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OPERATIONAL RADIOACTIVE WASTE MANAGEMENT PLAN FOR THE NEVADA TEST SITE

NOVEMBER 1980

PREPARED JOINTLY BY
REYNOLDS ELECTRICAL & ENGINEERING CO., INC.
AND
THE U.S. DEPARTMENT OF ENERGY NEVADA OPERATIONS OFFICE

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ABSTRACT

The Operational Radioactive Waste Management Plan for the Nevada Test Site establishes procedures and methods for the safe shipping, receiving, processing, disposal, and storage of radioactive waste. Included are NTS radioactive waste disposition program guidelines, procedures for radioactive waste management, a description of storage and disposal areas and facilities, and a glossary of specifications and requirements.

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Section 1

NEVADA TEST SITE RADIOACTIVE WASTE MANAGEMENT PROGRAM

1.1 PURPOSE

This plan establishes procedures and methods for the safe receipt, processing, disposal, and storage of radioactive wastes at the Nevada Test Site (NTS).

1.2 POLICY

It is the policy of the U. S. Department of Energy Nevada Operations Office (DOE/NV) to receive, process, and store or dispose of radioactive wastes in a manner that will have little or no adverse effect on the environment and to ensure that present and future radiation exposures are kept as low as practicable and do not exceed the radiation exposure guides established in AEC/ERDA Manual Chapter 0524.

1.3 RESPONSIBILITY

The DOE/NV Manager has those responsibilities and authorities as assigned in AEC/ERDA Manual Chapter 0511-038.

A. The Assistant Manager for Defense is responsible to the Manager to:

1. Direct contractor execution of radioactive waste management activities concerning construction, equipment and supplies, work space, radioactive waste management site (RWMS) maintenance and operations, and utilities. These activities will be coordinated through the NTS Support Office if field support is needed.

2. Assure operational coordination of all radioactive waste shipments to the NTS for which security, nuclear accountability, and equipment and/or facilities are required.

3. Establish and implement plans to conduct approved NV radioactive waste management waste disposal and storage activities in accordance with approved procedures.

4. Assure that radioactive waste management operations are conducted so that any radiation exposure and associated risk to human beings and their environment over the lifetime of the radionuclides is minimal.

5. Advise NV staff on technical aspects of studies related to the geology and hydrology of radioactive waste management areas.

B. The Assistant Manager for Administration is responsible to the Manager to:

1. Provide physical protection (security and property protection) for radioactive waste and radioactive waste operations as is required by Safeguards and Security Division DOE/NV.

2. Provide nuclear materials inventory and security as necessary for radioactive waste management.

C. The Director, Office of Safety and Health is responsible to the Manager to:

1. Review and approve the Safety Analysis Review and related documents required by U.S. DOE Order 5481.1 to determine that adequate consideration has been given to applicable DOE regulations governing safety and health.

2. Review and determine the adequacy of the criticality safety assessment when applicable.

1.4 WASTE MANAGEMENT AREAS AT THE NEVADA TEST SITE

As a condition of DOE Contract DE-AC08-76NV00410, under the direction of the DOE/NV Office of the Assistant Manager for Administration, Reynolds Electrical and Engineering Co., Inc. (REECo), is responsible for the safe management of

radioactive waste which includes the operation, maintenance, and surveillance of radioactive waste management sites at the NTS.

REECo/Radioactive Waste Management Operations (RWMO) performs the following in relation to Radioactive Waste Management (RWM) in compliance with the policy set forth in 1.2 above.

A. Conducts research and development activities, as required by DOE/NV, related to radioactive waste storage or disposal and updating waste storage and disposal technology.

B. Implements DOE regulations relative to RWM and monitors effluents to determine compliance with AEC/ERDA Manual Chapters 0511, 0513, and 0524.

C. Audits of RWM operations are conducted semiannually.

D. Performs waste treatment operations at the NTS RWM sites. Operations by other contractors will occur only as directed by DOE/NV.

E. Provides radiological monitoring in compliance with the exposure guidelines of AEC/ERDA Manual Chapter 0524 and maintains a continuing effort to achieve as low as practicable personnel exposures.

F. Maintains RWM records and reports as required by DOE/NV.

G. Reviews plans and designs, as requested by the NTS Support Office or the Radiological Operations Branch, for new construction and makes recommendations concerning radioactive waste handling, storage, and disposal at the NTS.

H. Provides data (as available) to the NV Radiological Operations Branch concerning potential personnel exposures resulting from radioactive waste storage or disposal at the NTS.

I. Ensures that all new NTS radioactive waste storage and disposal areas are approved by the DOE/NV Manager.

J. Assures that RWM reports (regarding AEC/ERDA Manual Chapter 0511) are submitted to DOE/NV for review ten days prior to DOE Headquarters due dates.

1.5 GENERAL GUIDELINES FOR RADIOACTIVE WASTE MANAGEMENT

All phases of the RWM project are conducted to ensure that present and future radiation exposures to individuals and population groups are as low as practicable and do not exceed the standards established in AEC/ERDA Manual Chapter 0524 and the policies and philosophies reflected in AEC/ERDA Manual Chapter 0511, WASH-1202 "Plan for the Management of AEC-Generated Radioactive Wastes," and LA-5645 "Guidelines for the Interim Storage of AEC-Generated Solid Transuranic Waste."

Where practical, wastes are compacted, oxidized, dehydrated, or otherwise concentrated to achieve the maximum possible volume reduction.

Radioactive organic waste or mixtures containing organic waste which may be affected by aerobic or anaerobic bacteria must be dehydrated, incinerated, or otherwise preserved to permit indefinite storage. As an alternative, organic waste is reduced by bacterial decomposition provided volatile radionuclides are retained and the resultant sludge is treated for storage or disposal.

All user organizations generating radioactive waste are responsible for assuring that their radioactive waste is in the appropriate form, and correctly packaged and labeled prior to delivery to REECo/RWMO for storage or disposal.

REECo/RWMO controls the access to and use of the RWM areas (except for classified site control). DOE/NV approval must be obtained for NTS storage or disposal of radioactive waste of "other than NTS" origin. A letter of request for non-NTS-generated radioactive waste storage or disposal must be submitted to the Assistant Manager for Defense, DOE/NV, for consideration and approval. All users are responsible for providing the data shown in Appendix B, Part IV, to the REECo/RWMO for each package of radioactive waste of any origin.

Transuranic (TRU) contaminated waste in excess of 10 nanocuries per gram must be segregated from other radioactive wastes. These TRU wastes must be stored so that the packages may be readily retrieved in an intact contamination-free*

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*See Appendix A

condition for a period of 20 years (AEC/ERDA Manual Chapter 0511). Some TRU waste packages may require future processing at the NTS prior to shipment in order to meet Waste Isolation Pilot Plant Criteria.

No liquid radioactive wastes are to be stored or disposed of in an RWM area. Waste package size and configuration must be standardized to the maximum extent practical to permit efficient utilization of the RWMS.

Nonradioactive wastes are not to be accepted for storage or disposal in RWM areas.

Radioactive wastes containing hazardous materials as defined by Resource Conservation recovery Act (RCRA) must be identified and handled on a case by case basis by contacting DOE/NV.

Free liquids and unvented vessels or those having the capability of venting used to collect gases; pyrophoric chips, turnings, fines, and particles (i.e., pyrophoric material having dimensions less than a 0.25-inch (.635 cm) cube); liquid metals; acids; elemental alkaline metals; explosives; and other reactive materials that could cause a fire, explosion or pressure buildup, are prohibited without special shipment approval from DOE/NV.

1.6 SPECIFIC GUIDES

Procedures. Support operations within the RWM sites are provided by REECo. RWM operations include pit and trench excavation, radioactive waste storage and disposal radiological monitoring, site maintenance, and report preparation.

Limitations. DOE/NV will consider requests from DOE offices, DOE contractors, or other government agencies to ship TRU and low level radioactive waste to the NTS. These requests (not covered by a current Letter of Agreement) will be considered on a case-by-case basis. The Manager of the cognizant DOE field office must submit a written request to the Manager, DOE/NV which includes:

- chemical composition
- description of waste
- package description
- estimated number of waste packages and tentative delivery schedule
- method of shipment
- justification for shipping waste to NTS and a cost-benefit analysis, if appropriate.
- method of funding

Tritium (^{3}H) package design must be sent to DOE/NV for approval prior to shipping to NTS/RWMS.

If DOE/NV agrees to accept the waste, a Letter of Agreement between the requesting DOE field office and DOE/NV will be executed, allowing the new generator to ship to the NTS.

In order to plan for future waste shipments, forecasts of waste volume, total curie content, number and types of waste packages, number of shipments, etc., shall be provided to DOE/NV and REECo/RWMO. Forecasts are to be prepared for a 3 fiscal year period, the first fiscal year divided into 6-month increments,

i.e., October 1 through March 31, April 1 through September 30. These forecasts are to be updated every six months and are due at DOE/NV on or before September 15 and March 15. REECo/RWMO uses these forecasts to project manpower, equipment, and storage or disposal area requirements.

1.7 COSTING

Funding for costs incurred by the REECo/Environmental Sciences Department (ESD) for management of radioactive waste generated by the weapons testing program is authorized for each NTS user by the DOE/NV Program Management and Budget Division and end-costing is made to the category Technical Support - Radiological Safety. One-time costs related to radioactive waste generated offsite, e.g., initial handling, compacting, solidification, incineration, repackaging, loading, off-loading, and transportation, are funded by the DOE/ Headquarters Division of Waste Products or the waste generator, as appropriate, in accordance with fiscal responsibility. Funding for storage and disposal activities is arranged by the NV Program Management and Budget Division.

1.8 RECORDS AND REPORTS

The U.S. Comptroller General, in a report to Congress dated January 12, 1976, entitled "Improvements Needed in the Land Disposal of Radioactive Water - A Problem of Centuries," recommended that the ERDA Administrator and the NRC Chairman "direct their staffs to study ways to improve record-keeping practices at commercial and Government-owned disposal sites." This recommendation is implemented as follows.

A. Each TRU waste package shall be marked so that it can be identified from a separate set of records. Such package markings shall be designed to be legible for a period of 20 years.

B. The waste generator must prepare DOE Solid Waste Information Management System (SWIMS) Forms 735 and 736* and form RE-0167/0166 (available from REECo/RWMO) and include those items listed in Appendix B, Part VI.

C. All organizations generating, storing, or disposing of solid radioactive waste are required by AEC/ERDA Manual Chapter 0511 to complete forms 735 and 736. NV contractors shall submit one original and two copies to the NV-designated offices no later than 20 days following the reporting period.

D. REECo/RWMO submits the SWIMS data containing the radioactive waste records for each 3-month interval to DOE/NV within 20 days following the reporting period.

E. REECo/ESD prepares and submits an annual summary which includes RWM environmental monitoring data and an assessment of the effects of the RWM program on the ecology and the environment. All active RWM sites, including classified radioactive waste sites, seepage basins, cribs, and subterranean liquid injection sites, are included in the annual summary.

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*Submitted to Idaho

Section 2

RADIOACTIVE WASTE DISPOSITION PROCEDURES

2.1 PROCEDURES

The following procedures are established to facilitate proper disposition of radioactive waste at NTS. Further assistance can be obtained from the NV Radiological Operations Branch (Commercial 702-734-3181, FTS 598-3181), or at the NTS, from REECo/WMO (Commercial 702-986-0470 or 0827, FTS 546-0470 or 0827).

A. Identity, quantity, and concentrations of radionuclides in waste material must be recorded on the RE-0167/0166 form. See AEC/ERDA Manual Chapter 0511 for radioactive waste definition.

B. If TRU concentrations are greater than 10 nCi/g, prepare the waste form in conformance with criteria and packaging as described in Appendix B, Part IV. Criticality (under storage conditions) must be considered for fissile material.

C. If disposal is intended (TRU concentration is less than 10 nCi/g) and the existing radionuclides' half-lives are sufficiently long to justify disposal (or the waste cannot be held until decayed), then, prior to disposition, the physical form of the radioactive waste must be considered.

1. Solid radioactive waste must be separated into combustible or noncombustible waste and these categories further separated into compactible, noncompactible, and bulk waste.

   a. Compactible radioactive waste is to be compacted if the operation can be performed safely.

   b. Combustible and noncombustible waste shall be segregated and packaged separately. Waste packages containing combustible waste shall be marked with a bright green 10 cm (4-inch) equilateral triangle, painted on, or affixed to, the package. Labels shall be fixed to 3 locations on the sides of each drum and on each of the four sides of the boxes so as to be plainly visible to forklift operators who handle the waste package.

2. Radioactive organic waste (liquid or solid) may be reduced in volume by bacterial digestion, dehydration, or incineration by the generator. However, if these methods are unsuitable, organic material must be prepared for disposal by the addition of sufficient preservative and hydroscopic material to prevent bacterial action during the predisposal period.

3. Radioactive liquid waste* must be solidified or concentrated through evaporation and then solidified, or the radionuclide concentration reduced by ion exchange or other separation techniques and the resultant concentrate solidified before disposal.

4. Radioactive gases* may be stabilized, chemically reduced or oxidized, absorbed in charcoal, or limited quantities of an inert gas can be released under controlled conditions at the NTS. Bottled radioactive gases, further contained in a protective overpack, can be disposed of in the RWM area.

D. Bulk items (noncompactible) of TRU waste (concentration greater than 10 nCi/g) must be overpacked to permit 20-year retrievability and the outer surfaces must be contamination-free.

E. Bulk items (noncompactible) of non-TRU radioactive waste originating offsite must be contained or treated so that the outer surfaces meet Department of Transportation (DOT) regulations before transfer to a designated disposal area.

2.2 DESCRIPTION OF NTS RWM SITES AND FACILITIES

Three RWMS are established on the NTS for storage and disposal of waste. These are U3axbl (bulk waste), Area 5, and the U3fi 3-foot (0.9 meter) diameter cased shaft.

The major RWMS is located in Area 5 and accepts both classified and unclassified radioactive waste. It is surrounded by a barbed wire fence (1.2-meter [3.9 feet] 3-strand for unclassified waste; 1.2-meter [3.9 feet] 6-strand for classified waste) with entry and exit through locked gates.

*See AEC/ERDA Manual Chapter 0511-044, Operating Criteria

The Radioactive Waste Management Facility building (5-6), designed for RWM site control, is 40-feet by 60-feet (12.2 meter by 18.3 meter) prefabricated with a rigid metal frame, and a 14-foot (4.3 meter) eave height. It will house an 1,880-square foot (174.7 square meter) storage and work space, a 156 square foot (14.5 square meter) compactor room, and office, and restrooms. There will be floor drains in the work area and in the compactor area; therefore all water used for decontamination purposes will be drained via the floor drains to the outside radioactive waste open air sumps.

Facilities include trenches, pits, and pads for storage of tritium contaminated waste, low-level TRU waste, and potentially reusable activated or contaminated hardware and equipment.

Onsite-generated radioactive bulk waste is also disposed of at U3axbl. U3axbl is two subsidence craters which have been combined to form a common disposal site.

The Area 6 Decontamination Facility consists of equipment for decontaminating heavy construction equipment and critical tolerance instruments and a laundry facility for work clothing.

Dry waste compactors are located at the loading platform of the laundry facility, outside the RAMATROL Building at Mercury, and in Area 25.

2.3 SEEPAGE BASINS AT NTS

Seepage basins are unlined earth excavations within fenced areas posted with appropriate radiation warning signs. Contaminated low-level liquid waste materials from tunnels are carried to the seepage basins through subsurface pipes or by large mobile metal tanks. Percolated liquids from the seepage basins are completely absorbed by the tuff and there is no communication with subterranean aquifers. If seepage basins associated with tunnel tailing become overloaded with settled solids, they are dredged and the resulting contaminated soil removed to an RWMS for disposal.

2.4 RADIOACTIVE MATERIALS TRANSPORTATION

All shipments of radioactive material consigned to the NTS must be made in accordance with applicable DOT hazardous materials regulations and DOE/NV requirements contained herein.

Motor carriers transporting radioactive materials to the NTS should be given a copy of the map "Routes for Vehicles Transporting Hazardous Materials - Las Vegas Area" (Figure 1), familiarize themselves with the approved routes, and be instructed to follow these routes when passing through the Las Vegas metropolitan area enroute to the NTS. Those routes shown on the map have been designated and approved by the U.S. DOT.

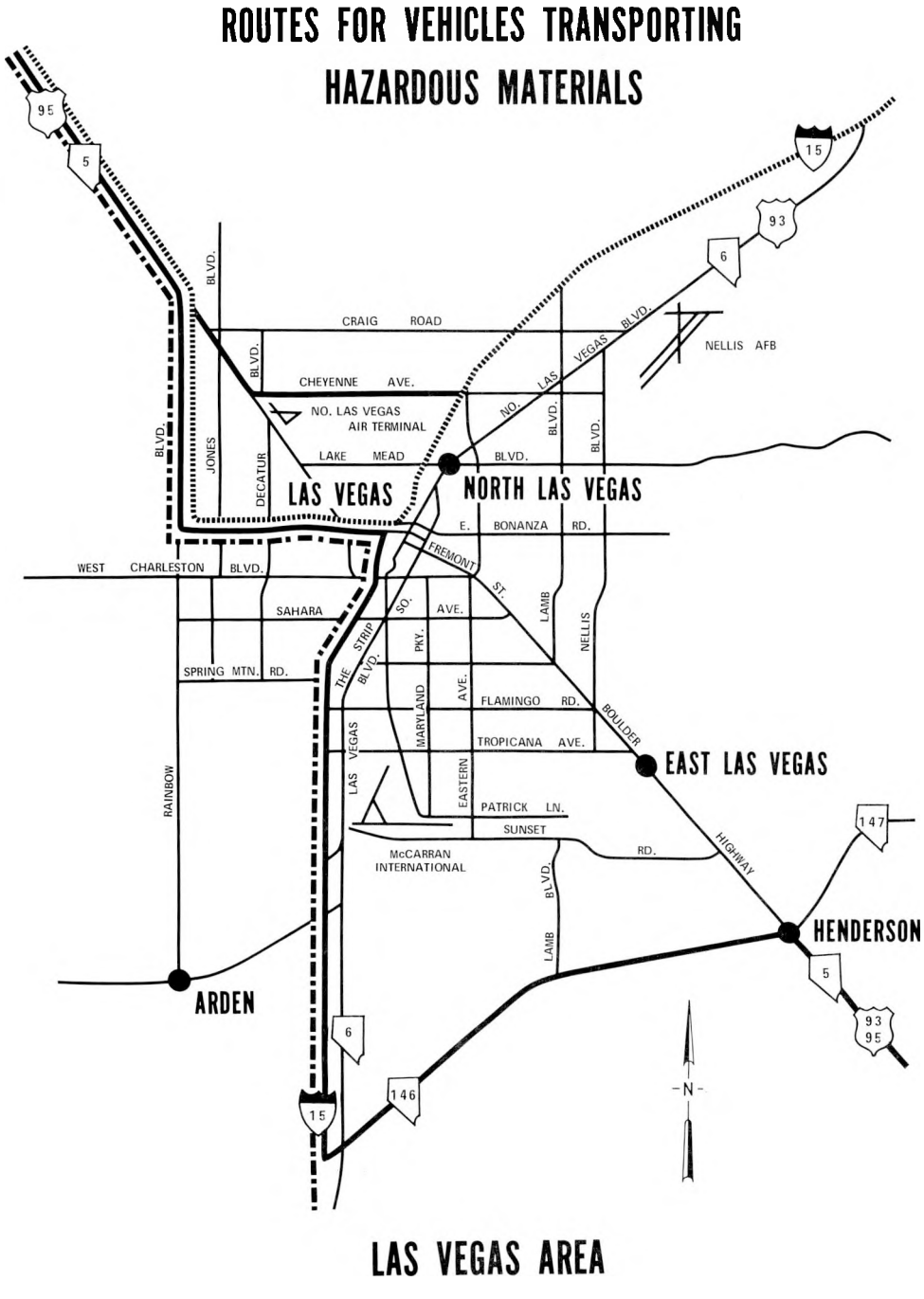

Figure 1. Routes for Vehicles Transporting Radioactive and Hazardous Materials - Las Vegas Area

Section 3

RADIOACTIVE WASTE MANAGEMENT PROCEDURES

3.1 RWMS MAINTENANCE

Trenches and pits for disposal of radioactive waste are excavated and storage pads are prepared in advance of anticipated needs. The trench and pit centerlines and corners are permanently marked with cement monuments immediately upon closure of any excavation. The pits and trenches are filled to within one meter (3.3 feet) of surface grade and covered with a minimum of 2 meters (6.6 feet) of soil which is at least one meter (3.3 feet) above the existing grade. All trench and pit areas are covered sufficiently to ensure that radiation levels at the surface are 0.2 mrem/hr or less.

3.2 RWMS OPERATION

Upon receipt of classified or unclassified radioactive waste at the RWMS, REECo/RWMO personnel:

A. Verify that retrievable storage TRU waste is packaged in accordance with Appendix B Part IV.

B. Inspect containers for package integrity, external radioactive contamination, accurate labeling (i.e., NV-211, Figure 5), and overpack, if necessary.

C. Receive the radioactive waste generator's records and obtain other RWM data (see Appendix B, Part VI), Records.

D. Process compactible waste and verify that generator's documentation notes 'solidified liquids' prior to disposal at RWMS.

E. Assign radioactive waste to an appropriate storage or disposal area.

F. Waste containers, including labeling and color coding, intended for disposal at RWMS shall meet all applicable requirements of 49 CFR 173.398(b) for packaging intended for radioactive material shipment.

3.3 RADIOACTIVE WASTE MANAGEMENT

Basic Guides. Radioactive bulk or compactible solid radioactive waste storage or disposal is permitted only at RWM areas designated by OSD/NV. Organizations on or off the NTS desiring to store or dispose of solid wastes are required to prepare their radioactive waste as indicated in Appendix B, Part I. At the NTS, transfers of bulk items, either radioactive or contaminated, to an RWM area can be accomplished through ESD/RWMO. ESD will assure that adequate precautions are taken to minimize personnel exposure and prevent the spread of contamination.

Arrangements for the disposition of radioactive wastes are to be made with REECo/RWMO at telephone number 702-986-0827, or -0470 (FTS 546-0827). If REECo/RWMO is required to provide transportation, monitoring, packaging, or waste treatment (i.e., compaction or

solidification) for radioactive waste intended for storage or disposal at the NTS, the costs* incurred will be assigned to the appropriate organization.

3.4 LIQUID RADIOACTIVE WASTE

Basic Guides. Liquid radioactive waste concentrations discharged on the ground at the NTS shall not be in excess of the Radiation Concentration Guide (RCG) values of Table II, Annex A, Appendix 0524. Tunnel seepage basins and tile fields previously established are excepted from this guidance. Continued efforts will be made at NTS to collect contaminated waters and dispose of these in subterranean debris zones at U8d and at other NV-selected event sites, or concentrate the radionuclides through evaporation, solidify the remaining sludge, and transfer it to an RWMS. Liquid radioactive waste shall be solidified prior to disposal at U3fi, U3axbl, or the Area 5 RWMS.

As technically and economically practical, cribs, seepage basins, and similar open storage facilities for contaminated liquid effluents at the NTS shall be modified with systems that have the least adverse affect on the environment.

Radioactive drilling mud and water are returned to the site of origin when practical, or transferred to U2bu to permit drying and ultimate disposal.

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*See 1.7 "Costing"

3.5 GASEOUS RADIOACTIVE WASTE

Following an underground nuclear test, one or more reentry holes are drilled back into the underground radioactive debris formed by the explosion. Samples of radioactive debris are brought to the surface for scientific analysis. During this sample recovery, small quantities of gaseous radioactive effluent may be released to the atmosphere. To minimize the effluent release the user laboratories use control equipment to either force the gases back down into the ground or filter the gases to remove particulates and radioiodines. In those cases where noble gases (primarily xenon-133) are released to the atmosphere, the volatile radionuclides are directed through a system of prefilters, high-efficiency particulates-absolute (HEPA) filters, and charcoal filters. These and any other radioactive gaseous effluents at NTS must be monitored and documented by the cognizant contractor in accordance with AEC/ERDA Manual Chapters 0513 and 0524.

3.6 CLASSIFIED RADIOACTIVE WASTE

Storage or disposal of classified radioactive waste is authorized only within the designated fenced portion of the Area 5 RWMS, or at U3fi.

Use of a classified RWMS is controlled by the DOE/NV through the Operations Coordination Center (OCC) at CP-1, phone 702-986-2781. All classified disposals at these locations must be of classified radioactive materials.

REECo/RWMO personnel monitor disposal operations to assure that all radioactive waste material is properly handled and disposed. For classified disposal, all compactible radioactive waste must be compacted or packaged in a nondispersible manner (see Appendix B).

If the TRU content requires 20-year retrievability, the classified waste must be packaged appropriately and immobilized in the classified area.

The OCC will arrange for a security patrol to stand by during disposal operations in a classified waste area.

DOE/NV Safeguards and NTS Security Branch is responsible for maintaining accountable nuclear material records* of stored or disposed of radioactive waste.

Access to a classified RWM area is limited to "Q"-cleared personnel.

3.7 TRANSURANIC WASTE MANAGEMENT

The NTS provides long-term storage for TRU radionuclides. NTS users desiring storage of TRU-contaminated waste are required by AEC/ERDA Manual Chapter 0511 to provide packaging suitable for 20-year retrievability. Appendix B, Parts IV and V, list DOE restrictions and

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*See Appendix B, Part VI, Records for Radioactive Waste

requirements for preparing TRU waste for 20-year retrievability. REECo/RWMO assists NTS users in complying with the requirements of this document.

3.8 RADIOLOGICAL MONITORING AND CONTROL

The REECo/ESD and other NTS users monitor and evaluate onsite liquid and airborne effluents, to determine compliance with Federal and state guidance, and with respect to personnel radiation protection as required by AEC/ERDA Manual Chapter 0524, and to provide for the protection of the environment as prescribed by AEC/ERDA Manual Chapter 0510.

The REECo/ESD ensures that radioactive waste materials are properly segregated and packaged before they are transported from controlled areas or Areas 25 and 26 of NTS, that they are transported directly to an RWMS in a safe manner, and that appropriate treatment is provided at the specified RWMS.

REECo/RWMO is to be advised through NV/Radiological Operations Branch, NTS users, and NV contractors of any special radioactive waste disposition problems. Certain items requiring special handling, justify advance planning to avoid excessive radiation exposure to personnel, and to limit the dispersion of contamination.

In addition to many documented radioactive waste storage areas near-surface disposal sites, cribs, selected deep subterranean low-level liquid disposal areas, and seepage basins, the NTS has numerous nuclear test locations where there is deep subsurface radioactive contamination

consisting of both fission products and TRU radionuclides. In view of these areas and conditions just described, and the extensive low-level surface contamination now being delineated and documented, radiological surveillance and control is required for an indefinite period of time at the NTS.

Appendix A

SELECTED GLOSSARY

1. Carrier

An individual, firm, co-partnership, corporation, company, association, or joint-stock association engaged in the transportation of passengers or property by:

(1) Land or water, as a common, contract, or private carrier, or

(2) Civil aircraft.

2. Combustible

Any material which can be ignited to produce fire through friction, the absorption of moisture, spontaneous chemical changes, the application of an external flame, or by any other physical or chemical means is considered combustible. If the only combustible content of a package is plastic lining or wrapping around noncombustible material which is used for contamination control purposes the package contents as a whole may be considered noncombustible.

3. Contamination-Free

Removable beta-gamma radioactive contamination is not significant if the average amount of radioactive contamination as measured on the wiping material does not exceed 10 percent of 10^{-10} curies per square centimeter or 220 disintegrations/minute per square centimeter when averaged over 300 square centimeters. Alpha emitters shall not exceed 10^{-11} curies per square centimeter or 22 disintegrations/minute per square centimeter when averaged over 300 square centimeters. Swiping techniques shall be described in Title 49 CFR 173.397

4. Disposal

The placement of radioactive waste in a manner which is considered permanent so that routine recovery is not provided for.

5. High-Level Wastes

High level wastes (HLW) are either intact fuel assemblies that are being discarded after having served their useful life in a nuclear reactor (spent fuel) or the portion of the wastes generated in the reprocessing of spent fuel that contain virtually all of the fission products and most of the actinides not separated out during reprocessing. These wastes are being considered for disposal in geologic repositories or by other technical options designed to provide long-term isolation of the wastes from the biosphere.

6. TRU Contaminated Solid Waste

Retrievable waste that can be handled, packaged, stored, and retrieved without shielding and without accumulation of significant doses of direct radiation, and which meets the definition of solid radioactive wastes. Examples are expendable material such as absorbent tissues, clothing, gloves, plastic bags, solidified sludge, and equipment removed from plutonium processing and fabrication facilities.

7. Low-Level Waste

Low-level wastes (LLW) includes all radioactive waste not classified as high level spent fuel, TRU, or uranium mill tailings. Low-level wastes are generated in almost all activities involving radioactive materials and are presently being disposed of by shallow land interment.

8. Management (Waste)

The planning (including design and process improvement), execution, and surveillance of essential functions related to control of radioactive waste, including solidification, initial or long-term storage, and disposal.

9. Operations

Broad classification of waste management activities in terms of their basic function (e.g., waste storage, treatment, transportation or disposal).

10. Overpack

Secondary (or additional) external containment for packaged nuclear waste.

11. Package

The packaging together with its radioactive contents but excluding any shielding added solely for transport safety.

12. Packaging

The assembly of components necessary to contain retrievable and non-retrievable waste in a manner that ensures compliance with the requirements of this document.

13. Radioactive Waste Generator

A person, persons, or organization whose activities with radioactive material, accelerators, or nuclear reactors result in radioactive waste as a by-product.

14. Radioactive Waste Management Areas

Any NTS location where waste handling, storage or disposal is conducted (i.e., retention basins, seepage ponds, exhaust systems, injection wells or tile fields).

15. Radiolytic

Pertaining to any chemical reaction induced by radiation. (For example, hydrogen gas can be produced from a hydrogenous substance when it is subject to energetic alpha radiation.)

16. Retrievability

Capability to remove waste from its place in final storage. The method and rate of removal and the subsequent location of the waste must satisfy retrievability criteria.

17. Retrievable Storage

Radioactive waste retention under control and surveillance in such form and location that (a) no further processing or manipulation is considered necessary for a period up to 20 years, and (b) the packages can be readily retrieved in an intact and contamination-free condition during this period.

18. Retrievable Transuranium-Contaminated Solid Waste (Retrievable Waste)

Any solid waste material contaminated with certain longer-lived alpha-emitting transuranium elements (greater than 10 nCi/g) that may, under pending Nuclear Regulatory Commission (NRC) regulations, be required to be transferred by licensees to a DOE site(s). The radionuclides include plutonium and transplutonium nuclides with half-lives of 30 years or

greater. These wastes are classified into the categories of low-gamma and high-gamma transuranium-contaminated solid waste, based upon radiation levels of the waste packages during the storage period.

19. Shipper

As used herein, the "shipper" is the originator and the generator of the radioactive waste shipment.

20. Short-Lived Nuclides

Radioactive isotopes with half-lives no greater than about 30 years, e.g., ^{137}Cs and ^{90}Sr.

21. Solid Radioactive Waste

Radioactive waste material in an essentially dry solid form. This includes liquids which have been entrapped or otherwise solidified, so that they will retain their solid form without the presence of free liquids during handling, transportation, storage, or disposal (see ANSI N14.9.1).

22. Solidification

Conversion of radioactive waste to a dry, stable solid; no free liquids.

23. Storage Facility

An engineered structure such as a covered pad concept, warehouse-type structure, or existing DOE building which will be used for storage of retrievable wastes at a designated DOE site.

24. Transportation

Movement of materials between sites. Includes alternative methods for packaging, handling, and transport of waste materials and plutonium compounds. Concepts include all conventional methods of land and water transport required by the waste management system.

25. Transuranic Elements

Elements with an atomic number greater than 92. They include neptunium, plutonium, americium, and curium.

26. Transuranic Waste (TRU)

TRU wastes result predominantly from spent fuel reprocessing, the fabrication of plutonium to produce nuclear weapons, and, if it should occur, plutonium fabrication for recycle to nuclear reactors. TRU waste is currently defined as material containing more than 10 nanocuries of alpha activity per gram of material. This numerical value is presently under study by NRC and may be increased. If this happens, the TRU waste volumes would decrease. The recategorized wastes would then be low-level and suitable for intermediate depth disposal.

27. Treatment By Generators

Operations intended to benefit safety or economy by changing the waste characteristics. Four basic treatment concepts are:

a. Volume reduction

b. Immobilization of radioactivity

c. Change of composition

d. Removal of radioactivity from the waste

Appendix B

PART I

LOW LEVEL RADIOACTIVE WASTE TRANSFER REQUIREMENTS

To prepare and transfer radioactive waste to the NTS-RWM sites, all radioactive waste generators must:

A. Contact REECo/RWMO* for designation of RWM sites, records, etc.

B. Consider and effect all applicable requirements listed below:

1. Complete records of all radioactive waste (see Part VI of this Appendix, page 47) must be submitted to RWM personnel.

2. Radioactive contamination on external surfaces should be fixed or covered sufficiently for safe transfer, or if from off-NTS locations, not greater than those values given in DOT, Title 49 CFR 173.397.

---

*Phone 702-986-0827/0470 at NTS for further information.

3. Compactible radioactive waste shall be compacted, following separation from noncompactible components, before disposal at the NTS.

4. Combustible radioactive waste must be packaged to exclude other components of combustion (i.e., oxidizing or reducing agents). Combustibles being offered for disposal must be packaged and clearly identified to permit handling at the RWMS without the risk of fire.

5. No radioactive waste package shall contain free liquids. All liquids must be entrapped or solidified so as to be immobilized. For example, the radioactive liquid wastes must be treated in such a manner as to eliminate the chance of fluidity dispersibility or freedom of movement within the package. At the NTS, depending on origin, certain liquids having a low radionuclide concentration may be excepted from solidification, if the method of disposal has NV concurrence and an NTS Operations Permit.

6. Radiation dose rates for radioactive waste packages received from off-NTS locations shall not exceed DOT, Title 49 CFR 173.393 shipping regulations for the outer container.

7. Radioactive waste containing unstable materials must be made inert by suitable techniques or packaged separately, clearly labeled, and transferred to an NTS-RWMS in accordance with DOT regulations.

8. All organic material must be prepared for disposal by dehydration or by the addition of sufficient preservative and desiccant to prevent bacterial action or free liquid, or entombed in concrete, before disposal.

9. Radioactive gases may be chemically reduced or oxidized, or absorbed in charcoal to prepare them for disposal; however, in the case of inert gases, limited quantities may be released at the NTS under controlled conditions, having had prior NV approval. Bottled radioactive gases further contained in a protective overpack can be disposed of at an RWMS.

10. Bulk items of contaminated or radioactive waste for which packaging is not practical will be transferred to the RWMS at U3axbl for disposal. Bulk items of classified debris must be transferred to the Area 5 RWMS for disposal.

C. Documentation Required

1. A bill of lading or "Radioactive Material Shipment Record" (NV-152) is required for each shipment.

2. The original and one copy of completed Form RE-0167/0166 "Radioactive Waste Storage and Disposal" (Figures 2 and 3) shall accompany each shipment. The data required by the RE-0167/0166 may be furnished by alternate methods (computer tapes) if approved by DOE/NV and REECo/RWMO. These documents should be addressed to:

• *See Instructions on Reverse*

Prepared By

Date Area Code Phone

Approved By Responsible Personnel

Date Area Code Phone

SECTION 1

SHIPMENT NUMBER (MANDATORY)	OPER. OFFICE	CONTRACTOR CODE	SITE	OPER. TYPE	FISCAL YEAR	FISCAL QTR.	STORAGE AND DISPOSAL DATE (Y Y M M D D)	ACTUAL or FORE.	NUCLIDE	C=Curie CURIE QUANTITY	F=Cu.Ft. M=Cu.M K=Gal. L=Liter GROSS VOLUME	K=Kilogram P=Pound G=Gram GROSS WEIGHT
2	9	10 11 12 13	14	15	16	17	18 19 20 21 22 23	24	25	26 34	35 36 44	45 46 54

SECTION 2

NUCLIDE DESCRIPTION	C=Curie G=Gram QUANTITY	SEQUENCE	COMMENTS
2	15 16 24	25 26 27	75
3			
3			
3			
3			
3			
3			
3			

SECTION 3

Waste Codes	F=Cu.Ft. M=Cu.M K=Gal. L=Liter VOLUME	% COMB.	K=Kilograms P=Pound G=Gram WEIGHT	SEQUENCE	COMMENTS
2 3	4 12	13 14 16	17 25	26 27	28 75
4					
4					
4					
4					

SECTION 4

TREAT	F=Cu.Ft. M=Cu.M K=Gal. L=Liter VOLUME BEFORE TREATMENT	F=Cu.Ft. M=Cu.M K=Gal. L=Liter VOLUME AFTER TREATMENT	K=Kilograms P=Pound G=Gram WEIGHT BEFORE TREATMENT	K=Kilograms P=Pound G=Gram WEIGHT AFTER TREATMENT	SEQUENCE	
2 3	3 11	12 13 21	22 23 31	32 33 41	42 43	44 75
5						
5						
5						

SECTION 5

CONTAINER NUMBER (a)	SEAL NUMBER	SERIAL NUMBER	FILL DATE	CLASS CODE	CONTENT CODE	ATTRIBUTE CODE	P=Pounds K=Kilograms GROSS WEIGHT	F=Cu. Ft. M=Cu. M K=Gal. L=Liter GROSS VOLUME	RADIATION AT SURFACE mrem/h	RADIATION AT 3 FT. mrem/h	COST CODE
2 6	7 12	13 18	19 24	25 28	29 31	32 35	36 44	45 46 54	55 56 63	64 71	72 75
6											
6											
6											

CONTAINER NUMBER (b)	PRIMARY CHEM. SYMBOL & ISOTOPE	P=Pound K=Kilogram G=Gram PRIMARY UNIT PRIMARY ISOTOPE WEIGHT	C=CURIE CURIE QUANTITY (PRIMARY)	C	SECONDARY CHEM SYMBOL & ISOTOPE	P=Pound K=Kilogram G=Gram SECONDARY UNIT SECONDARY ISOTOPE WEIGHT	C=CURIE CURIE QUANTITY (SECONDARY)	C	DISPOSAL LOCATION NV GRID COORD. NORTH	EAST	Tier	7475
2 6	7 12	13 21	22 23 31	32	33 37	38 46	47 48 56	57	58 64	65 71	72 73	
7												
7												
7												

DISTRIBUTION:
1st Copy - RWMS
2nd Copy - Originator

RE-0167 (8/80)

Figure 2. Radioactive Waste Management - Storage and Disposal Form RE-0167

SECTION 1

SHIPMENT NUMBER (MANDATORY) 2–9	OPER. OFFICE / CONTRACTOR CODE 10–11	SITE 12–13	OPER. TYPE 14	FISCAL YEAR 15–16	FISCAL QTR. 17	STORAGE AND DISPOSAL DATE Y Y M M D D 18–23	ACTUAL or FORE NUCLIDE 24–25

Prepared By

Date Area Code Phone

Approved By Responsible Personnel

Date Area Code Phone

SECTION 5

CONTAINER NUMBER (a) 2–6	SEAL NUMBER 7–12	SERIAL NUMBER 13–18	FILL DATE 19–24	CLASS CODE 25–28	CONTENT CODE 29–31	ATTRIBUTE CODE 32–35	GROSS WEIGHT (P=Pounds K=Kilograms) 36–44	GROSS VOLUME (F=Cu. Ft. M=Cu. M K=Gal. L=Liter) 46–54	RADIATION AT SURFACE mrem/h 56–63	RADIATION AT 3 FT. mrem/h 64–71	COST CODE 72–75
6											
6											
6											
6											
6											
6											
6											
6											
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CONTAINER NUMBER (b) 2–6	PRIMARY CHEM. SYMBOL & ISOTOPE 7–12	PRIMARY ISOTOPE WEIGHT (P=Pound K=Kilogram G=Gram PRIMARY UNIT) 13–21	CURIE QUANTITY (PRIMARY) (C=CURIE) 22–31 C	SECONDARY CHEM SYMBOL & ISOTOPE 32–37	SECONDARY ISOTOPE WEIGHT (P=Pound K=Kilogram SECONDARY UNIT) 38–46	CURIE QUANTITY (SECONDARY) (C=CURIE) 47–56 C	DISPOSAL LOCATION NV GRID COORD. NORTH 57–64 EAST 65–71	Tier 72–73	74–75
7									
7									
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DISTRIBUTION:

1st Copy - RWMS
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Figure 3. RWM - Storage and Disposal (Continuation Sheet) Form RE-0166

RE-0166 (8/80)

Site Manager

Radioactive Waste Management Operations

Reynolds Electrical & Engineering Co., Inc.

Post Office Box 14400

Las Vegas, NV 89114

3. When accountable source and special nuclear material is involved, DOE/NRC Form 741 "Nuclear Material Transaction Report" (Figure 4) shall be executed and forwarded to the DOE Safeguards and Security Division prior to the shipment.

D. Exception or Nonstandard Shipment Requirements

DOE/NV must approve all exceptions to the criteria specified in this document. A safety analysis will be required for any exceptions which will increase the fissile loading, affect the container 20-year integrity, and/or other areas that would be considered significant areas of noncompliance. All exceptions must be approved by DOE/NV prior to shipment.

Any container, other than those listed previously, shall have a safety analysis submitted to DOE/NV for approval prior to use. Each container in this category must support a uniformly distributed load of 750 pounds (340.2 kilograms) per square foot (0.0929 square meter) which is required to support other waste packages and earth cover, without crushing during the stacking and covering operation. In addition, the waste package must be suitable for handling with a mechanical unit such as a forklift.

DOE/NRC FORM 741
REV. (7-78) DP

10 CFR 30, 40, 50, 70, 75, 150

Previous editions are obsolete

U.S. DEPARTMENT OF ENERGY AND U.S. NUCLEAR REGULATORY COMMISSION

NUCLEAR MATERIAL TRANSACTION REPORT

Approved by GAO
B-180225 (R0040)

1. SHIPPER'S RIS (1-4)	2. RECEIVER'S RIS (5-8)	3. TRANSACTION NO. (9-14)	4. CORRECTION NO. (15)	5. PROCESSING CODE (16) SHIPPER	5. PROCESSING CODE (16) RECEIVER	6. RESERVED (17)	7. ACTION CODE (18) SHIPPER	7. ACTION CODE (18) RECEIVER	8. DATA CODE (19)	DOCUMENTATION (Only if document is classified SECRET) PAGE OF PAGES COPY OF COPIES, SERIES

9. A. NAME AND ADDRESS OF SHIPPER	B. LICENSE NO.	10 A. NAME AND ADDRESS OF RECEIVER	B. LICENSE NO.	11. NO. OF DATA LINES 1(20-21)	12. NATURE OF TRANSACTION 1(22)
C. ATTENTION D. TELEPHONE		C. ATTENTION: D. TELEPHONE		13. A. SHIPPED FOR ACCOUNT OF	B. RIS 1(23-26)
				14. A. SHIPPED TO ACCOUNT OF	RIS 1(27-30)

NO	DISTRIBUTION OF COPIES
1	
2	
3	
4	
5	
6	
7	
8	
9	

15. TRANSFER AUTHORITY - CONTRACT, NRC DRAFT, OR ORDER NUMBER 1(34-50)

16. EXPORT OR IMPORT TRANSFERS: A. LICENSE NO. 3(22-31)
B. U.S. PORT EXIT/ENTRY 3(32-35)

17. MATERIAL TYPE AND DESCRIPTION

21. MISCELLANEOUS

18. TRANSPORTATION PROFILE A. TRIP SEG.	B. CARRIER IDENTIFICATION	C. TRANSFER POINT	19. PACKAGE IDENTIFICATION A. MODEL ID	B. NUMBER	20. ACTION DATE	MONTH 1(70-71)	DAY 1(72-73)	YEAR 1(74-75)
1	3(36-39)	3(40-44)	4(22-25)	4(26-28)	A. SHIPMENT			
2	3(45-48)	3(49-53)	4(29-32)	4(33-35)	B. SHIPPER'S CORRECTION			
3	3(54-57)	3(58-62)	4(36-39)	4(40-42)	C. RECEIPT			
4	3(63-66)	3(67-71)	4(43-46)	4(47-49)	D. RECEIVER'S MEASUREMENT			
5	3(72-75)		4(50-53)	4(54-56)	E. RECEIVER'S CORRECTION			

22. TOTAL GROSS WEIGHT 4(57-66)

23. TOTAL VOLUME *(Waste Transfers Only)* 4(67-75)

	LINE NO. 2(5-20-21) A.	TYPE OF INV. CHANGE 2(22-23) B	IDENTIFICATION (BATCH NAME) 2(24-39) C.	NO. OF ITEMS 2(40-43) D.	PROJECT NUMBER 2(44-53) E.	MATERIAL TYPE 2(54-55) F.	COMP./ FACILITY CODE 2(56-59) G.	PROD CODE 2(60) H.	OWNER CODE 2(61) I.	COUNTRY CONTROL NUMBER 2(62-69) J.	KEY MEAS. POINT 2(70-71) K.	MEAS. IDENT. L. 1 BASIS 2(72)	2 DMP 2(73-74)	3 METHOD 2(75)	GROSS WEIGHT M.	NET WEIGHT N.	ELEMENT WEIGHT 5(43-53) O.	ELEMENT LIMIT OF ERROR 5(54-58) P.	WEIGHT % ISOTOPE 5(59-64) Q.	ISOTOPE WEIGHT 5(65-75) R.	ISOTOPE LIMIT OF ERROR 5(76-80) S.
24. SHIPPER'S DATA																					

24. SHIPPER'S DATA
V. SIGNATURE OF AUTHORIZED OFFICIAL AND DATE SIGNED

25. RECEIVER'S DATA
T. SIGNATURE OF AUTHORIZED OFFICIAL AND DATE SIGNED

25. RECEIVER'S DATA																					

18. U.S.C. SECTION 1001, ACT OF JUNE 25, 1948, 62 STAT. 749, MAKES IT A CRIMINAL OFFENSE TO MAKE A WILLFULLY FALSE STATEMENT OR REPRESENTATION TO ANY DEPARTMENT OR AGENCY OF THE UNITED STATES AS TO ANY MATTER WITHIN ITS JURISDICTION

GPO 931 032

Figure 4. Nuclear Material Transaction Report DOE/NRC 741

APPENDIX B

PART II

DOE/NV CERTIFICATION REQUIREMENTS FOR THE PACKAGING AND SHIPPING OF LOW LEVEL RADIOACTIVE MATERIALS TO AND FROM THE NEVADA TEST SITE

I. Basic Criteria

A. Title 49, Code of Federal Regulations (U.S. Department of Transportation)

B. Operational Radioactive Waste Management Plan for the Nevada Test Site (NVO-185, latest revision).

C. U.S. Department of Energy Environmental Safety, and Health Manual (Draft Order 5001), Chapters I and II

D. Other applicable Department of Energy/Nevada Operations Office/Nevada Test Site - Standard Operating Procedures, and Department of Transportation Regulations

II. DOE/NV Certification Requirements

A. For Defense low-level waste, packaging shall be consistent with NVO-185 (latest revision) using the DOT 17C or 17H steel drums and DOT 7A 4 ft. x 4 ft. x 7 ft. (1.2m x 1.2m x 2.1m) wooden boxes as the primary shipping containers.

B. A certifying label (NV-211), furnished by DOE/NV (Figure 5) shall be affixed to each package offered for shipment. This will certify, by the certifying official's signature on each package, that inspection is in accordance with DOT and DOE/NV requirements. This label will provide highly visible confirmation that a knowledgeable, responsible person has made proper certification of an intended radioactive shipment/package.

Each shipper/generator is to provide REECo/ESD, through the cognizant field office and NV Radiological Operations Branch, with the name(s) of a knowledgeable, responsible individual (designated as such by the organization's top management) as the certifying official(s). Each label must be legibly signed manually. REECo/ESD personnel will observe/monitor compliance with all requirements and provide the DOE/NV Radiological Operations Branch with documentation of any breach of DOT or DOE/NV requirements within a 24-hour period after discovery.

If, upon evaluation of the documentation (in regard to a shipping/packaging violation) DOE/NV determines that action should be taken, the shipper/generator will be requested through the cognizant field

NV-211

PACKAGING CERTIFICATION

THIS CERTIFIES THAT THIS PACKAGE AND ITS CONTENTS ARE IN ACCEPTABLE CONDITION FOR TRANSPORTATION ACCORDING TO DOT & DOE/NV REQUIREMENTS.

DATE: _____

CERTIFIED BY: _____

TITLE: _____

ORGANIZATION: _____

Figure 5. Packaging Certification Label – NV-211

office to replace the certifying official. If two (2) violations are noted in any six-month period, the shipper/generator shall be denied disposal privileges until the problems can be resolved with the DOE field office personnel and their cognizant shipper/generators. Standard operating procedures shall be established and documented (if not in effect by the shipper/generator) covering their entire packaging and shipping operations. A packaging and shipping quality assurance audit shall be performed by the shipper/generator at least on an annual basis. Documented training of all personnel responsible for shipments shall be available for inspection by any DOE official, and updated annually. Certification of shipping papers and containers shall be made by similar responsible administrative personnel as outlined above.

Regulations listed under basic criteria shall be made available by shipper management to all personnel involved in the packaging and shipping process. A procedure shall be established to keep these regulations updated. Inspections, in conjunction with the cognizant DOE field office, shall be conducted as required at the shipper's facility. DOE/NV review of routing and transportation requirements shall be obtained prior to shipping.

For Defense low-level waste shipments, the shipper is to notify REECo/RWMO, (FTS 546-0827) of the pending shipment and estimated date of arrival (for operational planning purposes).

APPENDIX B

PART III

PROCEDURES FOR NOTIFICATION AND DELIVERY OF LOW LEVEL WASTE TO THE NEVADA TEST SITE

In order to facilitate the receiving and handling of low level waste at the Nevada Test Site, all generators are required to comply with the following procedure. Past experiences have proven this policy to be an invaluable tool in preventing delays or problems for the generators carriers and the Test Site personnel.

Prior to departure from point of origin, contact the REECo Traffic Section at (702) 986-0180 (commercial number) or 546-0180 (FTS), and provide the following data:

> Time of departure from shipping point, estimated time of arrival at the NTS; carrier, tractor/ trailer numbers; description of load (pieces and weight); seal numbers; driver's name; and any additional information deemed necessary.

The hours for receiving are 0800 to 1500, Monday through Friday, except holidays. In the event that a shipment arrives too late to off-load, the REECo Duty Officer will escort the driver to a secured compound area designated for overnight storage.

Housing is available onsite and can be pre-arranged by the REECo Traffic Section, or the Duty Officer will make accommodations available upon arrival after hours.

APPENDIX B

PART IV

SPECIFICATIONS AND REQUIREMENTS FOR TRANSURANIC RETRIEVABLE WASTE PACKAGING

These specifications and requirements are based on current waste management practices and philosophies, and expanded upon in LA-5645, "Guidelines for the Interim Storage of AEC-Generated Solid Transuranic Wastes." However, it should be recognized that these requirements must be tailored to the specific waste and storage environment, and may therefore be modified as part of the contractual agreement between the generator and DOE.

A. Waste Form Criteria

1. Combustible Materials

Combustible materials must be avoided whenever possible. Combustible waste shall be segregated from noncombustible waste and packaged separately.

2. Pyrophoric or Explosive Materials

Positive steps must be taken to ensure that pyrophoric materials, explosive materials, and cylinders of compressed gases (including unpunctured aerosol cans) are converted to a nonreactive form before packaging.

3. Spontaneous Combustion

Materials which could lead to spontaneous combustion (i.e., strong oxidants in combination with oils, greases, solvents, or other materials) shall not be combined within a waste package.

4. Toxic Materials

Highly toxic materials contaminated with transuranic elements shall be identified in accordance with RCRA 1976 in order to permit special handling, treatment, or packaging at the storage site to minimize the hazards to the site operators.

5. Free Liquids

The waste must contain no free liquids. Waste containing liquids shall have an absorbent and/or stabilizer added and mixed so that there will be no free liquid during packaging, handling, transport, and storage. For example the radioactive liquid wastes must be treated in such a manner as to eliminate the characteristics of fluidity, dispersibility, or freedom of movement within the packaging.

6. Nuclear Safety

The quantity of fissile materials within a package must be limited so that an infinite array of such packages will remain subcritical,

even with close water reflection on all sides. This quantity must be determined on the basis of a specific nuclear safety analysis, considering credible accident situations, and taking into account the actual materials in the waste.

7. Nuclear Heating

The quantity of radioactive materials must be limited for each waste matrix and package type so that the effects of nuclear decay heat will not adversely affect the physical or chemical stability of the contents or package integrity.

Accessible external package surfaces shall not exceed 100°C (212°F) (ambient temperature 25°C [77°F]) nor shall the heat source exceed 10 watts per package.

8. Radiation Dose Rate

The radiation dose rate (mrem/hr) for packages of TRU retrievable waste must not, considering the ingrowth of radioactive nuclides, exceed the defined radiation package limit* during handling, shipment, and retrievable storage.

9. External Contamination

Packages must be contamination-free upon receipt at the NTS RWMS. See page 26 for further explanation.

10. Stability of Contents

The combination of the waste matrix and waste packaging must be such that no spontaneous chemical or physical reaction would limit the life of the retrievable package.

11. The waste generator must load the waste packages to ensure that the interior volume is efficiently and compactly loaded with radioactive material. This high density loading will reduce the number of radioactive waste shipments and enhance RWMS space utilization.

B. TRU Waste Packaging

DOE currently uses the following type packagings, which are approved for waste packaging:

1. Approved Packaging for TRU Waste

a. Specifications

(1) DOT 17H or 17C 208-liter (55-gallon) drums. The DOT 208-liter (55-gallon) drums must contain a rigid 2.3 mm (90 mil) molded polyethylene liner. (Figure 6)

---

*200 mrem/hr on contact and 10 mrem/hr at one meter

(2) DOT 6M 208-liter (55-gallon) drums and DOT 2R specifications (49 CFR 178.34) for the inner pipe. DOT 6M 208-liter (55-gallon) drums shall contain the 2R container firmly supported by solid fibrous material in the center of the outer 17C drum. Waste placed in the 2R container shall be sealed in a plastic wrapping at least 0.15 mm (0.006 inch) thick. (Figure 7)

(3) The DOT 17H 114-liter (30-gallon) drum is a standard steel drum constructed of 18-gauge material with a removable head. (Figure 8)

(4) The DOT 7A specification wooden box is an externally cleated plywood box normally 4 ft x 4 ft x 7 ft (1.2 m x 1.2 m x 2.1 m) long (Figure 9). These boxes are being replaced by the box shown in Figure 10.

The DOT 7A specification wooden box is a flush panel plywood box with internal stiffeners (Figure 10).

The DOT 7A specification fiberglass flush panel box contains a fiberboard liner and a PVC liner (Figure 11).

(5) The DOT 7A steel box is a 50-3/8" x 58-3/8" x 72-3/8" (127 cm x 147 cm x 182 cm) rectangular steel box used for the shipment of waste in non-DOT approved containers or,

as an overpack in the shipment of DOT approved containers (Figure 12). When used as an overpack, it will hold eight 17C 55-gallon (208-liter) drums in two layers of four drums each, or twelve 17H 30-gallon (114-liter) drums in two layers of six each. This box does not require a security seal when being used as an overpack provided that each DOT approved inner package contains a security seal.

b. Packaging Requirements

(1) Each DOT Spec 17H or 17C drum or DOT Spec 6M metal packaging must have attached to it a uniquely numbered sealing device which will preclude removal of the lid without destroying the seal. Acceptable sealing methods include (a) spot welding a uniquely numbered metal strap across the tightened drum closure ring lugs, or (b) the placement of a uniquely numbered padlock-type stainless steel/plastic seal through a hole in the threaded end of the bolt within 1.27 cm (1/2-inch) of the tightened closure ring lug. The drum closure ring lug must be torqued to 54 newton-meters (40 foot-pounds).

(2) For DOT Spec 7A fiberglass-coated wooden boxes, the fiberglass coating applied by the waste generator may serve as the sealing device. Each such box must be identified by a metal tag with a unique number on one side and the top. Weight is not to exceed 5 tons.

(3) DOT 17H or 17C drums are limited to not more than 200 grams (0.44 lb) of fissile materials as defined in 49 CFR Part 173.396.

(4) DOT 6M drums are limited to not more than 500 grams (1.1 lb) of fissile material.

(5) DOT 7A fiberglass coated wooden boxes are limited to not more than 5 grams (0.01 lb) of fissile material per cubic foot (0.03 cubic meter) of waste and not more than 350 grams (0.77 lb) of fissile material per box.

(6) Each package containing combustible waste must be clearly marked with two bright green 10 cm (4-inch) equilateral triangles on opposite sides of the package and one on the top.

Labels shall be affixed to three locations on the sides of each drum and on each of the four sides of the boxes so as to be plainly visible to forklift operators who handle the waste package.

(7) The quantity of radioactive material in each package must be limited so that the total heat generated by radioactive decay during transportation and storage does not exceed 10 watts per package.

(8) The waste generator shall package all waste to minimize gas buildup. The amount of activity on hydrogenous materials must be restricted to less than 4×10^5 nCi of alpha activity per gram of waste, provided the total activity in a 55-gallon (208 liter) waste package does not exceed 14.6 curies. This quantity corresponds to about 200 grams (0.44 lb) of weapons grade plutonium or 1 gram (0.002 lb) of heat source grade plutonium in a 55-gallon (208-liter) waste package (200 grams [0.44 lb] fissionable material limit). The maximum curie limit for containers of different sizes is considered to be directly proportional to the fissionable material limit. The total activity permitted in a 30-gallon (114-liter) waste package (100 grams [0.22 lbs] fissionable material limit) would be 7.3 curies.

The exterior of all packages must be reasonably free of dirt, moisture, rust and removable surface contamination. A condition of waste packages outer surfaces, as determined by appropriate swipe surveys or direct radiation instrument surveys, which when used under standard radiation work procedures for the NTS, will not require respiratory protection during package handling. Removable beta-gamma radioactive contamination is not significant if the average amount of radioactive contamination as measured on the wiping material does not exceed 10 percent

of 10^{-10} curies per square centimeter or 220 disintegrations/minute per square centimeter when averaged over 300 square centimeters. Alpha emitters shall not exceed 10^{-11} curies per square centimeter or 22 disintegrations/minute per square centimeter when average over 300 square centimeters. Swiping techniques shall be described in Title 49 CFR 173.397.

2. Packaging - Design Criteria

Tables 1 & 2 provide specific packaging criteria. These criteria, along with the associated general criteria cite the requirements for acceptable packaging on which waste will be accepted at NTS.

Retrievable Waste Packaging Criteria - All other packagings used for containment of retrievable waste must satisfy the specifications listed below. Specific analyses shall be provided for review and prior approval by DOE to ensure that the package requirements are adequate for retrievable storage.

a. The package closure must be sturdy enough that it will not be breached under normal handling conditions and will not serve as a weak point for package failure. Package closure methods must provide positive sealing such as provided by welding, complete fiberglass resin coating, or durable gasketing with bolt closures. The sealing method must be adequate to ensure that the package cannot be opened without destroying the seal.

b. Fire Prevention

Combustible materials must be packaged in such a manner that a fire occurring in one package will not propagate to another package.

c. Design and Construction

All waste to be stored retrievably must be contained by two independent barriers, both of which have an expected lifetime meeting retrievable storage requirements and together meet criteria specified in the DOT Hazardous Material Regulations [49 CFR 170-189, paragraph 173.24(c)]. Any material used as shielding to reduce the external radiation must also have an expected lifetime of 20 years.

d. Package Strength

If waste generators use packages other than the standard container packages described in this section, the waste generator must submit drawings of the container and containment systems for DOE/NV concurrence. In addition, the waste package must be, through good engineering means, capable of supporting a uniformly distributed load of 750 pounds (340.2 kilograms) per square foot (0.0929 square meter), which is required to support other waste packages and earth cover without crushing during

stacking and covering operations. The waste packages must also be suitable for handling with a mechanical unit such as a forklift or crane.

e. Package Color

All external TRU waste packaging must be light in color to reflect radiant heat.

f. Corrosion Protection For TRU Containers

External packaging surfaces must be coated with corrosion inhibitors (such as primers, paints, galvanizing, fiberglass, and resin coatings, etc.) with characteristics to ensure corrosion protection during handling, transportation, and storage.

3. Protection of Packages

a. Damage to Packages

Each waste package shall be prepared for shipment so as to minimize damage during transit. Minor damage incurred during transit, not attributable to poor packaging, will be repaired at the NTS without charge to the waste generator. Damage caused by waste generator or carrier negligence may be backcharged to the waste generator.

b. Pre-Shipment Environment

The pre-shipment storage environment must be controlled to avoid adverse influence on the containment ability of the waste package throughout the handling, transport, and retrievable storage. The generator or NTS user preparing waste for storage shall take all reasonable precautions to preclude accumulation of moisture on packages prior to their arrival at the NTS Area 5 RWMS.

Preplanning the loading of each package is essential to the reduction of waste shipments to NTS and the space required for storage. Storage space at NTS is limited; consequently, volume reduction at the waste generator's facilities must receive increased emphasis.

DOT SPEC. 17C STEEL DRUM (55 gallon)

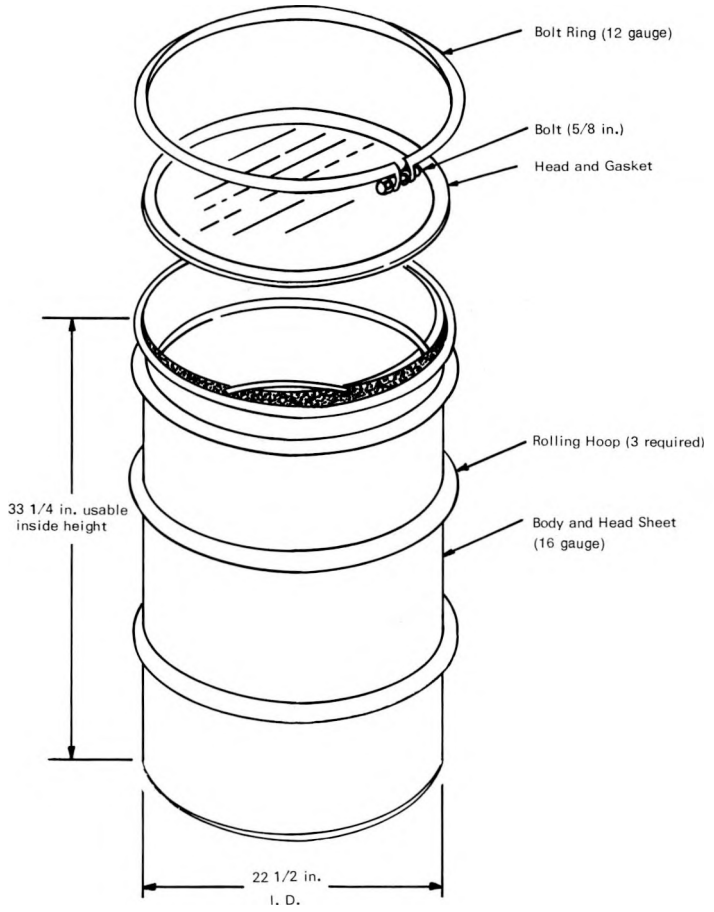


Figure 6. DOT 17C or 17H 55-Gallon (208-Liter) Drum

DOT SPEC. 6M PACKAGING

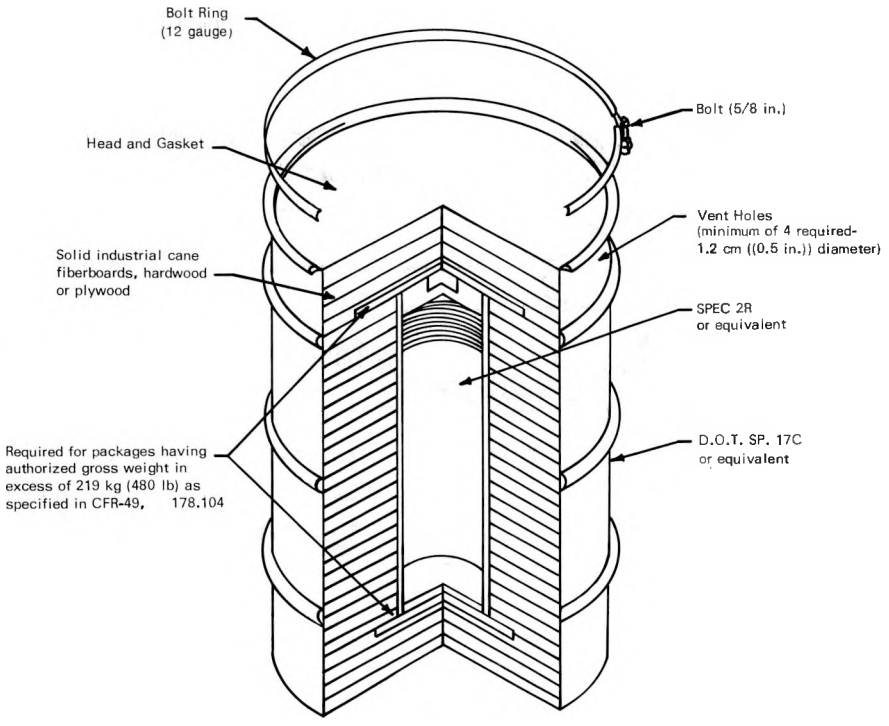


Figure 7. DOT 6M 55-Gallon (208-Liter) Drum

DOT SPEC. 17H STEEL DRUM (30 gallon)

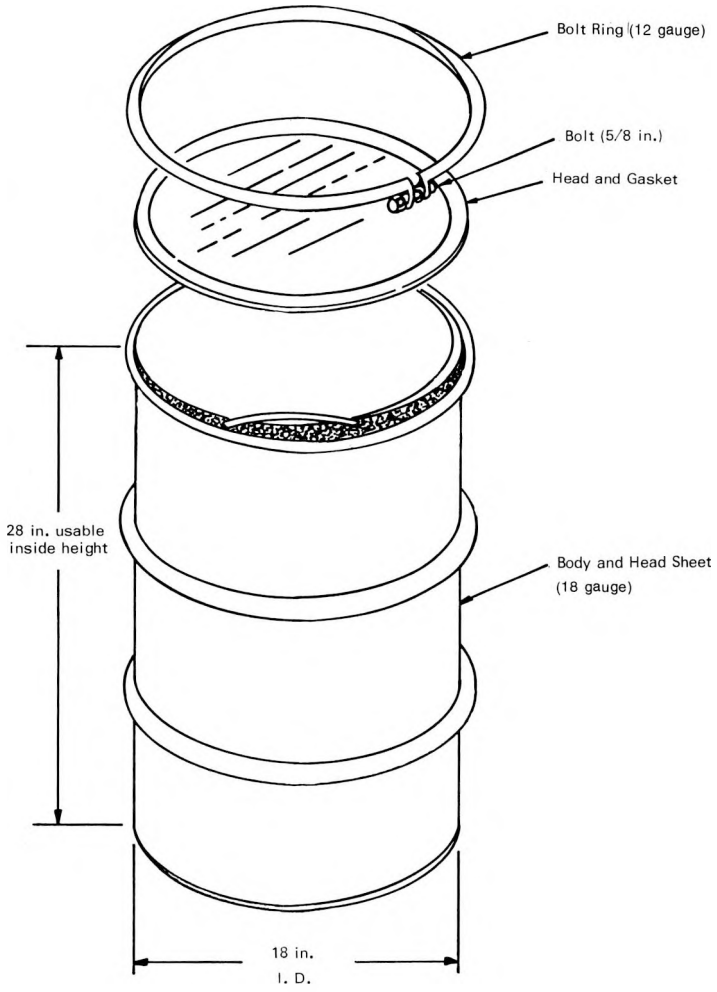
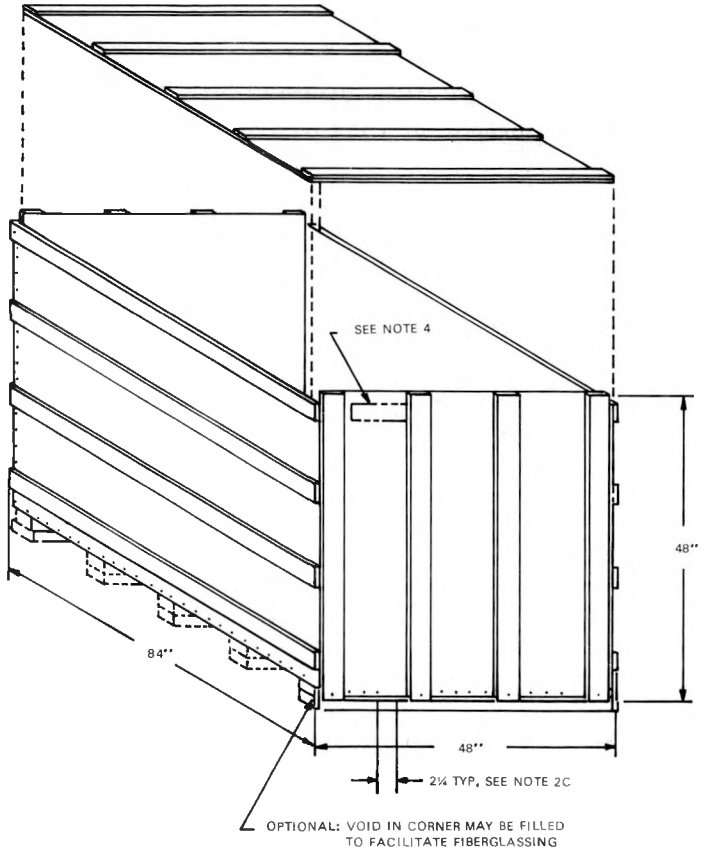


Figure 8. DOT 17H 30-Gallon (114-Liter) Drum

DOT 7A Cleated Plywood Box Assembly



NOTES:

1. BOX DIMENSIONS BEFORE FIBERGLASSING:

   OUTSIDE: 84L x 40W x 49-1/20 x 115 FT^3
   INSIDE: 81L x 45W x 42-1/20 x 90 FT^3

2. ASSEMBLE BOX WITH THREE-WAY CORNERS AS FOLLOWS:

   A. APPLY ELASTOMERIC CONSTRUCTION ADHESIVE (B.F. GOODRICH PL-200 OR APPROVED EQUIVALENT) IN A CONTINUOUS BEAD OF 1/4 INCH MINIMUM DIAMETER ALONG EACH PLYWOOD-TO-PLYWOOD JOINT. REMOVE EXCESS ADHESIVE FROM OUTSIDE OF BOX.

   B. EACH END OF EACH CLEAT SHALL BE FASTENED WITH AT LEAST ONE 16 PENNY CEMENT-COATED BOX NAIL.

   C. APPLY 8 PENNY CEMENT-COATED BOX NAILS OR 2 INCH PLASTIC COATED STAPLES THRU THE PLYWOOD INTO THE APPROPRIATE CLEAT OR STRINGER AS SHOWN. FASTENERS SHALL BE FLUSH TO 1/16 MAXIMUM BELOW SURFACE. STAPLE CROWNS SHALL CROSS GRAIN OF FIRST PLY AT NOT LESS THAN A 40° ANGLE. INTERIOR OF BOX SHALL BE FREE OF PROTRUDING FASTENERS.

3. FIBERGLASS BOX AND ASSEMBLE SKIDS PER 572013. COATING MAY BE DONE ON INDIVIDUAL PANELS OR ON ASSEMBLED BOX.

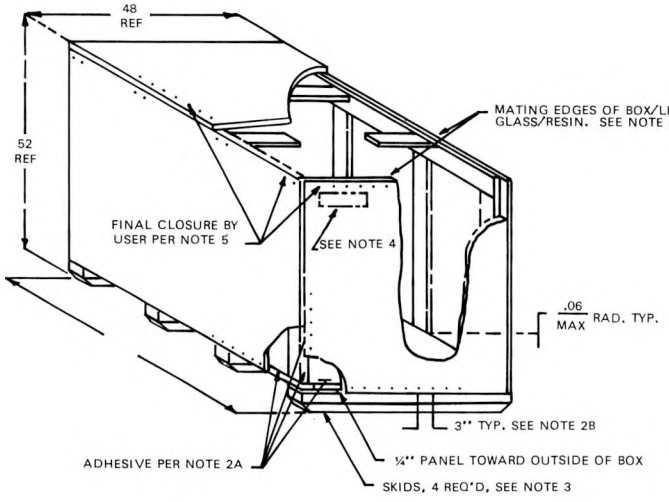
4. DURABLY AND LEGIBLY MARK MANUFACTURER'S NAME OR SYMBOL AND DATE OF MANUFACTURE 2 PLACES ON OPPOSITE ENDS OF BOX, USING CHARACTERS AT LEAST 1/4 INCH HIGH. A PAPER LABEL WITH RESIN COVERCOAT ACCEPTABLE.

5. WHEN THE PURCHASE ORDER SPECIFIES A NON-FIBERGLASSED BOX, OMIT ASSEMBLY STEPS PER NOTE 3. ATTACH SKIDS PER SHEET 2 OF THIS DRAWING SERIES. TEMPORARILY SECURE LID WITH DOUBLE-HEADED NAILS OR OTHER SUITABLE FASTENERS TO RESIST BLOWING IN HIGH WINDS DURING STORAGE OR TRANSPORATION.

6. FINAL LID CLOSURE BY USER SHALL BE MADE USING CONSTRUCTION ADHESIVE AND 8 PENNY CEMENT COATED NAILS OR 2 INCH PLASTIC COATED STAPLES.

Figure 9. DOT 7A Specification Externally Cleated Wooden Box

DOT 7A Flush Panel Plywood Box Assembly



NOTES:

1. NOMINAL BOX SIZE:

   TYPE 1 - 48 x 48 x 84: OVERALL HEIGHT 52
   TYPE 2 - 24 x 48 x 84: OVERALL HEIGHT 28

   ALL DIMENSIONS ARE IN INCHES, EXCEPT AS NOTED.

2. ASSEMBLE BOX AS FOLLOWS:

   A. APPLY ELASTOMERIC CONSTRUCTION ADHESIVE (B.F. GOODRICH PL-200 OR APPROVED EQUIVALENT) IN A CONTINUOUS BEAD OF 1/4 INCH MINIMUM DIAMETER ALL AROUND 3/4 INCH BOTTOM PANEL AND ON BOTH SIDE EDGES OF END PANELS. APPLY A BEAD OF ADHESIVE BETWEEN VERTICAL END STRUTS AND END PANELS. REMOVE EXCESS ADHESIVE FROM OUTSIDE OF BOX.

   B. FASTEN PANELS USING 10 PENNY CEMENT-COATED STAPLES WITH 3 INCH MAXIMUM SPACING. FASTENERS SHALL BE DRIVEN FLUSH TO 1/16 MAXIMUM BELOW SURFACE. STAPLE CROWNS SHALL CROSS GRAIN OF FIRST PLY AT NOT LESS THAN A 40° ANGLE. INTERIOR OF BOX SHALL BE FREE OF PROTRUDING FASTENERS AND SPLIT LUMBER.

   C. EDGES OF SIDE AND END PANELS SHALL BE FLUSH TO 1/16 MAXIMUM ABOVE BOTTOM OF BOX.

3. FIBERGLASS BOX AND ASSEMBLE SKIDS PER 572013. COATING MAY BE DONE ON INDIVIDUAL PANELS OR ON ASSEMBLED BOX. MATING EDGES OF BODY AND LID SHALL BE FREE OF GLASS AND MEASURABLE RESIN OVER-SPRAY. BOX EDGES MAY BE BROKEN 3/4 MAXIMUM RADIUS OR CHAMFER TO FACILITATE FIBERGLASSING.

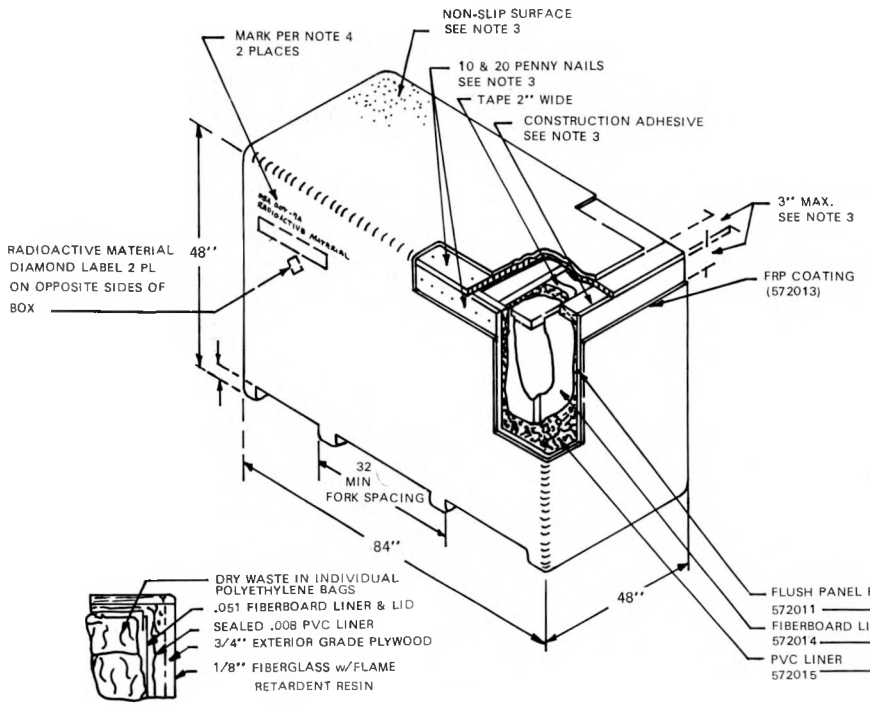
4. DURABLY AND LEGIBLY MARK MANUFACTURER'S NAME OR SYMBOL, DATE OF MANUFACTURE, 2 PLACES ON OPPOSITE ENDS OF BOX USING CHARACTERS AT LEAST 1/4 INCH HIGH (MAY BE PAPER LABEL WITH RESIN OVERCOAT.)

5. USER SHALL MAKE FINAL BOX CLOSURE WITH THE MATERIALS SPECIFIED IN NOTE 2. APPLY ADHESIVE ALL AROUND TOP EDGES OF VERTICAL 3/4 INCH PANELS. IN ADDITION TO 10 PENNY NAILS ON 3 INCH CENTERS, DRIVE TWO 20 PENNY CEMENT-COATED NAILS THROUGH SIDE PANEL INTO EACH 2 x 4 ON TOP PANEL (8 PLACES).

6. WHEN THE PURCHASE ORDER SPECIFIES A NON-FIBER GLASSED BOX, OMIT ASSEMBLY STEPS PER NOTE 3. ATTACH SKIDS PER SHEET 2 OF THIS DRAWING SERIES. TEMPORARILY SECURE LID WITH DOUBLE-HEADED NAILS OR OTHER SUITABLE FASTENERS TO RESIST BLOWING OFF IN HIGH WINDS DURING STORAGE OR TRANSPORTATION.

Figure 10. DOT 7A Specification Flush Panel Wooden Box

DOT 7A FIBERGLASS REINFORCED FLUSH PANEL
OR CLEATED PLYWOOD BOX ASSEMBLY



TYPICAL BOX SECTION

SCALE: NONE

NOTES:

1. SECURELY BLOCK LARGE, HEAVY ITEMS WITHIN THE BOX TO PREVENT MOVEMENT. TIGHTLY PACK OTHER MATERIAL IN INDIVIDUAL PLASTIC BAGS AS APPROPRIATE, ALL MATERIAL SHALL BE FREE OF LIQUID.
2. PLACE LID ON FIBERBOARD LINER, FOLD OVER PVC LINER AND SEAL WITH TAPE.
3. FASTEN LID ON BOX USING CONSTRUCTION ADHESIVE AND CEMENT-COATED NAILS PER THE APPLICABLE BOX ASSEMBLY DRAWING. ADD FRP COATING PER 572013 IN AREA THREE INCHES EITHER SIDE OF JOINT TO SEAL BOX. SPRAY TOP OF BOX WITH A LIGHT COAT OF RESIN AND DISTRIBUTE ABOUT ONE QUART OF FINE GRAVEL INTO WET RESIN TO PROVIDE A NON-SLIP SURFACE.
4. DURABLY AND LEGIBLY MARK "USA DOT-7A", "RADIOACTIVE MATERIAL", NAME AND ADDRESS OF USER, AND GROSS WEIGHT USING CHARACTERS AT LEAST 1.0 INCH HIGH, 2 PLACES, ON OPPOSITE SIDES OF BOX.
5. ALL DIMENSIONS ARE IN INCHES AND ARE GIVEN FOR REFERENCE ONLY. SEE THE APPLICABLE BOX ENGINEERING DRAWING FOR DETAILS. FLUSH PANEL BOX, SHOWN. BOXES MAY BE ORDERED IN TWO HEIGHTS. SEE TABLE FOR SIZES.
6. WHEN USING 24 x 48 x 84 BOX, CUT FIBERBOARD AND PVC LINERS TO FIT.

NOMINAL BOX SIZE	OVERALL HEIGHT
48 x 48 x 84	52
24 x 48 x 84	28

Figure 11. DOT 7A Specification Fiberglass Box

DOT SPEC. 7A STEEL BOX

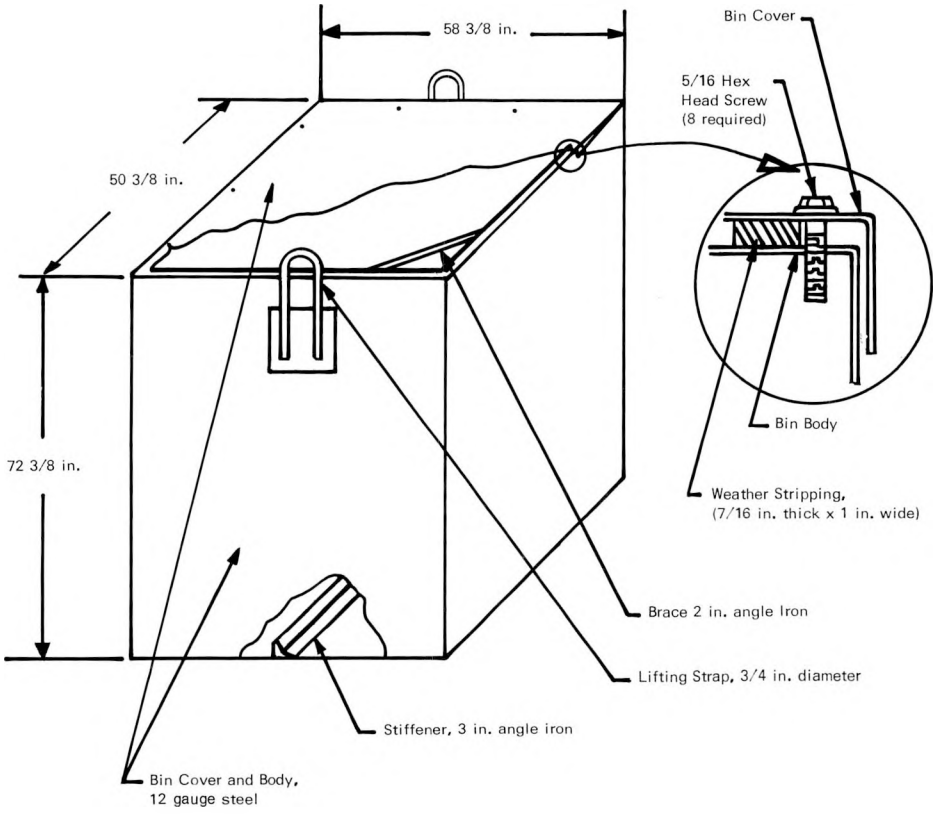


Figure 12. DOT 7A Steel Box

TABLE 1

PACKAGING CRITERIA FOR
NONRETRIEVABLE TRANSURANIC-CONTAMINATED LOW-LEVEL WASTE (DISPOSAL)

Characteristic	DOT 17C 55-Gallon Drum (1)	DOT 7A Specification Wooden Box (1)
Gross Weight Limit	800 lb/drum	5000 lb/box
Dimension Limit	55-gallon drum	4' x 4' x 7' and 2' x 4' x 7'
Radiation at Surface	<200 mrem/hr	<200 mrem/hr
TRU and ^{233}U Content	<10 nCi/g of waste	<10 nCi/g of waste
Fissionable Material Limit	<200 g/drum	<5 g/ft^3 of waste volumetric avg. and <350 g/box maximum
Liner	Double continuous 5 mil poly film as a minimum, sealed with tape	Continuous 8 mil poly film as a minimum, sealed with tape
Banding	N/A	Three (3) 1-1/2 inch steel bands equally spaced around the long axis of each box
Lid Seal	Watertight (2)	(3)

TABLE 1 (Cont.)

PACKAGING CRITERIA FOR
NONRETRIEVABLE TRANSURANIC-CONTAMINATED LOW-LEVEL WASTE (DISPOSAL)

Special Instructions

1. These containers, as defined in Section IV, are the minimum acceptable for this type of waste. Containers with greater physical integrity are acceptable upon review and approval by DOE/NV.

2. The lid seal shall be coated with Permatex #2 nonhardening adhesive, or equivalent, applied to the sealing areas at final closure. Closure ring bolts shall be torqued to a minimum of 40 ft/lb.

3. Apply Elastomeric Construction Adhesive (B. F. Goodrich PL-200 or approved equivalent) in a continuous bead of 1/4 inch minimum diameter all around lid surface. Place and nail lid using 8-penny cement-coated nails on 3-inch centers. Remove excess adhesive from outside of box.

TABLE 2

PACKAGING CRITERIA FOR
RETRIEVAL TRANSURANIC LOW-LEVEL WASTE (STORAGE)

Characteristics	DOT 17C 55-Gallon Drum	DOT 6M Packaging	DOT 7A Steel Box	DOT 7A Fiberglassed Box (1)
Gross Weight Limit	800 lb/drum	640 lb/drum	3200 lb/box	10,000 lb/box
Dimension Limit	55-gallon drum	55-gallon drum	50-3/8" x 58-3/8" x 72-3/8"	4' x 4' x 7'
Radiation at Surface	<200 mrem/hr	<200 mrem/hr	<200 mrem/hr	<200 mrem/hr
Fissionable Material	<200 g/drum	<500 g/drum	<60 g ^{233}U or Pu <100 g ^{235}U	<5 g/ft^3 of waste volumetric average and <350 g/box maximum
TRU and ^{233}U Content	>10 nCi/g	>10 nCi/g	>10 nCi/g	>10 nCi/g
Liner	90 mil rigid poly liner (2)	DOT 2R inside containment vessel (3)	Rigid inner container(s) (4)	Fiberboard liner and continuous 8 mil poly film, as a minimum, sealed with tape
Security Seal	Yes (5)	Watertight (7)	Watertight (8)	Seal provided in fiberglassing
Lid Seal	Watertight (7)	Watertight (7)	Watertight (8)	Seal provided in fiberglassing

TABLE 2 (Cont.)

PACKAGING CRITERIA FOR
RETRIEVAL TRANSURANIC LOW-LEVEL WASTE (STORAGE)

Special Instructions

1. See Figure 4 for requirement on placement of liners, and final fiberglassing of the wooden container.

2. The rigid poly liner used, shall be used inside the DOT 17C drum and shall be sealed with an adhesive.

3. See Standard Container (Section IV) for the special approvals required prior to using the 6M Packaging Criteria.

4. Non-DOT approved container(s) (i.e., wooden boxes, 55-gallon drums, metal cans, etc.) used inside the DOT 7A steel box shall be constructed of materials sufficiently rigid to preserve the integrity of the loaded package under normal handling and shall be sealed. Wastes shall be suitably packaged before placement in DOT 7A box to provide double containment.

5. Each drum shall be sealed by the shipper with a numbered seal so as to preclude removal of the lid without destroying the seal. Sealing methods include spot welding a numbered stainless steel strap across the tight end closure or placing a numbered, padlock-type, stainless steel/plastic seal through a hole in the bolt of the closure within 1/2 inch of the tightened closure ring. Bolts shall be torqued a minimum of 40 ft-lb prior to sealing.

6. Each steel box shall be sealed with a numbered seal in such a manner as to preclude removal of the lid without destroying the seal provided each inner package is not sealed per Note 5. Acceptable sealing methods include: (a) spot welding two straps from box to lid on opposite sides of the box (placing a numbered seal around one welded strap) and, (b) placing a numbered, padlock-type, stainless steel wire and plastic seal through a hole in head of each of two bolts adjacent to the lifting ears and around one side of each lifting assembly.

7. The lid seal shall be coated with Permatex #2 nonhardening adhesive, or equivalent, applied to seal areas at final closure.

8. The lid to the DOT 7A steel box shall contain weather stripping 7/16" thick, 1" wide.

APPENDIX B

PART V

SUMMARY OF TRANSURANIC WASTE TRANSFER REQUIREMENTS

A. Fissile material for TRU waste storage from on or off the NTS shall not be packaged in quantities or concentrations exceeding:

1. 200 grams (0.44 lb) per 208-liter (55-gallon) container, 500 grams (1.1 lb) per DOT 6M, or 350 grams (0.77 lb) per DOT 7A.

2. 5 grams (0.01 lb) per cubic foot (except as shown above).

3. 0.5 mCi ^{238}Pu per gram waste (0.5 watts/g ^{238}Pu).

B. Materials packaged as retrievable radioactive waste shall <u>not</u> include:

1. Pyrophoric* or explosive materials

2. Compressed gases i.e., aerosol cans

3. Strong oxidants, i.e., perchlorates, nitrates

---

*Must be converted to nonreactive form before packaging.

4. Oils, greases, or solvents absorbed on cellulosic material

5. Corrosive chemicals that may react with the container

6. Highly toxic chemicals, i.e., potassium cyanide, vinyl chloride, phosgene, etc.*

7. Free liquids (see Appendix B, Part IV.A.5 for definition)

C. A certifying label (Figure 5), furnished by DOE/NV shall be affixed to each package offered for shipment. This will certify, by the certifying official's signature on each package, that inspection is in accordance with DOT and DOE/NV requirements. This label will provide highly visible confirmation that a knowledgeable, responsible person has made proper certification of an intended radioactive shipment/package.

Each generator is to provide REECo/RWMO, through the cognizant field office and DOE/NV Radiological Operations Branch, the name(s) of a knowledgeable, responsible individual (designated by the organization's top management) as the certifying official(s). Each label must be legibly signed manually. REECo/RWMO personnel will observe/monitor compliance with all requirements and provide the DOE/NV Radiological Operations Branch with documentation of any breach of DOT or DOE/NV requirements within a 24-hour period after discovery.

---

*Must be converted to nonreactive form before packaging.

If, upon evaluation of the documentation (in regard to a shipping/packaging violation) DOE/NV determines that action should be taken, the generator will be requested through the cognizant field office to replace the certifying official. If two (2) violations are noted in any six-month period, the generator shall be denied disposal privileges until the problems can be resolved with DOE field office personnel and their cognizant generators. Standard operating procedures shall be established and documented (if not in effect by the generator) covering their entire packaging and shipping operations. A packaging and shipping quality assurance audit shall be performed by the generator at least on an annual basis. Documented training of all personnel responsible for shipments shall be available for inspection by any DOE official, and updated annually. Certification of shipping papers and containers shall be made by similar administrative responsible personnel as outlined above.

D. All shipments of radioactive waste across state or interstate highways shall comply with Title 49 CFR 173-178 and AEC/ERDA Manual Chapter 0529.

Each radioactive waste container must be marked as indicated in 49 CFR 172.300 series.

E. Radiation dose rates of radioactive waste packages submitted for disposal or storage at the NTS shall not exceed:

1. 200 mrem/hr at contact* with shipping container.

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*See 49 CFR 173.393(j) for other shipping conditions.

2. 10 mrem/hr at one meter* (3.3 feet) from shipping container.

3. Generator must certify that ingrowth of daughter products will not cause radiation levels to exceed the above limits during handling and shipping.

A calibrated radiation detection survey instrument shall be used to verify radiation levels defined above.

F. Removable external radioactive contamination on any package of radioactive waste sent to the NTS for disposal or storage shall not exceed those values shown on page 26.

G. The combination of radioactive TRU waste, waste matrix, and container shall be such that the package can be retrieved in an intact and contamination-free condition at the end of 20 years.

H. The primary TRU waste container must have an impermeable liner** to prevent inadvertent corrosion due to the possible incompatibility of contents with container.

**Polyethylene, polystrene, hypalon, isoprene, tygon, neoprene, or lucite 2.3mm (90 mils) thickness. NOTE: Cellulosic and polyethylene matrices generate significant quantities of hydrogen as to make them unacceptable for packaging of TRU waste.

I. Compactible radioactive waste shall be, following separation from noncompactible components, compacted for storage at NTS.

J. Radioactive waste containing TRU in excess of 10 nCi/g (see AEC/ERDA Manual Chapter 0511) must be packaged to permit 20-year retrievability.

K. Combustible TRU waste must be packaged to exclude other combustion factors (i.e., oxidizing or reducing agents).

L. All TRU waste shall be in dry solid form, chemically, biologically, thermally, and radioactively stable.

M. The thermal decay energy generation of any segment of a package containing TRU or volatile radionuclides must not exceed the rate of free air heat loss at the package surface. The surface temperature (ambient temperature of 25°C [77°F]) shall not exceed 100°C (212°F). Thermal decay energy output shall not exceed 10 watts/package.

N. Organic material containing or combined with retrievable quantities of TRU elements must be dehydrated, incinerated, or packaged with sufficient hydroscopic material that the contents will remain solid for 20 years.

O. The waste generator must load the containers to insure that the interior volume is efficiently and compactly loaded with radioactive material. Such high density loading will reduce the number of radioactive shipments by the waste generators and enhance space utilization at the RWMS.

APPENDIX B

PART VI

RECORDS FOR RADIOACTIVE WASTE

The records shall include:

1. Information required on DOE SWIMS Forms 735 and 736* will be provided on Forms RE-0166/0167 - Radioactive Waste Storage and Disposal Record.

2. Waste matrix composition*

3. Location (as noted on REECo Forms RE-0167/0166) of package in the disposal trench, pit, or storage area will be determined by REECo/RWMO.

4. Each package of radioactive waste shall be marked in a manner that the package can be identified from a separate set of records

5. For TRU waste, the package markings should be designed to be legible after 20 years*

---

*Applicable only to TRU waste.

6. Radioactive waste containing accountable nuclear material from other than NTS sources must be accompanied by ERDA Form 741 - Memorandum of Transfer, to be sent to the Safeguards and NTS Security Branch, DOE/NTSSO.

7. Form RE-0398 "Radioactive Waste Shipment Receiver Form"

APPENDIX C

ABBREVIATIONS

AEC/ERDA	Atomic Energy Commission/Energy Research & Development Administration
ANSI	American National Standards Institute
CFR	Code of Federal Regulations
CP	Control Point
Cs	Cesium
DOE/NTSSO	Department of Energy/Nevada Test Site Support Office
DOE/NV	Departmment of Energy/Nevada Operations Office
DOT	Department of Transportation
ESD	Environmental Sciences Department
HEPA	High Efficiency Particulates - Absolute
HLW	High Level Waste
LLW	Low Level Waste
NRC	Nuclear Regulatory Commission
NTS	Nevada Test Site
OCC	Operations Coordination Center
OSD/NV	Operations Support Division/Nevada Operations Office
RCG	Radiation Concentration Guide
RCRA	Resource Conservation Recovery Act
REECo	Reynolds Electrical & Engineering Co., Inc.

ABBREVIATIONS (continued)

RWMO	Radioactive Waste Management Office
RWMS	Radioactive Waste Management Site
Sr	Strontium
SWIMS	Solids Waste Information Management System
TRU	Transuranic

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Mound Laboratory
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J. J. Thompson
Lovelace Foundation
5200 Gibson Blvd., SE
Albuquerque, NM 87108

J. C. Haugen (3)
DOE/CORO
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Argonne, IL 60439