National Nuclear Security Administration

DOE/NV-325-Rev. 7-01
May 2009

Nevada Test Site
Waste Acceptance Criteria

Prepared by
U.S. Department of Energy
National Nuclear Security Administration
Nevada Site Office
Waste Management Project

May 2009

Disclaimer Notice

Reference herein to any specific commercial product, process, or service by trade name, trade mark, manufacturer, or otherwise does not necessarily constitute or imply its endorsement, recommendation, or favoring by the United States Government or any agency thereof.

Available for sale to the public, in paper, from:

U.S. Department of Commerce
National Technical Information Service
5285 Port Royal Road
Springfield, VA 22161
Phone: (800) 553-6847
Fax: (703) 605-6900
E-mail: orders@ntis.fedworld.gov
Online Ordering: http://www.ntis.gov/ordering.htm

Available electronically at http://www.osti.gov/bridge

Available for a processing fee to the U.S. Department of Energy and its contractors, in paper, from:

U.S. Department of Energy
Office of Scientific and Technical Information
P.O. Box 62
Oak Ridge, TN 37831-0062
Phone: (865) 576-8401
Fax: (865) 576-5728
E-mail: reports@adonis.osti.gov

Photograph on front cover: Desert National Wildlife Range landscape located southeast of Mercury, Nevada

DOE/NV-325-Rev. 7-01

Nevada Test Site
Waste Acceptance Criteria

Issued May 2009

Effective July 1, 2009

Prepared by
U.S. Department of Energy
National Nuclear Security Administration
Nevada Site Office
Waste Management Project

This page intentionally left blank.

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.

Approved and
Issued by:

Date: 5/19/09

Acting *Assistant Manager*
Environmental Management Nevada Site Office
National Nuclear Security Administration
U.S. Department of Energy

Concur:

Date: 6/25/09

Manager
Nevada Site Office
National Nuclear Security Administration
U.S. Department of Energy

Concur:

Date: 5/6/09

Federal Project Director
Waste Management Project
Nevada Site Office
National Nuclear Security Administration
U.S. Department of Energy

Concur:

Date: 5/6/2009

Federal Sub-Project Director
Low-Level Waste Project
Nevada Site Office
National Nuclear Security Administration
U.S. Department of Energy

NTSWAC 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 NTS.	Rev. 7-01, Sections, 1.1, 3.1.18, 3.2.8, 3.2.10 App. D, App. H, and References

** <u>Historical Note</u>: 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 also titled as the "Nevada Test Site Waste Acceptance Criteria." What we know today as the NTSWAC was an evolution of requirements spanning almost three decades of waste acceptance at the NTS.*

Table of Contents

List of Figures

List of Tables

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
DOE	U.S. Department of Energy
DOT	U.S. Department of Transportation
DQO	Data Quality Objectives
EPA	U.S. Environmental Protection Agency
ETA	Estimated Time of Arrival
FGE	Fissile Gram Equivalence
HEPA	High-Efficiency Particulate Arresting
HRI	Human Readable Interpretation
LDR	Land Disposal Restrictions
LLW	Low-Level Waste
M	Manual, Mega
MC&A	Materials Control and Accountability
M&TE	Measuring and Test Equipment
MW	Mixed Waste
MLLW	Mixed Low-Level Waste
MWP	Mixed Waste Profile(s)
NCSE	Nuclear Criticality Safety Evaluation
NDEP	Nevada Department of Conservation and Natural Resources, Division of Environmental Protection
NIC	NTSWAC Implementation Crosswalk
NNSA/NSO	National Nuclear Security Administration Nevada Site Office
NRC	U.S. Nuclear Regulatory Commission
NSTec	National Security Technologies, LLC
NTS	Nevada Test Site
NTSWAC	Nevada Test Site Waste Acceptance Criteria

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
SW-846	EPA Document SW-846, "Test Methods for Evaluation Solid Waste, Physical/Chemical Methods"
TID(s)	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
WMP	Waste Management Project
WP	Waste Profile

1.0 Radioactive Waste Management at the Nevada Test Site

Gate 100 – Mercury, Nevada

This page intentionally left blank.

1.0 Radioactive Waste Management at the Nevada Test Site

1.1 Purpose and Scope

This document establishes the U.S. Department of Energy (DOE), National Nuclear Security Administration Nevada Site Office (NNSA/NSO), Nevada Test Site Waste Acceptance Criteria (NTSWAC). The NTSWAC provides the requirements, terms, and conditions under which the Nevada Test Site (NTS) will accept low-level radioactive waste (LLW) and mixed low-level waste (MLLW) for disposal.

The NTSWAC includes requirements for the generator waste certification program, characterization, traceability, waste form, packaging, and transfer. The criteria apply to radioactive waste received at the NTS Area 3 and Area 5 Radioactive Waste Management Complex (RWMC) for disposal.

The NNSA/NSO and support contractors are available to assist you in understanding or interpreting this document. For assistance, please call the NNSA/NSO Waste Management Project (WMP): at (702) 295-7063 or fax to (702) 295-1153.

1.2 Policy

1.2.1 NNSA/NSO Policies

- Ensure safe and compliant disposal of radioactive waste.
- Ensure consistency with the current revision of all applicable federal, state, and local regulations.
- 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); Title 10 CFR 835, “Occupational Radiation Protection”; DOE Order 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 Order 435.1, “Radioactive Waste Management”; Title 10 CFR 830.122, “Quality Assurance”; and DOE Order 414.1, “Quality Assurance.”

1.2.2 Process

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

1.2.3 Waste Type and Eligibility Determination

Only DOE LLW and MLLW or U.S. Department of Defense classified wastes are accepted for disposal at the NTS.

Waste streams ***shall*** have a "clear and unambiguous nexus" to a DOE-funded project, DOE-performed operation, DOE-owned material/waste, or project whose waste disposition is directed by statute. Documentation demonstrating the waste nexus to DOE or that it is being directed to DOE for disposal may be requested. To verify eligibility of proposed waste types, contact the NNSA/NSO WMP.

1.2.4 Regulators and Stakeholders

NNSA/NSO will facilitate appropriate oversight by state agencies and supports the involvement of stakeholders. Where appropriate, to the extent possible, and in accordance with applicable NNSA/NSO authority, NNSA/NSO will provide regulatory agencies and stakeholders access to information related to Nevada Test Site Waste Acceptance Criteria (NTSWAC) activities, including waste characterization data, from all generators. Upon request by such parties, arrangements may be made to observe NTSWAC-related facility evaluations and participate in other activities such as NTSWAC revisions.

1.3 Requirements

Requirements are identified by "***shall***." 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 NNSA/NSO policy. Section 5.0 requirements are written in accordance with DOE Order 414.1, "Quality Assurance"; Title 10 CFR 830.122, "Quality Assurance"; and NNSA/NSO Policy, unless otherwise noted by superscript.

1.4 Responsibilities

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

1.4.1 Manager

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

1.4.2 Assistant Manager for Environmental Management (AMEM)

Responsibilities and authorities as assigned in DOE Order 435.1 and implementation of the NNSA/NSO Radioactive Waste Management Program (RWAP) according to DOE Manual 435.1-1, "Radioactive Waste Management Manual." Approves waste generators to dispose or store radioactive waste at the NTS and any deviations from the requirements of this document. Responsible for suspension of waste generator's waste certification programs, if necessary. AMEM responsibilities may be delegated with exception of generator waste certification program approvals and/or suspensions.

1.4.3 Federal Project Director, Waste Management Project

Responsible for radioactive waste management operation of the Areas 3 and 5 RWMC in compliance with applicable DOE Orders and federal and state regulations. Develop, implement, and maintain the NTSWAC.

1.4.4 Federal Sub-Project Director, Low-Level Waste Project

Responsible for management of radioactive waste disposal operations at NNSA/NSO, and implementation of the RWAP program to ensure compliance with the NTSWAC, DOE Orders, and federal regulations. Responsible for the management of MW disposal operations at NNSA/NSO.

1.4.5 Radioactive Waste Acceptance Program Task Manager

Responsible for interfacing with waste generators regarding RWAP program criteria and procedures, scheduling facility evaluations of waste generator programs, mixed waste verifications, maintaining RWAP quality records as defined by RWAP instructions, and initiating formal recommendations to the AMEM regarding the status of waste generator programs.

1.4.6 RWAP Manager

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

1.4.7 RWAP Personnel

Responsible for development, implementation, and maintenance of RWAP program documents (NTSWAC, Work Instructions, Facility Evaluation records, etc.). Perform document reviews of waste generator program documents, waste profiles, and conduct of assessments of waste generators shipping radioactive waste to the NTS.

2.0 Approval Process

Bristlecone Pine, Rainer Mesa and Stockade Wash, Nevada Test Site

This page intentionally left blank.

2.0 Approval Process

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

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

2.1 Generator Document Requirements

Generators should contact NNSA/NSO WMP and verify that the proposed waste type can be accepted at the NTS. Generators ***shall*** develop, implement, and maintain the program documents listed below. These documents will describe the generators waste certification program and ***shall*** be submitted to the RWAP Manager as evidence of programmatic compliance.[7.5]

2.1.1 Quality Assurance Program Plan

A controlled copy of the site Quality Assurance Program Plan (QAPP) or NTSWAC specific Waste Certification Program Plan (WCPP***) shall*** be documented in accordance with Section 5.0 and issued to the RWAP Manager.7.5

2.1.2 NTSWAC Implementation Crosswalk

The NTSWAC Implementation Crosswalk (NIC) ***shall*** be prepared and submitted annually to RWAP in accordance with Section 5.0.[7.5] An electronic copy of the NIC is available from the NNSA/NSO website at

http://www.nv.doe.gov/emprograms/environment/wastemanagement/rwap.aspx

2.1.3 Waste Profiles

A Waste Profile (WP) ***shall*** be prepared and submitted to NNSA/NSO 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/NSO or on the NNSA/NSO website at

http://www.nv.doe.gov/emprograms/environment/wastemanagement/rwap.aspx[7.5]

2.1.4 Certification Personnel List

A current list identifying the site Waste Certification Official(s) (WCOs), Alternate WCO(s), and Package Certifier(s) ***shall*** be developed and submitted to

RWAP in writing.[7.5] The list ***shall*** include the name and telephone number of each individual authorized to certify waste packages and shipments.[7.5] The WCO is responsible for maintaining the authorized certification personnel list and notifying RWAP, 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 assure that shipments are from authorized personnel. Any packages or shipments certified by unauthorized personnel ***shall not*** be accepted at the RWMC.[7.5]

2.1.5 Document and Personnel Changes

Generators ***shall*** notify RWAP in writing of any changes to the generators QAPP or WCPP, waste profiles and/or key personnel. Controlled documents and/or revisions to documents may be submitted electronically to the 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 RWAP in writing of any critical process and/or procedure changes to the approved certification program.[7.5] 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 RWAP Manager.

2.2 RWAP Review

The NNSA/NSO 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/NSO Corrective Action Requests (CARs) may be issued when conditions adverse to quality are identified. CARs 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.

Audit

New generators ***shall*** submit the documents described in Section 2.1 to RWAP prior to scheduling their initial audit.[7.5] Discretionary programmatic audits of approved generators may be conducted as directed by NNSA/NSO.

The purpose of the audit is to examine and evaluate objective evidence to verify that the 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.

Surveillance

Scheduled or unscheduled surveillances may be performed to evaluate specific program elements, new waste streams, and verify implementation of corrective actions.

2.2.2 Waste Profiles

Waste Profiles (WPs) ***shall*** be submitted to RWAP for review through the Waste Acceptance Review Panel (WARP) process.[7.5] The WARP may require additional information from the generator, recommend surveillance, or NNSA/NSO 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.[7.5]

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 temporarily 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 NTS-approved LLW WPs, based on the current revision date of each profile, to ensure the characterization data, waste stream information, and referenced procedures are current.[7.5] For annual recertification of Mixed Waste Profiles (MWP), 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.).[7.5] 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/NSO 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/NSO 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/NSO 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/NSO. 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/NSO AMEM after the generator has demonstrated satisfactory implementation of the NTSWAC. Factors considered in determining approval include, recommendations from RWAP, results of facility evaluations, review of program documents, waste profiles and procedures, and generator readiness.

The NNSA/NSO AMEM will provide written notice of program approval, identifying the last facility evaluation number, current program document (QAPP or WCPP) and revision, and approved waste profile(s). Any special conditions affecting the program or waste profile approval will also be identified.

Approved waste generators ***shall*** ensure the following documents are maintained current within RWAP while their approval to ship waste is in effect:[7.5]

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

2.4. Suspending Approval

NNSA/NSO may suspend approval if generator's waste or documents do not meet NTSWAC requirements. Individual waste streams or the generator's entire waste certification program may be suspended. Suspension may be issued verbally by

NNSA/NSO 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,
- Incorrect waste characterization,
- Waste container integrity deficiencies,
- Inadequate nuclear criticality safety limits, and
- Facility evaluation results.

2.5 Technical Support

NNSA/NSO provides qualified technical assistance on NTSWAC issues at no cost to the generator. Generators wanting an independent review and one-on-one consulting on issues regarding their low-level waste and/or low-level mixed waste management program are encouraged to contact NNSA/NSO. NNSA/NSO assistance to waste generators includes:

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

For additional information on requesting technical support, contact the NNSA/NSO RWAP Task Manager.

2.6 NNSA/NSO Policy

Because of changes in regulatory requirements, NTS policies, and changes instituted as a result of lessons learned, any aspect of the waste certification process may be subject to a full review to ensure its 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/NSO.

This page intentionally left blank.

3.0 Waste Criteria

Area 5 Radioactive Waste Management Complex, Nevada Test Site

This page intentionally left blank.

3.0 Waste Criteria

Waste accepted at the NTS ***shall*** be radioactive and ***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. Waste streams deviating from these requirements will be evaluated in accordance with Section 3.4, NTSWAC Deviations.[7.5/6.15]

3.1 General Waste Form Criteria

These waste criteria are based on DOE radioactive 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: ^{237}Np, ^{238}Pu, ^{239}Pu, ^{240}Pu, ^{242}Pu, ^{244}Pu, ^{241}Am, ^{242m}Am, ^{243}Am, ^{243}Cm, ^{245}Cm, ^{246}Cm, ^{247}Cm, ^{248}Cm, ^{250}Cm, ^{247}Bk, ^{249}Cf, ^{251}Cf. Additional information on determining the transuranic alpha concentration can be found in the document "Determining Transuranic Alpha Activity Concentration for Compliance with NTSWAC" located at the web address:

http://www.nv.doe.gov/emprograms/environment/wastemanagement/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/NSO, 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

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, such waste ***shall not*** be accepted for disposal.[5.3] For MW, 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 NNSA/NSO 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;

- If the treatment standard is provided in "mg/kg" (totals), the "listed" constituents ***shall*** be less than one-tenth of the concentration of the RCRA Land Disposal Restriction (LDR) (Title 40 CFR 268.40). If the treatment standard is provided in "mg/l TCLP," the TCLP concentration ***shall*** be less than the Safe Drinking Water Act Standard (MCL);

- Laboratory data including QA/Quality Control data.

The Nevada Department of Conservation and Natural Resources, Division of Environmental Protection (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] Liquid waste and waste containing free liquids should be processed to a solid form or packaged in sufficient sorbent for twice the volume of the liquid. The free liquid ***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] 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 NTSWAC requirement. Generators ***shall*** document the decisions made when characterizing and determining sorbents for high moisture content waste (see the Nevada Test Site Generator Work Group "Position Paper for High Moisture Content Waste," Revision 0, dated 11/3/1998, for use as guidance located at

http://www.nv.doe.gov/emprograms/environment/wastemanagement/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

LLW 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] Wastes ***shall not*** react with other wastes or the packaging during storage, shipping, handling, and disposal.[6.8]

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, or liquids are not generated [6.13] (specifically when different waste forms are combined in a single waste container).

3.1.9 Etiologic Agents

LLW containing pathogens, infectious wastes, or other etiologic agents as defined in Title 49 CFR ***shall not*** be accepted.[7.6]

3.1.10 Chelating Agents

LLW packages containing chelating or complexing agents in amounts greater than 1 percent of the waste ***shall not*** be accepted unless stabilized or solidified.[6.9/7.6]

3.1.11 Polychlorinated Biphenyls

LLW 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.

PCB contaminated LLW ***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. LLW containing PCBs that meet the requirements for disposal in a permitted hazardous waste landfill ***shall*** be segregated into a separate waste stream and profiled and packaged separately from other waste streams.[8.0] 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] The notice ***shall*** be faxed to the NTS at (702) 295-6852 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.

3.1.12 Explosives

Waste containing un-reacted explosives ***shall*** not be accepted at the NTS. Such waste may have RCRA characteristics and ***shall*** be treated to meet LDRs before being acceptable for disposal at NTS.[6.12]

3.1.13 Pyrophorics

Pyrophoric materials contained in the waste ***shall*** be treated, prepared, and packaged to be nonflammable.[6.12] 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 criteria (Section 3.1.1), considering only the mass of the source and any component integral to the source.[7.3]

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

Sealed sources that have an activity of 3.7 MBq (100 μCi) or greater ***shall*** be segregated from other waste and profiled as a separate waste stream.[7.3] These sealed sources ***shall*** be characterized on an individual basis using the volume or mass of the source to determine the radionuclide concentration [7.3] Sealed sources may be co-packaged with other waste streams provided Section 3.0, Waste Criteria, are met.

Additional guidance on the definition, proper packaging, and characterization of sealed sources can be found in the "Position Paper on the Proper Characterization and Disposal of Sealed Radioactive Sources," located at the web address below:

http://www.nv.doe.gov/emprograms/environment/wastemanagement/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 (SW1300001, current revision), state-of-generation, and the NTS Management Plan for the Disposal of Low-Level Waste with Regulated Asbestos Waste, current revision.[7.2] Packages containing RALLW ***shall*** meet the applicable shipping requirements for the radioactive contents of the package.[4.5] 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 which 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] 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]

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

RALLW ***shall*** be segregated into a separate waste stream.[7.9] Because of state notification requirements and disposal cell capacity, RALLW ***shall*** be packaged separately from other waste streams.[7.2] Call NNSA/NSO WMP at (702) 295-7063 for assistance and a copy of the current NTS Management Plan for the Disposal of Low-Level Waste with Regulated Asbestos Waste, which includes specific requirements for pre-shipment notifications. The pre-shipment notification ***shall*** be faxed to NNSA/NSO at least seven (7) days prior to shipment arrival.[7.5] A signed copy of the notification will be returned to the generator indicating authorization of the shipment.

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/NSO 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 Manual 470.4-4, "Information Security," Section A, Chapter III – 3 and 4 are satisfied for permanent burial of classified waste at NTS.[6.3] Generators ***shall*** submit a signed DOE or NNSA Security Authorization for permanent burial without sanitization with their classified waste profile.[7.5] This approval does not replace or eliminate the Material Control and Accountability requirements of Section 6.3.1.

Classified waste (LLW or MLLW) ***shall*** be segregated into a separate waste stream.[7.6] Classified waste requiring protection from visual observation, the "Advance Shipment Notification" form identified in Appendix C.4 ***shall*** be faxed to NTS at (702) 295-6852 at least seven (7) days prior to shipment arrival.[7.6]

3.1.19 Hydrocarbon Burdened LLW

LLW hydrocarbon burdened soil and closely related construction and demolition debris (greater than 100 mg/kg Total Petroleum Hydrocarbons) resulting from a petroleum release generated by NNSA/NSO Operation will be disposed in Pit 6. The concentration level of TPH is measured using U.S. EPA Method 8015, modified.

NTS 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. Waste packages ***shall*** be capable of withstanding the stresses associated with the loading, handling, stacking, and shipping of the package.[4.4] NNSA/NSO has adopted the following waste package criteria to assure that the NTS 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 the NTS 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.

The PE-g limit for all waste packages (e.g., drums, boxes, soft-sided packages, bulk or wrapped objects) is 300 PE-g total, except for DOT Type B containers, for which there is no limit as long as the DOT Type B container is also the disposal container.

The PE-g limit for a shipment is 2000 PE-g total. Any shipment that has a package that exceeds the package limit will be refused for disposal. Any shipment that exceeds the shipment limit will be refused for disposal.

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.[4.5]

3.2.4 Lead Shielding

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

- 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 LLW. 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. 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]

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 Nevada Test Site," located at the following web address:

http://www.nv.doe.gov/emprograms/environment/wastemanagement/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 lbs/ft^2).[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 this requirement. This requirement does not apply to bulk waste, waste packaged in steel drums, or cargo containers.

Bulk waste containers, including cargo containers, ***shall*** be sufficiently strong to 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.

3.2.6 Handling

Waste packages that require remote handling may incur additional cost for the generator and delay waste profile approval. Packages exceeding 1 mSv/hr (100mR/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]

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 NTS Operations 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. Any other structural part of the package which 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]

LLW 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 lbs.

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 7ft or 4 x 2 x 7ft, or 55/85-gallon drums).

Alternate packages (e.g., super-sacks, burrito wraps) will be considered; however, RWMC operations personnel need to be consulted to ensure equipment compatibility. MW, "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 LLW ***shall*** meet the requirements of Title 49 CFR.[4.7] 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 waste profile review process. The request that containers be returned should be identified in the special-handling section of the waste profile. The return of bulk containers may incur additional operational costs.

3.2.8 Weight

Weight limits for final waste packages ***shall*** not exceed the approved packaging design or NTS limits of 4,082 kg (9,000 lbs) per box and 544 kg (1,200 lbs) 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:

- Final weight ***shall*** not exceed the approved manufacturer design limits;
- Final weight of MLLW ***shall*** not exceed the NTS RTR weight capacity of 11000 lbs;
- Each overweight box ***shall*** be clearly marked "Overweight Box," and
- 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] More than one waste stream may be packaged in a disposal container, except those waste streams that ***shall*** be profiled separately (MW, Classified Waste, ALLW, etc.).[7.5/7.6/8.0] MW 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.[7.13/1.6]

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 NTS:[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.
- Wastes packaged in drums from off-site facilities are to be shipped in a closed conveyance.
- Alternative shipping containers / methods for transport of bulk items (SCO, LSA equipment, large machinery, etc.) will be approved on a case-by-case basis by the Waste Management Federal Project Director at (702) 295-7063.

3.3 Mixed Waste

MW offered for disposal ***shall*** meet the applicable characterization, treatment, packaging, and disposal requirements of the NTSWAC, Title 40 CFR, state of Nevada, and state-of-generation regulations.[8.0]

3.3.1 Acceptable Hazardous Waste Numbers

MW 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	U359
F001 through F009, F039	U364
P001 through P205	U367
U001 through U249	U373
U271	U387
U278	U389
U279	U394
U280	U395
U328	U404
U353	

3.3.2 Mixed Waste Treatment Notification

Generators with MW that requires treatment to meet the LDR standards, but the treatment has yet to occur, ***shall*** submit to NNSA/NSO 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 NTSWAC requirements for waste profiles in Section 2.1.1, MWPs ***shall*** be profiled and packaged separately from LLW. MWPs ***shall*** be approved for a finite volume of waste.[8.0] MWPs ***shall*** include the number of containers, container sizes, and dose rates at 30 cm for the mixed waste covered by the MWP.[8.0]

MWPs have annual expiration dates and ***shall*** be recertified annually (based upon the profile revision date) to NNSA/NSO with the information contained in Appendix G-2.[8.0]

3.3.4 Land Disposal Restrictions

MW ***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). 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. 3.11/8.0

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

MWs 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

MW 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 MWP.[3.9] Examples of nonbiodegradable sorbents according to Title 40 CFR 265.314(f) include:

- 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 MW Package Criteria

In addition to Section 3.2, MW 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, MW packages of 416 liters (110 gallons) or less ***shall*** be marked with the following:[3.5]

- 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

Containers of MW ***shall*** be at least 90 percent full when placed in the landfill. [3.10] Additional information on the mixed waste void space criteria can be found at the following web address:

http://www.nv.doe.gov/emprograms/environment/wastemanagement/rwap.aspx

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 NTS verification plan, the TID ***shall*** not be removed or altered. The package ***shall*** be loaded and transported to protect the TID from damage.

3.3.7 Analytical Data

Analytical data used to make MW 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 MW Verification

Verification frequencies and methods for MWPs are determined by the WARP in accordance with RWAP procedures. 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 NTS. Verifications are conducted in accordance with RWAP procedures.[8.1]

3.3.8.1 MW Verification Frequency

MW verification frequencies are assigned by the WARP. Per the MWP 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/NSO 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.)
- MW containing regulated asbestos
- Waste 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 containing beryllium

Chemical screening of waste container contents are performed by RWAP personnel at the generator's site. If a container is too large to RTR at NTS, the waste will be visually verified at the generator's site.[8.0]

Generators ***shall*** provide the necessary authorizations, facilities, and personnel to allow for RWAP personnel to perform MW 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 MW Packages

MW packages (parent packages) previously rejected that are repackaged and/or split into additional MW 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/NSO prior to shipping previously rejected MW packages (parent and/or progeny) back to NTS.[7.5]

3.4 NTSWAC Deviations

Deviations from the NTSWAC that do not compromise the performance objectives for the disposal site, NTS 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 NTSWAC requirement.

The following information ***shall*** be provided with the WP or as a stand-alone document approved by the WCO: NTSWAC 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.[6.15/7.5]

Example:

Requirement: NTSWAC, Revision 7-01, Section 3.2.5, Strength, requires that disposal packages ***shall*** be capable of supporting a uniformly distributed load of 16,477 kg/m^2 (3,375 lbs/ft^2).

Justification: Two 4 x 4 x 7ft metal boxes (#33248 and # 33798) do not meet the NTSWAC strength requirement. The boxes contain contaminated soil from a remediation project. The waste meets characterization data represented by the approved waste profile. However, because of ALARA concerns, the generator seeks to avoid unnecessary exposure to personnel and allow this waste to remain in these boxes. The boxes will be clearly marked "Box Does Not Meet NTSWAC 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 Complex, Nevada Test Site

This page intentionally left blank.

4.0 Waste Characterization

Generators ***shall*** characterize waste destined for disposal at NTS.[6.16] 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 NTSWAC requirements in Section 3.0. For waste characterized as MW, generators ***shall*** demonstrate that the MW meets the applicable Title 40 CFR LDR and WAC.[3.10] 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]

Generators ***shall*** prepare and submit a WP for each waste stream which provides NNSA/NSO 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/NSO for review during facility evaluations or upon NNSA/NSO 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. These results ***shall*** be reported in the waste profile on Table B-1 (page 4-5).[7.5] Refer to the waste profile 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/NSO 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
- LCS 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			Dinitrotoluene		
Mercury			Hexachlorobenzene		
Selenium			Hexachloro-1,3-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 Hydroxide		
TCLP Volatiles			**TCLP Pesticides and Herbicides:**		
Tetrachloroethylene			Lindane		
Trichloroethylene			Methoxychlor		
Vinyl chloride			Toxaphene		
Dichloroethylene			2,4,5-TP (Silvex)		

5.0 Quality Assurance Requirements for Waste Certification Programs

Area 5 Radioactive Waste Management Complex Workers Labeling Boxes, Nevada Test Site

This page intentionally left blank.

5.0 Quality Assurance Requirements for Waste Certification Programs

RWAP quality requirements are written in accordance with DOE Order 414.1, "Quality Assurance"; Title 10 CFR 830.122, "Quality Assurance"; and NNSA/NSO 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 NTSWAC, DOE Order 435.1, "Radioactive Waste Management," DOE Order 414.1, "Quality Assurance," and/or Title 10 CFR, 830.122, "Quality Assurance." In lieu of using a site QAPP, an NTSWAC specific Waste Certification Program Plan (WCPP) may be submitted as the site implementing program document. A controlled copy of the generators site QAPP or WCPP ***shall*** be maintained with the RWAP Manager.

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

Procedures, processes, or methods referenced should include:

- Implementing plans, procedures, documents, and/or records that demonstrate how implementation of applicable NTSWAC 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 NTSWAC.
- Documents assuring conformance to marking, labeling, electronic reporting, and form submittal requirements.

The WCO shall perform an annual review of the NIC to ensure referenced procedures, processes, and methods are current. Upon completion of the annual review, the WCO ***shall*** sign the NIC cover sheet and submit a copy to the RWAP Manager. An electronic copy of the NIC and instructions are available on the NNSA/NSO web site (see Section 2.2.1).

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. The WCO ***shall*** ensure that the waste certification processes, including waste, waste packages, supporting data, and waste shipments, comply with the requirements of the NTSWAC. The alternate WCO ***shall*** report to the primary WCO for certification activities. 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.

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.

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 NTSWAC 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. 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/NSO ***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 assure 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 other 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 assure accuracy.

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

5.6 Design

Structures, Systems, and Components (SSCs) designed and/or constructed to ensure that waste will satisfy certification requirements ***shall*** be designed using sound engineering/scientific principles and standards and performed in accordance with established design processes.

Design adequacy of SSCs ***shall*** be verified or validated by qualified personnel other than those who initiated the design. Verification and validation of SSC designs ***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 product or process designs (e.g., waste containers, sorbents, waste treatment operations) 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 on the basis of 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 NTSWAC 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 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 effectively carry out the assessment activities.

Waste certification programs ***shall*** be independently assessed annually to verify compliance with NTSWAC 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.

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
6.0 Waste Transportation and Receipt Information

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

This page intentionally left blank.

6.0 Waste Transportation and Receipt

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

6.1 Shipment Scheduling and Limitations

NTS Operations may impose schedule limitations on waste profiles that have specific handling and/or processing requirements. Classified Waste, ALLW, and MW 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 NTS 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.

NTS Operations may occasionally extend operating hours (i.e., Fridays). During these extra periods, NTS Operations will designate the type of shipments that will be received on the given date (e.g., on the third Friday in September, the NTS will accept cargo containers of standard LLW and DOT non-regulated bulk).

6.2 Shipping Arrangements

After a generator secures written approval from the NNSA/NSO AMEM to send waste to an NTS RWMC, the generator ***shall*** contact NTS operations to arrange for transfer of the waste and accompanying records.[7.5] The operator of the NTS coordinates waste shipment transfers at NTS.

6.2.1 Waste Receipt and Handling at NTS

To expedite waste receipt and handling at NTS, waste generators ***shall***, at a minimum, comply with the following:[7.6]

- Prior to departure of a waste shipment to the NTS, 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 NTS before leaving the RWMC.
- Enter the following pre-notification information on the HAZTRAK database.[7.6] If the generator is unable to enter information on the HAZTRAK, fax the NTS Advance Shipment Notification (see Appendix C.4) to the operator of the NTS at (702) 295-6852. Enter NTS shipments in the

HAZTRAK database prior to 1500 NTS 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 NTS local time on the previous Thursday).[7.6] NTS advance shipment notification being faxed to the NTS ***shall*** be received prior to the cutoff time and date.[7.6] For classified waste, having classified shipping documents, generators ***shall*** contact Wackenhut Services at (702) 295-7028.[7.6] For all shipments, the following information ***shall*** be provided.[7.6]

- Date and time shipment departed generator site
- Estimated date and time of arrival (ETA) at NTS
- Shipment number, shipper's name, shipper's contact number
- Carrier, driver's name (shall be a U.S. Citizen), driver's license number and state (information shall be legible)
- 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
- Waste stream number and description of waste

If the shipment's ETA should change, the generator ***shall*** notify NTS operations and ***shall*** enter the changes on the HAZTRAK database at the earliest opportunity and provide the new ETA.[7.6] Generators unable to update information on the HAZTRAK ***shall*** notify the NTS by phone at (702) 295- 6811.[7.6]

The majority of the above information can be found on the "Bill of Lading."

- For waste shipments containing regulated asbestos, the 7-day advance notification form ***shall*** be faxed to NNSA/NSO; 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
Waste Management
Nevada Test Site - Zone 2
Mercury, NV 89023

Because unclassified and classified shipments are processed differently, they ***shall*** be shipped separately (i.e., on different trailers and have different shipment numbers and separate shipping papers).[7.6] This also applies to ALLW and MW (i.e., shipped separately from standard LLW). Under small-volume conditions, combined shipments can be arranged by contacting the operator of the NTS.

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 Nevada Test Site 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 NTS to return after 0700 hours for off-loading. Shipments may be subject to off-loading delays at any time due to NTS 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 NTS main gate. If the shipment tracking number is listed, the shipment will be authorized to enter the NTS. 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] Nuclear Material Transaction reports ***shall*** be faxed to (702) 295-6852 prior to shipment arrival. The original Nuclear Material Transaction Reports ***shall*** accompany the shipment paperwork.[7.5] Generators shipping waste that require a DOE/NRC Form 741 ***shall*** also complete and fax a "Nevada Test Site – Waste RIS VAB Accountable Nuclear Materials Authorization to Ship Waste" form to (702) 295-4215 seven (7) days prior to shipment.

Generators ***shall*** obtain authorization to ship from NTS Material Control & Accountability (MC&A) prior to shipping the waste to the NTS.[7.5] An electronic copy of the "Nevada Test Site – Waste RIS VAB Accountable Nuclear Materials Authorization to Ship Waste" form is available on the NNSA/NSO website at http://www.nv.doe.gov/emprograms/environment/wastemanagement/rwap.aspx.

Applicable shipment numbers ***shall*** be included on both the Nuclear Material Transaction Report (DOE/NRC Form 741) and on the Nevada Test 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 Wackenhut Services 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" accompanied by the appropriate documentation ***shall*** be used when shipping MW.[3.4/.12]

6.3.3 PSDR Submittal

The original completed and signed PSDR, or the original of an equivalent, ***shall*** accompany each shipment.[6.20/7.6] An electronic version of the PSDR ***shall*** be transmitted to NTS Operations prior to shipment arrival (E-mail address: 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 Certification Statements

An appropriate LLW Certification Statement ***shall*** be signed by an authorized WCO or Alternate WCO for LLW (see following example of the required LLW Certification).[3.12/6.21/7.5]

An appropriate LDR Certification Statement ***shall*** be signed by an authorized WCO or Alternate WCO for MW (see Title 40 CFR 268.7 for information required to be included in an LDR certification/notification).[7.5]

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

Low-Level Waste Certification
I certify that containers:
Container I.D. number(s)
do not contain hazardous waste as defined in Title 40 CFR 261 or _____ (state-of-generation) hazardous waste regulations:
(1) According to the results of tests performed in accordance with the requirements as specified in Subpart C of Title 40 CFR 261, and/or (2) According to the supporting documentation provided to me about the materials and processes that produced this waste.
To the best of my knowledge, I believe the information I have submitted is true, accurate, and complete.
Generator Waste Certification Official (print name / sign) Date

6.4 Waste Transportation

Waste shipments consigned to NTS ***shall*** be made in accordance with applicable DOE, DOT, EPA, state, and local hazardous waste regulations and requirements.[7.5] Waste shipments to the NTS ***shall*** be made by "exclusive-use vehicles" only.[4.11] The sharing of conveyances with other DOE waste generators shipping directly to the NTS is acceptable. Generators are responsible for the evaluation of the motor carriers used for transporting radioactive waste. Motor carrier documentation (e.g., past carrier performance, prior evaluations, accident history, vehicle maintenance) should be reviewed to ensure that the carrier is in compliance 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 NTS.

NNSA/NSO ***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/NSO personnel informed of generator transportation plans, activities, and issues. NNSA/NSO personnel will use the information provided to inform stakeholders of transportation activities for radioactive LLW destined for the NTS. NNSA/NSO personnel may request to participate in the review of transportation-related information. NNSA/NSO 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 is completed prior to waste shipment. Transportation of waste to the NTS should conform to a supporting finding or decision based on the impact analysis.

NNSA/NSO encourages approved generators and their carriers to review route selections. Transportation of LLW and MW to the NTS ***shall*** avoid Hoover Dam and Las Vegas.[7.5] Routes selected are required 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 NTS will be responsible for inspecting radioactive waste shipments upon arrival and maintaining shipment records for NNSA/NSO. The operator of the RWMC will take receipt of the waste 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/NSO, Federal Sub-Project Director Low-Level Waste Project.

Generators ***shall*** fax (702-295-3112) or email (gordonsj@nv.doe.gov) a "Monthly Shipment Schedule" by the last Monday of each month that includes: [7.19]

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

6.7 Disposition of Noncompliant Conditions

NTS RWMC and RWAP personnel are responsible for identifying and documenting noncompliance issues (i.e., physical or documentation errors) discovered when conducting MW and LLW receipt and disposal activities. MW and radioactive waste shipments received at the NTS that are not in compliance

with requirements may be returned to the generator facility or require resolution from the generator.

NNSA/NSO ***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/NSO and operator of the NTS to ensure rejected shipments/containers of MW are returned to the generator or an alternate treatment, storage, or disposal facility within 60 days from the date of receipt at the NTS.[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

LLW or MLLW shipments received at the NTS that do not comply with the NTSWAC requirements will not be accepted for disposal. NTS operations personnel will be responsible for notifying the appropriate NNSA/NSO personnel regarding any refused radioactive or mixed 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 NTS to cover the cost of handling and disposal.
- A DOE/NRC Form 741 on file at the NTS prior to the shipment's arrival.
- A signed certification statement accompanying the shipment.
- Successful verification performed on the waste containers in accordance with the NTSWAC, NTS Waste Analysis Plan, and applicable procedures.
- Written approval from MC&A for shipment of accountable materials.

This page intentionally left blank.

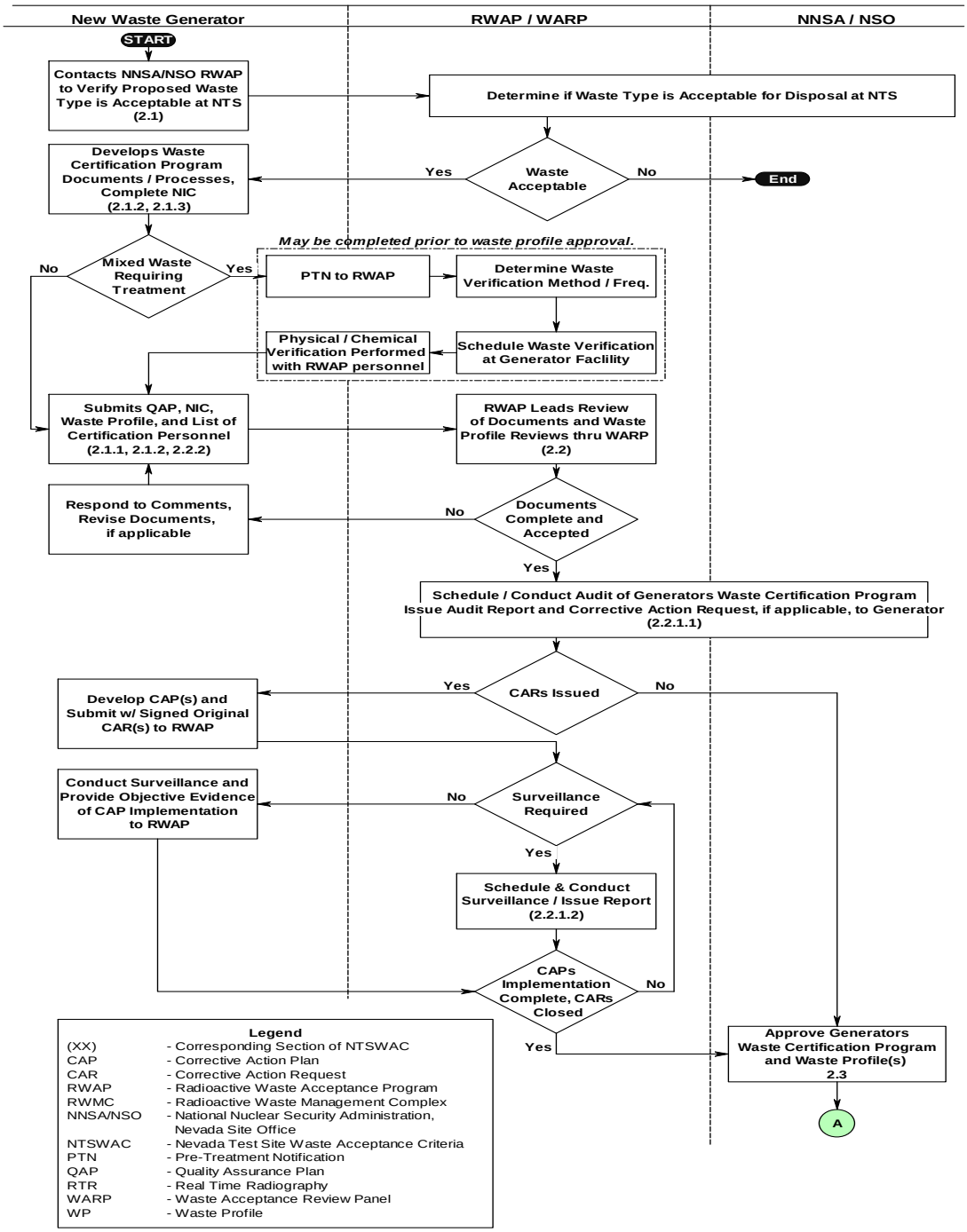
Appendix A

Waste Process Flow Diagrams

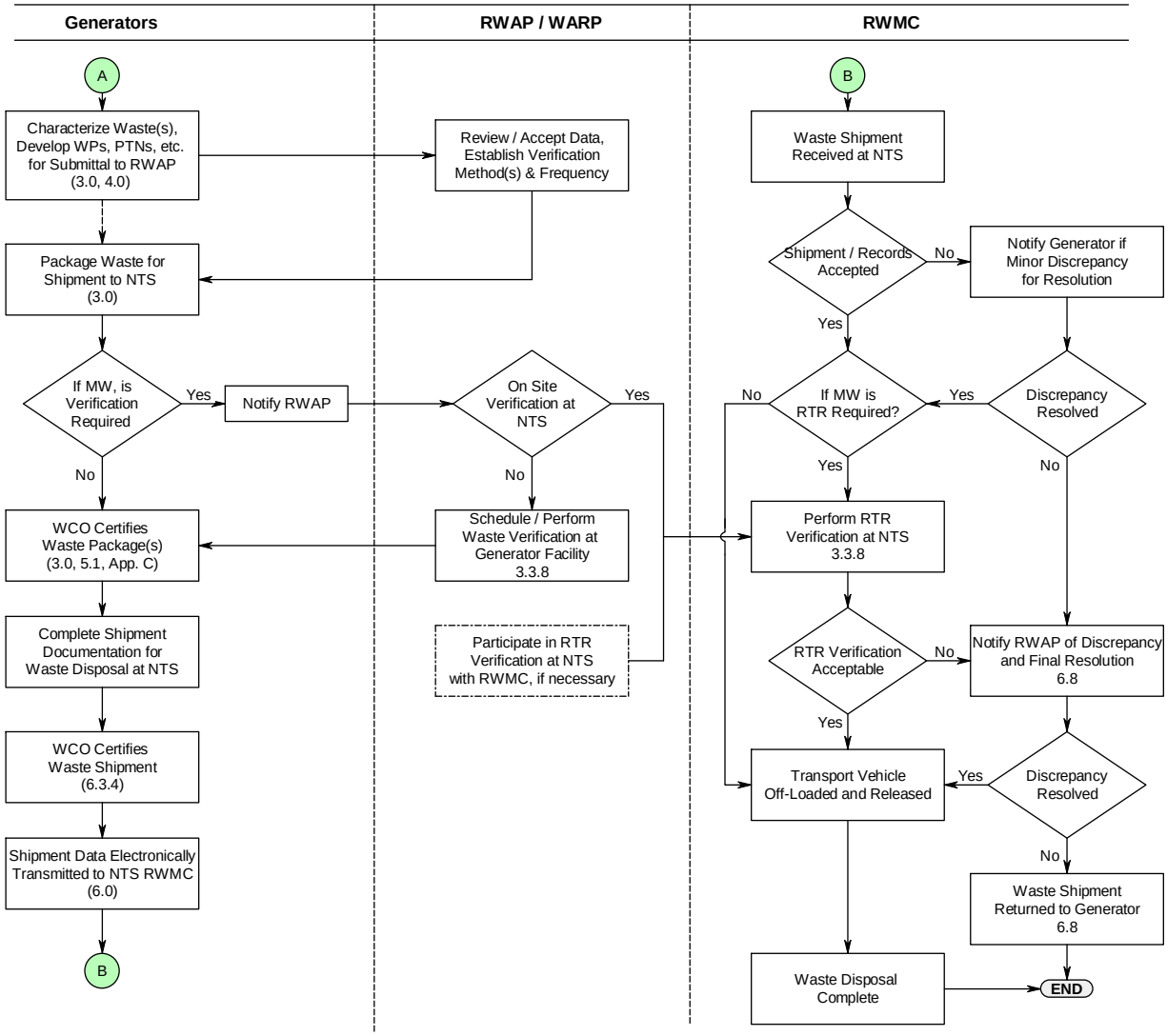
This page intentionally left blank.

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).



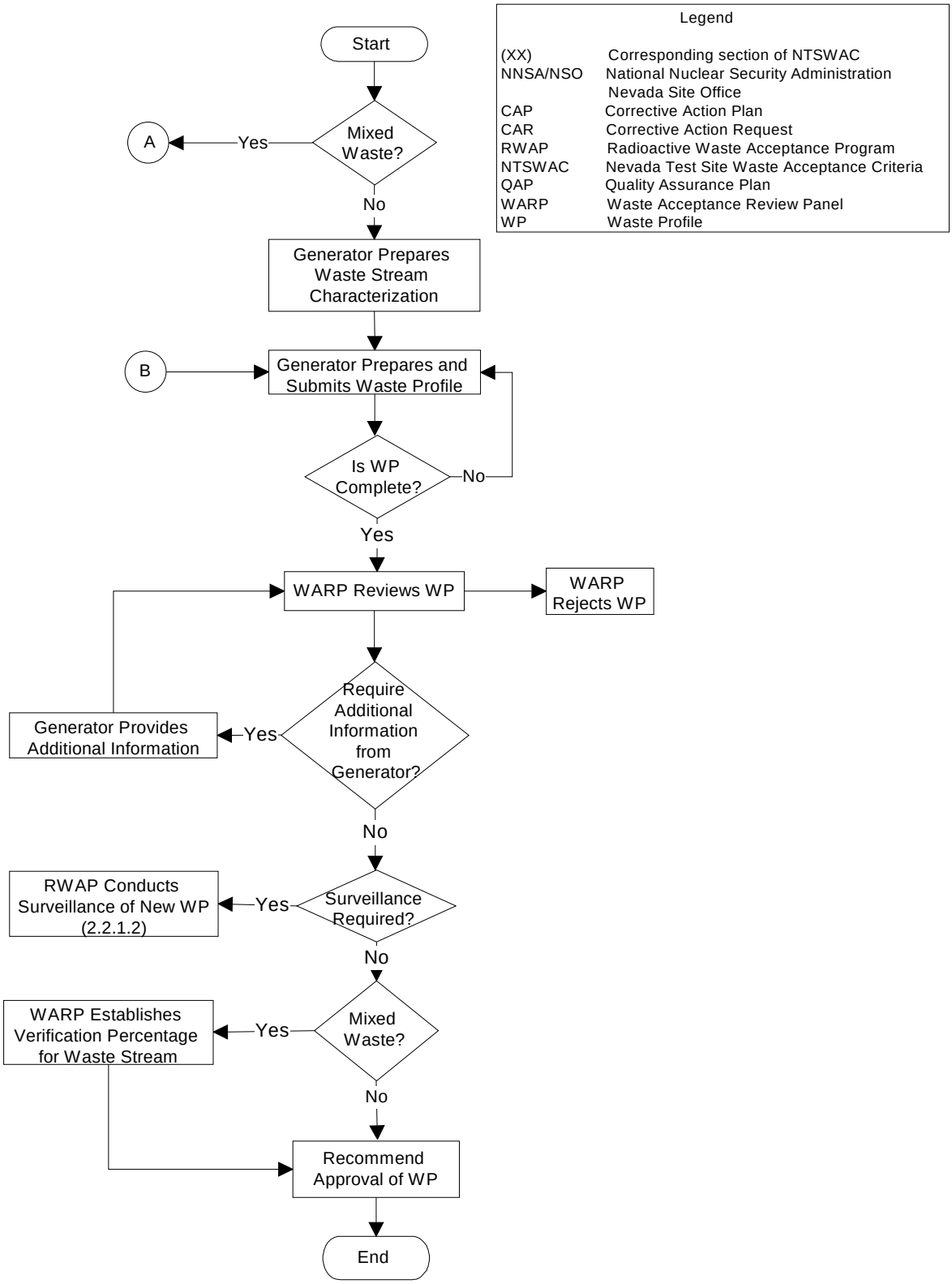
Appendix A - Waste Process Flow Diagram (continued)



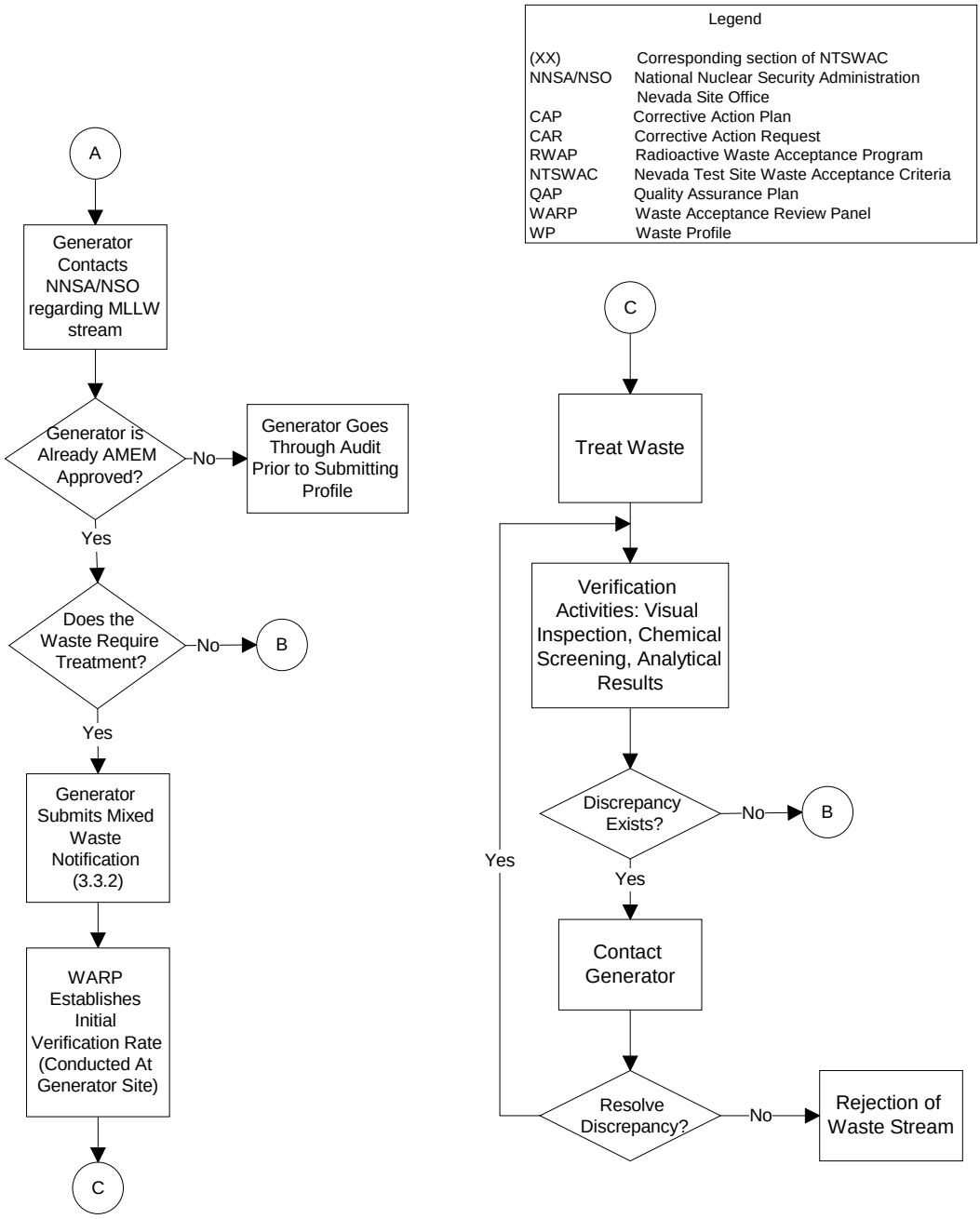
Legend

(XX)	- Corresponding Section of NTSWAC
CAP	- Corrective Action Plan
CAR	- Corrective Action Request
RWAP	- Radioactive Waste Acceptance Program
RWMC	- Radioactive Waste Management Complex
NNSA/NSO	- National Nuclear Security Administration, Nevada Site Office
NTSWAC	- Nevada Test Site Waste Acceptance Criteria
PTN	- Pre-Treatment Notification
QAP	- Quality Assurance Plan
RTR	- Real Time Radiography
WARP	- Waste Acceptance Review Panel
WP	- Waste Profile

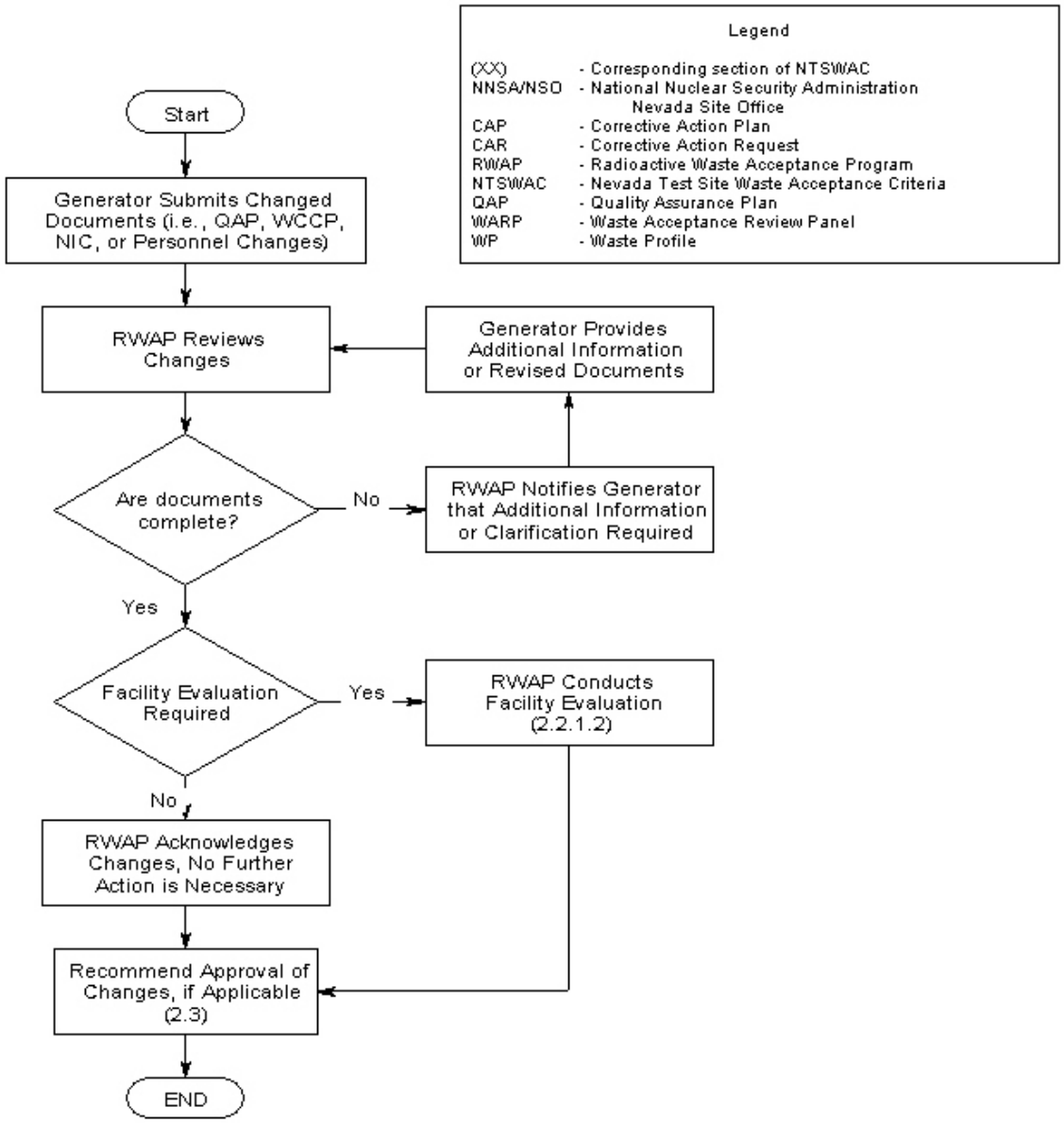
Waste Profile Approval Process



Waste Profile Approval Process (continued)



Document and Personnel Changes



This page intentionally left blank.

Appendix B

Plutonium Equivalent Gram (PE-g) Radionuclide Conversion Factors

This page intentionally left blank.

Appendix B – Plutonium Equivalent Gram (PE-g) Radionuclide Conversion Factors

* 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. [7.18]

Nuclide	CONVERSION FACTORS ----PE-g / Bq	Nuclide	CONVERSION FACTORS ---- PE-g / Bq	Nuclide	CONVERSION FACTORS ---- PE-g / Bq
Ac-224	1.12E-13	Au-194	8.69E-16	Br-80	2.40E-17
Ac-225	9.19E-12	Au-195	1.10E-14	Br-80m	3.34E-16
Ac-226	1.12E-12	Au-198	2.79E-15	Br-82	1.30E-15
Ac-227	5.70E-09	Au-198m	4.12E-15	Br-83	7.59E-17
Ac-228	2.62E-13	Au-199	1.28E-15	Br-84	8.22E-17
Ag-102	2.87E-17	Au-200	7.56E-17	C-11	1.04E-17
Ag-103	4.97E-17	Au-200m	1.87E-15	C-14	1.79E-15
Ag-104	6.05E-17	Au-201	2.28E-17	Ca-41	1.15E-15
Ag-104m	5.32E-17	Ba-126	3.12E-16	Ca-45	5.64E-15
Ag-105	3.97E-15	Ba-128	2.58E-15	Ca-47	5.57E-15
Ag-106	2.81E-17	Ba-131	5.70E-16	Cd-104	6.42E-17
Ag-106m	6.08E-15	Ba-131m	3.94E-18	Cd-107	9.26E-17
Ag-108m	2.56E-14	Ba-133	6.64E-15	Cd-107	9.26E-17
Ag-110m	6.83E-14	Ba-133m	5.29E-16	Cd-109	9.73E-14
Ag-111	5.23E-15	Ba-135m	4.28E-16	Cd-113	1.42E-12
Ag-112	5.64E-16	Ba-139	1.46E-16	Cd-113m	1.30E-12
Ag-115	5.60E-17	Ba-140	3.18E-15	Cd-115	3.59E-15
Al-26	6.77E-14	Ba-141	6.86E-17	Cd-115m	6.14E-14
Am-237	2.04E-17	Ba-142	3.50E-17	Cd-117	3.84E-16
Am-238	7.30E-16	Be-10	3.02E-13	Cd-117m	3.72E-16
Am-239	3.90E-16	Be-7	2.73E-16	Ce-134	6.96E-15
Am-240	1.56E-15	Bi-200	5.60E-17	Ce-135	1.35E-15
Am-241	4.44E-10	Bi-201	1.63E-16	Ce-137	3.56E-17
Am-242	4.97E-14	Bi-202	1.08E-16	Ce-137m	1.20E-15
Am-242m	4.35E-10	Bi-203	7.05E-16	Ce-139	7.71E-15
Am-243	4.44E-10	Bi-205	3.68E-15	Ce-141	7.62E-15
Am-244	1.41E-14	Bi-206	5.57E-15	Ce-143	2.88E-15
Am-244m	5.98E-16	Bi-207	1.70E-14	Ce-144	3.18E-13
Am-245	6.86E-17	Bi-210	1.67E-13	Cf-244	8.44E-15
Am-246	5.38E-17	Bi-210m	6.45E-12	Cf-246	5.10E-13
Am-246m	2.84E-17	Bi-212	1.84E-14	Cf-248	4.31E-11
As-69	4.16E-17	Bi-213	1.46E-14	Cf-249	4.91E-10
As-70	1.08E-16	Bi-214	5.60E-15	Cf-250	2.23E-10
As-71	1.08E-15	Bk-245	3.75E-15	Cf-251	5.01E-10
As-72	3.46E-15	Bk-246	1.46E-15	Cf-252	1.17E-10
As-73	2.94E-15	Bk-247	4.88E-10	Cf-253	2.65E-12
As-74	6.77E-15	Bk-249	1.18E-12	Cf-254	2.50E-10
As-76	3.18E-15	Bk-250	6.42E-15	Cl-36	1.87E-14
As-77	8.97E-16	Br-74	7.34E-17	Cl-38	1.14E-16
As-78	2.27E-16	Br-74m	1.39E-16	Cl-39	9.63E-17
At-207	2.06E-15	Br-75	1.11E-16	Cm-238	4.53E-15
At-211	8.69E-14	Br-76	1.36E-15	Cm-240	6.83E-12
Au-193	2.46E-16	Br-77	2.35E-16	Cm-241	1.25E-13
Cm-242	1.47E-11	Es-254	3.50E-11	Ge-77	8.97E-16
Cm-243	2.61E-10	Es-254m	4.75E-13	Ge-78	2.44E-16

Nuclide	CONVERSION FACTORS ----PE-g / Bq
Cm-244	2.11E-10
Cm-245	4.60E-10
Cm-246	3.84E-10
Cm-247	3.53E-10
Cm-248	1.41E-09
Cm-249	1.64E-16
Co-55	1.78E-15
Co-56	3.37E-14
Co-57	7.71E-15
Co-58	9.26E-15
Co-58m	8.00E-17
Co-60	1.86E-13
Co-60m	1.81E-18
Co-61	9.01E-17
Co-62m	2.87E-17
Cr-48	7.46E-16
Cr-49	6.17E-17
Cr-51	2.84E-16
Cs-125	3.53E-17
Cs-127	5.01E-17
Cs-129	1.35E-16
Cs-130	2.54E-17
Cs-131	1.42E-16
Cs-132	1.05E-15
Cs-134	4.00E-14
Cs-134m	3.72E-17
Cs-135	3.87E-15
Cs-135m	2.10E-17
Cs-136	6.23E-15
Cs-137	2.72E-14
Cs-138	8.63E-17
Cu-60	5.89E-17
Cu-61	1.59E-16
Cu-64	2.36E-16
Cu-67	1.05E-15
Dy-155	1.89E-16
Dy-157	6.80E-17
Dy-159	2.07E-15
Dy-165	1.14E-16
Dy-166	6.36E-15
Er-161	7.71E-17
Er-165	2.54E-17
Er-169	1.78E-15
Er-171	4.79E-16
Er-172	3.50E-15
Es-250	4.09E-15
Es-251	4.03E-15
Es-253	3.37E-12

Nuclide	CONVERSION FACTORS ---- PE-g / Bq
Eu-145	2.33E-15
Eu-146	3.31E-15
Eu-147	3.01E-15
Eu-148	1.22E-14
Eu-149	1.61E-15
Eu-150 hr	5.73E-16
Eu-150 yr	2.28E-13
Eu-152	1.88E-13
Eu-152m	6.96E-16
Eu-154	2.43E-13
Eu-155	3.53E-14
Eu-156	1.20E-14
Eu-157	9.48E-16
Eu-158	8.00E-17
F-18	7.12E-17
Fe-52	1.86E-15
Fe-55	2.29E-15
Fe-59	1.26E-14
Fe-60	6.36E-13
Fm-252	3.59E-13
Fm-253	4.91E-13
Fm-254	4.94E-14
Fm-255	2.27E-13
Fm-257	1.99E-11
Fr-222	1.05E-14
Fr-223	5.29E-15
Ga-65	2.86E-17
Ga-66	1.58E-15
Ga-67	4.75E-16
Ga-68	1.18E-16
Ga-70	2.68E-17
Ga-72	1.58E-15
Ga-73	3.24E-16
Gd-145	3.84E-17
Gd-146	3.24E-14
Gd-147	1.53E-15
Gd-148	2.81E-10
Gd-149	1.95E-15
Gd-151	7.56E-15
Gd-152	2.07E-10
Gd-153	2.02E-14
Gd-159	8.31E-16
Ge-66	2.70E-16
Ge-67	5.16E-17
Ge-68	4.41E-14
Ge-69	7.15E-16
Ge-71	1.04E-16
Ge-75	6.05E-17

Nuclide	CONVERSION FACTORS ---- PE-g / Bq
H-3	5.45E-17
Hf-170	1.02E-15
Hf-172	2.71E-13
Hf-173	4.06E-16
Hf-175	4.75E-15
Hf-177m	8.41E-17
Hf-178m	2.09E-12
Hf-179m	8.60E-15
Hf-180m	1.98E-16
Hf-181	1.31E-14
Hf-182	2.83E-12
Hf-182m	5.29E-17
Hf-183	9.95E-17
Hf-184	7.27E-16
Hg-193	1.58E-16
Hg-193m	6.55E-16
Hg-194	1.54E-13
Hg-195	1.76E-16
Hg-195m	1.30E-15
Hg-197	6.05E-16
Hg-197m	1.02E-15
Hg-199m	5.73E-17
Hg-203	6.23E-15
Ho-155	3.81E-17
Ho-157	4.44E-18
Ho-159	5.54E-18
Ho-161	1.32E-17
Ho-162	2.00E-18
Ho-162m	2.14E-17
Ho-164	7.40E-18
Ho-164m	1.62E-17
Ho-166	2.67E-15
Ho-166m	6.58E-13
Ho-167	9.26E-17
I-120	3.78E-16
I-120m	2.25E-16
I-121	1.01E-16
I-123	2.52E-16
I-124	1.65E-14
I-125	2.06E-14
I-126	3.78E-14
I-128	4.03E-17
I-129	1.48E-13
I-130	2.25E-15
I-131	2.80E-14
I-132	3.24E-16
I-132m	2.55E-16
I-133	4.97E-15

Nuclide CONVERSION FACTORS --- PE-g / Bq	
I-134	1.12E-16
I-135	1.05E-15
In-109	1.01E-16
In-110 hr	1.15E-16
In-110 min	2.62E-16
In-111	7.15E-16
In-112	7.68E-18
In-113m	3.50E-17
In-114m	7.56E-14
In-115	3.18E-12
In-115m	1.13E-16
In-116m	6.49E-17
In-117	3.13E-17
In-117m	1.51E-16
In-119m	3.78E-17
Ir-182	4.12E-17
Ir-184	1.96E-16
Ir-185	4.66E-16
Ir-186	7.75E-16
Ir-187	1.79E-16
Ir-188	1.31E-15
Ir-189	1.40E-15
Ir-190	5.45E-15
Ir-190m	2.59E-17
Ir-192	2.40E-14
Ir-192m	3.27E-13
Ir-194	2.47E-15
Ir-194m	5.83E-14
Ir-195	1.18E-16
Ir-195m	2.12E-16
K-40	1.05E-14
K-42	1.16E-15
K-43	5.89E-16
K-44	7.05E-17
K-45	4.38E-17
Kr-85	1.1E-14
La-131	4.41E-17
La-132	4.66E-16
La-135	5.04E-17
La-137	7.46E-10
La-138	1.17E-12
La-140	4.12E-15
La-141	4.94E-16
La-142	2.15E-16
La-143	5.10E-17
Lu-169	1.15E-15
Lu-170	2.19E-15
Lu-171	2.54E-15
Lu-172	4.25E-15

Nuclide CONVERSION FACTORS ---- PE-g / Bq	
Lu-174	3.37E-14
Lu-174m	2.16E-14
Lu-176	5.64E-13
Lu-176m	2.27E-16
Lu-177	2.09E-15
Lu-177m	6.11E-14
Lu-178	3.97E-17
Lu-178m	2.78E-17
Lu-179	2.87E-16
Md-257	4.88E-14
Md-258	1.41E-11
Mg-28	4.19E-15
Mn-51	9.76E-17
Mn-52	4.85E-15
Mn-52m	5.76E-17
Mn-53	4.25E-16
Mn-54	5.70E-15
Mn-56	3.21E-16
Mo-101	3.53E-17
Mo-90	1.05E-15
Mo-93	2.42E-14
Mo-93m	3.27E-16
Mo-99	3.37E-15
Na-22	6.80E-15
Na-24	1.03E-15
Nb-88	2.29E-17
Nb-89(122)	3.50E-16
Nb-89(66)	1.52E-16
Nb-90	1.95E-15
Nb-93m	2.51E-14
Nb-94	3.53E-13
Nb-95	4.94E-15
Nb-95m	2.07E-15
Nb-96	1.95E-15
Nb-97	7.05E-17
Nb-98	1.04E-16
Nd-136	9.82E-17
Nd-138	8.75E-16
Nd-139	1.80E-17
Nd-139m	3.18E-16
Nd-141	8.75E-18
Nd-147	5.83E-15
Nd-149	1.90E-16
Nd-151	2.65E-17
Ni-56	3.53E-15
Ni-57	1.61E-15
Ni-59	2.30E-15
Ni-63	5.35E-15
Ni-65	2.93E-16

Nuclide CONVERSION FACTORS ---- PE-g / Bq	
Np-232	1.07E-15
Np-233	1.85E-18
Np-234	1.73E-15
Np-235	3.53E-15
Np-236 hr	7.02E-14
Np-236 yr	8.85E-11
Np-237	4.60E-10
Np-238	3.15E-14
Np-239	2.13E-15
Np-240	6.93E-17
Os-180	1.48E-17
Os-181	1.14E-16
Os-182	1.17E-15
Os-185	8.82E-15
Os-189m	2.54E-17
Os-191	3.56E-15
Os-191m	2.58E-16
Os-193	1.70E-15
Os-194	5.70E-13
P-32	1.32E-14
P-33	1.97E-15
Pa-227	4.16E-14
Pa-228	3.75E-13
Pa-230	1.25E-12
Pa-231	1.09E-09
Pa-232	7.78E-14
Pa-233	8.12E-15
Pa-234	6.93E-16
Pb-195m	2.64E-17
Pb-198	6.55E-17
Pb-199	6.20E-17
Pb-200	6.74E-16
Pb-201	2.23E-16
Pb-202	8.34E-14
Pb-202m	1.52E-16
Pb-203	4.50E-16
Pb-205	3.34E-15
Pb-205	3.34E-15
Pb-209	8.06E-17
Pb-210	1.16E-11
Pb-211	7.40E-15
Pb-212	1.44E-13
Pb-214	6.64E-15
Pd-100	3.34E-15
Pd-101	1.58E-16
Pd-103	1.34E-15
Pd-107	1.09E-14
Pd-109	9.32E-16
Pm-141	2.70E-17

Nuclide CONVERSION FACTORS --- PE-g / Bq	
Lu-173	1.92E-14
Pm-144	4.57E-14
Pm-145	2.59E-14
Pm-146	1.25E-13
Pm-147	3.34E-14
Pm-148	9.29E-15
Pm-148m	1.92E-14
Pm-149	2.50E-15
Pm-150	3.08E-16
Pm-151	1.49E-15
Po-203	6.74E-17
Po-205	1.15E-16
Po-207	1.72E-16
Po-210	8.00E-12
Pr-136	2.10E-17
Pr-137	4.06E-17
Pr-138m	1.15E-16
Pr-139	4.91E-17
Pr-142	2.45E-15
Pr-142m	3.14E-17
Pr-143	6.90E-15
Pr-144	3.68E-17
Pr-145	5.73E-16
Pr-147	2.59E-17
Pt-186	1.13E-16
Pt-188	2.67E-15
Pt-189	1.52E-16
Pt-191	5.23E-16
Pt-193	1.93E-16
Pt-193m	7.46E-16
Pt-195m	1.04E-15
Pt-197	4.82E-16
Pt-197m	1.04E-16
Pt-199	3.87E-17
Pt-200	1.42E-15
Pu-234	2.33E-14
Pu-235	1.94E-18
Pu-236	1.23E-10
Pu-237	1.68E-15
Pu-238	3.90E-10
Pu-239	4.35E-10
Pu-240	4.35E-10
Pu-241	8.50E-12
Pu-242	4.09E-10
Pu-243	1.40E-16
Pu-244	3.43E-10
Pu-245	1.12E-15
Ra-223	6.68E-12
Ra-224	2.69E-12
Ra-225	6.61E-12

Nuclide CONVERSION FACTORS ---- PE-g / Bq	
Ni-66	7.08E-15
Ra-226	7.30E-12
Ra-227	2.42E-16
Ra-228	4.06E-12
Rb-79	4.19E-17
Rb-81	1.11E-16
Rb-81m	1.71E-17
Rb-82m	2.47E-16
Rb-83	4.19E-15
Rb-84	5.54E-15
Rb-86	5.64E-15
Rb-87	2.75E-15
Rb-88	7.12E-17
Rb-89	3.65E-17
Re-177	2.03E-17
Re-178	1.92E-17
Re-181	5.48E-16
Re-182(12.7)	3.43E-16
Re-182(64)	2.43E-15
Re-184	4.38E-15
Re-184m	1.25E-14
Re-186	2.72E-15
Re-186m	3.07E-14
Re-187	4.63E-17
Re-188	1.71E-15
Re-188m	3.50E-17
Re-189	1.06E-15
Rh-99	2.63E-15
Rh-99m	7.37E-17
Rh-100	1.18E-15
Rh-101	8.66E-15
Rh-101m	6.36E-16
Rh-102	1.02E-13
Rh-102m	4.06E-14
Rh-103m	4.35E-18
Rh-105	8.12E-16
Rh-106m	1.82E-16
Rh-107	2.06E-17
Rn-220	3.15E-14
Rn-222	8.82E-13
Ru-94	1.13E-16
Ru-97	3.84E-16
Ru-103	7.62E-15
Ru-105	3.87E-16
Ru-106	4.06E-13
S-35	1.11E-14
Sb-115	2.22E-17
Sb-116	1.97E-17
Sb-116m	6.52E-17
Sb-117	2.13E-17

Nuclide CONVERSION FACTORS ---- PE-g / Bq	
Pm-143	9.26E-15
Sb-118m	2.23E-16
Sb-119	1.79E-16
Sb-120 day	3.46E-15
Sb-120 min	1.11E-17
Sb-122	4.38E-15
Sb-124	2.14E-14
Sb-124m	8.82E-18
Sb-125	1.04E-14
Sb-126	9.98E-15
Sb-126m	2.89E-17
Sb-127	5.13E-15
Sb-128 hr	1.44E-15
Sb-128 min	1.50E-17
Sb-129	5.48E-16
Sb-130	8.82E-17
Sb-131	1.22E-16
Sc-43	2.20E-16
Sc-44	4.19E-16
Sc-44m	6.45E-15
Sc-46	2.52E-14
Sc-47	1.57E-15
Sc-48	3.50E-15
Sc-49	8.66E-17
Se-70	1.50E-16
Se-73	3.90E-16
Se-73m	3.94E-17
Se-75	7.21E-15
Se-79	8.38E-15
Se-81	2.19E-17
Se-81m	7.53E-17
Se-83	4.66E-17
Si-31	1.90E-16
Si-32	8.63E-13
Sm-141	2.61E-17
Sm-141m	4.97E-17
Sm-142	1.83E-16
Sm-145	9.38E-15
Sm-146	7.02E-11
Sm-147	6.36E-11
Sm-151	2.55E-14
Sm-153	1.67E-15
Sm-155	2.14E-17
Sm-156	5.95E-16
Sn-110	4.28E-16
Sn-111	2.31E-17
Sn-113	9.07E-15
Sn-117m	3.68E-15
Sn-119m	5.32E-15
Sn-121	4.35E-16

Nuclide CONVERSION FACTORS ---- PE-g / Bq	
Sn-121m	9.79E-15
Sn-123	2.77E-14
Sn-123m	3.94E-17
Sn-125	1.32E-14
Sn-126	8.47E-14
Sn-127	2.76E-16
Sn-128	1.84E-16
Sr-80	4.28E-16
Sr-81	7.18E-17
Sr-83	1.29E-15
Sr-85	4.28E-15
Sr-85m	7.24E-18
Sr-87m	3.65E-17
Sr-89	3.53E-14
Sr-90	1.11E-12
Sr-91	1.41E-15
Sr-92	6.86E-16
Ta-172	4.82E-17
Ta-173	2.72E-16
Ta-174	5.73E-17
Ta-175	3.24E-16
Ta-176	3.97E-16
Ta-177	2.61E-16
Ta-178	7.05E-17
Ta-179	5.54E-15
Ta-180	2.08E-13
Ta-180m	7.93E-17
Ta-182	3.81E-14
Ta-182m	1.14E-17
Ta-183	4.44E-15
Ta-184	9.73E-16
Ta-185	7.15E-17
Ta-186	2.07E-17
Tb-147	1.77E-16
Tb-149	6.23E-15
Tb-150	2.65E-16
Tb-151	5.32E-16
Tb-153	9.26E-16
Tb-154	1.01E-15
Tb-155	6.61E-16
Tb-156	3.34E-15
Tb-156m 24.4)	6.49E-16
Tb-156m (5.0)	1.85E-16
Tb-157	7.84E-15
Tb-158	2.18E-13
Tb-160	2.13E-14
Tb-161	2.90E-15
Tc-101	1.52E-17
Tc-104	6.99E-17
Tc-93	6.05E-17

Nuclide CONVERSION FACTORS ---- PE-g / Bq	
Tc-93m	2.85E-17
Tc-94	2.29E-16
Tc-94m	1.20E-16
Tc-96	2.02E-15
Tc-96m	1.97E-17
Tc-97	8.44E-16
Tc-97m	4.16E-15
Tc-98	1.95E-14
Tc-99	7.08E-15
Tc-99m	2.77E-17
Te-116	2.26E-16
Te-121	1.62E-15
Te-121m	1.36E-14
Te-123	8.97E-15
Te-123m	9.01E-15
Te-125m	6.20E-15
Te-127	2.71E-16
Te-127m	1.83E-14
Te-129	7.62E-17
Te-129m	2.04E-14
Te-131	4.06E-16
Te-131m	5.45E-15
Te-132	8.03E-15
Te-133	7.84E-17
Te-133m	3.68E-16
Te-134	1.08E-16
Th-226	2.98E-14
Th-227	1.38E-11
Th-228	2.13E-10
Th-229	1.83E-09
Th-230	2.77E-10
Th-231	7.46E-16
Th-232	1.39E-09
Th-234	2.98E-14
Ti-44	8.66E-13
Ti-45	1.83E-16
Tl-194	7.84E-18
Tl-194m	3.81E-17
Tl-195	3.94E-17
Tl-197	4.22E-17
Tl-198	1.40E-16
Tl-198m	9.10E-17
Tl-199	5.92E-17
Tl-200	4.00E-16
Tl-201	2.00E-16
Tl-202	8.38E-16
Tl-204	2.05E-15
Tm-162	1.87E-17
Tm-166	3.21E-16
Tm-167	2.51E-15

Nuclide CONVERSION FACTORS ---- PE-g / Bq	
Tm-170	2.24E-14
Tm-171	7.78E-15
Tm-172	4.16E-15
Tm-173	4.09E-16
Tm-175	1.97E-17
U-230	1.66E-11
U-231	1.01E-15
U-232	5.60E-10
U-233	1.15E-10
U-234	1.13E-10
U-235	1.05E-10
U-236	1.07E-10
U-237	3.00E-15
U-238	1.02E-10
U-239	3.18E-17
U-240	1.93E-15
V-47	5.98E-17
V-48	8.69E-15
V-49	2.94E-16
W-176	9.07E-17
W-177	5.54E-17
W-178	2.30E-16
W-179	2.98E-18
W-181	1.29E-16
W-185	6.39E-16
W-187	5.26E-16
W-188	3.50E-15
Xe-120	2.21E-16
Xe-121	9.70E-16
Xe-122	2.96E-17
Xe-123	3.37E-16
Xe-125	1.45E-16
Xe-127	1.55E-16
Xe-129m	1.28E-17
Xe-131m	4.66E-18
Xe-133	1.91E-17
Xe-133m	1.69E-17
Xe-135	1.47E-16
Xe-135m	2.37E-16
Xe-138	6.05E-16
Y-86	1.46E-15
Y-86m	8.47E-17
Y-87	1.49E-15
Y-88	2.39E-14
Y-90	7.18E-16
Y-90m	4.00E-16
Y-91	4.16E-14
Y-91m	3.09E-17
Y-92	6.64E-16
Y-93	1.83E-15

Nuclide CONVERSION FACTORS ---- PE-g / Bq	
Y-94	5.95E-17
Y-95	3.21E-17
Yb-162	1.90E-17
Yb-166	2.53E-15
Yb-167	7.12E-18
Yb-169	6.86E-15
Yb-175	1.38E-15
Yb-177	1.24E-16
Yb-178	1.38E-16
Zn-62	1.75E-15
Zn-63	6.93E-17
Zn-65	1.73E-14
Zn-69	3.34E-17
Zn-69m	6.93E-16
Zn-71m	3.31E-16
Zn-72	4.25E-15
Zr-86	1.87E-15
Zr-88	2.07E-14
Zr-89	2.02E-15
Zr-93	2.73E-13
Zr-95	2.01E-14
Zr-97	3.68E-15

Appendix C

Marking and Labeling

This page intentionally left blank.

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 NTS Operations prior to the first shipment to ensure RWMC equipment can be used to read the bar code.[7.6]

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 MW 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.[6.21/7.6] If the waste is unpackaged bulk, a signed PCL ***shall*** accompany the shipment papers.[6.21/7.6]
6. Shipment number in the following sequence: Two alpha character generator-site-designator codes assigned by NNSA/NSO/WMP (see Section C-3); one alpha character for type of waste (L for LLW, M for MW); two numerical characters for current fiscal year; three alpha numerical 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 through the use of a label, additions to bar code labels, or by writing the weight on the side of the waste package.

NV-211 October 2005 **USDOE**

PACKAGE CERTIFICATION LABEL

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

PACKAGE NUMBER: _____

DATE: _____

CERTIFIED BY (print): _____

CERTIFIED BY (signature): _____

Waste Certification Official ☐

Alternate Waste Certification Official ☐

Package Certifier ☐

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
BWXT Y-12	BWXT	BW
Duratek	DRTK	DR
EnergX	FWOR	FW
GA Technologies	BGAT	BG
INL	INEL	IN
Kansas City	ABXK	AS
LANL	LANL	LA
LLNL	BCLA	LL
Lovelace Foundation	ALVI	LV
NSTec - NTS	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
Princeton Plasma Physics Lab	PPPL	PL
Sandia - Albuquerque	ASLA	SA
Savannah River	SVRS	SR
Stoller –Navarro	LITN	IT
UT-Battelle	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 NTS Advance Shipment Notification

Nevada Test 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. (Lbs): _____ 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 Test Site will accept low-level radioactive waste and mixed waste for disposal. This information will be used by the U.S. Department of Energy, National Nuclear Security Administration Nevada Site Office and its contractors. Failure to provide this information will result in either a delay in waste receipt or waste refusal at the Nevada Test Site.

PRIVACY ACT INFORMATION

This page intentionally left blank.

Appendix D

Package Shipment Disposal Request

This page intentionally left blank

Appendix D – Package Shipment Disposal Request

The activity of each nuclide in a waste package as documented on the (PSDR) ***shall not*** exceed the corresponding maximum radionuclide concentration specified on the waste profile.[7.6] See Section 3.1.2 for reportable nuclides.

Shipment Number: _____ Prepared By: _____

Date: _____ Manifest No:_____

Package No.		**Contact (mSv/h):**		**Completed Date:**	
Container Code:		**One Meter (mSv/h):**		**Operation Type:**	
External Volume (m^3):		**Gross Weight (kg):**		**Total Activity (bq):**	
Waste Volume (m^3):		**Net Weight (kg):**		**Activity Date:**	
Comment(s):					

Waste Stream Profile	Form Code	Form Description	Treatment Code	Treatment Description	Rev. No.	Rev. Date	Nuclide	Qty. (Bq)	EPA Code

If you have any questions on completing this document, contact the operator of the NTS 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 WMP, L (low-level) or M (mixed), 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 WMP for fiscal year 2008.

MANIFEST NUMBER: Required only on LLW with PCBs and mixed waste shipments; a twelve digit number

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 DDMMMYYYY 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.

					*** External Volume**	
Code	**Description**	**Length**	**Width**	**Height**	**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
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	0.9663-2.4777
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 W rap	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.

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

OPERATION TYPE: B for burial, or R for retrievable.

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

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

TOTAL ACTIVITY: Total Becquerels; ***shall*** equal the sum of becquerels for each nuclide reported. Written in scientific notation X.XXXE±00.

WASTE VOLUME: Actual volume of waste material in package 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.

ACTIVITY DATE: The date in DDMMMYYYY format (e.g., 01Jan1992), that the activity of the package was determined.

COMMENT: A twenty-seven (27) alphanumeric character field. If the package was rejected from NTS, returned to the generator and will be re-shipped to the NTS, the original rejected package number (parent) ***shall*** be entered in parentheses. All packages generated from the repackaging of rejected waste (progeny) ***shall*** 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: LRY5000000001 represents waste from the NTS.

WASTE FORM CODE: Enter the appropriate three-digit waste form code, exactly as shown below, that categorizes the waste in the package.

020 - Charcoal
021 - Incinerator Ash
022 - Soil
023 - Gas
024 - Oil
025 - Aqueous Liquid
026 - Filter Media
027 - Mechanical Filter
028 - EPA Hazardous
029 - Demolition Rubble
030 - Cation Exchange Media
031 - Anion Exchange Media
032 - Mixed Bed Ion Exchange Media
033 - Contaminated Equipment
034 - Organic Liquid (except oil)
035 - Glassware or Labware
036 - Sealed Source or Device
037 - Paint or Plating
038 - Evaporator Bottoms /Sludges Concentrates
039 - Compactable Trash
040 - Non-Compactable Trash
041 - Animal Carcasses
042 - Biological Material (except animal carcasses)
043 - Activated Material (except activated metal)
044 - Activated Metal
045 - Other (Describe)

WASTE TREATMENT CODES: Enter the appropriate three-digit treatment code, exactly as shown below, that categorizes the treatment process used on the containerized waste.

Sorption

060 - Speedi Dri
061 - Celetom
062 - Floor Dry/Superfine
063 - HiDri
064 - Safe T Sorb
065 - Safe N Dry
066 - Florco
067 - Florco X
068 - Solid A Sorb
069 - Chemsil 30
070 - Chemsil 50
071 - Chemsil3030
072 - Dicaperl HP200
073 - Dicaperl HP500
074 - Zonolite Gd4
075 - Petroset
076 - Petroset II
077 - Aquaset
078 - Aquaset II
079 - Other (Describe)
080 - Quicksolid

Solidification

090 - Cement
091 - Concrete Encapsulation
092 - Bitumen
093 - Vinyl Toluene
094 - Vinyl Ester Styrene
095 - Other (Describe)
100 - No Sorption or Solidification

Mixed Waste

101 - AMLGM
102 - CARBN
103 - CHOXD
104 - CHRED
105 - CMBST
106 - DEACT
107 - MACRO
108 - STABL
109 - Other (Provide LDR Specified Treatment Technology Code)
110 - Meets Concentration Based LDR standards

REVISION: WP Revision number found in Section B.1 of the approved profile will be a two-digit number.

REVISION DATE: WP Date found in Section B.1 of the approved profile: in DDMMMYYYY 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: Mixed waste containers only, enter the four-digit EPA Hazardous Waste Code Number associated with the waste package. Enter "STHW" if the container is mixed waste with a state hazardous waste number and not a federal EPA Hazardous Waste Number.

Appendix E

Radiological Waste Characterization and Reporting Requirements

This page intentionally left blank.

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 waste profile (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. Waste packages exceeding the activity concentration upper limit will not be accepted without approval of a revised waste profile; 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]

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	^{228Th}	4.3E+13
^{40}K	9.4E+10	^{229Th}	2.8E+10
^{41}Ca	2.8E+12	^{230Th}	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, ^{126m}Sb, ^{126}Sb, ^{137m}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, ^{234m}Pa, ^{234}Pa, ^{222}Rn, ^{218}Po, ^{214}Pb, ^{214}Bi, ^{214}Po, ^{210}Bi, ^{210}Po
^{240}U, ^{240m}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/NSO 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 Controls and Accountability (MC&A)

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

B. Gross Radiation Measurements

Scaling factors can be developed that relate gross radiation measurements to the activity concentration of a waste stream. Generators using gross radiation measurements ***shall*** ensure that measurements correlate with activity concentration on a consistent basis.[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 which 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] 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 which generated waste, and Material Safety Data Sheets.

B. Evaluation of PK and historical data

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

D. Reviewed and approved procedures:

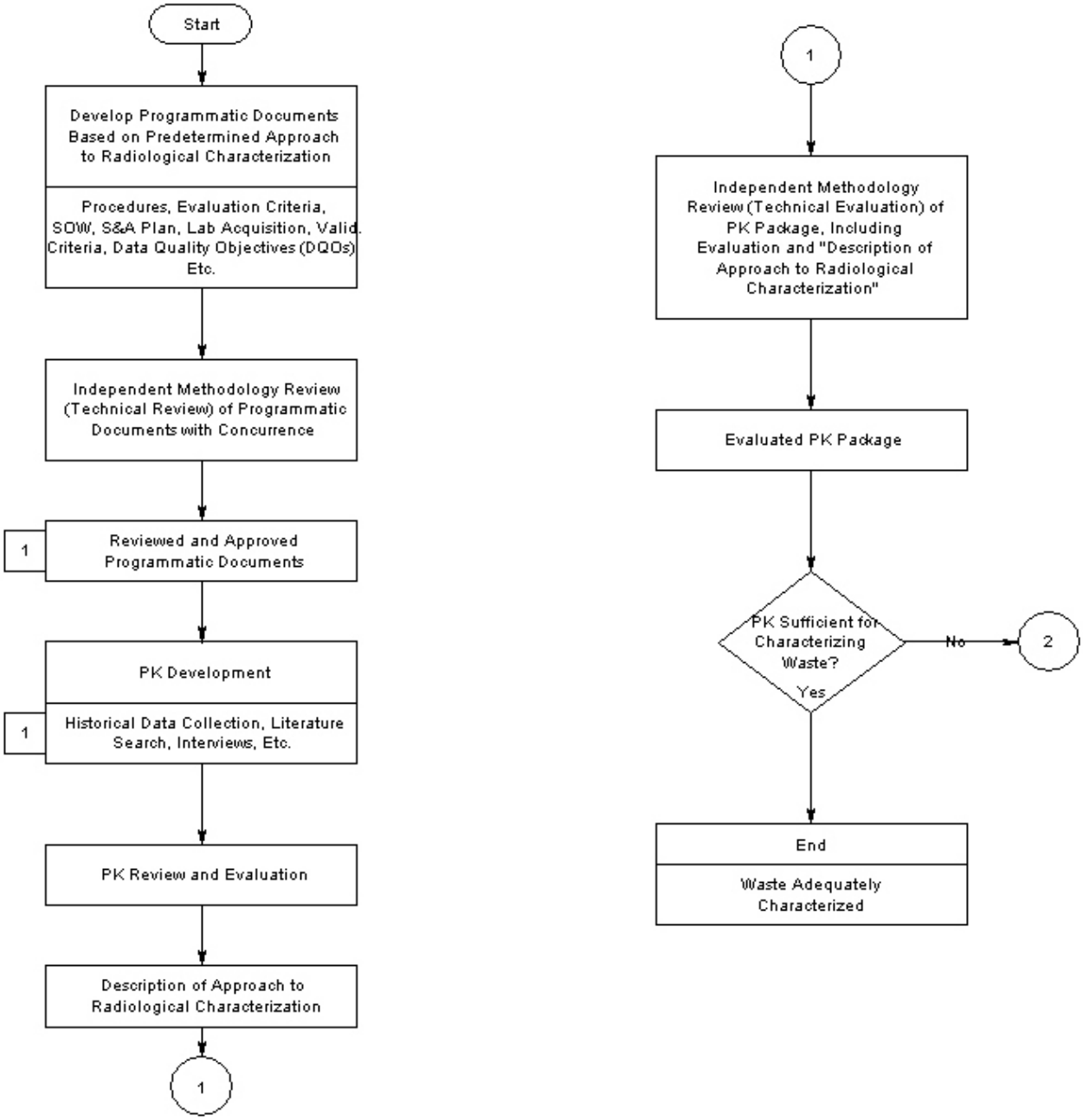
Direct measurement and/or survey processes, surface area estimations (when surface area of waste material is utilized in radiological characterization calculations), and ratio/scaling factor information (approach to ratio/scaling factor development, application of ratios/scaling factors, justification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

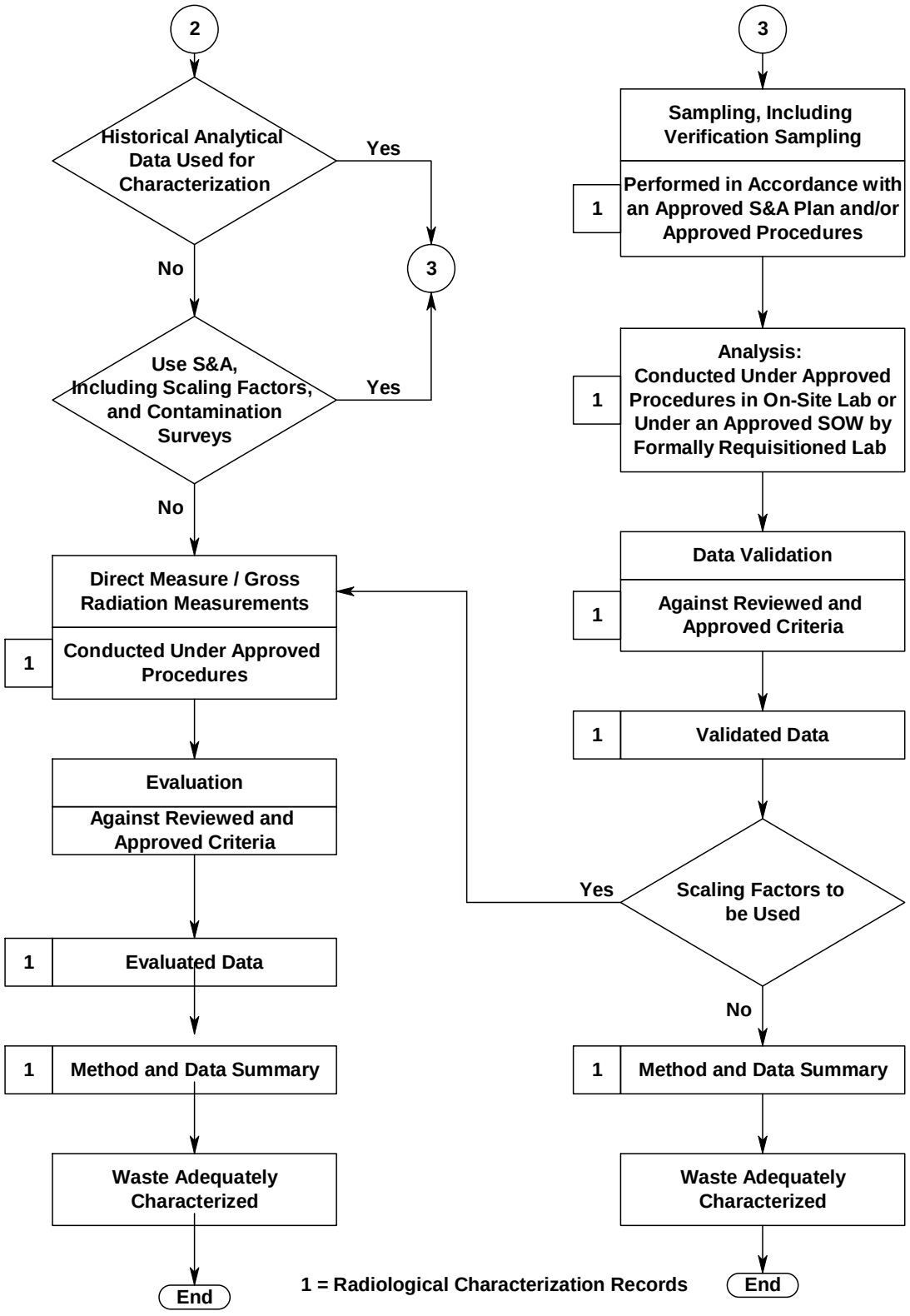
Figure E-1, the radiological characterization flow diagram, illustrates the approach that should be used to obtain adequate radiological characterization. The approach allows for the utilization of generally accepted radiological characterization methodologies and documentation. Radiological characterization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

Figure E-1: Radiological Characterization Flow Diagram



1 = Radiological Characterization Record

Figure E-1 (continued)



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

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. Does not exceed 15 g of ^{235}U Fissile Gram Equivalence (FGE) per package.[4.10] FGE is determined by completing Table E.3.

2. Does not exceed 350 grams of ^{235}U FGE per package nor does it 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). **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 RWAP Task Manager for further information on the criteria for performing a NCSE.

If the waste stream contains enriched uranium (^{235}U weight percent $\geq$0.90), ^{233}U, ^{239}Pu, ^{241}Pu, ^{242m}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.

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

Nuclide (A)	High Activity Conc. (Bq/m3) (B)	Volume of Package (m3) (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 ^{235}U Enrichment = $\frac{\text{Total } ^{235}U \text{ FGE}}{\text{Total U}}$							**TOTAL ^{235}U FGE**	
Effective ^{235}U Enrichment =								

Instructions for completing Table E.3:

1. Multiply high activity range of the waste stream (Bq/m^3) 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 ^{235}U, the activity is required to be included only if the ^{235}U 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 ^{235}U FGE factor (Column G) to determine FGE (Column H).

4. If the FGE value is greater than 1 percent of the ^{235}U mass, then include in Column I to determine the total ^{235}U FGE for a waste package.

5. Effective ^{235}U enrichment (weight %) is calculated by dividing the total ^{235}U 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

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 NTSWAC (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 B2O3 is required to have 4 kg of boron	≥ 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	≤1% by weight
Maximum hydrogen content of waste as packed and as received at the NTS	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 2. All hydrogenous materials, such as plastics and cellulose, may be assumed to be water to determine an equivalent water mass. That is, 1 g plastics = 1 g 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 ^{235}U 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:

1. For waste with nuclides found in Table E-3 of the NTSWAC (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 total ^{235}U FGE and effective ^{235}U 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

This page intentionally left blank.

Appendix F – Requirements for Intermodal (Roll-off boxes) LLW Disposal

These requirements are specific to intermodal roll-off containers that will be unloaded 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.

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

Prohibited Waste Types:

1. Classified waste
2. Asbestiform LLW (regulated)
3. MLLW
4. LLHB waste
5. PCB Waste
6. Fine particulates that could become airborne
7. Gas cylinders, fire extinguishers, aerosol cans (pressurized or not)
8. LLW Beryllium Waste (particulate)
9. Sealed sources

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 NTS waste operations upon profile submission.

Radionuclide Activities:

1. Activities ***shall*** be less than 300 PE-g based on conversions in the NTSWAC.

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 35,000 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 NTS 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 NTS 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 Waste Forms

This page intentionally left blank.

Appendix G – Mixed Waste Forms

G.1 Pre-Treatment Notification Form for Mixed Waste

A. Generator Information

1. Company name:
2. Facility address:
3. Generator facility:
4. Primary technical contact: email: Phone: Fax:
5. Waste certification official: email: Phone: Fax:

B. General Waste Stream Information

1. Waste stream name:

2. Waste stream identification number:

3. Waste generating process description:

4. Estimated volume after treatment: ☐ Inventory attached
   a. Estimated disposal container counts, container size, and weights:

   b. Estimated container dose rates at 30 centimeters (mR/hr @ 30 cm):

Container Number	Container Count	Container Size	Weight (lbs).	Dose rate (mR/hr @ 30 cm)
55-gallon Carbon steel drums	**~207**	**7.5 cu/ft**	**~600**	**<50**

5. Regulatory status. Check all boxes below that describe the regulatory status of the waste stream as generated:

   ☐ Federally regulated (RCRA) hazardous waste (40 CFR 261). List all EPA hazardous waste numbers and applicable regulatory subcategories:

   ☐ State regulated hazardous waste codes:

6. Waste composition. Describe the gross composition/component of the waste stream and all hazardous constituents that contribute to any waste codes or LDR treatment standards.

CAS Number	Chemical Constituent	Waste Component

7. Reportable radionuclides. List the radionuclides that could be reportable in the waste stream:

Isotope	Activity (Bq/m^3)

C. Proposed Treatment Information

1. Applicable LDR Treatment Standards:

2. Treatment standards: ☐ Concentration Based ☐ Technology Based

3. Proposed Treatment Facility:

☐ On-site Generator procedures:
☐ Commercial Facility name:
Address:
EPA Identification number:
Permit number:

4. DOECAP audit number and date completed of the treatment facility:

5. Treatment process(es) or technology(ies):

6. Proposed final waste form:

☐ Solidified/Stabilized ☐ Debris ☐ Macroencapsulated
☐ Incinerator Ash ☐ Soil ☐ Other; describe:

7. ☐ Waste will contain sorbent.

What kind? *Sorbents used **shall** meet 40 CFR 264.314(e)(1) or (2).*

8. Schedule for treatment:

9. Training or PPE necessary for visual inspection of treatment/waste:

Technical Contact Signature: _____ Date: _____

WCO Signature: _____ Date: _____

G.2 Mixed Waste Profile Annual Certification Example

Waste Profile Number:
Waste Profile Revision No.: Expiration Date:
Facility: WCO:

The above Mixed Waste Profile (MWP) is about to expire. The NTSWAC requires generators to recertify MWPs 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 waste 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/NSO WMP. 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 NTS 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 NTSWAC.

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.

☐	No	☐	Yes	Has the waste generating process changed?
☐	No	☐	Yes	Have the methods used to perform radiological characterization changed?
☐	No	☐	Yes	Have the methods used to perform physical/chemical characterization changed?
☐	No	☐	Yes	Have any of the RCRA or state waste codes changed?
☐	No	☐	Yes	Has the LDR status (subcategories, treatment, etc.) changed?
☐	No	☐	Yes	Have there been any other changes to the waste stream that could affect management of the waste at NTS?
☐	No	☐	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: _____

This page intentionally left blank.

Appendix H

Glossary

This page intentionally left blank.

Appendix H – Glossary

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

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

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

Classified Waste: Radioactive waste for which access is limited for national security reasons and cannot be declassified will be managed in accordance with the requirements of DOE Directive 470.4 directives.

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 authority that information or matter no longer requires protection as classified information against unauthorized disclosure because of national security concerns.

Disposal: The emplacement of Low-Level Waste (LLW) or Mixed Waste (MW) in a manner which is considered permanent in that routine recovery is not provided for.

Facility Evaluation: A documented review to evaluate a generator's program to be in compliance with the NTSWAC. 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 which 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 one 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 Hdrocarbon (TPH) resulting from a petroleum release and generated by NNSA.NSO 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: Low-level radioactive waste is radioactive waste that is not high-level radioactive waste, spent nuclear fuel, transuranic waste, by product 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 Waste: Waste containing both radioactive and hazardous components as defined by the Atomic Energy Act of 1954 (as amended) and the RCRA. MW ***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.

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

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

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

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

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

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

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

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

Radioactive Waste Management Site: Designated locations where radioactive waste handling 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/NSO 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 Stream: A waste or group of wastes from a process or a facility with similar physical, chemical, and radiological properties.

This page intentionally left blank.

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
	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 265.314
3.10	40 CFR 265.315
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

Title 49 - Transportation

4.1 49 CFR 172.200 - .205
4.2 49 CFR 172 Subparts D and E
4.3 49 CFR 172.310
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.

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

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)
7.3 "Position Paper on the Proper Characterization and Disposal of Sealed Radioactive Sources." Revision 2, October 1997
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/NSO RWAP
7.6 NNSA/NSO 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/NSO 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.

7.16 S. G. Vessard and T. P. McLaughlin, "Nuclear Criticality Safety Evaluation of Low Level Waste Disposal at the Nevada Test Site Radioactive Waste Management Sites," Criticality Safety Evaluation (CSE)-A490.101, August, 2002.

7.17 S. G. Vessard and T. P. McLaughlin, "Nuclear Criticality Safety Evaluation of Low Level Waste Disposal at the Nevada Test Site Radioactive Waste Management Sites," CSE-A490.103, June, 2003.

7.18 Memo A490-06-TC-0005 to James B. Zovi from Thomas Collens, May 23, 2006, "Isotopes with No Direct Plutonium Equivalent Conversion Factor in the Nevada Test Site Waste Acceptance Criteria."

7.19 Radioactive Waste Projects - NSTec

NTS Permits and Plans

8.0 RWAP-P2, RWAP Waste Analysis Plan

8.1 RWAP Procedure, RWAP-09, *Waste Verification Process*