be completed for certain aspects of the program, and designated hold points for certification of the waste. Therefore, certain steps of the flow chart are determined by the criteria in the waste acceptance document. The waste generator needs to determine what existing company organizations can be used to meet the program needs and what organizations or activities must be created to ensure a thorough program. Once a flow chart is completed, the real work begins with assignment of responsibilities, development of new procedures, forms and activities required for the program to be complete.

Waste Evaluation

Once a generator has identified the waste stream(s), all general, physical, chemical (including RCRA), radiological, and other pertinent information regarding the waste should be compiled and documented following a waste evaluation process that must be developed. Development of this waste evaluation process will ensure that, as waste streams are identified, a formal evaluation is performed.

The format of this process should be documented. The procedure must include who is responsible for completing the form, what information is required, how the waste will be evaluated, and finally, where the records will be maintained. In addition, a waste evaluation form should be prepared, incorporating all of the pertinent data required by the procedure.

Form Contents

General Information

General information regarding the waste contained in a waste stream consists of a description of the generation process and the

type and content of the waste. This information is necessary for characterization purposes. Description of the waste process should include the date of generation and the source of the waste (e.g., radioactive contaminated compactible trash generated from nuclear testing activities). Type and content of the waste should be as specific as practicable, and should provide a listing of waste contents. For example, waste type and content for the general process described above would include the following listing: "Concrete,...plastics: bioassay bottles, bags, hard hats, and safety glasses."

Physical Characteristics
Information should include a description of the waste appearance; for example, "dirty, dusty, soiled (dried mud), or oil stained." The waste form should also be identified in one of the following categories: dry solid, liquid, or containerized gas. Any information including color of the waste should be provided.

Chemical Information
All of the chemical data available for the waste and generation process should be compiled. This information should include all applicable Material Safety Data Sheets (MSDS), any chemical analysis, and process knowledge. Of particular importance is any information pertaining to the RCRA characteristics of toxicity, corrosivity, reactivity, and ignitability. Additionally, it should be stated if the substance is specifically listed as a hazardous waste under RCRA. If the chemical information is unknown, this must be stated. Typically, nuclear facilities possess comprehensive sampling programs and are able to determine metal content, volatile organic compounds (VOC) content, semi-volatile organic compound contents, and hydrocarbon content through laboratory analysis. If such a program is not incorporated, the waste generator should perform chemical analysis of the waste as it is generated and immediately establish either administrative or physical controls over the waste to prevent prohibited materials from being introduced to the waste stream.

Radiological Information
All radiological data available should be included. This includes analytical data, filed survey data, nuclide content, and process knowledge. As discussed earlier, the NTS WAC are very specific as to waste content, and only LLW is accepted for disposal. For these reasons, the waste generators must be able to provide a listing of all radionuclides that are present in the waste, as well as the activity of each nuclide. In order to do this, a radiological assay program must be available with the capability of measuring alpha, beta, and gamma emitters. The assay program should utilize information from instrument and smear surveys, and spectroscopy. The waste generator should list all radionuclides that may be present in the waste.

RCRA Information
If waste contains chemicals that exhibit any of the RCRA characteristics of ignitability, corrosivity, reactivity, or toxicity, detailed information should be provided. Additionally, if any of the waste is determined to be an EPA-listed hazardous waste, this information should also be included. It is recommended that information pertaining to chemical quantities and concentrations be included.

Other Pertinent Information
Any additional background information regarding the waste that would prove useful in evaluating its content should be included. This would include references to materials or products used during the generation of waste, factors that may alter the contents of the waste, administrative or physical controls used during the waste generation process, and descriptions of any unique characteristics of the waste.

The waste generator must then provide all of this information to the organization responsible for reviewing the data. The classification of the waste will significantly impact how the

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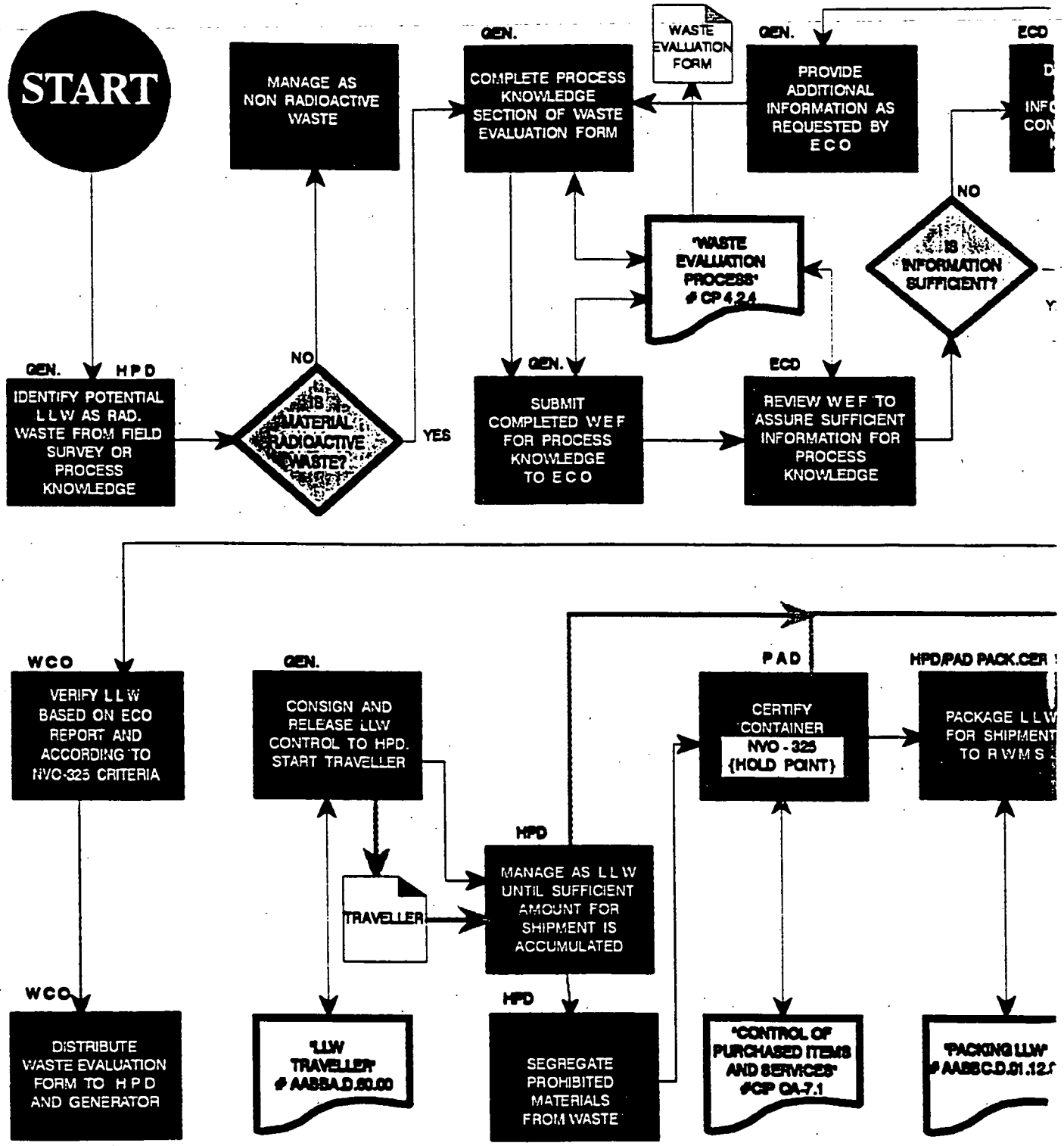

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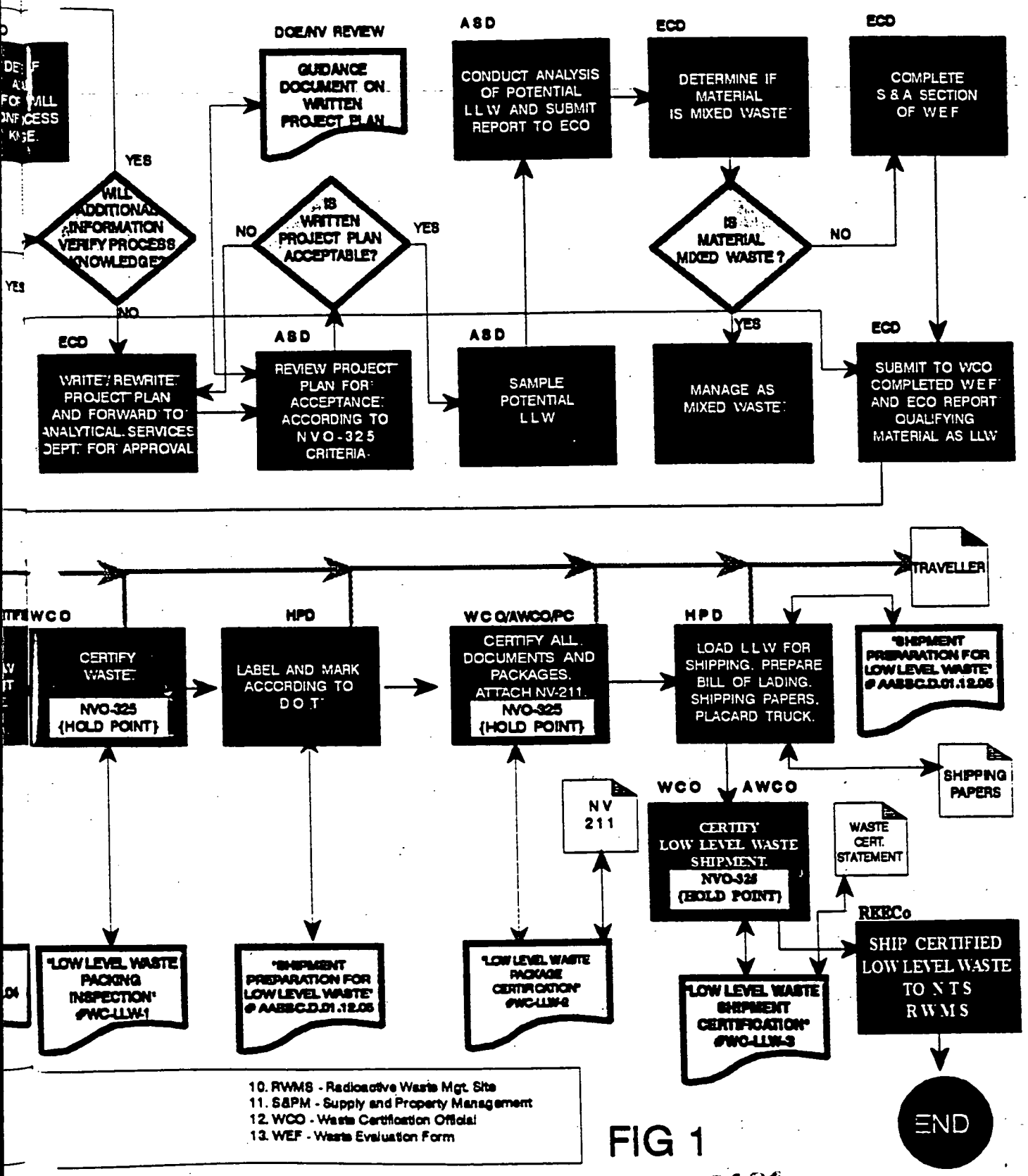

FIG 1

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waste must be managed. The data provided to the evaluating organization will be used to determine the appropriate waste classification. Appropriate classification leads to significant cost savings. For instance, radiological waste that is found to contain hazardous constituents would be classified as "mixed waste." As a result of this classification, it would not be eligible for consideration for disposal at the NTS disposal facility at the present time, and processes outside the scope of the LLW program would need to be implemented. Waste that is found to be free of radioactivity would also be excluded from disposal at the NTS. Only waste that is found to be low-level radioactive can be managed, certified, and disposed of according to regulations.[4]

Waste Characterization

As discussed earlier, the process of determining the physical, chemical, and radiological constituents of the waste is defined as waste characterization. This determination is typically performed in one of two ways: 1) by the process by which the waste is generated (process knowledge) or 2) through waste stream sampling and analysis. Use of these methods must be consistent with the Code of Federal Regulations[10] which specifies waste characterization techniques. Documentation of waste characterization, as described in the waste evaluation process discussed earlier, is essential to meeting both DOE and EPA requirements.

The NTS disposal facility will not accept waste without knowing its specific constituents. A primary concern of the facilities in accepting certified low-level radioactive waste for disposal is that the waste contain no hazardous waste as defined by the Code of Federal Regulations.[11] Substantiated characterization and documentation of the waste to establish that no hazardous wastes are present will be audited by the DOE/NV. In addition, state or EPA inspectors in the area where the disposal facility resides may review the program documentation. Improper disposal is a violation of state and federal EPA regulations and may subject the generator and disposal facility to civil and criminal litigation.

Process Knowledge

Process knowledge characterization of waste is exactly that: the demonstration, via knowledge of the waste generation process, of the physical, chemical and radiological makeup of the waste.

This is often simple to document if the raw materials used in the process are known. If the generator is certain of the chemical process which results in the waste generation, a mass balance can be performed. For example, pure magnesium is used as a liner material to contain Uranium Tetrafluoride (UF_4) in a carbon steel pot during furnace operations of uranium metal production. The magnesium fluoride waste composition can be derived since the raw materials are known and the composition of the product (uranium metal) is known. The waste contains the difference of the two.

In cases in which the waste resulted from a process in which raw materials were unknowns, additional information can be gathered from several indirect sources to provide a process knowledge evaluation. For example, protective clothing used during decontamination operations can only be contaminated with radionuclides and chemicals present in the radiological control area. Analytical data taken during decontamination operations (air sampling, sump sampling, etc.) can be used to show the types and approximate, or maximum amounts, of contaminants that could be present on the clothing. Although the clothing was not directly analyzed, and mass balance would be impractical, process knowledge characterization can be provided by the analytical data from associated operations; however, in and of itself, this analytical data cannot be used to fully characterize the waste stream.

Sampling and Analysis
Sampling and analysis of waste is a much more involved process for characterizing waste than is characterization by process knowledge. In this process, samples of the waste are taken, then analyzed for radiological and chemical constituents.

Prior to initiating sampling, a sampling plan must be generated specifying such items as type of equipment used, sample chain of custody forms and procedures, sample volumes, analytical parameters and methods, quality control levels for analytical work, data reporting format, and statistical evaluation of data.

Samples are generally obtained to prove that no constituents of the waste material need to be regulated as hazardous waste. Sampling should include an examination of the types and activity levels of the suspected radionuclides present within the waste. Personnel who perform the sampling must have documentation of training that qualifies them to perform environmental sampling procedures.

All documentation of sampling and analytical activities are subject to audit review by the DOE/NV team, and the state or EPA regulators. In addition, the waste generator is required to perform annual audits of the laboratory where analytical work was performed. Depending on the specifics of the contract, the generator may also be responsible for the waste generated by the laboratory.

Analytical data must be maintained in the characterization record. The chain of custody process becomes important at this point. The sample obtained from the container must be traceable to the analytical data and to supporting quality assurance requirements so that a representative population of containers is traceable to the characterization records.

Sampling and analysis are more complicated and costlier than characterization by process knowledge, but are necessary in those cases in which the waste generation process is unknown.

Waste characterization is a very important part of the disposal of radioactive waste. The method of characterization and the controls used for characterization are all scrutinized by disposal facility representatives. Thorough consideration should be given to the ease and ability of auditing the characterization method chosen for various waste streams. Procedures for characterization and a traceability file for the waste stream must be in place for documenting the characterization process. Without these aspects of the program in place, approval of the waste stream is unlikely. All of these steps are shown on the waste generation flow chart in Figure 1.

Waste Certification

Once the waste stream has been identified and the characterization information compiled, the waste must be certified. Certification[2] is "the act of determining, verifying, and attesting in writing to the qualifications of personnel, processes, procedures, or items in accordance with specified requirements." To ensure compliance with the WAC,[4] the generator must incorporate a waste certification process that is operationally independent from the waste management program.

The certification process is directed by a Waste Certification Official (WCO) who must be operationally independent from the waste management program. In most cases, this independence is maintained within an organization by providing the WCO with direct access to the generating facility manager.

Collectively, the waste management program and the waste certification process constitute a waste certification program. "The purpose of the waste certification program is to ensure safe, efficient, and effective management of waste received at the NTS by providing an auditable system for verifying that the generators are properly identifying, characterizing, segregating, packaging, certifying, and shipping their wastes."[4]

The waste certification program covers all facets of the waste management program and transcends all aspects of operations. The certification program includes the conducting of routine audits, inspections, and surveillance of processes related to the waste management program. It is the responsibility of the WCO to ensure that these certification processes are carried out in accordance with the waste certification plan. The WCO is also responsible for certifying the waste, signing required certification statements for shipment, and accepting liability for violations of the WAC.

In addition to those responsibilities listed previously, there are six specific functions required of the WCO[4]:

1. Sign the generator's application signature page certifying that the waste stream(s) meet(s) the WAC[4] requirements upon completion of the certification program.

2. Ensure the performance of internal audits, inspections, and surveillances.

3. Ensure timely identification of deficiencies and completion of effective corrective action.

4. Be responsible for ensuring that each Package Certifier is properly trained and qualified to applicable requirements.[4]

5. Sign and affix the appropriate package certification sticker to each waste package.[12]

6. Sign the LLW certification statement. The statement must be included with the shipping paper and indicate that the shipment meets all applicable requirements.[4]

Hold Points

In addition to these specific duties, four "hold points" have been identified[4] that must be included in the certification program. Hold Points are specific certification steps that must be successfully completed before the certification process can continue. These hold points apply to every package offered for disposal, and all shipments to the NTS disposal facility must have documented acceptance or rejection. These rejection loops ensure that those items not meeting the certification standards are removed from the process until corrective action is completed. The handling of these non-conforming items must be in accordance with applicable requirements.[2]

The hold points consist of:

1. Inspection of waste containers, showing that the specifications for closure, strength, handling, size, and weight are complied with;

2. Certification of the waste contents, ensuring that the waste has been characterized to applicable requirements[4] and is free from prohibited materials;

3. Certification of the waste packages, ensuring that they are properly sealed, marked, and labeled; and

4. Certification of the shipment, ensuring that all the required shipping papers are in order, that certification documents are signed, and that the shipment is properly placarded.

The four hold points are included in the waste generator's program flow chart. A more detailed certification flow chart is included in Figure 2. This flow chart shows the associated rejection loops which are required.[4]

Shipping

The final step in the generator process is the shipping of the waste. Once all of the certification processes have been completed, the shipment must be made in accordance with applicable DOE, DOT, EPA, state, and local

hazardous waste regulations. There are specific requirements with which the waste generator must comply in order to facilitate the waste transfer. These include the:

- Placement of seals on trailers or packages on enclosed trailers;
- Notification to the disposal facility, by phone, of shipment and shipment information;
- Consignment of the shipment;
- Notification of change in estimated time of arrival, and arrival of shipment during receiving hours.

There is also a requirement that the appropriate shipping papers, as described in DOT regulations, and a "Radioactive Waste Management-Storage and Disposal" form be provided to the disposal facility upon arrival.

Upon arrival at the NTS, the shipment will be inspected by the REECo Radioactive Materials Control group and the REECo Traffic section to ensure compliance with DOT regulations regarding placarding and shipping papers.

Upon arrival at the NTS Radioactive Waste Management Site, waste management personnel will conduct a thorough inspection of the waste shipment. All documentation will be checked for completeness and accuracy. Placarding of the transport vehicle will also be checked. The waste packages will be inspected for integrity, external radiation levels, and radioactive contamination. The packages, including markings and labels, will also be inspected to ensure that they conform to applicable requirements.[4] If the shipment meets all of these requirements, the waste is accepted for disposal. Waste that does not meet the requirements is segregated and corrective actions are taken to bring the shipment into conformance at the generator's expense.

Training

It is also apparent that, in order to develop a program with such a large scope, training must be provided to all of the employees involved in the program. This includes courses providing general background information into the requirements of NVO-325 and the RCRA. Specific training on these procedures needs to be provided and documented for all individuals who are directly involved in the waste management program. This would include health physicists, technicians, environmental specialists, managers and general site workers.

Conclusion

It should be clear that the development of a waste management program which meets the requirements of NVO-325 is a complex process that involves all of the resources of a facility. The program crosses all organizational lines within a facility, from employees that generate waste to the Waste Certification Official. Developing and implementing such a program requires a firm management commitment and a dedicated effort by a variety of individuals with expertise in several areas of facility operations. Technical expertise is required for the evaluation of the radiological and chemical contents of waste offered for disposal. Operational expertise is required for the development of procedures that effectively manage the LLW to meet the requirements mandated by the DOE. Quality expertise is required for the development of a waste certification program, ensuring compliance with the WAC. The realm of radioactive waste management has been expanded to include not only health physics concerns, but also environmental, operational, and quality concerns as well.

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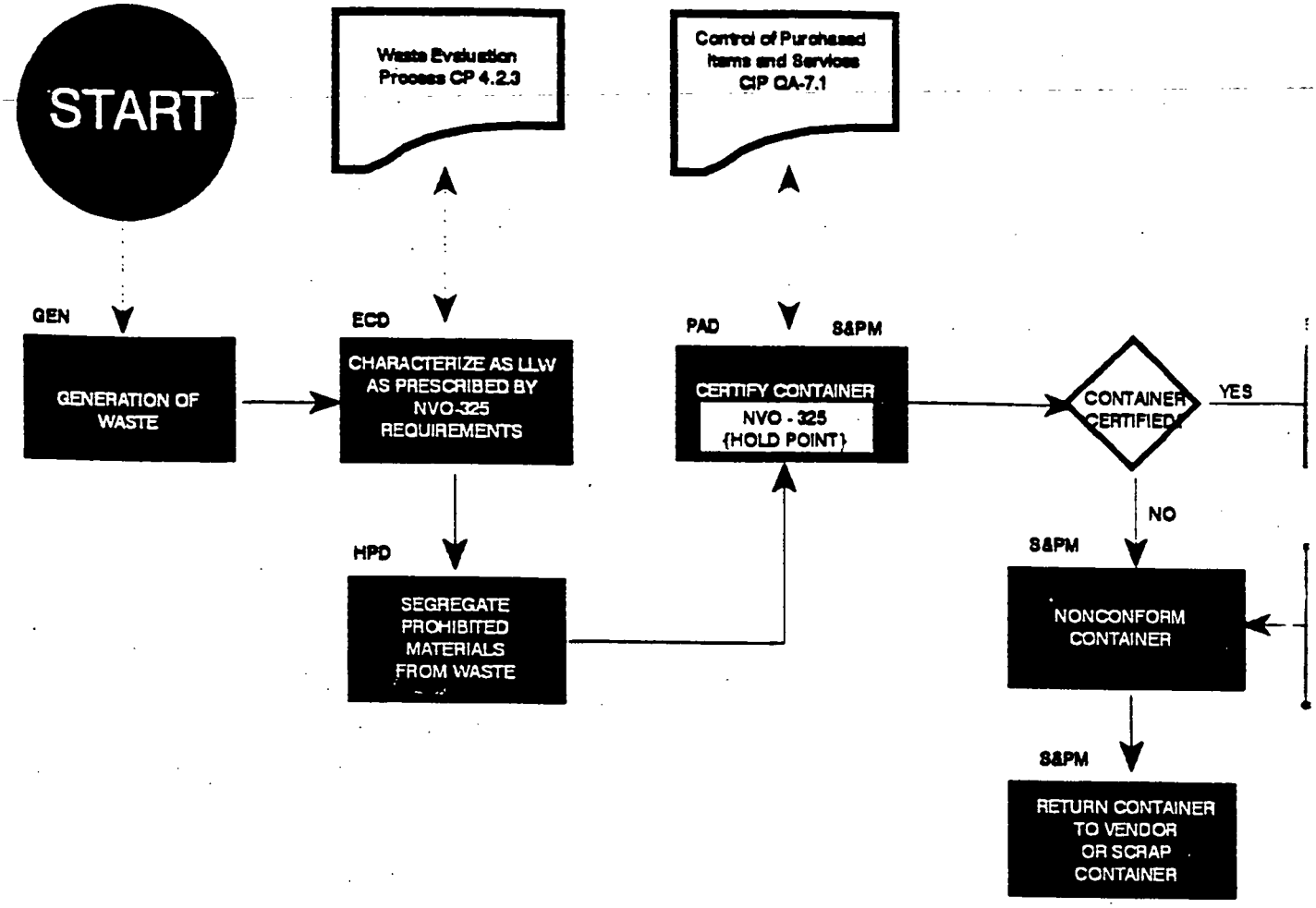
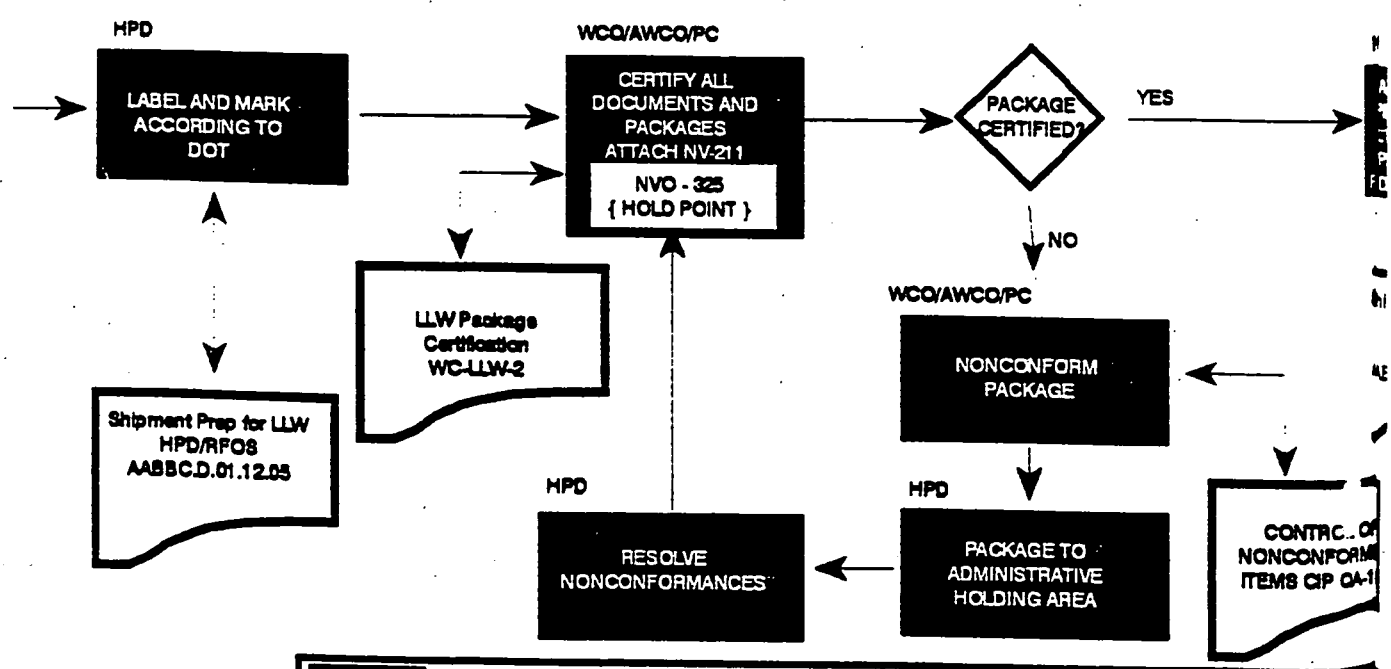
REECo WASTE CERTIFICATI





LEGEND

1. AWCO - Alternate Waste Certification Official
2. DOT - Department of Transportation
3. ECD - Environmental Compliance Department
4. GEN - Generator of Waste
5. HPD - LLW Ha
6. LLW - Low Le
7. PAD - Perform
8. PC - Packa

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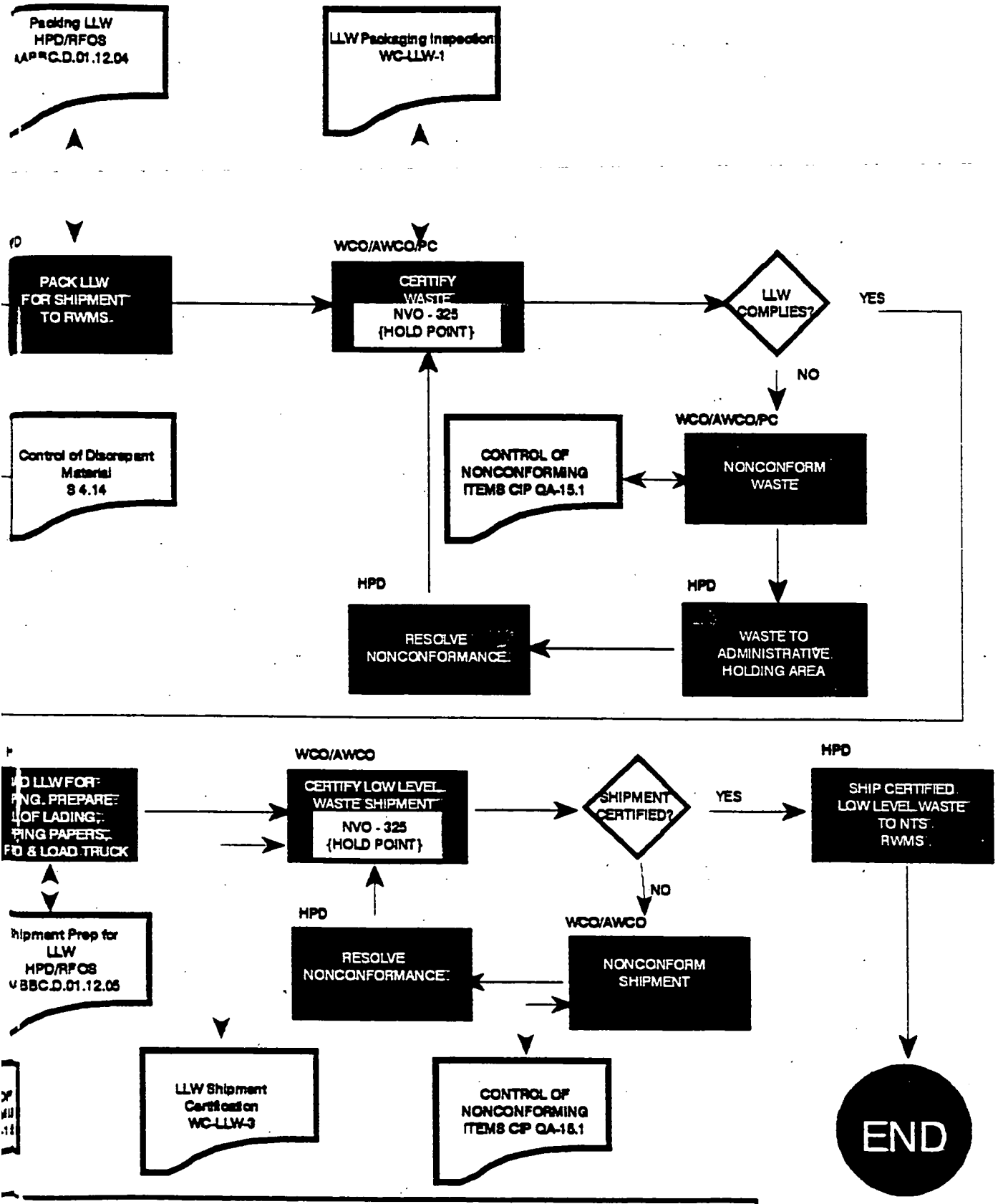
IN FLOW DIAGRAM

REECo



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9. RWMS - Radioactive Waste Management Site
10. S&PM - Supply and Property Management
11. WAC - Waste Acceptance Criteria
12. WCO - Waste Certification Official

FIG 3

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