

Nevada National Security Site Waste Acceptance Criteria

**Prepared by
U.S. Department of Energy
National Nuclear Security Administration
Nevada Field Office
Environmental Management Operations**



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Photograph on front cover: Aerial view of Area 5 Radioactive Waste Management Complex, Nevada National Security Site

**Nevada National Security Site
Waste Acceptance Criteria**

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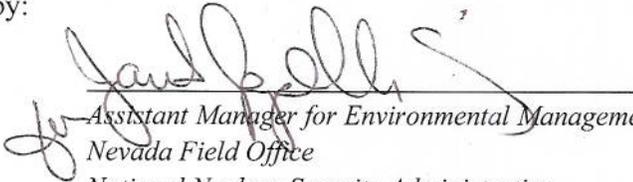
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Approval Signatures

This document is correct and the process and criteria stated within meet the U.S. Department of Energy and appropriate federal regulation requirements.

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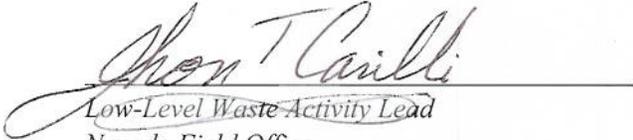
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Nevada National Security Site Waste Acceptance Criteria

NNSSWAC Revision History

Date	Pages Changed	Revision
1981		* Historical note below.
09/1996	All	Rev. 0
08/1997	All	Rev. 1
05/1999	All	Rev. 2
02/2000	i, vi, 3-5, Ref-1	Rev. 2, DCN DOE/NV-325-03-01
11/2000	All	Rev. 3
01/2002	All	Rev. 4
10/2003	All	Rev. 5
07/2005	3-8, 3-10, Appendix G	Rev. 5-01, DOE/NV-325-Rev 5-DCN-05-01
10/2005	All	Rev. 6
06/2006	ii, 3-1, 3-6, 3-9,3-13, 4-2, 4-5, 6-3, 6-4, B-1, E-1, E-3, G-1, H-2, Ref-4	Rev. 6-01, DOE/NV-325-Rev 6-DCN-06-01
10/2006	i, ii- viii, 1-1, 1-2, 1-3, 2-1, 2-3, 3-1, 3-4, 3-6, 3-7, 3-8, 3-9, 3-11, 3-12, 3-16, 6-1, 6-2, 6-3, 6-4, 6-5, 6-6, 6-7, B-1, C-1, C-2, C-4, D-1, D-2, D-4, E-2, E-9, G-3, H-1, Ref-3, Ref-4	Rev. 6-02, DOE/NV-325-Rev 6-DCN-06-02
06/2008	All	Rev. 7 - Clarifications and edits based on NNSA/NSO, NDEP, RWAP, and Waste Generator reviews. Revisions identified by change bars.
05/2009	Incorporate new classified waste disposal requirement; remove the term “storage” for waste received at NNS.	Rev. 7-01, Sections, 1.1, 3.1.18, 3.2.8, 3.2.10, App. D, App. H, and References
09/2010	Selected areas as stated, Incorporate new Appendix B	Rev. 8, Change NTS to NNS, 3.1.15, 3.1.18, 3.1.19, 3.2.5, 3.2.13, 3.2.14, 3.3.1, 3.3.5.2, 3.3.6.1, 6.3.1, 6.3.4, Appendix B, C, E, F, H
01/2011	Section 3.3.1	Rev. 8-01, Section 3.3.1, Revise EPA Hazardous Waste Codes, 6.4, Added Hoover Dam Bypass Bridge
02/2012	Sections 1.1, 1.2.1, 1.2.3, 1.2.4, 1.4, 2.1.2, 2.1.5, 2.3, 2.4, 2.5, 2.6, 3.0, 3.1.4, 3.1.7, 3.1.8, 3.1.9, 3.1.10, 3.1.14, 3.1.15, 3.1.18, 3.1.19, 3.2.2, 3.2.4, 3.2.6, 3.2.8, 3.2.13, 3.2.14, 3.3.1, Table B-1, 5.0, 5.9, 6.3.4, Appendix A, Figure C-2, Appendix D, Glossary, References	Rev. 9, Update acronyms and chapter figures, add information on DOE non-radioactive classified waste and DOE non-radioactive hazardous classified waste and DOD classified waste, update titles of personnel to differentiate between NNSA/NSO and Contracting Organization, update Package Shipment Disposal Request sample and instructions; other revisions identified by change bars

Nevada National Security Site Waste Acceptance Criteria

Date	Pages Changed	Revision
03/2013	Sections 1.1 1.2, 1.3, 1.4, 2.1; 2.2, 2.6, 3.1, 3.2.2, 3.2.4, 3.2.6, 3.2.13, 3.3, 4.0, 5.6, 5.10, 6.1, 6.3.2, 6.3.4, 6.4, 6.6, Appendix C, Appendix F, Appendix G, Appendix H	Rev. 10, Add information regarding disposing/transferring classified matter at the NNSS, update acronyms and abbreviations, change Waste Management Project to Environmental Management Operations, incorporate new PE-g limits, update shipping forms for MLLW and classified non-radioactive hazardous waste/matter, update definitions, change NNSA/NSO to NNSA/NFO to reflect the new name of the Nevada Field Office; other revisions identified by change bars

** Historical Note: The original Nevada Test Site Waste Acceptance Criteria known then as “NVO-185” was written in 1981 and underwent five or six revisions. It came into being when the NTS first started receiving significant quantities of offsite LLW. While the original NVO-185 was far less prescriptive and rigorous than the current version, many of the current DOE order requirements, laws, and regulation did not exist. In 1996, NVO-185 was replaced by the current DOE/NV--325 and was titled as the “Nevada Test Site Waste Acceptance Criteria (NTSWAC).” What we know today as the NNSSWAC was an evolution of requirements spanning almost three decades of waste acceptance at the NNSS.*

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Acronyms

ACM	Asbestos-containing material
ALARA	As Low as Reasonably Achievable
ALLW	Asbestiform Low-Level Waste
AMEM	Assistant Manager for Environmental Management
Bq	Becquerel
CAR	Corrective Action Request
CFR	Code of Federal Regulations
Ci	Curie
CSE	Criticality Safety Evaluation
DET	Determination of Equivalent Technology
DOD	U.S. Department of Defense
DOE	U.S. Department of Energy
DOT	U.S. Department of Transportation
DQO	Data Quality Objectives
EMO	Environmental Management Operations
EPA	U.S. Environmental Protection Agency
FGE	Fissile Gram Equivalence
HEPA	High-Efficiency Particulate Arresting
HRI	Human Readable Interpretation
LDR	Land Disposal Restrictions
LLW	Low-Level Waste
M	Mega
MC&A	Materials Control and Accountability
M&TE	Measuring and Test Equipment
MLLW	Mixed Low-Level Waste
MWP	Mixed Waste Profile(s)
NCSE	Nuclear Criticality Safety Evaluation
NDEP	Nevada Division of Environmental Protection
NIC	NNSSWAC Implementation Crosswalk
NNSA/NFO	National Nuclear Security Administration Nevada Field Office
NNSS	Nevada National Security Site
NNSSWAC	Nevada National Security Site Waste Acceptance Criteria
NRC	U.S. Nuclear Regulatory Commission
NSTec	National Security Technologies, LLC

Acronyms (continued)

PCB	Polychlorinated Biphenyls
PCL	Package Certification Label
PE-g	Plutonium Equivalent Gram
PK	Process Knowledge
PSDR	Package Shipment Disposal Request
QA	Quality Assurance
QAPP	Quality Assurance Program Plan
RALLW	Regulated Asbestos Low-Level Waste
RCRA	Resource Conservation and Recovery Act
RTR	Real-Time-Radiography
RWAP	Radioactive Waste Acceptance Program
RWMC	Radioactive Waste Management Complex
SSC	Structures, Systems, and Components
TID	Tamper-Indicating Device
TCLP	Toxicity Characteristic Leaching Procedure
WAC	Waste Acceptance Criteria
WARP	Waste Acceptance Review Panel
WCO	Waste Certification Official
WCPP	Waste Certification Program Plan
WP	Waste Profile

1.0 Radioactive Waste Management at the Nevada National Security Site



Frank DiSanza, NNSA/NSO Federal Project Director (retired), dedicating the opening of the Mixed Waste Cell, January 26, 2011

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1.0 Waste Management at the Nevada National Security Site

1.1 Purpose and Scope

This document establishes the U.S. Department of Energy (DOE), National Nuclear Security Administration Nevada Field Office (NNSA/NFO), Nevada National Security Site Waste Acceptance Criteria (NNSSWAC). The NNSSWAC provides the requirements, terms, and conditions under which the Nevada National Security Site (NNSS) will accept the following:

- DOE hazardous and non-hazardous non-radioactive classified waste
- DOE low-level radioactive waste (LLW)
- DOE mixed low-level waste (MLLW)
- U.S. Department of Defense (DOD) classified waste

The LLW and MLLW listed above may also be classified waste. Classified waste is the only waste accepted for disposal that may be non-radioactive and *shall* be required to meet the waste acceptance criteria for radioactive waste as specified in this document.^{7.5} Classified waste may be sent to the NNSS as classified matter. Section 3.1.18 provides the requirements that must be met for permanent burial of classified matter.

The NNSA/NFO and support contractors are available to assist the generator in understanding or interpreting this document. For assistance, please call the NNSA/NFO Environmental Management Operations (EMO) at (702) 295-7063, and the call will be directed to the appropriate contact.

1.2 Policy

1.2.1 NNSA/NFO Policies

- Protect the environment, personnel, and public from chemical and radiological hazards in accordance with Title 40 Code of Federal Regulations (CFR), the Resource Conservation and Recovery Act (RCRA); U.S. Department of Energy Order DOE O 435.1, “Radioactive Waste Management”; and State of Nevada and applicable U.S. Department of Transportation (DOT) regulations.
- Ensure that present and future radiation exposures are kept as low as reasonably achievable (ALARA) and do not exceed the radiation protection standards established in Title 10 CFR 835, “Occupational Radiation Protection.”
- Ensure that Quality Assurance (QA) programs are established and implemented to fulfill the requirements of DOE O 435.1, “Radioactive Waste Management”; Title 10 CFR 830.122, “Quality Assurance”; and DOE O 414.1, “Quality Assurance.”

- Ensure long-term protection of national security interests by accepting non-radioactive classified waste for permanent disposal.
- Accept for permanent disposal radioactive sources or material that the U.S. Government has taken ownership of when it is in the interest of national security.

1.2.2 Process

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

1.2.3 Waste Type and Eligibility Determination

Waste streams originating at non-DOE locations *shall* have a clear and unambiguous nexus (connection/association) to a DOE-funded project and/or a DOE-performed operation, or be DOE-owned material/waste, or a federal statute that mandates disposal at a DOE facility.^{7.21} To obtain verification of eligibility for a proposed waste stream, the requester must provide the NNSA/NFO EMO the necessary documents for review and approval (see the DOE's *Radioactive Waste Acceptance Program (RWAP) Instruction - Eligibility Determination for Disposal Low-Level Waste at the Nevada Test Site (NTS)*). The eligibility document can be located at:

<http://www.nv.doe.gov/emprograms/rwap.aspx>.

1.2.4 Regulators and Stakeholders

NNSA/NFO will facilitate/support appropriate involvement of stakeholders in the disposal processes at the NNSS. Where appropriate, to the extent possible, and in accordance with applicable NNSA/NFO authority, NNSA/NFO will provide regulatory agencies and stakeholders access to information related to NNSSWAC activities, including waste characterization data, from all generators. Upon request, arrangements will be made for the Nevada Division of Environmental Protection (NDEP) to observe NNSSWAC-related facility evaluations and participate in other activities such as NNSSWAC revisions.

1.3 Requirements

Requirements are identified by “*shall*.” The source of requirements is identified by a superscript number that corresponds to the reference list at the end of this document. Unless otherwise stated, superscript references are to the latest edition and/or revision available for the respective documents. Statements not identified with a “*shall*” are provided as guidance. Section 2.0 requirements do not have corresponding references because the approval process is by NNSA/NFO direction. Section 5.0 requirements are written in accordance with DOE O 414.1, “Quality Assurance”; Title 10 CFR 830.122, “Quality Assurance”; and NNSA/NFO policy, unless otherwise noted by superscript.

DOE orders and manuals, CFRs, Federal Policies, Nevada Administrative Codes, RWAP Instructions, and NNSP Permits/Plans, referenced herein, may be superseded after issuance of this document revision. In those cases, the NNSSWAC will also apply to any successor documents.

1.4 Responsibilities

The following offices and personnel have responsibilities for management and acceptance of waste at the NNSP.

1.4.1 NNSA/NFO Manager

Responsibilities and authorities as assigned in DOE O 435.1, "Radioactive Waste Management."

1.4.2 NNSA/NFO Assistant Manager for Environmental Management (AMEM)

Responsibilities and authorities as assigned in DOE O 435.1 and implementation of the NNSA/NFO Radioactive Waste Acceptance Program (RWAP) according to U.S. Department of Energy Manual DOE M 435.1-1, "Radioactive Waste Management Manual."

1.4.3 Environmental Management Operations Manager

Responsible for waste management operation of the Areas 3 and 5 Radioactive Waste Management Complex (RWMC) in compliance with applicable DOE orders and federal and state regulations. Develop, implement, and maintain the NNSSWAC. Approve waste generators to dispose or store waste at the NNSP and any deviations from the requirements of this document.

1.4.4 Low-Level Waste Activity Lead

Responsible for management of waste disposal operations at NNSA/NFO.

1.4.5 NNSA/NFO Radioactive Waste Acceptance Program Manager

Responsible for interfacing with waste generators regarding RWAP program criteria and procedures, scheduling facility evaluations of waste generator programs, MLLW waste verifications, maintaining RWAP quality records as defined by RWAP instructions, and initiating formal recommendations to the NNSA/NFO EMO Manager regarding the status of waste generator programs. Responsible for the suspension of a waste generator's NNSP waste certification program, if necessary. Responsible for issuance/closure of corrective action requests and approval of corrective action plans provided by the generator.

1.4.6 Radioactive Waste Acceptance Program Manager (Contracting Organization)

Responsible for coordinating and managing daily activities of the RWAP program and RWAP personnel.

1.4.7 Radioactive Waste Acceptance Program Personnel (Contracting Organization)

Responsible for development, implementation, and maintenance of RWAP program documents (NNSWAC, Work Instructions, Facility Evaluation records, etc.). Perform document reviews of waste generator program documents, waste profiles (WPs), and conduct of facility evaluations of waste generators shipping waste to the NNS by traveling to the generator facilities.

2.0 Approval Process



Bristlecone Pine, Rainer Mesa and Stockade Wash, Nevada National Security Site

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2.0 Waste Generator Approval Process

All waste offered for disposal *shall* be evaluated pursuant to DOE O 435.1, “Radioactive Waste Management.” The following describes the approval process and generator document requirements used by NNSA/NFO to verify that waste generators have a program in place to ensure that compliant waste is shipped to the NNSS.

A flow diagram of the approval process is provided in Appendix A.

2.1 Document Requirements

Generators *shall* develop, implement, and maintain the program documents listed below. These documents describe the generators’ waste certification program and *shall* be submitted to the Contracting Organization (CO) RWAP Manager as objective evidence of programmatic compliance.

2.1.1 Quality Assurance Program Plan

A controlled copy of the site Quality Assurance Program Plan (QAPP) or NNSSWAC specific Waste Certification Program Plan (WCPP) *shall* be documented in accordance with Section 5.0 and transmitted to the CO RWAP Manager.

The QAPP/WCPP is considered site specific. If a generator elects to perform work with off-site facilities or projects managed by others, the approved generator should follow the guidelines established in the RWAP Guidance, *Off-Site Waste Certification Guidance and NNSSWAC Compliance*, which will facilitate project/profile approval. This instruction can be located at:

<http://www.nv.doe.gov/emprograms/rwap.aspx>.

2.1.2 NNSSWAC Implementation Crosswalk

The NNSSWAC Implementation Crosswalk (NIC) *shall* be prepared and submitted annually but no later than 90 days after a revision of the NNSSWAC to the CO RWAP Manager in accordance with Section 5.0. An electronic copy of the NIC is available from the NNSA/NFO website at:

<http://www.nv.doe.gov/emprograms/rwap.aspx>.

The NIC is considered site specific. If a generator elects to perform work with off-site facilities or projects managed by others, the approved generator should follow the guidelines established in the RWAP Guidance, *Off-Site Waste Certification Guidance and NNSSWAC Compliance*, which will facilitate project/profile approval.

2.1.3 Waste Profiles

As a best practice, generators should contact the NNSS/NFO EMO Manager and verify that the proposed waste type or stream can be accepted at the NNSS. A Waste Profile (WP) *shall* be prepared and submitted to NNSA/NFO for each waste stream proposed for disposal. The WP summarizes the waste form and characterization data, and *shall* include a list of referenced procedures, citing the number and title. The WP instructions, numbering, and format that *shall* be used are available from NNSA/NFO or on the NNSA/NFO website at:

<http://www.nv.doe.gov/emprograms/rwap.aspx>.

2.1.4 Certification Personnel List

A current list identifying the site Waste Certification Official (WCO), Alternate WCO(s), and Package Certifier(s) *shall* be developed and submitted to the CO RWAP Manager in writing. The list *shall* include the name and telephone number of each individual authorized to certify waste packages and shipments. The WCO is responsible for maintaining the authorized certification personnel list and notifying the CO RWAP Manager, in writing, of any changes in personnel.

This information is used by RWMC personnel to verify signatures on the Package Certification Labels (PCLs) and to ensure that shipments are from authorized personnel. The WCO and Alternate WCO(s) are the only positions authorized to certify shipments and waste packages. Package Certifiers are only authorized to certify waste packages. Any packages or shipments certified by unauthorized personnel *shall not* be accepted at the RWMC.

2.1.5 Required Notifications

Generators *shall* notify the CO RWAP Manager in writing of any changes to the generator's QAPP or WCPP, WPs, and/or key personnel. Controlled documents and/or revisions to documents may be submitted electronically to the CO RWAP Manager. Documents submitted in this manner *shall* be approved in accordance with the generator's program. The e-mail correspondence is maintained as the official record of transmittal for controlled documents.

Prior to implementation, the WCO *shall* immediately notify the CO RWAP Manager in writing of any critical process and/or procedure changes to the approved certification program. Examples of critical processes and/or procedures include, but are not limited to, the following:

- Changes in inspection frequency;
- Changes in characterization methodology; and
- Changes in training requirements.

Assistance in determining critical processes and/or procedures requiring written notification can be obtained from the CO RWAP Manager.

RWAP requests notification from the generator when that generator has been informed of critical waste or waste shipment non-compliances when shipping to other treatment, storage, or disposal facilities. Examples of critical noncompliances are as follows:

- Issuance of a notice of violation
- Shipment suspension
- Waste returned to the generator

2.2 RWAP Review

The NNSA/NFO approval process for a generator's waste certification program and waste streams include a combination of on-site assessments and document reviews to verify continued program implementation. NNSA/NFO Corrective Action Requests (CARs) may be issued when conditions adverse to quality are identified. CARs *shall* require the generator to document a root cause, corrective action, and action to preclude recurrence. Failure to respond to CARs, in a timely manner, could lead to delays in approval or result in a program or waste stream suspension in accordance with Section 2.4.

2.2.1 Facility Evaluations

Facility evaluations (audits, surveillances) are scheduled and conducted by RWAP.

2.2.1.1 *Audit*

New generators *shall* submit the documents described in Section 2.1 to RWAP prior to scheduling their initial audit. Discretionary programmatic audits of approved generators may be conducted as directed by NNSA/NFO.

The purpose of an audit is to examine and evaluate objective evidence to verify that program documents contain the necessary elements and are adequately implemented. The audit scope will include an on-site evaluation of the characterization, QA, and waste traceability program elements. Audits are both programmatic and performance-based evaluations.

2.2.1.2 *Surveillance*

Scheduled or unscheduled surveillances may be performed to evaluate specific program elements, evaluate new waste streams, conduct mixed waste and classified hazardous waste/matter verifications, and verify implementation of corrective actions.

2.2.2 Waste Profiles

WPs *shall* be submitted to the CO RWAP Manager for review through the Waste Acceptance Review Panel (WARP) process. The WARP may require additional information from the generator, recommend surveillance, or recommend NNSA/NFO approval or a suspension of the waste stream.

New generators *shall* complete and submit at least one profile to RWAP for review prior to the initial audit of their waste certification program.

WPs for new waste streams or changes to approved waste streams may be submitted to RWAP for review by the WARP at any time. When WPs are revised, depending on the significance of the revision, authorization for continued shipping under the current approved WP may be suspended until the changes have been reviewed and accepted.

Generators should provide written responses to WARP comments within 90 days of comment submittal to ensure continued processing of WPs. If responses are not received within 90 days, review of the WP may be terminated.

The WCO *shall* perform a documented annual review of NNSA approved WPs, based on the current revision date of each profile, to ensure the characterization data, waste stream information, and referenced procedures are current. For annual recertification of MLLW Waste Profiles (MWPs) and classified hazardous waste/matter profiles, refer to Section 3.3.3.

Generators *shall* notify RWAP in writing when terminating an approved WP (project is complete, one-time-only waste stream and has been shipped, etc.). WPs and/or revisions may be submitted electronically in accordance with Section 2.1.5.

2.2.3 Split Sampling

The purpose of the split sampling program is to verify the results of waste analysis. NNSA/NFO may select a waste stream for split sampling based on its annual volume, the potential for finding hazardous components, or the scope and complexity of the sampling process to be performed. NNSA/NFO may require split sampling prior to the waste stream being approved.

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

2.3 Approval

Waste Certification Program approval is granted by the NNSA/NFO EMO Manager after the generator has demonstrated satisfactory implementation of the NNSSWAC. Factors considered in determining approval include recommendations from RWAP, results of facility evaluations, review of program documents, WPs and procedures, and generator readiness.

NNSA/NFO will provide written notice of program approval, identifying the last facility evaluation number, special conditions affecting the program or WP, current program document (QAPP or WCPP) and revision, and approved WP(s). Approved waste generators *shall* ensure the following documents are maintained current within RWAP while their approval to ship waste is in effect:

- Approved list of Authorized Certification Personnel
- Latest approved WP (Active WPs Only)
- Controlled copy of their site QAPP
- NIC

2.4 Suspending Approval

NNSA/NFO may suspend approval if the generator's waste or documents do not meet NNSSWAC requirements. Individual waste streams or the generator's entire waste certification program may be suspended. Suspension may be issued verbally by NNSA/NFO representatives, followed by official written notification. Reasons for suspension may include, but are not limited to:

- Improper manifesting (e.g., incorrect nuclide inventory or activity level reported),
- Repetitive programmatic deficiencies,
- Radiological contamination events,
- Incorrect waste characterization,
- Waste container integrity deficiencies,
- Transportation routing violations,
- Inadequate nuclear criticality safety limits, and
- Facility evaluation results.

2.5 Technical Support

NNSA/NFO provides qualified technical assistance on NNSSWAC issues. Generators wanting an independent review and one-on-one consulting on issues regarding their waste management program are encouraged to contact NNSA/NFO. NNSA/NFO assistance to waste generators includes the following:

- Gap-analysis site visits
- Policy and regulatory interpretations
- Waste packaging and transportation issue assistance

For additional information on requesting technical support, contact the NNSA/NFO EMO Manager.

2.6 NNSA/NFO Direction

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

3.0 Waste Criteria



Waste Packages in Cell 18, Nevada National Security Site

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3.0 Waste Criteria

Waste accepted at the NNSS *shall* meet the waste criteria outlined below.^{6.6} Generators *shall* ensure that waste is handled, stored, and shipped in accordance with applicable DOE, DOT, U.S. Environmental Protection Agency (EPA), state, and local regulations and requirements.^{7.5} Waste streams deviating from these requirements will be evaluated in accordance with Section 3.4, NNSSWAC Deviations.

3.1 General Waste Form Criteria

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

3.1.1 Transuranics

The concentration of alpha-emitting transuranic nuclides with half-lives greater than 20 years *shall not* exceed 100 n curie (Ci)/g.^{6.5} The net weight of the waste (excluding the weight of the container and shielding) *shall* be used to calculate the specific activity of the waste in each container.^{7.5} The following isotopes *shall* be considered when making the transuranic waste determination: ²³⁷Np, ²³⁸Pu, ²³⁹Pu, ²⁴⁰Pu, ²⁴²Pu, ²⁴⁴Pu, ²⁴¹Am, ^{242m}Am, ²⁴³Am, ²⁴³Cm, ²⁴⁵Cm, ²⁴⁶Cm, ²⁴⁷Cm, ²⁴⁸Cm, ²⁵⁰Cm, ²⁴⁷Bk, ²⁴⁹Cf, ²⁵¹Cf.^{7.5} Additional information on determining the transuranic alpha concentration can be found in the document “Determining Transuranic Alpha Activity Concentration for Compliance with NNSSWAC” located at:

<http://www.nv.doe.gov/emprograms/rwap.aspx>.^{6.4}

3.1.2 Radionuclide Content or Concentration

Radionuclide concentration *shall* be reported in accordance with Appendix E, “Radionuclide Characterization and Reporting Requirements.”^{6.7/6.16/6.18}

Radionuclide limits for disposal are listed in Table E-1, “Radionuclide Action Levels for Waste Characterization and Reporting.” Waste having radionuclide concentrations above these limits may be acceptable for disposal upon review by NNSA/NFO, provided the content does not exceed the package activity limits identified in Section 3.2.2.

3.1.3 Reserved to maintain section numbering.

3.1.4 Hazardous Waste

Unless the waste is classified, waste regulated solely under Title 40 CFR 261–268 and State of Nevada hazardous waste regulations *shall not* be accepted for disposal.^{3.3/5.4} State of Nevada regulations require that waste regulated as hazardous in the state of generation *shall* be regulated as hazardous when brought into the state of Nevada; therefore, unless the material is classified, such waste *shall not* be accepted for disposal.^{5.3} For MLLW, see Section 3.3.

Environmental media from cleanup activities may be acceptable for disposal if:

The state of origin makes a “Contained-In Determination” for LLW environmental media that was in contact with “listed” wastes. The generator *shall* submit this determination to the NNSA/NFO EMO Manager for evaluation, and provide and demonstrate:^{7.5}

- Documentation that the waste is primarily environmental media (not debris). For the purpose of this determination, environmental media is defined as materials found in the natural environment such as soil, groundwater, surface water, and sediments; or a mixture of such with liquids, sludges, or solids, which are inseparable by simple mechanical removal processes;
- Documentation that the media was representatively sampled and evaluated for total contaminant concentrations (mg/kg) and Toxicity Characteristic Leaching Procedure (TCLP) concentrations (mg/L) where applicable; and
- Laboratory data including QA/Quality Control data.

NDEP will evaluate the state of origin “Contained-In Determination” on a case-by-case basis for concurrence and will issue written correspondence through the WARP process once the generator has provided and demonstrated the above-stated items.

Debris contaminated with “listed” constituents will be evaluated, independent of the criteria established above for environmental media.

3.1.5 Free Liquids

Liquid waste and waste containing free liquids *shall* be converted into a form that contains as little free-standing and noncorrosive liquid as is reasonably achievable.^{6.11/7.5} Liquid waste and waste containing free liquids should be processed into a solid form or packaged in sufficient sorbent for twice the volume of the liquid. The free liquid *shall* not exceed 1 percent of the volume of the waste when the waste is in a disposal container; or 0.5 percent of the volume of the waste processed to a solidified form.^{6.11/7.5} Provisions for additional sorbent should be made when significant temperature and atmospheric differences exist between the generating site and the disposal site.

Waste *shall* be evaluated to determine its potential to release liquid during handling, storage, and transportation.^{7.6} High moisture content waste is defined as waste that has the potential to release moisture from its final waste form in excess of the NNSWAC requirement. Generators *shall* document the decisions made when characterizing and determining sorbents for high moisture content waste; see the Nevada National Security Site Generator Work Group “Position Paper for High Moisture Content Waste,” Revision 0, dated 11/3/1998 for use as guidance located at:^{7.5}

<http://www.nv.doe.gov/emprograms/rwap.aspx>.

3.1.6 Particulates

Fine particulate wastes **shall** be immobilized so that the waste package contains no more than 1 weight percent of less-than-10-micrometer-diameter particles, or 15 weight percent of less-than-200-micrometer-diameter particles.^{7.6} Waste known to be in a fine particulate form or in a form that could mechanically or chemically be transformed to a particulate during handling and interim storage **shall** be immobilized.^{7.6}

Secure packaging may be used in place of immobilization. The following are examples of acceptable packaging: steel boxes, drums with a sealed 6 mil minimum (or equivalent) liner, containers with contents individually wrapped and sealed in plastic, and over-packed containers.

3.1.7 Gases

Waste gases **shall** be packaged at a pressure that does not exceed 1.5 atmospheres absolute at 20°C.^{6.14/7.6} Compressed gases as defined by Title 49 CFR **shall not** be accepted.^{7.6} Examples of compliance methods include puncturing aerosol cans and removing the valve mechanism from expended gas cylinders.

3.1.8 Stabilization

Where practical, waste **shall** be treated to reduce volume and provide a more stable waste form.^{6.23/7.5} Wastes **shall not** react with other wastes or the packaging during storage, shipping, handling, and disposal.^{6.8/7.5}

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

Chemical stability and compatibility **shall** be demonstrated to ensure that no reactions occur and significant quantities of harmful gases, vapors, liquids, or explosive conditions and compounds are not generated^{6.13/7.5} (specifically when different waste forms are combined in a single waste container).

3.1.9 Etiologic Agents

Waste containing pathogens, infectious wastes, or other etiologic agents as defined in Title 49 CFR **shall not** be accepted.^{7.6}

3.1.10 Chelating Agents

Waste packages containing chelating or complexing agents in amounts greater than 1 percent of the waste **shall not** be accepted unless stabilized or solidified.^{6.9/7.6}

3.1.11 Polychlorinated Biphenyls

Waste containing Polychlorinated Biphenyls (PCBs) that meet the requirements for disposal in a solid waste or permitted hazardous waste landfill as specified in 40 CFR Part 761 and NAC 444.9452 **shall** be accepted.^{3.23/5.5}

PCB contaminated waste **shall** be packaged, marked, and labeled in accordance with the requirements of Title 40 and Title 49 CFR^{3.22/4.3} and meet applicable shipping requirements for the radioactive content of the package. Waste containing PCBs that meet the requirements for disposal in a permitted hazardous waste landfill **shall** be segregated and profiled into a separate waste stream and packaged and shipped under different shipment numbers than other waste streams.^{8.0/7.6} These types of PCB wastes **shall** also meet requirements listed in Section 3.3.5 and 3.3.6.2.^{8.0}

Generators **shall** provide written notice, a minimum of 15 days, in advance of the first shipment of each waste stream containing PCB remediation waste or bulk product waste.^{3.21/3.24} The notice **shall** be submitted to the RWMC via fax (702) 295-6852 or e-mail to wminfo@nv.doe.gov and should contain information specified in 40 CFR 761.61 for PCB remediation waste and/or 40 CFR 761.62 for PCB Bulk Product Waste.^{7.6}

3.1.12 Explosives

Waste containing un-reacted explosives **shall** not be accepted at the NNSS.^{7.6} Such waste may have RCRA characteristics and **shall** be treated to meet LDRs before being acceptable for disposal at the NNSS.^{6.12/7.6}

3.1.13 Pyrophorics

Pyrophoric materials contained in the waste **shall** be treated, prepared, and packaged to be nonflammable.^{6.12/7.6} Pyrophoric materials that are blended in a hardened concrete matrix are considered to be treated to be nonflammable.

3.1.14 Sealed Sources

Sources containing transuranic nuclides **shall** be individually evaluated against the transuranic waste criteria (NNSSWAC, Section 3.1.1).^{7.5} The mass of the source and any component integral to the source **shall** be used to determine the activity concentration (nCi/g) for reporting on the WP (Section D.6).^{7.5}

Sealed sources that have an activity of 3.7 Mega (M) Becquerel(s) (Bq) (100 μ Ci) or greater **shall** be segregated from other waste and grouped together and profiled as a separate waste stream.^{7.5} Sealed sources that have an activity of less than 3.7 MBq can either be a component of other waste streams or included with sealed sources that have an activity of 3.7 MBq or greater.

In completing the WP for sealed sources, the radionuclide activity concentration (Bq/m³) reported in Section D.5 of the WP is the activity of each radionuclide in the disposal package divided over the volume of the waste package. During the profile approval process, RWAP may request an inventory list of the sources covered by the WP.

The following are specific items related to sealed sources:

- Stabilization: Sealed sources may need to be stabilized in the shipping/disposal container to ensure that dose rates remain the same during transport (e.g., stabilization using concrete to ensure sources do not shift during transport).
- Lead shielding: Lead used as shielding that either is integral or external to the sealed source and that is used to reduce radiation exposure is acceptable as LLW. This includes lead that if removed would cause undue or excessive radiation exposure to workers.
- Smoke detectors: In determining the transuranic activity concentration for sources in smoke detectors, the activity is divided over the mass of the entire smoke detector.

The requirements found in NNSWAC Section 3.2.4, Lead Shielding, *shall* be followed if new packaging with lead shielding is used.^{7.5}

The “Position Paper on the Proper Characterization and Disposal of Sealed Radioactive Sources” is no longer a requirements document and is for information only. It may be found at the web address:

<http://www.nv.doe.gov/emprograms/rwap.aspx>.

3.1.15 Low-Level Waste Containing Regulated Asbestos

Regulated Asbestos Low-Level Waste (RALLW) is defined as any LLW containing friable asbestos material; Category I nonfriable asbestos-containing material (ACM) that has become friable; Category I nonfriable ACM that will be or has been subjected to sanding, grinding, cutting, or abrading; or Category II nonfriable ACM that has a high probability of becoming or has become crumbled, pulverized, or reduced to powder. RALLW *shall* be packaged, marked, and labeled in accordance with the requirements of Title 40 CFR, State of Nevada Solid Waste Disposal Site Permit (SW 532, current revision), and state-of-generation regulations.^{5.1/5.2} Packages containing RALLW *shall* meet the applicable shipping requirements for the radioactive contents of the package.^{4.12} RALLW *shall* be wetted with a water and surfactant mixture and packaged in a plastic bag that is not less than 6 mil in thickness, a combination of plastic bags that equal 6 mil in thickness, or a container that is lined with plastic.^{5.1}

If free liquid is present, sorbent *shall* be added to ensure compliance with the

free-liquids criteria.^{6.11/7.6} Sharp edges and corners in the package *shall* be padded or protected to prevent damage to the plastic bag during handling, shipping, and disposal.^{7.6}

Each container used to dispose RALLW *shall* bear a label that contains one of the statements below.^{5.2}

<p>(1) CAUTION CONTAINS ASBESTOS FIBERS AVOID OPENING OR BREAKING CONTAINER BREATHING ASBESTOS IS HAZARDOUS TO YOUR HEALTH</p>	
<p>(2) CAUTION CONTAINS ASBESTOS FIBERS AVOID CREATING DUST MAY CAUSE SERIOUS BODILY HARM</p>	<p>(3) DANGER CONTAINS ASBESTOS FIBERS AVOID CREATING DUST CANCER AND LUNG DISEASE HAZARD</p>

RALLW *shall* be profiled and segregated into a separate waste stream.^{7.6} Because RALLW must be disposed in a separate permitted cell with limited disposal capacity, RALLW *shall* be packaged separately and shipped under different shipment numbers than other waste streams.^{7.2} RALLW *shall* not be packaged into soft-sided containers as the only containment.^{7.2} The Package Shipment Disposal Request (PSDR) for asbestos shipments must be uploaded twenty-four (24) hours in advance of shipment arrival at Area 5. The comment section must denote “asbestos.”

3.1.16 Radioactive Animal Carcasses

Animal carcasses containing, or contained in, radioactive materials *shall* be packaged with the biological material layered with lime and placed in a metal container meeting applicable requirements.^{1.1/1.2/7.6} If the resultant waste matrix is capable of gas generation, the container *shall* be vented with a carbon composite High-Efficiency Particulate Air (HEPA) filtration device.^{1.1/7.6} NNSA/NFO may require analysis of the waste decomposition gases. Animal carcasses preserved with formaldehyde *shall not* be accepted for disposal.^{7.6}

3.1.17 Beryllium Waste

For this section, beryllium is defined as elemental beryllium and any insoluble beryllium compound or alloy containing 0.1 percent beryllium or greater that may be released as an airborne particulate. Beryllium-containing waste and beryllium-contaminated equipment *shall* be packaged in sealed, impermeable bags (minimum 6 mil), containers, or enclosures to prevent the release of beryllium dust during handling and transportation.^{1.4/7.6} The bags, containers, and enclosures *shall* be labeled with the following information.^{1.5}

“DANGER, CONTAMINATED WITH BERYLLIUM
DO NOT REMOVE DUST BY BLOWING OR SHAKING
CANCER AND LUNG DISEASE HAZARD”

3.1.18 Classified Waste

Generators are responsible for ensuring requirements of DOE O 471.6, “Information Security,”^{6.3} or the NNSA Policy Letter NAP-70.4, “Information Security,”^{7.20} are satisfied for permanent burial of classified waste/matter at NNSS. Generators **shall** submit a signed DOE or NNSA Security Authorization for permanent burial without sanitization with their classified WP.^{7.5} This approval does not replace or eliminate the Material Control and Accountability requirements of Section 6.3.1.

Weapons components described as pits, canned subassemblies, neutron generators, or detonators will not be accepted unless demilitarization has been performed.

Classified waste/matter (LLW, MLLW, non-radioactive, and non-radioactive hazardous) **shall** be profiled and segregated into a separate waste stream and have different shipment numbers from other waste streams.^{7.6} Generators shipping classified waste that requires protection from visual observation **shall** submit the “Advance Shipment Notification” form, identified in Appendix C.4, to the RWMC at least seven (7) days prior to shipment arrival.^{7.6} This form can be forwarded via fax at (702) 295-6852 or e-mail to wminfo@nv.doe.gov. A copy of the Advance Shipment Notification Form can be found at the following web address:

<http://www.nv.doe.gov/emprograms/rwap.aspx>.

Generators that intend to ship classified matter to the NNSS, in anticipation of a further waste determination and disposal, in accordance with the Military Munitions Rule (40 CFR Part 266 Subpart M) **shall** declare this intent on the waste profile sheet by checking the appropriate box in B.5.^{7.5} If classified matter is managed in accordance with RCRA, the generator **shall** check the appropriate box in B.5 on the profile sheet and follow the mixed waste requirements in this document.^{7.5}

Generators that ship classified matter to the NNSS for permanent burial **shall** use a Bill of Lading or the NSTec Classified Matter Hazardous Material Shipping Document.^{7.6} Commercial Treatment Facilities that treat classified matter **shall** ship this waste to the Area 5 RWMC using a Uniform Hazardous Waste Manifest.^{3.4/7.5}

If the generator elects to treat classified matter on-site or provide a justification for Macroencapsulation Equivalency (see Section 3.3.4.2), the generator **shall** follow the requirements outlined above.^{7.5} The generator **shall** also provide a LDR certification with the shipment.^{7.5}

Following cradle-to-grave tracking is important and is a generator responsibility. The Area 5 RWMC will provide a certificate of disposal to the generator or treatment facility, as appropriate.

3.1.19 Petroleum Hydrocarbon Burdened LLW

Petroleum hydrocarbon burdened LLW is only regulated when generated within the state of Nevada. Petroleum hydrocarbon burdened LLW soil and closely related construction and demolition debris, greater than 100 mg/kg Total Petroleum Hydrocarbons (TPH), resulting from a petroleum release generated by NNSA/NFO Operations will be disposed at the RWMC. The concentration level of TPH is measured using U.S. EPA Method 8015, as modified.

NSSS generated hydrocarbon waste *shall* be packaged separately from other LLW, the containers identified as “HYDROCARBON WASTE” near the bar code labels, and shipped under separate shipping documents (Bill of Lading, Shipping Manifest, Package Shipment Disposal Request, Certification Statement, etc.).^{7.2}

3.2 Waste Package Criteria

Waste packages *shall* meet applicable DOE orders, Title 10 CFR, Title 40 CFR, and Title 49 CFR requirements such as design, nuclear safety, radiation levels, activity limits, nuclear heating, and multiple hazards.^{7.5} Waste packages *shall* be capable of withstanding the stresses associated with the loading, handling, stacking, and shipping of the package.^{4.4} NNSA/NFO has adopted the following waste package criteria to ensure that the NNSS RWMC is operated safely and efficiently:

3.2.1 Nuclear Criticality Safety

The quantity of fissile (fissionable) material in a waste package *shall* be limited so that an infinite array of such packages will be subcritical under “as packaged” conditions and if the array were to be flooded with water to any credible degree.^{6.2/7.14} Waste packages *shall* comply with the fissile material limits in Appendix E.^{7.5} Compliance of a waste package with the fissile material limits is required to be documented in the WP.

3.2.2 Package Activity Limitations

Package Activity limits at NNSS are based on Plutonium 239 Equivalent-grams (PE-g). The total PE-g for either a waste package or a shipment *shall* be calculated by multiplying the activity of each radionuclide by the PE-g conversion factor (Appendix B) and then adding each radionuclide PE-g to get the total PE-g.^{7.5}

The PE-g limit for waste packages (e.g., drums, boxes, soft-sided packages, bulk or wrapped objects) is 300 PE-g total. For waste packages that are DOT

specification 7A, Type A, or if the generator can provide documentation for DOT specification 7A, Type A equivalence, the allowable PE-g limit per package is 12,000 PE-g. DOT Type B Certificate of Compliance (CoC) packages have no PE-g limit as long as the DOT Type B container is also the disposal container. DOT specification 7A, Type A certification/equivalence and DOT Type B certification *shall* be provided with profile submittal.^{7.22} Any shipment that has a package that exceeds the PE-g package limit will be refused for disposal. The PE-g limit for a shipment (sum of all the packages) is 2000 PE-g total. For waste shipments that contain only DOT specification 7A, Type A package(s), or if the generator can provide documentation for DOT specification 7A, Type A equivalence, the allowable PE-g limit per shipment is 60,000 PE-g. Waste shipments that contain only DOT Type B CoC container(s) have no PE-g limit as long as the DOT Type B container is also the disposal container. Any shipment that exceeds the shipment limit will be refused for disposal.

For reference purposes, DOT specification 7A, Type A or equivalent package(s) cannot be lifted higher than nominally 12–15 feet above ground at the Area 5 RWMC.

3.2.3 Closure

Waste package closures *shall* be designed to ensure they will withstand the effects of changing temperatures, weather, pressures, and/or vibrations under normal handling and shipping conditions and not breach or lose the package contents.^{4.4}

3.2.4 Lead Shielding

The use of lead for shielding (radioactively contaminated or radioactively uncontaminated) in containers for the disposal of waste is an acceptable practice. Generators *shall* maintain the following:^{5.6}

- Documentation demonstrating that standard packaging without lead shielding would not reduce the exposure rate to less than 0.005 rem/hr (5 mrem/hr) at 30 centimeters and the shielding is necessary for radiation protection; and,
- Documentation demonstrating that the amount of lead used for shielding is not excessive for each specific container of waste. The documentation *shall* include calculations demonstrating the amount of lead (thickness/quantity) in the container is not excessive by justifying the quantity of lead required in each given container on a container-by-container basis.^{5.6} Justification for using the appropriate amount of lead shielding can be demonstrated by a detailed dose rate survey that shows the shielded dose rate exceeds 0.005 rem/hr at 30 cm from the waste package.^{7.12}

For lead shielded containers that meet the criteria specified above, the documentation *shall* be provided to NNSA/NFO RWAP Manager by email emlead@nv.doe.gov at least seven (7) days in advance of waste shipment. An example “Use of Lead Shielding Form” can be located at the following web

address:

<http://www.nv.doe.gov/emprograms/rwap.aspx>.

Additional information on the use of lead shielding can be found in the “Position Paper on the Use of Lead Shielding for the Disposal of Low Level Waste at the NNSS,” located at the following web address:

<http://www.nv.doe.gov/emprograms/rwap.aspx>.

3.2.5 Strength

The disposal package (packaging and contents) **shall** be capable of supporting a uniformly distributed load (compressive strength) of 16,477 kg/m² (3,375 lb/ft²).^{7.4}

This is required to support other waste packages and earth cover without crushing during stacking and covering operations. Actual physical testing or design engineering calculations may be used to demonstrate compliance.

This requirement does not apply to bulk waste (e.g., supersacks, burrito wraps, unpackaged waste items), waste packaged in steel drums, high integrity containers, cargo transport containers, or roll-off containers. These containers **shall** be sufficiently strong to ensure they will not breach under normal offloading conditions.^{7.6}

Bulk waste containers with a reasonable probability of breaching during offloading (i.e., burrito wraps), regardless of the type of transport vehicle (i.e., intermodals), **shall** meet the package activity limitations of Section 3.2.2.^{7.6}

Alternative packaging will be evaluated for approval on a case-by-case basis dependent on waste stream characteristics. Refer to NNSSWAC Section 3.2.14 for additional information.

3.2.6 Handling

Waste packages that require remote handling may incur additional cost for the generator and delay WP approval. Packages exceeding 1 mSv/hr (100mrem/hr) dose rate at 30 centimeters **shall** be considered for remote handling.^{7.6} Handling procedures and ALARA documentation **shall** be referenced on the WP for wastes requiring remote handling and made available to the disposal site upon request.^{7.6}

Prior to shipment, dose rates **shall** be forwarded to RWMC Operations (fax 702-295-6852 or email to wminfo@nv.doe.gov) for internal packages when they are being removed for disposal (e.g., canisters removed from a Type B cask.)^{7.6} A Radiological Data Form ALARA Planning Purposes can be located at the following web address:

<http://www.nv.doe.gov/emprograms/rwap.aspx>.

Waste packages **shall** be provided with cleats, offsets, rings, handles, permanently attached or removable skids, or other auxiliary lifting devices to allow handling by means of forklifts, cranes, or similar handling equipment.^{7.6} All waste packages requiring cranes for off-loading **shall** have an approved lift plan generated by NNSS RWMC prior to shipment.^{7.6} Additional costs incurred by development and implementation will be the responsibility of the waste generator.

Waste packages with permanently attached lifting devices are permissible, provided they are recessed, offset, or hinged in a manner that does not inhibit stacking the packages. Auxiliary lifting devices for any portion of the package extending from the top of the waste package **shall** be no higher than 0.1 meter (4 inches) in normal position.^{7.6} Lifting devices **shall** be designed in accordance with the DOE Hoisting & Rigging Manual, DOE-STD-1090-Current Publication.^{7.1}

Lifting devices that are a structural part of the package **shall** be designed with a minimum safety factor of three-to-one against yielding when used to lift the package to ensure any failure of a lifting attachment under excessive load would not impair the integrity of the package.^{4.4} Any other structural part of the package that could be used to lift the package **shall** be capable of being rendered inoperable for lifting the package during transport or **shall** be designed with strength equivalent to that required for lifting attachments.^{4.4}

Rigging devices (e.g., slings, spreader bars, rings, hooks) not permanently attached to the waste package that are provided by the generator for off loading **shall** have a current load test based on the requirements of the DOE Hoisting & Rigging Manual, DOE-STD-1090-Current Publication.^{7.1} Non-permanently attached rigging devices **shall** have traceable certifications provided with the shipping documents.^{7.6} They **shall** not show any signs of corrosion, kinking, birdcaging, or other deterioration.^{7.6}

Waste packages that have abnormal centers of gravity **shall** be clearly marked with the center of gravity.^{7.6} Top-heavy loads are severely discouraged, and bulk waste shipments with complex geometries **shall** be loaded in the most stable configuration.^{7.6} Cargo containers are exempted from this requirement until the gross weight exceeds 30,000 lb.

For waste packages that are DOT Type B or DOT Type AF and are being delivered to the RWMC for waste removal, the generators **shall** submit the following information^{7.6}:

- CoC for the package
- Sections 1, 7, and 8 of the Safety Analysis Report for Packaging (SARP) for the package
- Section 9 of the SARP for those packages that have a Section 9

- Certificates for all rigging

Bulk waste containers that require special handling may incur additional cost.

3.2.7 Size

Waste containers/packages that allow for optimum handling and stacking efficiency in disposal cells should be considered for use (i.e., cargo containers, boxes measuring 4 x 4 x 7 ft or 4 x 2 x 7 ft, or 55/85-gallon drums).

Packages (e.g., super-sacks, burrito wraps) will be considered; however, RWMC Operations personnel need to be consulted to ensure equipment compatibility. MLLW, "Classified Waste," RALLW, PCBs, or Low-Level Hydrocarbon-Burdened waste that is not packaged in hard-sided containers meeting the strength requirement, allowing the packages to be stacked at least 14 feet high in a safe and stable manner, may incur additional handling costs.

Bulk waste generally exists in a form not suited to the conventional packaging requirements. Bulk waste *shall* meet the requirements of Title 49 CFR.^{7,6} Large items of bulk waste, such as machinery, may be considered for disposal unpackaged. For the transfer of unpackaged bulk material having external contamination, the contamination *shall* be fixed, covered, or contained sufficiently for safe transfer.^{4,8}

Refer to Appendix F for specific packaging requirements and limitations for intermodal (Roll-off boxes) containers to be returned to the generator. All other types of containers that are requested to be returned will be evaluated on a case-by-case basis during the WP review process. The request that containers be returned should be identified in the special-handling section of the WP. The return of containers may incur additional operational costs.

3.2.8 Weight

Weight limits for final waste packages *shall* not exceed the approved packaging design or NNSS limits of 4,082 kg (9,000 lb) per box and 544 kg (1,200 lb) per drum.^{2,1} These weight limits do not apply to bulk wastes.

Exception to the specified box weight limit is allowed if the following requirements are satisfied:^{7,6}

- Final weight *shall* not exceed the approved manufacturer design limits.
- Final weight of MLLW *shall* not exceed the NNSS RTR weight capacity of 11000 lb.
- Boxes exceeding 11,000 lb *shall* be shipped on a flatbed trailer and cribbed to a 4-inch minimum height to allow offloading with a forklift.

3.2.9 Loading (Void Space)

Waste packages *shall* be loaded to ensure that the interior volume is as efficiently and compactly loaded as practical to minimize void space.^{6.10/7.6} More than one waste stream may be packaged in a disposal container, except those waste streams that *shall* be profiled separately (MLLW, Classified Waste, RALLW, etc.).^{7.5/7.6/8.0} MLLW packages *shall* meet the void space criteria in Section 3.3.6.2.^{8.0}

3.2.10 Package Protection

Methods *shall* be employed to ensure that the integrity of the in-process waste package is not compromised (i.e., prohibited items are not introduced into the waste package).^{7.5}

Once waste packaging activities have been completed and the container has been sealed, they *shall* be stored in a secure area to prevent unauthorized intrusion and protected from the environment to maintain package integrity and prevent deterioration.^{7.5} Storage should include protection from adverse weather, particularly rain and/or snow. Tamper-indicating devices (TIDs), clips, or banding can be used to indicate that the package has not been opened. These devices *shall not* contain lead.^{7.5}

3.2.11 Marking and Labeling

Each waste package *shall* be marked and labeled according to Appendix C.^{7.6} Markings and labels *shall* be intact and readable when the shipment arrives at the disposal site.^{7.6}

3.2.12 Bar Coding

The shipment and package numbers *shall* be bar coded according to the standards in Appendix C.^{7.6}

3.2.13 Contamination Levels

External contamination levels for waste packages and transport vehicles *shall* meet the release limits specified in Title 10 CFR Part 835, Appendix D.^{1.6/7.13} Prior to shipment, internal contamination levels (i.e., internal contamination of a Type B cask for waste removal and return to the generator) *shall* be forwarded to RWMC Operations (fax 702-295-6852 or e-mail to wminfo@nv.doe.gov).

Removable contamination levels from inside of a cask, intermodal, sea/land, overpack, or equivalent container that requires any inner package(s) to be removed *shall* be reported on the ALARA planning spreadsheet.^{7.6} A Radiological Data Form ALARA Planning Purposes can be located at the following web address:

<http://www.nv.doe.gov/emprograms/rwap.aspx>.

3.2.14 Waste Containers and Shipping Configuration

Generators *shall* ensure the following requirements are satisfied to improve transportation safety and off loading at the NNSS:^{7.5}

- Waste containers used for shipping, at a minimum, will be Industrial Package-1 (IP-1) meeting the requirements of 49 CFR 173.410 and 173.411.
- Waste packaged in drums will be palletized and banded. Pallet design should ensure they will support container weights without failure during handling and shipping. Banding should securely hold the drums to the pallet. Typical banding configurations would include two vertical and two horizontal bands around the drums. Drum palletizing and banding requirements do not apply to drums in groups of three drums or less.
- Wastes packaged in drums from off-site facilities are to be shipped in a closed transport vehicle. Conestoga and other curtain-side trailers are accepted as closed transport vehicles.
- Waste being transported as bulk waste with no packaging (SCO, LSA, equipment, large machinery, etc.) *shall* be identified on the waste profile with a complete description of the item(s) and the means to which the waste will meet regulatory requirements. These will be approved on a case-by-case basis.

3.3 Mixed Low-Level Waste

MLLW offered for disposal *shall* meet the applicable characterization, treatment, packaging, and disposal requirements of the NNSSWAC, Title 40 CFR, State of Nevada, and state-of-generation regulations.^{8.0} Hazardous classified matter shipped to the NNSS for permanent burial *shall* meet the applicable requirements in this section.^{8.0}

3.3.1 Acceptable Hazardous Waste Numbers

MLLW accepted for disposal *shall* have one or more of the EPA hazardous waste numbers listed below or *shall* be considered a hazardous waste in the state of generation:^{8.0}

Waste Codes

D004 through D043

F001 through F011, F039

P001 through P205

U001 through U249, U271, U278, U279, U280, U328, U353, U359, U364, U367, U373, U387, U389, U394, U395, U404, U411

Additional waste codes may be added through NNSS Permit modifications without necessitating a NNSSWAC revision. If a waste code is not identified in the list above, please contact the NNSA/NFO RWAP Manager, and a determination will be made as to its acceptability.

3.3.2 Mixed Waste Treatment Notification

Generators with MLLW and classified non-radioactive hazardous waste/matter that requires treatment to meet the LDR standards, but the treatment has yet to occur, **shall** submit to NNSA/NFO the information contained in the Pre-Treatment Notification Form found in Appendix G.^{8.0} This will allow the scheduling of on-site verification activities in accordance with Section 3.3.8. If treatment is performed by a commercial facility, it **shall** have a current DOE Consolidated Audit Program (DOECAP) audit, or equivalent.^{8.0}

3.3.3 Mixed Waste Profiles

In addition to the NNSSWAC requirements for WPs in Section 2.1.1, MWPs and classified non-radioactive hazardous waste/matter **shall** be segregated and profiled into a separate waste stream and packaged and shipped under a different shipment number than other waste streams.^{7.6} MWPs and classified nonradioactive hazardous waste/matter profiles **shall** be approved for a finite volume of waste.^{8.0} MWPs and classified non-radioactive hazardous waste/matter profiles **shall** include the number of containers, container sizes, and dose rates at 30 cm for the waste/matter covered by the profile.^{8.0}

MWPs and classified non-radioactive hazardous waste/matter profiles have annual expiration dates and **shall** be recertified annually (based upon the profile revision date) to NNSA/NFO with the information contained in Appendix G-2.^{8.0}

3.3.4 Land Disposal Restrictions

MLLW and classified non-radioactive hazardous waste/matter **shall** meet the LDR treatment standard requirements in Nevada Administrative Code (NAC) 444.8632 (incorporating Title 40 CFR 268.40 and 268.45), including standards for underlying hazardous constituents (UHCs).^{3.11/8.0} Waste meeting the alternative LDR treatment standard for contaminated soil, as defined by NAC 444.8632 (incorporating Title 40 CFR 268.49), is also accepted.

LDR notification/certification **shall** be made in accordance with Section 6.3.4.^{3.11/8.0}

3.3.4.1 *Determinations of Equivalent Technology*

MLLW and non-radioactive hazardous waste/matter that have been treated based on a Determination of Equivalent Technology (DET) will require NDEP concurrence on the DET. NDEP will require the DET documentation, including EPA regions' determinations. Any documentation of state-of-generation involvement in the DET should also be submitted.^{8.0}

3.3.5 Waste Form Criteria / Prohibited Items

MLLW and classified non-radioactive hazardous waste/matter accepted for disposal **shall** meet the general waste form criteria as described in Section 3.1 except as indicated below.^{8,0}

3.3.5.1 Free Liquids

Free liquids **shall** be absorbed, stabilized, or otherwise removed from the waste. Containerized free liquids such as ampules, small articles that contain free liquids required for the article to function (e.g., batteries or capacitors), are acceptable.^{3,9}

3.3.5.2 Sorbents

Sorbents **shall** be nonbiodegradable and identified on the profile.^{3,9} Examples of nonbiodegradable sorbents according to Title 40 CFR 264.314(d) and/or 40 CFR 265.314(e) includes:

- Inorganic minerals, other inorganic materials and elemental carbon (e.g., aluminosilicates, clays, smectites, fuller's earth, bentonite, calcium bentonite, montmorillonite, calcined montmorillonite, kaolinite, micasillite, vermiculites, zeolites; calcium carbonate [organic free limestone], oxides/hydroxides, alumina, lime, silica sand, diatomaceous earth; perlite [volcanic glass], expanded volcanic rock; volcanic ash; cement kiln dust; fly ash; rice hull ash, activated charcoal/activated carbon).
- High molecular weight synthetic polymers (e.g., polyethylene, polypropylene, polyurethane). This does not include polymers derived from biological material or polymers specifically designed to be degradable.
- Sorbents determined to be nonbiodegradable under American Society for Testing and Materials (ASTM) Method G21-70, Standard Practice for Determining Resistance of Synthetic Polymer Materials to Fungi; ASTM Method G22-76, Standard Practice for Determining Resistance of Plastics to Bacteria; or OWCS test 301B, CO2 Evolution.

3.3.5.3 Compatibility

Incompatible wastes, or incompatible wastes and materials, **shall not** be placed in the same container if such placement.^{3,8}

- Generates extreme heat or pressure, fire or explosion, or violent reaction;
- Produces uncontrolled toxic mists, fumes, dusts, or gases in sufficient quantities to threaten human health;

- Produces uncontrolled flammable fumes or gases in sufficient quantities to pose a risk of fire or explosions;
- Damages the structural integrity of the device or facility containing the waste; or
- Through other like means threatens human health or the environment.

3.3.6 MLLW and Classified Non-Radioactive Hazardous Waste/Matter Package Criteria

In addition to Section 3.2, MLLW and classified non-radioactive hazardous waste/matter packaged for disposal *shall* meet the following waste package criteria:

3.3.6.1 *Marking and Labeling*

In addition to the marking and labeling requirements in Appendix C, packages of 451 liters (119 gallons) or less *shall* be marked with the following:^{3.5/3.25}

- The words “HAZARDOUS WASTE – Federal law prohibits improper disposal. If found, contact the nearest police or public safety authority of the U.S. Environmental Protection Agency;”
- Generator’s name and address
- Manifest Document Number.

The marking *shall* be durable, in English, displayed on a background of sharply contrasting color, printed or affixed to the surface of the package; or on a label, tag, or sign un-obscured by other labels or attachments, located away from any marking that could substantially reduce its effectiveness.^{3.5}

Marking and labeling of the waste packages *shall* be for the hazardous and radioactive characteristics of the waste.^{4.3/7.6}

3.3.6.2 *Void Space*

Unless they are very small, such as an ampule, containers must be either:

- (a) At least 90 percent full when placed in the landfill; or
- (b) Crushed, shredded, or similarly reduced in volume to the maximum practical extent before burial in the landfill.^{3.10}

3.3.6.3 *Package Protection*

In addition to the requirements of Section 3.2.10, if a package has been inspected as part of the NNSS verification plan, the TID **shall** not be removed or altered.^{8.1} The package **shall** be loaded and transported to protect the TID from damage.^{8.1}

3.3.7 **Analytical Data**

Analytical data used to make characterization determinations or LDR certifications **shall** be from a DOECAP audited laboratory, or equivalent (i.e., State Certified or Carlsbad Field Office Certified).^{8.0} Generators **shall** document their review and acceptance of the most recent certification audit for analytical laboratory used.^{7.5}

3.3.8 **MLLW and Classified Non-Radioactive Hazardous Waste/Matter Verification**

Verification frequencies and methods for MWP are determined by the WARP in accordance with RWAP instructions. The methods include split sampling, field chemical screening, visual inspection and/or Real-Time Radiography (RTR) at the generator or treatment facility and RTR at the NNSS. Verifications are conducted in accordance with RWAP instructions.^{8.1}

3.3.8.1 *Verification Frequency*

Verification frequencies are assigned by the WARP. Per the profile a minimum of 5 percent of waste containers **shall** be physically screened by either visual inspection or RTR.^{8.0}

Exceptions to the physical screening requirements **shall** be approved by the NNSA/NFO RWAP Manager.^{8.0}

Unless exempted, a minimum of 10 percent of containers physically screened **shall** be chemically screened.^{8.0} The following wastes are exempted from chemical screening:^{8.0}

- Waste subjected to an LDR-specified technology standard
- Hazardous debris
- Chemical-containing equipment removed from service (ballasts, batteries, etc.)
- Waste/matter containing regulated asbestos
- Waste/matter from the cleanup of spills or a release of a single substance or known material (e.g., material for which a Material Safety Data Sheet [MSDS] can be provided)

- Confirmed noninfectious waste generated from laboratory tissue preparation, slide staining, or fixing processes
- Waste/matter containing beryllium

Chemical screening of container contents are performed by generator personnel under the supervision of RWAP at the generator's site. Chemical screening materials will be provided by RWAP.

If a container is too large to RTR at NNSS, the waste will be visually verified at the generator's site.^{8.0}

Generators **shall** provide the necessary authorizations, facilities, and personnel to allow RWAP personnel to perform verification at the generator or treatment facility.^{7.5}

RWAP personnel **shall** be provided access to containers and facilities to allow for visual inspection of the contents of packaged containers, performing chemical screening on homogeneous samples of the waste, and split sampling.^{8.0}

3.3.8.2 *Previously Rejected Packages*

Packages (parent packages) previously rejected that are repackaged and/or split into additional packages (progeny packages) **shall** be traceable to the original package number.^{8.0}

In addition to transportation and shipping requirements of Section 6.0, generators **shall** notify NNSA/NFO prior to shipping previously rejected packages (parent and/or progeny) back to NNSS.^{7.5}

3.4 **NNSSWAC Deviations**

Deviations from the NNSSWAC that do not compromise the performance objectives for the disposal site, NNSS Documented Safety Analysis requirements and limitations, or violate permit requirements are evaluated on a case-by-case basis for acceptance. Deviations are not used as an all-inclusive relief from meeting a specified NNSSWAC requirement.

The following information shall be provided with the WP or as a stand-alone document approved by the WCO:

- NNSSWAC requirement(s) that cannot be satisfied;
- Justification for not meeting the requirement that includes a description of the item(s) and/or process affected;
- Duration of the deviation; and
- Planned action(s) to correct the deviation, if applicable.

Example:

Requirement: NNSSWAC, Revision 9, Section 3.2.5, Strength, requires that disposal packages shall be capable of supporting a uniformly distributed load of 16,477 kg/m² (3,375 lb/ft²).

Justification: Two 4 x 4 x 7 ft metal boxes (#33248 and # 33798) do not meet the NNSSWAC strength requirement. Because of ALARA concerns, the generator seeks to avoid unnecessary exposure to personnel. The boxes will be clearly marked “Box Does Not Meet NNSSWAC Strength Requirement,” at a minimum, on the top and one side.

Duration: One time only for box numbers 33248 and 33798.

Corrective Action: None required; it is the intent of the generator to ensure that only compliant containers will be used on future shipments.

4.0 Waste Characterization



Area 3 Radioactive Waste Management Site Concrete Monolith of Low-Level Waste Disposed in Area 3, Nevada National Security Site

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4.0 Waste Characterization

Generators **shall** characterize waste destined for disposal at NNSS.^{6.16/7.5} When similar requirements are listed in separate regulations, the most stringent **shall** be met.^{7.5} Waste will not be accepted until the generator, through sampling and analysis, process knowledge (PK), or a combination of both, demonstrates the waste to be LLW that meets the NNSSWAC requirements in Section 3.0. For waste characterized as MLLW, generators **shall** demonstrate that the MLLW meets the applicable Title 40 CFR LDR and WAC.^{3.11} Generators **shall** characterize waste with sufficient accuracy to permit proper segregation, treatment, storage, and disposal.^{6.16} The characterization methods and procedures employed by the generator **shall** ensure that the physical, chemical, and radiological characteristics of the waste are recorded and known during all stages of the waste management process.^{6.16} Methods selected by the generator for waste characterization **shall** undergo a documented peer review.^{7.5} The Data Quality Objective (DQO[s]) process, or a comparable process, **shall** be used for identifying characterization parameters and acceptable uncertainty in characterization data.^{6.17} The intent of this paragraph also applies to classified non-radioactive and classified hazardous waste/matter.

Generators **shall** prepare and submit a WP for each waste stream that provides NNSA/NFO with a summary of waste characterization information.^{6.7/6.22/7.5} Generators **shall** provide waste characterization documentation that supports the WP (see Appendix E for radiological requirements) to NNSA/NFO for review during facility evaluations or upon NNSA/NFO request.^{6.16/7.5}

Waste characterization documentation **shall** be traceable to the WP and disposal packages.^{7.5} Isotopic distributions and corresponding activity concentrations **shall** be traceable to the package.^{7.5} Traceability to a parcel level **shall** be required if characterization is being conducted at that level (e.g., individual sealed sources, bags, or components characterized on an individual basis, but packaged together).^{7.5} Waste characterization may be conducted using PK, sampling and analysis, or a combination of both. The following sections provide specific information and requirements for these characterization methods.

4.1 Process Knowledge

PK is a characterization technique that relies on the generator's knowledge of the physical, chemical, and radiological properties of the materials associated with the waste generation processes. It includes knowledge of the fate of those materials during and subsequent to the process, and the associated administrative controls. PK sources include, but are not limited to, the following programmatic and waste stream-specific components:

- Plans and drawings
- Areas and/or buildings where each waste stream is generated
- Material inputs, including MSDSs
- Manufacturing specifications

- Mass balance documentation
- Literature searches
- Living memory (documented interviews)
- Laboratory notes and batch records
- Process logs and batch records
- Procedures

Historical data should be routinely verified through controlled analytical methods such as verification sampling and analysis; however, if the data can successfully undergo a full validation, this verification may not be necessary.

When PK relies on living memory, the individual's knowledge *shall* be documented and signed by both the interviewer and the interviewee.^{7.5} For telephone interviews, a statement outlining relevant information *shall* be signed by the interviewer (and interviewee, if possible).^{7.5}

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

Generators *shall* conduct a documented evaluation of compiled PK sources used for waste characterization.^{7.10} The generator's evaluation *shall* identify uncertainties, inconsistencies, limitations, and usefulness.^{7.10}

4.2 Sampling and Analysis

Generators *shall* ensure that all data be scientifically valid, defensible, and of known precision and accuracy to identify the physical, chemical, and radiological properties of the waste.^{7.7} When waste streams are characterized by sampling and analysis, the process *shall* be controlled and documented.^{6.24/1.3} Propagation of error throughout the sampling and analytical process shall be evaluated and considered when ascertaining usability of data for characterization of waste.^{6.16} Generators should determine the appropriate analysis (total vs. TCLP) for RCRA hazardous and UHC determinations. The results *shall* be reported in the WP on Table B-1 (Page 4-4).^{7.5} Refer to the WP instructions for further details on reporting sampling results.

Generators *shall* demonstrate that controls are in place to trace each sample number to a specific package number.^{7.5} NNSA/NFO RWAP may evaluate sampling and analysis documentation to ensure that: (1) samples will be representative of the waste inventory, (2) appropriate analytical procedures are used, and (3) sufficient quality controls have been established to allow measurement and documentation of data quality.

4.2.1 Data Validation

Data validation is a comprehensive analysis and review of analytical data conducted against a set of predetermined criteria and leading to the assignment of relative usability (i.e., completely usable, estimated value, unusable) for each analytical result. The validation criteria should be developed using the DQO process and depend upon the type(s) of data involved and the purpose for which the data are collected. Data shall be validated by technically qualified personnel who are independent of those performing the analyses.^{7.5}

When sampling and analysis is used as a method of characterization, data validation shall be conducted on a portion of chemical and radiological data prior to use of the data for characterization.^{7.5}

The WP instructions require completion of an analytical results summary (Table B-1) for inclusion in the WP. As required by the above paragraph, data validation will be performed on a portion of the data used to complete the table. If in subsequent sampling events, variations of analytical results remain less than 80 percent of the applicable regulatory threshold, revision of Table B-1 is not required. If the results ever exceed 80 percent of the regulatory threshold, it will be necessary to revise the table and submit appropriate validation summary reports (case narratives) for the values entered in the revised table.

Validation summary reports should cite the guidelines or procedures used to validate the data and include, at a minimum:

- Method/Analysis-general discussion of the data set, including preparation/dilutions, initial and continuing calibration, holding times
- Method blank Analysis
- Laboratory Control Samples Analysis
- Surrogate Spike Recoveries
- Data Qualifier Codes
- Discussion/statement of data quality

Table B-1: Analytical Results

Table B-1 Analytical Results	Statistical Mean	Upper Confidence Limit		Statistical Mean	Upper Confidence Limit
TCLP Metals:			TCLP Semivolatiles:		
Arsenic	_____	_____	o-Cresol	_____	_____
Barium	_____	_____	p-Cresol	_____	_____
Cadmium	_____	_____	m-Cresol	_____	_____
Chromium	_____	_____	Cresol	_____	_____
Lead	_____	_____	2,4 Dinitrotoluene	_____	_____
Mercury	_____	_____	Hexachlorobenzene	_____	_____
Selenium	_____	_____	Hexachloro-butadiene	_____	_____
Silver	_____	_____	Nitrobenzene	_____	_____
TCLP Volatiles			Pentachlorophenol	_____	_____
Benzene	_____	_____	2,4,5-Trichlorophenol	_____	_____
Carbon Tetrachloride	_____	_____	2,4,6-Trichlorophenol	_____	_____
Chlorobenzene	_____	_____	Hexachloroethane	_____	_____
Chloroform	_____	_____	TCLP Pesticides and Herbicides:		
1,4-Dichlorobenzene	_____	_____	Chlordane	_____	_____
1,2-Dichloroethane	_____	_____	2,4-D	_____	_____
Methyl ethyl ketone	_____	_____	Endrin	_____	_____
Pyridine	_____	_____	Heptachlor and its epoxide	_____	_____
TCLP Volatiles			TCLP Pesticides and Herbicides:		
Tetrachloroethylene	_____	_____	Lindane	_____	_____
Trichloroethylene	_____	_____	Methoxychlor	_____	_____
Vinyl chloride	_____	_____	Toxaphene	_____	_____
1,1-Dichloroethylene	_____	_____	2,4,5-TP (Silvex)	_____	_____

5.0 Quality Assurance Requirements for Waste Certification Programs



RWAP Surveillance Activities on Remediation Waste Stream at Test Cell C

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5.0 Quality Assurance Requirements for Waste Certification Programs

RWAP quality requirements are written in accordance with DOE O 414.1, “Quality Assurance”; Title 10 CFR 830.122, “Quality Assurance”; and NNSA/NFO policy unless otherwise noted by superscript.

Generators **shall** develop, approve, and maintain a Quality Assurance Program Plan (QAPP) demonstrating compliance to the current revision of the NNSSWAC; DOE O 435.1, “Radioactive Waste Management”; DOE O 414.1, “Quality Assurance”; and/or Title 10 CFR 830.122, “Quality Assurance.” In lieu of using a site QAPP, an NNSSWAC specific Waste Certification Program Plan (WCPP) may be submitted as the site-implementing program document. A controlled copy of the generator’s site QAPP or WCPP **shall** be maintained with the RWAP Manager (Contracting Organization).^{7.5}

Generators **shall** also complete the NNSSWAC Implementation Crosswalk (NIC) and submit it to the RWAP Manager (Contracting Organization).^{7.5} The NIC **shall** reference the applicable quality-affecting procedures, processes, or methods and the organization/group directly responsible for implementation.^{7.5}

Procedures, processes, or methods referenced should include:

- Implementing plans, procedures, documents, and/or records that demonstrate how implementation of applicable NNSSWAC requirements is performed, including support organizations.
- Waste characterization data, methods, and records demonstrating compliance.
- Documents demonstrating compliance to waste and packaging criteria in Section 3.0 of the NNSSWAC.
- Documents ensuring conformance to marking, labeling, electronic reporting, and form submittal requirements.

Within 90 days after a revision of the NNSSWAC or at a minimum annually, the WCO **shall** perform a review of the NIC to ensure referenced procedures, processes, and methods are current.^{7.5} Upon completion of this review, the WCO **shall** sign the NIC cover sheet and submit a copy of the NIC to the RWAP Manager (Contracting Organization).^{7.5} An electronic copy of the NIC and instructions are available on the NNSA/NFO website (see Section 2.1.2).

5.1 Program

Generators **shall** develop an organizational chart specific to the waste management and support organizations. The organizational chart **shall** depict the organizational structure, functional responsibilities, levels of authority, and interfaces necessary to manage the waste certification program. The chart **shall** identify the organizations that generate, characterize, package, inspect, assess, ship, and perform support functions (i.e., procurement, document control, RCRA oversight, and training).

Each generator **shall** designate a WCO and alternate(s), if applicable, who are responsible for verifying implementation of the QAPP or WCPP.^{7.5} The WCO **shall** ensure that the waste certification processes, including waste, waste packages, supporting data, and waste shipments, comply with the requirements of the NNSWAC.^{7.5} The alternate WCO **shall** report to the primary WCO for certification activities.^{7.5} The organizational structure **shall** ensure the independence of the WCO, alternates(s), and package certifiers from the waste generator and allow for direct access to a management level (including the local DOE field office), having sufficient authority and organizational freedom, if necessary, to ensure compliance with the LLW program.^{7.5}

Generators may delegate responsibility for signing the Package Certification Label (PCL) to Package Certifiers; however, the Package Certifiers **shall** report directly to the WCO when performing waste certification activities.^{7.5}

5.2 Personnel Training and Qualification

Personnel **shall** be trained and qualified to perform their assigned functions and tasks. The level and type of training **shall** be evaluated and documented. Training **shall** be commensurate with the importance of the task and the activities affecting compliance with the NNSWAC waste certification activities. Personnel **shall** be provided training to ensure that job proficiency with established requirements (e.g., processes, procedures, and instructions) is maintained. Records of training **shall** be specified and maintained to ensure personnel training are current.

5.3 Quality Improvement

Process controls to detect and prevent quality problems and verify conformance to specified requirements **shall** be established and implemented by the generator. Performance of quality improvement processes **shall** be documented.

Control of nonconforming components and processes **shall** provide for the identification, documentation, evaluation, segregation (when practical), disposition, and notification to the affected organizations, including the WCO. Nonconforming components **shall** be conspicuously labeled, tagged, or otherwise marked to ensure removal from the waste certification process and prevent inadvertent use.

The disposition of nonconforming components, services, and processes **shall** be reviewed for technical justification and disposition by authorized personnel. When nonconforming conditions are identified that affect the quality of previously shipped waste, NNSA/NFO EMO Manager **shall** be notified.

A process **shall** be established for the identification and timely correction of quality problems. The root cause, corrective action, action to prevent recurrence, and estimated completion date **shall** be documented. The WCO and appropriate levels of management **shall** be involved in the corrective action process. Corrective action documents **shall** be tracked until successful resolution can be demonstrated.

5.4 Documents and Records

Activities affecting the quality of the waste certification program *shall* be prescribed and performed in accordance with written instructions, procedures, or drawings, and available to those performing the work. A document control system *shall* be established to ensure that these documents are prepared, reviewed, approved, controlled, and revised.

The WCO *shall* document the review and concurrence of procedures (including revisions) critical to waste certification activities (generation, packaging, inspection, characterization, certification, etc.).

The records system *shall* be defined and implemented in accordance with written instructions, procedures, or other documentation.

Records documenting compliance with waste certification criteria *shall* be specified, prepared, reviewed, and signed by authorized personnel.

Records *shall* be compiled into a records management system that includes provisions for transmittal, distribution, retention, handling, correction, disposition, and retrievability. Completed records *shall* be protected from damage, loss, and deterioration.

The generator *shall* maintain records for time periods equivalent to on-site records retention requirements, but not less than three years (or for time periods designated by applicable regulatory authorities).

5.5 Work Processes

Work *shall* be planned and performed to established technical standards and administrative controls using approved instructions, procedures, or other appropriate means.

Processes important to waste certification activities *shall* have controls or verification steps identified as part of the operating procedures.

Controls *shall* be established to ensure that the traceability of waste from the point of generation through shipment is maintained. Waste characterization documentation *shall* be traceable to the exact package in which waste was placed. Waste containers *shall* be controlled through the life cycle of the component (e.g., receipt, handling, storage, packaging, and shipping) to prevent damage, loss, or deterioration.

Components used in the certification process such as waste containers, liners, sorbents, and solidifiers *shall* be controlled to ensure that only correct and acceptable items are used. Identification *shall* be maintained on items or documents traceable to the items.

Measuring and Test Equipment (M&TE) used for process monitoring or data collection *shall* be uniquely identified, controlled, and calibrated. Records of calibration *shall* be maintained, traceable to the equipment, and the equipment suitably marked to indicate calibration status. The M&TE marking *shall* include a unique identification, date of calibration, calibration due date, and any limitations. Calibration equipment for M&TE *shall* be traceable to a nationally recognized standard or equivalent means to ensure accuracy.

Testing and validation of computer programs and verification of data results from those programs (i.e., Package Shipment Disposal Request [PSDR] data, radioactivity calculations) *shall* be conducted and documented.

5.6 Design

Design items and processes *shall* use sound engineering/scientific principles and appropriate standards. Design work and design changes *shall* incorporate applicable requirements and design bases. Design inputs *shall* be specified and translated into design documents.

Design adequacy *shall* be verified by qualified personnel other than those who designed the item or computer program. Verification of designs items and processes *shall* be completed and approved prior to implementation of the design or design changes.

Design interfaces *shall* be identified and controlled. Waste generators *shall* document their review of item(s) or process(es) when performed by others (e.g., suppliers or other generators) to ensure that they conform to established requirements and end-use application.

Design changes *shall* be approved commensurate with the same control measures that were applied to the original design.

5.7 Procurement

Components and services critical to the waste certification program *shall* be procured under a controlled and documented system. Procurement documents *shall* identify applicable technical requirements such as drawings, specifications, codes, standards, regulations, tests, inspection and acceptance criteria, and certification records.

Procurement documents *shall* be reviewed and approved by authorized personnel to ensure that they contain appropriate references and technical requirements. Changes to procurement documents *shall* receive the same degree of review and approval as the original documents.

Selection of suppliers providing components and services critical to the waste certification program *shall* be evaluated and selected based on specified criteria (e.g., waste packaging, waste treatment services). The methods of evaluation

(i.e., audits, surveillance, source inspection, receipt inspection, third party audits) **shall** be established and provide adequate confidence that the selected supplier can meet the established requirements. When third-party audits are used to qualify a supplier, a documented evaluation of the report **shall** be performed by a qualified Lead Auditor, identifying the activities, findings, conclusions, and basis for qualification.

Suppliers of components (e.g., off-the-shelf sorbents) that are tested or verified by the purchasing organization for conformance to technical requirements may not need to be evaluated (audited), provided the testing demonstrates the procured component conforms to design requirements. Conformance testing **shall** be documented.

A process to ensure approved suppliers continue to provide acceptable components and/or services **shall** be established and implemented. Methods of evaluation **shall** be specified and documented.

5.8 Inspection and Acceptance Testing

Inspection and testing of components, services, and processes critical to the waste certification program **shall** be conducted using established acceptance and performance criteria. In-process inspections of waste certification activities **shall** be performed by qualified personnel having no responsibility for the work process or item being inspected.

Receipt inspections **shall** be performed to verify conformance of components received to the procurement documents and design criteria.

In-process inspections, including waste container pre-use inspections and waste packaging activities, **shall** be conducted throughout the waste certification process. Final inspections **shall** be conducted to verify conformance of the waste, containers, and waste certification process to the NNSWAC prior to shipment of the waste.

Records of inspection **shall** identify the type of inspection, component(s), services, or process inspected, date of inspection, inspector, inspection results, and action taken if nonconforming conditions are identified.

5.9 Management Assessment

Management of Waste Certification Program elements described in this document (Sections 3.0–6.0) **shall** periodically assess their processes to ensure conditions that preclude their organization from achieving objectives are identified and corrected. Management assessments should be focused on finding systemic and programmatic issues or the evaluation of the overall health of a program or project. Management assessments should include managerial involvement. Management assessment programs/processes **shall** ensure results of management assessments are documented in a final report issued to the appropriate organization(s) and the WCO for review.

5.10 Independent Assessment

Assessment activities (audits and surveillances) shall be planned, scheduled, and conducted in accordance with a documented and approved process. Assessment personnel shall be independent of the assessed areas and have sufficient authority and freedom to perform assessment activities. RWAP facility evaluations do not satisfy the independent assessment requirement.

Waste certification programs shall be independently assessed annually to verify compliance with NNSWAC program requirements to promote process improvement.

Surveillances may be accumulated and used in lieu of a formal annual assessment provided they were conducted within 12 months of the last annual assessment and encompass the entire waste certification program and supporting elements. When surveillances are used as the annual assessment, a final report shall be prepared identifying the assessed program elements/activities, conclusions, findings, and corrective actions initiated to resolve them and their status.

Annual independent assessments and/or surveillance roll-up shall be performed and documented by a qualified Lead Auditor. An approved copy of the annual independent assessment report, including any findings issued, shall be forwarded to the RWAP Manager (Contracting Organization).

The WCO and/or supporting oversight organizations shall schedule and conduct periodic surveillances of specific activities critical to the waste certification program (personnel training, waste packaging, receipt inspection, control of M&TE, etc.). Personnel performing surveillances shall be qualified in the surveillance process and knowledgeable of the areas being assessed.

Results of assessment activities (audits and surveillances) shall be documented, approved, and reported to responsible management, including the WCO.

Deficiencies identified during assessment activities shall be tracked until acceptable resolution is achieved and verified.

6.0 Waste Transportation and Receipt Information



Receiving waste in the Area 5 Radioactive Waste Management Complex, Nevada National Security Site

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6.0 Waste Transportation and Receipt

This section provides general requirements and guidelines that generators follow to expedite waste transportation and receipt.

6.1 Shipment Scheduling and Limitations

RWMC Operations may impose schedule limitations on WPs that have specific handling and/or processing requirements. Classified waste/matter, RALLW, and MLLW shipments may have a shipment frequency limitation to accommodate additional processing needs. (For example, classified shipments may be limited to four shipments per day per generator, with a generator limited to Tuesday and Thursday arrivals.) All scheduling limitations *shall* be made through RWMC Operations.^{7.6} Containers that are to be returned to the generator (intermodal containers, shipping casks, etc.) may have shipment scheduling limitations (e.g., due to weather conditions), and the schedule may be modified and/or suspended as warranted.

RWMC Operations may occasionally extend operating hours (i.e., Fridays). During these extra periods, RWMC Operations will designate the type of shipments that will be received on the given date (e.g., on the third Friday in September, the NNSS will accept cargo containers of standard LLW and DOT non-regulated bulk). Extending operating hours incurs additional cost that *shall* be passed on to those generators receiving the benefits associated with this action.^{7.6}

6.2 Shipping Arrangements

After a generator secures written approval from the NNSA/NFO EMO Manager to ship waste to the NNSS RWMC, the generator *shall* contact RWMC Operations to arrange for the acceptance of approved waste streams and accompanying records.^{7.6} The operator of the RWMC coordinates waste shipment acceptance at the NNSS.

6.2.1 Waste Receipt and Handling at NNSS

To expedite waste receipt and handling at NNSS, waste generators *shall*, at a minimum, comply with the following:^{7.6}

- Prior to departure of a waste shipment to the NNSS, attach security seals to the shipping trailer's door latches or to each package if not enclosed in a trailer.^{7.6}
- Instruct transport driver on the importance of fully completing the "Drivers Questionnaire" at the NNSS before leaving the RWMC.
- Enter the following pre-notification information into the HAZTRAK database.^{7.6} If the generator is unable to enter information into HAZTRAK, the NNSS Advance Shipment Notification (see Appendix C.4) may be faxed to

(702) 295-6852 or emailed to wminfo@nv.doe.gov. Enter NNSS shipments in the HAZTRAK database prior to 1500 NNSS local time, at least one working day prior to shipment arrival (e.g., shipments scheduled to arrive Monday will be entered in HAZTRAK by 1500 NNSS local time on the previous Thursday).^{7.6} NNSS advance shipment notification being faxed to the NNSS **shall** be received prior to the cutoff time and date.^{7.6} For classified waste, having classified shipping documents, generators **shall** contact NSTec at (702) 295-7028.^{7.6} For all shipments, the following information **shall** be provided.^{7.6}

- Date shipment departed generator site
- Estimated date of arrival at NNSS
- Shipment number, shipper's name, shipper's contact number
- Carrier, driver's name (**shall** be a U.S. Citizen)
- Trailer number, seal number(s), DOT "Proper Shipping Name(s)"
- Number of packages, package type (boxes, drums, cargo containers, burrito wraps, etc.), and gross weight

If the shipment's estimated date of arrival should change, the generator **shall** notify RWMC Operations and **shall** enter the changes on the HAZTRAK database at the earliest opportunity and provide the new estimated date of arrival.^{7.6} Generators unable to update information on the HAZTRAK **shall** notify the NNSS by phone at (702) 295-6811.^{7.6}

The majority of the above information can be found on the "Bill of Lading" Classified Matter Hazardous Material Shipping Document, or Uniform Hazardous Waste Manifest.

- For waste shipments containing regulated asbestos, the 7-day advance notification form **shall** be submitted to NNSA/NFO; see Section 3.1.15.

6.2.2 Consignment of Shipments

Consign waste shipments to:

National Security Technologies, LLC (NSTec)
For U.S. Department of Energy,
National Nuclear Security Administration
Waste Management
Nevada National Security Site - Zone 2
Mercury, NV 89023

Because classified waste/matter, RALLW, PCB Remediation Waste, and MLLW shipments are processed differently, they **shall** be shipped separately (i.e., with different shipment numbers and separate shipping papers).^{7.6} Under small-volume

conditions, combined shipments can be arranged by contacting Area 5 Disposal Operations.

6.2.3 Receiving Hours

The hours for receiving waste at the RWMC are from 0700 to 1400 hours, Monday through Thursday, except holidays. Tractor-trailers arriving between 0700 and 1400 hours (Monday through Thursday) will be allowed to remain at the Area 3 or 5 RWMC until their delivery is complete. Shipments containing waste streams having tritium (H-3) should arrive at the NNSS no later than 1200 hours to allow ample time for off loading, survey, and swipe analysis. If a shipment arrives between 1400 and 0700 hours, tractor-trailers will be required to exit the NNSS to return after 0700 hours for off-loading. Shipments may be subject to off-loading delays at any time due to NNSS operational schedules.

All shipments to Area 3 or Area 5 RWMC will be verified against a shipment tracking list by a Security Police Officer (SPO) at the NNSS main gate. If the shipment tracking number is listed, the shipment will be authorized to enter the NNSS. If the shipment is not listed, the SPO will attempt to contact an RWMC official to verify the shipment to authorize entry.

6.3 Shipping Documentation

The following records are required:

6.3.1 Accountable or Special Nuclear Material Shipments

For accountable or special nuclear material shipments, a “Nuclear Material Transaction Report” (DOE/U.S. Nuclear Regulatory Commission [NRC] Form 741) **shall** be completed for transfers of nuclear material between facilities having differing Reporting Identification Symbols.^{6.3.1} The original Nuclear Material Transaction Reports **shall** accompany the shipment paperwork or submitted via e-mail to wminfo@nv.doe.gov prior to shipment arrival.^{7.5} Generators shipping waste that require a DOE/NRC Form 741 **shall** also complete and fax a “Nevada National Security Site – Waste RIS VAB Accountable Nuclear Materials Authorization to Ship Waste” form to (702) 295-4215 or e-mail (klamanda@nv.doe.gov or pricem@nv.doe.gov) seven (7) days prior to shipment.

Generators **shall** obtain authorization to ship from NNSS Material Control and Accountability (MC&A) prior to shipping the waste to the NNSS.^{7.5} An electronic copy of the “Nevada National Security Site – Waste RIS VAB Accountable Nuclear Materials Authorization to Ship Waste” form is available on the NNSA/NFO website at:

<http://www.nv.doe.gov/emprograms/rwap.aspx>.

Applicable shipment numbers **shall** be included on both the Nuclear Material Transaction Report (DOE/NRC Form 741) and on the Nevada National Security

Site – Waste RIS VAB Accountable Nuclear Materials Authorization to Ship Waste form.^{7.5}

For additional information, call the RWMC at (702) 295-6811. Contact the Senior Security Specialist at (702) 295-7028 if the shipping documentation contains classified information.

6.3.2 DOT-Regulated Shipments

For materials regulated by DOT, complete shipping papers with shipper's certification, as required by Title 49 CFR, *shall* accompany each shipment.^{4.1}

A "Uniform Hazardous Waste Manifest," a "Classified Matter Hazardous Material Shipping Document," or a "Bill of Lading" accompanied by the appropriate documentation *shall* be used when shipping MLLW and classified non-radioactive hazardous waste/matter.^{3.4}

6.3.3 PSDR Submittal

The original completed and signed PSDR, or the original of an equivalent, *shall* accompany each shipment.^{7.6} An electronic version of the PSDR *shall* be transmitted to RWMC Operations prior to shipment arrival (e-mail wmdata@nv.doe.gov).^{7.6} Shipments *shall* not be accepted if an electronic PSDR is not on file.^{7.6}

6.3.4 Additional Shipment Certification Statements

A Waste Shipment Certification Statement *shall* be signed by an authorized WCO or Alternate WCO (see following example of the required Shipment Waste Certification Statement).^{3.12/7.5}

An appropriate LDR Certification Statement *shall* be signed by a knowledgeable authorized individual, which may include the WCO or Alternate WCO for MLLW or classified non-radioactive hazardous waste/matter (see Title 40 CFR 268.7 for information required to be included in an LDR certification/notification).^{3.12}

The LDR certification/notification is required for the initial shipment of the waste/matter stream or when the WP/LDR information changes.

<p>Shipment Waste Certification Statement Check only one box (either A. or B.)</p>
<p><input type="checkbox"/> A. I certify that low-level waste or non-radioactive non-hazardous classified waste/matter containers:</p>
<p>Container I.D. number(s)</p>
<p>Do not contain hazardous waste as defined in Title 40 CFR 261 or _____ (state-of-generation) hazardous waste regulation:</p>
<p>(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</p> <p>(2) According to the supporting documentation provided to me about the materials and processes that produced this waste.</p>
<p><input type="checkbox"/> B. I certify that mixed low-level waste or non-radioactive hazardous classified waste/matter containers:</p>
<p>Container I.D. number(s)</p>
<p>Meet all applicable Land Disposal Restrictions in accordance with the requirements of 40 CFR Part 268</p>
<p>To the best of my knowledge, I believe the information I have submitted is true, accurate, and complete.</p>
<p>Generator Waste Certification Official (print name / sign) Date</p>

6.4 Waste Transportation

Waste shipments consigned to the NNSS *shall* be made in accordance with applicable DOE, DOT, EPA, state and local hazardous waste regulations and requirements.^{7.5} Waste shipments to the NNSS *shall* be made by “exclusive-use vehicles” only.^{4.11} The sharing of conveyances with other DOE waste generators shipping directly to the NNSS is acceptable. Generators are responsible for the evaluation of the motor carriers used for transporting waste. Motor carriers identified on the DOE Motor Carrier Evaluation Program are automatically approved for use. Motor carrier documentation (e.g., past carrier performance, prior evaluations, accident history, vehicle maintenance) is reviewed to ensure that the carrier complies with Title 49 CFR, state, and local transportation requirements. If carrier performance has been determined to violate federal, state, or local transportation safety regulations, a demonstration of corrective action may be required. Failure to initiate corrective action may result in waste refusal at the NNSS.

The NNSA/NFO EMO Manager *shall* be notified when (1) the motor carrier(s) is being evaluated; (2) the motor carrier route selection is being reviewed; (3) a motor carrier discrepancy, noncompliance, or inadequate performance has been identified; or (4) there is a transportation incident or emergency situation.^{7.6} This notification will keep NNSA/NFO personnel informed of generator transportation plans, activities, and issues. NNSA/NFO personnel will use the information provided to inform stakeholders of transportation activities for shipments destined for the NNSS. NNSA/NFO personnel may request to participate in the review of transportation-related information. NNSA/NFO may provide driver advisories to inform generators of local driving conditions (e.g., road construction, detours, and safety issues). The generators will be responsible for providing carriers with driver advisories.

Generators *shall* ensure that a National Environmental Policy Act (NEPA) analysis (Title 10 CFR 1021) of the potential waste transportation impacts has been completed prior to waste shipment.^{1.7} Transportation of waste to the NNSS should conform to a supporting finding or decision based on the relevant NEPA impact analysis.

NNSA/NFO encourages approved generators and their carriers to review route selections. Waste transportation to the NNSS, regardless of DOT classification, *shall* avoid the Hoover Dam Bypass Bridge and Las Vegas.^{7.5} Routes should be selected to minimize radiological risk. Information on accident rates, time in transit, population density, construction activities, and time of day *shall* be considered when determining radiological risk.^{4.9}

6.5 Waste Receipt and Records

The operator of the RWMC will be responsible for inspecting waste shipments upon arrival and maintaining shipment records for NNSA/NFO. The operator of

the RWMC will take receipt of the waste or classified matter after it has been unloaded, inspected, verified, and accepted by RWMC personnel.

6.6 Funding and Forecasting

For information regarding funding and forecasting requirements, contact the NNSA/NFO Low-Level Waste Activity Lead.

Generators *shall* fax (702-295-3084) or email (gordonsj@nv.doe.gov) a “Monthly Shipment Schedule” by the last Monday of each preceding month that includes the following:^{7.19}

- Estimated number of shipments and arrival dates for the upcoming month
- WP number(s)
- Type and quantity of containers/packaging
- Special handling requirements, if applicable

6.7 Disposition of Noncompliant Conditions

NNSS RWMC and RWAP personnel are responsible for identifying and documenting noncompliance issues (i.e., physical or documentation errors) discovered when conducting waste receipt and disposal activities. Waste shipments received at the NNSS that are not in compliance with requirements may be returned to the generator facility or require resolution from the generator.

The NNSA/NFO EMO Manager *shall* be notified of waste shipment noncompliance issues.^{7.6} Appropriate action will be initiated based upon the type of the noncompliance and the established program requirements. Generators may be charged for costs incurred for noncompliant waste shipments.

Generators *shall* work with NNSA/NFO EMO Manager and the operator of the RWMC to ensure rejected waste shipments/containers are returned to the generator or an alternate treatment, storage, or disposal facility within 60 days from the date of receipt at the NNSS.^{7.5} Generators *shall* be responsible for dispositioning rejected wastes and coordinating transportation and manifesting back to the generator’s site or an alternate facility.^{7.5}

6.8 Waste Refusal

Shipments received at the NNSS that do not comply with the NNSSWAC requirements will not be accepted for disposal. RWMC Operations personnel will be responsible for notifying the appropriate NNSA/NFO personnel regarding any refused waste shipments. Generators will be responsible for arranging timely return of rejected shipments. Reasons for waste shipment refusal include, but are not limited to, failure to have:

- Conforming package activity limits as specified in Section 3.2.2.

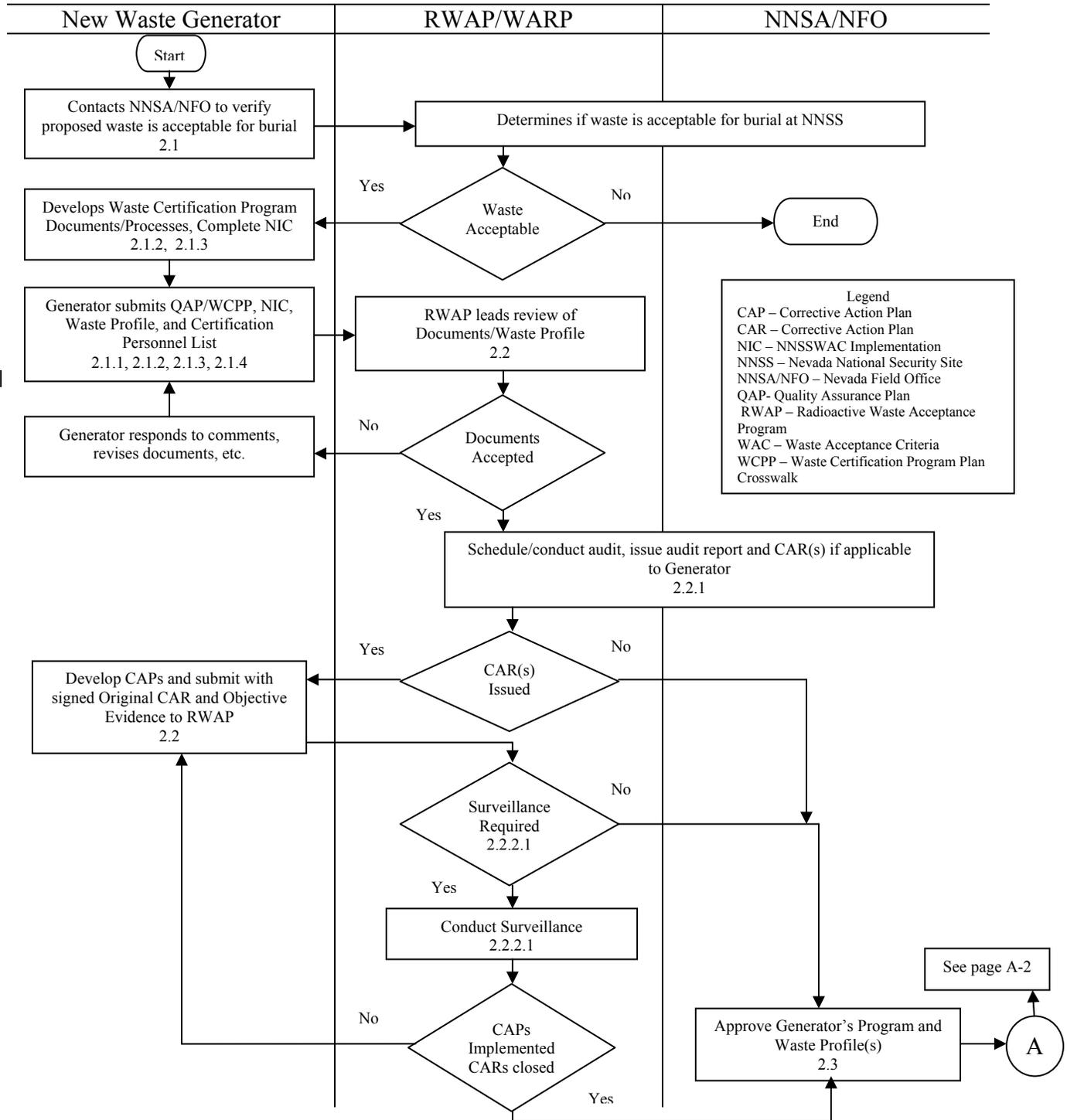
- Sufficient funding transferred to the operator of the NNSS to cover the cost of handling and disposal.
- A DOE/NRC Form 741 on file at the NNSS prior to the shipment's arrival.
- A signed certification statement accompanying the shipment.
- Successful verification performed on the waste containers in accordance with the NNSWAC, NNSS Waste Analysis Plan, and applicable procedures.
- Written approval from MC&A for shipment of accountable materials.

Appendix A
Waste Process Flow Diagrams

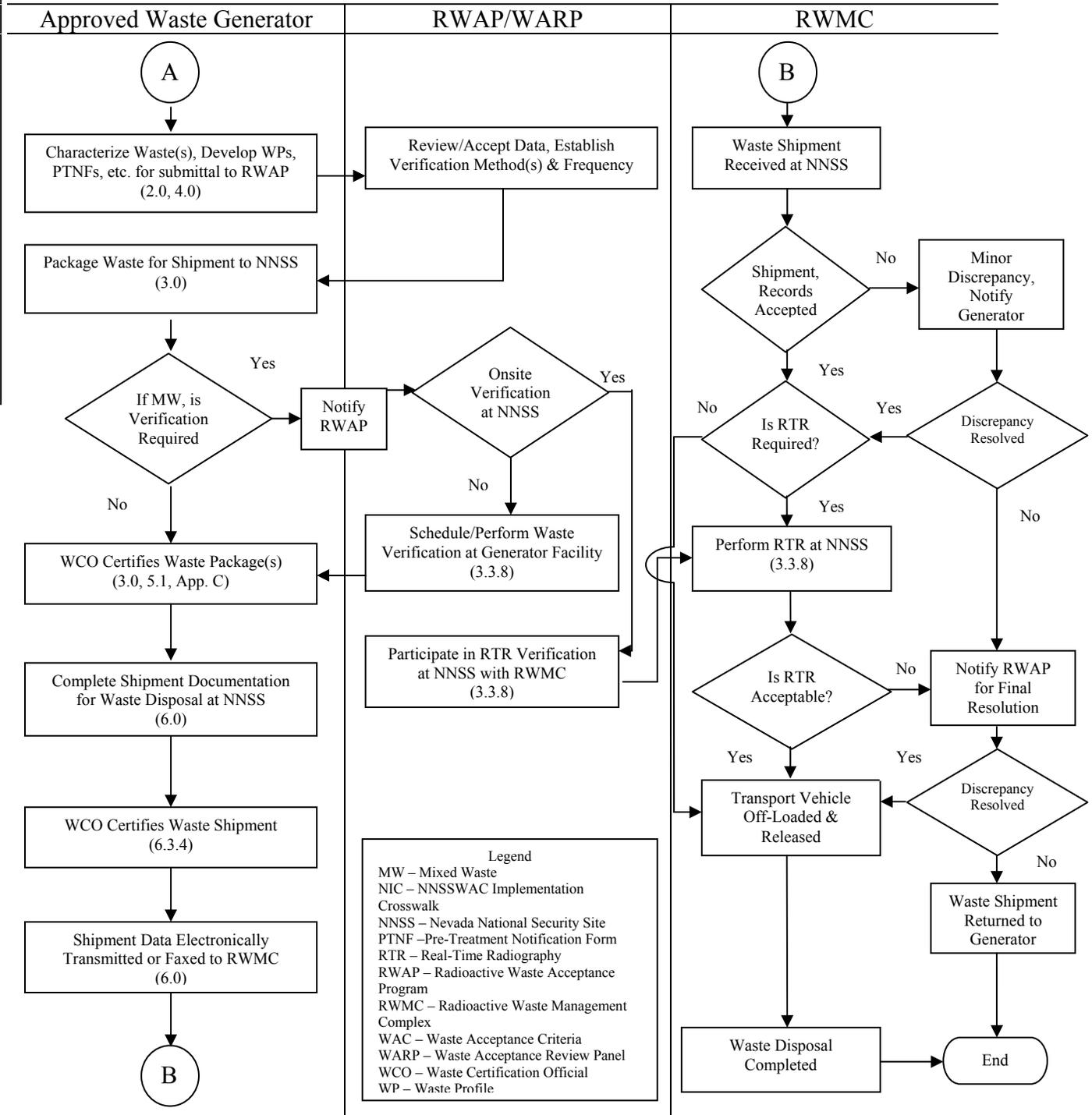
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Appendix A – Waste Process Flow Diagram

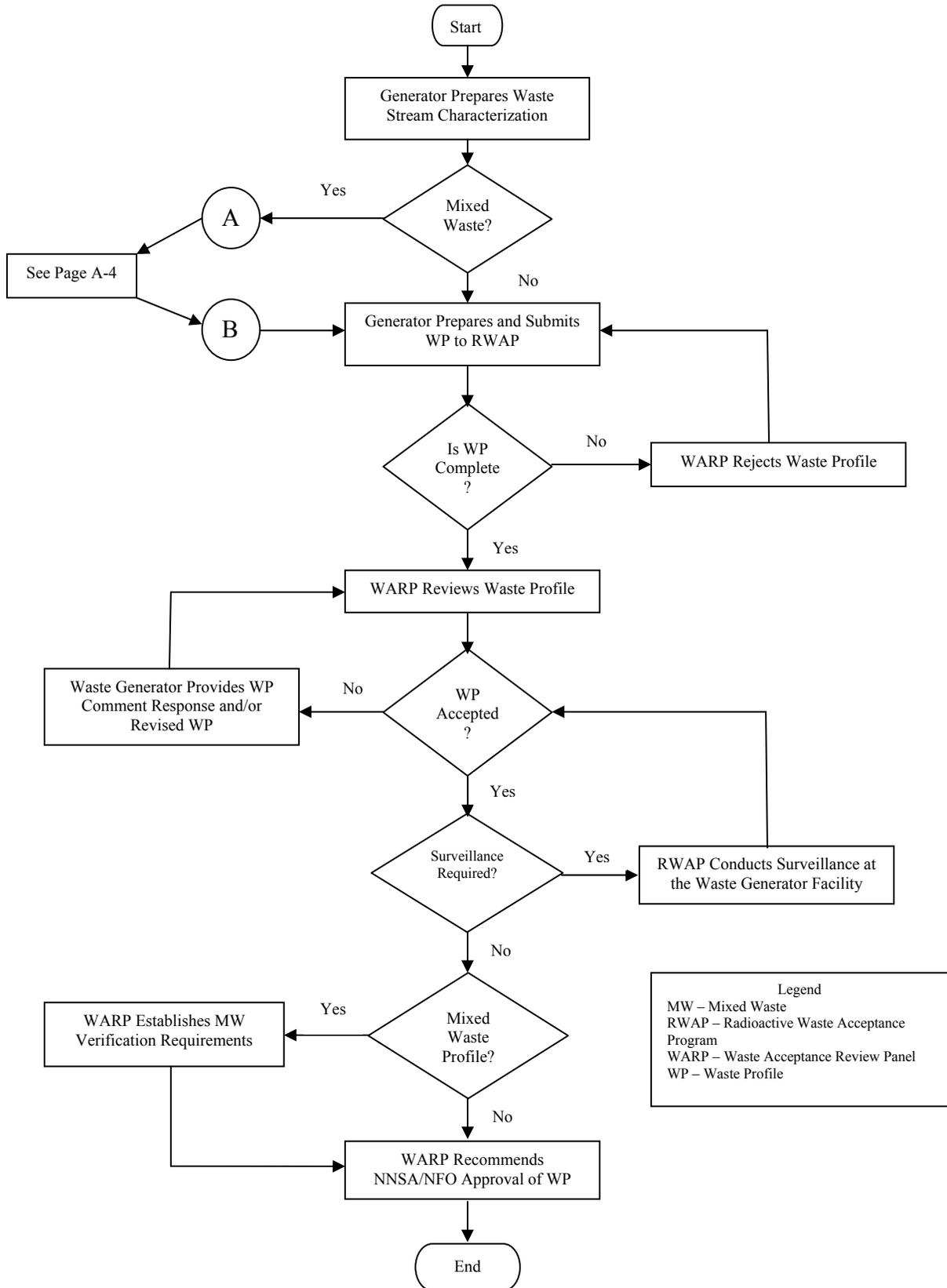
The following diagram identifies key process steps. Operations and logistics may influence the order in which these activities are conducted. Technical support may be requested at any time by the generator (Section 2.5).



Appendix A – Waste Process Flow Diagram (continued)

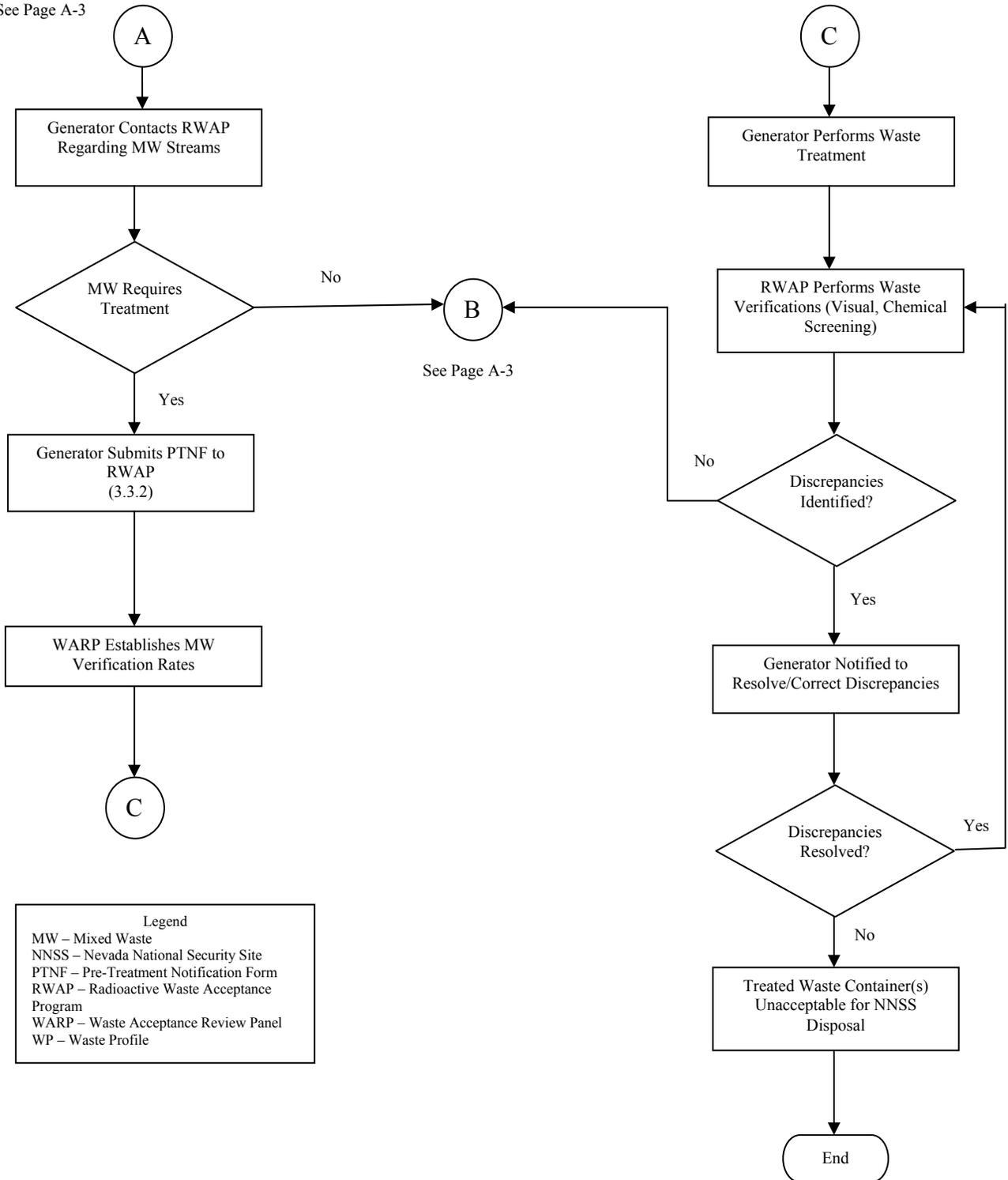


Waste Profile Approval Process



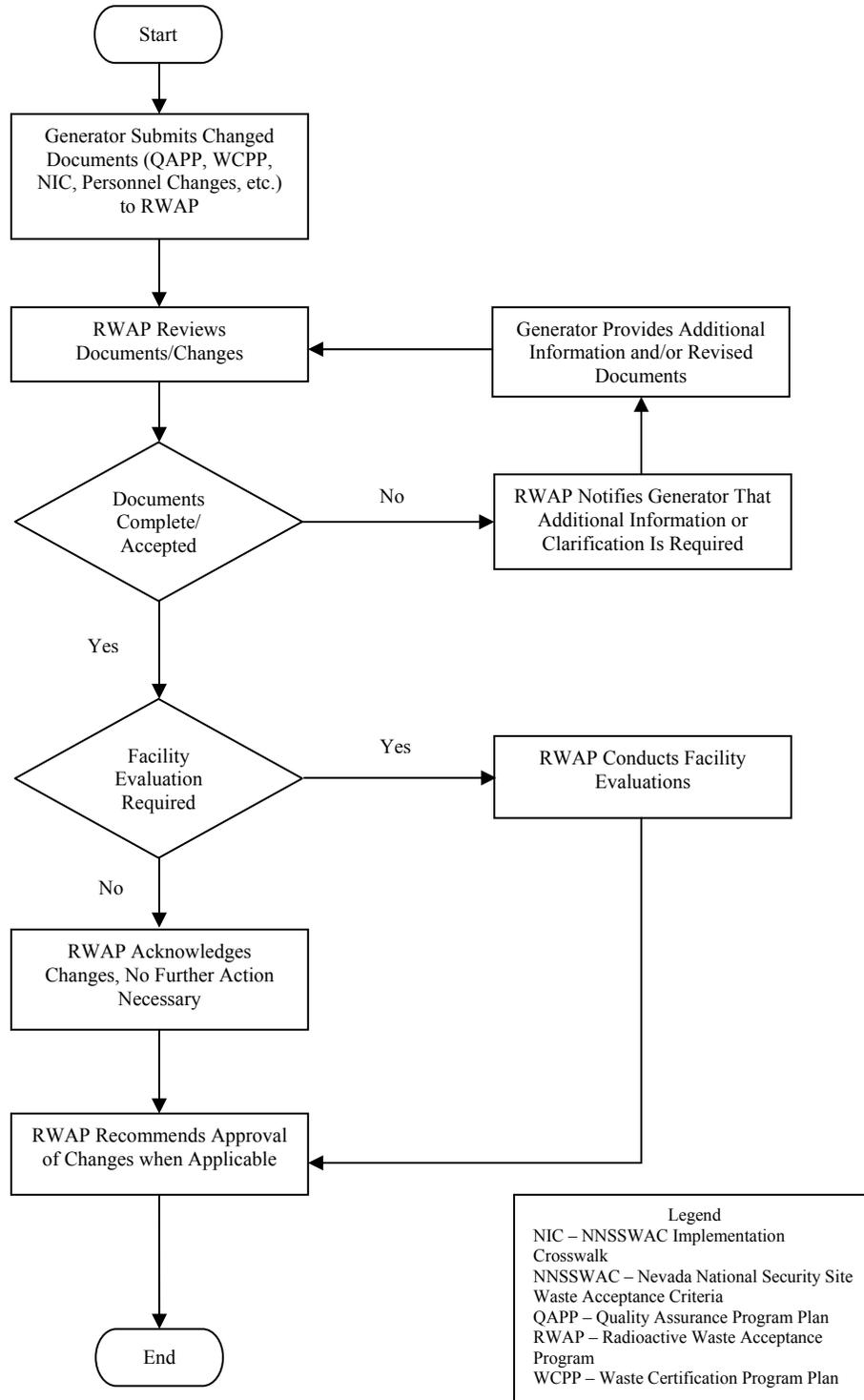
Waste Profile Approval Process (continued)

See Page A-3



Legend
 MW – Mixed Waste
 NNSS – Nevada National Security Site
 PTNF – Pre-Treatment Notification Form
 RWAP – Radioactive Waste Acceptance Program
 WARP – Waste Acceptance Review Panel
 WP – Waste Profile

Document and Personnel Changes



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Appendix B

Plutonium Equivalent Gram (PE-g) Radionuclide Conversion Factors

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Appendix B – Plutonium Equivalent Gram (PE-g) Radionuclide Conversion Factors^{7.18}

* Note: For isotopes not having a direct PE-g conversion factor, the total activity *shall* be treated as Pu-239 for alpha emission and as Cs-137 for beta/gamma emission.

Nuclide CONVERSION FACTORS --- PE-g/Bq	
Ac-224	3.31E-12
Ac-225	2.33E-10
Ac-226	3.54E-11
Ac-227	4.28E-09
Ac-228	4.01E-13
Ag-102	4.92E-16
Ag-103	7.51E-16
Ag-104	1.03E-15
Ag-104m	7.04E-16
Ag-105	2.25E-14
Ag-106	4.27E-16
Ag-106m	3.09E-14
Ag-108m	1.04E-12
Ag-110m	3.40E-13
Ag-111	4.74E-14
Ag-112	4.79E-15
Ag-115	7.95E-16
Al-26	3.00E-12
Am-237	7.18E-16
Am-238	5.18E-15
Am-239	6.52E-15
Am-240	1.19E-14
Am-241	2.65E-09
Am-242	5.42E-13
Am-242m	2.53E-09
Am-243	2.63E-09
Am-244	1.02E-13
Am-244m	4.42E-15
Am-245	1.55E-15
Am-246	1.91E-15
Am-246m	6.46E-16
As-69	6.06E-16
As-70	1.92E-15
As-71	1.10E-14
As-72	2.61E-14
As-73	3.72E-14
As-74	6.89E-14
As-76	2.16E-14
As-77	1.18E-14
As-78	2.57E-15
At-207	7.04E-14
At-211	3.27E-12
Au-193	3.28E-15
Au-194	6.70E-15
Au-195	4.82E-14
Au-198	2.36E-14
Au-198m	5.34E-14
Au-199	2.17E-14
Au-200	9.66E-16
Au-200m	2.01E-14
Au-201	4.86E-16

Nuclide CONVERSION FACTORS --- PE-g/Bq	
Ba-126	2.93E-15
Ba-128	3.74E-14
Ba-131	2.38E-14
Ba-131m	2.14E-16
Ba-133	2.83E-13
Ba-133m	1.27E-14
Ba-135m	9.88E-15
Ba-139	1.61E-15
Ba-140	1.61E-13
Ba-141	9.36E-16
Ba-142	6.03E-16
Be-7	1.52E-15
Be-10	9.51E-13
Bi-200	9.59E-16
Bi-201	1.92E-15
Bi-202	1.58E-15
Bi-203	7.73E-15
Bi-205	2.91E-14
Bi-206	5.06E-14
Bi-207	1.07E-12
Bi-210	3.65E-12
Bi-210m	2.72E-10
Bi-212	9.14E-13
Bi-213	8.77E-13
Bi-214	4.23E-13
Bk-245	6.20E-14
Bk-246	9.21E-15
Bk-247	4.59E-09
Bk-249	1.11E-11
Bk-250	5.74E-14
Br-74	1.09E-15
Br-74m	1.77E-15
Br-75	1.56E-15
Br-76	1.20E-14
Br-77	2.42E-15
Br-80	2.84E-16
Br-80m	2.28E-15
Br-82	1.83E-14
Br-83	1.45E-15
Br-84	1.06E-15
C-11	5.08E-16
C-14	1.58E-13
Ca-41	4.98E-15
Ca-45	1.00E-13
Ca-47	5.80E-14
Cd-104	9.66E-16
Cd-107	2.30E-15
Cd-109	2.24E-13
Cd-113	3.29E-12
Cd-113m	3.02E-12
Cd-115	2.95E-14

Nuclide CONVERSION FACTORS --- PE-g/Bq	
Cd-115m	2.10E-13
Cd-117	4.70E-15
Cd-117m	5.71E-15
Ce-134	3.71E-14
Ce-135	1.39E-14
Ce-137	2.88E-16
Ce-137m	1.22E-14
Ce-139	5.28E-14
Ce-141	1.03E-13
Ce-143	2.29E-14
Ce-144	1.45E-12
Cf-244	3.91E-13
Cf-246	1.38E-11
Cf-248	3.10E-10
Cf-249	4.61E-09
Cf-250	2.02E-09
Cf-251	4.70E-09
Cf-252	5.50E-10
Cf-253	4.44E-11
Cf-254	1.13E-09
Cl-36	1.04E-12
Cl-38	1.30E-15
Cl-39	1.34E-15
Cm-238	1.22E-13
Cm-240	9.59E-11
Cm-241	1.03E-12
Cm-242	1.63E-10
Cm-243	1.91E-09
Cm-244	1.57E-09
Cm-245	2.71E-09
Cm-246	2.68E-09
Cm-247	2.47E-09
Cm-248	9.90E-09
Cm-249	1.11E-15
Co-55	1.47E-14
Co-56	1.86E-13
Co-57	2.75E-14
Co-58	5.82E-14
Co-58m	4.59E-16
Co-60	8.47E-13
Co-60m	3.81E-17
Co-61	1.40E-15
Co-62m	5.69E-16
Cr-48	6.08E-15
Cr-49	9.66E-16
Cr-51	1.02E-15
Cs-125	5.45E-16
Cs-127	1.06E-15
Cs-129	2.13E-15
Cs-130	3.87E-16
Cs-131	1.31E-15

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Nuclide CONVERSION FACTORS --- PE-g/Bq	
Cs-132	8.40E-15
Cs-134	5.61E-13
Cs-134m	1.64E-15
Cs-135	2.35E-13
Cs-135m	4.32E-16
Cs-136	7.65E-14
Cs-137	1.08E-12
Cs-138	1.18E-15
Cu-60	9.44E-16
Cu-61	2.16E-15
Cu-64	3.25E-15
Cu-67	1.66E-14
Dy-155	2.25E-15
Dy-157	8.55E-16
Dy-159	1.21E-14
Dy-165	1.77E-15
Dy-166	5.73E-14
Er-161	1.40E-15
Er-165	2.31E-16
Er-169	3.19E-14
Er-171	6.45E-15
Er-172	3.37E-14
Es-250	3.72E-14
Es-251	5.89E-14
Es-253	8.69E-11
Es-254	2.79E-10
Es-254m	1.42E-11
Eu-145	1.58E-14
Eu-146	2.28E-14
Eu-147	3.23E-14
Eu-148	9.74E-14
Eu-149	9.88E-15
Eu-150hr	5.63E-15
Eu-150yr	3.46E-12
Eu-152	2.57E-12
Eu-152m	5.99E-15
Eu-154	3.04E-12
Eu-155	3.44E-13
Eu-156	1.06E-13
Eu-157	8.55E-15
Eu-158	1.35E-15
F-18	1.62E-15
Fe-52	1.75E-14
Fe-55	2.15E-14
Fe-59	1.11E-13
Fe-60	7.73E-12
Fm-252	9.66E-12
Fm-253	1.26E-11
Fm-254	1.81E-12
Fm-255	8.10E-12
Fm-257	2.27E-10
Fr-222	7.65E-13
Fr-223	3.31E-13
Ga-65	4.79E-16
Ga-66	1.27E-14

Nuclide CONVERSION FACTORS --- PE-g/Bq	
Ga-67	7.23E-15
Ga-68	1.42E-15
Ga-70	4.55E-16
Ga-72	1.52E-14
Ga-73	4.25E-15
Gd-145	5.65E-16
Gd-146	2.01E-13
Gd-147	1.17E-14
Gd-148	7.09E-10
Gd-149	2.21E-14
Gd-151	2.73E-14
Gd-152	5.23E-10
Gd-153	6.59E-14
Gd-159	8.17E-15
Ge-66	2.62E-15
Ge-67	7.07E-16
Ge-68	8.77E-13
Ge-69	8.40E-15
Ge-71	3.28E-16
Ge-75	1.06E-15
Ge-77	1.08E-14
Ge-78	2.78E-15
H-3	7.21E-15
Hf-170	9.44E-15
Hf-172	8.92E-13
Hf-173	4.82E-15
Hf-175	3.92E-14
Hf-177m	2.60E-15
Hf-178m	7.30E-12
Hf-179m	1.21E-13
Hf-180m	3.90E-15
Hf-181	1.63E-13
Hf-182	8.47E-12
Hf-182m	1.35E-15
Hf-183	1.72E-15
Hf-184	9.74E-15
Hg-193	2.21E-15
Hg-193m	7.51E-15
Hg-194	6.53E-13
Hg-195	2.21E-15
Hg-195m	1.61E-14
Hg-197	9.29E-15
Hg-197m	1.61E-14
Hg-199m	9.29E-16
Hg-203	8.03E-14
Ho-155	5.88E-16
Ho-157	1.23E-16
Ho-159	1.78E-16
Ho-161	1.82E-16
Ho-162	8.17E-17
Ho-162m	6.24E-16
Ho-164	2.44E-16
Ho-164m	3.31E-16
Ho-166	1.93E-14
Ho-166m	7.88E-12

Nuclide CONVERSION FACTORS --- PE-g/Bq	
Ho-167	2.09E-15
I-120	2.85E-15
I-120m	2.43E-15
I-121	7.58E-16
I-123	2.07E-15
I-124	1.22E-13
I-125	1.43E-13
I-126	2.71E-13
I-128	5.38E-16
I-129	9.88E-13
I-130	1.86E-14
I-131	2.03E-13
I-132	3.14E-15
I-132m	2.47E-15
I-133	4.03E-14
I-134	1.54E-15
I-135	8.84E-15
In-109	1.23E-15
In-110min	1.36E-15
In-110hr	3.62E-15
In-111	6.73E-15
In-112	2.13E-16
In-113m	5.77E-16
In-114m	2.57E-13
In-115	1.07E-11
In-115m	1.72E-15
In-116m	1.31E-15
In-117	8.40E-16
In-117m	2.10E-15
In-119m	4.99E-16
Ir-182	6.80E-16
Ir-184	3.22E-15
Ir-185	5.25E-15
Ir-186	1.21E-15
Ir-187	2.18E-15
Ir-188	1.17E-14
Ir-189	1.67E-14
Ir-190	6.45E-14
Ir-190m	2.84E-16
Ir-192	1.82E-13
Ir-192m	1.08E-12
Ir-194	1.53E-14
Ir-194m	3.49E-13
Ir-195	1.97E-15
Ir-195m	4.67E-15
K-40	2.33E-12
K-42	9.81E-15
K-43	1.06E-14
K-44	9.07E-16
K-45	6.81E-16
Kr-85	2.31E-23
La-131	6.64E-16
La-132	4.72E-15
La-135	4.06E-16
La-137	2.42E-13

Nevada National Security Site Waste Acceptance Criteria

Nuclide CONVERSION FACTORS --- PE-g/Bq	
La-138	4.29E-12
La-140	3.13E-14
La-141	4.33E-15
La-142	2.59E-15
La-143	6.22E-16
Lu-169	1.06E-14
Lu-170	1.84E-14
Lu-171	2.42E-14
Lu-172	4.28E-14
Lu-173	8.84E-14
Lu-174	1.90E-13
Lu-174m	1.16E-13
Lu-176	4.13E-12
Lu-176m	3.17E-15
Lu-177	3.29E-14
Lu-177m	4.44E-13
Lu-178	7.04E-16
Lu-178m	9.21E-16
Lu-179	3.02E-15
Md-257	7.88E-13
Md-258	1.79E-10
Mg-28	3.49E-14
Mn-51	1.19E-15
Mn-52	3.92E-14
Mn-52m	8.10E-16
Mn-53	9.36E-15
Mn-54	8.99E-14
Mn-56	3.53E-15
Mo-101	7.19E-16
Mo-90	9.96E-15
Mo-93	6.39E-14
Mo-93m	4.71E-15
Mo-99	2.73E-14
Na-22	8.03E-13
Na-24	1.37E-14
Nb-88	7.88E-16
Nb-89(66)	1.95E-15
Nb-89(122)	3.33E-15
Nb-90	1.83E-14
Nb-93m	4.87E-14
Nb-94	1.34E-12
Nb-95	4.82E-14
Nb-95m	2.42E-14
Nb-96	1.83E-14
Nb-97	1.24E-15
Nb-98	1.61E-15
Nd-136	1.49E-15
Nd-138	6.81E-15
Nd-139	2.88E-16
Nd-139m	4.30E-15
Nd-141	1.43E-16
Nd-147	6.60E-14
Nd-149	2.53E-15
Nd-151	4.94E-16
Ni-56	2.89E-14

Nuclide CONVERSION FACTORS --- PE-g/Bq	
Ni-57	1.46E-14
Ni-59	1.22E-14
Ni-63	3.46E-14
Ni-65	2.47E-15
Ni-66	4.94E-14
Np-232	3.18E-15
Np-233	4.68E-17
Np-234	1.53E-14
Np-235	1.72E-14
Np-236hr	2.48E-13
Np-236yr	2.18E-10
Np-237	1.37E-09
Np-238	9.59E-14
Np-239	2.82E-14
Np-240	2.49E-15
Os-180	4.02E-16
Os-181	1.79E-15
Os-182	1.06E-14
Os-185	4.45E-14
Os-189m	1.46E-16
Os-191	5.26E-14
Os-191m	4.36E-15
Os-193	1.44E-14
Os-194	2.34E-12
P-32	1.07E-13
P-33	4.95E-14
Pa-227	2.18E-12
Pa-228	1.91E-12
Pa-230	2.10E-11
Pa-231	6.32E-09
Pa-232	6.41E-14
Pa-233	1.06E-13
Pa-234	1.14E-14
Pb-195m	7.13E-16
Pb-198	1.76E-15
Pb-199	9.96E-16
Pb-200	9.51E-15
Pb-201	3.25E-15
Pb-202	3.42E-13
Pb-202m	2.76E-15
Pb-203	6.01E-15
Pb-205	2.34E-14
Pb-209	1.68E-15
Pb-210	1.55E-10
Pb-211	3.31E-13
Pb-212	5.22E-12
Pb-214	4.05E-13
Pd-100	2.36E-14
Pd-101	1.70E-15
Pd-103	1.23E-14
Pd-107	1.61E-14
Pd-109	1.03E-14
Pm-141	4.07E-16
Pm-143	7.95E-14
Pm-144	4.70E-13

Nuclide CONVERSION FACTORS --- PE-g/Bq	
Pm-145	2.32E-13
Pm-146	1.22E-12
Pm-147	1.92E-13
Pm-148	5.97E-14
Pm-148m	1.58E-13
Pm-149	1.99E-14
Pm-150	3.63E-15
Pm-151	1.30E-14
Po-203	1.01E-15
Po-205	1.91E-15
Po-207	2.30E-15
Po-210	1.17E-10
Pr-136	3.78E-16
Pr-137	5.76E-16
Pr-138m	2.06E-15
Pr-139	5.45E-16
Pr-142	1.52E-14
Pr-142m	1.93E-16
Pr-143	6.71E-14
Pr-144	5.03E-16
Pr-145	4.61E-15
Pr-147	5.20E-16
Pt-186	1.59E-15
Pt-188	5.38E-14
Pt-189	2.73E-15
Pt-191	7.80E-15
Pt-193	1.84E-14
Pt-193m	2.68E-14
Pt-195m	3.17E-14
Pt-197	9.59E-15
Pt-197m	2.18E-15
Pt-199	7.95E-16
Pt-200	1.69E-14
Pu-234	6.52E-13
Pu-235	4.16E-17
Pu-236	2.88E-10
Pu-237	1.08E-14
Pu-238	4.42E-10
Pu-239	4.41E-10
Pu-240	4.41E-10
Pu-241	4.80E-12
Pu-242	4.13E-10
Pu-243	2.38E-15
Pu-244	3.43E-10
Pu-245	1.20E-14
Ra-223	2.39E-10
Ra-224	9.21E-11
Ra-225	2.13E-10
Ra-226	2.62E-10
Ra-227	1.26E-14
Ra-228	4.41E-10
Rb-79	7.73E-16
Rb-81	2.19E-15
Rb-81m	4.85E-16
Rb-82m	3.95E-15

Nevada National Security Site Waste Acceptance Criteria

Nuclide CONVERSION FACTORS --- PE-g/Bq		Nuclide CONVERSION FACTORS --- PE-g/Bq		Nuclide CONVERSION FACTORS --- PE-g/Bq	
Rb-83	3.98E-14	Sb-128hr	1.16E-14	Ta-172	9.66E-16
Rb-84	6.93E-14	Sb-129	6.87E-15	Ta-173	3.20E-15
Rb-86	1.29E-13	Sb-130	1.48E-15	Ta-174	1.19E-15
Rb-87	4.18E-13	Sb-131	1.20E-15	Ta-175	3.69E-15
Rb-88	7.58E-16	Sc-43	3.15E-15	Ta-176	5.53E-15
Rb-89	6.11E-16	Sc-44	5.05E-15	Ta-177	2.87E-15
Re-177	4.03E-16	Sc-44m	3.94E-14	Ta-178	1.88E-15
Re-178	4.03E-16	Sc-46	1.86E-13	Ta-179	1.56E-14
Re-181	7.18E-15	Sc-47	1.99E-14	Ta-180	7.04E-13
Re-182(12.7)	5.72E-15	Sc-48	3.07E-14	Ta-180m	1.22E-15
Re-182(64)	3.57E-14	Sc-49	1.09E-15	Ta-182	2.87E-13
Re-184	6.35E-14	Se-70	2.11E-15	Ta-182m	5.89E-16
Re-184m	2.76E-13	Se-73	5.77E-15	Ta-183	6.00E-14
Re-186	3.25E-14	Se-73m	5.97E-16	Ta-184	1.21E-14
Re-186m	1.70E-12	Se-75	3.67E-14	Ta-185	1.34E-15
Re-187	1.15E-15	Se-79	1.86E-13	Ta-186	5.02E-16
Re-188	1.50E-14	Se-81	4.04E-16	Tb-147	2.21E-15
Re-188m	3.66E-16	Se-81m	1.40E-15	Tb-149	1.49E-13
Re-189	1.26E-14	Se-83	9.29E-16	Tb-150	3.14E-15
Rh-99	2.41E-14	Si-31	2.17E-15	Tb-151	6.61E-15
Rh-99m	1.11E-15	Si-32	3.12E-12	Tb-153	5.67E-15
Rh-100	9.81E-15	Sm-141	4.38E-16	Tb-154	1.05E-14
Rh-101	1.49E-13	Sm-141m	9.21E-16	Tb-155	6.61E-15
Rh-101m	5.76E-15	Sm-142	2.05E-15	Tb-156	3.35E-14
Rh-102	4.82E-13	Sm-145	8.03E-14	Tb-156m (5.0)	2.88E-15
Rh-102m	1.97E-13	Sm-146	6.99E-10	Tb-156m (24.4)	6.41E-15
Rh-103m	7.51E-17	Sm-147	6.35E-10	Tb-157	8.17E-14
Rh-105	9.66E-15	Sm-151	2.53E-13	Tb-158	2.88E-12
Rh-106m	3.04E-15	Sm-153	1.91E-14	Tb-160	2.27E-13
Rh-107	4.58E-16	Sm-155	4.90E-16	Tb-161	3.86E-14
Rn-220	1.66E-24	Sm-156	6.62E-15	Tc-101	3.40E-16
Rn-222	1.71E-24	Sn-110	4.45E-15	Tc-104	7.88E-16
Ru-94	1.22E-15	Sn-111	3.79E-16	Tc-93	9.81E-16
Ru-97	3.00E-15	Sn-113	1.08E-13	Tc-93m	4.79E-16
Ru-103	8.10E-14	Sn-117m	7.73E-14	Tc-94	3.53E-15
Ru-105	4.93E-15	Sn-119m	9.14E-14	Tc-94m	1.26E-15
Ru-106	1.81E-12	Sn-121	6.84E-15	Tc-96	1.95E-14
S-35	5.12E-14	Sn-121m	4.12E-13	Tc-96m	2.10E-16
Sb-115	3.76E-16	Sn-123	3.54E-13	Tc-97	4.91E-14
Sb-116	3.60E-16	Sn-123m	7.80E-16	Tc-97m	1.14E-13
Sb-116m	1.35E-15	Sn-125	9.66E-14	Tc-98	1.23E-12
Sb-117	4.82E-16	Sn-126	4.25E-12	Tc-99	3.67E-13
Sb-118m	3.37E-15	Sn-127	3.95E-15	Tc-99m	5.54E-16
Sb-119	1.03E-15	Sn-128	2.68E-15	Te-116	3.05E-15
Sb-120min	2.01E-16	Sr-80	3.74E-15	Te-121	1.14E-14
Sb-120day	3.02E-14	Sr-81	1.02E-15	Te-121m	1.56E-13
Sb-122	3.11E-14	Sr-83	9.36E-15	Te-123	1.08E-13
Sb-124	2.36E-13	Sr-85	2.26E-14	Te-123m	1.40E-13
Sb-124m	1.62E-16	Sr-85m	1.19E-16	Te-125m	1.14E-13
Sb-125	3.26E-13	Sr-87m	5.80E-16	Te-127	3.83E-15
Sb-126	8.92E-14	Sr-89	2.18E-13	Te-127m	2.69E-13
Sb-126m	5.39E-16	Sr-90	4.32E-12	Te-129	1.08E-15
Sb-127	5.16E-14	Sr-91	1.12E-14	Te-129m	2.18E-13
Sb-128min	4.08E-16	Sr-92	6.23E-15	Te-131	7.80E-16

Nevada National Security Site Waste Acceptance Criteria

Nuclide CONVERSION FACTORS --- PE-g/Bq	
Te-131m	2.94E-14
Te-132	5.64E-14
Te-133	5.39E-16
Te-133m	2.44E-15
Te-134	1.90E-15
Th-226	1.69E-12
Th-227	2.85E-10
Th-228	1.09E-09
Th-229	6.58E-09
Th-230	2.79E-09
Th-231	9.21E-15
Th-232	3.02E-09
Th-234	2.12E-13
Ti-44	3.43E-12
Ti-45	2.57E-15
Tl-194	1.62E-16
Tl-194m	8.55E-16
Tl-195	7.36E-16
Tl-197	1.06E-15
Tl-198	2.06E-15
Tl-198m	1.90E-15
Tl-199	1.31E-15
Tl-200	4.92E-15
Tl-201	5.31E-15
Tl-202	1.08E-14
Tl-204	5.22E-13
Tm-162	4.53E-16
Tm-166	4.99E-15
Tm-167	3.51E-14
Tm-170	2.56E-13
Tm-171	5.87E-14
Tm-172	3.37E-14
Tm-173	5.31E-15
Tm-175	5.34E-16
U-230	4.46E-10
U-231	1.42E-14
U-232	1.02E-09
U-233	2.64E-10
U-234	2.59E-10
U-235	2.33E-10
U-236	2.40E-10
U-237	5.17E-14
U-238	2.21E-10
U-239	6.61E-16
U-240	1.60E-14
V-47	8.40E-16
V-48	7.40E-14
V-49	1.89E-15
W-176	1.90E-15
W-177	1.28E-15
W-178	2.13E-14

Nuclide CONVERSION FACTORS --- PE-g/Bq	
W-179	3.78E-17
W-181	7.51E-15
W-185	1.06E-13
W-187	1.15E-14
W-188	4.27E-13
Xe-120	1.72E-21
Xe-121	8.30E-21
Xe-122	2.12E-22
Xe-123	2.71E-21
Xe-125	1.04E-21
Xe-127	1.09E-21
Xe-129m	8.85E-23
Xe-131m	3.38E-23
Xe-133	1.29E-22
Xe-133m	1.24E-22
Xe-135	1.07E-21
Xe-135m	1.83E-21
Xe-138	5.28E-21
Y-86	1.30E-14
Y-86m	7.88E-16
Y-87	1.08E-14
Y-88	1.69E-13
Y-90	4.12E-14
Y-90m	2.78E-15
Y-91	2.45E-13
Y-91m	3.13E-16
Y-92	4.85E-15
Y-93	1.16E-14
Y-94	7.65E-16
Y-95	4.34E-16
Yb-162	3.84E-16
Yb-166	2.12E-14
Yb-167	1.91E-16
Yb-169	8.17E-14
Yb-175	1.99E-14
Yb-177	1.91E-15
Yb-178	2.07E-15
Zn-62	1.50E-14
Zn-63	1.01E-15
Zn-65	6.18E-14
Zn-69	7.73E-16
Zn-69m	7.33E-15
Zn-71m	4.47E-15
Zn-72	3.58E-14
Zr-86	1.20E-14
Zr-88	1.00E-13
Zr-89	1.51E-14
Zr-93	6.90E-13
Zr-95	1.61E-13
Zr-97	2.71E-14

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Appendix C
Marking and Labeling

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Appendix C – Marking and Labeling

C.1 Bar Code

Bar codes (see Figure C-1) used on packages **shall** meet the following standards:^{7.6}

- Code 39.
- Low- to medium density, low-density preferred.
- 1-inch high bar code not to exceed 6 inches wide.
- Human readable interpretation (HRI) 1/2 inch high, printed below the bar code.
- Spacing between bar code and HRI will be 1/10 of an inch.
- Minimum left and right margin (quiet zones) will be at least 1/25 inch.
- Bar codes and HRI will be stacked with a minimum separation of 1/2 inch and in the following order: shipment number, container number.
- A total of two bar code labels **shall** be placed on each package near the top and on opposite sides.^{7.6} Drums **shall** have a total of two bar code labels, one on top of the drum lid and one on the side near the top.^{7.6}

Note: Exceptions to these requirements **shall** be verified with the RWMC Operations prior to shipment.

- Labels **shall** be:^{7.6}
 - Securely attached and able to withstand shipping conditions.
 - Weatherproof and not deform when wet or fade in the sun.
 - Resistant to tearing, peeling, and cracking.
 - Printed with permanent indelible ink and remain legible.

A sample bar code **shall** be submitted to RWMC Operations prior to the first shipment to ensure RWMC equipment can be used to read the bar code.^{7.6}



MDL02001



000001

Figure C-1: Bar Code Label Example

Note: Not actual size.

C.2 Marking and Labeling

Packages **shall** have the following markings and labels:^{7.6}

1. Marking and labeling as required in Title 49 CFR;
2. For additional asbestos labeling, see Section 3.1.15.
3. For additional beryllium labeling, see Section 3.1.17.
4. For additional MLLW labeling, see Section 3.3.6.1
5. “Package Certification Label” (PCL) (see Figure C-2), signed by the Waste Certification Official or package certifier.^{7.6} If the waste is unpackaged bulk, a signed PCL **shall** accompany the shipment papers.^{7.6}
6. Shipment number in the following sequence: Two alpha character generator-site-designator codes assigned by NNSA/NFO/EMO (see Section C-3); one alpha character for type of waste (L for LLW, M for MLLW, C for non-radioactive classified waste/matter, H for non-radioactive hazardous classified waste/matter); two numerical characters for current fiscal year; three alphanumerical characters for shipment sequence. This number **shall** be on the bar code.^{7.6} Example: MDL99001 indicates a shipment from the Mound Facility of LLW in fiscal year 1999 and the first shipment.
7. Package number **shall** be six characters (alpha, numeric, or combination) with no duplication within the shipment.^{7.6} This number **shall** be on the bar code.^{7.6}
8. Package weight in units of kilograms and pounds **shall** be included on the side of each waste package.^{7.6} The requirement can be met with a label, additions to bar code labels, or by writing the weight on the side of the waste package.

NV-211 February 2012	USDOE
PACKAGE CERTIFICATION LABEL	
This label asserts that this container and its contents meet the requirements of DOT (49 CFR), EPA (40 CFR), and NNSSWAC for transportation and disposal.	
PACKAGE NUMBER: _____	
DATE: _____	
CERTIFIED BY (print): _____	
CERTIFIED BY (signature): _____	
Waste Certification Official	<input type="checkbox"/>
Alternate Waste Certification Official	<input type="checkbox"/>
Package Certifier	<input type="checkbox"/>
RWMC DESIGNATION (i.e., ONLO, ARIR): _____	

Figure C-2: Package Certification Label

C.3 Generator Waste Stream and Shipment Codes

GENERATOR	RWMC DESIGNATION	SITE DESIGNATOR
Aberdeen Proving Ground	USAA	AP
Advanced MW Treatment Project	AMWP	AM
Argonne National Lab	ANLE	AE
Boeing	BNRC	BN
Brookhaven National Lab	BNLX	BR
Y-12	BWXT	BW
Duratek/ES	DRTK	DR
GA Technologies	BGAT	BG
Idaho National Lab	NEID	NE
Idaho Cleanup Project	INEL	IN
LANL	LANL	LA
LLNL	BCLA	LL
Nevada National Security Site	LRY5	DP
Nuclear Fuel Services	NFSI	NF
Oak Ridge Reservation	ORTN	OR
Paducah	PGDP	PD
Pantex	AMHP	PX
PermaFix - M&EC	PERM	PF
Portsmouth	PORT	PO
Sandia – Albuquerque	ASLA	SA
Savannah River	SVRS	SR
Navarro-Intera	LITN	IT
TRU Waste Processing Center	FWOR	FW
Oak Ridge National Lab	ORNL	OL
West Valley	WVDP	WV

Note: If generator site is not listed, develop designations and submit with first waste profiles. A database verification of uniqueness will be conducted by RWAP.

C.4 NNSS Advance Shipment Notification

Nevada National Security Site Advance Shipment Notification

Shipper Name and Address: _____

Contact Name: _____ Phone/Cell/Pager: _____

Waste Stream Number(s): _____

Shipment Number: _____

Shipment Departure Date: _____ Time: _____

Estimated Arrival Date: _____ Time: _____

Carrier: _____ Driver's Name: _____
(Must be U.S. Citizen)

Driver's License No. _____ State: _____

Tractor License No. _____ Trailer No. _____ Seal No. _____

Gross Wt. (lb): _____ Type/Number of Packages: Box _____ Drum _____

Bulk _____ (cargo containers, equipment, burrito wraps, etc.) Other _____

DOT Proper Shipping Name(s) or Attached Bill of Lading:

Special Handling Considerations:

Asbestos Classified Mixed Waste Other: _____

Attachments:

PSDR Bill of Lading Other: _____

Privacy Act Statement: The information on this form is protected by the Privacy Act of 1974. The purpose of requesting this information is to comply with the terms and conditions under which the Nevada National Security Site will accept waste for disposal. This information will be used by the U.S. Department of Energy, National Nuclear Security Administration Nevada Field Office and its contractors. Failure to provide this information will result in either a delay in waste receipt or waste refusal at the Nevada National Security Site.

PRIVACY ACT INFORMATION

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Appendix D
Package Shipment Disposal Request

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Appendix D – Package Shipment Disposal Request

The activity of each nuclide in a waste package as documented on the Package Shipment Disposal Request (PSDR) *shall not* exceed the corresponding maximum radionuclide concentration specified on the waste profile.^{7,6} See Section 3.1.2 for reportable nuclides.

Package Shipment and Disposal Request

Shipment Number: **DPM12002**

Prepared By: _____

Date: 21-Dec-2011

Manifest Number: MANIFEST2012

Package No: **000002** Contact (mSv/h): **0.01** Completed Date: **05-Dec-2011**
 Container Code: **100** 1 Meter (mSv/h): **0.01** Total Activity (Bq): **4.600E+00**
 External Volume (m³): **4.650E+00** Gross Weight (kg): **1.846E+03** Activity Date: **05-Dec-2011**
 Waste Volume (m³): **3.400E+00** Net Weight (kg): **1.172E+03** Accountable Material? **N**
 Comment: **pcb bulk product llw**

Waste Stream /Profile	Rev. No.	Revision Date	Nuclide	Qty (Bq)
LRY5TESTINGKJ	00	05-Dec-2011	PU-239	3.400E+00
LRY5TESTINGKJ	00	05-Dec-2011	U-233	1.200E+00

Waste Stream /Profile	Rev. No.	Revision Date	EPA Code

Package No: **000001** Contact (mSv/h): **0.01** Completed Date: **05-Dec-2011**
 Container Code: **100** 1 Meter (mSv/h): **0.01** Total Activity (Bq): **4.460E+04**
 External Volume (m³): **4.650E+00** Gross Weight (kg): **1.846E+03** Activity Date: **05-Dec-2011**
 Waste Volume (m³): **3.400E+00** Net Weight (kg): **1.172E+03** Accountable Material? **N**
 Comment: **pcb bulk product llw**

Waste Stream /Profile	Rev. No.	Revision Date	Nuclide	Qty (Bq)
LRY5TESTINGKJ	00	05-Dec-2011	PU-239	4.460E+04
LRY5TESTINGKJ	00	05-Dec-2011	U-232	3.000E+00

Waste Stream /Profile	Rev. No.	Revision Date	EPA Code
LRY5TESTINGKJ	00	05-Dec-2011	PCBS
LRY5TESTINGKJ	00	05-Dec-2011	U007

Reviewed By: _____

Page 1 of 1

If you have any questions on completing this document, contact the operator of the NNSS at (702) 295-6811. Data entered on the form must be legible. Hand printing or typing of letters and numbers is preferred to handwritten entries. When using a decimal, it must be clearly defined.

DO NOT USE COMMAS.

PSDR Instructions

- SHIPMENT NUMBER:** Consists of eight alphanumeric characters in the following sequence: two-digit generator code assigned by EMO; L (LLW), M (MLLW), C (non-radioactive classified waste/matter), or H (non-radioactive hazardous classified waste/matter); the last two digits of the current fiscal year (Oct. 1–Sept. 30); and the consecutive number of shipments from the generating facility. EXAMPLE: DPL08001 represents the generator, NSTec, low-level waste, fiscal year 2008, and the first shipment to EMO for fiscal year 2008.
- PREPARED BY:** The person who prepared the PSDR.
- DATE:** The date the PSDR was prepared.
- MANIFEST NUMBER:** Twelve alphanumeric required characters on LLW containing PCB waste that meets the requirements for disposal in a permitted hazardous waste landfill and MLLW shipments.
- PACKAGE NUMBER:** Six unique alphanumeric characters for each container in the shipment. See the instructions on the comment field for required information for previously rejected packages.
- CONTACT:** Maximum radiation reading at the surface of the package in mSv/H: Written in scientific notation X.XXXE±00.
- COMPLETION DATE:** The date, in DDMMYY format (e.g., 01Jan1992), that the last waste material was placed in the package.
- CONTAINER CODE:** Three-digit number that identifies the type of container. If your container is not listed, contact the RWMC at (702) 295-6811.

Code	Description	Length	Width	Height	* External Volume	
					Cubic Feet	Cubic Meters
100	Miscellaneous	N/A	N/A	N/A	N/A	N/A
101	30-gallon drum	N/A	N/A	N/A	4.99–6.99	0.141–0.1979
102	55-gallon drum	N/A	N/A	N/A	7.99–9.99	0.226–0.283
110	Miscellaneous drum	N/A	N/A	N/A	0–20.98	0–0.594
120	Miscellaneous box	N/A	N/A	N/A	0–163.33	0–4.625
130	Miscellaneous soft-sided	N/A	N/A	N/A	0–1481.1	0–41.94
124	85-gallon drum	N/A	N/A	N/A	12.99–14.99	0.368–0.424
125	110-gallon drum	N/A	N/A	N/A	18.99–20.99	0.537–0.594
200	Half box	78"–90"	42"–56"	18"–30"	34.125–87.5	0.966–2.4777
201	Wooden half box	78"–90"	42"–56"	18"–30"	34.125–87.5	0.9663–2.4777
210	Full box	78"–90"	42"–56"	42"–56"	79.625–163.33	2.2547–4.6250
211	Wooden full box	78"–90"	42"–56"	42"–56"	79.625–163.33	2.2547–4.6250
220	Cargo Container	234"–246"	90"–102"	90"–102"	1,096.875–1,481.125	31.060–41.940
230	Supersack	N/A	N/A	N/A	N/A	N/A
240	Burrito Wrap	N/A	N/A	N/A	N/A	N/A
250	Concrete Monolith	N/A	N/A	N/A	149.734–199.987	4.24–5.663

* External volumes reported for any container *shall* be based on the containers' external dimensions. Volume should be within ranges specified. ^{7.6}

Nevada National Security Site Waste Acceptance Criteria

1 METER:	Maximum radiation reading at 1 meter in mSv/h: Written in scientific notation X.XXXE±00.
TOTAL ACTIVITY:	Total becquerels; <i>shall</i> equal the sum of becquerels for each nuclide reported. Written in scientific notation X.XXXE±00.
EXTERNAL VOLUME:	Total volume displaced by the container in cubic meters. Refer to CONTAINER CODE. Written in scientific notation X.XXXE±00.
GROSS WEIGHT:	Total weight of container including waste and solidification or absorbent media in kilograms. Written in scientific notation X.XXXE±00.
ACTIVITY DATE:	The date in DDMMYYYY format (e.g., 01Jan1992) that the activity of the package was determined.
WASTE VOLUME:	Actual volume of waste material in package in cubic meters. Written in scientific notation X.XXXE±00.
NET WEIGHT:	Total weight of waste and solidification or absorbent media, excluding container, in kilograms. Written in scientific notation X.XXXE±00.
ACCOUNTABLE MATERIAL:	Answers whether or not the package contains accountable material.
COMMENT:	A forty (40) alphanumeric character field. This field is required when unique and critical information is necessary for RWMC personnel. If the package was rejected from NNSS, returned to the generator and will be re-shipped to the NNSS, the original rejected package number (parent) <i>shall</i> be entered in parentheses. All packages generated from the repackaging of rejected waste (progeny) <i>shall</i> have the original rejected package number (parent) entered in parentheses in the comment section. ^{7.5}
WASTE STREAM PROFILE:	Waste Stream Identification or profile number. Thirteen alphanumeric characters. First four characters will be the RWMC designation. Next nine alphanumeric characters will be assigned by the generator. EXAMPLE: LRY500000001 represents waste from the NNSS.
REVISION:	WP Revision number found in Section B.2.a of the approved profile will be a two-digit number.
REVISION DATE:	WP Date found in Section B.2.a of the approved profile: in DDMMYYYY format (e.g., 01Jan1992).
NUCLIDE:	Valid nuclide description will be reported in the following format: Elemental symbol as shown on the periodic table followed by a dash (-) and then atomic mass units (e.g., Cs-137, Pu-239). Attach additional sheet(s), as needed.

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

EPA CODE: MLLW waste containers only, enter the four-digit EPA Hazardous Waste Code Number associated with the waste package. Enter “STHW” if the container is MLLW with a state hazardous waste number and not a federal EPA Hazardous Waste Number. Enter PCBS if the container is LLW containing PCB waste that meets the requirements for disposal in a permitted hazardous waste landfill.

Appendix E

**Radiological Waste Characterization
and Reporting Requirements**

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Appendix E – Radiological Waste Characterization and Reporting Requirements

E.1 Radionuclide Reporting

Reportable radionuclides *shall* be reported on the Waste Profile (WP) and Package Shipment Disposal Request (PSDR).^{6.18/7.5} Activity concentrations reported on the WP are applied at the waste stream level; activity concentrations reported on the PSDR are applied at the waste package level. Radionuclides reported on the PSDR *shall* be identified on the WP.^{7.5} (See Appendix D for example of the PSDR.) Determination of activity concentrations reported on the WP (Sections D.5 and D.6) and the PSDR *shall* be documented and available for review. Verification of calculations used to determine the radionuclide concentrations (data results) *shall* be conducted and documented.^{7.5} Waste packages exceeding the activity concentration upper limit will not be accepted without approval of a revised WP; waste concentrations less than the lower limit will be accepted without prior approval.

A. Reportable Radionuclides

Radionuclides known or reasonably expected to be present in a waste stream *shall* be reported as follows:^{6.7/6.16/6.18/7.5}

1. The activity concentration of the radionuclides in the final waste form exceeds 1 percent of the Action Level (Table E-1).^{6.7/7.9} These radionuclides require rigorous waste characterization and *shall* be reported on the PSDR and the WP.^{7.5}
2. Radionuclides that are alpha-emitting and transuranic with a half-life greater than 20 years that exceed 10 pCi/g *shall* be reported on the WP.^{7.5} The waste mass *shall* be determined as described in Section E.4.^{7.5} Transuranic waste radionuclides with concentrations that exceed 1 nCi/g require rigorous waste characterization methods and *shall* be reported on the PSDR and the WP.^{7.5}
3. Activity concentrations in the final waste form that exceed 1 percent of the total activity concentration *shall* be reported on the PSDR and the WP.^{7.5} The total activity concentration *shall* include the activity of all radionuclides, except for those that are exempt from the reporting requirements as specified.^{6.7/7.9} For these radionuclides and for those present at a level less than the detection limit of industry-accepted characterization methods, Process Knowledge (PK) should be sufficient for characterization.

Table E-1: Radionuclide Action Levels for Waste Characterization and Reporting

Nuclide	Action Level (Bq m ⁻³)	Nuclide	Action Level (Bq m ⁻³)
³ H	6.2E+11	²¹⁰ Pb	3.5E+11
¹⁴ C	5.4E+15	²²⁶ Ra	2.1E+07
²⁶ Al	9.7E+07	²²⁸ Ra	1.7E+12
³⁶ Cl	1.9E+08	²²⁷ Ac	1.7E+11
³⁹ Ar	9.9E+20	²²⁸ Th	4.3E+13
⁴⁰ K	9.4E+10	²²⁹ Th	2.8E+10
⁴¹ Ca	2.8E+12	²³⁰ Th	6.0E+07
⁵⁹ Ni	1.7E+14	²³² Th	8.1E+09
⁶³ Ni	3.2E+14	²³¹ Pa	1.0E+10
⁶⁰ Co	1.6E+12	²³² U	4.3E+10
⁸⁵ Kr	2.0E+20	²³³ U	8.2E+10
⁹⁰ Sr	4.3E+11	²³⁴ U	1.3E+10
⁹³ Zr	1.1E+14	²³⁵ U	1.1E+11
^{93m} Nb	4.6E+15	²³⁶ U	2.8E+11
⁹⁴ Nb	1.2E+10	²³⁸ U	3.5E+11
⁹⁹ Tc	3.2E+09	²³⁷ Np	3.4E+10
¹⁰⁷ Pd	2.9E+14	²³⁸ Pu	1.8E+12
^{113m} Cd	6.2E+12	²³⁹ Pu	5.1E+11
^{121m} Sn	2.1E+14	²⁴⁰ Pu	5.2E+11
¹²⁶ Sn	1.1E+10	²⁴¹ Pu	5.8E+12
¹²⁹ I	3.4E+09	²⁴² Pu	3.7E+11
¹³³ Ba	5.4E+12	²⁴⁴ Pu	4.8E+10
¹³⁵ Cs	2.8E+12	²⁴¹ Am	1.7E+11
¹³⁷ Cs	2.5E+11	²⁴³ Am	5.8E+10
¹⁵⁰ Eu	9.4E+10	²⁴³ Cm	8.3E+11
¹⁵² Eu	4.7E+11	²⁴⁴ Cm	3.4E+12
¹⁵⁴ Eu	1.7E+12	²⁴⁵ Cm	4.6E+10
¹⁵¹ Sm	2.4E+15	²⁴⁶ Cm	9.2E+10
^{166m} Ho	1.2E+10	²⁴⁸ Cm	2.9E+10
²⁰⁷ Bi	1.1E+11	²⁵⁰ Cf	1.5E+12

B. Exempt Radionuclides

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

1. Any radionuclide, as listed in Table E-2, that will reach a state of transient or secular equilibrium with a parent radionuclide within the operational period of the disposal site.
2. Any radionuclide occurring at activity concentrations not exceeding background ranges for the region in which it was generated and material of interest.

Table E-2: Exempt Radionuclides

^{90}Y , ^{93}Nb , $^{126\text{m}}\text{Sb}$, ^{126}Sb , $^{137\text{m}}\text{Ba}$
^{233}Pa , ^{225}Ra , ^{225}Ac , ^{221}Fr , ^{217}At , ^{213}Bi , ^{213}Po , ^{209}Tl , ^{209}Pb
^{239}Np , ^{231}Th , ^{227}Th , ^{223}Fr , ^{223}Ra , ^{219}Rn , ^{215}Po , ^{211}Pb , ^{211}Bi , ^{211}Po , ^{207}Tl
^{234}Th , $^{234\text{m}}\text{Pa}$, ^{234}Pa , ^{222}Rn , ^{218}Po , ^{214}Pb , ^{214}Bi , ^{214}Po , ^{210}Bi , ^{210}Po
^{240}U , $^{240\text{m}}\text{Np}$, ^{240}Np , ^{228}Ra , ^{228}Ac , ^{228}Th , ^{224}Ra , ^{220}Rn , ^{216}Po , ^{212}Pb , ^{212}Bi , ^{212}Po , ^{208}Tl

Note: The progeny radionuclides listed are exempt from reporting requirements when a parent radionuclide is present.

E.2 Reserved to maintain section numbering.

E.3 Radiological Characterization Methods

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

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

A. Materials Control and Accountability (MC&A)

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

B. Gross Radiation Measurements

Scaling factors can be developed that relate gross radiation measurements to the activity concentration of a waste stream. Generators using gross radiation measurements *shall* ensure that measurements correlate with activity concentration on a consistent basis.^{7,8} Radionuclide distributions in the waste stream *shall* be initially determined and periodically verified through direct measurements or sampling and analysis.^{7,8} Generators *shall* document all methods used to develop scaling factors that relate gross radiation measurements to the activity concentration.^{7,8} When developing scaling factors, generators *shall* consider the waste package and detector geometry, shielding and attenuation effects, self-absorption, and the energy spectra and decay schemes of radionuclides in the waste.^{7,8}

C. Direct Measurement of Specific Radionuclides

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

D. Sampling and Analysis

Radiological characterization using sampling and analysis, including swipes taken for characterization, *shall* be controlled.^{6.24/1.3}

E. Process Knowledge

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

E.4 Determination of Waste Volume

Waste activity concentration *shall* be determined based on the volume of the final waste form as offered for disposal.^{7.5} Measurement or analysis of samples may be performed prior to final processing if the measured activity concentration can be related to the final activity concentration. The volume of the waste can usually be taken as the internal volume of the container if the radionuclides are reasonably homogeneously distributed throughout the waste and the waste fills at least 90 percent of the waste container. When

these conditions are not met (for example when the package contains significant void space or contains irregularly shaped equipment or components), the volume *shall* be taken as the volume occupied by the waste in the container.^{6.19/7.5} The activity concentration of transuranic radionuclides in units of nCi/g *shall* be based on the mass of the contents of a single waste container, excluding the mass of the container and any shielding present.^{7.6}

E.5 Examples of Waste Characterization Documentation

A. PK documentation:

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

B. Evaluation of PK and historical data

C. Independent review of program documents: May be in the form of a sign-off page within the approved document.

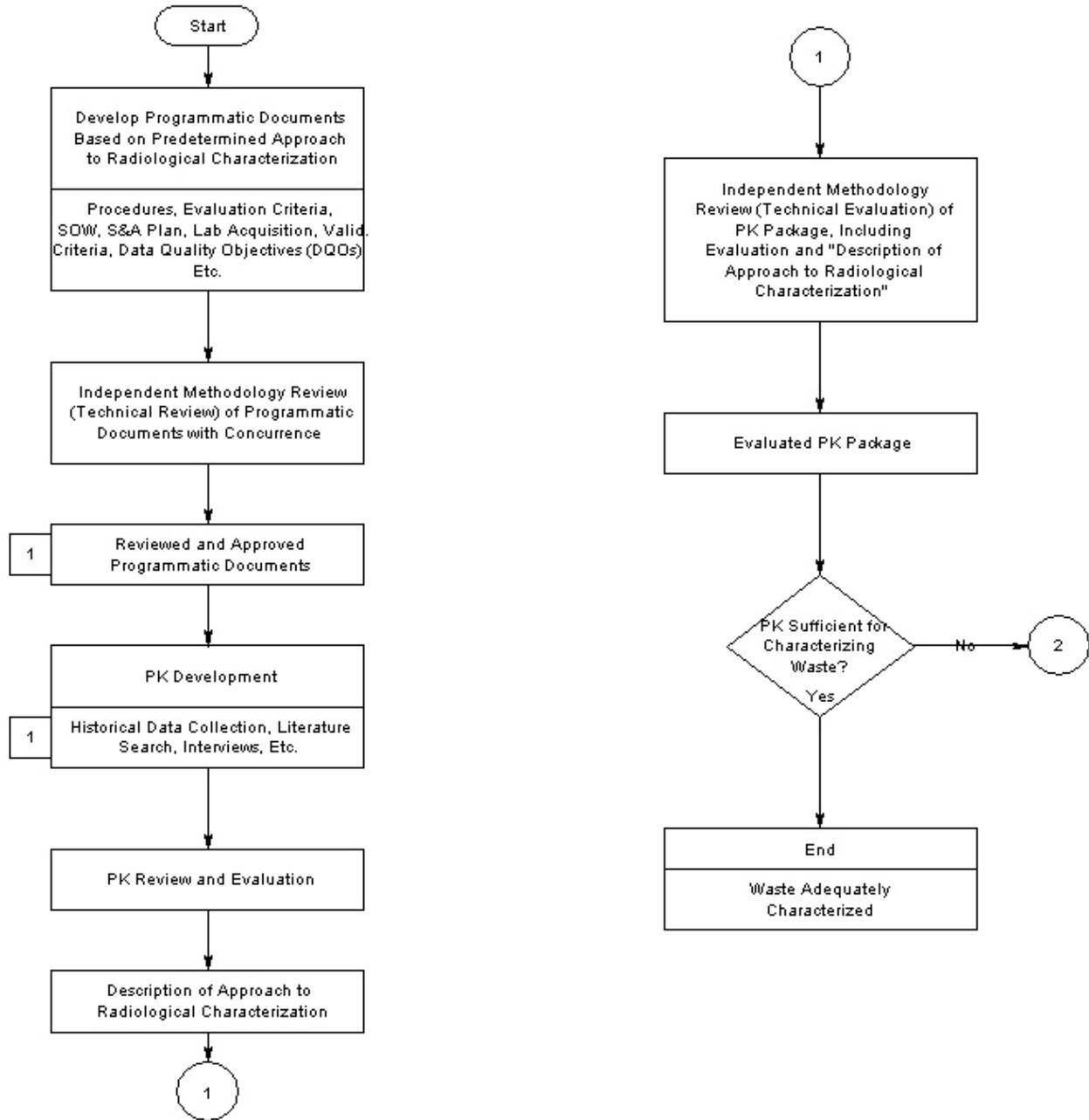
D. Reviewed and approved procedures:

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

E. Evaluated Data, Validated Data, Sampling and Analysis Plan, Scope of Work, and Laboratory Acquisition Document.

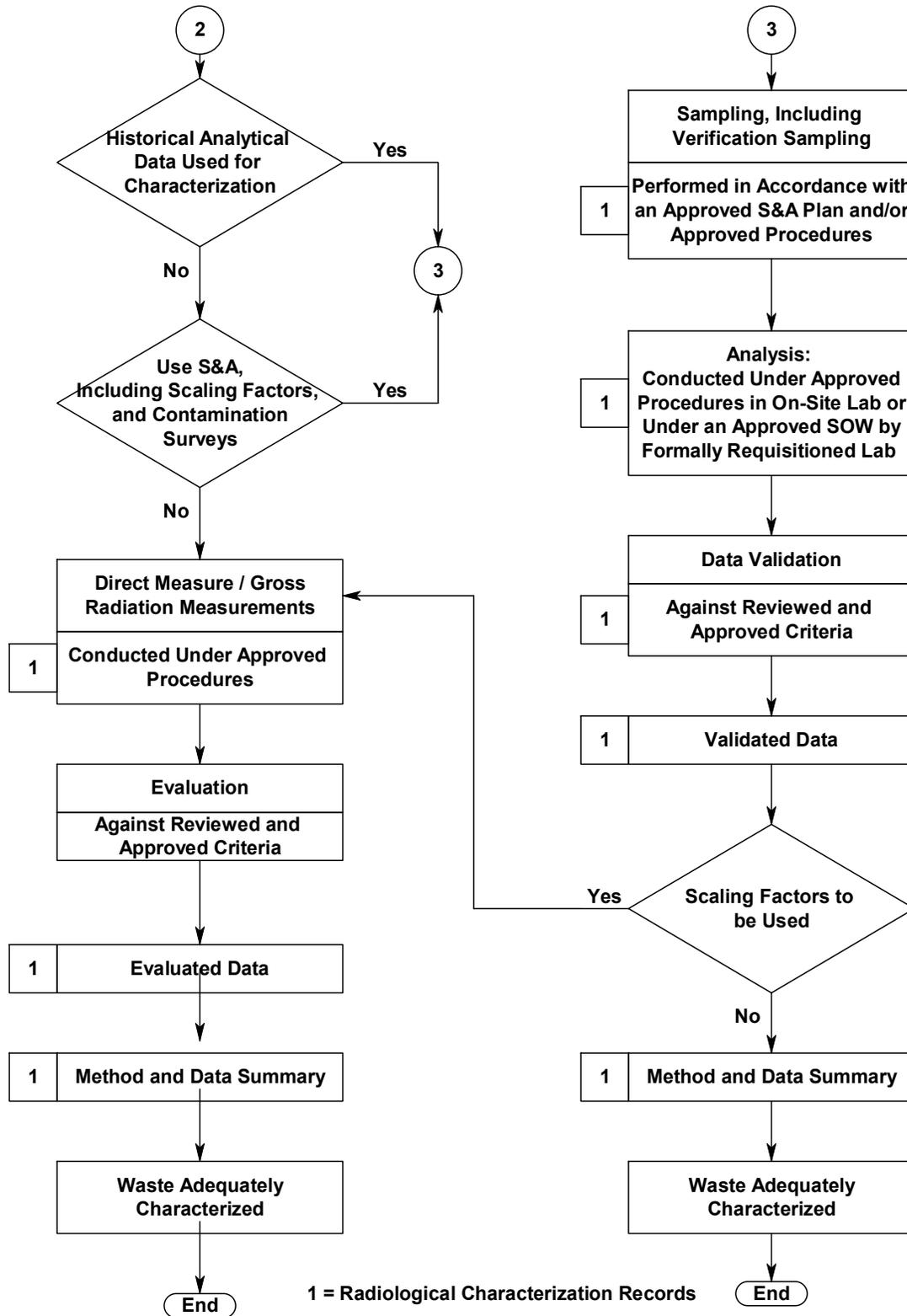
E.6 Radiological Characterization Flow Diagram Overview

Figure E-1, the radiological characterization flow diagram, illustrates the approach that should be used to obtain adequate radiological characterization. The approach allows for the utilization of generally accepted radiological characterization methodologies and documentation. Radiological characterization documentation requirements are outlined in the radiological characterization flow diagram.



1 = Radiological Characterization Record

Figure E-1: Radiological Characterization Flow Diagram



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

Figure E-1 (continued)

E.7 Fissile Material Limits

The quantity of fissile material in a waste package acceptable for disposal **shall** be demonstrated to meet any of the following:

1. Meets criteria specified in 49 CFR 173.453, Fissile materials – exceptions.
2. Does not exceed 350 grams of ^{235}U FGE per package nor exceed 2 g of ^{235}U FGE per kilogram of waste (mass of the package is not included in the mass of the waste) (graphite and beryllium **shall** not exceed 1% by mass of the waste). FGE is determined by completing Table E.3. Both limits **shall** not be exceeded.^{7.15} This criteria applies to 55-gallon metal drums or larger containers (i.e., 85-gallon drums, 4 x 4 x 6 ft metal boxes) and is not applicable to drums <55-gallon or soft sided, wood, or plastic containers.
3. Does not exceed the limits and the waste package meets the conditions as specified in Table E.4.^{7.14/7.16}
4. Does not exceed the limits and the waste package meets the conditions as specified in Tables E.5 and E.6.^{7.17}

Note: Waste containing uranium with enrichment less than 0.90 percent ^{235}U by weight and those nuclides listed in Table E.3 such that their FGE is 1 percent or less of the tabulated grams of ^{235}U do not provide a fissile material concern.

If the waste does not comply with any of above, then a waste specific nuclear criticality safety evaluation (NCSE) may be necessary for acceptance of the waste. Please contact the NNSA/NFO RWAP Manager for further information on the criteria for performing a NCSE.

If the waste stream contains enriched uranium (^{235}U weight percent ≥ 0.90), ^{233}U , ^{239}Pu , ^{241}Pu , $^{242\text{m}}\text{Am}$, ^{243}Cm , ^{245}Cm , ^{247}Cm , ^{249}Cf , or ^{251}Cf , the ^{235}U FGE and ^{235}U effective enrichment is required to be reported with the profile by completing Table E.3 for each enrichment range. The waste **shall not** exceed the total FGE as specified for the effective enrichment.

Nevada National Security Site Waste Acceptance Criteria

Table E-3: Calculation of ²³⁵U Fissile Gram Equivalent and Effective ²³⁵U Enrichment for LLW Packages

Nuclide (A)	High Activity Conc. (Bq/m ³) (B)	Volume of Package (m ³) (C)	Activity (Bq) (D)	Specific Activity (Bq/g) (E)	Mass of Nuclide (g) (D/E=F)	²³⁵ U FGE Factors (G)	²³⁵ U FGE (F*G=H)	If FGE is > 1% of ²³⁵ U Mass, then include (I)
²³³ U				3.6E+08		1.4E+00		
²³⁵ U				8.1E+04		1.0E+00		
²³⁹ Pu				2.3E+09		1.6E+00		
²⁴¹ Pu				3.8E+12		3.5E+00		
^{242m} Am				3.6E+11		5.4E+01		
²⁴³ Cm				1.9E+12		7.8E+00		
²⁴⁵ Cm				6.4E+09		2.3E+01		
²⁴⁷ Cm				3.5E+06		7.8E-01		
²⁴⁹ Cf				1.5E+11		7.0E+01		
²⁵¹ Cf				5.9E+10		1.4E+02		
Effective ²³⁵U Enrichment = $\frac{\text{Total } ^{235}\text{U FGE}}{\text{Total U}}$							TOTAL ²³⁵U FGE	
Effective ²³⁵U Enrichment =								

Instructions for completing Table E.3:

1. Multiply high activity range of the waste stream (Bq/m³) by volume of waste to determine the maximum activity that could be present in a waste package for the nuclides listed above, resulting in Bq (Column D). For ²³⁵U, the activity is required to be included only if the ²³⁵U enrichment is equal to or greater than 0.90 percent by weight of total U.
2. Divide activity (Bq) (Column D) by the specific activity of the nuclide (Bq/g) (Column E) to determine the mass of the nuclide (Column F).
3. Multiply the mass (g) (Column F) of each nuclide by the ²³⁵U FGE factor (Column G) to determine FGE (Column H).
4. If the FGE value is greater than 1 percent of the ²³⁵U mass, then include in Column I to determine the total ²³⁵U FGE for a waste package.
5. Effective ²³⁵U enrichment (weight %) is calculated by dividing the total ²³⁵U FGE by the total mass (g) of uranium and multiplying by 100.

Table E-4: Allowable Package Fissile Loadings for Various Package Steel Weights

²³⁵ U Enrichment Weight %	Refer to below instructions when using this table. Maximum Grams of ²³⁵ U per Package			
	35 Pounds (16 kg) Steel	50 Pounds (23 kg) Steel	70 Pounds (32 kg) Steel	105 Pounds (48 kg) Steel
80 - 100	54	66	82	103
60 - 80	55	67	83	105
40 - 60	56	68	85	107
20 - 40	60	73	90	110
15 - 20	65	78	95	120
10 - 15	70	83	100	130
8 - 10	75	90	110	140
7 - 8	80	97	120	150
6 - 7	85	104	130	160
5 - 6	90	109	135	170
4.5 - 5	100	121	150	190
4 - 4.5	105	129	160	200
3.5 - 4.0	110	136	170	210
3.0 - 3.5	120	146	180	230
2.5 - 3.0	140	170	210	270
2.0 - 2.5	170	209	260	330
1.9 - 2.0	220	271	340	440
1.8 - 1.9	240	296	370	480
1.7 - 1.8	260	324	410	530
1.6 - 1.7	290	363	460	590
1.5 - 1.6	330	411	520	670
1.4 - 1.5	380	479	610	790
1.3 - 1.4	460	580	740	960
1.25 - 1.3	580	739	950	1250
1.20 - 1.25	670	854	1100	1460
1.15 - 1.20	780	1003	1300	1700
1.10 - 1.15	950	1220	1580	2100
1.07 - 1.10	1150	1514	2000	2700
1.04 - 1.07	1400	1829	2400	3200
1.02 - 1.04	1700	2214	2900	4000
1.00 - 1.02	2000	2643	3500	4800
0.99 - 1.00	2350	3143	4200	5800
0.98 - 0.99	2600	3500	4700	6500
0.97 - 0.98	3000	4029	5400	7600
0.96 - 0.97	3400	4600	6200	8500
0.95 - 0.96	3800	5171	7000	10000
< 0.95	4400	5943	8000	unlimited

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Instructions for using Table E-4:

1. For LLW that has enrichment exactly at the boundary between two enrichment ranges, the larger fissile mass loading may be used.
2. Linear interpolations between steel weights are allowed. For steel weights in excess of 105 lb (48 kg), use the fissile mass for 105 lb (48 kg); do not extrapolate to a larger fissile mass.
3. Table E-4 is not acceptable for LLW containing more than 1 percent beryllium and carbon graphite by package weight.
4. For waste with nuclides found in Table E-3 of the NNSWAC (other than ^{235}U) such that their fissile gram equivalence (FGE) exceeds 1 percent of the grams of ^{235}U present in the waste, then these nuclides **shall** be accounted for. To account for these nuclides, an effective enrichment **shall** be calculated as: (^{235}U grams + FGE) divided by Total U and multiplied by 100 percent. The effective enrichment and the sum of the total ^{235}U FGE are determined by completing Table E-3, and they are used to verify compliance with Table E-4.
5. The total weight of steel in a package may include that of all inner drums such as 10-, 15-, and 30-gallon drums inside of a 55-gallon drum, and the outer drum.
6. Mixing drums in an overpack, such as commingling 15-, 30-, and 55-gallon drums in a 4 x 4 x 7 box, is acceptable as long as the individual drums comply with Table E-4 limits.

Low-level waste (LLW) packages meeting the restrictions as specified in Table E-5 and the fissile limits in Table E-6 satisfy the criticality safety criteria specified in Section 3.2.1.

Table E-5: Criticality Safety Restrictions for the Use of the Fissile Limits in Table E-6

Volume of overpack, if used	> nominal 55 gallons (outermost container)
Volume of waste container	55 gallon drum (may contain inner drums such as a 10-gallon container inside a 30-gallon drum, both within the 55-gallon outer drum)
Space between 55-gallon drum (waste container) and inner containers	If filled, the material shall be loose, pourable material (e.g., vermiculite).
Boron location	Boron shall be inside 55-gallon drum.
Boron physical properties (natural)	≈ 20 atom % ^{10}B , ≈ 80 atom % ^{11}B
Boron weight Note: For example, 12.9 kg of B_2O_3 is required to have 4 kg of boron	\geq nominal 9 pounds (4 kg) Note: the form is not controlled; e.g., Boraxo, B4C, and Borosilicate glass are all acceptable, but it shall be loose / pourable.
Beryllium and graphite by package weight	$\leq 1\%$ by weight
Maximum hydrogen content of waste as packed and as received at the NNS.	Hydrogen to ^{235}U atom ratio (H/X) shall be less than 50. For example, this limit is equivalent to a water-to- ^{235}U mass ratio of all hydrogenous materials, such as plastics and cellulose, may be assumed to be water to determine an equivalent water mass. That is, 1g plastics = 1g water.
Packaging (drum) material and mass	No restrictions.
^{235}U limits per package	The values presented in Table E-6.

**Table E-6: Maximum Grams of ²³⁵U as a Function of Enrichment
(Controls as specified in Table E-5)**

²³⁵ U Enrichment (Weight %)	²³⁵ U (g)	²³⁵ U Enrichment (Weight %)	²³⁵ U (g)
0.95	9000	2.50	1810
0.96	8900	3.00	1650
0.97	8800	3.50	1554
0.98	8700	4.00	1485
0.99	8357	4.50	1436
1.00	7800	5.00	1400
1.02	7195	6.00	1225
1.04	6580	7.00	1179
1.07	5860	8.00	1125
1.10	5200	9.00	1072
1.15	4400	10.00	1028
1.20	3840	15.00	929
1.25	3500	20.00	873
1.30	3225	30.00	814
1.40	2895	40.00	776
1.50	2650	50.00	743
1.60	2460	60.00	720
1.70	2335	70.00	715
1.80	2215	80.00	700
1.90	2135	90.00	690
2.00	2060	100.00	680

Instructions for using Table E-6:

- For waste with nuclides found in Table E-3 of the NNSSWAC (other than ²³⁵U) such that their fissile gram equivalence (FGE) exceeds 1 percent of the grams of ²³⁵U present in the waste, then these nuclides **shall** be accounted for. To account for these nuclides, an effective enrichment **shall** be calculated as (²³⁵U grams + FGE) divided by Total U and multiplied by 100 percent. The total ²³⁵U FGE and effective ²³⁵U enrichment are determined by completing Table E-3 and they are used to verify compliance with Table E-6.

Appendix F
Requirements for Intermodal (Roll-Off Boxes)
LLW Disposal

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Appendix F – Requirements for Intermodal (Roll-Off Boxes) LLW Disposal

These requirements are specific to intermodal roll-off containers that will be emptied and returned to the generator facility. Intermodals to be returned will have required shipping documents, etc. prepared and provided by the generator. RWMC personnel will ensure applicable DOT requirements are satisfied before released, but will not be responsible for completing required shipping documents. Waste contamination levels should be provided to RWMC Operations personnel prior to receipt.

Intermodal (roll-offs) containers used for disposal of bulk LLW *shall* meet applicable NNSSWAC requirements and the following:

Prohibited Waste Types:

1. Classified waste/matter (may be approved on a case-by-case basis)
2. Asbestiform LLW (regulated)
3. MLLW
4. PCB Waste (Except PCB Bulk Product Waste, see #5 below.)
5. Fine particulates that could become airborne
6. LLW Beryllium Waste (particulate)

Acceptable Waste Types:

1. Soil and gravel
2. Concrete rubble
3. Scrap metal
4. Building rubble
5. PCB Bulk Product Waste meeting definition found in 40 CFR 761.62(b)(1).
6. Other materials may be acceptable (with prior approval on a case-by-case basis)

Dose Rates and Radiological Concerns:

1. Dose rates should be less than 5 mR/hr on contact of the loaded intermodal.
2. Dose rates *shall* be less than 5 mR/hr @ 30 cm from the waste.
3. Return survey requirements *shall* be clearly communicated to NNSW waste operations upon profile submission.

Size, Weight, and Loading:

1. All pieces within container *shall* be reduced to no larger than 3 feet in any dimension.
2. Soils need to be free of scrap metals, large rocks, or debris.
3. Maintain a clearance of at least 18 inches between the top of the waste and the bottom of the top header brace located near the door end of the container.
4. Waste *shall* fit into the intermodal container without wedging into any area of the container.
5. The load *shall* be prepared to prevent movement during transportation and allow the waste to exit under the header and through the rear door with sufficient clearance to prevent jamming.

6. Precautions *shall* be taken during loading to ensure weight is not resting against the door.

Weights:

1. Weight of intermodal may not exceed 44,000 lb gross weight.
2. Weight *shall* be evenly distributed.

Liners:

Waste *shall* be placed in a liner within the roll-off container:

1. Liners *shall* be at least 18 mil for scrap metals and debris
2. Liners *shall* be at least 12 mil for contaminated soils.
3. Liners *shall* be secured around the waste package and cannot be attached to the inside of the intermodal container.
4. Sufficient absorbent material needs to be added to prevent any accumulation of free liquids inside the container, either from precipitation penetration or from condensation.

Marking and Labeling:

1. All markings and labels not intended for NNSS or DOT use *shall* be obliterated.
2. All placards *shall* be removable by the transporter.

Container Design:

1. No top-hinged tailgate intermodals will be accepted for disposal.
2. There *shall* be no need for RWMC Operations to open the top lid of the container for any reason.
3. There *shall* be attachments to secure the door in the open position during off-loading.
4. Containers *shall* be at least standard 6 x 8 x 20 ft IP-1 intermodals.

Off-Loading:

Any container that does not off-load successfully will be buried intact.

Appendix G
Mixed Low-Level Waste and Non-Radioactive Hazardous
Classified Waste/Matter Forms

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G.2 Mixed Low-Level Waste and Non-Radioactive Hazardous Classified Waste/Matter Profile Annual Certification Example

Waste Profile Number:

Waste Profile Revision No.:

Facility:

Expiration Date:

WCO:

The above profile is about to expire. The NNSSWAC requires generators to recertify MWP's and Non-Radioactive Hazardous Classified Waste/Matter profiles on an annual basis. No waste may be shipped under this profile after the expiration date unless it has been recertified or a new waste profile has been submitted and approved.

Please indicate your preference by checking the appropriate box below. If the waste stream has not changed significantly and the profile is still accurate, recertify by checking the third box below, providing the additional information requested, signing the certification statement, and returning this form to NNSA/NFO EMO. Upon approval, a letter will be sent which authorizes continued shipment of the waste stream for up to an additional year.

Check the appropriate box:

- This waste profile is no longer needed. Please cancel the waste profile.
- There have been significant changes to this waste stream. I understand that this waste stream cannot be shipped to the NNS until a revised or new profile is approved. I will revise it or submit a new waste profile.
- I want to recertify the waste profile. I have reviewed the revision no. _____ and certify that it is current, complete, and accurate description of the waste stream and the methods employed to ensure that the waste meets the NNSSWAC.

If you checked the third box above, answer the following questions to confirm that the waste stream has not changed significantly. Significant changes will require a revision to the waste profile.

- | | | | | |
|--------------------------|----|--------------------------|-----|---|
| <input type="checkbox"/> | No | <input type="checkbox"/> | Yes | Has the generating process changed? |
| <input type="checkbox"/> | No | <input type="checkbox"/> | Yes | Have the methods used to perform radiological characterization changed? |
| <input type="checkbox"/> | No | <input type="checkbox"/> | Yes | Have the methods used to perform physical/chemical characterization changed? |
| <input type="checkbox"/> | No | <input type="checkbox"/> | Yes | Have any of the RCRA or state waste codes changed? |
| <input type="checkbox"/> | No | <input type="checkbox"/> | Yes | Has the LDR status (subcategories, treatment, etc.) changed? |
| <input type="checkbox"/> | No | <input type="checkbox"/> | Yes | Have there been any other changes to the waste stream that could affect management of the waste at NNS? |
| <input type="checkbox"/> | No | <input type="checkbox"/> | Yes | Do you have any new waste analysis data that confirms or improves your waste characterization? |

Provide the volume remaining in the waste stream:

If you checked any "Yes" boxes, please explain below and attach additional sheets as necessary.

Certification: I certify that, to the best of my knowledge, the information provided on this form and any attached documentation is accurate and complete.

WCO Signature: _____

Date: _____

Print Name: _____

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Appendix H

Glossary

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Appendix H – Glossary

Bulk Waste: Waste packaged in a soft-sided container (e.g., supersacks, burrito wraps), metal cage/pallet combinations or unpackaged waste items, surface contaminated object, low specific activity equipment, large machinery storage tanks, etc. *See NNSWAC Section 3.2.14 for additional information.*

Certificate of Compliance: Certificate is issued to certify that the package (packaging and contents) meets the applicable safety standards set forth in Title 10 Code of Federal regulations Part 71, “Packaging and Transportation of Radioactive Material.”

Certified Waste: Waste that has been confirmed to comply with disposal site Nevada National Security Site Waste Acceptance Criteria (NNSWAC) under an approved certification program.

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

Chemical Screening: Process in which waste is examined for characteristics such as ignitability, corrosivity, and reactivity.

Classified Matter: Radioactive matter or non-radioactive matter for which access is limited for national security reasons and cannot be declassified; classified matter will be managed in accordance with the requirements of DOE O 471.6, “Information Security,” or the NNSA Policy Letter NAP-70.4, “Information Security.” Classified matter may or may not have a hazardous component as defined by RCRA.

Classified Waste: Radioactive waste or non-radioactive waste for which access is limited for national security reasons and cannot be declassified; classified waste will be managed in accordance with the requirements of DOE O 471.6, “Information Security,” or the NNSA Policy Letter NAP-70.4, “Information Security.” Classified waste may or may not have a hazardous component as defined by RCRA.

Closed Transport Vehicle: Transport vehicle or conveyance equipped with a securely attached exterior enclosure that during normal transportation restricts the access of unauthorized persons to the cargo space containing wastes transported for disposal at the NNS. The enclosure may be either temporary or permanent, and in the case of packaged materials may be of the “see-through” type, but must limit access from the top, sides, and bottom and provide protection from unfavorable weather conditions during transit.

Controlled Copy: An approved, uniquely numbered document regulated through controlled distribution.

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

Declassification: A determination by an appropriate security authority that information or matter no longer requires protection as classified information against unauthorized disclosure because of national security concerns.

Disposal: The emplacement of LLW, MLLW, classified non-radioactive, and classified hazardous

waste/matter in a manner that is considered permanent in that routine recovery is not provided for.

DOT Specification 7A, Type A Equivalence: Design specifications, testing data, analyses, or other documentation on the containers being used to evaluate the containers and ensure that they are capable of, at a minimum, meeting the requirements of U.S. DOT specification 7A, Type A, packaging. Equivalence must be reviewed and approved by a cognizant authority (e.g., a Registered Professional Engineer).

Facility Evaluation: A documented review to evaluate a generator's program for compliance with the NNSSWAC. Facility evaluations are conducted by Radioactive Waste Acceptance Program (RWAP) personnel in the form of an audit, surveillance, program reviews, or a combination of these.

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

Friable Material: Any material containing more than 1 percent asbestos, as determined using Polarized Light Microscopy, that, when dry, can be crumbled, pulverized, or reduced to powder by hand pressure.

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

Hazardous Waste Component: Waste identified or listed in Title 40 Code of Federal Regulations (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.

Hydrocarbon Burdened LLW: Soil and closely related construction and demolition debris contaminated with greater than 100 mg/kg Total Petroleum Hydrocarbon (TPH) resulting from a petroleum release and generated by NNSA/NFO Operations.

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

Inspection: A planned and documented activity, performed by authorized personnel, to verify that an item, service, or process conforms to specified criteria.

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

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

Low-Level Waste (LLW): Low-level radioactive waste is radioactive waste that is not high-level radioactive waste, spent nuclear fuel, transuranic waste, byproduct material (as defined in section 11e.(2) of the Atomic Energy Act of 1954, as amended), or naturally occurring radioactive material. Small quantities of 11e.(2) byproduct material and naturally occurring radioactive material may be managed as low-level waste provided they can be managed to meet the requirements for low-level waste disposal (DOE M 435.1-1, Section IV.B.(4)). 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 concentration of transuranic waste does not exceed 100 nCi/g.

Mixed Low-Level Waste (MLLW): Waste containing both radioactive and hazardous components as defined by the Atomic Energy Act of 1954 (as amended) and RCRA. MLLW *shall* meet the LDRs as listed in Title 40 CFR 268.

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

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

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

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

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

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

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

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

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

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

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

Stabilization: A technique that limits the solubility and mobility of waste constituents by bonding or chemical reaction with the stabilizing material.

Sealed Sources: Sources where the radioactive material is contained in a sealed capsule, sealed between layers of non-radioactive material, or firmly fixed to a non-radioactive surface by electroplating or other means. The confining barrier prevents dispersion of the radioactive material under normal and most accidental conditions related to the use of the source.

Solidification: A technique that limits the solubility and mobility of waste constituents by immobilization through physical means.

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

Tamper-Indicating Devices: Devices that may be used on containers and that, because of their uniqueness in design or structure, reveal violations of containment integrity.

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

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

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

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

Waste Package: Packaging/container (e.g., drum, metal box, soft-sided bags, cargos) together with its contents of waste in final form for disposal/burial at the NNS.

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

References

Text Superscripts	Requirement Documents
	Code of Federal Regulations (CFR)
	Title 10 - Energy
1.1	10 CFR 61.56(a)(5)
1.2	10 CFR 61.56(a)(8)
1.3	10 CFR 830.122
1.4	10 CFR 850.32(b)
1.5	10 CFR 850.38
1.6	10 CFR 835, Appendix D
1.7	10 CFR 1021
	Title 29 - Labor
2.1	29 CFR 1910.178(0)(2)
	Title 40 - Protection of Environment
3.1	40 CFR 260.11(a)
3.2	40 CFR 261
3.3	40 CFR 261.1(a)
3.4	40 CFR 262.20(a)
3.5	40 CFR 262.32(b)
3.6	40 CFR 264.170 - .179
3.7	40 CFR 264.314(d)
3.8	40 CFR 265.177
3.9	40 CFR 264.314
3.10	40 CFR 264.315
3.11	40 CFR 268
3.12	40 CFR 268.7
3.13	40 CFR 761.50(b)(7)(ii)
3.14	40 CFR 761.60(b)(4)
3.15	40 CFR 761.60(b)(6)(ii)(A)
3.16	40 CFR 761.61(a)(5)(i)(B)(2)(ii)
3.17	40 CFR 761.61(a)(5)(v)(A)
3.18	40 CFR 761.62(b)(1)(i and ii)
3.19	40 CFR 761.64(b)(2)
3.20	40 CFR 761.79(g)(6)
3.21	40 CFR 761.62(b)(4)(i)
3.22	40 CFR 761.40
3.23	40 CFR 761
3.24	40 CFR 761.61(a)(5)(i)(B)(2)(iv)
3.25	40 CFR 262.31
	Title 49 – Transportation
4.1	49 CFR 172.200
4.2	49 CFR 172 Subparts D and E
4.3	49 CFR 172.300

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4.4	49 CFR 173.410
4.5	49 CFR 173.24
4.6	49 CFR 173.423
4.7	49 CFR 173.427
4.8	49 CFR 173.427(a)(6)(ii)
4.9	49 CFR 397.101
4.10	49 CFR 173.453
4.11	49 CFR 173.403
4.12	49 CFR 173.401
	Nevada Administrative Code (NAC)
5.1	NAC 444.971(1)
5.2	NAC 444.971(2)
5.3	NAC 444.8565(2)(b)
5.4	NAC 444.8632
5.5	NAC 444.9452
5.6	Nevada Division of Environmental Protection
	Department of Energy – Orders (O) & Manuals (M)
	DOE O 420.1, “Facility Safety”
6.1	420.1 4.3.2
6.2	420.1 4.3.3
6.3	DOE M 470.4-4, “Information Security”
	DOE M 470.4-6, “Nuclear Material Control and Accountability”
6.3.1	470.4-6, Section A, II-12 5(a)(2)
	DOE O 435.1, “Radioactive Waste Management”
	DOE M 435.1-1, “Radioactive Waste Management”
6.4	435.1-1
6.5	435.1-1 III. A
6.6	435.1-1 IV. G(1)
6.7	435.1-1 IV. G(1)(a)
6.8	435.1-1 IV. G(1)(b)
6.9	435.1-1 IV. G(1)(c)
6.10	435.1-1 IV. G(1)(d)(1)
6.11	435.1-1 IV. G(1)(d)(2)
6.12	435.1-1 IV. G(1)(d)(3)
6.13	435.1-1 IV. G(1)(d)(4)
6.14	435.1-1 IV. G(1)(d)(5)
6.15	435.1-1 IV. G(2)
6.16	435.1-1 IV. I
6.17	435.1-1 IV. I(1)
6.18	435.1-1 IV. I(2)
6.19	435.1-1 IV. I(2)(b)
6.20	435.1-1 IV. I(2)(d)
6.21	435.1-1 IV. J(2)
6.22	435.1-1 IV. K
6.23	435.1-1 IV. O
6.24	DOE O 414.1, “Quality Assurance”

	Federal Manuals, Policy, and Organizations
7.1	DOE Hoisting & Rigging Manual, DOE-STD-1090-Current Publication
7.2	State of Nevada Solid Waste Disposal Site Permit (SW1300001, current revision)
7.4	Memo 9109-35 to Carol A. Shelton from Steve Okosisi, 11-21-1995, "Request for Evaluation of NVO-325 Criteria to Ensure Safe and Compliant Radioactive Waste Disposal Operations."
7.5	NNSA/NFO RWAP
7.6	NNSA/NFO Operations
7.7	"Test Methods for Evaluating Solid Waste, Physical/Chemical Methods," EPA Publication SW-846, Chapter 1, Section 1.0, 12/1996
7.8	Low-Level Waste Licensing Branch, Technical Position on Radioactive Waste Classification, May 1983, Revision 0, Section C.1.c
7.9	NNSA/NFO Performance Assessment
7.10	USEPA "Waste Analysis at Facilities that Generate, Treat, Store, and Dispose of Hazardous Wastes" PB94-463603, OSWER 9938.4-03, April 1994, Section 1.5.2
7.11	Title 42 USC, Chapter 23, Section 2021.c(b)(2)
7.12	"Position on the Use of Lead Shielding for the Disposal of Low Level Radioactive Waste at the Nevada Test Site," current version.
7.13	DOE/NV letter from Carl P. Gertz, 8/19/1998, "Contamination Release Limits for Radioactive Waste Transport Vehicles."
7.14	T. P. McLaughlin, "Nuclear Criticality Safety Review of Low-Level Waste Disposal at the Nevada Test Site Radioactive Waste Management Sites," CSR-A490.100, August 2002.
7.15	Bechtel Jacobs Company, "Nuclear Criticality Safety for Emplacement of ORR Waste at the Nevada Test Site, NCSE-MS-NTS1492, Rev. 0, August 2001.
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7.22	RWMC Documented Safety Analysis
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8.0	Mixed Waste Disposal Unit Waste Analysis Plan, Current Revision
8.1	RWAP Procedure, RWAP-09, <i>Waste Verification Process</i>

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